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01-14300

COURT COURT OF QUEEN'S BENCH OF ALBERTA

JUDICIAL CENTRE CALGARY

APPLICANTS REBECCA MARIE INGRAM, HEIGHTS BAPTIST CHURCH, NORTHSIDE BAPTIST CHURCH, ERIN BLACKLAWS and TORRY TANNER

RESPONDENTS HER MAJESTY THE QUEEN IN RIGHT OF THE PROVINCE OF ALBERTA and THE CHIEF MEDICAL OFFICER OF HEALTH

DOCUMENT BOOK OF AUTHORITIES OF THE APPLICANTS REBECCA MARIE INGRAM, HEIGHTS BAPTIST CHURCH, NORTHSIDE BAPTIST CHURCH, ERIN BLACKLAWS, and TORRY TANNER IN SUPPORT OF APPICATION UNDER RULE 9.13

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1.	Stone Sapphire Ltd. v. Transglobal Communications Group Inc., 2008 ABQB 142	
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3.	Alberta (Child, Youth and Family Enhancement, Director) v. B.M., 2009 ABCA 258	
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6.	<u>CM v Alberta, 2022 ABQB 462</u>	
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8.	Ladd v. Marshall[1954] EWCA Civ1	
9.	Grassy Narrows First Nation v. Ontario (Minister of Natural Resources) 2014 SCC 48	
SECONDARY SOURCES		
10.	Effectiveness of Adding a Mask Recommendation to Other Public Health Measures to Prevent SARS-CoV-2 Infection in Danish Mask Wearers : A Randomized Controlled Trial - PubMed (nih.gov)	
11.	COVID-19 in children and the role of school settings in transmission - second update (europa.eu)	
12.	Measures implemented in the school setting to contain the COVID-19 pandemic: a rapid scoping review - Krishnaratne, S - 2020 Cochrane Library	
13.	SARS-CoV-2 seroprevalence among Vancouver public school staff in British Columbia, Canada (medrxiv.org)	
14.	Clusters of SARS-CoV-2 Infection Among Elementary School Educators and Students in One School District — Georgia, December 2020–January 2021 MMWR (cdc.gov)	
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17.	COVID-19 Mitigation Practices and COVID-19 Rates in Schools: Report on Data from Florida, New York and Massachusetts medRxiv	

18.	Household COVID-19 risk and in-person schooling (saocamilo-sp.br)
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21.	Effectiveness of Non-Pharmaceutical Interventions on Child and Staff COVID-19 Cases in US Summer Camps medRxiv
22.	https://www.theglobeandmail.com/news/national/chief-justice-says-canada-attempted-cultural- genocide-on-aboriginals/article24688854/
23.	Code of Ethics - College of Physicians & Surgeons of Alberta CPSA
24.	Informed-Consent.pdf (cpsa.ca)
25.	AHS Consent to Treatment/Procedure(s) Policy Summary Sheet (albertahealthservices.ca);
26.	CONSENT TO TREATMENT/PROCEDURE(S) policy PRR-01 (ahsnet.ca)

TAB 1

Court of Queen's Bench of Alberta

Citation: Stone Sapphire Ltd. v. Transglobal Communications Group Inc., 2008 ABQB 142

Date: 20080304 **Docket:** 0503 00170 **Registry:** Edmonton

Between:

Stone Sapphire Ltd.

Plaintiff

- and -

Transglobal Communications Group Inc. and Steven Prescott

Defendants

And Between:

Transglobal Communications Group Inc.

Plaintiff by Counterclaim

- and -

Stone Sapphire Ltd., Stone Sapphire Limited, Gary Rana, Vick Rana and Alex Chan

Defendants by Counterclaim

Memorandum of Decision of the Honourable Mr. Justice Robert A. Graesser

Introduction

[1] This matter has a lengthy history before the courts. It was case managed by Justice Lee until November, 2007 when I became temporary case manger pending Justice Lee's return from a leave of absence.

[2] On April 12, 2007, Justice Lee granted Summary Judgment in the amount of \$1,533,352.62 in favour of Stone Sapphire (*Stone Sapphire Ltd. v. Transglobal Communications Group Inc.*, (2007 ABQB 236).

[3] At paragraph 89 of that decision, Justice Lee concluded that as Stone Sapphire is a nonresident company and the Defendants have a plausible counterclaim, "Stone Sapphire's Summary Judgment will be made conditional, on the payment within 60 days of USD \$1,533,352.62 into court".

[4] A series of applications followed which ultimately allowed Stone Sapphire to pay the required amount over a period of time. The last payment was made in January, 2008 with the result that the full amount of \$1,533,352.62 now stands as security for Stone Sapphire's judgment but is unavailable to them until the Defendants' Counterclaim has been resolved.

[5] Transglobal has a substantial counterclaim against Stone Sapphire Ltd., Stone Sapphire Limited, Gary Rana, Vick Rana and Alex Chan. The amount of the counterclaim exceeds the amount of Stone Sapphire's Summary Judgment.

[6] There were some difficulties finalizing the form of Summary Judgment Order and before the order was finalized, Transglobal brought the present application to adduce new or additional evidence on the Summary Judgment motion.

[7] The prayer for relief in the Notice of Motion seeks to:

- 1. Adjourn this motion to a date to be scheduled in accordance with the Order of Mr. Justice Lee dated June 5, 2007;
- 2. permit Transglobal to adduce new evidence in opposition to Stone Sapphires's motion for Summary Judgment;
- 3. discharge or set aside the Order for Summary Judgment granted by Justice Lee on April 12, 2007; or vary the Order for Summary Judgment to find that there is a genuine issue for trial as to the amount owed by Transglobal to Stone Sapphire;
- 4. direct payment out of some or all of the funds paid into court by Transglobal back to Transglobal, plus any accrued interest, forthwith;

- 5. direct Stone Sapphire to produce a further and better Affidavit of Records to include the purchase orders, invoices, quotes and other relevant and material documents between Stone Sapphire and Shanghai Factory No. 8, Shanghai Factory No. 10, Heifei Factory and Shanghai Embossing; and
- 6. pay costs of the application including conduct money of Transglobal's affiants to attend cross-examinations and on an elevated scale due to Stone Sapphire's failure to be forthcoming with Transglobal and the court.
- [8] In support of the Notice of Motion, Transglobal has filed a number of affidavits, being:
 - (a) The affidavit of Robert Raschke sworn May 23, 2007;
 - (b) The affidavit of Luke Wing Kong (Ronald Luk) sworn May 30, 2007;
 - (c) The affidavit of Steven Prescott sworn June 1, 2007;
 - (d) The first supplemental affidavit of Steven Prescott sworn June 2, 2007;
 - (e) The second supplemental affidavit of Steven Prescott sworn June 13, 2007;
 - (f) The affidavit of Katherine Obermeyer filed June 30, 2007;
 - (g) The affidavit of David Ross sworn July 17, 2007;
 - (h) The affidavit of Steven Prescott sworn July 18, 2007.
 - (i) The affidavit of Steven Prescott, filed November 22, 2007; and
 - (j) The affidavit of Steven Prescott sworn January 17, 2008.

[9] The Notice of Motion to set aside or vary the Summary Judgment Order is now returnable before Justice Lee on April 2, 2008. As a preliminary matter to that application, the parties agreed that I should determine if any of the new or additional evidence set forth in the various affidavits should be put before Justice Lee.

Issues

1. Is the application out of time?

[10] There are three issues for me to determine. The first issue relates to a letter the entire application is out of time. The second relates to what evidence should be considered for the purposes of the motion. The third issue relates to whether any of the evidence meets the test for fresh evidence and should be put before Justice Lee.

[11] In case managing the variation application, Justice Lee imposed time lines on the application. By his Order of June 5, 2007, he required that the Notice of Motion to set aside or vary the Summary Judgment Order be filed and served by June 11th. Although the Notice of Motion is dated June 11th, it was not filed and served until June 13, 2007. Stone Sapphire takes the position that the entire application should be dismissed on that basis. Stone Sapphire takes the alternative position that only affidavits filed by the June 11th date should be considered on this application and the main application before Justice Lee.

[12] As can be seen from the volume of materials that have been filed, a number of affidavits were sworn and filed after the Notice of Motion was filed on June 13, 2007. Mr. Prescott, Transglobal's principal officer, has sworn three further affidavits, and the affidavits of Katherine Obermeyer and David Ross also post-date the filing of the Notice of Motion.

[13] It is also clear from the Record that after June 13, 2007, the parties continued to meet with Justice Lee for case management relating to Transglobal putting the summary judgment amount into court and scheduling matters with respect to the main application.

[14] Stone Sapphire has referred to a number of cases relating to court imposed deadlines: *Burgoin v. Burgoin*, (1997), 35 R.F.L. (4^{th)} 135 (Alta. C.A.); *Victory Community Credit Union Ltd. v. Van Huizein*, (2000) CarswellOnt 2802 (Ont. Master); *Paszowski v. R.*, (1998), 141
F.T.R. 149; and *Re Young Estate*, 2003 ABQB 607.

[15] As acknowledged by counsel for Stone Sapphire, the Court has a wide discretion and jurisdiction to deal with its own process. Court imposed deadlines are not strict limitation periods.

[16] The objection to the entire motion is that Transglobal's Notice of Motion was filed on June 13, 2007 and was thus out of time and should be struck. That position should have been the subject of a Notice of Motion by Stone Sapphire immediately after June 13, 2007 if Stone Sapphire intended to rely on that delay as a basis to resist the application. That did not occur. In any event, that argument is without merit. No prejudice is alleged. The Court has ample jurisdiction to relieve against a technical irregularity such as this (Rule 548) and I consider it appropriate to do so with respect to the deficiency in meeting a filing deadline which arose in case management.

[17] The time to file and serve the Notice of Motion and initial supporting materials is extended to June 13, 2007. This is not to say that deadlines can be ignored, whether arising out of case management or otherwise. But here the delay was two days and the issue of late filing does not appear to have been formally raised until Stone Sapphire's reply brief to this motion. It is too late for them to raise the breach as a bar to Transglobal's motion.

2. What evidence should be considered for the purposes of the motion?

[18] With respect to the so-called late filing of Affidavits, there is nothing in the Rules and nothing in Justice Lee's Order of June 5, 2007 precluding the filing of Supplemental Affidavits or further materials on the motion. A final filing date could be imposed on application or during case management, but I do not read the record of these proceedings as containing or imposing a date by which all evidence needed to be filed. Justice Lee's Order of June 5, 2007 required that the Notice of Motion and materials in support be filed by June 11, 2007. Considerable materials

were prepared before that date and ultimately filed on June 13, 2007. I have ruled that delay to be forgivable in the present motion.

[19] The application was adjourned in July 2007, mainly so that Stone Sapphire could crossexamine on the various Affidavits. It was never suggested that Transglobal was unable or unwilling to argue the merits of their application at that time, or that any adjournments were at their urging. In any event, I see no merit to the argument that affidavits filed or sworn after June 13, 2007 should not be considered on this motion. As such, for the purposes this application, I will consider <u>all</u> Affidavits and materials filed with respect to this matter, regardless of the filing date.

[20] The cases referred to by Stone Sapphire recognize the Court's discretion as to enforcement of Court-imposed deadlines. Each case turns on its own facts. This is not an appropriate case to deny Transglobal the opportunity to bring this application or restrict the evidence to be adduced on the motion because of a minor delay and non-compliance with Justice Lee's June 5 Order.

3. Has Transglobal Communications satisfied the test or requirement for adducing fresh or additional evidence?

[21] Transglobal's position is that they have now provided evidence that was not before Justice Lee on the Summary Judgment application which they claim should be put before Justice Lee to "prevent a miscarriage of justice". Transglobal submits that this evidence "may lead Justice Lee to conclude that there is indeed a triable issue". They hope such fresh or additional evidence will cause Justice Lee to rethink his decision on Summary Judgment, especially with respect to setoff.

Test for New Evidence

[22] There does not appear to be any recent Alberta appellate authority with respect to an application to introduce new evidence before the trial or motions judge before the judgment roll has been entered. In *Kay v. Wirstiak*, [1978] 1 W.W.R. 317, Steer, J. reviewed the authorities to that date and concluded:

 $\P 28$ My conclusion is that the following are the three general factors that must be weighed in this kind of application:

(1) The fundamental consideration is that a miscarriage of justice does not occur and therefore the discretion in unfettered. In this regard it is important to keep in mind that regard must be had to the interests of the defendant as well as those of the plaintiff.

(2) Once reasons have been given, the successful party is not to be deprived of it without very solid grounds.

(3) The greatest care must be exercised to avoid abuse of the Court's process.

[23] Greckol, J. in *Alberta Turkey Producers v. Leth*, 2006 ABQB 283 considered an application to make further submissions on constitutional issues, after she had granted an Order but before the terms of formal Order were resolved. She extensively canvassed the law on various issues relating to reopening a Judgment or Order before formal entry. She noted at paragraphs 25, 26, and 27 that the Court's discretion in this area is intended to avoid "miscarriages of justice".

[24] She quoted with approval Veit, J.'s comment in *Dell Chemical & Marketing Ltd. v. Aquasol International Inc.*, 2000 ABQB 930 at paragraph 42 that:

"Exceptional circumstances are required before a court will grant an application for a re-hearing."

[25] The position in Alberta with respect to adducing further fresh evidence before filing of the Judgment Order it has been clear since *Stevenson v. Dandy*, [1918] 3 W.W.R. 662 (Alta. S.C. A.D.) that the trial (or chambers) Judge is the person in the best position to judge the evidence bearing on the case in light of the evidence already given. The trial (or chambers) judge is not bound by the same rule as is a Court of Appeal in an application to hear further evidence. That position was also endorsed by the British Columbia Court of Appeal in *Clayton v. British American Securities Ltd.*, [1934] 3 W.W.R. 257.

[26] Stone Sapphire relies on *Chase Industries Ltd. v. Vermette*, 2004 MBQB 152 to resist this application. In that case, Scurfield, J. recognized at paragraph 7 that "a trial judge's discretion is said to be unfettered". He noted at paragraph 8 that "the jurisdiction to admit new evidence and change a decision is clearly broader where an order or judgment has not yet been signed." In allowing the defendants to reopen his earlier decision, he stated:

21 However, the failure to file a substantive affidavit prior to the delivery of a summary judgment should not function as an absolute bar to the admission of new evidence if an acceptable explanation is offered and the order has not yet been signed. If the court admits new evidence at this stage, the court must be satisfied that the new evidence:

- (a) has the appearance of credibility,
- (b) establishes a genuine issue to be tried,
- (c) is presented in good faith,

- (d) contains material facts that could not have been provided by reasonable diligence prior to the scheduled motion, and
- (e) establishes that the balance of prejudice favours the admission of the new evidence.

If these standards are met, then the court is entitled to exercise its discretion in a judicial fashion and reopen the hearing.

[27] In *671122 Ontario Ltd. v. Sagaz Industries Canada Inc.*, [2001] 2 S.C.R., the trial judge had assessed and awarded damages against the defendants. After his Reasons for Judgment were released, but before formal Judgment had been entered, the defendant brought an application to have the trial reopened to hear fresh evidence. The thrust of the new evidence was evidence from a witness recanting the evidence given at trial. The trial judge dismissed the motion. The Manitoba Court of Appeal allowed the appeal and reversed the trial judge's decisions. A new trial was ordered based on the fresh evidence.

[28] The Supreme Court of Canada approved the B. C. Court of Appeal's statement in *Clayton* that "the trial judge would of course discourage unwarranted attempts to bring forward new evidence available at the trial to disturb the basis of a judgment delivered or to permit a litigant after discovering the effect of a judgment to re-establish a broken down with the aid for further proof." (at para. 60).

[29] Ultimately, the Supreme Court held that the B. C. Court of Appeal erred in substituting its discretion for that of the trial judge, even in a case where a witness had come forward and recanted his prior testimony.

[30] *Effigi Inc. v. CG Operations (H/O) Ltd. (c.o.b. Cotton Ginny)*, [2007] O.J. No. 1613 (Ont. S.C.J.), bears a close resemblance to the case at bar. There, the plaintiff had moved for partial summary judgment based on the supply of goods to the defendant. The defendant resisted summary judgment on the basis that there was a triable issue with respect to whether there was a debt owing to the plaintiff because of damages claimed by the defendant and equitable set off exceeding the amount of the plaintiff's claim.

[31] After argument, but before decision, Cotton Ginny sought to file fresh evidence in support of its defence to the motion.

[32] Justice Pepall stated the applicable test for admitting fresh evidence at paragraph 14:

The decision whether or not to reopen the motion was discretionary. While the test has been expressed in a number of different ways, it essentially comes to this. The court must consider whether the evidence would probably have changed the result and whether that evidence could have been discovered by the exercise of reasonable diligence. The

reasonable diligence requirement will, however, be relaxed in exceptional circumstances where necessary to avoid a miscarriage of justice.

[33] Pepall, J. declined the application on the bases firstly that the defendants had not met the due diligence aspect of the test. Secondly, no exceptional circumstances had been shown. Thirdly, the proposed new evidence was, in any event, of no assistance to her in deciding the matter.

[34] With respect to the statement of the test by Pepall, J., I do not think that her summary sets forth the applicable standard in Alberta. The Alberta standard was set by Beck, J. in *Sales v. Calgary Stock Exchange*, [1931] 3 W.W.R. 392 (Alta. S.C.) and repeated by Steer, J. in **Kay v. Wirstiak** (infra. See also *Commercial Life Assurance C. V. Williamson* (No. 2), (1944), 24 C.B.R. 257 (Alta S.C.). The standard which is applied to the Court of Appeal in considering an application to hear new evidence may be considered, but those rules do not govern applications to the trial or chambers judge before entry of the order.

[35] I likewise do not accept the test enunciated in *Chase*, requiring proof that the new facts could not have been provided by reasonable diligence, as being applicable in Alberta on an application before the original trier of fact before the entry of the judgment or order. Diligence may be a factor, but is not a required element in the Judge deciding to accept the new evidence.

[36] As such, I do not consider *Public School Boards' Assn. (Alberta) et al. v. Alberta (Attorney General)*, (1998) A.J. No. 317 (Alta. C.A.) to be applicable to this case

Conclusion

[37] The test in Alberta on an application such as this requires the original trier of fact to review the evidence tendered and the circumstances, and to exercise his or her discretion as to its admissibility on the motion.

[38] Only he or she can fairly judge whether the evidence should be considered, and whether it may have an effect or impact on the previously-rendered decision.

[39] As a result, I am of the opinion that <u>all</u> of the Affidavit evidence should be put before Justice Lee on the motion to set aside or vary his Summary Judgment Order.

[40] The jurisdiction for a chambers judge or a trial judge to hear further submissions or receive further evidence after the hearing, and even after the issuance of the decision, but before the entry of the formal Order of Judgment, is very broad. It is accurately described as being "unfettered", although cautions are placed on that width to avoid an abuse of the Court's processes but in any event to avoid a miscarriage of justice.

[41] Nothing has changed since *Stevenson v. Dandy* in that the judge who heard the matter remains the person in the best position to judge the bearing of further evidence on the case.

[42] I am satisfied that <u>all</u> of the additional evidence submitted to date should be put before Justice Lee. Only Justice Lee can assess whether or not any of such additional evidence may have had a bearing on some aspect of his decision, had it been before him on the earlier motion. Only Justice Lee can determine if leaving his decision of April 12, 2007 in place could result in a miscarriage of justice.

[43] Having regard to my decision on these aspects of the matter, it would be in appropriate for me to comment on the substantive aspects of the main application, namely whether the new evidence may establish a genuine issue to be tried or whether it may have a material effect on the existing decision.

Case Management Matters

[44] The application on the merits set to be heard by Justice Lee on April 2, 2008. As a result of this decision, briefs will have to be prepared for that application in accordance with court practice on special applications. It is now over ten months since Justice Lee issued his Reasons for Decision on the Summary Judgment application. Affidavits have been filed on this motion to and including January, 2008. I think it appropriate at this stage to direct that the Defendants provide any evidence on which they intend to rely on the application by Friday, March 7, 2008 at the latest. It has not been suggested that there may be any further evidence put forward, but I do not want there to be any surprises on further delays in having this matter heard.

Costs

[45] Costs of this application should be determined by Justice Lee in the application on April 2, 2008.

Heard on the 13th day of February, 2008. **Dated** at the City of Edmonton, Alberta this 4th day of March, 2008.

Robert A. Graesser J.C.Q.B.A.

Appearances:

Kenneth W. Fitz

McLennan Ross LLP for the Plaintiffs / Defendants by Counterclaim

William J. Kenny, Q.C. Miller Thomson LLP for the Defendants / Plaintiffs by Counterclaim

TAB 2

Sagaz Industries Canada Inc., Sagaz Industries Inc. and Joseph Kavana Appellants

v.

671122 Ontario Limited, formerly Design Dynamics Limited Respondent

INDEXED AS: 671122 ONTARIO LTD. V. SAGAZ INDUSTRIES CANADA INC.

Neutral citation: 2001 SCC 59.

File No.: 27820.

2001: June 19; 2001: September 28.

Present: McLachlin C.J. and Iacobucci, Major, Bastarache, Binnie, Arbour and LeBel JJ.

ON APPEAL FROM THE COURT OF APPEAL FOR ONTARIO

Torts — Vicarious liability — Employee versus independent contractor — Original supplier suffering substantial losses when it was replaced as supplier because of bribery scheme in large commercial transaction — Whether rival supplier vicariously liable to original supplier for tortious conduct of its consultant.

Trial — Evidence — Re-opening of trial to admit fresh evidence — Trial judge declining to reopen trial to admit fresh evidence on a motion brought after release of reasons but before formal judgment entered — Whether Court of Appeal erred in substituting its discretion for that of trial judge in decision to reopen trial.

The respondent ("Design") was Canadian Tire's principal supplier of synthetic sheepskin car seat covers for 30 years. In 1984, Design was advised by S, the head of Canadian Tire's automotive division, that the corporate appellants ("Sagaz") would be replacing Design as Canadian Tire's seat cover supplier. S terminated Canadian Tire's supply relationship with Design in favour of Sagaz because of bribery in the form of a "kickback" scheme. Sagaz retained American Independent Marketing Inc. ("AIM"), which was owned and controlled by L, to assist in marketing Sagaz's seat covers. S was to Sagaz Industries Canada Inc., Sagaz Industries Inc. et Joseph Kavana Appelants

с.

671122 Ontario Limited, auparavant Design Dynamics Limited Intimée

RÉPERTORIÉ : 671122 ONTARIO LTD. C. SAGAZ INDUSTRIES CANADA INC.

Référence neutre : 2001 CSC 59.

Nº du greffe : 27820.

2001 : 19 juin; 2001 : 28 septembre.

Présents : Le juge en chef McLachlin et les juges Iacobucci, Major, Bastarache, Binnie, Arbour et LeBel.

EN APPEL DE LA COUR D'APPEL DE L'ONTARIO

Responsabilité délictuelle — Responsabilité du fait d'autrui — Employé par opposition à entrepreneur indépendant — Fournisseur initial subissant des pertes considérables après avoir été remplacé à la suite du versement d'un pot-de-vin dans le cadre d'une opération commerciale d'envergure — La responsabilité du fait d'autrui du fournisseur rival est-elle engagée en raison de la conduite délictueuse de son consultant?

Procès — Preuve — Réouverture du procès pour admettre un nouvel élément de preuve — Juge de première instance refusant de rouvrir le procès pour admettre un nouvel élément de preuve à la suite d'une motion présentée en ce sens après le dépôt des motifs, mais avant l'inscription du jugement formel — La Cour d'appel a-t-elle eu tort de substituer son pouvoir discrétionnaire à celui du juge de première instance en décidant de rouvrir le procès?

L'intimée (« Design ») était depuis 30 ans le principal fournisseur de housses de siège d'auto en peau de mouton synthétique de Canadian Tire. En 1984, S, directeur de la division de l'automobile de Canadian Tire, a informé Design qu'elle serait remplacée par un autre fournisseur de housses de siège d'auto, à savoir les sociétés appelantes (« Sagaz »). S a remplacé Design par Sagaz comme fournisseur après s'être vu offrir un potde-vin sous forme de commission occulte. Sagaz avait retenu les services de la société American Independent Marketing Inc. (« AIM »), appartenant à L et contrôlée receive two percent of all sales from L and AIM and incorporated a sham corporation to receive this money. S's wrongdoing was discovered and his employment was terminated. New management at Canadian Tire determined it preferred the seat cover products of Sagaz to those of Design and retained Sagaz as its supplier. Having lost its major customer, Design's manufacturing business went into a steep decline and, in 1989, Design brought an action alleging that AIM, L, Sagaz and K, Sagaz's president, had bribed S and, but for the bribes, Design would have continued as supplier to Canadian Tire. At trial, damages were assessed against L and AIM, jointly and severally, including punitive damages. The action was dismissed as against Sagaz and K. After the trial judge's reasons for judgment were released, but before formal judgment was entered, L, who did not testify at trial, gave Design an affidavit admitting to the conspiracy to bribe S and implicating K in it. On the basis of the affidavit, Design brought a motion to have the trial reopened to hear L's fresh evidence. The trial judge dismissed the motion. The Court of Appeal reversed the decisions of the trial judge, finding that Sagaz was vicariously liable to Design and therefore jointly and severally liable with L and AIM for the damages awarded, with the exception of punitive damages. A new trial was ordered with respect to the liability of K on the basis that the trial judge should have reopened the trial to hear L's evidence.

Held: The appeal should be allowed and the order of the trial judge restored.

The Court of Appeal erred in holding Sagaz vicariously liable to Design. Although the categories of relationships in law that attract vicarious liability are neither exhaustively defined nor closed, the most common one to give rise to vicarious liability is the relationship between master and servant, now more commonly called employer and employee. This is distinguished from the relationship of an employer and independent contractor which, subject to certain limited exceptions, typically does not give rise to a claim for vicarious liability. The main policy concerns justifying vicarious liability are to provide a just and practical remedy for the plaintiff's harm and to encourage the deterrence of future harm. Vicarious liability is fair in principle because the hazards of the business should be borne by

par celui-ci, pour qu'elle l'aide à commercialiser ses housses de siège d'auto. L et AIM devaient verser une commission de 2 pour 100 sur toutes les ventes à S qui, pour toucher cette commission, a créé une société fictive. S a été congédié après la découverte de son acte fautif. Le nouveau directeur chez Canadian Tire a décidé que les produits de Sagaz étaient préférables à ceux de Design et a conservé Sagaz comme fournisseur. Après avoir perdu son principal client, Design a vu son chiffre d'affaires baisser considérablement et a intenté, en 1989, une action dans laquelle elle alléguait que AIM, L, Sagaz et K, président de Sagaz, avaient versé un potde-vin à S et que, n'eût été de ce pot-de-vin, elle aurait continué d'approvisionner Canadian Tire. En première instance, L et AIM ont été condamnés solidairement à verser des dommages-intérêts, y compris des dommages-intérêts punitifs. L'action a été rejetée en ce qui concernait Sagaz et K. Après le dépôt des motifs du juge de première instance, mais avant l'inscription du jugement formel, L, qui n'avait pas témoigné au procès, a remis à Design un affidavit dans lequel il impliquait K et reconnaissait avoir comploté de verser un pot-de-vin à S. Forte de cet affidavit, Design a présenté au juge de première instance une motion visant la réouverture du procès pour recevoir le nouvel élément de preuve de L. Le juge de première instance a rejeté cette motion. La Cour d'appel a infirmé les décisions du juge de première instance après avoir conclu que Sagaz était responsable du fait d'autrui envers Design et qu'elle était donc solidairement responsable avec L et AIM du paiement des dommages-intérêts accordés, à l'exception des dommages-intérêts punitifs. Un nouveau procès concernant la culpabilité de K a été ordonné pour le motif que le juge de première instance aurait dû rouvrir le procès pour entendre le témoignage de L.

Arrêt : Le pourvoi est accueilli et l'ordonnance du juge de première instance est rétablie.

La Cour d'appel a eu tort de décider que Sagaz était responsable du fait d'autrui envers Design. Bien que les catégories de relations juridiques donnant ouverture à l'application de la responsabilité du fait d'autrui ne soient ni définies de manière exhaustive ni limitatives, la relation qui donne le plus souvent naissance à ce type de responsabilité est la relation maître-serviteur, désormais mieux connue sous le nom de relation employeuremployé. Cette relation diffère de la relation employeurentrepreneur indépendant qui, sous réserve de certaines exceptions limitées, ne donne généralement pas ouverture à une action en responsabilité du fait d'autrui. Les principales considérations de politique générale justifiant la responsabilité du fait d'autrui sont l'idée de fournir un recours juste et pratique pour le préjudice the business itself; thus, it does not make sense to anchor liability on an employer for acts of an independent contractor, someone who was in business on his or her own account. In addition, the employer does not have the same control over an independent contractor as over an employee to reduce accidents and intentional wrongs by efficient organization and supervision. There is no one conclusive test which can be universally applied to determine whether a person is an employee or an independent contractor. What must always occur is a search for the total relationship of the parties. The central question is whether the person who has been engaged to perform the services is performing them as a person in business on his own account. In making this determination, the level of control the employer has over the worker's activities will always be a factor. However, other factors to consider include whether the worker provides his or her own equipment, whether the worker hires his or her own helpers, the degree of financial risk taken by the worker, the degree of responsibility for investment and management held by the worker, and the worker's opportunity for profit in the performance of his or her tasks. Although the contract designated AIM as an "independent contractor", this classification is not always determinative for the purposes of vicarious liability. Looking at the non-exhaustive list of factors set out in Market Investigations, it is clear, based on the total relationship of the parties, that AIM was an independent contractor. On the totality of the evidence, AIM was in business on its own account. Absent exceptional circumstances which are not present in this case, it follows that the relationship between Sagaz and AIM, as employer and independent contractor, is not one which attracts vicarious liability.

The Court of Appeal erred in substituting its discretion for that of the trial judge in deciding to reopen the trial. Absent an error of law, an appellate court should not interfere with the exercise by a trial judge of his or her discretion in the conduct of a trial. Appellate courts should defer to the trial judge, who is in the best position to decide whether fairness dictates that the trial be reopened. The case law dictates that the trial judge must exercise his discretion to reopen the trial "sparingly and with the greatest care" so that "fraud and abuse of the Court's processes" do not result. In this case, the trial judge decided not to exercise his discretion to reopen

subi et celle de dissuader de causer un préjudice à l'avenir. La responsabilité du fait d'autrui est équitable en principe parce qu'une entreprise doit assumer elle-même les risques qu'elle entraîne. Il n'est donc pas logique d'imputer à un employeur la responsabilité des actes accomplis par un entrepreneur indépendant qui, par définition, exploite une entreprise pour son propre compte. En outre, l'employeur n'exerce pas sur un entrepreneur indépendant le même contrôle que sur un employé et n'est pas, de ce fait, en mesure de réduire les accidents et les fautes intentionnelles au moyen d'une organisation et d'une supervision efficaces. Aucun critère universel ne permet de déterminer, de façon concluante, si une personne est un employé ou un entrepreneur indépendant. Il faut toujours déterminer quelle relation globale les parties entretiennent entre elles. La question centrale est de savoir si la personne qui a été engagée pour fournir les services les fournit en tant que personne travaillant à son compte. Pour répondre à cette question, il faut toujours prendre en considération le degré de contrôle que l'employeur exerce sur les activités du travailleur. Cependant, il faut aussi se demander, notamment, si le travailleur fournit son propre outillage, s'il engage lui-même ses assistants, quelle est l'étendue de ses risques financiers, jusqu'à quel point il est responsable des mises de fonds et de la gestion et jusqu'à quel point il peut tirer profit de l'exécution de ses tâches. Bien que AIM soit désignée dans le contrat comme étant un « entrepreneur indépendant », cette désignation n'est pas toujours déterminante de la responsabilité du fait d'autrui. Compte tenu de la liste non exhaustive de facteurs énumérés dans la décision Market Investigations et de la relation globale entre les parties, il est évident que AIM était un entrepreneur indépendant. D'après l'ensemble de la preuve, AIM exploitait une entreprise pour son propre compte. Par conséquent, à moins qu'il n'y ait des circonstances exceptionnelles - ce qui n'est pas le cas en l'espèce -, la relation employeur-entrepreneur indépendant qui existe entre Sagaz et AIM ne donne pas naissance à la responsabilité du fait d'autrui.

La Cour d'appel a eu tort de substituer son pouvoir discrétionnaire à celui du juge de première instance en décidant de rouvrir le procès. En l'absence d'une erreur de droit, une cour d'appel ne doit pas toucher à l'exercice du pouvoir discrétionnaire du juge de première instance au cours d'un procès. Les cours d'appel doivent faire preuve de retenue envers le juge de première instance qui est le mieux placé pour déterminer si l'équité commande la réouverture du procès. La jurisprudence exige que le juge de première instance n'exerce son pouvoir discrétionnaire de rouvrir le procès qu'« avec modération et la plus grande prudence » de façon à évithe trial because neither of the two steps of the test in *Scott* was met to his satisfaction. First, he could not say that the new evidence, if presented at trial, would probably have changed the result, only that it may have changed the result. Second, the trial judge found that L's evidence could have been obtained before trial. L's affidavit evidence contradicts his sworn evidence on discovery, particularly with respect to the existence of the bribery scheme which L avoids acknowledging on discovery. Evidence which is not presumptively credible may fail to probably change the result under the first branch of the test in *Scott*. This is how the trial judge dealt with the affidavit evidence, and he was correct in so doing.

Cases Cited

Referred to: London Drugs Ltd. v. Kuehne & Nagel International Ltd., [1992] 3 S.C.R. 299; Scott v. Cook, [1970] 2 O.R. 769; Mayer v. J. Conrad Lavigne Ltd. (1979), 27 O.R. (2d) 129; Co-operators Insurance Association v. Kearney, [1965] S.C.R. 106; Bazley v. Curry, [1999] 2 S.C.R. 534; Jacobi v. Griffiths, [1999] 2 S.C.R. 570; Wiebe Door Services Ltd. v. M.N.R., [1986] 3 F.C. 553; Regina v. Walker (1858), 27 L.J.M.C. 207; Hôpital Notre-Dame de l'Espérance v. Laurent, [1978] 1 S.C.R. 605; Montreal v. Montreal Locomotive Works Ltd., [1947] 1 D.L.R. 161; Stevenson Jordan and Harrison, Ltd. v. Macdonald, [1952] 1 The Times L.R. 101; Market Investigations, Ltd. v. Minister of Social Security, [1968] 3 All E.R. 732; Lee Ting Sang v. Chung Chi-Keung, [1990] 2 A.C. 374; Hamstra (Guardian ad litem of) v. British Columbia Rugby Union, [1997] 1 S.C.R. 1092; Clayton v. British American Securities Ltd., [1934] 3 W.W.R. 257; Ladd v. Marshall, [1954] 1 W.L.R. 1489.

Statutes and Regulations Cited

Rules of Civil Procedure, R.R.O. 1990, Reg. 194, r. 59.06(2)(a).

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ter « la supercherie et le recours abusif aux tribunaux ». En l'espèce, le juge de première instance a décidé de ne pas exercer son pouvoir discrétionnaire de rouvrir le procès parce qu'il estimait que l'on n'avait satisfait à ni l'un ni l'autre des deux volets du critère de la décision Scott. Premièrement, il lui était possible d'affirmer non pas que l'issue du procès aurait vraisemblablement été différente si le nouvel élément de preuve avait été présenté, mais seulement qu'elle aurait pu être différente. Deuxièmement, le juge de première instance a décidé que l'élément de preuve de L aurait pu être obtenu avant le procès. L'affidavit de L contredit le témoignage qu'il a fait sous serment lors de l'interrogatoire préalable, en particulier en ce qui concerne l'existence du système de pots-de-vin, qu'il avait alors évité de reconnaître. Un élément de preuve qui n'est pas présumé crédible ne contribuera vraisemblablement pas à modifier l'issue du procès, au sens du premier volet du critère de la décision Scott. Telle est la façon dont le juge de première instance a traité la preuve constituée d'un affidavit et il a eu raison d'agir ainsi.

Jurisprudence

Arrêts mentionnés : London Drugs Ltd. c. Kuehne & Nagel International Ltd., [1992] 3 R.C.S. 299; Scott c. Cook, [1970] 2 O.R. 769; Mayer c. J. Conrad Lavigne Ltd. (1979), 27 O.R. (2d) 129; Co-operators Insurance Association c. Kearney, [1965] R.C.S. 106; Bazley c. Curry, [1999] 2 R.C.S. 534; Jacobi c. Griffiths, [1999] 2 R.C.S. 570; Wiebe Door Services Ltd. c. M.R.N., [1986] 3 C.F. 553; Regina c. Walker (1858), 27 L.J.M.C. 207; Hôpital Notre-Dame de l'Espérance c. Laurent, [1978] 1 R.C.S. 605; Montreal c. Montreal Locomotive Works Ltd., [1947] 1 D.L.R. 161; Stevenson Jordan and Harrison, Ltd. c. Macdonald, [1952] 1 The Times L.R. 101; Market Investigations, Ltd. c. Minister of Social Security, [1968] 3 All E.R. 732; Lee Ting Sang c. Chung Chi-Keung, [1990] 2 A.C. 374; Hamstra (Tuteur à l'instance de) c. British Columbia Rugby Union, [1997] 1 R.C.S. 1092; Clayton c. British American Securities Ltd., [1934] 3 W.W.R. 257; Ladd c. Marshall, [1954] 1 W.L.R. 1489.

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APPEAL from a judgment of the Ontario Court of Appeal (2000), 46 O.R. (3d) 760, 183 D.L.R. (4th) 488, 128 O.A.C. 46, 2 B.L.R. (3d) 1, 48 C.C.L.T. (2d) 79, 41 C.P.C. (4th) 107, [2000] O.J. No. 121 (QL), reversing the decisions of the Ontario Court (General Division) (1998), 40 O.R. (3d) 229, 42 C.C.L.T. (2d) 50, [1998] O.J. No. 2194 (QL), and [1998] O.J. No. 4018 (QL). Appeal allowed.

H. Lorne Morphy, *Q.C.*, *John B. Laskin* and *M. Paul Michell*, for the appellants.

Martin Teplitsky, *Q.C.*, and *James M. Wortzman*, for the respondent.

The judgment of the Court was delivered by

MAJOR J. — This appeal raises two issues: the application of vicarious liability for a bribery scheme in a large commercial transaction and the appellate court's review of the trial judge's exercise of discretion not to reopen the trial to admit fresh evidence on a motion brought after the release of his reasons but before formal judgment was entered.

Vicarious liability describes the event when the law holds one person responsible for the misconduct of another because of their relationship. In this case, the respondent (the original supplier) suffered substantial losses when it was replaced as Canadian Tire's synthetic car seat cover supplier. This happened because a bribe was paid by a rival

- Douglas, William O. « Vicarious Liability and Administration of Risk I » (1928-1929), 38 Yale L.J. 584.
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POURVOI contre un arrêt de la Cour d'appel de l'Ontario (2000), 46 O.R. (3d) 760, 183 D.L.R. (4th) 488, 128 O.A.C. 46, 2 B.L.R. (3d) 1, 48 C.C.L.T. (2d) 79, 41 C.P.C. (4th) 107, [2000] O.J. No. 121 (QL), infirmant les décisions de la Cour de l'Ontario (Division générale) (1998), 40 O.R. (3d) 229, 42 C.C.L.T. (2d) 50, [1998] O.J. No. 2194 (QL), et [1998] O.J. No. 4018 (QL). Pourvoi accueilli.

H. Lorne Morphy, c.r., John B. Laskin et *M. Paul Michell*, pour les appelants.

Martin Teplitsky, c.r., et James M. Wortzman, pour l'intimée.

Version française du jugement de la Cour rendu par

LE JUGE MAJOR — Le présent pourvoi soulève deux questions, celle de l'imputation de la responsabilité du fait d'autrui relativement à un système de pots-de-vin versés dans le cadre d'une opération commerciale d'envergure et celle de l'examen en appel de l'exercice par le juge de première instance du pouvoir discrétionnaire de ne pas rouvrir le procès pour admettre un nouvel élément de preuve à la suite d'une motion présentée en ce sens après le dépôt de ses motifs, mais avant l'inscription du jugement formel.

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Il y a responsabilité du fait d'autrui lorsqu'une personne est juridiquement tenue responsable de l'inconduite d'une autre personne en raison de la relation qui existe entre elles. En l'espèce, l'intimée (le fournisseur initial) a subi des pertes considérables lorsqu'elle a été remplacée comme fournisseur de housses synthétiques de siège d'auto de 3

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The first question is whether the appellant Sagaz (the rival automotive supplier) is vicariously liable for the tortious conduct of its consultant who was hired to assist in securing Canadian Tire's business. In my opinion the appellant Sagaz, the competitive supplier, is not vicariously liable for the bribery scheme perpetrated by its consultant. The consultant was not an employee of the supplier but an independent contractor. Based on policy considerations, the relationship between an employer and independent contractor does not typically give rise to a claim in vicarious liability.

On the second question, the motion to reopen the trial to adduce fresh evidence, I conclude for the reasons that follow that the Court of Appeal erred in substituting its discretion for that of the trial judge.

I. Facts

The respondent, 671122 Ontario Limited, formerly Design Dynamics Limited ("Design"), was Canadian Tire Corporation's principal supplier of synthetic sheepskin car seat covers for 30 years. Canadian Tire was the party in the position of strength in the relationship. This is so as it represented more than 60 percent of the Canadian seat cover market and, by 1983, was Design's largest customer accounting for over 50 percent of its sales.

In June 1984, Design lost Canadian Tire's business. Robert Summers, the head of Canadian Tire's automotive division, advised Design that another company, the appellants Sagaz Industries Canada Inc. and Sagaz Industries Inc. (collectively "Sagaz"), would be replacing Design as Canadian Tire's seat cover supplier. Sagaz is a Florida corCanadian Tire. Ce changement de fournisseur est survenu à la suite du versement, par un consultant d'un fournisseur rival, d'un pot-de-vin au directeur de la division de l'automobile de Canadian Tire.

La première question qui se pose est de savoir si la responsabilité du fait d'autrui de l'appelante Sagaz (le fournisseur rival de produits pour l'auto) est engagée en raison de la conduite délictueuse du consultant dont elle a retenu les services afin d'obtenir la clientèle de Canadian Tire. Selon moi, la responsabilité du fait d'autrui du fournisseur rival, l'appelante Sagaz, n'est pas engagée en raison du système de pots-de-vin établi par son consultant. Celui-ci était non pas un employé du fournisseur, mais un entrepreneur indépendant. Pour des considérations de politique générale, la relation entre un employeur et un entrepreneur indépendant ne donne pas ouverture habituellement à une action en responsabilité du fait d'autrui.

Quant à la seconde question, celle de la motion visant à rouvrir le procès pour permettre la présentation d'un nouvel élément de preuve, je conclus, pour les raisons qui suivent, que la Cour d'appel a eu tort de substituer son pouvoir discrétionnaire à celui du juge de première instance.

I. Les faits

L'intimée, 671122 Ontario Limited, auparavant Design Dynamics Limited (« Design »), était depuis 30 ans le principal fournisseur de housses de siège d'auto en peau de mouton synthétique de la Société Canadian Tire. C'est Canadian Tire qui occupait la position de force dans cette relation du fait qu'elle représentait plus de 60 pour 100 du marché canadien des housses de siège d'auto et qu'en 1983 elle était le client le plus important de Design, comptant pour plus de 50 pour 100 des ventes de cette dernière.

En juin 1984, Canadian Tire a cessé de s'approvisionner chez Design. Robert Summers, directeur de la division de l'automobile de Canadian Tire, a informé Design qu'elle serait remplacée par un autre fournisseur de housses de siège d'auto, à savoir les appelantes Sagaz Industries Canada Inc. et Sagaz Industries Inc. (appelées collectivement poration and the appellant, Joseph Kavana, is its president. Sagaz Industries Inc. continues to supply Canadian Tire and Sagaz Industries Canada Inc. is inactive.

Summers terminated Canadian Tire's supply relationship with Design in favour of Sagaz because of bribery in the form of a "kickback" scheme. Sagaz retained American Independent Marketing Inc. ("AIM"), a New York corporation, to assist in marketing Sagaz's seat covers to Canadian Tire. AIM was owned and controlled by Stewart Landow. It was later determined that Summers accepted a bribe from Landow and AIM in relation to the Sagaz seat cover contract. Specifically, Summers incorporated a sham corporation, International Marketing Consultants ("IMC"), to receive the bribery money. Summers employed a surrogate, Anthony Brathwaite, as a token manager of IMC. Brathwaite was the puppet of Summers who received all the profits of IMC. Summers entered into an agreement with Landow whereby Landow (through AIM) would pay Summers (through IMC) two percent of all sales by Sagaz to Canadian Tire of synthetic seat covers in order to ensure the sales occurred. As a result of the bribe, Summers terminated Canadian Tire's relationship with Design.

Summers' wrongdoing was discovered in 1985. His employment with Canadian Tire was terminated and he was eventually convicted of corruptly accepting benefits and went to prison. He later went bankrupt. Brathwaite pleaded guilty to similar charges.

Summers was replaced by new management at Canadian Tire which re-evaluated its purchase of synthetic seat covers. Management determined that it preferred the seat cover products of Sagaz to those of Design. Accordingly, Canadian Tire retained its relationship with Sagaz as its supplier. « Sagaz »). Sagaz est une société floridienne dont le président est l'appelant Joseph Kavana. Sagaz Industries Inc. continue d'approvisionner Canadian Tire, alors que Sagaz Industries Canada Inc. est inactive.

Monsieur Summers a remplacé Design par Sagaz comme fournisseur après s'être vu offrir un pot-de-vin sous forme de commission occulte. Sagaz avait retenu les services d'une entreprise new-yorkaise, American Independent Marketing Inc. (« AIM »), pour qu'elle l'aide à commercialiser ses housses de siège d'auto chez Canadian Tire. AIM appartenait à Stewart Landow qui en avait également le contrôle. Il a plus tard été établi que M. Summers avait accepté un pot-de-vin de M. Landow et de AIM relativement au contrat de vente de housses de siège d'auto conclu par Sagaz. Plus précisément, M. Summers avait, pour toucher le pot-de-vin, créé une société fictive, International Marketing Consultants (« IMC »), dont il avait confié la gestion à un homme de paille Anthony Brathwaite. Ce dernier était le pantin de M. Summers qui encaissait tous les profits de IMC. Messieurs Summers et Landow avaient conclu un accord en vertu duquel M. Landow (par le truchement de AIM) verserait à M. Summers (par le truchement de IMC) une commission de 2 pour 100 sur toutes les ventes de housses synthétiques de Sagaz à Canadian Tire, et ce, afin de garantir la réalisation de ces ventes. Par suite de ce pot-devin, M. Summers a mis fin à la relation de Canadian Tire avec Design.

L'acte fautif de M. Summers a été découvert en 1985. Il a été congédié et a finalement été condamné à une peine d'emprisonnement pour avoir accepté un avantage par corruption. Par la suite, il a fait faillite. Monsieur Brathwaite a plaidé coupable à des accusations analogues.

Le remplaçant de M. Summers chez Canadian Tire, après avoir réévalué l'achat de housses de siège synthétiques, a décidé que les produits de Sagaz étaient préférables à ceux de Design. Canadian Tire a donc conservé Sagaz comme fournisseur. 7

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Having lost its major customer, Design's manufacturing business went into a steep decline. It sold its assets in 1988. In 1989, Design brought an action against some 13 defendants, including Canadian Tire, Summers, Brathwaite, Landow, AIM, Sagaz and Kavana. At the trial, only AIM, Landow (who did not testify), Sagaz and Kavana remained as defendants. Canadian Tire paid Design \$750,000 to settle the action against it. The action against Summers was discontinued when he went bankrupt. Design's action alleged that AIM, Landow, Sagaz and Kavana had bribed Summers and, but for those bribes, Design would have continued as supplier to Canadian Tire.

II. Judicial History

- A. Ontario Court (General Division) (1998), 40 O.R. (3d) 229
- ¹¹ The trial judge found that the decision of Canadian Tire management to switch suppliers of seat covers had nothing to do with any belief that the Sagaz product was superior to the Design product. Design's business was lost solely because of the bribe.
- ¹² The bribery scheme was profitable to Landow as commissions on the sales from Sagaz to Canadian Tire would be paid to his solely-owned corporation, AIM. Landow could not hide behind the corporate veil of AIM in his use of the corporation as his agent in the commission of an intentional tort. The trial judge found that Landow and AIM conspired with Summers and IMC to engage in the unlawful conduct of taking away Design's business from Canadian Tire.
- ¹³ While the tort of civil conspiracy was sufficient to establish liability, the trial judge found that liability was more directly addressed through the tort

Après avoir perdu son principal client, la société Design a vu son chiffre d'affaires baisser considérablement. Elle a vendu ses actifs en 1988, puis a intenté en 1989 une action contre quelque 13 défendeurs, dont Canadian Tire, AIM et Sagaz ainsi que MM. Summers, Brathwaite, Landow et Kavana. Au procès, il ne restait plus comme défendeurs que AIM et Sagaz ainsi que MM. Landow (qui n'a pas témoigné) et Kavana. Canadian Tire a versé 750 000 \$ à Design afin de régler l'action que cette dernière avait intentée contre elle. L'action contre M. Summers a été abandonnée au moment où il a fait faillite. Design a allégué dans son action que AIM, M. Landow, Sagaz et M. Kavana avaient versé un pot-de-vin à M. Summers et que, n'eût été de ce pot-de-vin, elle aurait continué d'approvisionner Canadian Tire.

II. Historique des procédures judiciaires

 A. Cour de l'Ontario (Division générale) (1998), 40 O.R. (3d) 229

Le juge de première instance a conclu que la décision de la direction de Canadian Tire de changer de fournisseur de housses de siège d'auto n'avait rien à voir avec la conviction que le produit de Sagaz était supérieur à celui de Design. Cette dernière avait perdu son client uniquement en raison du pot-de-vin.

Monsieur Landow a profité de ce système de pots-de-vin en ce sens que les commissions sur les ventes de Sagaz à Canadian Tire étaient versées à la société AIM dont il était l'unique propriétaire. Il ne pouvait pas se cacher derrière le voile de la personnalité morale de son entreprise après s'en être servi pour commettre un délit intentionnel. Le juge de première instance a décidé que M. Landow et AIM avaient comploté avec M. Summers et IMC de faire perdre illégalement à Design la clientèle de Canadian Tire.

Même si le délit de complot civil suffisait à établir la responsabilité, le juge de première instance a estimé que la question de la responsabilité était

of unlawful interference with economic relations, for which Landow and AIM were liable.

There were suspicious business dealings raised at the trial in an attempt to implicate Kavana, President of Sagaz, in the bribery scheme, for instance, commissions that Landow received in respect of the sale of seat covers from Sagaz to Canadian Tire. Before Sagaz secured the seat cover contract with Canadian Tire, it was paying Landow a five percent commission on sales. Sagaz then raised Landow's commission from five to six percent. At the same time, or close to it, Landow entered into the agreement with Summers whereby Landow paid Summers two percent in the form of the kickback scheme. It was Design's theory at trial that Landow's commission was raised from five to six percent to fund the bribe to Summers. That implied that Kavana and Landow agreed to share or split the payment of the two percent bribe. Kavana denied involvement in the bribery scheme. He testified that he was misled by Landow in agreeing to change the commission from five to six percent because Landow told him that he was required to hire someone to provide instore service in Canada which would entail additional expense. Another suspicious event was the payment of \$15,000 by Kavana to Landow in March 1985 which eventually found its way to Robin Addie, a senior buyer for Canadian Tire. Again, Kavana testified and denied any improper conduct. He claimed that Landow told him that this expenditure was tied to the purchase of a car as part of an intended promotion to display the Canadian Tire seat covers. In fact, a car was never purchased.

These suspicious circumstances surrounding Kavana were presented at the trial. The trial judge believed Kavana, found him credible and accepted his evidence that he had trusted Landow and had accepted Landow's explanation about the commismieux abordée sous l'angle du délit d'ingérence illicite dans des relations économiques imputable à M. Landow et à AIM.

Au cours du procès, on a tenté d'impliquer M. Kavana, président de Sagaz, dans le système de pots-de-vin en évoquant certaines opérations commerciales louches comme, par exemple, les commissions que M. Landow touchaient pour la vente de housses de siège d'auto de Sagaz à Canadian Tire. Avant de se voir accorder par Canadian Tire le contrat des housses de siège d'auto, Sagaz versait à M. Landow une commission de 5 pour 100 sur les ventes réalisées. Sagaz a ensuite augmenté cette commission à 6 pour 100. Au même moment ou à peu près au même moment, M. Landow a conclu avec M. Summers l'accord en vertu duquel il lui verserait une commission occulte de 2 pour 100. Design a soutenu au procès que la commission de M. Landow avait été majorée à 6 pour 100 dans le but de financer le pot-de-vin versé à M. Summers, ce qui impliquait que MM. Kavana et Landow avaient accepté de partager le paiement du pot-de-vin de 2 pour 100. Monsieur Kavana a nié toute participation au système de pots-de-vin. Il a témoigné que, s'il avait accepté de majorer la commission à 6 pour 100, c'était parce que Landow l'avait induit en erreur en lui affirmant qu'il devait embaucher quelqu'un pour fournir des services en magasin au Canada, ce qui entraînerait des dépenses supplémentaires. Un autre incident louche était le fait que Robin Addie, acheteur principal chez Canadian Tire, s'était retrouvé en possession d'une somme de 15 000 \$ que M. Kavana avait versée à M. Landow au mois de mars 1985. Dans son témoignage, M. Kavana a nié encore une fois toute inconduite de sa part. Il a prétendu que M. Landow lui avait déclaré que cette somme servirait à acheter une automobile pour une campagne de publicité visant les housses de siège vendues par Canadian Tire. En fait, aucune auto n'a jamais été achetée.

Cette situation louche dans laquelle s'est trouvé M. Kavana a été exposée au procès. Le juge de première instance a jugé M. Kavana crédible et a retenu son témoignage selon lequel il avait fait confiance à M. Landow et avait accepté ses expli14

sion and car purchase. As well Summers did not implicate Kavana in his testimony. The trial judge concluded that Kavana was not involved in the bribery scheme. He pointed out that had Kavana known of the bribe by Landow then Kavana and Sagaz would have been held directly liable and obviously vicarious liability would not have been an issue.

- ¹⁶ The trial judge was brief on the issue of whether Sagaz was vicariously liable to Design for the wrongdoing of Landow and AIM. He held that, on the evidence, AIM was an independent contractor to Sagaz. Citing *London Drugs Ltd. v. Kuehne & Nagel International Ltd.*, [1992] 3 S.C.R. 299, he held that vicarious liability could not and should not be imposed upon Sagaz for the tortious acts of an independent contractor.
- Damages were assessed at \$1,807,500 against Landow and AIM, jointly and severally, plus \$50,000 in punitive damages, and pre-judgment interest. The action was dismissed as against Sagaz and Kavana. The trial judge refused to award Sagaz and Kavana their costs against Design, but awarded Sagaz and Kavana their costs against Landow and AIM under a "Sanderson order".

B. Ontario Court (General Division), [1998] O.J. No. 4018 (QL)

After the trial judge's reasons for judgment were released, but before formal judgment was entered, Landow, who did not testify at the trial, gave Design an affidavit admitting to the conspiracy to bribe Summers and implicating Kavana in it. On the basis of the affidavit, Design brought a motion before the trial judge pursuant to rule 59.06(2)(a) of the *Rules of Civil Procedure*, R.R.O. 1990, Reg. 194, to have the trial reopened to hear Landow's fresh evidence. Design claimed that the fresh evications au sujet de la commission et de l'achat d'une automobile. De même, M. Summers n'a pas impliqué M. Kavana dans son témoignage. Le juge de première instance a conclu que M. Kavana n'avait pas participé au système de pots-de-vin. Il a souligné que, si M. Kavana avait été au courant du versement d'un pot-de-vin par M. Landow, sa responsabilité et celle de Sagaz auraient alors été directement engagées et, de toute évidence, la question de la responsabilité du fait d'autrui ne se serait pas posée.

Le juge de première instance a examiné brièvement la question de savoir si Sagaz était responsable envers Design de l'acte fautif de M. Landow et de AIM. Il a conclu que la preuve démontrait que AIM était un entrepreneur indépendant de Sagaz. Citant l'arrêt *London Drugs Ltd. c. Kuehne & Nagel International Ltd.*, [1992] 3 R.C.S. 299, il a ajouté que la responsabilité du fait d'autrui de Sagaz ne pouvait et ne devait pas être engagée en raison des actes délictueux d'un entrepreneur indépendant.

Le juge a condamné M. Landow et AIM, solidairement, à verser la somme de 1 807 500 \$ à titre de dommages-intérêts, plus la somme de 50 000 \$ à titre de dommages-intérêts punitifs, ainsi que des intérêts avant jugement. L'action a été rejetée en ce qui concernait Sagaz et M. Kavana. Le juge a refusé de condamner Design à payer les dépens de Sagaz et de M. Kavana, mais il a rendu une ordonnance de type Sanderson enjoignant à M. Landow et à AIM de payer les dépens de ces deux parties.

B. Cour de l'Ontario (Division générale), [1998]
 O.J. No. 4018 (QL)

Après le dépôt des motifs du juge de première instance, mais avant l'inscription du jugement formel, M. Landow, qui n'avait pas témoigné au procès, a remis à Design un affidavit dans lequel il impliquait M. Kavana et reconnaissait avoir comploté de verser un pot-de-vin à M. Summers. Forte de cet affidavit, Design a présenté au juge de première instance une motion fondée sur l'al. 59.06(2)a) des *Règles de procédure civile*, R.R.O. 1990, règl. 194, en vue d'obtenir la réouverture du

dence would show that Kavana was involved in and had knowledge of the tortious activity of Landow, and was also liable to Design.

The trial judge dismissed the motion. He found that there was no direct evidence at trial that Kavana was a party to the bribe paid to Summers. Summers dealt directly with Landow. Summers did not implicate Kavana in his testimony. Kavana testified and denied involvement in the bribe. He was subjected to a thorough and rigorous crossexamination and was credible in his testimony. Landow did not testify nor attend the trial. He was represented by counsel throughout the trial. In the cross-examination of Landow on his affidavit given in connection with the fresh evidence motion, Landow acknowledged that he was aware of his right to attend the trial and to testify. He received daily reports about the course of the trial over its duration.

In dismissing the motion to reopen the trial, the trial judge applied a two-part test from *Scott v*. *Cook*, [1970] 2 O.R. 769 (H.C.). First, would the evidence, if presented at trial, probably have changed the result? Second, could the evidence have been obtained before trial by the exercise of reasonable diligence?

The trial judge found that neither of the two steps was met. He could not say that the new evidence, if presented at trial, would probably have changed the result, only that it may have changed the result. As well, if the trial were reopened, Landow's evidence might well not be believed. His credibility would be very much in issue. On the second part of the test, the trial judge found that Landow's evidence could have been obtained before trial. Design could have compelled Landow procès pour recevoir le nouvel élément de preuve de M. Landow. Design prétendait que ce nouvel élément de preuve démontrerait que M. Kavana était au fait des actes délictueux de M. Landow et y avait pris part, et que sa responsabilité envers Design était également engagée.

Le juge de première instance a rejeté la motion pour le motif qu'aucun élément de preuve soumis au procès n'établissait directement la participation de M. Kavana au versement d'un pot-de-vin à M. Summers. Ce dernier avait traité directement avec M. Landow. M. Summers n'a pas impliqué M. Kavana dans son témoignage. Pour sa part, M. Kavana a nié toute participation au versement d'un pot-de-vin lorsqu'il a lui-même témoigné. Il a également témoigné de façon crédible lors du contre-interrogatoire complet et serré dont il a fait l'objet. Monsieur Landow n'a ni témoigné ni assisté au procès. Un avocat l'a représenté pendant toute la durée du procès. Contre-interrogé au sujet de l'affidavit qu'il avait souscrit relativement à la motion visant l'admission d'un nouvel élément de preuve, M. Landow a reconnu qu'il savait qu'il avait le droit d'assister au procès et de témoigner. Pendant toute la durée du procès, il recevait chaque jour un rapport concernant le déroulement des procédures.

En rejetant la motion en réouverture du procès, le juge de première instance a appliqué le critère à deux volets énoncé dans la décision *Scott c. Cook*, [1970] 2 O.R. 769 (H.C.). Premièrement, l'issue du procès aurait-elle vraisemblablement été différente si l'élément de preuve en cause avait été présenté? Deuxièmement, aurait-il été possible d'obtenir l'élément de preuve avant le procès en faisant preuve de diligence raisonnable?

Le juge a conclu que l'on n'avait satisfait à ni l'un ni l'autre de ces deux volets. Il pouvait seulement dire que l'issue du procès aurait pu être différente, et non pas qu'elle aurait vraisemblablement été différente, si le nouvel élément de preuve avait été présenté. De même, s'il y avait réouverture du procès, il se pourrait bien que l'on n'ajoute pas foi à l'élément de preuve présenté par M. Landow. Sa crédibilité serait considérablement mise en doute. En ce qui concerne le second volet du critère, le

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to testify under oath at trial, although that evidence may not have been helpful to Design. The trial judge concluded that the court would not allow a party to correct what in hindsight was an unsuccessful strategy at trial.

C. Ontario Court of Appeal (2000), 183 D.L.R. (4th) 488

The Court of Appeal reversed the decisions of the trial judge. The gist of its view was that Sagaz was vicariously liable to Design. Applying the "organization test" (from Mayer v. J. Conrad Lavigne Ltd. (1979), 27 O.R. (2d) 129 (C.A.), as previously approved by this Court in Co-operators Insurance Association v. Kearney, [1965] S.C.R. 106), the Court of Appeal found that Landow and AIM did their work as part of the "Sagaz sales team". Sagaz was therefore jointly and severally liable with Landow and AIM for the damages awarded, with the exception of punitive damages. For this reason, the Court of Appeal also allowed Landow's and AIM's cross-appeal on the issue of costs and set aside the costs award to Sagaz and Kavana against Landow and AIM. Design was entitled to costs against Sagaz.

A new trial was ordered with respect to the liability of Kavana on the basis that the trial judge should have reopened the trial to hear Landow's evidence. The Court of Appeal found that the evidence, if presented at trial and accepted as credible, would implicate Kavana and Sagaz in the bribery scheme. Also, it held that Landow's evidence was not discoverable by reasonable diligence prior to trial as Design made serious efforts to no avail to persuade Landow to co-operate and to testify against Kavana and Sagaz. juge de première instance a décidé que l'élément de preuve de M. Landow aurait pu être obtenu avant le procès. Design aurait pu forcer M. Landow à témoigner sous serment au procès, même si son témoignage pouvait ne pas lui être utile. Le juge de première instance a conclu que la cour ne permettrait pas à une partie de corriger ce qui, a posteriori, paraissait avoir été une stratégie de procès infructueuse.

C. Cour d'appel de l'Ontario (2000), 183 D.L.R. (4th) 488

La Cour d'appel a infirmé les décisions du juge de première instance. Elle a estimé essentiellement que Sagaz était responsable du fait d'autrui envers Design. Appliquant le « critère d'organisation » (tiré de l'arrêt Mayer c. J. Conrad Lavigne Ltd. (1979), 27 O.R. (2d) 129 (C.A.), et auparavant approuvé par notre Cour dans l'arrêt Co-operators Insurance Association c. Kearney, [1965] R.C.S. 106), la Cour d'appel a jugé que M. Landow et AIM avaient agi en tant que membres de « l'équipe de vendeurs de Sagaz ». Sagaz était donc solidairement responsable avec M. Landow et AIM du paiement des dommages-intérêts accordés, à l'exception des dommages-intérêts punitifs. Pour cette raison, la Cour d'appel a également accueilli l'appel incident de M. Landow et de AIM sur la question des dépens et a annulé la condamnation de ces derniers à payer les dépens de Sagaz et de M. Kavana. Design avait droit au paiement de ses dépens par Sagaz.

Un nouveau procès concernant la culpabilité de M. Kavana a été ordonné pour le motif que le juge de première instance aurait dû rouvrir le procès pour entendre le témoignage de M. Landow. La Cour d'appel a conclu que si cet élément de preuve était présenté au procès et jugé crédible, il impliquerait M. Kavana et Sagaz dans le système de pots-de-vin. Elle a également jugé qu'il n'aurait pas été possible en faisant preuve de diligence raisonnable de découvrir l'élément de preuve de M. Landow avant le procès, étant donné que Design n'avait ménagé aucun effort pour convaincre M. Landow de collaborer et de témoigner contre M. Kavana et Sagaz, mais n'y était pas parvenue.

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- III. Issues
 - 1. Did the Court of Appeal err in holding Sagaz vicariously liable to Design?
 - 2. Did the Court of Appeal err by substituting its discretion for that of the trial judge in the decision to reopen the trial?

IV. Analysis

- A. Vicarious Liability
 - (1) <u>Policy Rationale Underlying Vicarious Lia-</u> bility

Vicarious liability is not a distinct tort. It is a theory that holds one person responsible for the misconduct of another because of the relationship between them. Although the categories of relationships in law that attract vicarious liability are neither exhaustively defined nor closed, the most common one to give rise to vicarious liability is the relationship between master and servant, now more commonly called employer and employee.

In general, tort law attempts to hold persons accountable for their wrongful acts and omissions and the direct harm that flows from those wrongs. Vicarious liability, by contrast, is considered to be a species of strict liability because it requires no proof of personal wrongdoing on the part of the person who is subject to it. As such, it is still relatively uncommon in Canadian tort law. What policy considerations govern its discriminate application?

As Fleming stated in an oft-quoted passage:

[T]he modern doctrine of vicarious liability cannot parade as a deduction from legalistic premises, but

- III. Les questions en litige
 - 1. La Cour d'appel a-t-elle eu tort de décider que Sagaz était responsable du fait d'autrui envers Design?
 - 2. La Cour d'appel a-t-elle eu tort de substituer son pouvoir discrétionnaire à celui du juge de première instance en décidant de rouvrir le procès?

IV. Analyse

A. Responsabilité du fait d'autrui

(1) <u>Le raisonnement de principe qui sous-tend</u> la responsabilité du fait d'autrui

La responsabilité du fait d'autrui n'est pas un délit distinct. Elle est une théorie selon laquelle une personne est responsable de l'inconduite d'une autre personne en raison de la relation qui existe entre elles. Bien que les catégories de relations juridiques donnant ouverture à l'application de la responsabilité du fait d'autrui ne soient ni définies de manière exhaustive ni limitatives, la relation qui donne le plus souvent naissance à ce type de responsabilité est la relation maître-serviteur, désormais mieux connue sous le nom de relation employeur-employé.

En général, le droit de la responsabilité délictuelle vise à tenir les gens responsables de leurs actes ou omissions fautifs ainsi que du préjudice qui en découle directement. Par contre, la responsabilité du fait d'autrui est considérée comme un type de responsabilité stricte parce qu'elle n'exige pas de prouver que la personne qui y est assujettie a accompli personnellement un acte fautif. Pour cette raison, les cas où elle s'applique sont encore relativement rares en droit canadien de la responsabilité délictuelle. Quelles sont les considérations de politique générale qui en régissent l'application restreinte?

Pour reprendre un passage souvent cité de Fleming :

[TRADUCTION] [L]a règle contemporaine de la responsabilité du fait d'autrui ne peut pas passer pour une déduc24

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should be frankly recognised as having its basis in a combination of policy considerations

(*The Law of Torts* (9th ed. 1998), at p. 410, cited in *Bazley v. Curry*, [1999] 2 S.C.R. 534, at para. 26, *per* McLachlin J. (as she then was); see also *Jacobi v. Griffiths*, [1999] 2 S.C.R. 570, released concurrently, at para. 29, *per* Binnie J.)

However, McLachlin J. noted in *Bazley*, at para. 27 (cited in *Jacobi*, at para. 29) that "[a] focus on policy is not to diminish the importance of legal principle."

The most recent discussion by this Court of the policy considerations that justify the imposition of vicarious liability was in Bazley, at paras. 26-36, where McLachlin J. succinctly reviewed the relevant jurisprudence. She began with La Forest J.'s opinion (dissenting on the cross-appeal) in London Drugs, supra, which held that vicarious liability is generally considered to rest on one of two logical bases. The first, known as the "master's tort theory", posits that the employer is vicariously liable for the acts of his employee because the acts are regarded as being authorized by him so that in law the acts of the employee are the acts of the employer. The second, known as the "servant's tort theory", attributes liability to the employer simply because the employer was the employee's superior and therefore in charge or command of the employee (G. H. L. Fridman, The Law of Torts in Canada (1990), vol. 2, at pp. 314-15, and P. S. Atiyah, Vicarious Liability in the Law of Torts (1967), at pp. 6-7).

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However, La Forest J. acknowledged that neither of the logical bases for vicarious liability succeeds completely in explaining the operation of the doctrine, and he found that the vicarious liability regime is a response to a number of policy considerations, including compensation, deterrence and loss internalization (*London Drugs, supra*, at tion fondée sur des prémisses formalistes, mais devrait franchement être reconnue comme reposant sur une combinaison de considérations de politique générale...

(*The Law of Torts* (9^e éd. 1998), p. 410, cité dans les arrêts rendus simultanément *Bazley c. Curry*, [1999] 2 R.C.S. 534, par. 26, madame le juge McLachlin (maintenant Juge en chef); voir aussi *Jacobi c. Griffiths*, [1999] 2 R.C.S. 570, par. 29, le juge Binnie.)

Madame le juge McLachlin a toutefois souligné, au par. 27 de l'arrêt *Bazley* (cité au par. 29 de l'arrêt *Jacobi*), que « [1]'accent mis sur une politique générale ne doit pas diminuer l'importance des principes juridiques. »

La plus récente analyse que notre Cour a faite des considérations de politique générale justifiant l'imputation de la responsabilité du fait d'autrui se trouve aux par. 26 à 36 de l'arrêt Bazley, dans lesquels madame le juge McLachlin a procédé à un examen succinct de la jurisprudence pertinente. Elle a d'abord évoqué l'opinion du juge La Forest (dissident relativement au pourvoi incident) dans l'arrêt London Drugs, précité, selon laquelle on considère généralement que la responsabilité du fait d'autrui repose sur l'un des deux fondements logiques suivants. Le premier, connu sous le nom de « théorie du délit de l'employeur », veut que l'employeur soit responsable des actes de son employé parce qu'il est réputé les avoir autorisés, de sorte que, en droit, les actes de l'employé sont les actes de l'employeur. Le deuxième fondement, connu sous le nom de « théorie du délit de l'employé », veut que la responsabilité de l'employeur soit engagée du seul fait qu'il est le supérieur de l'employé et que ce dernier est donc sous ses ordres (G. H. L. Fridman, The Law of Torts in Canada (1990), vol. 2, p. 314-315, et P. S. Atiyah, Vicarious Liability in the Law of Torts (1967), p. 6-7).

Le juge La Forest a toutefois reconnu qu'aucun de ces fondements logiques ne permet d'expliquer complètement l'application de la règle de la responsabilité du fait d'autrui, et a conclu que cette règle répond à un certain nombre de questions de politique générale liées notamment au dédommagement, à la dissuasion et à l'imputation de la perte p. 336). McLachlin J. noted that Fleming identified similar policies to justify the imposition of vicarious liability, including the provision of a just and practical remedy for the harm and the deterrence of future harm, and held that these two ideas "usefully embrace the main policy considerations that have been advanced" (*Bazley, supra*, at para. 29).

Identification of the policy considerations underlying the imposition of vicarious liability assists in determining whether the doctrine should be applied in a particular case and it is for that reason that the policy considerations set out by this Court in *Bazley* should be briefly reviewed.

First, vicarious liability provides a just and practical remedy to people who suffer harm as a consequence of wrongs perpetrated by an employee. Many commentators are suspicious of vicarious liability in principle because it appears to hold parties responsible for harm simply because they have "deep pockets" or an ability to bear the loss even though they are not personally at fault. The "deep pockets" justification on its own does not accord with an inherent sense of what is fair (see also R. Flannigan, "Enterprise control: The servant-independent contractor distinction" (1987), 37 U.T.L.J. 25, at p. 29). Besides an ability to bear the loss, it must also seem just to place liability for the wrong on the employer. McLachlin J. addresses this concern in Bazley, supra, at para. 31:

Vicarious liability is arguably fair in this sense. The employer puts in the community an enterprise which carries with it certain risks. When those risks materialize and cause injury to a member of the public despite the employer's reasonable efforts, it is fair that the person or organization that creates the enterprise and hence the risk should bear the loss. This accords with the notion that it is right and just that the person who creates a risk bear the loss when the risk ripens into harm. (London Drugs, précité, p. 336). Le juge McLachlin a souligné que Fleming a relevé des considérations de politique générale similaires qui justifient l'imputation de la responsabilité du fait d'autrui, dont l'idée de fournir un recours juste et pratique pour le préjudice subi et celle de dissuader de causer un préjudice à l'avenir, ajoutant que ces deux idées « englobent utilement les principales considérations de politique générale qui ont été présentées » (*Bazley*, précité, par. 29).

La détermination des considérations de politique générale qui sous-tendent l'imputation de la responsabilité du fait d'autrui aide à décider s'il y a lieu d'appliquer la règle dans un cas donné et c'est pourquoi il convient d'examiner brièvement celles que notre Cour a énoncées dans l'arrêt *Bazley*.

Premièrement, la responsabilité du fait d'autrui fournit un recours juste et pratique à ceux qui ont subi un préjudice en raison des fautes commises par un employé. Bien des commentateurs se méfient a priori de la notion de responsabilité du fait d'autrui parce qu'elle semble tenir des parties responsables d'un préjudice pour la simple raison qu'elles ont « la bourse bien garnie » ou qu'elles sont en mesure d'assumer la perte, même si elles n'ont rien à se reprocher personnellement. La justification de la « bourse bien garnie » ne concorde pas en soi avec ce qui est perçu comme étant foncièrement équitable (voir également R. Flannigan, « Enterprise control : The servant-independent contractor distinction » (1987), 37 U.T.L.J. 25, p. 29). L'imputation de la responsabilité de la faute à l'employeur doit sembler équitable et non pas dépendre uniquement de la capacité de ce dernier d'assumer la perte. Le juge McLachlin aborde cette question au par. 31 de l'arrêt Bazley, précité :

Dans ce sens, il est possible de soutenir que la responsabilité du fait d'autrui est équitable. L'employeur implante dans la collectivité une entreprise qui comporte certains risques. Quand ces risques se matérialisent et causent un préjudice à un membre du public malgré les efforts raisonnables de l'employeur, il est juste que la perte soit assumée par la personne ou l'organisme qui a créé l'entreprise et, en conséquence, le risque. Cela concorde avec l'idée qu'il est juste et équitable que la personne à l'origine d'un risque assume la perte qui résulte quand le risque se matérialise et cause un préjudice. 30

Similarly, Fleming stated that "a person who employs others to advance his own economic interest should in fairness be placed under a corresponding liability for losses incurred in the course of the enterprise" (p. 410). McLachlin J. states that while the fairness of this proposition is capable of standing alone, "it is buttressed by the fact that the employer is often in the best position to spread the losses through mechanisms like insurance and higher prices, thus minimizing the dislocative effect of the tort within society" (Bazley, at para. 31). Finally on this point, it is noteworthy that vicarious liability does not diminish the personal liability of the direct tortfeasor (Fleming, supra, at p. 411; London Drugs, supra, at p. 460, per McLachlin J.).

³² The second policy consideration underlying vicarious liability is deterrence of future harm as employers are often in a position to reduce accidents and intentional wrongs by efficient organization and supervision. This policy ground is related to the first policy ground of fair compensation, as "[t]he introduction of the enterprise into the community with its attendant risk, in turn, implies the possibility of managing the risk to minimize the costs of the harm that may flow from it" (*Bazley*, *supra*, at para. 34).

(2) Employee Versus Independent Contractor

The most common relationship that attracts vicarious liability is that between employer and employee, formerly master and servant. This is distinguished from the relationship of an employer and independent contractor which, subject to certain limited exceptions (see Atiyah, *supra*, at pp. 327-78), typically does not give rise to a claim for vicarious liability. If a worker is determined to be an employee as opposed to an independent contractor such that vicarious liability can attach to the employer, this is not the end of the analysis. The tortious conduct has to be committed by the

De même Fleming a affirmé que [TRADUCTION] « la personne qui emploie d'autres personnes pour promouvoir ses propres intérêts financiers devrait, en toute équité, se voir imputer une responsabilité correspondante pour les pertes causées dans le cadre de l'exploitation de son entreprise » (p. 410). Le juge McLachlin précise que, quoique la justesse de cette proposition puisse être évidente en soi, « elle est étayée par le fait que l'employeur est souvent le mieux placé pour répartir les pertes au moyen de mécanismes comme l'assurance et la hausse de prix, et ainsi pour réduire l'effet perturbateur du délit dans la société » (Bazley, par. 31). Il convient enfin de noter, à ce sujet, que la responsabilité du fait d'autrui ne diminue en rien la responsabilité personnelle de l'auteur même du délit (Fleming, op. cit., p. 411; London Drugs, précité, p. 460, le juge McLachlin).

La seconde considération de politique générale qui sous-tend la responsabilité du fait d'autrui est l'idée de dissuader de causer un préjudice à l'avenir étant donné que les employeurs sont souvent en mesure de réduire les accidents et les fautes intentionnelles au moyen d'une organisation et d'une supervision efficaces. Cette considération de politique générale est liée la première, celle de la juste indemnisation, vu que « [1]'implantation de l'entreprise dans la collectivité avec les risques qu'elle comporte implique, en revanche, la possibilité de gérer le risque afin de réduire les coûts du préjudice qui peut en découler » (*Bazley*, précité, par. 34).

(2) <u>Employé par opposition à entrepreneur</u> indépendant

La relation qui donne le plus souvent naissance à la responsabilité du fait d'autrui est la relation employeur-employé, autrefois appelée relation maître-serviteur. Elle diffère de la relation employeur-entrepreneur indépendant qui, sous réserve de certaines exceptions limitées (voir Atiyah, *op. cit.*, p. 327-378), ne donne généralement pas ouverture à une action en responsabilité du fait d'autrui. Toutefois, l'analyse ne s'arrête pas à la décision qu'un travailleur est un employé et non pas un entrepreneur indépendant et que la responsabilité du fait d'autrui de son employeur peut

employee in the course of employment. For the reasons that follow, this second stage of the analysis is not relevant and need not be analysed in the present appeal.

What is the difference between an employee and an independent contractor and why should vicarious liability more likely be imposed in the former case than in the latter? This question has been the subject of much debate. The answer lies with the element of control that the employer has over the direct tortfeasor (the worker). If the employer does not control the activities of the worker, the policy justifications underlying vicarious liability will not be satisfied. See Flannigan, *supra*, at pp. 31-32:

This basis for vicarious liability discloses a precise limitation on the scope of the doctrine. If the employer does not control the activities of the worker it is clear that vicarious liability should not be imposed, for then insulated risk-taking [by the employer] does not occur. Only the worker, authorized to complete a task, could have affected the probability of loss, for he alone had control in any respect. Thus, because there is no mischief where employer control is absent, no remedy is required.

Explained another way, the main policy concerns justifying vicarious liability are to provide a just and practical remedy for the plaintiff's harm and to encourage the deterrence of future harm (Bazley, supra, at para. 29). Vicarious liability is fair in principle because the hazards of the business should be borne by the business itself; thus, it does not make sense to anchor liability on an employer for acts of an independent contractor, someone who was in business on his or her own account. In addition, the employer does not have the same control over an independent contractor as over an employee to reduce accidents and intentional wrongs by efficient organization and supervision. Each of these policy justifications is relevant to the ability of the employer to control the activities of the employee, justifications which are generally deficient or missing in the case of an independent contractor. As discussed above, the policy justifications for imposing vicarious liabildonc être engagée. Il faut encore que l'employé ait accompli l'acte délictueux dans l'exercice de ses fonctions. Pour les raisons qui suivent, il n'est pas nécessaire de passer à cette seconde étape de l'analyse, qui n'est pas pertinente en l'espèce.

Quelle différence y a-t-il entre un employé et un entrepreneur indépendant, et pourquoi la responsabilité du fait d'autrui est-elle plus susceptible d'être imputée dans le premier cas? Cette question a été largement débattue. C'est dans le contrôle exercé par l'employeur sur l'auteur même du délit (le travailleur) que réside la réponse. Si l'employeur ne contrôle pas les activités du travailleur, les considérations de politique générale justifiant la responsabilité du fait d'autrui ne jouent pas. Voir Flannigan, *loc. cit.*, p. 31-32 :

[TRADUCTION] Le fondement de la règle de la responsabilité du fait d'autrui en détermine une restriction précise. Si l'employeur ne contrôle pas les activités du travailleur, il est évident que la responsabilité du fait d'autrui ne doit pas lui être imputée car, dans ce cas, il n'y a pas de prise de risque [par l'employeur] qui soit protégée. Seul le travailleur autorisé à accomplir une tâche peut influer sur la probabilité de perte car c'est lui seul qui exerce un contrôle à cet égard. Ainsi, comme il ne saurait y avoir de méfait en l'absence de contrôle par l'employeur, aucune réparation n'est nécessaire.

En d'autres termes, les principales considérations de politique générale justifiant la responsabilité du fait d'autrui sont l'idée de fournir un recours juste et pratique pour le préjudice subi et celle de dissuader de causer un préjudice à l'avenir (Bazley, précité, par. 29). La responsabilité du fait d'autrui est équitable en principe parce qu'une entreprise doit assumer elle-même les risques qu'elle entraîne. Il n'est donc pas logique d'imputer à un employeur la responsabilité des actes accomplis par un entrepreneur indépendant qui, par définition, exploite une entreprise pour son propre compte. En outre, l'employeur n'exerce pas sur un entrepreneur indépendant le même contrôle que sur un employé et n'est pas, de ce fait, en mesure de réduire les accidents et les fautes intentionnelles au moyen d'une organisation et d'une supervision efficaces. Toutes ces considérations de politique générale se rattachent à la capacité de l'employeur de contrôler les activités de l'em34

ity are relevant where the employer is able to control the activities of the employee but may be deficient in the case of an independent contractor over whom the employer has little control. However, control is not the only factor to consider in determining if a worker is an employee or an independent contractor. For the reasons discussed below, reliance on control alone can be misleading, and there are other relevant factors which should be considered in making this determination.

Various tests have emerged in the case law to help determine if a worker is an employee or an independent contractor. The distinction between an employee and an independent contractor applies not only in vicarious liability, but also to the application of various forms of employment legislation, the availability of an action for wrongful dismissal, the assessment of business and income taxes, the priority taken upon an employer's insolvency, and the application of contractual rights (Flannigan, *supra*, at p. 25). Accordingly, much of the case law on point while not written in the context of vicarious liability is still helpful.

The Federal Court of Appeal thoroughly reviewed the relevant case law in *Wiebe Door Services Ltd. v. M.N.R.*, [1986] 3 F.C. 553. As MacGuigan J.A. noted, the original criterion of the employment relationship was the control test set out by Baron Bramwell in *Regina v. Walker* (1858), 27 L.J.M.C. 207, and adopted by this Court in *Hôpital Notre-Dame de l'Espérance v. Laurent*, [1978] 1 S.C.R. 605. It is expressed as follows: "the essential criterion of employer-employee relations is the right to give orders and instructions to the employee regarding the manner in which to ployé, une dimension qui est généralement inexistante ou insuffisante dans le cas d'un entrepreneur indépendant. Comme nous l'avons vu, les considérations de politique générale justifiant l'imputation de la responsabilité du fait d'autrui sont pertinentes lorsque l'employeur est en mesure de contrôler les activités de l'employé, mais peuvent être insuffisantes dans le cas d'un entrepreneur indépendant sur lequel l'employeur a peu de contrôle. Le contrôle n'est toutefois pas le seul facteur à considérer pour décider si un travailleur est un employé ou un entrepreneur indépendant. Pour les raisons exposées plus loin, l'application de ce seul facteur risque d'induire en erreur, et il y a lieu de tenir compte d'autres facteurs pour en décider.

Les tribunaux ont établi divers critères pour aider à décider si un travailleur est un employé ou un entrepreneur indépendant. La distinction entre un employé et un entrepreneur indépendant est utile non seulement en matière de responsabilité du fait d'autrui mais aussi lorsqu'il s'agit d'appliquer diverses lois sur l'emploi, de déterminer si une action pour congédiement injustifié peut être intentée, d'établir des cotisations en matière d'impôt sur le revenu ou de taxe d'affaires, de dresser l'ordre de collocation dans le cas où un employeur devient insolvable ou d'appliquer des droits contractuels (Flannigan, loc. cit., p. 25). Il s'ensuit qu'une bonne partie des décisions en la matière ne sont pas moins utiles du fait qu'elles n'ont pas été rendues dans le contexte de la responsabilité du fait d'autrui.

La Cour d'appel fédérale a procédé à un examen détaillé de la jurisprudence pertinente dans l'arrêt *Wiebe Door Services Ltd. c. M.R.N.*, [1986] 3 C.F. 553. Comme le juge MacGuigan l'a fait remarquer, c'est le critère de contrôle énoncé par le baron Bramwell dans l'affaire *Regina c. Walker* (1858), 27 L.J.M.C. 207, et adopté par notre Cour dans l'arrêt *Hôpital Notre-Dame de l'Espérance c. Laurent*, [1978] 1 R.C.S. 605, qui a d'abord été appliqué pour déterminer l'existence d'une relation employeur-employé. Il était ainsi formulé : « le critère essentiel destiné à caractériser les rapports de commettant à préposé est le droit de donner des ordres et instructions au préposé sur la manière de

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carry out his work" (*Hôpital Notre-Dame de l'Es-pérance, supra,* at p. 613).

This criterion has been criticized as wearing "an air of deceptive simplicity" (Atiyah, *supra*, at p. 41). The main problems are set out by MacGuigan J.A. in *Wiebe Door*, *supra*, at pp. 558-59:

A principal inadequacy [with the control test] is its apparent dependence on the exact terms in which the task in question is contracted for: where the contract contains detailed specifications and conditions, which would be the normal expectation in a contract with an independent contractor, the control may even be greater than where it is to be exercised by direction on the job, as would be the normal expectation in a contract with a servant, but a literal application of the test might find the actual control to be less. In addition, the test has broken down completely in relation to highly skilled and professional workers, who possess skills far beyond the ability of their employers to direct.

An early attempt to deal with the problems of the control test was the development of a fourfold test known as the "entrepreneur test". It was set out by W. O. Douglas (later Justice) in "Vicarious Liability and Administration of Risk I" (1928-1929), 38 *Yale L.J.* 584, and applied by Lord Wright in *Montreal v. Montreal Locomotive Works Ltd.*, [1947] 1 D.L.R. 161 (P.C.), at p. 169:

In earlier cases a single test, such as the presence or absence of control, was often relied on to determine whether the case was one of master and servant, mostly in order to decide issues of tortious liability on the part of the master or superior. In the more complex conditions of modern industry, more complicated tests have often to be applied. It has been suggested that a fourfold test would in some cases be more appropriate, a complex involving (1) control; (2) ownership of the tools; (3) chance of profit; (4) risk of loss. Control in itself is not always conclusive. remplir son travail » (*Hôpital Notre-Dame de l'Es-pérance*, précité, p. 613).

On a dit de ce critère qu'il était [TRADUCTION] « d'une simplicité trompeuse » (Atiyah, *op. cit.*, p. 41). Le juge MacGuigan expose les principales difficultés qu'il soulève, dans l'arrêt *Wiebe Door*, précité, p. 558-559 :

Ce critère a le grave inconvénient de paraître assujetti aux termes exacts du contrat définissant les modalités du travail : si le contrat contient des instructions et des stipulations détaillées, comme c'est chose courante dans les contrats passés avec un entrepreneur indépendant, le contrôle ainsi exercé peut être encore plus rigoureux que s'il résultait d'instructions données au cours du travail, comme c'est l'habitude dans les contrats avec un préposé, mais une application littérale du critère pourrait laisser croire qu'en fait, le contrôle exercé est moins strict. En outre, le critère s'est révélé tout à fait inapplicable pour ce qui est des professionnels et des travailleurs hautement qualifiés, qui possèdent des aptitudes bien supérieures à la capacité de leur employeur à les diriger.

L'une des premières tentatives faites pour régler les difficultés du critère de contrôle a été l'établissement du critère à quatre volets appelé « critère de l'entreprise ». Ce critère a été énoncé par W. O. Douglas (plus tard nommé juge) dans « Vicarious Liability and Administration of Risk I » (1928-1929), 38 Yale L.J. 584, puis appliqué par lord Wright dans l'arrêt *Montreal c. Montreal Locomotive Works Ltd.*, [1947] 1 D.L.R. 161 (C.P.), p. 169 :

[TRADUCTION] Dans des jugements antérieurs, on s'appuyait souvent sur un seul critère, comme l'existence ou l'absence de contrôle, pour décider s'il s'agissait d'un rapport de maître à serviteur, la plupart du temps lorsque des questions de responsabilité délictuelle de la part du maître ou du supérieur étaient en cause. Dans les situations plus complexes de l'économie moderne, il faut souvent recourir à des critères plus compliqués. Il a été jugé plus convenable dans certains cas d'appliquer un critère qui comprendrait les quatre éléments suivants : (1) le contrôle; (2) la propriété des instruments de travail; (3) la possibilité de profit; (4) le risque de perte. Le contrôle en lui-même n'est pas toujours concluant. 38

As MacGuigan J.A. notes, a similar general test, known as the "organization test" or "integration test" was used by Denning L.J. (as he then was) in *Stevenson Jordan and Harrison, Ltd. v. Macdonald*, [1952] 1 *The Times* L.R. 101 (C.A.), at p. 111:

One feature which seems to run through the instances is that, under a contract of service, a man is employed as part of the business, and his work is done as an integral part of the business; whereas, under a contract for services, his work, although done for the business, is not integrated into it but is only accessory to it.

⁴¹ This decision imported the language "contract of service" (employee) and "contract for services" (independent contractor) into the analysis. The organization test was approved by this Court in *Co-operators Insurance, supra* (followed in *Mayer, supra*), where Spence J. observed that courts had moved away from the control test under the pressure of novel situations, replacing it instead with a type of organization test in which the important question was whether the alleged servant was part of his employer's organization (from Fleming, *supra*, at p. 416).

However, as MacGuigan J.A. noted in Wiebe Door, the organization test has had "less vogue in other common-law jurisdictions" (p. 561), including England and Australia. For one, it can be a difficult test to apply. If the question is whether the activity or worker is integral to the employer's business, this question can usually be answered affirmatively. For example, the person responsible for cleaning the premises is technically integral to sustaining the business, but such services may be properly contracted out to people in business on their own account (see R. Kidner, "Vicarious liability: for whom should the 'employer' be liable?" (1995), 15 Legal Stud. 47, at p. 60). As MacGuigan J.A. further noted in Wiebe Door, if the main test is to demonstrate that, without the work of the alleged employees the employer would be out of business, a factual relationship of mutual dependency would always meet the organization test of Comme le souligne le juge MacGuigan, le lord juge Denning (plus tard maître des rôles) a appliqué un critère général similaire, appelé « critère d'organisation » ou « critère d'intégration » dans l'arrêt *Stevenson Jordan and Harrison, Ltd. c. Macdonald*, [1952] 1 *The Times* L.R. 101 (C.A.), p. 111 :

[TRADUCTION] Un élément semble se retrouver dans tous les cas : en vertu d'un contrat de louage de services, une personne est employée en tant que partie d'une entreprise et son travail fait partie intégrante de l'entreprise; alors qu'en vertu d'un contrat d'entreprise, son travail, bien qu'il soit fait pour l'entreprise, n'y est pas intégré mais seulement accessoire.

Cet arrêt a introduit dans l'analyse les expressions « contrat de louage de services » (employé) et « contrat d'entreprise » (entrepreneur indépendant). Notre Cour a approuvé le critère d'organisation dans l'arrêt *Co-operators Insurance*, précité (suivi dans *Mayer*, précité), où le juge Spence a fait remarquer que, sous la contrainte de situations nouvelles, les tribunaux avaient abandonné le critère de contrôle et l'avaient remplacé par une sorte de critère d'organisation faisant intervenir l'importante question de savoir si le soi-disant préposé faisait partie de l'organisation de son employeur (Fleming, *op. cit.*, p. 416).

Le juge MacGuigan signale toutefois dans l'arrêt Wiebe Door, précité, p. 561, que le critère d'organisation a été « reçu avec moins d'enthousiasme dans d'autres juridictions de common law », dont l'Angleterre et l'Australie. Il peut notamment être difficile à appliquer. Il est généralement possible de répondre par l'affirmative à la question de savoir si l'activité ou le travailleur fait partie intégrante de l'entreprise de l'employeur. Par exemple, la personne chargée du nettoyage des locaux est techniquement indispensable à l'entreprise, mais les services de nettoyage peuvent légitimement être confiés en sous-traitance à des personnes travaillant à leur compte (voir R. Kidner, « Vicarious liability: for whom should the "employer" be liable? » (1995), 15 Legal Stud. 47, p. 60). Comme le juge MacGuigan l'a également souligné dans l'arrêt Wiebe Door, si le critère principal consistait à démontrer que, sans le travail des soi-disant

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an employee even though this criterion may not accurately reflect the parties' intrinsic relationship (pp. 562-63).

Despite these criticisms, MacGuigan J.A. acknowledges, at p. 563, that the organization test can be of assistance:

Of course, the organization test of Lord Denning and others produces entirely acceptable results when properly applied, that is, when the question of organization or integration is approached from the persona of the "employee" and not from that of the "employer," because it is always too easy from the superior perspective of the larger enterprise to assume that every contributing cause is so arranged purely for the convenience of the larger entity. We must keep in mind that it was with respect to the business of the employee that Lord Wright [in *Montreal*] addressed the question "Whose business is it?" [Emphasis added.]

According to MacGuigan J.A., the best synthesis found in the authorities is that of Cooke J. in *Market Investigations, Ltd. v. Minister of Social Security*, [1968] 3 All E.R. 732 (Q.B.D.), at pp. 737-38 (followed by the Privy Council in *Lee Ting Sang v. Chung Chi-Keung*, [1990] 2 A.C. 374, *per* Lord Griffiths, at p. 382):

The observations of LORD WRIGHT, of DENNING, L.J., and of the judges of the Supreme Court in the U.S.A. suggest that the fundamental test to be applied is this: "Is the person who has engaged himself to perform these services performing them as a person in business on his own account?" If the answer to that question is "yes", then the contract is a contract for services. If the answer is "no" then the contract is a contract of service. No exhaustive list has been compiled and perhaps no exhaustive list can be compiled of considerations which are relevant in determining that question, nor can strict rules be laid down as to the relative weight which the various considerations should carry in particular cases. The most that can be said is that control will no doubt always have to be considered, although it can no longer be regarded as the sole determining factor; and that factors, which may be of importance, are such matters as whether the man performing the services provides his employés, l'employeur ne pourrait pas exploiter son entreprise, l'existence d'un lien factuel de dépendance mutuelle satisferait toujours au critère d'organisation d'un employé même s'il se peut que ce critère ne reflète pas exactement la relation intrinsèque des parties (p. 562-563).

Le juge MacGuigan reconnaît qu'en dépit de ces critiques le critère d'organisation peut être utile (à la p. 563) :

De toute évidence, le critère d'organisation énoncé par lord Denning et d'autres juristes donne des résultats tout à fait acceptables s'il est appliqué de la bonne manière, c'est-à-dire quand la question d'organisation ou d'intégration est envisagée du point de vue de l'« employé » et non de celui de l'« employeur ». En effet, il est toujours très facile, en examinant la question du point de vue dominant de la grande entreprise, de présumer que les activités concourantes sont organisées dans le seul but de favoriser l'activité la plus importante. Nous devons nous rappeler que c'est en tenant compte de l'entreprise de l'employé que lord Wright [dans l'arrêt *Montreal*] a posé la question « À qui appartient l'entreprise[?] » [Je souligne.]

Selon le juge MacGuigan, c'est le juge Cooke qui a fait la meilleure synthèse du problème dans la décision *Market Investigations, Ltd. c. Minister of Social Security*, [1968] 3 All E.R. 732 (Q.B.D.), p. 737-738 (suivie par le Conseil privé dans l'arrêt *Lee Ting Sang c. Chung Chi-Keung*, [1990] 2 A.C. 374, lord Griffiths, p. 382) :

[TRADUCTION] Les remarques de LORD WRIGHT, du LORD JUGE DENNING et des juges de la Cour suprême des États-Unis laissent à entendre que le critère fondamental à appliquer est celui-ci : « La personne qui s'est engagée à accomplir ces tâches les accomplit-elle en tant que personne travaillant à son compte? » Si la réponse à cette question est affirmative, alors il s'agit d'un contrat d'entreprise. Si la réponse est négative, alors il s'agit d'un contrat de service personnel. Aucune liste exhaustive des éléments qui sont pertinents pour trancher cette question n'a été dressée, peut-être n'est-il pas possible de le faire; on ne peut non plus établir de règles rigides quant à l'importance relative qu'il faudrait attacher à ces divers éléments dans un cas particulier. Tout ce qu'on peut dire, c'est qu'il faudra toujours tenir compte du contrôle même s'il ne peut plus être considéré comme le seul facteur déterminant; et que des facteurs qui peuvent avoir une certaine importance sont des questions comme

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own equipment, whether he hires his own helpers, what degree of financial risk he takes, what degree of responsibility for investment and management he has, and whether and how far he has an opportunity of profiting from sound management in the performance of his task. [Emphasis added.]

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Finally, there is a test that has emerged that relates to the enterprise itself. Flannigan, supra, sets out the "enterprise test" at p. 30 which provides that the employer should be vicariously liable because (1) he controls the activities of the worker; (2) he is in a position to reduce the risk of loss; (3) he benefits from the activities of the worker; (4) the true cost of a product or service ought to be borne by the enterprise offering it. According to Flannigan, each justification deals with regulating the risk-taking of the employer and, as such, control is always the critical element because the ability to control the enterprise is what enables the employer to take risks. An "enterprise risk test" also emerged in La Forest J.'s dissent on cross-appeal in London Drugs where he stated at p. 339 that "[v]icarious liability has the broader function of transferring to the enterprise itself the risks created by the activity performed by its agents."

In my opinion, there is no one conclusive test which can be universally applied to determine whether a person is an employee or an independent contractor. Lord Denning stated in *Stevenson Jordan, supra*, that it may be impossible to give a precise definition of the distinction (p. 111) and, similarly, Fleming observed that "no single test seems to yield an invariably clear and acceptable answer to the many variables of ever changing employment relations . . ." (p. 416). Further, I agree with MacGuigan J.A. in *Wiebe Door*, at p. 563, citing Atiyah, *supra*, at p. 38, that what must always occur is a search for the total relationship of the parties:

[I]t is exceedingly doubtful whether the search for a formula in the nature of a single test for identifying a

celles de savoir si celui qui accomplit la tâche fournit son propre outillage, s'il engage lui-même ses aides, quelle est l'étendue de ses risques financiers, jusqu'à quel point il est responsable des mises de fonds et de la gestion, et jusqu'à quel point il peut tirer profit d'une gestion saine dans l'accomplissement de sa tâche. [Je souligne.]

Enfin, un critère se rapportant à l'entreprise ellemême est apparu. Flannigan (loc. cit., p. 30) énonce le [TRADUCTION] « critère de l'entreprise » selon lequel l'employeur doit être tenu responsable du fait d'autrui pour les raisons suivantes : (1) il contrôle les activités du travailleur, (2) il est en mesure de réduire les risques de perte, (3) il tire profit des activités du travailleur, (4) le coût véritable d'un bien ou d'un service devrait être assumé par l'entreprise qui l'offre. Pour Flannigan, chaque justification a trait à la régulation du risque pris par l'employeur, et le contrôle est donc toujours l'élément crucial puisque c'est la capacité de contrôler l'entreprise qui permet à l'employeur de prendre des risques. Le juge La Forest a lui aussi formulé un « critère du risque de l'entreprise » dans l'opinion dissidente qu'il a exposée relativement au pourvoi incident dans l'arrêt London Drugs. Il a écrit, à la p. 339, que « [1]a responsabilité du fait d'autrui a pour fonction plus générale de transférer à l'entreprise elle-même les risques créés par l'activité à laquelle se livrent ses mandataires. »

À mon avis, aucun critère universel ne permet de déterminer, de facon concluante, si une personne est un employé ou un entrepreneur indépendant. Lord Denning a affirmé, dans l'arrêt Stevenson Jordan, précité, qu'il peut être impossible d'établir une définition précise de la distinction (p. 111) et, de la même façon, Fleming signale que [TRADUCTION] « devant les nombreuses variables des relations de travail en constante mutation, aucun critère ne semble permettre d'apporter une réponse toujours claire et acceptable » (p. 416). Je partage en outre l'opinion du juge MacGuigan lorsqu'il affirme — en citant Atiyah, op. cit., p. 38, dans l'arrêt Wiebe Door, p. 563 - qu'il faut toujours déterminer quelle relation globale les parties entretiennent entre elles :

[TRADUCTION] [N]ous doutons fortement qu'il soit encore utile de chercher à établir un critère unique percontract of service any longer serves a useful purpose.... The most that can profitably be done is to examine all the possible factors which have been referred to in these cases as bearing on the nature of the relationship between the parties concerned. Clearly not all of these factors will be relevant in all cases, or have the same weight in all cases. Equally clearly no magic formula can be propounded for determining which factors should, in any given case, be treated as the determining ones.

Although there is no universal test to determine whether a person is an employee or an independent contractor, I agree with MacGuigan J.A. that a persuasive approach to the issue is that taken by Cooke J. in Market Investigations, supra. The central question is whether the person who has been engaged to perform the services is performing them as a person in business on his own account. In making this determination, the level of control the employer has over the worker's activities will always be a factor. However, other factors to consider include whether the worker provides his or her own equipment, whether the worker hires his or her own helpers, the degree of financial risk taken by the worker, the degree of responsibility for investment and management held by the worker, and the worker's opportunity for profit in the performance of his or her tasks.

It bears repeating that the above factors constitute a non-exhaustive list, and there is no set formula as to their application. The relative weight of each will depend on the particular facts and circumstances of the case.

(3) Application to the Facts

According to the agreement between Sagaz and AIM dated January 29, 1985, AIM was hired to "provide assistance to Sagaz in retaining the goodwill of [Canadian Tire]". Although the contract designated AIM as an "independent contractor", this classification is not always determinative for the purposes of vicarious liability. The starting point for this analysis is whether AIM, while engaged to perform such services for Sagaz, was in business on its own account. If so, AIM is an independent contractor as opposed to an employee mettant d'identifier les contrats de louage de services [...] La meilleure chose à faire est d'étudier tous les facteurs qui ont été considérés dans ces causes comme des facteurs influant sur la nature du lien unissant les parties. De toute évidence, ces facteurs ne s'appliquent pas dans tous les cas et n'ont pas toujours la même importance. De la même façon, il n'est pas possible de trouver une formule magique permettant de déterminer quels facteurs devraient être tenus pour déterminants dans une situation donnée.

Bien qu'aucun critère universel ne permette de déterminer si une personne est un employé ou un entrepreneur indépendant, je conviens avec le juge MacGuigan que la démarche suivie par le juge Cooke dans la décision Market Investigations, précitée, est convaincante. La question centrale est de savoir si la personne qui a été engagée pour fournir les services les fournit en tant que personne travaillant à son compte. Pour répondre à cette question, il faut toujours prendre en considération le degré de contrôle que l'employeur exerce sur les activités du travailleur. Cependant, il faut aussi se demander, notamment, si le travailleur fournit son propre outillage, s'il engage lui-même ses assistants, quelle est l'étendue de ses risques financiers, jusqu'à quel point il est responsable des mises de fonds et de la gestion et jusqu'à quel point il peut tirer profit de l'exécution de ses tâches.

Ces facteurs, il est bon de le répéter, ne sont pas exhaustifs et il n'y a pas de manière préétablie de les appliquer. Leur importance relative respective dépend des circonstances et des faits particuliers de l'affaire.

(3) Application aux faits

Aux termes de l'accord conclu entre Sagaz et AIM le 29 janvier 1985, AIM était engagée pour [TRADUCTION] « aider Sagaz à obtenir la clientèle de [Canadian Tire] ». Bien que AIM y soit désignée comme étant un « entrepreneur indépendant », cette désignation n'est pas toujours déterminante de la responsabilité du fait d'autrui. Il faut d'abord se demander si, bien qu'elle ait été engagée pour fournir ces services à Sagaz, AIM exploitait une entreprise pour son propre compte. Dans l'affirmative, AIM est un entrepreneur indépendant 47

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of Sagaz and vicarious liability likely will not follow. It is helpful to examine the non-exhaustive list of factors from *Montreal* and *Market Investigations* to assist in this determination.

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There is some evidence to suggest that Landow and AIM were employees of Sagaz. In other words, in response to the query "whose business is it?", there is some suggestion that Landow worked in what was characterized as a "joint effort" with Sagaz sales managers in order to secure Canadian Tire's business. Specifically, although it was Landow's duty under the contract to obtain Canadian Tire's business and maintain its goodwill, the first letter sent to Canadian Tire on behalf of Sagaz was written by Canadian Tire's national sales manager, David English, who gave price quotations. The first meeting was attended by Landow, English and Kavana. Following that meeting, revised price quotations were sent by English. Landow's role was limited to presenting prices that were set and negotiated by Kavana and English and he required instructions with respect to terms and various other aspects of the business that he was conducting on Sagaz's behalf. Quotations given to Canadian Tire did not disclose Landow as a sales representative. Rather, the space on the invoice for the sales representative was left blank and the account was characterized as a "house account".

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There was also some issue made about the fact that in a letter dated June 12, 1984, Landow communicated with Canadian Tire directly using Sagaz's letterhead. On cross-examination, Kavana admitted that Landow had been supplied with Sagaz letterhead. The courts below speculated that these factors came about because Canadian Tire preferred to deal with its suppliers, like Sagaz, directly and not through external sales agents. et non un employé de Sagaz et la responsabilité du fait d'autrui est vraisemblablement écartée. Pour répondre à cette question, il est utile d'examiner la liste non exhaustive de facteurs énumérés dans les décisions *Montreal* et *Market Investigations*.

Certains éléments de preuve indiquent que M. Landow et AIM étaient des employés de Sagaz. En d'autres termes, on laisse entendre, pour répondre à la question « À qui appartient l'entreprise? », que M. Landow participait avec les directeurs des ventes de Sagaz à ce qui a été décrit comme un « effort concerté » en vue d'obtenir la clientèle de Canadian Tire. Plus précisément, même si, aux termes du contrat, il incombait à M. Landow d'obtenir et de conserver la clientèle de Canadian Tire, la première lettre envoyée à cette dernière au nom de Sagaz contenait des propositions de prix et avait été rédigée par le directeur national des ventes de Canadian Tire, David English. Messieurs Landow, English et Kavana ont assisté à la première rencontre. À la suite de cette rencontre, M. English a envoyé de nouvelles propositions de prix. Le rôle de M. Landow se limitait à soumettre les prix qui avaient été établis et négociés par MM. Kavana et English, et il devait suivre des directives en ce qui concernait les modalités et divers autres aspects de la démarche qu'il accomplissait au nom de Sagaz. Monsieur Landow n'était pas non plus désigné comme représentant des ventes dans les propositions de prix soumises à Canadian Tire; aucune inscription ne figurait dans l'espace réservé au représentant des ventes sur la facture, et le compte était décrit comme étant un « compte hors commission ».

On a également insisté jusqu'à un certain point sur le fait qu'une lettre en date du 12 juin 1984 adressée à Canadian Tire avait été écrite par M. Landow sur du papier à correspondance offide Sagaz. contre-interrogatoire, cielle En M. Kavana a reconnu que M. Landow avait reçu du papier à correspondance officielle de Sagaz. Les tribunaux d'instance inférieure ont supposé que cela était dû au fait que Canadian Tire préférait traiter directement avec ses fournisseurs, comme Sagaz, plutôt que de traiter avec des représentants commerciaux indépendants.

On the other hand, there are some compelling points which indicate that AIM and Sagaz were separate legal entities, some of which are that AIM had its own offices, located in New York, while the Sagaz head offices were located in Florida. According to the agreement between the parties, AIM was to pay all of its own costs of conducting its business, including travel expenses, commissions and other compensation of salespersons employed by it. AIM remained free to carry on other activities and represent other suppliers provided that it did not take on any competing lines of business.

With respect to AIM's responsibility for investment and management, Sagaz did not either specify or control how much time AIM was to devote to representing them in maintaining their goodwill with Canadian Tire, or to performing in-store services. Similarly, it was up to AIM and Landow to decide how many, if any, trips Landow would take to Toronto. According to the agreement and Kavana's testimony, AIM had no authority to bind the Sagaz company.

In terms of a risk of loss or an opportunity for profit, Landow and AIM worked on commission on sales of Sagaz's products. As such, the risk of loss and the opportunity for profit depended on whether AIM's expenses (such as travel expenses) exceeded its commissions.

Central to this inquiry is the extent of control that Sagaz had over AIM. While Sagaz directed the prices, terms and other conditions that AIM was to negotiate on Sagaz's behalf, AIM was ultimately in control of providing assistance to Sagaz in retaining the goodwill of Canadian Tire. Again, AIM decided how much time to devote to Sagaz and how much time to devote to its services for other supply companies. Although Sagaz controlled what was done, AIM controlled how it was done. This indicates that Landow was not controlled by Sagaz. Des éléments convaincants indiquent, par contre, que AIM et Sagaz étaient des entités juridiques distinctes, dont le fait que AIM possédait ses propres bureaux à New York alors que le siège social de Sagaz était situé en Floride. Aux termes de l'accord conclu entre les parties, AIM assumait tous les frais liés à l'exploitation de son entreprise, y compris les frais de déplacement, les commissions et autres rémunérations versées aux vendeurs qu'elle employait. AIM était libre de poursuivre d'autres activités et de représenter d'autres fournisseurs pourvu qu'il ne s'agisse pas d'entreprises rivales.

Quant à la responsabilité de AIM en matière de mises de fonds et de gestion, Sagaz n'a pas précisé pendant combien de temps AIM devrait la représenter auprès de Canadian Tire ou fournir des services en magasin, et elle n'a exercé aucun contrôle à cet égard. De même, il appartenait à AIM et à M. Landow de décider si ce dernier devrait se rendre à Toronto et, le cas échéant, du nombre de fois qu'il le ferait. Il ressort de l'accord et du témoignage de M. Kavana que AIM n'avait pas le pouvoir de lier la société Sagaz.

En ce qui concerne le risque de perte ou la possibilité de profit, M. Landow et AIM touchaient une commission sur les ventes des produits de Sagaz. Par conséquent, AIM pourrait subir une perte ou réaliser un profit selon que le montant de ses dépenses (tels les frais de déplacement) serait supérieur ou inférieur à celui des commissions qu'elle toucherait.

Le degré de contrôle exercé sur AIM par Sagaz revêt une importance cruciale dans la présente analyse. Alors que Sagaz fixait les prix, les conditions et les autres modalités que AIM devait négocier pour le compte de Sagaz, c'est AIM qui, en définitive, décidait de l'aide apportée à Sagaz en vue d'obtenir la clientèle de Canadian Tire. Là encore, AIM décidait combien de temps elle consacrait respectivement à Sagaz et aux autres fournisseurs qu'elle desservait. Sagaz décidait de ce qu'il y avait à faire alors que AIM déterminait comment le faire. Cela indique que Sagaz n'exerçait aucun contrôle sur M. Landow.

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In my opinion, the contravening factors such as the suggestion that the Canadian Tire account was a "house account" and the one letter written by Landow on Sagaz's letterhead, while of interest, are not sufficient to show that AIM was an employee as part of the Sagaz "sales team". I agree with the courts below that these factors likely came about because Canadian Tire preferred to deal with its suppliers, like Sagaz, directly and not through external sales agents. Looking at the non-exhaustive list of factors set out in Market Investigations, supra, including ownership of tools, hiring its own helpers, the degree of financial risk or opportunity for profit by AIM and the responsibility for investment and management, it is clear to me that, based on the total relationship of the parties, AIM was an independent contractor.

⁵⁷ On the totality of the evidence, I agree with the trial judge that AIM was in business on its own account. Absent exceptional circumstances which are not present in this case (see Atiyah, *supra*, at pp. 327-49), it follows that the relationship between Sagaz and AIM, as employer and independent contractor, is not one which attracts vicarious liability. In finding that AIM was an independent contractor and not an employee in relation to Sagaz, I need not consider the second stage of the analysis which inquires into whether the tortious conduct of an employee was committed within the scope of employment.

Design submitted that if AIM was not an independent contractor, then AIM was an agent of Sagaz and therefore Sagaz was liable for the economic tort committed by AIM in the scope and course of its authority. Absent evidence to the contrary, it cannot be presumed that the scope of AIM's authority in providing "assistance to Sagaz in retaining the goodwill of [Canadian Tire]" was so broad as to include unlawful means such as

À mon avis, en dépit de l'importance qu'ils peuvent avoir, les facteurs contraires, telles l'indication que le compte Canadian Tire était un « compte hors commission » et la lettre écrite par M. Landow sur du papier à correspondance officielle de Sagaz, ne sont pas suffisants pour démontrer que AIM faisait partie de « l'équipe de vendeurs » de Sagaz et était à ce titre un employé. Je conviens avec les tribunaux d'instance inférieure que cela était vraisemblablement dû au fait que Canadian Tire préférait traiter directement avec ses fournisseurs, comme Sagaz, plutôt que de traiter avec des représentants commerciaux indépendants. Compte tenu de la liste non exhaustive de facteurs énumérés dans la décision Market Investigations, précitée, - dont la propriété de l'outillage, l'embauche de ses propres assistants, l'étendue des risques financiers, la possibilité de profit et la responsabilité en matière de mises de fonds et de gestion — ainsi que de la relation globale entre les parties, il me paraît évident que AIM était un entrepreneur indépendant.

Je suis d'accord avec le juge de première instance pour dire que, d'après l'ensemble de la preuve, AIM exploitait une entreprise pour son propre compte. Par conséquent, à moins qu'il n'y ait des circonstances exceptionnelles (voir Atiyah, *op. cit.*, p. 327-349) — ce qui n'est pas le cas en l'espèce —, la relation employeur-entrepreneur indépendant qui existe entre Sagaz et AIM ne donne pas naissance à la responsabilité du fait d'autrui. Puisque j'ai conclu que AIM était un entrepreneur indépendant et non un employé de Sagaz, il n'est pas nécessaire de passer à la deuxième étape de l'analyse, qui vise à déterminer si l'<u>employé</u> a accompli l'acte délictueux dans l'exercice de ses fonctions.

Design a prétendu que, si AIM n'était pas un entrepreneur indépendant, elle était alors un mandataire de Sagaz et Sagaz était donc responsable du délit économique commis par AIM dans l'exercice de son pouvoir. En l'absence d'un élément de preuve contraire, on ne saurait présumer le pouvoir de AIM [TRADUCTION] « [d']aider Sagaz à obtenir la clientèle de [Canadian Tire] » était large au point de l'autoriser à recourir à des moyens illé-

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bribery. This is confirmed by the finding of the trial judge at p. 241 that "Mr. Kavana was not a party to the conspiracy of Messrs. Summers and Landow". As well he also found at p. 245 "that it has not been proven on a balance of probabilities that Mr. Kavana knew of the bribery by Mr. Landow". In the result, the payment of the bribe by AIM to Summers exceeded the actual and apparent authority of AIM as representative of Sagaz.

B. Motion to Reopen the Trial

After the trial judge's reasons were released, but before the formal judgment was entered, Landow, who did not testify at trial, gave Design an affidavit admitting to the conspiracy to bribe and implicating Kavana in the conspiracy. Design brought a motion to have the trial reopened to hear the fresh evidence. The trial judge applied the two-part test from Scott, supra, to assist in determining whether to exercise his discretion to reopen the trial. First, he decided that the evidence, if presented at trial, probably would not have changed the result. Second, he found that the evidence could have been obtained before trial by the exercise of reasonable diligence. The Court of Appeal overturned the trial judge's decision, having found that he erred on both branches of the test and that the trial should have been reopened to hear Landow's evidence. Was the Court of Appeal in error to reverse the trial judge's exercise of discretion to refuse to reopen the trial?

This Court provided in *Hamstra (Guardian ad litem of) v. British Columbia Rugby Union*, [1997] 1 S.C.R. 1092, at para. 26:

gaux comme le versement d'un pot-de-vin. Cela est confirmé par la conclusion du juge de première instance que [TRADUCTION] « M. Kavana n'a pas participé au complot de MM. Summers et Landow » (p. 241) et « qu'il n'a pas été prouvé, selon la prépondérance des probabilités, que M. Kavana était au courant du versement du potde-vin par M. Landow » (p. 245). En définitive, le versement par AIM d'un pot-de-vin à M. Summers excédait le pouvoir réel et apparent que possédait AIM en tant que représentante de Sagaz.

B. Motion visant la réouverture du procès

Après le dépôt des motifs du juge de première instance, mais avant l'inscription du jugement formel, M. Landow, qui n'avait pas témoigné au procès, a remis à Design un affidavit dans lequel il impliquait M. Kavana et reconnaissait avoir comploté de verser un pot-de-vin. Design a présenté une motion en vue d'obtenir la réouverture du procès pour recevoir le nouvel élément de preuve. Le juge de première instance a appliqué le critère à deux volets tiré de la décision Scott, précitée, pour déterminer s'il devait exercer son pouvoir discrétionnaire de rouvrir le procès. Premièrement, il a décidé que l'issue du procès n'aurait vraisemblablement pas été différente si l'élément de preuve en cause avait été présenté. Deuxièmement, il a conclu qu'il aurait été possible d'obtenir l'élément de preuve avant le procès en faisant preuve de diligence raisonnable. La Cour d'appel a infirmé la décision du juge de première instance après avoir conclu qu'il avait commis une erreur concernant chacun des deux volets du critère et que le procès aurait dû être rouvert pour entendre le témoignage de M. Landow. La Cour d'appel a-t-elle eu tort d'infirmer la décision discrétionnaire du juge de première instance de refuser de rouvrir le procès?

Notre Cour a affirmé dans l'arrêt *Hamstra* (*Tuteur à l'instance de*) c. British Columbia Rugby Union, [1997] 1 R.C.S. 1092, par. 26 :

Il est établi depuis longtemps qu'en l'absence d'une erreur de droit une cour d'appel ne devrait pas toucher à l'exercice du pouvoir discrétionnaire du juge de première instance au cours d'un procès.



It has long been established that, absent an error of law, an appellate court should not interfere with the exercise by a trial judge of his or her discretion in the conduct of a trial.

Appellate courts should defer to the trial judge who is in the best position to decide whether, at the expense of finality, fairness dictates that the trial be reopened. See *Clayton v. British American Securities Ltd.*, [1934] 3 W.W.R. 257 (B.C.C.A.), at p. 295:

[The trial judge] would of course discourage unwarranted attempts to bring forward new evidence available at the trial to disturb the basis of a judgment delivered or to permit a litigant after discovering the effect of a judgment to re-establish a broken-down case with the aid of further proof.

- ⁶¹ Further, the case law dictates that the trial judge must exercise his discretion to reopen the trial "sparingly and with the greatest care" so that "fraud and abuse of the Court's processes" do not result (see *Clayton*, *supra*, at p. 295, cited in *Scott*, at p. 774).
- 62 In this case, the trial judge decided not to exercise his discretion to reopen the trial because neither of the two steps of the test in Scott, supra, was met to his satisfaction. First, he found that he could not say that the new evidence, if presented at trial, would probably have changed the result, only that it may have changed the result. If the trial were to be reopened, Landow's evidence might well not be believed. His credibility would be in issue. Second, the trial judge found that Landow's evidence could have been obtained before trial. Design could have compelled Landow to testify under oath at trial. While this carried some risk, the trial judge viewed it as a trial strategy, a conclusion he was entitled to reach.
 - In my opinion, the Court of Appeal erred in substituting its discretion for that of the trial judge in deciding to reopen the trial. On the first branch of the test set out in *Scott*, the trial judge found that

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Les cours d'appel doivent faire preuve de retenue envers le juge de première instance qui est le mieux placé pour déterminer si l'équité exige de faire un accroc au caractère définitif du procès et de le rouvrir. Voir *Clayton c. British American Securities Ltd.*, [1934] 3 W.W.R. 257 (C.A.C.-B.), p. 295 :

[TRADUCTION] [Le juge de première instance] découragerait bien sûr les tentatives injustifiées de présenter un nouvel élément de preuve — qui existe au moment du procès — dans le but d'ébranler le fondement d'un jugement rendu ou de permettre à une partie ayant pris connaissance de l'effet d'un jugement de redresser une preuve chancelante au moyen d'un autre élément de preuve.

De plus, la jurisprudence exige que le juge de première instance n'exerce son pouvoir discrétionnaire de rouvrir le procès qu'[TRADUCTION] « avec modération et la plus grande prudence » de façon à éviter « la supercherie et le recours abusif aux tribunaux » (voir *Clayton*, précité, p. 295, cité dans *Scott*, p. 774).

En l'espèce, le juge de première instance a décidé de ne pas exercer son pouvoir discrétionnaire de rouvrir le procès parce qu'il estimait que l'on n'avait satisfait à ni l'un ni l'autre des deux volets du critère de la décision Scott, précitée. Premièrement, il a conclu qu'il était possible d'affirmer non pas que l'issue du procès aurait vraisemblablement été différente si le nouvel élément de preuve avait été présenté, mais seulement qu'elle aurait pu être différente. Il se pourrait, si le procès était rouvert, que l'on n'ajoute pas foi à l'élément de preuve de M. Landow. Sa crédibilité serait mise en doute. Deuxièmement, le juge de première instance a décidé que l'élément de preuve de M. Landow aurait pu être obtenu avant le procès. Design aurait pu le forcer à témoigner sous serment au procès. Il a estimé qu'en dépit du risque qu'elle comportait une telle démarche était une stratégie de procès, et il lui était loisible de tirer cette conclusion.

Je suis d'avis que la Cour d'appel a eu tort de substituer son pouvoir discrétionnaire à celui du juge de première instance en décidant de rouvrir le procès. En ce qui concerne le premier volet du criLandow's credibility would be in issue whereas the Court of Appeal found it difficult to see how the trial judge could make this determination without hearing Landow testify. In the Court of Appeal's determination, it was not sufficiently clear that Landow would be disbelieved. I disagree with the Court of Appeal on this point. Landow's affidavit evidence contradicts his sworn evidence on discovery, particularly with respect to the existence of the bribery scheme which Landow avoids acknowledging on discovery. To this significant extent, Landow is akin to a recanting liar. Lord Denning's comments in *Ladd v. Marshall*, [1954] 1 W.L.R. 1489 (C.A.), at p. 1491, are applicable:

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It is very rare that application is made to this court for a new trial on the ground that a witness has told a lie. The principles to be applied are the same as those always applied when fresh evidence is sought to be introduced. To justify the reception of fresh evidence or a new trial, three conditions must be fulfilled: first, it must be shown that the evidence could not have been obtained with reasonable diligence for use at the trial; secondly, the evidence must be such that, if given, it would probably have an important influence on the result of the case, though it need not be decisive; thirdly, the evidence must be such as is presumably to be believed, or in other words, it must be apparently credible, though it need not be incontrovertible.

We have to apply those principles to the case where a witness comes and says: "I told a lie but nevertheless I now want to 'tell the truth'". It seems to me that the fresh evidence of such a witness will not as a rule satisfy the third condition. A confessed liar cannot usually be accepted as being credible. To justify the reception of the fresh evidence, some good reason must be shown why a lie was told in the first instance, and good ground given for thinking the witness will tell the truth on the second occasion. [Emphasis added.]

These comments, in my opinion, apply with equal force to the present case. Landow is akin to a "recanting liar" because he failed to tell his "truth"

tère de la décision Scott, le juge de première instance a conclu que la crédibilité de M. Landow serait mise en question, tandis que la Cour d'appel a jugé qu'il était difficile de voir comment le juge de première instance pouvait tirer cette conclusion sans avoir entendu le témoignage de M. Landow. La Cour d'appel a estimé qu'il n'était pas suffisamment évident que M. Landow ne serait pas cru. Je ne suis pas de cet avis. L'affidavit de M. Landow contredit le témoignage qu'il a fait sous serment lors de l'interrogatoire préalable, en particulier en ce qui concerne l'existence du système de pots-de-vin, qu'il avait alors évité de reconnaître. Dans cette large mesure, M. Landow ressemble à un menteur qui se rétracte. Les observations de lord Denning dans l'arrêt Ladd c. Marshall, [1954] 1 W.L.R. 1489 (C.A.), p. 1491, sont pertinentes :

[TRADUCTION] Il arrive très rarement qu'on demande à la cour d'ordonner un nouveau procès parce qu'un témoin a menti. Les principes qui doivent être appliqués sont les mêmes que ceux qui sont toujours appliqués dans le cas d'une demande de présentation de nouveaux éléments de preuve. Trois conditions doivent être remplies pour justifier la réception d'un nouvel élément de preuve ou la tenue d'un nouveau procès. Premièrement, il faut démontrer qu'il n'aurait pas été possible en faisant preuve de diligence raisonnable d'obtenir l'élément de preuve pour le procès. Deuxièmement, il doit s'agir d'un élément de preuve qui, s'il était présenté, aurait probablement une influence importante sur l'issue de l'affaire; il n'est pas nécessaire toutefois qu'il soit déterminant. Troisièmement, l'élément de preuve doit pouvoir être présumé crédible ou, autrement dit, il doit être apparemment crédible, bien qu'il n'ait pas à être irréfutable.

Nous devons appliquer ces principes à la situation où un témoin vient affirmer : « J'ai menti, mais malgré cela, je veux maintenant "dire la vérité" ». Il me semble qu'en principe ce nouvel élément de preuve ne satisfait pas à la troisième condition. Un menteur avoué ne peut habituellement pas être jugé crédible. Pour justifier la réception d'un nouvel élément de preuve, il faut expliquer de façon satisfaisante pourquoi le témoin a d'abord menti et pourquoi on pense qu'il dira maintenant la vérité. [Je souligne.]

J'estime que ces propos sont tout aussi applicables en l'espèce. Monsieur Landow ressemble à un « menteur qui se rétracte », car il a omis de dire

when he had the opportunity to do so on discovery and again when he declined to testify at trial. Although the determination in Ladd was made under the third branch of the test applied in that case, a branch that is absent from the two-part test in Scott, the application of the Scott test to the situation of a "recanting liar" has the same result in this case. Evidence which is not presumptively credible may fail to probably change the result under the first branch of the test in Scott. This is how the trial judge dealt with the affidavit evidence, and in my view he was correct in so doing. Further, it cannot be ignored that the trial decision imposing liability on Landow and AIM provided incentive for Landow to attempt to shift some responsibility to Kavana in order to share the liability of the corresponding damage award. The trial judge had also seen the evidence of Kavana in the first instance, which he found to be credible even in the face of a vigorous cross-examination.

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The court in *Scott* mandated that both branches of the test to reopen a trial to admit fresh evidence must be met. Having failed to meet the first branch of the test, it is unnecessary to examine whether the precluded evidence in this case could have been obtained by the exercise of reasonable diligence. It is sufficient to say that that too is a matter largely within the discretion of the trial judge and, absent error by him, that finding should not be interfered with.

V. Disposition

The appeal is allowed with costs to the appellants in this Court and in the Court of Appeal. The order of the Court of Appeal is set aside. The order of Cumming J., dated December 23, 1998, is restored.

Appeal allowed with costs.

ce qui était selon lui la vérité lorsqu'il lui était possible de le faire au cours de l'interrogatoire préalable et, de nouveau, lorsqu'il a refusé de témoigner au procès. Bien que la décision Ladd ait été fondée sur le troisième volet du critère appliqué dans cette affaire, lequel volet est absent du critère à deux volets de la décision Scott, l'application de ce dernier critère à la situation d'un « menteur qui se rétracte » entraîne le même résultat en l'espèce. Un élément de preuve qui n'est pas présumé crédible ne contribuera vraisemblablement pas à modifier l'issue du procès, au sens du premier volet du critère de la décision Scott. Telle est la façon dont le juge de première instance a traité la preuve constituée d'un affidavit et j'estime qu'il a eu raison d'agir ainsi. Il ne faut pas oublier non plus que la décision de première instance imputant une responsabilité à M. Landow et à AIM était de nature à inciter M. Landow à tenter d'en faire assumer une partie par M. Kavana pour qu'il participe au paiement des dommages-intérêts accordés. Le juge de première instance avait aussi, dès le départ, pris connaissance du témoignage de M. Kavana qu'il a jugé crédible même après un vigoureux contreinterrogatoire.

Dans la décision *Scott*, la cour précise qu'il ne peut y avoir réouverture d'un procès pour admettre un nouvel élément de preuve que si l'on a satisfait aux deux volets du critère. Étant donné que l'on n'a pas satisfait au premier volet, il n'est pas nécessaire d'examiner s'il aurait été possible en l'espèce d'obtenir l'élément de preuve écarté en faisait preuve de diligence raisonnable. Il suffit de dire que cette question relève elle aussi largement du pouvoir discrétionnaire du juge de première instance et qu'il n'y a pas lieu de modifier la conclusion de ce dernier en l'absence d'une erreur de sa part.

V. Dispositif

Le pourvoi est accueilli avec dépens en faveur des appelants en notre Cour et en Cour d'appel. L'ordonnance de la Cour d'appel est annulée. L'ordonnance du juge Cumming datée du 23 décembre 1998 est rétablie.

Pourvoi accueilli avec dépens.

Solicitors for the appellants: Torys, Toronto.

Solicitors for the respondent: Teplitsky, Colson, Toronto.

Procureurs des appelants : Torys, Toronto.

Procureurs de l'intimée : Teplitsky, Colson, Toronto.

TAB 3

In the Court of Appeal of Alberta

Citation: Alberta (Child, Youth and Family Enhancement, Director) v. B.M., 2009 ABCA 258

Date: 20090723 Docket: 0703-0362-AC Registry: Edmonton

Between:

Alberta (Director of Child Youth and Family Enhancement)

Respondent/Applicant (Respondent)

- and -

B.M.

Applicant/Respondent (Appellant)

Restriction on Publication: No one may publish any information serving to identify a child or guardian of a child who has come to a Minister's or a director's attention under the *Child, Youth and Family Enhancement Act.* See the *Child, Youth and Family Enhancement Act*, s. 126.2.

Reasons for Decision of The Honourable Mr. Justice Jean Côté

Application to Vacate/Vary Civil Contempt

Reasons for Decision of The Honourable Mr. Justice Jean Côté

A. Introduction

[1] On June 23, 2009, I convicted the Director of Child, Youth and Family Enhancement, Richard Ouellet, of civil contempt of court. That involved failure to obey a Court of Appeal judgment, 2009 ABCA 40, 448 A.R. 53 (Jan. 30), *sub nom.* "B.M.". The reasons which I gave then were oral, but they have since been transcribed, and a copy of them is attached as Appendix A to the present Reasons.

[2] After giving those reasons for conviction, I then heard oral argument on penalty and reserved decision on penalty. Before I could give a decision on penalty, the Court received a letter on June 26 from Mr. Cranston, Q.C., the new lawyer for Mr. Ouellet. A copy of that letter is attached as Appendix B. It proposed to reopen and upset the contempt conviction on one topic. On July 10 a similar notice of motion was filed by Mr. Cranston, Q.C. on behalf of Mr. Ouellet, relying on proposed new evidence in the form of an affidavit by Mr. Ouellet.

[3] At the beginning of oral argument of this motion to reopen, it was agreed that I could decide all together the three questions before me:

- (a) whether to hear further argument,
- (b) whether to receive further evidence, and
- (c) whether to set aside the conviction for contempt in part or in whole.

So none of these questions would be decided separately. There was a request to cross-examine Mr. Ouellet on his affidavit, and similarly that cross-examination evidence would be heard tentatively.

[4] Mr. Ouellet then took the stand and was sworn, and Ms. Kellett cross-examined him live in front of me. There was re-examination by Mr. Cranston, Q.C., and further cross-examination by Ms. Kellett. After that, I heard oral argument from Ms. Kellett and Mr. Cranston, Q.C., and very briefly from Ms. Harwardt. (Counsel for the child and the Band were served, but did not attend.) I then reserved decision. My decision is found below.

B. Facts

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[5] Sufficient facts appear in the original Oral Reasons for Decision, Appendix A. But those oral Reasons were vague on one point, which was who was the appellant. In the Court of Queen's Bench, the Director was, and got a stay; in the Court of Appeal, B.M. was and got a stay.

[6] Mr. Ouellet was present for the June 23 contempt motion (except the first preliminary minutes). He was seated beside his lawyer, Ms. Harwardt, at the counsel table. He heard everything that she said about liability and penalty, and indeed he spoke some words himself.

[7] There is one loose end in the oral Reasons, Appendix A. On pp. 39-40 of them, I referred to a British Columbia decision about a union holding a discussion or taking a vote about whether to obey a court order. No name or citation was given in the oral reasons, but I believe that the decision to which I was referring is *R. v. United Fisherman & Allied Workers' Union* (1967) 62 W.W.R. 65 (B.C. C.A.), leave den. [1968] S.C.R. 255.

[8] Other facts are mentioned below under the specific legal topics to which they relate.

C. Reopening a Decision

1. The Tests

(a) General Tests

[9] The question here is what are the tests for reopening and varying a decision made by a judge before the formal order or judgment resulting from his or her decision has been signed and entered. It is not necessary to discuss here either

- (a) reopening one party's case before any decision has been pronounced by the judge, nor
- (b) attempts to reconsider or amend decisions which have been reduced to a signed entered order or judgment, nor
- (c) reopening or setting aside judgments or orders which were given *ex parte* or were obtained through fraud or perjury.

[10] It is usually impossible to open up, reconsider, or vary a decision after the formal judgment has been signed and entered. In that case, the judge simply has no jurisdiction to do so. That bar does not exist where the judgment has not been formally entered, and some cases simply make that point and say no more. But a number of more recent cases have pointed out that it is not enough simply to say that the judge has jurisdiction to reopen the matter. The question is whether he or she **should** reopen the matter, and under what circumstances.

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[11] Leaving aside those cases which do not discuss the point, or simply go off on want of jurisdiction because of formal entered order or judgment, the cases all seem to agree on one thing. That is that the Courts should be very sparing in their reopening of a pronounced decision, and should not do so simply for the asking. This is not an occasion for the losing party to advance new argument which he or she simply did not think of before. Or worse still, one which he or she held back. If parties are not forced to prove fully their whole case once and for all, then endless wrangling and never-ending rehearings will result: *Kay v. Wirstiuk* (1977) 8 A.R. 405 (para. 18); *Simpson v. The Co-operators*, 1998 ABCA 302, 228 A.R. 96 (C.A.); *Sagaz Ind. Can. v. 671122 Ont.*, 2001 SCC 59, [2001] 2 S.C.R. 983, 274 N.R. 366 (para. 61).

[12] Much the same is true of the question of whether to admit further evidence on that motion to vary the earlier pronounced judgment or order. Indeed, most of the cases say that the rules as to when that should or should not be done are very similar to the well-known rules for receiving new evidence on appeal to the Court of Appeal. (Doubts on that in *Stevenson v. Dandy* (1918) 43 D.L.R. 238 (Alta. C.A.) are overruled by *Sagaz Ind. Can. v. 671122 Ont.*, *supra*). Those rules for new evidence are variously stated, but usually boil down to the following:

- Could the evidence have been obtained earlier if due diligence had been observed? *Nat. Arts v. Bank of B.C.* (1981) 31 A.R. 205, 214 (para. 32); *Guaranty Tr. Co. of Can. v. Bailey* (1986) 72 A.R. 303 (C.A.); *Sagaz Ind. v. 671122 Ont., supra* (paras. 59, 62); *Re Petruik Est.* (2002) 314 A.R. 330 (para. 35). That the evidence was available to the applicant but not looked for because it was hard to access and because other matters pressed, is fatal: *Nat. Arts v. Bank of B.C., supra* (para. 33).
- 2. Is the evidence credible? *Re Petruik Est.*, *supra* (para. 38).
- 3. Would the evidence have been practically conclusive in producing the opposite result to that earlier pronounced? *Friesen v. Braun* [1926] 2 D.L.R. 1032 (Sask. C.A.); *Kay v. Wirstiuk*, *supra* (para. 22); *F.B.D.B. v. Silver Spoon etc.*, 2000 NSCA 138, 189 N.S.R. (2d) 133 (paras. 8-9). A debatable matter of opinion is not sufficient: *Kay v. Wirstiuk*, *supra* (para. 33). Nor is controvertible evidence which would open up an extremely complex and convoluted exercise: *Luscar v. Pembina (#2)* (1992) 128 A.R. 77 (para. 13). Some criminal cases use a test less strict, such as likely to produce a different result. The difference does not matter here. Neither version of this test is met.
- 4. Is the evidence in its present form admissible under the ordinary rules of evidence? *R. v. R.S.D.L.*, 2009 NSCA 74, [2009] N.S.J. #289, file CAC 277660 (June 24) (para. 17).

[13] A number of the cases give various criteria for deciding whether to reopen a decision, and vary it on the merits. The cases do not disagree, but no one case lists all the criteria. Among those commonly listed are the following:

- Would there be a miscarriage of justice without the reopening? *Caisse Pop. de Morinville v. Pasay* (1982) 47 A.R. 311, 317 (M.) (para. 39); *Fullowka v. Royal Oak Ventures*, 2002 NWTSC 14, File CV 05408 (para. 4) (Feb. 20), <u>affd.</u> 2002 NWTCA 3, [2003] 2 W.W.R. 213. This is similar to the requirement that new evidence be practically conclusive in changing the result: *Caisse Pop. de Morinville v. Pasay*, *supra*.
- The power to reopen is to be used sparingly, and the pronounced decision is not to be taken away without very solid grounds: *Luscar v. Pembina Res. (#2)*, *supra* (para. 8, subparas. 4,5); *Fullowka v. Royal Oak*, *supra* (paras. 4-5); *Alta. Turkey Prod. v. Leth (#2)*, 2006 ABQB 283, 399 A.R. 259 (para. 24).
- 3. Is the applicant trying to raise a new issue which he could have raised earlier? *Luscar v. Pembina Res. (#2)*, *supra* (para. 10).
- A new argument alone is not enough; new important facts are necessary: *Public School Boards Assn. v. A.-G. Alta. (#3)* (1998) 209 A.R. 384 (one J.A.) (para. 13); *Becker v. Dir. of Empl. Stds. (#2)*, 2003 ABCA 130, Calg. 01-17856 (one J.A. Apr. 16); *Proprietary Ind. v. Workum*, 2006 ABCA 226, 391 A.R. 137 (para. 6); *Chevron Can. Res. v. Dir. of Indian Oil etc.*, 2006 ABQB 946, [2007] 7 W.W.R. 696, 701, 418 A.R. 166 (paras, 6, 10).
- 5. Has any other party relied on the order to its detriment? (Discussed in subpart (g) below.)
- 6. Does the applicant's new factual stance contradict his earlier factual assertions or evidence? (Discussed in subpart (e) below.)

[14] However, the law in this area is developing, and few of the reported cases say that the criteria which they list are exclusive. To put it another way, few of those cases say that meeting all those criteria is sufficient and should lead the judge to reopen his or her decision. As the case law develops and more fact situations are considered by the Courts, I have no doubt that further criteria will be developed.

(b) The Test in Contempt

It has been suggested that the Courts should be more willing to reopen a pronounced but [15] unentered decision finding civil contempt than they would be for other types of order. See Berube v. Wingrowich (#4), 1999 ABQB 698, 2 Alta. L.R. (4th) 59 (affirmed orally on unrecorded grounds C.A. Nov. 26 '02, Edm. file #9903-0432-AC). I have three reservations about that distinction. First, there might be some exceptions to it. For example, a purely procedural decision, especially one dealing with logistics and practicalities, would probably be easier to reopen. However, there may be something to be said for the philosophical approach of being more receptive to reopening pronounced but unentered finding of civil contempt on the merits, than for doing so for another type of substantive judgment such as debt or liability in tort. Second, however, in my view any different approach for contempt must be handled on an [16] issue-by-issue basis. There may be certain types of criteria which should be more laxly applied in a contempt case, but not other bars such as dishonesty, holding a point in reserve to see if it is needed, election or estoppel, or (especially) prejudice to the other side. In those cases, I can see no reason why the reopening rules should be more lax in the case of civil contempt.

[17] Third, I would also draw a distinction as to whether the contempt is ongoing, or whether it has finished and performance has been given or the harm done has been repaired. Someone who temporarily violated a court order and has since repaired the harm, is not in the same position as someone who is still refusing or neglecting to perform a court order against him or her.

[18] For about 12 days after the contempt motion was filed here (and 18 days after the Court of Appeal clarified its judgment), everyone concerned on the government side was in clear and obvious breach of the Court of Appeal judgment.

2. Obstacles to Reopening the Contempt Motion Here

- (a) No Legal Error
 - (i) General

[19] The grounds advanced for reconsidering the contempt conviction are factual, not legal. I did not understand any error of law to have been suggested by counsel. Nor has one come to my attention during argument of the reopening motion.

[20] In any event, none of the points raised could get anywhere without further evidence, maybe even without removing or somehow impairing some of the facts given to the Court during the earlier proceeding. That makes the tests for admitting new evidence doubly important.

(ii) Personal Liability

[21] On this motion to reopen, counsel for Mr. Ouellet constantly referred to "Mr. Ouellet in his personal capacity" and contrasted that with his official capacity. He cited no authority for such a distinction, and I know of none in law.

[22] Consider an example. If the Director, without lawful authority, seizes some private clothing or documents (or instructs an official to do so), that is the tort of conversion. The Director is personally liable for that tort, and his own bank account can be garnished to pay the judgment. That also extends to criminal liability. And it is a key rule of our constitution. Hence my quotation from Dicey's authoritative text, and its approval in *Roncarelli v. Duplessis* [1959] S.C.R. 121. See my June 23 oral judgment, Appendix A.

[23] I am beginning to wonder whether Mr. Ouellet paid much attention to that portion of my decision, though he sat at the counsel table during its pronouncement.

(iii) Mandatory Court Orders

[24] I must also discuss disobedience of mandatory court orders or judgments.

[25] A great deal of case law on what is contempt of court by disobeying an injunction or other court order, is not so general as it appears on the surface. Most of those decisions are about disobeying a negative injunction; in other words, an order forbidding someone to do something either expressly or by implication. But the present case involves disobedience of positive judgment directing someone to do something (return the child to the previous foster home). Therefore, many aspects of the cases on negative injunctions and their disobedience are distinguishable.

[26] If a negative injunction is issued **forbidding** someone to do something (such as using someone else's name or trade name in connection with his own business), what need the person so enjoined do? He or she need do nothing whatever (unless he or she has already set in motion steps to do the forbidden act). And if someone else disobeys that injunction, the party enjoined is not liable unless he or she has done something to aid, abet, assist, encourage or instruct that (or has earlier instructed it and not cancelled those instructions).

[27] But it is very different when a court judgment or order is given directing someone to **do** something. Then doing nothing is not an alternative. Simply doing nothing is itself contempt. Furthermore, it is not enough to take feeble and ineffective steps. For example, to simply ask someone else to follow the order without sufficient steps to ensure that that person is reliable, understands the task, will give it sufficient priority, has sufficient resources and understanding, and so forth. In other words, negligent or inadequate attempts to obey the court order or to obey it in due course, are themselves contempt of court. Such a failure to obey by relying carelessly on others, is in no sense vicarious liability. The duty is that of the person commanded.

[28] The rule of law is not disputed by anyone in the present motion, and indeed *Michel v. Lafrentz*, 1998 ABCA 231, 219 A.R. 192 was reproduced and cited by new counsel for Mr. Ouellet. It reviews the authorities holding that due diligence is contempt where the order disobeyed is mandatory rather than negative. And since then, that proposition in *Michel v. Lafrentz* has been approved by a panel of the Alberta Court of Appeal. See *Broda v. Broda*, 2004 ABCA 72, 346 A.R. 372 (para. 7).

[29] I mention this because it is important to note the narrow scope of the motion to reopen the contempt conviction here. It was simply based on the theory that Mr. Ouellet never was involved with this child. The implication was that the judgment should not have been made against him, or that somehow, despite its wording, he need not have carried it out.

(b) Lack of Due Diligence in Adducing Evidence

[30] All the facts raised on behalf of Mr. Ouellet by his counsel on the motion to reopen were matters very well known to Mr. Ouellet for a long time. He is the only person whose new evidence was adduced, and he does not suggest that any of the substantive matters which he raises were brought to his attention, or learned through other people. It is true that his new evidence says that at the relevant times he did not know certain things, but he has known for a long time that he did not know them. He knew on June 10 and June 23 that he did not know them. In other words, it is his own personal knowledge or ignorance which is at issue. He sought no adjournment on June 23.

[31] In my view, due diligence is one of the criteria to be weighed when deciding whether to take the rare step of reopening a pronounced decision. Litigation will rarely have any finality if a party can keep disclosing another part of his or her case, confident in the knowledge that if that does not work, he can wait, hear the judge's decision, and then adduce some more evidence, and try again to plug whatever holes in the case that the judge has identified. There is already far too much tendency in Alberta in the last ten years to relitigate decided points.

[32] The matter is even clearer when the issue is adducing new evidence not adduced at the first hearing. Case law is unanimous that that is the first hurdle to be overcome when someone seeks to adduce new evidence to reopen a pronounced decision (or on appeal). (See para. 12(1) *supra*.)

[33] This also ties in with a number of the other points below, especially point (e). Lack of diligence in raising the argument or the additional evidence becomes acute when there is any indication that there is any inconsistency between the two positions, or that a tactical or strategic choice has been made.

(c) New Evidence of June 5 Contempt Not Favorable

[34] The June 23 conviction for civil contempt was based on conduct or inaction at two periods of time. One of them was the period from June 5 to the actual return of the child on June 22.

[35] The new evidence adduced with respect to that period is not practically conclusive, and would not have likely produced the opposite result (acquittal) if adduced promptly before June 23.

[36] Indeed, the opposite is correct. The new evidence would be fatal for Mr. Ouellet on this point if adduced. It shows that on June 5 he learned the following. A Court of Appeal decision of January 30 had not yet been obeyed, though the Court of Appeal on June 4 had clarified what should be done. None of the various officials directly concerned had yet returned the child, and they were still considering legal alternatives to returning the child, i.e. trying to see if there was

something which they could legally do to avoid returning the child, and in some fuzzy way were balancing the disadvantages of obeying the judgment.

[37] The officials asked for direction from Mr. Ouellet. He simply told them that he was satisfied with the course which they were following. He did not tell them that they could not wiggle out of obeying the order, nor that wasting time looking for alternatives to obedience was wrong. He did not say to return the child. Indeed he told me in open court on June 23 that the officials' task on June 5 was to balance the conflicting interests of the two foster families and the child. The totality of his written and oral evidence on July 10 and 14 was largely consistent with that (though he went back and forth on that). So is Mr. Gillis' affidavit (para. 17) consistent. Nor did Mr. Ouellet set any deadlines, nor inquire into how quickly the child would be returned, nor the methods which would be used. He was content to leave it with the debating officials.

[38] Nor did Mr. Ouellet ask them to report, nor set up any checking or diarization methods.

[39] Yet Mr. Ouellet admitted that he had full power to give those other officials binding directions, and that he had a duty to act if he saw something wrong, including a court order not obeyed. The warning to all staff to comply with court orders by his successor (Acting Director) was within that official's powers. It is freely admitted (and in evidence) that Mr. Ouellet was at all relevant times the Director, and he knew that he was.

[40] Worst of all, just before the meeting Mr. Ouellet was given a packet of material relating to this problem, but never read it, whether before or after the meeting.

[41] I must emphasize that Mr. Ouellet knew throughout this time that counsel for the successful appellant to whom the child was to be returned was seeking a finding of contempt.

[42] Therefore, it would be no kindness to Mr. Ouellet to admit this new evidence, nor to reconsider contempt on June 5 or thereafter. To do so would only make matters worse for Mr. Ouellet.

[43] I do not want to give the impression that only Mr. Ouellet's evidence supports a finding of contempt on June 5 or later. As noted, Mr. Gillis' affidavit (filed June 22 to resist the contempt motion) contains similar statements confirming the contempt.

(d) New Evidence not Favorable Respecting Events Before June 5

[44] For this period also, the overall effect of the new evidence tendered would do Mr. Ouellet very little good. It would be the opposite of conclusive, and in considerable part admitting the new evidence would simply confirm the findings of contempt before June 5. I discuss below five particulars.

(i) No System or Diligence

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[45] The new evidence (if received) confirms that Mr. Ouellet had no system whatsoever for follow-up or supervision of whether court orders against the Director were being obeyed; not even when the litigation had got as high as an appeal to the Court of Appeal. The Court of Appeal judgment was issued January 30, clarified June 4, contempt threatened June 4, formally moved for June 10, and the child was not returned until June 22. Yet throughout that period of almost five months, Mr. Ouellet had no idea whether or when the child had been returned, and did not ask. Apparently no one was supposed to tell him. The last that Mr. Ouellet knew (on June 5) was that the child had **not** been returned, and that whether to return the child was being discussed. He still knew nothing and made no inquiries up to June 23.

[46] That posture continued despite the fact that systems in place within the government required that the Director make a recommendation to the Deputy Minister before an appeal could be launched even to the Court of Queen's Bench (and such an appeal was launched here).

[47] Crown officials have a duty to respect private legal rights, and to have the court clarify its injunctions, not to disregard court orders in cases of doubt: *E. Tr. Co. v. McKenzie Mann & Co.* [1915] A.C. 750, 84 L.J.P.C. 152, at p. 156 (P.C.(Can.)).

[48] It cannot be suggested (and no one did) that Mr. Ouellet was ignorant of the fact that he was the party named in most or all Alberta court proceedings involving child protection. Indeed he more or less swears to that in para. 7 of his July 10 affidavit for this motion to reopen. Examination of a database for Court of Queen's Bench and Alberta Provincial Court judgments for the last two years reveals 40 and 44 relevant judgments respectively naming the Director of Child Welfare or the Director of Child, Youth and Family Enhancement. (Because of appeals, probably some cases appear more than once.) There is only one relevant case naming any Child and Family Services Authority.

[49] Even if obeying a court order takes time and preparation, that is still no excuse for nonperformance, where previous time to prepare or begin the task has not been used: *Whitemud Hills etc. v. Balogun*, 2005 ABQB 541, [2005] A.R. Uned. 540 (July 7) (paras. 13, 16). On the need for diligence to obey a court or order, see *Michel v. Lafrentz*, *supra*; *Harding v. Tingey* (1864) 12 W.R. 684, 685; *Bird v. Hadkinson* [2000] C.P. Rep. 21, [1999] B.P.I.R. 653, *Times* Apr. 7 (1999) (Mar. 4); *Broda v. Broda*, 2004 ABCA 72, 346 A.R. 372; *Dreco Enr. Serv. v. Wenzel*, 2004 ABQB 517 (paras. 55-58); *Free Est. v. Jones*, 2004 ABQB 486, 364 A.R. 384 (paras. 28-31).

(ii) Ignorance of the Law is No Defence

[50] The best that can be said is that Mr. Ouellet seems to have had some grave misunderstandings of the law respecting Court judgments, their obedience, and contempt of court. It is even possible that he even got bad legal advice, but evidence of that is limited, and no

one has waived privilege, so I cannot pursue that aspect. I emphasize that the legal advice in question was not given by Ms. Harwardt.

[51] Ignorance of the law or even bad legal advice is not a defence to contempt of court by disobeying an order: *Free Est. v. Jones*, *supra* (para. 32); *Glazer v. Union Contractors* (1960) 33 W.W.R. 145, 173 (B.C.), <u>affd.</u> (1960) 34 W.W.R. 193, 201 (B.C. C.A.); *Baxter Travenol Labs of Can. v. Cutter* (#2) (1986) 14 D.L.R. (4th) 641, 649, <u>affd.</u> on this point (1987) 81 N.R. 220, 225 (F.C.A.). The *Glazer* case involved a Cabinet Minister, not a party to the suit, who helped a party violate an injunction.

[52] The act or omission need not be wilful to be contempt, and there need be no intent to disobey: *R. v. Daye* [1908] 2 K.B. 333, 339 (D.C.); *Baxter Travenol* case, *supra*; *A.-G. Man. v. Groupe Quebecor* [1987] 5 W.W.R. 270, 282-83, 47 Man. R. (2d) 187 (C.A.); *Bird v. Hadkinson*, *supra*, at pp. 8, 9, 10-11; *Topgro Greenhouses v. Houweling*, 2003 BCCA 355, 35 C.P.C. (5th) 313 (para. 6); *Stancomb v. Trowbridge U.D.C.* [1910] 2 Ch. 190; *Broda v. Broda*, *supra* (para. 7).

[53] But reliance on bad legal advice, or good intent, can mitigate the punishment.

(iii) Mistaken Order is not a Defence to Contempt

[54] The new defence to the contempt motion which is raised on this motion to reconsider boils down to the following. Other branches of the government, or other entities or people authorized by the government such as regional authorities, are the ones who were involved with this child. So the Courts, especially the Court of Appeal, should not have made an order that Mr. Ouellet as Director return the child.

[55][But that is the old fallacy of the *Poje* defence. See *R. v. Poje* [1953] 1 S.C.R. 516, 527-28, <u>affg.</u> *Cdn. Tpt. v. Albury* [1953] 1 D.L.R. 385 (B.C. C.A.). It is simply a suggestion that the order of the Court of Appeal was mistaken, or may have been mistaken, and that therefore the order need not be obeyed. It has been settled long before *Poje*, held then, and since repeatedly by every court in Canada, that an error or lack of foundation in the court order or injunction in question is no defence to the charge of contempt for disobeying that court order. See *E. Tr. Co. v. McKenzie Mann & Co., supra*, at 157 (L.J.P.C.); *Cdn. Human Rts. Comm. v. Cdn. Liberty Net* [1998] 1 S.C.R. 626, 224 N.R. 241, 295 (para. 50); *Regina (City) v. Cunningham* [1994] 8 W.W.R. 457, 460-61, 123 Sask R. 233; *Cdn. Tpt. (U.K.) v. Albury, supra*, <u>affd.</u> as *Poje v. A.-G. B.C., supra*; *Isaacs v. Robertson* [1985] A.C. 97, [1984] 3 W.L.R. 705, 708-09 (P.C.(St. V.)); *R. v. Bridges (#2)* (1990) 78 D.L.R. (4th) 529, 544 (B.C. C.A.).

[56] For government officials to refuse to obey an order, especially one about a person's custody, because the government thought that the order was wrong, was "unprecedented in this Court and the whole history of British law." Even at the height of the Irish rebellion, the officials

concerned were ordered imprisoned, until the government relented and obeyed the order: *Egan v. General Macready* [1921] 1 Ir. R. 265, 280.

(iv) He Had and Exercised His Duties and Powers in Law

[57] There is some evidence that in law the Director of Child, Youth and Family Enhancement was the one who had the rights and powers and duties here. Even instructions from the Child and Family Services Authority (delegate) to Alberta Justice were in effect from the Director through delegation, testified Mr. Ouellet (p. 12, ll. 20-26). And the Act which sets up the Child and Family Services Authority says that each is "an agent of the Crown in right of Alberta under the Minister's direction." (s. 6 of 2000, c. C-11). So they are not autonomous. Nor has anyone sworn that their staff do not work for the Government of Alberta.

[58] And the Director appears to have acted in this case.

[59] The current affidavit and submissions given by Mr. Ouellet on the motion to reopen would give the impression that Ms. Kellett had launched all the court proceedings using a sloppy or out-of-date style of cause, and that she is now using that technicality against Mr. Ouellet, instead of against some Child and Family Services Authority.

[60] That is not so. The court proceedings were begun by the Director, not by Ms. Kellett, and the Director chose the style of cause naming himself. (The Director was presumably Mr. Ouellet's predecessor.) I have examined the Court of Queen's Bench file #FL03 09572 and note on it these papers, filed in the name of and for the Director:

- 1. Notice of appeal July 19, 2007,
- 2. Notice of motion for stay of execution in favor of Director July 19, 2007,
- 3. Affidavit in support July 20, 2007,
- 4. Formal order granting Director a stay September 24, 2007,
- 5. Memorandum in support of appeal to Court of Queen's Bench September 14, 2007, and
- 6. Formal order allowing appeal in favor of Director November 30, 2007.

The evidence on the contempt motion shows clearly that the Director has taken the fruits of that stay and that appeal.

[61] Mr. Ouellet's testimony said that formal policy required that he advise and recommend any such appeal to the Deputy Minister, though he could not find paperwork on that for this appeal.

[62] The style of cause in the Court of Appeal is identical to that chosen and used by the Director in the Court of Queen's Bench.

[63] I am not willing to assume (without strong evidence) that counsel in the Court of Queen's Bench filing all these papers, and making all the statements in them, acted without authority and so practised a gross deception on the Court of Queen's Bench. Rather, I must take it that these papers were true and authorized.

[64] Furthermore, the sworn affidavit (item 3) used to get the Court of Queen's Bench stay (item 4) is by a case worker with personal knowledge. She speaks only of the Ministry, not of any Child and Family Services Authority, and says that the decisions under appeal were by the Director (paras. 7-10), and that the Director was then opposing the (present appellant's) application to change guardians.

[65] Even in the Court of Appeal, counsel signed and filed a factum in the name of the Director.

(v) Legal Rights, Powers and Duties Do Not Depend on Administrative Reporting Pathways

[66] Administrative structure is not the same as law.

[67] New evidence was tendered as to the extremely convoluted and puzzling structure of who administratively is involved with child protection in Alberta, and the various ways that Mr. Ouellet as Director of Child, Youth and Family Enhancement was involved in child protection proceedings, including adoption proceedings.

[68] Mr. Ouellet seems to think that because the people involved on the ground were not reporting directly to him in a functional sense, that the Court should ignore the fact that he had full legal and administrative powers (as his July 14 evidence would confirm) to see to obedience of court orders like the one in question. And his counsel's argument ignores the fact that changing administrative set-ups or introducing other people cannot change what in law are the powers and duties of the Director, particularly to obey a court order. Administrative arrangements cannot remove legal duties.

[69] That someone is only a party named in the style of cause, and is not really involved in running the lawsuit, does not exempt him from obeying an order of the court against him in that suit: *Seal & Edgelow v. Kingston* [1908] 2 K.B. 579, 582-83 (C.A.).

Page: 1

[70] New counsel for the Director places great stress on the fact that there is legal power to "delegate" the powers of the Director to various other bodies such as regional agencies. He produces a precedent for a memorandum of understanding purporting to do some of that, and extracts from some website as to others. One website entry is vague and unhelpful (except for citing a section in the legislation), and the other merely says that the Child and Family Services Authority boards "oversee the delivery of services." The precedent says that the Child and Family Services and its Chief Executive Officer is an employee of the Government of Alberta and reports both to the Deputy Minister and to the Child and Family Services Authority Boards, and ultimately the Minister governs. I find nothing in it which (if signed) would remove legal powers or duties from the Director, nor take from him any status as guardian which he was formerly given.

[71] Counsel for Mr. Ouellet seems to assume that the Director no longer has those powers (though that is not what Mr. Ouellet's cross-examination before me said). However, the Supreme Court of Canada has held that

the extent of the delegation depends upon the language of the grant, but full original powers are retained.

A.-G. N.S. v. A.-G. Can. [1951] S.C.R. 31, 46

The Supreme Court of Canada there cites and quotes with approval *Huth v. Clarke* (1890) 25 Q.B.D. 391, 395. The full passage from *Huth* is as follows:

Delegation, as that word is generally used, does not imply a parting with powers by the person who grants the delegation, but points rather to the conferring of an authority to do things which otherwise that person would have to do himself. The best illustration of the use of the word is afforded by the maxim, Delegatus non potest delegare, as to the meaning of which it is significant that it is dealt with in Broom's Legal Maxims under the law of contracts: it is never used, by legal writers, so far as I am aware, as implying that the delegating person parts with his power in such a manner as to denude himself of his rights. If it is correct to use the word in the way in which it is used in the maxim, as generally understood, the word "delegate" means little more than an agent.

[72] In Manitoba, a defendant was ordered by the court not to operate a certain business or profession. He continued notwithstanding the order, and then sought to defend himself against a contempt charge by swearing that the business was now carried on by an incorporated company.

That was no defence, absent evidence that he was not in control and not at the relevant time responsible for conduct of the business: *Macievich v. Anderson (#2)* 6 W.W.R. (ns) 488, 491-92, [1952] 4 D.L.R. 507 (Man. C.A.).

[73] It is useful to keep in mind the policy underlying the legal rules here. Even where the person who has been a party to breach of a court order is not a true party to the suit, why do the courts punish his or her contempt?

... it is a punitive jurisdiction founded upon this, that it is for the good, not of the plaintiff or of any party to the action, but of the public, that the orders of Court not be disregarded, and that people should not be permitted to assist in the breach of those orders in what is properly called contempt of Court ...

Rigby L.J. in *Seaward v. Paterson* [1897] 1 Ch. 545, 558, 66 L.J. Ch. 267, 272 (C.A.)

[74] Therefore, the Director lost none of his powers, and had no legal obstacle to obeying the Court of Appeal judgment. Mr. Ouellet's cross-examination evidence would (if admitted) confirm that.

(e) Contradictory Stance

[75] If one compares the original defence tendered on June 23 with this July 14 motion to reopen, Mr. Ouellet was not attempting to blow hot and hotter, nor to amplify the position which he took in June, simply to fill in a gap. Instead, his positions on those two dates were inconsistent.

[76] Yet he had warning: the contempt motion heard June 23 was the hearing of a notice of motion filed on June 10. And there had been written warnings before the notice of motion from the appellant's lawyer, Ms. Kellett, that such a motion would be brought, and an almost identical motion filed in the Court of Queen's Bench on June 8 and served. At the meeting on June 5, Mr. Ouellet was told personally that that contempt motion was pending. He did not read the papers and ignored the matter, and did not even bother to come to the contempt hearing on June 23 until I ordered him to attend. So at best he is the author of his own misfortune by his neglect.

[77] On June 23, Mr. Ouellet sat next to the lawyer who appeared for him. She made arguments in his favor. He never once contradicted her authority to speak for him. Indeed, when he was told that he did not have to say anything but could address the Court on the subject of guilt, he did address the Court. He then spoke along the same lines as she had previously.

[78] There was no hint then of any of the factual matters which were raised in the reopening motion heard on July 14.

[79] I have very considerable difficulty in reconciling a number of the things which Mr. Ouellet said in his affidavit filed in July for the reopening motion, and said in his cross-examination and re-examination on July 14, with

- (a) what he and his counsel had earlier said on June 23 re liability or when speaking to penalty after the conviction had been entered, or
- (b) what was said in a sworn affidavit of Mr. Gillis which was filed by his first counsel to oppose the motion, and referred to in his presence during the June 23 hearing.

[80] Mr. Ouellet's July 10 affidavit, filed to reopen the contempt conviction, in essence says that all these matters are and were run by Child and Family Services Authorities, independent bodies which he did not supervise, and so he had no connection. (He took some of that back in his July 14 cross-examination.)

[81] But the June 23 submissions of Ms. Harwardt as to liability were different. She said merely that there were many children in care, and that Mr. Ouellet could not personally be familiar with every case, and that he delegated responsibility to many people (pp. 8, 26). (Similar was p. 51 on penalty.) Obviously Mr. Ouellet had to make the final determination how to return the child, she said (p. 27, ll. 26-27).

[82] Significantly, Ms. Harwardt emphasized that the Director was and is the guardian of this child (p. 28, ll. 1-6). That may well be true. Examination of the Court of Queen's Bench adoption file shows certified copies of two Provincial Court orders dated September 24, 2003. One says that "a director" successfully applied for permanent guardianship, and the other grants an application by "the director" for a no-access order.

[83] Then when Ms. Harwardt spoke to me about penalty, she said (with Mr. Ouellet beside her) that the lesson to all was to make sure that the Director is better informed as to what is going on (p. 52, ll. 2-5). She said that he relied on "other people in his ministry to make sure" that court orders were obeyed (p. 53, ll. 2-8). She also said they recognized that the Director could have and should have done things differently, and accepted that finding, but that he relied on legal advice (p. 54, ll. 6-15). She said, "Mr. Ouellet in particular recognizes the need to comply with this court order. There is no question." (pp. 56-57).

[84] Those statements are not consistent with the July 13 and 14 factual statements by and for Mr. Ouellet.

[85] Though Mr. Ouellet now suggests that before June 5 everything was done by a Child and Family Services Authority and not by his Ministry, that is not at all what Mr. Gillis swears to. Mr. Gillis' affidavit was filed June 22 to resist the contempt motion.

[86] Mr. Gillis never mentioned Child and Family Services Authorities, and gave a strong implication that he and another named official were officials of the Ministry of which Mr. Ouellet was senior management. Mr. Gillis' affidavit clearly states that he and that other official were making the decisions with respect to the child in question.

[87] The inference during argument by new counsel for Mr. Ouellet on July 14 seems to have been that his July evidence was more accurate, and that the June 22 and 23 statements sworn and unsworn were no longer operative (to use a phrase which became famous in the United States in the 1970s). In my view, that is just the sort of change of direction which the case law is designed to prevent by putting considerable restrictions on reopening a pronounced order or judgment.

[88] I am not criticizing Mr. Cranston, Q.C. who had nothing to do with the matter on June 23 or earlier, and had to do the best he could with the instructions which he was given thereafter.

[89] It is possible that some of the evidence given for the rehearing on July 14 was closer to the truth in some respects than some of the evidence and the unsworn statements given in Court and by way of affidavit on June 23.

[90] However, no Court should be placed in the position of choosing between the two inconsistent successive stories told by a litigant before and after an unfavorable judgment. If he or she tells one version to the Court at the definitive hearing where he or she is supposed to present the full case, and loses, it would set a lamentable example and backwards incentives and disincentives, to let him or her then try a second time with inconsistent factual allegations. (There could be exceptional circumstances of due diligence and unavoidability in rare cases, but not here.)

[91] The Supreme Court of Canada has held that a litigant who gives evidence to one effect and then loses, should not be allowed afterwards to reopen the verdict with new contradictory evidence, especially as the incentives shift once the first decision is pronounced: *Sagaz Ind. v.* 671122 Ont., supra (paras. 63-64).

[92] Along the same lines, I again cite *Berube v. Wingrowich*, *supra*. In that case, someone who had been given money to hold in trust went quietly all through a hearing about staying an order to turn the money over. Only after he lost did he reveal that he had parted with the money before the hearing even started. The Court properly said that that in itself was contempt by misleading the Court.

[93] In several contexts, the Alberta Court of Appeal has said that a party's position or objections in court are

not . . . a game of linguistic hide-and-seek, the object of which is to conceal the real meaning of the spoken word from the judge and see whether the judge can find it before counsel leaves the courtroom. A presiding justice is entitled to treat a statement by counsel as having that meaning which a reasonable person would infer from the statement. The presiding justice is not there to cross-examine counsel concerning the subtleties or nuances of a statement to the court . . .

R. v. Heikel (1992) 125 A.R. 298, 305 (para. 24) (C.A.); *R. v. deKock*, 2009 ABCA 225 (June 16)

[94] Here of course I am not criticizing Mr. Cranston, Q.C. (nor even Ms. Harwardt). I refer to Mr. Ouellet who stood by and even took a similar tack to Ms. Harwardt's.

(f) Suggestion that the Director Had No Duties

[95] The repeated argument on the motion to reopen was that this child had not been apprehended by the Director of Child, Youth and Family Enhancement, and that he was not the one who was pursuing the appeals, and not the person to whom the court order was directed.

[96] The latter suggestion is patently wrong. The Court of Appeal order, whether it is correct or not, named him and no one else as respondent in the style of cause. (It copied his use of librarians' style of citation, and instead of saying Director of Child, Youth and Family Enhancement of Alberta, said "Alberta (Director of Child, Youth and Family Enhancement)." That is a small clerical difference. Someone mentioned this point in passing as a curiosity. It is less than that, and not worthy of extended discussion.)

[97] Mr. Ouellet admittedly knew all along that various pieces of litigation and appeals in various children's cases constantly were taken in the name of the Director, i.e. in his name.

[98] That was not confined to other litigation. Copies of the papers for this case were handed to Mr. Ouellet just before he came to the meeting about the Court of Appeal judgment on June 5. He chose to shut his eyes and not even read the papers, though he was told they were about obedience of a court order and contempt. So he has himself to blame for the result.

[99] Extended failure to have the parties to the lawsuit corrected to reflect the appropriate people, barred a motion to reopen, in *Caisse Pop. de Morinville v. Pasay*, *supra* (paras. 41, 44).

(g) Change of Position

[100] In many areas of civil litigation, including the law of appeals, there is a rule that a party cannot approbate and reprobate an order or a remedy. If there is a choice or election to be made, once the party has taken a benefit, or the other side has relied upon it, he or she cannot change his or her election. So if the opponent would suffer detriment, the Court cannot undo the order later. For example, that reliance or detriment may bar an appeal: see the cases cited in the *Civil Procedure Encyclopedia*, Chap. 74, Part I.4 (pp. 74-38 to 74-39). Or it may bar opening up default judgment: see the cases cited *op. cit. supra*, Chap. 17, Part J (p. 17-29). That is a mere example of the more general principle that a party will not be relieved of his or her slip or granted an indulgence, where that would prejudice the other side.

[101] That general rule applies here. Applying that bar to motions to reopen is *McNiven v*. *Pigott* (1914) 19 D.L.R. 846, 858-59 (Ont. C.A.).

[102] When the contempt conviction had been entered here, and the question of penalty was pending, it was pointed out that there had been considerable confusion as to what remedy could be sought for the non-return of the child and, in particular, what Court should be resorted to. Two other parallel proceedings to this contempt motion in the Court of Appeal had been launched. One was a motion for *mandamus* in the Court of Queen's Bench, and the other was a very similar motion for contempt in the Court of Queen's Bench. As a result of my finding of contempt, it was agreed on all hands that the two enforcement motions in the Court of Queen's Bench should be ended. (See transcript pp. 49-50).

[103] Though they have not been formally discontinued, I understand that those parallel motions have been taken off the list, and nothing has been done to pursue them or advance them over this whole time, in reliance upon that. And counsel for the appellant B.M. has given an undertaking to discontinue those proceedings.

[104] That is a change of position to the detriment of that innocent appellant.

[105] A deserving litigant is sometimes allowed to resile from a position and cure a slip on appropriate terms. Possibly some terms along those lines could be worked out here, but I see little reason to give this litigant an indulgence, given his shifts in position.

[106] If this were the only impediment to opening up the contempt finding, and if the contempt finding would otherwise be unjust, then I might try to devise such terms and conditions. None of those things is so, and I leave this question of election or change of position as one more thing to weigh.

3. Conclusion

[107] I will not admit any of the new evidence, and I will not reopen the conviction for civil contempt.

[108] There has been no miscarriage of justice in the conviction for contempt; indeed the opposite. To reopen the matter and receive the new evidence would simply make things worse for Mr. Ouellet.

D. Action by Others

1. Introduction

[109] Several things lead me to say more: the disturbing nature of some of the events and arguments here, and the similar comments of judges on breaches or evasions by the previous Director: see *Re L.S., A.B. and K.S.*, 2007 ABPC 274 (Sept. 18), and *C.B. v. Director of Child, Youth and Family Enhancement Act*, 2008 ABQB 165, JDC FL 01-02601 (Mar. 13). Mr. Cranston, Q.C.'s argument that the view of the law found above would necessitate restructuring the whole child protection administration (which argument I do not accept) nudges me the same way.

[110] The contempt here was lengthy and undisputed. Only the name of the exact culprits has been questioned.

[111] Children's well-being and care should not be delayed or made uncertain by failures of communication or disobedience of court orders. And parents often have rights too.

2. Counsel and Judges

[112] Counsel opposing the child protection authorities henceforth in the near future might be well advised to take care to learn what government officials are involved in such litigation, and consider naming them all in the style of cause or in court orders. And court orders may be best served personally on the officials. Similarly, judges in Alberta may need to take care about names of officials and the style of cause. Some things should not be assumed. Avenues to escape obedience may be undesirable for a time.

3. Cabinet Ministers

[113] Her Majesty's government of Alberta, in my 42 years' experience, has not been in the habit of hiding identities, equivocating, nor evading court orders against it. And purely technical defences have been rare.

[114] But the present case raises doubts about whether everyone in the child protection parts of the government now shares those high standards, or even fully understands court orders. The complex administrative structure suggested by the evidence tendered here must exacerbate opacity and the opportunities for deniability.

[115] The government is established under the Constitution to administer the law, including the law about children. Counsel have become used to relying upon the government's trustworthiness

and fairness in obeying court orders. That should remain possible. Counsel should not fear that they should deal with the Crown and its lawyers the way that they would when their opponent was a fly-by-night small business with a scofflaw history. The government's obedience to court orders should be and be seen to be willing, prompt and automatic, not strained through the mesh of contempt motions.

[116] Any contempt of court which included shuffling off responsibility to obey a court order among different officials (at times like the dried pea under three walnut shells) would be almost unprecedented. The closest parallel which I can find is *Re Thompson (R. v. Woodward)* (1889) 5 T.L.R. 565 and 601 (D.C.). There the Divisional Court, including that fairest of judges, Mathew J., was scathing in its language about the government officials concerned, and rightly so.

[117] It is highly undesirable that the courts and Bar of Alberta even contemplate having to assume all the burden of enforcing court orders in child protection cases. After all, the parents or foster parents often lack resources and rely on Legal Aid. So the taxpayers would suffer too if government officials were to play a game of hide-and-go-seek.

[118] After this judgment, ignorance or neglect by such officials will be a smaller excuse for disobeying court orders than before. A repetition might lead to litigation over whether those higher up were not immune.

[119] The affidavit of the successful appellant, and her counsel's argument on June 23, suggested that the government was stalling the return of this child while hastening countervailing adoption. I lack enough evidence to make any fact finding about that, but it deserves careful investigation.

[120] Mr. Cranston, Q.C. several times mentioned in his argument that other people may have been guilty of contempt here. That sounds likely, as the disobedience was lengthy and undenied, and other people seem to have had day-to-day conduct of these files. I cannot be sure who those responsible are, but clues may be found in the Court of Queen's Bench adoption file, in the affidavit filed here by the Director's counsel on June 22 to oppose the contempt motion, in Ms. Harwardt's submissions on June 23 (especially pp. 5-6), and in Mr. Ouellet's oral evidence on July 14 about the June 5 meeting (pp. 7-8). Doubtless government files would tell more.

[121] The Court is poorly equipped to investigate or prosecute contempt. And Ms. Kellett presumably has no investigative resources. I invite the Attorney-General to investigate and follow up.

[122] The Deputy Registrar will send a copy of these Reasons to the Minister of Children and Youth Services, and to the Minister of Justice and Attorney-General of Alberta.

E. Procedure for Penalty Phase

[123] On June 23, I heard argument on penalty and reserved decision on penalty. Given subsequent events, Mr. Cranston, Q.C. may make further submissions on that topic. His submissions on penalty should be written and should be filed within 10 days of the date of these reasons. Those submissions may cover any aspect of penalty (given the change of counsel). They should include:

- (a) whether Mr. Ouellet wants his evidence given to the court in his affidavit and live on July 14 taken into account or not;
- (b) the apparent dilemma (jail seems harsh but a fine could be circular) raised with Ms. Harwardt in the June 23 transcript; and
- (c) what hourly rate (or other basis) should be used if any of the costs are to be taxed on a solicitor-client basis.

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[124] I intended on June 23 to give Mr. Ouellet a chance (if he wished) to speak to penalty after Ms. Harwardt had spoken. I see that I forgot to do so, so I extend that invitation now. It would be in writing, with the same deadline. He is not obliged to do that.

Application heard on July 14, 2009

Reasons filed at Edmonton, Alberta this 23rd day of July, 2009

Côté J.A.

Appearances:

D.R.	Cranston, Q.C.
	for the Respondent/Applicant (Respondent) Ouellet

D.B. Harwardt

for the Respondent/Applicant (Respondent) Director of Child, Youth and Family Enhancement

A.C. Kellett

for the Applicant/Respondent (Appellant) B.M.
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APPENDIX A

10 THE COURT: I can give my decision now. 11 This is a motion for contempt arising out of Appeal No. 07030362 AC. 12 13 The Applicant is who was the successful Appellant in the substantive appeal, and 14 the Respondent is the Director of Child Youth and 15 16 Family Enhancement, whose name is Richard Ouellet, and 17 he is before me. 18 The facts here are long and many facetted. For 19 present purposes, it will be enough to say that the 20 Director took from the foster home of the Appellant 21 the child in question, and his decision to remove was 22 appealed to an Appeal Panel, which gave fairly extensive written reasons which are in the material 23 24 for this motion as an exhibit to an affidavit. That

25 panel came to the conclusion that the child should not
26 have been removed from the home.

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The Director appealed to the Court of Queen's

35 Bench against the decision of that Appeal Panel and 1 got a stay of execution at a later stage. In any 2 event, the child stayed where the Director had the 3 child. The Director's appeal to the Court of Queen's 4 5 Bench was successful. 6 The other side then, that's the foster parent, appealed to the Court of Appeal. There was a partial 7 stay only and the child in the interval remained where 8 9 the Director had put the child. The appeal was argued last September, that's 10 September, 2008. On January 30th of this year, 2009, 11 the Court of Appeal gave written reasons allowing the 12 appeal and reinstating the decision of the Appeal 13 Panel and, as I mentioned, that decision of the Appeal 14 Panel was some pages long and contained reasons. 15 Since then the decision of the Court of Appeal has 16 been reduced to a written entered formal judgment. 17 The time for seeking leave to appeal to the 18 Supreme Court of Canada is long past. No one has done 19 No one has sought any kind of a stay of the 20 so. decision of the Court of Appeal. Though, ironically, 21 the Director has acted on the fact that the stay 22 awaiting the Court of Appeal decision ended when the 23 24 Court of Appeal spoke. 25 Very promptly after the Court of Appeal's decision, counsel for the successful Appellant, the 26

foster mother, made it plain in writing to the

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36 Director that she interpreted the decision of the 1 Court of Appeal as requiring restoration of the child 2 to her. The Director disagreed. Plainly, there was a 3 difference of opinion. No one seems to have looked 4 very carefully at the decision of the Appeal Panel 5 which was restored by the Court of Appeal. 6 I am prepared to accept that a reasonable person 7 in the shoes of the Director could have had some doubt 8 as to whether the January 30th decision of the Court 9 of Appeal required the restoration of the child to the 10 Appellant foster mother or not. That being so, I am 11 prepared to accept that the Director could and may 12 have had such a reasonable doubt. 13 We have no evidence from the Director himself, 14 and his counsel submits that he cannot immerse himself 15 in every file for every child within the purview of 16 his office in Alberta. At some stage, he personally 17 did become involved in the matter of this child and 18 this appeal. It is not completely plain when that 19 happened. We certainly know that he was acting on the 20 advice of his officials, and one of them, Mr. Gillis, 21 has filed a lengthy affidavit in response to this 22 motion for contempt. It was not filed until late 23

yesterday in violation of the Rule which calls for the
filing of response affidavits at least 24 hours before
the hearing.

Ms. Kellett, do you have any objection to my

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	1	looking at Mr. Gillis's affidavit?
9	2	MS. KELLETT: Not particularly, Sir.
ø	3	THE COURT: No? Thank you.
	4	I will therefore shorten the time for the Court's
	5	receiving that affidavit filed on behalf of the
	6	Director and take it into account.
	7	However, it must have been apparent to any
	8	reasonable person that counsel for the Appellant
	9	foster mother was strongly urging the proposition that
	10	the Court of Appeal decision of January 30th meant
	11	that the child should be returned. Anyone who took
	12	legal advice or took care to read the papers,
	13	especially the decision of the Appeal Panel, would
	14	have seen that that position taken by counsel for the
	15	foster mother was also arguable.
	16	It is the duty of someone who receives a court
	17	order telling him or her to do something, to obey that
	18	court order. If there is some doubt as to what the
	19	court order means, then steps must be taken to clarify
	20	the doubt. Now, various steps in various
	21	circumstances might be reasonable or pardonable, but
	22	something must be done.
	23	The evidence before me in the form of an
	24	affidavit from the foster mother attaching many
	25	documents, and the affidavit from Mr. Gillis, an
	26	intermediate official of the Respondent, also
	27	attaching many documents, does not conflict much and

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does not conflict on anything of any real importance to the present motion.

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It is evident that between January 30th and June the 4th, the Director did nothing of any consequence toward obeying the order of the Court of Appeal, or to clarify what it meant and what he was required to do. He and his officials, however, did find the time to take many steps to make it more difficult for the foster mother ultimately to win.

10 Counsel for the foster mother pursued the matter 11 and sought clarification. On June the 4th of this 12 year, the Deputy Registrar of the Court of Appeal, 13 after a due application to the Court, gave notice to 14 both parties in writing that the panel which had heard 15 the appeal considered that their judgment meant that 16 the child was to be returned.

One would have thought that the only thing that 17 would stand in the way of the immediate return of the 18 child then might have been some logistics. I accept 19 that the child was in a comparatively remote Northern 20 Alberta community at the time, and it was not just a 21 matter of a 20-minute drive across Edmonton to get him 22 to the foster mother. The child was not returned 23 until yesterday, the 22nd of June, five minutes before 24 noon. Now, I am not sure that the precise hour is in 25 the sworn material and, in any event, nothing turns on 26 It is common ground that the child was returned it. 27

yesterday.

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It is very interesting that that was the day before the return of the contempt motion. If one looks at the affidavit filed yesterday afternoon by Mr. Gillis, the official in charge of this matter, it is evident that that was no coincidence. The instruction was that the child had to be returned before the contempt motion. That indicates an interest in sanctions, but not very much interest in I have spoken of what and was not done between duty. January 30th and the 4th of June.

12 If we now switch our focus to the period from June 4th to June 22nd, a period of approximately 18 13 days, one finds both in the sworn Affidavit of 14 Mr. Gillis, the official in charge of this matter, and 15 also in the voluntary statement before me a few 16 17 minutes ago by the Director, Mr. Ouellet, a conception which, I must say, is a misconception. 18 That misconception is that the Director and his officials 19 20 had conflicting considerations and duties before him. Duties to the child, duties to the Band, duties to 21 22 various people, considerations of the best interests of the child, and so forth. When a Court, still more 23 24 a Superior Court, gives a direction to a person, the 25 duty of that person is to obey the order without hesitation and without delay.

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Many years ago contempt was found on the part of

a union. I believe it was in British Columbia. The 1 union had been served with an injunction telling them 2 to stop something, probably picketting. The union 3 held a meeting to decide whether to obey the Court 4 order. That was in itself held to be contempt. 5 Obviously, the order of the Court of Appeal did 6 not mean that the child had to be returned within the 7 hour. It did not mean that the Director had to 8 charter a private jet and bring the child to Edmonton 9 within two or three hours. Obviously not. But I have 10 looked at Mr. Gillis's affidavit carefully, and I 11 cannot find in it any excuse, logistical or otherwise, 12 for taking 18 days to bring the child back. 13 I am very disturbed at the suggestion that the 14 Director or any of his officials decided that they 15 should weigh various countervailing considerations, 16 and weigh on the one hand the direction of the Court 17 of Appeal and on the other hand the directions in 18 their own consciences or their own views of the law as 19 to what were the best interests of the child. 20 . Ever since in Re Poje, P-O-J-E, a decision of the 21 Supreme Court of Canada about 1953, upholding a 22 decision of the British Columbia Court of Appeal, the 23 law in Canada has been extremely plain. When faced 24 with a mistaken and erroneous Court order, one's duty 25

26 is simply to obey it. Whether or not one thinks that 27 the Court order was mistaken and should not have been

granted, and whether or not it is, in fact, mistaken or should not have been granted, one's duty is the same, to obey without question.

Now, I am not for a moment suggesting that I think that there was anything wrong with the decision of the Court of Appeal. All I am saying is that any belief that may have been harboured by the Respondent Director or his officials along those lines or partly along those lines avails them nothing in law.

10I am tempted to point out that the Court of11Appeal of Alberta is the top Court in Alberta, but it12is not necessary to go into that, because the same13respect is to be accorded to any order of any judge or14any Court in Alberta.

15 Now, at the beginning of these proceedings, I learned from counsel for the Respondent Director, and 16 I learned also from her during her argument, that the 17 view in the office of the Director is that this is a 18 large organization, and that there is no one person 19 responsible. I want to point out a decision of the 20 Supreme Court of Canada in Roncarelli v. Duplessis, 21 22 [1959] Supreme Court Reports, beginning at page 121. One of the members of the majority of that panel of 23 the Supreme Court of Canada was Mr. Justice Abbott, 24 the former Federal Minister of Finance. He quoted in 25 his judgment what he called the well-known passage 26 from the Dicey's Law of the Constitution, 9th Edition, 27

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which says.

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... every official, from the Prime Minister 2 down to a constable or a collector of 3 taxes, is under the same responsibility for 4 every act done without legal justification 5. as any other citizen. The Reports abound 6 with cases in which officials have been 7 brought before the courts, and made, in 8 their personal capacity, liable to 9 punishment, or to the payment of damages, 10 for acts done in their official character 11 but in excess of their lawful authority. A 12 colonial governor, a secretary of state, a 13 military officer, and all subordinates, 14 though carrying out the commands of their 15 official superiors, are as responsible for 16 any act which the law does not authorize as 17 is any private and unofficial person. 18 While it is not directly on point, the decision in 19 Roncarelli v. Duplessis was to hold personally liable 20 to pay damages for acts done as the Premier of Quebec. 21 In 1918, at the height of the conscription crisis 22 in Canada, in general, and in Alberta in particular, 23 the Alberta Court of Appeal, which was then the 24 Appellate Division of the Supreme Court of Alberta, 25 granted orders for habeas corpus releasing several 26 conscripted men on the grounds that the amending Order 27

in Council under which they had been conscripted was <u>ultra vires</u>. The military authorities under wartime emergency and facing a shortage of men simply refused to obey the Sheriff who came to get the men.

The decision from Chief Justice Harvey on the 5 duty of all to obey orders of the Court, including the 6 highest officials, is very educational. It is 7 entitled In Re Norton, and it is reported in 1918, 8 Vol. 2 Western Weekly Reports, 865. If who would win 9 the war and the sinews of war necessary were still 10 subject to obeying the orders of this Court then a 11 fortiori when an official wishes to take into his own 12 hands a decision as to what are in the best interests 13 14 of a child.

15The whole point of Courts is to have the law16govern and not the big battalions govern, and that17takes us back to Dicey's Law of the Constitution which18I quoted earlier.

19 There is one other gap in the law which I have been citing. Some of the propositions of law I have 20 given are (on reflection to a lawyer) obvious enough 21 22 that it is not necessary to cite authority for them. But I wish to close my discussion of the law by 23 quoting from another decision of the Supreme Court of 24 Canada, Baxter Travenol Laboratories v. Cutter [1983] 25 2 Supreme Court Reports 388. 26

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That was a case where an injunction was given in

patent litigation against, I believe, selling 1 something. The Rules of the Federal Court of Canada 2 at that time said that Court orders had no effect 3 until they were entered. That is not what the Alberta 4 Rules say, but that is what the Federal Court Rule 5 said at that time. The Defendant, therefore, thought 6 that in the week before the formal entry of the 7 judgment, a golden opportunity was before him and he 8 sold goods. I say "he", I think it was a company. I 9 should say "it". 10 And I will quote a few passages from the Supreme 11 Court of Canada which held that that was no obstacle 12 whatever to finding contempt. The Supreme Court sent 13 it back to the Federal Court of Appeal to try the 14 merits. 15 I quote from Mr. Justice Dickson, later Chief 16 Justice Dickson, on page 396. 17 The inquiry does not end with a 18 consideration of whether the injunction as 19 such has been breached. 20 The general purpose of the court's contempt 21 power is to ensure the smooth functioning 22 of the judicial process. Contempt extends 23 well beyond breach of court orders. 24 25 Contempt in relation to injunctions has 26 always been broader than actual breaches of 27

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	1	injunctions.
1	2	It is pointed out that someone who is not even named
8 1	3	as a party, and one thinks here of Mr. Gillis,
	4	could still be found in contempt if he,
	5	with knowledge of its existence,
	6	contravened its term. Although technically
	7	not a breach of an injunction, such an
	8	action would constitute contempt because it
	9	would tend to obstruct the course of
	10	justice.
	11	And one of the authorities he cites is the Poje case,
	12	which I referred to earlier, and he gives the proper
	13	citation, [1953] 1 Supreme Court Reports 516. Carrying
	14	on with the quotation,
	15	The same kind of analysis applies to the
	16	period between reasons for decision and the
	17	pronouncement of judgment. To accept an
	18	argument [that there is a period of
	19	grace]
	20	And I am leaving out a few words
	21	would completelydefeat the
	22	injunction. That would subvert the whole
	23	process of going to court to settle
	24	disputes. That is precisely what the
:	25	contempt power is designed to prevent.
	26	• • •
2	27	Once a judge has rendered his decision by

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giving reasons, and assuming any 1 prohibitions contained therein are clearly 2 worded, it is not, in my view, open to any 3 person to flout his disposition of the case Δ on the ground that there is no judgment yet 5 in effect... Once reasons for decision 6 have been released, any action which would 7 defeat the purpose of the anticipated 8 injunction undermines that which has 9 already been given judicial approval. Any 10 such action subverts the processes of the 11 Court and may amount to contempt of court. 12 The motion here is for civil contempt, and it has 13 two substantive particulars. One is not obeying the 14 decision of January 30th, 2009 and, second, not 15 obeying the clarification of June 4th, 2009. 16 I have explained why the failure to get 17 clarification after June 30th is contempt, and I have 18 explained why the obedience after June 4th was not 19 prompt. 20 Some cases take a very picky and technical and 21 procedural view of contempt and consider any little 22 flaw in the paperwork to be like a flaw in 17th 23 Century criminal law permitting the accused to walk 24 away free. I do not take that view. 25 If one points out the lack of a precise deadline 26 on either January 30th or June 4th, then it is obvious 27

1	that the most lenient interpretation in favour of the
2	Director was that the child should be returned within
3	a reasonable time. I have no hesitation in finding
4	that the 22nd of June was long after the expiry of a
5	reasonable time.
6	Stand up, Mr. Ouellet.
7	For the reasons given, I find you guilty of civil
я	contempt. You may sit down

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5 THE COURT: Good afternoon. Please be seated.
6 Two loose ends from this morning.
7 One, I had just meant to mention one other case
8 on the subject of negligence leading to contempt, and
9 that's no surprise. It's the one, which is tab 1 to
10 Ms. Kellett's material, Michel, M-I-C-H-E-L v.
11 Lafrentz, L-A-F-R-E-N-T-Z (1998) ABCA 231.

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APPENDIX B

1000 ATCO Centre, 10035 - 105th Street Edmonton, Alberta, Canada T5J 3T2 Tel: 780.421.8133 Fax: 780.421.7951 www.bennettjones.ca

Donald R. Cranston, Q.C. Direct Line: 780.917.4267 e-mail: cranstond@bennettjones.com

June 26, 2009

Delivered via facsimile - 780.422.4127

The Honourable Mr. Justice Jean E.L. Côté Court of Appeal of Alberta Law Courts Building 1A Sir Winston Churchill Square Edmonton, AB T5J 0R2

Dear Sir:

Re: Appeal Number: 0703 0362 AC

We have been retained to represent the personal interests of Mr. Richard Ouellet, who we understand was the subject of a personal contempt Order by Your Lordship on Tuesday, June 23, 2009.

We have contacted the Court Transcription Management Services and have asked that we receive a copy of the transcript as soon as possible. It is our current intention to make application to Your Lordship to ask that Your Lordship hear further submissions solely on the question whether or not Mr. Ouellet ought to personally be the subject of a contempt Order.

It is our understanding from speaking with those present that certain important facts concerning the role of Mr. Ouellet were not brought to Your Lordship's attention.

We have copied this letter to all other counsel and would propose to bring forward the application as soon as the transcript is available.

Yours truly,

BENNETT JONES LLP-

Donald R. Cranston

copy: Mr. Farrel Shadlyn, Q.C. (Goldsman Ritzen) Ms. April C. Kellett Ms. Denise Harwardt (Alberta Justice)

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CALGARY . TORONTO . EDMONTON

TAB 4

Court of Queen's Bench of Alberta

Citation: Aubin v Petrone, 2020 ABQB 708

Date: 20201117 Docket: 4803 168361 Registry: Edmonton

Between:

Renee Lyne Aubin

Applicant

- and -

Sabino Steven Anthony Petrone

Respondent

- and -

Quantiam Technologies Inc.

Respondent Not a Party to the Action

Reasons for Decision of The Honourable Madam Justice Ritu Khullar

I. Introduction

[1] Ms Aubin applies to vary a decision which I issued, sitting as a Court of Queen's Bench judge, on March 2, 2020: *Aubin v Petrone*, 2020 ABQB 163 (the March 2020 decision). The March 2020 decision was the last of several decisions I made in this matter that I heard as a trial judge in February 2018.

[2] The most significant decisions issued on this matter are the Merits decision (*Aubin v Petrone*, 2018 ABQB 536) and the Remedy decision (*Aubin v Petrone*, 2018 ABQB 973). Appeals to the Court of Appeal by Quantiam Technologies Inc. (Quantiam) and Mr Petrone were dismissed earlier this year: *Aubin v Petrone*, 2020 ABCA 13.¹ The Court of Appeal directed Ms Aubin, Mr Petrone and Quantiam to work towards execution of security agreements as had been directed in the Remedy decision. If that could not be achieved within 10 days, Ms Aubin was directed to apply to the trial judge or another judge of the Court of Queen's Bench for "direction and/or enforcement" (para 84). I agreed to hear that application which resulted in the March 2020 decision.

[3] In the Merits decision, among other things, I granted a matrimonial property judgment in favour of Ms Aubin for \$5,570,394 payable by Mr Petrone. In the Remedy decision, I ordered that Mr Petrone's shares in Quantiam and a building owned by Quantiam (the Building) be charged to secure the payment of the matrimonial property judgment and I directed the parties to give effect to the charges by entering into security agreements.

[4] In the March 2020 decision, I dispensed with the need for security agreements, confirmed that the two charges remained in place and set the terms on which the charges could be enforced. I instituted a plan for payment of the matrimonial property judgment, breach of which would entitle Ms Aubin to apply to a judge of the Court of Queen's Bench to enforce the charges against the Building and the shares.

[5] After I issued the March 2020 decision orally, counsel for Quantiam asked whether the restriction against Mr Petrone and Quantiam declaring bankruptcy, which was imposed by Appendix A of the Remedy decision, still remained in place. I answered positively. After the hearing, Mr Petrone's counsel wrote seeking clarification of this point and I indicated a willingness to reconsider my decision on the bankruptcy issue, upon hearing from the parties.

[6] In response, Ms Aubin's counsel advised of her intention to bring an application for a broader variation of the March 2020 decision, under 9.13 of the *Alberta Rules of Court*, AR 120/2010. However, the application was delayed as a result of the pandemic and the closure of the Court of Queen's Bench. Written submissions were received from all parties and an oral hearing was held on September 9, 2020.

¹ Leave to appeal to the Supreme Court of Canada was denied: June 25, 2020 (SCC files 39037 and 39038).

II. Legal principles governing applications under s 9.13

[7] The application is brought under r 9.13, which permits a party to apply to court, prior to a judgment or order being entered, to hear more evidence or change or modify its judgment. A court may do so "if it is satisfied there is a good reason to do so". In deciding whether to exercise this discretion, a court should keep in mind a number of factors, including:

- the desirability of avoiding unnecessary and costly appeals;
- the desirability of the appeal court having a fully developed factual and legal record;
- the need for finality and certainty in legal proceedings;
- that errors to be corrected should be objectively demonstrable (such as an incorrect statement of law or interpretation of a contract which all parties agree is incorrect);
- the rule is not a vehicle for seeking reconsideration of a judgment call; and
- the threshold for a court to exercise its discretion should be high to avoid applications which are in reality, a 'second kick at the can'.

Aubin v Petrone, 2018 ABQB 259 at paras 5-6; *Lewis Estates Communities Inc. v Brownlee LLP*, 2013 ABQB 731 at paras 28 & 31-33; *Clark v Unterschulz*, 2020 ABQB 423 at para 2.

III. Ms Aubin's application to vary under r 9.13

[8] Ms Aubin argues that this court has authority to vary the March 2020 decision because of a breach of fairness to the parties. She points to the fact that at the beginning of the oral hearing, on February 26, 2020, I shared some preliminary thoughts based on the written submissions and put to the parties a payment proposal along the lines that was finally adopted: that the charges on the shares and the Building would become enforceable if Mr Petrone defaulted on a four-year payment plan.

[9] Ms Aubin argues that she was caught off guard by the proposal and while she had some opportunity to comment on it during her oral submissions, the time in court was cut short and she was denied a fair opportunity to make submissions on the proposal.

[10] At the root of Ms Aubin's application is a concern that despite this court's expressed intention to ensure that the Merits and Remedy decisions not become practically meaningless, the March 2020 decision has that effect because it contains "significant gaps" which could permit Mr Petrone to continue his pattern of not paying the matrimonial property judgment and dissipating the assets of Quantiam in a manner prejudicial to Ms Aubin. Ms Aubin is not enthusiastic about the payment plan but is prepared to live with it so long as she is adequately protected until the matrimonial property judgment is paid.
[11] In summary, Ms Aubin is seeking the following changes to, and clarifications of, the March 2020 order pursuant to r 9.13:

- 1. That Quantiam be prohibited from continuing the foreclosure on the property owned by 159834 Alberta Ltd (159 Corp) in British Columbia until Mr Petrone has satisfied the matrimonial property judgment.
- 2. Clarification that the charge against the Building is *also* a charge against Quantiam's option to purchase the land on which the Building lies for \$1,620,000 and the land, if the option to purchase is exercised. This would mean that if Ms Aubin enforces her charge against the Building, she can insist that the option to purchase the land be exercised by Quantiam, or by Ms Aubin or as a part of a judicially supervised sale. In addition to this "clarification", Ms Aubin argues that the varied decision should include a requirement that Quantiam maintains the capacity to exercise the option until the matrimonial judgment has been fully satisfied by Mr Petrone. It appears that would include a requirement for Quantiam to retain sufficient funds to pay the option price.
- 3. That the payment plan and payments set out in the March 2020 decision should be modified so that (1) the first instalment payment would be equivalent to the outstanding mortgage owed by 159 Corp to Quantiam as of March 2, 2021 (which is \$2,011,925.90) and (2) the payment of the trial costs set by the Remedy decision (\$369,078.32) and the costs in the Court of Appeal and the Supreme Court are made part of the payment plan, such that if those costs are not paid by March 2021, Ms Aubin would be able to enforce her security.
- 4. That if Mr Petrone is in breach of any of his obligations the Merits decision or Remedy decision, including if he declares bankruptcy, Ms Aubin may apply to the court to enforce the charge against the shares and the Building.
- 5. That if this court lifts the restriction on Quantiam declaring bankruptcy, it should not lift the restriction on Mr Petrone because his bankruptcy may make Ms Aubin liable to pay certain outstanding matrimonial debts.

IV. Has the threshold to vary the March 2020 decision under r 9.13 been met?

[12] Quantiam and Mr Petrone argue that Ms Aubin's application is essentially the third and fourth kicks at the can. They submit that she is trying to obtain relief that she has sought in the past, which this court refused and that her proposed modifications clearly do not fall within the scope of r 9.13. Quantiam and Mr Petrone say that there is no new evidence, no new arguments, no new facts, no misstatement of the law and nothing to clarify. All Ms Aubin's application does is seek to obtain remedies which she has been unable to obtain in the past.

[13] However, both Quantiam and Mr Petrone ask me to lift the restrictions on either of them declaring bankruptcy or filing a proposal for bankruptcy, on the ground that the restrictions were always intended to be temporary and are no longer necessary to protect Ms Aubin.

[14] Despite the submissions of Quantiam and Mr Petrone, I am satisfied that this is a case in which it is appropriate to reconsider the March 2020 decision. This just means that the threshold to consider a variation has been met. It does not mean that I am granting all of the modifications and clarifications sought by Ms Aubin, only that I have jurisdiction to consider her arguments: *Lewis Estates* at paras 29-30.

[15] In my view, the circumstances of the February 25, 2020 hearing did not rise to the level of procedural unfairness. Nevertheless, I accept that Ms Aubin was surprised by my inquiry about the proposed payment plan. That and the unexpected curtailment of the hearing meant that Ms Aubin did not make all the arguments she would have made if she had more time. Given objectives that underlie the power to reconsider a decision, which include the desirability of avoiding unnecessary appeals, I find that this is an appropriate case to reconsider the March 2020 decision.

[16] However, I emphasize that even though the threshold for authority to reconsider the March 2020 decision is met, the test for exercising that authority and varying the decision is strict: Lewis Estates at para 34 (a high likelihood of error). I am not willing to consider new arguments and issues if they lack a demonstrable connection to the March 2020 decision.

[17] I will address each of Ms Aubin's proposed modifications and clarifications in turn.

A. Proposed injunction on Quantiam's ability to foreclose on the British Columbia property

[18] On March 5, 2018, after the conclusion of the trial but before a decision has been issued, I granted an injunction which, among other things, prevented Quantiam from taking any further steps in the foreclosure action in British Columbia. The injunction expired 15 days after the reasons for judgment were issued. Therefore, that injunction would have expired 15 days after the Remedy decision was issued on November 28, 2018. On that day, acknowledging that there was already an appeal filed on the Merits decision and a stay pending appeal, I stayed any enforcement steps by Ms Aubin pending the appeal and Quantiam agreed to continue the stay of the foreclosure proceeding. Now that all of the appeals have been exhausted and all stays have expired, it is clear that there is no order enjoining Quantiam from taking steps to foreclose the British Columbia property. The previous injunction and stays were always temporary pending the finalization of the litigation. The relief sought is a new issue and new remedy which goes beyond the scope of a r 9.13 application.

B. The Building

[19] In the Merits decision, at para 94, I adopted the uncontested expert report of Brad R Daviss, of Frost & Associates as to the value of the Building:

The parties accepted the valuation of real property by Brad Davis of Frost & Associates without the necessity of calling him as a witness. Mr. Davis assessed the value of the fee simple interest in the property located at 1651 - 94 Street, Edmonton, where Quantiam headquarters is located, as of November 3, 2017. This is an industrial office complex with 32,544 square feet with a 2,150 square foot mezzanine office. The building is located on 4.05 acres of an industrial business zoned site within the Edmonton Research and Development Park. Currently, the land is owned by Edmonton Economic Development Corporation. Mr. Davis concluded that the market value of the property is \$6,510,000. Based on forced sale with cash, the value would be \$5,210,000 and based on a forced sale with terms, it would be \$5,535,000. It is worth noting that Mr. Davis appraised the market value of the land alone to be \$2,590,000. Quantiam has an option to buy the land by 2020 for \$1,620,000.

[20] In the Remedy decision, at paras 30-31, I discussed securing the matrimonial property judgment against the Building as follows:

[...] I valued the shares in Quantiam to be \$15.2 million reflecting the hard assets of Quantiam (para 108, Merits Decision). One of those assets is the building owned by Quantiam located at 1651 - 94 Street, Edmonton (Building) which has been appraised between \$5,201,000 and \$6,510,000 depending on the valuation approach (para 94, Merits Decision)

So, in terms of remedy, under s 9(3)(b), (c) and (j) I declare that Ms. Aubin's judgment against Mr. Petrone in the amount of \$5,570,394 is protected by a security interest in Mr. Petrone's shares in Quantiam and a security interest in the Building.

[21] I do not think any further clarification is required on this point.

C. The Payment Plan

[22] Ms Aubin asks me to make two changes to the payment plan that I imposed in the March 2020 decision. First, to increase the amount of the first payment to make it equal to the amount of the outstanding mortgage owed by 159 Corp to Quantiam. Second, to make the trial costs and appeal costs, plus interest, payable at the time of the first payment.

[23] Quantiam and Mr Petrone objected to this relief although most of their submissions were focussed on that the threshold for the court to exercise its discretion had not been met.

[24] I accept the first argument, that the first payment from Mr Petrone to Ms Aubin on or before March 2, 2021 should be for an amount equal to the outstanding mortgage owed by 159 Corp to Quantiam, which Ms Aubin advises is \$2,011,925.90. It is not something that had been suggested or considered before, but I think makes eminent sense in these proceedings. It is not a fundamental change to the March 2020 decision but a slight modification which can be used to retire the mortgage and remove a key source of contention between these parties. However, I reject the request to include appeal costs and interest in the first payment as well because that is a fundamental change to the order, for which there is no compelling basis. None of my previous decisions held that the charges secure the payment of appeal costs.

[25] As a result of the increased first payment, the balance owing of 3,927,542.40 (5,570,394 + 369,078.32 - 20,011,929.90) shall be paid in a minimum of three equal installments, with the other provisions of the March 2020 decision relating to payment remaining the same.

D. Circumstances that trigger enforcement of the charges

[26] Ms Aubin asks me to vary the circumstances in which she can enforce the charges over the shares and the Building to include any default under the Merits decision or the Remedy decision. The suggested change is of wide scope. Its effect would be that if Mr Petrone missed a spousal support payment, or if he filed for bankruptcy (see below), both charges would become enforceable.

[27] I reject Ms Aubin's argument.

[28] The charges over the shares and the Building were granted in exercise of the court's authority under s 9(3)(b), (c) and (j) of the *Matrimonial Property Act*, RSA 2000, c M-8 to secure the equalization payment owed by Mr Petrone to Ms Aubin. The Remedy decision at paras 31-32 states as follows:

So, in terms of remedy, <u>under s 9(3)(b), (c) and (j) I declare that Ms. Aubin's</u> judgment against Mr. Petrone in the amount of \$5,570,394 is protected by a security interest in Mr. Petrone's shares in Quantiam and a security interest in the <u>Building</u>. Other assets of Quantiam remain unencumbered by this decision. I have chosen a specific asset of Quantiam instead of all assets, in order to recognize and protect the interest of the minority shareholders. The security interest in the Building may be registered. (See Appendix A for the wording of this order.)

<u>These remedies give protection to Ms. Aubin by securing the money judgment</u> <u>against Mr. Petrone's shares in Quantiam, and the Building owned by Quantiam</u>. There is an outstanding appeal of the Merits Decision and a stay pending appeal. In light of this, I order that Ms. Aubin can register her security interests but she is stayed from taking any steps in relation to enforcement pending the appeal.

[Emphasis added]

See also the Court of Appeal reasons: Aubin v Petrone, 2020 ABCA 13 at paras 18-19, 65-66.

[29] The key point is that the charges were imposed under s 9 of the *Matrimonial Property Act* to secure payment of the matrimonial property judgement. There is no authority under that *Act* to impose a charge to secure payment of spousal support or to secure performance of an obligation not to file for bankruptcy. Nor is it clear that this court has any other statutory authority to enforce, say Mr Petrone's spousal support payments or other collateral obligations, by granting charges over the shares or the Building. Certainly, no one argued that in this reconsideration application.

[30] Even if this court did have authority under the *Matrimonial Property Act* or another statute to grant a charge to secure Ms Aubin's obligations under the Merits decision and the Remedy decision, that ship has sailed. The Remedy decision, which included the charges to secure payment of the matrimonial property judgment under the *Matrimonial Property Act*, has been upheld by the Court of Appeal and there is no scope to change it now under the guise of a r 9.13 application.

E. Prohibition on declaring Bankruptcy

[31] As indicated, the March 2020 decision was delivered orally on March 2, 2020. In discussion afterwards with counsel, I was asked whether the prohibition on Quantiam and Mr Petrone declaring bankruptcy remained in place and I answered positively. On March 3, 2020 counsel for Mr Petrone wrote to the court seeking clarification of this issue. He pointed out that the restriction on declaring bankruptcy was supposed to last only until the parties had entered into a security agreement, that the March 2020 decision dispensed with the need for a security

agreement and set out the conditions under which the charges could be enforced. In the circumstances, Mr Petrone's counsel assumed that the prohibitions on declaring bankruptcy fell away.

[32] In this application, Mr Petrone argues that the restrictions on him and Quantiam declaring bankruptcy are no longer necessary to protect Ms Aubin. She has charges over the Building and the shares and will be a secured creditor in the insolvencies of Mr Petrone or Quantiam. For her part, Ms Aubin does not object to removing the restriction on Quantiam declaring bankruptcy but asks that the restriction continue for Mr Petrone.

[33] I find that it is appropriate to remove the restriction against Quantiam filing for bankruptcy. That restriction was intended to last for a short period of time and I am satisfied that Ms Aubin will be adequately protected in Quantiam's bankruptcy by the charge on the Building.

[34] However, the restriction on Mr Petrone filing for bankruptcy should remain in place for the time being. Mr Petrone and Ms Aubin's matrimonial debt included secured and unsecured joint lines of credit related to the matrimonial home. The Merits decision ordered the matrimonial home to be sold and the proceeds used to pay off these lines of credit. It appears that has not been done and the lines of credit still have outstanding balances. Ms Aubin does not take serious issue with the failure to sell the matrimonial home, but is concerned that if Mr Petrone files for bankruptcy, there is a risk that the bank will pursue her alone for the entire outstanding balances. That would be unfair because the debt is matrimonial debt, not Ms Aubin's sole responsibility and steps were to have been taken to retire that debt.

[35] To avoid that situation arising, I direct that Mr Petrone remains prohibited from declaring bankruptcy or filing a proposal for bankruptcy under the *Bankruptcy and Insolvency Act* until the two lines of credit are paid off and retired.

V. Conclusion

[36] If the parties cannot agree on the costs of this application, they can make submissions by letter (maximum two pages) by November 30, 2020.

Heard on the 9th day of September, 2020. **Dated** at the City of Edmonton, Alberta this 17th day of November, 2020.

Ritu Khullar J.C.Q.B.A.

Page: 9

Appearances:

R.M. Curtis, Q.C. P.C. Desrochers for the Plaintiff

D.E. Tumbach for the Defendant

M.R. Kinash, Q.C. for Quantiam Technologies Inc.

TAB 5



SUPREME COURT OF CANADA

CITATION: British Columbia (Attorney General) *v*. Provincial Court Judges' Association of British Columbia, 2020 SCC 20 APPEAL HEARD: December 9, 2019 JUDGMENT RENDERED: July 31, 2020 DOCKET: 38381

BETWEEN:

Attorney General of British Columbia Appellant

and

Provincial Court Judges' Association of British Columbia Respondent

- and -

Attorney General of Canada, Attorney General of Ontario, Attorney General of Quebec, Attorney General of Saskatchewan, Attorney General of Alberta, Canadian Superior Courts Judges Association, Canadian Bar Association, Canadian Association of Provincial Court Judges, Canadian Taxpayers Federation and Canadian Civil Liberties Association Interveners

CORAM: Wagner C.J. and Abella, Moldaver, Karakatsanis, Côté, Brown, Rowe, Martin and Kasirer JJ.

Reasons for Judgment:	Karakatsanis J. (Wagner C.J. and Abella, Moldaver, Côté,
(paras. 1 to 121)	Brown, Rowe, Martin and Kasirer JJ. concurring)

NOTE: This document is subject to editorial revision before its reproduction in final form in the *Canada Supreme Court Reports*.

B.C. (A.G.) v. PROV. CT. JUDGES' ASSN.

Attorney General of British Columbia	Appellant
v.	

Provincial Court Judges' Association of British Columbia	Respondent
--	------------

and

Attorney General of Canada, Attorney General of Ontario, Attorney General of Quebec, Attorney General of Saskatchewan, Attorney General of Alberta, Canadian Superior Courts Judges Association, Canadian Bar Association, Canadian Association, Canadian Association of Provincial Court Judges, Canadian Taxpayers Federation and Canadian Civil Liberties Association Interveners

Indexed as: British Columbia (Attorney General) v. Provincial Court Judges' Association of British Columbia

2020 SCC 20

File No.: 38381.

2019: December 9; 2020: July 31.

Present: Wagner C.J. and Abella, Moldaver, Karakatsanis, Côté, Brown, Rowe, Martin and Kasirer JJ.

ON APPEAL FROM THE COURT OF APPEAL FOR BRITISH COLUMBIA

Constitutional law — Judicial independence — Judicial remuneration — Judicial compensation commission making recommendations to provincial Attorney General about remuneration, allowances and benefits of provincial judges — Attorney General making submission to Cabinet concerning commission's recommendations and government's response — Legislative Assembly passing resolution rejecting commission's recommended increase in salary — Judges petitioning for judicial review of Legislative Assembly's resolution — Whether Cabinet submission should form part of record on judicial review.

In October 2016, the British Columbia judicial compensation commission recommended an 8.2 percent increase in the salary of provincial judges in 2017-18. The Attorney General made a submission to Cabinet concerning the commission's recommendations, and then tabled the government's proposed response to the commission's report and proposed a resolution rejecting the commission's recommended salary increase and adopting a 3.8 percent increase instead. The Legislative Assembly passed the resolution. The Provincial Court Judges' Association petitioned for judicial review of the resolution and sought an order to require the Attorney General to produce the Cabinet submission relied on in preparing the government's response. The master hearing the motion ordered the Attorney General to produce the Cabinet submission. Appeals by the Attorney General from the master's decision to the Supreme Court of British Columbia and then to the Court of Appeal were dismissed.

Held: The appeal should be allowed and the master's order for production of the Cabinet submission quashed.

A government must give specific reasons justifying any departure from the recommendations of a judicial compensation commission. The government's response to the commission's recommendations is subject to a limited form of judicial review as described in Bodner v. Alberta, 2005 SCC 44, [2005] 2 S.C.R. 286. Bodner review is the mechanism for ensuring that the government respects the commission process and for safeguarding the public confidence in the administration of justice that process serves to protect. The standard of justification to uphold the government's response is that of rationality. Bodner sets out a three-part test for determining whether a government's decision to depart from a commission's recommendation meets this standard: (1) whether the government has articulated a legitimate reason for departing from the commission's recommendations; (2) whether the government's reasons rely upon a reasonable factual foundation; and (3) whether the commission process has been respected and its purposes — preserving judicial independence and depoliticizing the setting of judicial remuneration — have been achieved.

The limited nature of *Bodner* review, the role of the reviewing court and the purpose of the process have implications for the evidence considered by the reviewing court. The rules of evidence and production must be applied in a manner that reflects the unique features of Bodner review, and respects both judicial independence and the confidentiality of Cabinet decision making. The record on Bodner review necessarily includes any submissions made to the commission by the judges and others; the commission's report, government. including its recommendations; and the government's response to the recommendations. Certain forms of additional evidence are admissible if they are relevant to determining whether any part of the *Bodner* test has been met, including evidence aimed at calling into question the reasonableness of the factual foundation relied on by the government, the government's lack of meaningful engagement with or respect for the commission process or whether the government's response was grounded in an improper or colourable purpose. To those ends, the party seeking review can ask that the government produce evidence in its possession. Since a Bodner review often concerns decisions in which Cabinet plays a part, a party seeking review may request the production of a confidential Cabinet document.

Generally, what is in issue in a *Bodner* review is whether a government failed to meet its constitutional obligations flowing from the principle of judicial independence in its response to a commission's recommendations. The relevance of any proposed additional evidence must therefore be tested in relation to the issues that the court must determine on such a review. To be relevant, the proposed evidence must contain something that tends to address a fact concerning one of the steps of the test established in *Bodner*.

However, something more than relevance is needed to strike the appropriate balance between respecting Cabinet confidentiality and maintaining the overall integrity of *Bodner* review. Although any inspection of a confidential Cabinet document undermines Cabinet confidentiality to some extent, judicial inspection of a document that concerns Cabinet deliberations about the judiciary would undermine it more significantly. Accordingly, special considerations arise when the party seeking *Bodner* review asks the government to produce a document related to Cabinet decision making. The party seeking review must point to something in the record, including otherwise admissible evidence, that supports its view that the document may tend to show that the government response failed to meet one or more parts of the *Bodner* test. It is not enough to simply say that the document was before the decision-maker or that it would provide additional background or context for the reviewing court.

If the party seeking review makes the requisite showing — that there is some basis to believe that the document may contain evidence which tends to show that the government failed to meet one of the requirements described in *Bodner* — the government must produce it for the court's examination. The reviewing court must then examine the document in private to determine whether it, in fact, provides some evidence which tends to show that the government failed to meet one of the parts of the *Bodner* test. The document must be of assistance in challenging the legitimacy of the government's reasons, the reasonableness of the factual foundation it relied on, the respect it has shown the commission process or whether the objectives of the process have been achieved.

Even if the document meets this test, its production remains subject to any other rule of evidence that bars its disclosure, such as public interest immunity. This doctrine prevents the disclosure of a document where the court is satisfied that the public interest in keeping the document confidential outweighs the public interest in its disclosure. Public interest immunity requires a careful balancing of these competing public interests, which must be weighed with reference to a specific document in the context of a particular proceeding. The government has the burden of establishing that a document should not be disclosed because of public interest immunity. In the case of confidential Cabinet documents, since there will be a strong public interest in keeping a document concerning Cabinet deliberations confidential, it must be outweighed by a still stronger public interest to warrant disclosure. The main factors relevant to balancing the public interests in confidentiality and disclosure are identified in Carey v. Ontario, [1986] 2 S.C.R. 637: the level of the decision-making process; the nature of the policy concerned; the contents of the documents; the timing of disclosure; the interests of the administration of justice; and whether the party seeking the production of the documents alleges unconscionable behaviour on the part of the government.

In the *Bodner* review context, various factors will often weigh in favour of keeping a document confidential. The Cabinet decision-making process is among the highest levels of decision making within the executive. Judicial remuneration is an important and sensitive area of public policy. The contents of a document concerning Cabinet deliberations may well reflect the views of individual ministers of the Crown and reveal disagreement among ministers; as a result, its contents will frequently be highly sensitive. Depending on the contents of the document, the timing may also weigh in favour of keeping the document confidential.

The interests of the administration of justice encompass a broad set of considerations, including the importance of the case and the need or desirability of producing the document. In the *Bodner* review context, these considerations cut both ways. Although such reviews are of great importance, the fact that a party seeks production of a relevant confidential Cabinet document in this context is not itself a general basis for disclosure. When considering the interests of the administration of justice, the focus must remain on the degree to which the document bears on what is at issue in the litigation. If the document tends to establish that the government set out to provide misleading public reasons for its response to the commission's recommendations, relied on a fundamentally flawed factual foundation, acted with an improper or colourable purpose, or was indifferent or disrespectful towards the commission process, this bears so directly — and so determinately — on the outcome of the *Bodner* review that to exclude the document would be contrary to the interests of the administration of justice. By contrast, if a Cabinet document's impact on the

Bodner review would be limited, and if its exclusion from the record could hardly keep the reviewing court from adjudicating the issues on their merits, the probative value of such evidence might not weigh heavily enough to warrant disclosure.

In the instant case, the Association did not meet the threshold necessary to compel production of the Cabinet document for judicial inspection. The Association failed to provide any evidence or point to any circumstances that suggest that the Cabinet submission may indicate that the government did not meet the standard required by *Bodner*. There is nothing on the face of the record that indicates the Cabinet submission may contain some evidence which tends to show that the government failed to meet a constitutional requirement. Furthermore, it is not sufficient to point to prior litigation in which the government relied on an inappropriate consideration — as revealed in a past Cabinet submission produced as part of the record — in order to make the Cabinet submission in the present case relevant. Something more would be required for there to be reason to believe that the submission may contain evidence that would tend to show that the government failed to meet a requirement described in *Bodner*.

Since the Association has failed to make the requisite threshold showing, the Attorney General need not produce the document for examination by the Court. It is unnecessary to determine whether any other rule of evidence, such as public interest immunity, would apply so as to permit the Attorney General to refuse to produce the Cabinet submission.

Cases Cited

By Karakatsanis J.

Explained: Provincial Court Judges' Assn. of New Brunswick v. New Brunswick (Minister of Justice); Ontario Judges' Assn. v. Ontario (Management Board); Bodner v. Alberta; Conférence des juges du Québec v. Quebec (Attorney General); Minc v. Quebec (Attorney General), 2005 SCC 44, [2005] 2 S.C.R. 286; Reference re Remuneration of Judges of the Provincial Court of Prince Edward Island, [1997] 3 S.C.R. 3; Carey v. Ontario, [1986] 2 S.C.R. 637; referred to: Nova Scotia (Attorney General) v. Judges of the Provincial Court and Family Court of Nova Scotia, 2020 SCC 21; Stonechild, Re, 2007 SKCA 74, 304 Sask R. 1; Beauregard v. Canada, [1986] 2 S.C.R. 56; Reference re Supreme Court Act, ss. 5 and 6, 2014 SCC 21, [2014] 1 S.C.R. 433; Conférence des juges de paix magistrats du Québec v. Quebec (Attorney General), 2016 SCC 39, [2016] 2 S.C.R. 116; Ell v. Alberta, 2003 SCC 35, [2003] 1 S.C.R. 857; Mackin v. New Brunswick (Minister of Finance), 2002 SCC 13, [2002] 1 S.C.R. 405; Reference re Canada Assistance Plan (B.C.), [1991] 2 S.C.R. 525; Wells v. Newfoundland, [1999] 3 S.C.R. 199; Delios v. Canada (Attorney General), 2015 FCA 117, 100 Admin L.R. (5th) 301; Sobeys West Inc. v. College of Pharmacists of British Columbia, 2016 BCCA 41, 80 B.C.L.R. (5th) 243; R. v. White, 2011 SCC 13, [2011] 1 S.C.R. 433; Lax Kw'alaams Indian Band v. Canada (Attorney General), 2011 SCC 56, [2011] 3 S.C.R. 535; Provincial Court Judges' Association of British Columbia v. British Columbia (Attorney General), 2012 BCSC 1022; Canada (Auditor General) v. Canada (Minister of

Energy, Mines and Resources), [1989] 2 S.C.R. 49; Fraser v. Public Service Staff Relations Board, [1985] 2 S.C.R. 455; New Brunswick Broadcasting Co. v. Nova Scotia (Speaker of the House of Assembly), [1993] 1 S.C.R. 319; Doucet-Boudreau v. Nova Scotia (Minister of Education), 2003 SCC 62, [2003] 3 S.C.R. 3; Ontario v. Criminal Lawyers' Association of Ontario, 2013 SCC 43, [2013] 3 S.C.R. 3; MacKeigan v. Hickman, [1989] 2 S.C.R. 796; Canada (House of Commons) v. Vaid, 2005 SCC 30, [2005] 1 S.C.R. 667; Chagnon v. Syndicat de la fonction publique et parapublique du Québec, 2018 SCC 39, [2018] 2 S.C.R. 687; Reference re Resolution to Amend the Constitution, [1981] 1 S.C.R. 753; Reference re Secession of Quebec, [1998] 2 S.C.R. 217; Babcock v. Canada (Attorney General), 2002 SCC 57, [2002] 3 S.C.R. 3; Reference re Remuneration of Judges of the Provincial Court of Prince Edward Island, [1998] 1 S.C.R. 3; Quebec (Commission des droits de la personne) v. Attorney General of Canada, [1982] 1 S.C.R. 215; R. v. D.L.W., 2016 SCC 22, [2016] 1 S.C.R. 402; R. v. Ahmad, 2011 SCC 6, [2011] 1 S.C.R. 110; Smallwood v. Sparling, [1982] 2 S.C.R. 686; Bisaillon v. Keable, [1983] 2 S.C.R. 60; Ainsworth Lumber Co. v. Canada (Attorney General), 2003 BCCA 239, 14 B.C.L.R. (4th) 302; Telezone Inc. v. Canada (Attorney General) (2004), 69 O.R. (3d) 161; Michaud v. Quebec (Attorney General), [1996] 3 S.C.R. 3; R. v. Barros, 2011 SCC 51, [2011] 3 S.C.R. 368; Somerville v. Scottish Ministers, [2007] UKHL 44, [2007] 1 W.L.R. 2734; Al Rawi v. Security Service, [2011] UKSC 34, [2012] 1 A.C. 531; Conway v. Rimmer, [1968] A.C. 910; Nova Scotia Provincial Judges' Association v. Nova Scotia (Attorney General), 2018 NSSC 13, 409 C.R.R. (2d) 117; Nova Scotia (Attorney General) v. Judges of the Provincial Court and Family Court of Nova

Scotia, 2018 NSCA 83, 429 D.L.R. (4th) 359; Newfoundland (Treasury Board) v. N.A.P.E., 2004 SCC 66, [2004] 3 S.C.R. 381; Commonwealth v. Northern Land Council, [1993] HCA 24, 176 C.L.R. 604; Air Canada v. Secretary of State for Trade, [1983] 2 A.C. 394.

Statutes and Regulations Cited

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Constitution Act, 1982, s. 42(1)(*d*).

Crown Liability and Proceedings Act, 2019, S.O. 2019, c. 7, Sch. 17, s. 13(2).

Crown Proceeding Act, R.S.B.C. 1996, c. 89, s. 9.

Judicial Compensation Act, S.B.C. 2003, c. 59, ss. 2, 5(1), (3), (5), (5.1), (5.2), 6(1), (2), (3), (4), 7.1, 8(1).

O.C. 213/2017.

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APPEAL from a judgment of the British Columbia Court of Appeal

(Bauman C.J.B.C. and Harris and Dickson JJ.A.), 2018 BCCA 394, 19 B.C.L.R. (6th)

188, 430 D.L.R. (4th) 660, 48 Admin L.R. (6th) 279, [2018] B.C.J. No. 3445 (QL),

2018 CarswellBC 2776 (WL Can.), affirming a decision of Hinkson C.J.S.C., 2018

BCSC 1390, 19 B.C.L.R. (6th) 168, [2018] B.C.J. No. 2995 (QL), 2018 CarswellBC

2158 (WL Can.), affirming an order of Master Muir, 2018 BCSC 1193, [2018] B.C.J.

No. 1410 (QL), 2018 CarswellBC 1891 (WL Can.). Appeal allowed.

Stein K. Gudmundseth, Q.C., Andrew D. Gay, Q.C., and Clayton J. Gallant, for the appellant.

Joseph J. Arvay, Q.C., and Alison M. Latimer, for the respondent.

Michael H. Morris and Marilyn Venney, for the intervener the Attorney General of Canada.

Sarah Kraicer and Andrea Bolieiro, for the intervener the Attorney General of Ontario.

Brigitte Bussières and Robert Desroches, for the intervener the Attorney General of Quebec.

Thomson Irvine, Q.C., for the intervener the Attorney General of Saskatchewan.

Doreen C. Mueller, for the intervener the Attorney General of Alberta.

Pierre Bienvenu, Azim Hussain and *Jean-Simon Schoenholz*, for the intervener the Canadian Superior Courts Judges Association.

Guy J. Pratte, Ewa Krajewska and Neil Abraham, for the intervener the Canadian Bar Association.

Steven M. Barrett and Colleen Bauman, for the intervener the Canadian Association of Provincial Court Judges.

Adam Goldenberg and Stephanie Willsey, for the intervener the Canadian Taxpayers Federation.

Andrew K. Lokan and Lauren Pearce, for the intervener the Canadian Civil Liberties Association.

The judgment of the Court was delivered by

KARAKATSANIS J. —

[1] This appeal arises in litigation that implicates the relationship between two branches of the state. It requires this Court to balance several constitutional imperatives relating to the administration of justice and the separation of powers between the executive, legislative and judicial branches of the state: the financial dimension of judicial independence; the shared responsibility of the executive and legislature to make decisions about public money; and the public interest in ensuring the executive can conduct its internal business in confidence.

[2] This appeal, along with its companion appeal, *Nova Scotia (Attorney General) v. Judges of the Provincial Court and Family Court of Nova Scotia*, 2020 SCC 21, asks whether a Cabinet submission concerning a government's response to a judicial compensation commission's recommendations is properly part of the record on a judicial review of the government's response. If so, the further issue arises whether the Attorney General of British Columbia should nevertheless be permitted to refuse to produce the submission on grounds of public interest immunity.

[3] The British Columbia courts found that the confidential Cabinet document requested by the Provincial Court Judges' Association of British Columbia was relevant and not protected by public interest immunity, and ordered that the Attorney General produce it.

[4] In my view, they were wrong to do so.

[5] In its judicial independence case law, this Court has consistently sought to strike a balance between several competing constitutional considerations by establishing a unique process for setting judicial remuneration, backed up by a focused, yet robust form of judicial review described in *Bodner v. Alberta*, 2005 SCC 44, [2005] 2 S.C.R. 286.¹ In resolving this appeal, the rules of evidence and production must be applied in a manner that reflects the unique features of the limited review described in *Bodner*, and respects both judicial independence and the confidentiality of Cabinet decision making.

[6] For the reasons that follow, where a party seeking *Bodner* review requests that the government produce a document relating to Cabinet deliberations, it must first establish that there is some basis to believe that the document may contain evidence which tends to show that the government failed to meet one of the requirements described in *Bodner*. Only then would the government be required to

¹ Provincial Court Judges' Assn. of New Brunswick v. New Brunswick (Minister of Justice); Ontario Judges' Assn. v. Ontario (Management Board); Bodner v. Alberta; Conférence des juges du Québec v. Quebec (Attorney General); Minc v. Quebec (Attorney General), 2005 SCC 44, [2005] 2 S.C.R. 286 (Bodner).

produce the document for judicial inspection. If the document does in fact provide some evidence which tends to show that the government's response does not comply with the constitutional requirements, the court can then determine whether its production is barred by public interest immunity or another rule of evidence invoked by the government.

[7] Public interest immunity requires a careful balancing between the competing public interests in confidentiality and disclosure. Since there will be a strong public interest in keeping a document concerning Cabinet deliberations confidential, it must be outweighed by a still stronger public interest to warrant the document's disclosure. In the *Bodner* context, the strength of the public interest in disclosure will often depend on the importance of the document to determining the issues before the court in the *Bodner* review.

[8] Here, the Provincial Court Judges' Association did not meet the threshold necessary to compel production of a confidential Cabinet document for judicial inspection. While this is not a high bar, it is not met simply by showing that the government considered the Cabinet document before making its response. I would allow the appeal and quash the order for production of the Cabinet submission.

I. Background

A. Judicial Compensation Act, S.B.C. 2003, c. 59

[9] In the *Reference re Remuneration of Judges of the Provincial Court of Prince Edward Island*, [1997] 3 S.C.R. 3 (*Provincial Judges Reference*), this Court set out the constitutional baseline for making changes to judicial remuneration. The *Judicial Compensation Act* implements that baseline in British Columbia.

[10] The Judicial Compensation Act provides for the appointment of a triennial judicial compensation commission to make recommendations about the remuneration, allowances and benefits of provincial judges and judicial justices: ss. 2 and 5(1). The commission must consider a prescribed set of factors and may consider other factors, provided it justifies their relevance: s. 5(5), (5.1) and (5.2). The commission communicates its recommendations in a final report to the Attorney General: s. 5(3).²

[11] Upon receipt of the commission's report, the Attorney General must then lay the report before the Legislative Assembly of British Columbia within a statutory timeline: s. 6(1). The Attorney General must also advise the Assembly that if it does not reject the commission's recommendations within a statutory timeline, the recommendations will go into effect: s. 6(1) and (3). The Assembly can then pass a resolution rejecting one or more recommendations and set judicial remuneration, allowances and benefits: s. 6(2). The resolution has binding legal effect: ss. 6(4) and 8(1).

² The Attorney General is the minister responsible for the *Judicial Compensation Act* designated by O.C. 213/2017, Appendix B; see also *Attorney General Act*, R.S.B.C. 1996, c. 22, s. 2(j); *Constitution Act*, R.S.B.C. 1996, c. 66, s. 10(3).

B. Judicial Compensation Commission's Recommendations and Government's Response

[12] In October 2016, the Judicial Compensation Commission submitted its final report to the Attorney General and made recommendations for the 2017-20 period. The commission recommended an 8.2 percent increase in the salary of provincial judges in 2017-18 and a 1.5 percent increase in both 2018-19 and $2019-20.^{3}$ The commission also recommended that the Provincial Court Judges' Association be reimbursed for the entirety of its costs of participating in the commission process.

[13] At some point after the commission submitted its report, the Attorney General made a submission to Cabinet concerning the commission's recommendations and the government's response. The Cabinet submission is not in the record before this Court and was not put before the courts below. Moreover, there is no evidence in the record about what the submission might contain.

[14] Having laid the commission's report before the Legislative Assembly in September 2017, the Attorney General tabled the government's proposed response to the commission's report in October 2017. The Attorney General did not table the Cabinet submission and there is no indication in the record that any member of the

³ The baseline salary used by the commission in making its recommendations was \$244,112 for the 2016-17 fiscal year, but the Legislative Assembly later retrospectively increased the salary for 2016-17 by 3.4 percent to \$252,290, thereby reducing the effect of the increase recommended by the commission for the 2017-20 period.

Legislative Assembly other than those serving in Cabinet was aware of the contents of the submission.

[15] The Attorney General moved to pass a resolution rejecting the commission's recommended increase in the salary of provincial judges and adopting a 3.8 percent increase in 2017-18 and a 1.5 percent increase in both 2018-19 and 2019-20.⁴ The Attorney General also proposed reducing the recommended reimbursement for the Provincial Court Judges' Association's costs of participating in the commission process from approximately \$93,000 to about \$66,000 in accordance with the formula established by s. 7.1 of the *Judicial Compensation Act*. With the support of government and opposition members, the Legislative Assembly passed the resolution.

[16] The Provincial Court Judges' Association petitioned for judicial review of the Legislative Assembly's resolution. Among other things, the Provincial Court Judges' Association asked to have the resolution quashed and sought a declaration that the government's response and the resolution were inconsistent with the *Judicial Compensation Act* and with the constitutional principle of judicial independence.

[17] In anticipation of the hearing of their petition on the merits, the Provincial Court Judges' Association asked the Attorney General to produce the Cabinet submission relied on in preparing the government's response. The Attorney General

⁴ The retrospective salary increase for 2016-17 similarly reduces the effect of the increase adopted by the Legislative Assembly for the 2017-20 period.

refused, so the Association sought an order to require the Attorney General to produce the submission: see *Supreme Court Civil Rules*, B.C. Reg. 168/2009, r. 22-1(4)(c).

II. <u>Procedural History</u>

A. Supreme Court of British Columbia, 2018 BCSC 1193 (Master Muir)

[18] The Provincial Court Judges' Association's motion was initially heard by a Supreme Court of British Columbia master. The master noted that the Attorney General did not contest that the government's response was informed by a detailed submission to Cabinet: para. 9 (CanLII).

[19] Turning to relevance, while acknowledging that the government had not referred to or relied on the submission to Cabinet in making its decision, the master concluded that the submission was relevant to the *Bodner* review and specifically to whether the government relied on a reasonable factual foundation in developing its response to the commission's recommendation, and whether its response demonstrates meaningful engagement with the commission process: paras. 9 and 18-21.

[20] Regarding public interest immunity, the master explained that the Attorney General did not provide any specific evidence of harm that would result from the production of the Cabinet submission: para. 23. The importance of review of

the government's response and the need for transparency outweighed the public interest in its remaining confidential: paras. 23 and 27. The master ordered the Attorney General to produce the Cabinet submission: para. 28.

B. Supreme Court of British Columbia, 2018 BCSC 1390, 19 B.C.L.R. (6th) 168 (Hinkson C.J.S.C.)

[21] The Supreme Court of British Columbia dismissed the appeal from the master's decision. Like the master, the court did not examine the Cabinet submission: para. 45.

[22] Hinkson C.J.S.C. found no error in the master's conclusion that the Cabinet submission was relevant, agreeing that the submission was relevant to the issue whether the government respected the commission process such that the overall objectives of the process were achieved: paras. 34-35.

[23] The court found no error in the master's conclusion that public interest immunity did not apply based on the factors identified in *Carey v. Ontario*, [1986] 2 S.C.R. 637. The court emphasized that the submission related to the subject matter of the litigation and that the Attorney General did not offer in any evidence that any particular harm would flow from disclosure: para. 46.

C. Court of Appeal for British Columbia, 2018 BCCA 394, 19 B.C.L.R. (6th) 188 (Bauman C.J.B.C., Harris and Dickson JJ.A.)

[24] The Court of Appeal for British Columbia dismissed the Attorney General's further appeal from the Supreme Court's decision. Writing for the Court of Appeal, Bauman C.J.B.C. explained that although the Legislative Assembly is the decision-maker under the *Judicial Compensation Act*, the Attorney General prepares the government's draft response for approval by Cabinet before presenting it to the Legislative Assembly: para 9. Cabinet is thus directly involved in the decision-making process.

[25] The Court of Appeal concluded that the Cabinet submission was necessarily relevant given that it informed the government's response to the commission's recommendations: paras. 9 and 16. Since Cabinet was "a primary actor in the impugned 'government response' . . . the Cabinet submission is clearly 'evidence which was before the administrative decision-maker'" and should be included in the record on judicial review: para. 19, quoting *Stonechild, Re*, 2007 SKCA 74, 304 Sask. R. 1, cited as *Hartwig v. Saskatchewan (Commission of Inquiry)*, at para. 33. The Court of Appeal also affirmed Hinkson C.J.S.C.'s analysis on public interest immunity: para. 22.

III. Issues

[26] This appeal raises two issues: (a) whether the Cabinet submission in this case should form part of the record on *Bodner* review and (b) whether the Cabinet submission is protected by public interest immunity.

IV. Analysis

A. Judicial Independence and the Nature of Bodner Review

[27] This appeal arises in the context of review of a government's response to a judicial compensation commission's recommendations. Such review aims to safeguard judicial independence.

[28] The constitutional principle of judicial independence flows from the recital in the preamble to the *Constitution Act, 1867* that our country is to have a "Constitution similar in Principle to that of the United Kingdom", ss. 96 to 101 of the *Constitution Act, 1867*, s. 11(*d*) of the *Canadian Charter of Rights and Freedoms* and s. 42(1)(*d*) of the *Constitution Act, 1982*: *Beauregard v. Canada*, [1986] 2 S.C.R. 56, at pp. 72-73; *Provincial Judges Reference*, at paras. 84 and 105-9; *Reference re Supreme Court Act, ss. 5 and 6*, 2014 SCC 21, [2014] 1 S.C.R. 433, at para. 94; *Conférence des juges de paix magistrats du Québec v. Quebec (Attorney General)*, 2016 SCC 39, [2016] 2 S.C.R. 116, at para. 31.

[29] These provisions and the broader principle of judicial independence serve not only to protect the separation of powers between the branches of the state and thus, the integrity of our constitutional structure, but also to promote public confidence in the administration of justice: *Ell v. Alberta*, 2003 SCC 35, [2003] 1 S.C.R. 857, at paras. 21-23; *Conférence des juges de paix magistrats*, at para. 31. They are fundamental to the rule of law and to democracy in Canada. [30] The overarching principle of judicial independence applies to all courts, whether of civil or criminal jurisdiction and whether their judges are appointed by federal, provincial or territorial authorities: *Provincial Judges Reference*, at para. 106; *Ell*, at paras. 21-24; *Conférence des juges de paix magistrats*, at para. 32.

[31] The three core characteristics of judicial independence are security of tenure, financial security and administrative independence: *Provincial Judges Reference*, at para. 118. The characteristic at issue in this appeal — financial security — in turn has three components, "which all flow from the constitutional imperative that . . . the relationship between the judiciary and the other branches of government be <u>depoliticized</u>": para. 131 (emphasis in original). First, absent a "dire and exceptional financial emergency precipitated by unusual circumstances", a government cannot change judicial remuneration parameters without first seeking the recommendations of an independent body, a "commission": paras. 133 and 137. (Government can, depending on the context, mean the executive, legislature or legislative assembly.) Second, judges cannot engage in negotiations with the government over remuneration: para. 134. Finally, judicial remuneration cannot fall below the basic minimum level required for the office of a judge: para. 135.

[32] More specifically, this appeal concerns the first component of financial security: the convening of a judicial compensation commission to make recommendations concerning judicial remuneration. The commission charged with

making such recommendations must be independent, effective and objective: *Provincial Judges Reference*, at para. 133.

[33] The effectiveness requirement means that the commission must be regularly convened, that no changes can be made to remuneration until the commission submits its report and that "the reports of the commission must have a meaningful effect on the determination of judicial salaries": *Provincial Judges Reference*, at paras. 174-75 and 179; see also *Bodner*, at para. 29.

[34] To ensure that the commission's recommendations have a meaningful effect, the government must formally respond to the commission's report: *Provincial Judges Reference*, at para. 179; *Bodner*, at para. 22. Because of the executive and legislature's shared constitutional responsibility to make decisions about the expenditure of public money,⁵ the commission's recommendations are not binding (unless the legislature so provides). The government must, however, give specific reasons justifying any departure from the recommendations: *Provincial Judges Reference*, at para. 180; *Bodner*, at paras. 18 and 20-21; *Conférence des juges de paix magistrats*, at para. 35.

[35] To hold a government to its constitutional obligations in jurisdictions where a commission's recommendations are not binding, the government's response to the commission's recommendations is subject to what this Court described in *Bodner* as a "limited form of judicial review": paras. 29 and 42. The standard of

⁵ See *Constitution Act, 1867*, ss. 54, 90 to 92, 100 to 102, 106 and 126.

justification to uphold the government's response is that of "rationality": *Provincial Judges Reference*, at paras. 183-84; *Mackin v. New Brunswick (Minister of Finance)*, 2002 SCC 13, [2002] 1 S.C.R. 405, at para. 57; *Bodner*, at para. 29. Both the standard of justification and the test used to measure the government's response against that standard are "deferential": *Bodner*, at paras. 30, 40 and 43. Both the fact that the government remains ultimately responsible for setting judicial compensation and the fact that the nature of a *Bodner* review is limited serve to balance the constitutional interests at stake.

[36] Building on the approach established by the *Provincial Judges Reference*, in *Bodner*, at para. 31, this Court set out a three-part test for determining whether a government's decision to depart from a commission's recommendation meets the rationality standard:

- (1) Has the government articulated a legitimate reason for departing from the commission's recommendations?
- (2) Do the government's reasons rely upon a reasonable factual foundation? and
- (3) Viewed globally, has the commission process been respected and have the purposes of the commission — preserving judicial independence and depoliticizing the setting of judicial remuneration — been achieved?

[37] Under the first two parts of the test, the focus is on the reasons given by government for departing from the commission's recommendations: *Bodner*, at paras. 32-33 and 36. The government "must respond to the [commission's] recommendations" by "giv[ing] legitimate reasons for departing from or varying them": paras. 23 and 24. The reasons must "show that the commission's recommendations have been taken into account and must be based on [a reasonable factual foundation] and sound reasoning": paras. 25 and 26. The reasons must also "articulat[e] the grounds for rejection or variation", "reveal a consideration of the judicial office and an intention to deal with it appropriately", "preclude any suggestion of attempting to manipulate the judiciary" and "reflect the underlying public interest in having a commission process, being the depoliticization of the remuneration process and the need to preserve judicial independence": para. 25.

[38] The third part of the *Bodner* test looks to whether the government has respected the commission process and, more broadly, whether the purposes of that process have been achieved: paras. 30-31, 38 and 43. This new part of the test was added by this Court in an effort to achieve the "unfulfilled" hopes this Court had in the *Provincial Judges Reference* of depoliticizing the process of setting judicial remuneration and thereby preserving judicial independence: paras. 10-12 and 31. The third step in the *Bodner* test requires the court to take a global perspective and ask whether the government demonstrated respect for the judicial office by engaging meaningfully with the commission process: see paras. 25, 31 and 38.

[39] However, this addition in *Bodner* was not intended to transform the analysis into a probing review of the process through which the government developed its response, whether it took place within the executive, the legislature or both. As a result, I cannot agree with the Provincial Court Judges' Association that references to the "totality" or "whole of the process" in *Bodner*, at para. 38, were meant to expand the scope of review such that the Cabinet decision-making process must necessarily be scrutinized in every case.

[40] There is no doubt that the *Provincial Judges Reference* and *Bodner* require that the reviewing court focus on the government's response. In *Bodner* itself, this Court looked at the Alberta, New Brunswick and Ontario governments' responses to commission recommendations to determine whether the third part of the *Bodner* test had been met: paras. 83, 100 and 130-31. That said, the third part of the *Bodner* test is not necessarily limited to consideration of the government's public reasons.

[41] Moreover, this does not mean that the government can hide behind reasons that conceal an improper or colourable purpose. The *Provincial Judges Reference* and *Bodner* cannot be interpreted to mean that as long as the government's public reasons are facially legitimate and appear grounded in a reasonable factual foundation, the government could provide reasons that were not given in good faith. Indeed, it is implicit in the third part of the *Bodner* test itself that, presented with evidence that the government's response is rooted in an improper or colourable purpose and has accordingly fallen short of the constitutional benchmark set in this
Court's jurisprudence, the reviewing court cannot simply accept the government's formal response without further inquiry.

[42] This is nothing new. In *Beauregard*, at p. 77, this Court made clear that "[i]f there were any hint that a federal law dealing with [the fixing of salaries and pensions of superior court judges] . . . was enacted for an <u>improper or colourable</u> <u>purpose</u>, or if there was discriminatory treatment of judges *vis-à-vis* other citizens, then serious issues relating to judicial independence would arise and the law might well be held *ultra vires* s. 100 of the *Constitution Act, 1867*" (emphasis added). This is true of all judges to whom the constitutional principle of judicial independence applies: see *Provincial Judges Reference*, at paras. 145 and 165.

[43] Considerations of legitimacy and respect for the process — and conversely, considerations of impropriety or colourability — permeate the entire *Bodner* analysis. Indeed, in *Bodner*, which concerned the remuneration of provincially-appointed judges, this Court considered whether the reasons given by the Alberta, New Brunswick, Ontario and Quebec governments were "based on purely political considerations", "reveal political or discriminatory motivations" or "evidence any improper purpose or intent to manipulate or influence the judiciary": paras. 66, 96 and 159; see also paras. 68 and 123.

[44] Reasons that reveal an improper or colourable purpose would fail the first step of the *Bodner* test which requires that a government articulate a legitimate reason for departing from a commission's recommendations. Similarly, in reviewing whether a government had relied on a reasonable factual foundation, this Court acknowledged the possibility that the government might also rely on "affidavits containing evidence of good faith and commitment to the process, such as information relating to the government's study of the commission's recommendations": *Bodner*, at para. 36. Finally, a government's conduct and the adequacy of its response are also directly engaged in the third part of the *Bodner* test, which looks to whether the government has respected the commission process and, more broadly, whether the purposes of that process have been achieved.

[45] Thus, even if a government's public reasons appear to satisfy the requirements of *Bodner*, the government's response remains subject to challenge on the basis that it is grounded in an improper or colourable purpose.

[46] In *Bodner*, this Court underscored that "[t]he limited nature of judicial review [of the government's response] dictates the choice of remedies. The remedies must be consistent with the role of the reviewing court and the purpose of the commission process": para. 42. In my view, the limited nature of *Bodner* review, the role of the reviewing court and the purpose of the process also have implications for the evidence considered by the reviewing court.

B. Evidence on Bodner Review

[47] The limited nature of *Bodner* review implies that the record for this type of review is narrower than it would be on ordinary judicial review. It also means that

relevance must be assessed in relation to the specific issues that are the focus of the court's inquiry on *Bodner* review: the legitimacy of the reasons given by government, the reasonableness of the factual foundation relied on by government, and the respect for the commission process by government such that the objectives of the process have been achieved. Further, since *Bodner* review tends to oppose two branches of the state, special considerations arise where the party seeking *Bodner* review requests the production of a confidential Cabinet document. As I detail below, those considerations require that the party seeking production establish that there is some basis to believe that the document may contain evidence which tends to show that the government failed to meet a requirement described in this Court's jurisprudence, including *Bodner*. Only then will the reviewing court examine the document to determine whether it should be produced.

(1) <u>Scope of the Record on *Bodner* Review</u>

[48] Like the Court of Appeal, the Provincial Court Judges' Association invokes the rule that the record on judicial review generally includes any evidence that was before the decision-maker, subject to limited exceptions that either add to or subtract from the record. According to the Provincial Court Judges' Association, since the submission was put before Cabinet and since Cabinet approved the resolution introduced by the Attorney General and ultimately passed by the Legislative Assembly, the Cabinet submission was part of the evidence before the decision-maker and is thus relevant to the judicial review. The Provincial Court Judges' Association argues that the submission must therefore be included in the record on judicial review.

[49] The Attorney General argues that the decision-maker was the Legislative Assembly, not Cabinet, so the Cabinet submission was not before the decision-maker and therefore should not be included in the record. More fundamentally, the Attorney General rejects the suggestion that the administrative law notion of the record on judicial review applies in this context.

[50] With respect to the identification of the formal decision-maker, neither the *Provincial Judges Reference* nor *Bodner* prescribes that a particular institution must make the decision to respond to a commission's recommendations. In some cases, it may be clear that only a single institution is involved, but in a jurisdiction like British Columbia where both the executive and Legislative Assembly play a substantive role, it would be artificial to focus solely on the Legislative Assembly's part and ignore the executive's involvement. Indeed, in this case the executive's proposed reasons for departing from the commission's recommendations were incorporated by reference into the resolution passed by the Legislative Assembly.

[51] More importantly, in my view, the *Provincial Judges Reference* and *Bodner* describe a unique form of review distinct from judicial review in the ordinary administrative law sense. In contrast to judicial review, *Bodner* review is available even when the decision-maker is the legislature (or any part of the legislature): see *Reference re Canada Assistance Plan (B.C.)*, [1991] 2 S.C.R. 525, at p. 558; *Wells v.*

Newfoundland, [1999] 3 S.C.R. 199, at para. 59. Further, the grounds for a *Bodner* review are narrower than those for a usual judicial review. The *Bodner* grounds centre on the legitimacy and sufficiency of a government's reasons for departing from a commission's recommendations, whether the government has respected the commission process more generally and whether the objectives of the process have been achieved.

[52] In the usual context of judicial review, the record generally consists of the evidence that was before the decision-maker: see *Delios v. Canada (Attorney General)*, 2015 FCA 117, 100 Admin L.R. (5th) 301, at para. 42; *Sobeys West Inc. v. College of Pharmacists of British Columbia*, 2016 BCCA 41, 80 B.C.L.R. (5th) 243, at para. 52. However, the rule that the record generally consists of the evidence that was before the decision-maker cannot be automatically transposed into the limited context of *Bodner* review.

[53] The record on *Bodner* review necessarily includes any submissions made to the commission by the government, judges and others; the commission's report, including its recommendations; and the government's response to the recommendations, which, as the *Provincial Judges Reference* recognized, at para. 180, may take different forms depending on which institution is charged with responding.

[54] As *Bodner* itself acknowledged, the record may also include certain forms of additional evidence put in by the government: paras. 27 and 36. The

government may be permitted to "provide details [concerning the factual foundation of its response], in the form of affidavits, relating to economic and actuarial data and calculations" and "affidavits containing evidence of good faith and commitment to the process, such as information relating to the government's study of the impact of the commission's recommendations": para. 36; see also paras. 63-64 and 103. But the government cannot use the additional evidence to "advance reasons other than those mentioned in its response" or to cure defects in the factual foundation it relied on in its response: paras. 27 and 36.

[55] Although the point was not made explicitly in *Bodner*, the party seeking *Bodner* review, which will usually be the judges whose remuneration is at stake, can also put in certain forms of additional evidence relevant to the issues the reviewing court must decide. The party seeking review can, for example, seek to introduce evidence to counter relevant evidence put in by a government. It may put in evidence aimed at calling into question the reasonableness of the factual foundation relied on by the government, the government's lack of meaningful engagement with or respect for the commission process or whether the government's response was grounded in an improper or colourable purpose. To those ends, the party seeking review can ask that the government produce evidence in its possession. For the government's part, provided it respects the rule against supplementing its reasons and bolstering their factual foundation, it can respond with additional evidence of its own to refute the allegations made by the party seeking review.

(2) <u>Relevance of Evidence to a *Bodner* Review</u>

[56] The Attorney General contends that the British Columbia courts were wrong to conclude that the Cabinet submission is relevant to the *Bodner* review sought by the Provincial Court Judges' Association. The attorneys general of Canada and of several provinces intervened to make similar submissions.

[57] Evidence is relevant when it has "some tendency as a matter of logic and human experience to make the proposition for which it is advanced more likely than the proposition would be in the absence of that evidence": *R. v. White*, 2011 SCC 13, [2011] 1 S.C.R. 433, at para. 36, quoting D. M. Paciocco and L. Stuesser, *The Law of Evidence* (5th ed. 2008), at p. 31. Put another way, [TRANSLATION] "a fact is relevant, in particular, if it is a fact in issue, if it contributes to rationally proving a fact in issue or if its purpose is to help the court assess the probative value of testimony": J.C. Royer and C. Piché, *La preuve civile* (5th ed. 2016), at para. 215.

[58] Evidence is thus relevant to a proceeding when it relates to a fact that is in issue in the proceeding. The pleadings, which must be read generously and in light of the governing law, define what is in issue: see *Lax Kw'alaams Indian Band v*. *Canada (Attorney General)*, 2011 SCC 56, [2011] 3 S.C.R. 535, at para. 41.

[59] Generally, what is in issue in a *Bodner* review is whether a government failed to meet its constitutional obligations flowing from the principle of judicial independence in its response to a commission's recommendations. The relevance of any proposed additional evidence must therefore be tested in relation to the issues that the court must determine on *Bodner* review.

[60] To be relevant, the proposed evidence must contain something that tends to establish a fact concerning one of the steps of the test established in *Bodner*. For instance, if the party seeking *Bodner* review contests the reasonableness of the factual foundation relied on by a government, the proposed evidence must either tend to support or undermine the reasonableness of that foundation. Likewise, if the party seeking *Bodner* review alleges disrespect for the commission process or that the government's response is grounded in an improper or colourable purpose, the proposed evidence must either tend to establish the legitimacy of the government's response or its illegitimacy. Finally, if the government introduces evidence of its good faith and commitment to the process, the applicant's proposed evidence may be tendered to undermine that evidence: see, e.g., *Provincial Court Judges' Association of British Columbia v. British Columbia (Attorney General*), 2012 BCSC 1022.

[61] However, as I will explain, the requirement of relevance alone — even as it pertains to the limited set of issues properly considered on a *Bodner* review — fails to adequately protect the competing constitutional imperatives that arise when a party seeking *Bodner* review requests production of a confidential Cabinet document.

(3) Confidential Cabinet Documents in the Bodner Context

[62] Since a *Bodner* review often concerns decisions in which Cabinet plays a part, a party seeking review may request the production of a confidential Cabinet document as additional evidence to show that the government's response does not meet the applicable constitutional requirements. Although the normal course would be for the judge to consider a description of the proposed evidence or examine it to determine whether it is relevant to the *Bodner* review, special considerations arise when the party seeking *Bodner* review asks the government to produce a document related to Cabinet deliberation and decision making.

[63] Unlike an action or an application for judicial review brought against the government by a private party, a *Bodner* review usually opposes two different branches of the state — the judiciary and the executive — as parties in the application. In the *Provincial Judges Reference*, at para. 7, Lamer C.J. underscored that while litigation is always "a very serious business", "it is even more serious where it ensue[s] between two primary organs of our constitutional system — the executive and the judiciary — which both serve important and interdependent roles in the administration of justice". Such litigation may prove necessary to hold the government to its constitutional obligations in jurisdictions where the commission's recommendations have not been made binding. *Bodner* review is the mechanism for ensuring that the government respects the commission process and for safeguarding the public confidence in the administration of justice that process serves to protect.

[64] But as this Court warned in *Canada (Auditor General) v. Canada (Minister of Energy, Mines and Resources)*, [1989] 2 S.C.R. 49, at pp. 89, 97-98, 103 and 109, the outcome of an action brought by one branch of the state against another can effectively alter the separation of powers. Such proceedings call for special prudence to keep courts from overstepping the bounds of the judicial role.

[65] Canadian constitutional law has long recognized that sovereign power in this country is divided not only between Parliament and the provincial legislatures, but also among the executive, legislative and judicial branches of the state: *Fraser v. Public Service Staff Relations Board*, [1985] 2 S.C.R. 455, at pp. 469-70; *New Brunswick Broadcasting Co. v. Nova Scotia (Speaker of the House of Assembly)*, [1993] 1 S.C.R. 319, at p. 389; *Doucet-Boudreau v. Nova Scotia (Minister of Education)*, 2003 SCC 62, [2003] 3 S.C.R. 3, at para. 33. Although there are limited areas of overlap, the branches play fundamentally distinct roles and have accordingly developed different core competencies: *Provincial Judges Reference*, at para. 139; *Ontario v. Criminal Lawyers' Association of Ontario*, 2013 SCC 43, [2013] 3 S.C.R. 3, at para. 29.

[66] As this Court underscored in *Criminal Lawyers' Association*, at para. 29, "each branch will be unable to fulfill its role if it is unduly interfered with by the others". Several doctrines work to prevent undue interference, including the secrecy afforded judicial deliberations (*MacKeigan v. Hickman*, [1989] 2 S.C.R. 796), and the recognition of the privileges, powers and immunities enjoyed by the Senate, the House of Commons and the legislative assemblies: *Constitution Act, 1867*, preamble and s. 18; *New Brunswick Broadcasting Co.*; *Canada (House of Commons) v. Vaid*, 2005 SCC 30, [2005] 1 S.C.R. 667; *Chagnon v. Syndicat de la fonction publique et parapublique du Québec*, 2018 SCC 39, [2018] 2 S.C.R. 687. These doctrines are a corollary to the separation of powers because they help to protect each branch's ability to perform its constitutionally-assigned functions.

[67] The executive, too, benefits from a degree of protection against undue interference. Deliberations among ministers of the Crown are protected by the constitutional convention of Cabinet confidentiality. Constitutional conventions do not have direct legal effect: *Reference re Resolution to Amend the Constitution*, [1981] 1 S.C.R. 753, at pp. 880-83; *Reference re Secession of Quebec*, [1998] 2 S.C.R. 217, at para. 98. However, as I will explain in greater detail, the common law respects the confidentiality convention and affords the executive public interest immunity over deliberations among ministers of the Crown: see *Carey*; *Babcock v. Canada (Attorney General)*, 2002 SCC 57, [2002] 3 S.C.R. 3, at paras. 18-19 and 60.

[68] Where the executive plays a role in formulating a government's response to a judicial compensation commission's recommendations, Cabinet will generally determine the position taken by the executive. Ministers' deliberations concerning their appreciation of the recommendations and how the government should respond will usually be protected by Cabinet confidentiality. [69] A document reflecting on Cabinet deliberations concerning a government's response may well be relevant, even if only to negate the claim that the government failed to meet its constitutional obligations. If the government sought to have the document admitted in support of an affidavit speaking to its good faith and its commitment to the process of the sort described in *Bodner*, at para. 36, the document would undoubtedly be considered relevant. It is difficult, then, to see why the same should not also be true where the party seeking *Bodner* review looks to have the document admitted to challenge the government's claims of good faith and commitment to the process or to raise the question whether the government acted for legitimate reasons or with an improper or colourable purpose.

[70] Thus, if relevance were the sole consideration, confidential Cabinet documents would routinely be part of the record in every *Bodner* review. For example, the Cabinet document would either tend to lend credence to the contention that a government's response failed to meet its constitutional requirements — or tend to refute that contention. In my view, something more than relevance is needed to strike the appropriate balance between respecting Cabinet confidentiality and maintaining the overall integrity of *Bodner* review.

[71] As I have said, *Bodner* review generally opposes two branches of the state: the members of the judiciary challenging the government's response and the attorney general defending it. Where the response is the product of the legislature or a collaboration between the executive and legislature, the interests of the three branches

may, whether directly or indirectly, be at stake. Yet, given our constitutional structure, a member of the judiciary will also necessarily be charged with hearing and determining the application for *Bodner* review: see *Provincial Judges Reference*, at para. 180; *Bodner*, at para. 29. Owing to the doctrine of necessity, this is so even if the judge charged with hearing the application is directly affected by the commission's recommendations and the government's response: see *Reference re Remuneration of Judges of the Provincial Court of Prince Edward Island*, [1998] 1 S.C.R. 3, at para. 5.

[72] Routine judicial inspection of a confidential Cabinet document would reveal to a member of the judiciary the content of Cabinet deliberations. Although any inspection of a confidential Cabinet document undermines Cabinet confidentiality to some extent, judicial inspection of a document that concerns Cabinet deliberations about the judiciary would undermine it more significantly. That is especially so where the judge is directly affected by the response resulting from those deliberations. As with adjudication of the *Bodner* review itself, judicial inspection is appropriate in this context only where it is strictly necessary.

[73] In my view, these special considerations should be accommodated at two distinct stages.

[74] First, a threshold showing is required.

[75] Before the reviewing court can examine the document, the party seeking *Bodner* review must first establish that there is some basis to believe that the Cabinet document in question may contain evidence which tends to show that the government failed to meet a requirement described in *Bodner*.

[76] This threshold is met if the party seeking review can show that there is reason to believe that the Cabinet document may contain something that would undermine the validity of the government response. This requires the party seeking review to point to something in the record, including otherwise admissible evidence, that supports its view that the document may tend to show that the government response failed to meet one or more parts of the test established in *Bodner*.

[77] Meeting this threshold does not require the party to have knowledge or information about the content of the Cabinet submission. Nor does it require that the party point to something in the record that explicitly refers to the Cabinet submission or its contents. It would be unfair to require the party to establish the contents of a confidential document: see, in the public interest immunity context, *Carey*, at p. 678.

[78] The party can, however, rely on additional evidence and the rest of the record, including submissions to the commission, to support its contention that the threshold is met. For instance, the party might point to statements made by ministers or others that suggest that the government's response may have been grounded in reasons other than those formally expressed, that the government may have relied on a flawed or incomplete factual foundation or that the government may have shown

disrespect for the commission process. The party may also be able to rely on additional evidence introduced by the government that suggests that a document concerning Cabinet deliberations may disclose reliance on improper purpose. But it is not enough to simply say that the document was before the executive in its capacity as decision-maker or that it would provide additional background or context for the reviewing court.

[79] If the party seeking review makes the requisite showing — that there is some basis to believe that the document may contain evidence which tends to show that the government failed to meet one of the requirements described in *Bodner* — the government must produce it for the court's examination.

[80] Second, the reviewing court must then examine the document in private to determine whether it, in fact, provides some evidence which tends to show that the government failed to meet one of the parts of the test mandated in *Bodner*. In other words, the document must, taken with the record as a whole and in light of the applicant's theory of the case, be of assistance in challenging the legitimacy of the government's reasons, the reasonableness of the factual foundation it relied on, the respect the government has shown the commission process or whether the objectives of the process have been achieved. It may suggest that the government response was based upon an improper or colourable purpose. To be clear, the cogency of the evidence need not be considered at this stage of the analysis. [81] Even if the document meets this test, production of the document remains subject to any other rule of evidence that bars its disclosure, such as solicitor-client privilege (which was raised in the courts below in the companion appeal) or public interest immunity (which was raised in this Court in both appeals).

[82] The Provincial Court Judges' Association submits that *Bodner* review is meaningless without the production of confidential Cabinet documents to illuminate the true reasons for the government's response, which may differ from its publicly-articulated reasons. The Provincial Court Judges' Association says that without an understanding of the actual basis on which the decision rests, the reviewing court will be unable to determine whether the government's response satisfies constitutional requirements.

[83] I do not agree that *Bodner* review is ineffective without any relevant Cabinet submission being included in the record. Though necessarily limited in scope, *Bodner* review is a robust form of review. The test requires that the government justify a *departure* from the commission's recommendations. The government must give legitimate and rational reasons for doing so and sound reasoning must be supported by a reasonable factual foundation. The government's response must demonstrate respect for the judicial office, for judicial independence, and for the commission process; as well, the broader objectives of the process must be achieved. [84] Thus, the party seeking *Bodner* review may well be able to make a strong case for overturning a government's response based on the public reasons given by the government. The party seeking *Bodner* review may also rely on additional admissible evidence to make their case, such as statements made by ministers or others, including more general statements made outside the commission process, about judges or their remuneration, and historical patterns, including the government's responses to past commission recommendations. Those forms of evidence might well support the contention that the government relied on an illegitimate reason for departing from the commission's recommendations or that its response does not "reveal a consideration of the judicial office and an intention to deal with it appropriately": *Bodner*, at para. 25. They might also support the contention that the government did not show appropriate respect for the underlying public interest in judicial independence and in having an effective commission process.

[85] I underscore that it is never enough for the government to simply repeat the submissions it made to the commission: *Bodner*, at para. 23. That does not justify a departure from the commission's recommendations. Similarly, a government that consistently rejects a commission's recommendations will put in question whether it is respecting the commission process and, as a result, whether the process is achieving its objectives. Although across-the-board salary increases or reductions that affect judges have been found to meet the rationality standard, a government that does not take into account the distinctive nature of judicial office and treats judges simply as a class of civil servant will fail to engage with the principle of judicial independence: *Provincial Judges Reference*, at paras. 143, 157 and 184; *Bodner*, at para. 25. More rarely, the level of remuneration itself may call the government's response into question: see *Provincial Judges Reference*, at para. 135.

[86] A government response that does not *meaningfully* engage with the commission process and its recommendations risks failing the *Bodner* test. As *Bodner*, at para. 31, makes clear, the reviewing court must ultimately be satisfied that the objectives of the commission process — namely, depoliticizing decisions about judicial remuneration and preserving judicial independence — have been met.

[87] To summarize, the object of *Bodner* review is the government's response to the commission's recommendations, which will generally consist of the government's decision to depart from the commission's recommendations and the reasons given for that decision. The submissions to the commission, the commission's recommendations, and the government's response accordingly form the core of the record on *Bodner* review. Certain forms of additional evidence are admissible if they are relevant to determining whether any part of the *Bodner* test has been met, including whether the government's response is grounded in an improper or colourable purpose. However, where a party seeking *Bodner* review requests the production of a confidential Cabinet document, the party must first establish there is some basis to believe that the document may contain evidence which tends to show that the government failed to meet a requirement described in *Bodner*. Only then will the reviewing court examine the document in private to determine whether it, in fact, provides some evidence which tends to show that the government failed to meet its constitutional obligations. If the document does provide such evidence, the court must then determine whether any other rule of evidence, such as public interest immunity, bars its production.

(4) <u>Application</u>

[88] Since the Provincial Court Judges' Association seeks production of a confidential Cabinet submission, the first issue is whether it has made the requisite threshold showing.

[89] The Provincial Court Judges' Association points to prior litigation involving judicial remuneration in which the Attorney General produced a Cabinet submission concerning the government's response commission's to а recommendations: see Provincial Court Judges' Association of British Columbia v. British Columbia (Attorney General), 2012 BCSC 1022. The Supreme Court of British Columbia in that case found that the submission revealed an "inappropriate emphasis" on the need to maintain a link between judicial salaries and public sector salaries: para. 81. The Provincial Court Judges' Association argues that this history makes the Cabinet submission in the present case relevant to resolve the issue of whether the government engaged with and showed respect for the commission process.

[90] I am not persuaded. The case relied on by the Provincial Court Judges' Association was decided nearly a decade ago. It does not follow that because a Cabinet submission revealed that the government relied on an inappropriate consideration 10 years ago, it may have relied on a like consideration in the present case. Indeed, the government would be expected to learn from its past mistakes. Something more would be required for there to be reason to believe that the submission may contain evidence that would tend to show that the government failed to meet a requirement described in *Bodner*.

[91] Although it is not determinative, I note that neither the executive nor the Legislative Assembly put the Cabinet submission in issue. Neither the government's response nor the Legislative Assembly's resolution refers to the Cabinet submission. Nor, in contrast with the affidavit filed in a past round of litigation opposing the Attorney General and Provincial Court Judges' Association, is there any reference to the Cabinet submission in the affidavit filed in support of the Attorney General's response to the petition for review. Nor is there anything on the face of the record that indicates the Cabinet submission may contain some evidence which tends to show that the government failed to meet a constitutional requirement.

[92] In my view, the Provincial Court Judges' Association has failed to make the requisite showing. It has not provided any evidence or pointed to any circumstances that suggest that the Cabinet submission may indicate that the government did not meet the standard required by *Bodner*. It was therefore not necessary for the Attorney General to produce the document for examination by this Court.

[93] This would effectively dispose of this appeal.

[94] It is therefore unnecessary in this case to determine whether public interest immunity would otherwise apply so as to permit the Attorney General to refuse to produce the Cabinet submission. However, since the parties and interveners in both appeals have made extensive submissions about the law of public interest immunity, I will examine how public interest immunity applies to confidential Cabinet documents sought in a *Bodner* review and why, in my view, it is not necessary to revisit this Court's public interest immunity doctrine as it applies in this context.

C. Public Interest Immunity

[95] There is a strong public interest in maintaining the confidentiality of deliberations among ministers of the Crown: *Carey*, at pp. 647 and 656-59; *Babcock*, at paras. 18-19. As a matter of constitutional convention, Cabinet deliberations are confidential: N. d'Ombrain, "Cabinet secrecy" (2004), 47(3) *Canadian Public Administration* 332, at pp. 334-35. Federal ministers swear an oath as Privy Counsellors to "honestly and truly declare [their] mind and [their] opinion" and to "keep secret all matters . . . secretly treated of" in Cabinet: see C. Forcese and A. Freeman, *The Laws of Government: The Legal Foundations of Canadian*

Democracy (2nd ed. 2011), at p. 352. Provincial and territorial ministers swear a similar oath as executive counsellors.

[96] Ministers enjoy freedom to express their views in Cabinet deliberations, but are expected to publicly defend Cabinet's decision, even where it differs from their views: see A. Heard, *Canadian Constitutional Conventions: The Marriage of Law & Politics* (2nd ed. 2014), at pp. 106-7; d'Ombrain, at p. 335. The confidentiality of Cabinet deliberations helps ensure that they are candid and frank and that what are often difficult decisions and hard-won compromises can be reached without undue external interference: see Forcese and Freeman, at p. 352; d'Ombrain, at p. 335. If Cabinet deliberations were made public, ministers could be criticized for publicly defending a policy inconsistent with their private views, which would risk distracting ministers and undermining public confidence in government.

[97] Grounded in constitutional convention as much as in practical considerations, this confidentiality applies whether those deliberations take place in formal meetings of the Queen's Privy Council for Canada,⁶ or a province or territory's Executive Council, or in meetings of Cabinet or of committees composed of ministers, such as Treasury Board. The confidentiality extends not only to records of Cabinet deliberations, but also to documents that reflect on the content of those deliberations: *Babcock*, at para. 18.

⁶ Although the Queen's Privy Council for Canada established by s. 11 of the *Constitution Act, 1867*, includes members who are not ministers of the Crown, confidentiality also extends to its proceedings.

[98] The common law protects the confidentiality of Cabinet deliberations through the doctrine of public interest immunity: *Babcock*, at para. 60. Public interest immunity forms part of federal common law and the common law of each province and territory: see *Babcock*, at paras. 19, 23 and 26. As with any common law rule, Parliament or a legislature may limit or do away with public interest immunity, provided it clearly expresses its intention to do so: *Quebec (Commission des droits de la personne) v. Attorney General of Canada*, [1982] 1 S.C.R. 215, at p. 228; *Babcock*, at para. 20; see, more generally, *R. v. D.L.W.*, 2016 SCC 22, [2016] 1 S.C.R. 402, at para. 21.⁷

[99] In *Smallwood v. Sparling*, [1982] 2 S.C.R. 686, and in *Carey*, this Court rejected absolute Crown privilege and instead recognized a qualified public interest immunity. Public interest immunity prevents the disclosure of a document where the court is satisfied that the public interest in keeping the document confidential outweighs the public interest in its disclosure: see *Carey*, at pp. 653-54 and 670; *Babcock*, at para. 19; see also *Bisaillon v. Keable*, [1983] 2 S.C.R. 60, at p. 97.⁸

⁷ Provincial legislatures have generally preserved public interest immunity: see, e.g., *Code of Civil Procedure*, CQLR, c. C-25.01, art. 283; *Crown Liability and Proceedings Act, 2019*, S.O. 2019, c. 7, Sch. 17, s. 13(2); *Crown Proceeding Act*, R.S.B.C. 1996, c. 89, s. 9; *Proceedings against the Crown Act*, R.S.N.S. 1989, c. 360, s. 11. By contrast, Parliament has partially displaced public interest immunity in ss. 37 to 39 of the *Canada Evidence Act*, R.S.C. 1985, c. C-5: see *Babcock*, at paras. 21 et seq.; *R. v. Ahmad*, 2011 SCC 6, [2011] 1 S.C.R. 110.

⁸ The same considerations generally apply to testimony. However, ministers and former ministers serving as members of the Senate, House of Commons or a legislative assembly benefit from a limited form of testimonial immunity as a matter of parliamentary privilege: see *Vaid* at para. 29; *Ainsworth Lumber Co. v. Canada (Attorney General)*, 2003 BCCA 239, 14 B.C.L.R. (4th) 302; *Telezone Inc. v. Canada (Attorney General)* (2004), 69 O.R. (3d) 161 (C.A.).

[100] Although this Court rejected claims of absolute Crown privilege in *Smallwood* and *Carey*, it did not "accord the individual an automatic right to discovery of sensitive and confidential documents held by the state": *Michaud v. Quebec (Attorney General)*, [1996] 3 S.C.R. 3, at para. 54. *Smallwood* and *Carey* thus require a careful balancing of the competing public interests in confidentiality and disclosure: see *Babcock*, at para. 19; *R. v. Barros*, 2011 SCC 51, [2011] 3 S.C.R. 368, at para. 35. These competing public interests must be weighed with reference to a specific document in the context of a particular proceeding.

[101] In *Carey*, at pp. 670-73, this Court described the main factors relevant to balancing the public interests in confidentiality and disclosure of documents concerning public decision making, including at the Cabinet level:

(1) the level of the "decision-making process";

- (2) the "nature of the policy concerned";
- (3) the "particular contents of the documents";
- (4) the timing of disclosure;
- (5) the "importance of producing the documents in the interests of the administration of justice"; and

(6) whether the party seeking the production of the documents "alleges unconscionable behaviour on the part of the government".

[102] Although public interest immunity may be raised by any party or by the reviewing court itself, the government has the burden of establishing that a document should not be disclosed because of public interest immunity: *Carey*, at pp. 653 and 678. The government should put in a detailed affidavit to support its claim of public interest immunity: pp. 653-54.

[103] As a general rule, when it is clear to the reviewing court, based on a government's submissions, that public interest immunity applies to a document, it need not inspect the document: *Carey*, at pp. 671 and 681. If, however, the court has doubts about whether public interest immunity applies, the court should inspect the document in private to resolve its doubts: pp. 674 and 681; see also *Somerville v*. *Scottish Ministers*, [2007] UKHL 44, [2007] 1 W.L.R. 2734, at paras. 156 and 204; *Al Rawi v. Security Service*, [2011] UKSC 34, [2012] 1 A.C. 531, at para. 145. Indeed, even if the court is persuaded that public interest immunity does not apply, the court should nevertheless inspect the document in private to ensure that it does not inadvertently order the disclosure of a document which should in fact remain confidential: see *Conway v. Rimmer*, [1968] A.C. 910 (H.L.), at p. 971. If, having inspected the document, the court concludes that the contents, or any part of the contents, are not protected by public interest immunity, the court can order production accordingly.

(1) <u>Public Interest Immunity in the Context of Bodner Review</u>

[104] As noted in *Carey*, the determination of public interest immunity often requires the reviewing court to examine the document in question. Since in the *Bodner* context the court will generally have examined the document to determine whether it should otherwise be part of the record, the document will usually already be before the court.

[105] Accordingly, the court must, looking to the factors identified in *Carey* and any other pertinent factors, determine whether the public interest in the Cabinet document's disclosure outweighs the public interest in its remaining confidential. In such a context, at least three *Carey* factors — the level of decision-making process to which the document relates, the nature of the policy on which the document bears and the contents of the document — will often weigh in favour of keeping the document confidential.

[106] Aside from decisions made by the Queen or her representatives, the Cabinet decision-making process is the highest level of decision making within the executive: see *Carey*, at p. 670; *Reference re Canada Assistance Plan (B.C.)*, at pp. 546-47.

[107] As the British Columbia courts acknowledged in the present case, judicial remuneration is an important and sensitive area of public policy, implicating not only the use of public money, but also the administration of justice and ultimately, judicial

independence. The British Columbia courts did not find this to be a factor weighing in favour of continued confidentiality: BCSC Reasons, at para. 42; C.A. Reasons, at para. 22; for similar statements by the Nova Scotia courts in the proceedings that gave rise to the companion appeal, see also Nova Scotia Provincial Judges' Association v. Nova Scotia (Attorney General), 2018 NSSC 13, 409 C.R.R. (2d) 117, at para. 144; Nova Scotia (Attorney General) v. Judges of the Provincial Court and Family Court of Nova Scotia, 2018 NSCA 83, 429 D.L.R. (4th) 359, at paras. 44-46. I cannot agree with such an approach. As this Court explained in Carey, at pp. 671-72, the nature of the policy on which the document bears may weigh in favour of continued confidentiality to varying degrees depending on its sensitivity and significance. A government's decision about how to respond to a judicial compensation commission's recommendations concerns not merely a matter of implementation, but involves the "formulation of policy on a broad basis": see Carey, at p. 672; see also Newfoundland (Treasury Board) v. N.A.P.E., 2004 SCC 66, [2004] 3 S.C.R. 381, at para. 58. That said, as I explain below, when the policy concerns a constitutional requirement relating to the justice system, and, thus, the administration of justice, as is the case in the *Bodner* context, this may *also* weigh in favour of disclosure.

[108] The contents of a document concerning Cabinet deliberations may well reflect the views of individual ministers of the Crown and reveal disagreement among ministers. Cabinet documents may also reveal considerations that were put before Cabinet. As a result, their contents will frequently be highly sensitive: see *Babcock*, at para. 18.

[109] Depending on the contents of the document, the timing may also weigh in favour of keeping the document confidential. A document that simply reveals that Cabinet made a decision to reject a recommendation made by a judicial compensation commission will bear little confidentiality once that decision is publicly announced. By contrast, ministers can rightly expect that a document that weighs several different possible responses to the commission's recommendations and proposes a particular response will remain confidential for some prolonged time even after the decision is publicly announced.

[110] In this case, the British Columbia courts appear to have treated the government's failure to assert a specific harm that would result from the Cabinet submission's disclosure as being conclusive of the need for disclosure: see Master Reasons, at para. 23; BCSC Reasons, at para. 46; C.A. Reasons, at para. 22.

[111] Because of the strong public interest in Cabinet confidentiality, the disclosure of a Cabinet document undermines that confidentiality and is, at least to some degree, harmful. As *Carey* recognized, certain Cabinet documents may, owing to their contents, raise additional concerns, as might be the case where they relate to defence or national security or refer to specific points of disagreement among ministers. It will often be helpful to the court for the government to be as specific as possible in raising the potential for such harm: pp. 653-54 and 671. But the government's failure to identify some specific harm resulting from a confidential Cabinet document's disclosure does not *automatically* mean the document must be

disclosed. The focus must remain on whether the public interest in the document's disclosure outweighs the public interest in its remaining confidential.

[112] Given the strong public interest in keeping documents concerning Cabinet deliberations confidential, a strong countervailing public interest will usually be necessary to justify their disclosure. The strength of the public interest in disclosure will often turn on the interests of the administration of justice, a factor identified in *Carey*.

[113] The notion of the "interests of the administration of justice" undoubtedly encompasses a broad set of considerations: see *Carey*, at pp. 647-48 and 671. Two stand out in the *Bodner* context: "the importance of the case and the need or desirability of producing the documents to ensure that [the case] . . . can be adequately and fairly presented": *Carey*, at p. 671.

[114] In the companion case, the Nova Scotia Court of Appeal concluded that disclosure of the report is in the public interest because the government knew its response to the commission's recommendations would be subject to review and because the review would focus on matters vital to the administration of justice and to the relationship between two branches of government: paras. 44-46.

[115] These considerations cut both ways. Although there is no doubt that *Bodner* reviews are of great importance, the fact that a party seeks production of a relevant confidential Cabinet document in the context of a *Bodner* review is not itself

a general basis for disclosure. Such an approach would effectively trump the public interest in the confidentiality of Cabinet deliberations in every *Bodner* review. It would also conflate the importance of the *issues* canvassed on such a review with the importance of the *evidence* provided by the Cabinet document to the disposition of those issues.

[116] In the *Bodner* context, the reviewing court's analysis of the factors bearing on the public interest in disclosure must necessarily be informed by its conclusion on the nature and probative value of the evidence. A document may provide some evidence that the government failed to meet one of the parts of the *Bodner* test, but the importance of the evidence may vary widely. When considering the interests of the administration of justice, the focus must therefore remain on the degree to which the document bears on what is at issue in the litigation.

[117] A document may contain information not otherwise available such that its exclusion from evidence would undermine the court's ability to adjudicate the issues on their merits: see *Carey*, at pp. 654 and 673; *Commonwealth v. Northern Land Council*, [1993] HCA 24, 176 C.L.R. 604, at p. 619. A document that tends to establish that the government set out to provide misleading public reasons for its response to the commission's recommendations; that the government relied on a fundamentally flawed factual foundation; that the government acted with an improper or colourable purpose; or that the government was indifferent or disrespectful towards the commission process will be highly probative. Such a document bears so directly

— and so determinately — on the issues that the reviewing court needs to resolve on *Bodner* review that to exclude the document would be contrary to the interests of the administration of justice: see *Air Canada v. Secretary of State for Trade*, [1983] 2 A.C. 394 (H.L.), at p. 435. Given the important constitutional interests at stake, the public interest in disclosure would almost certainly outweigh the public interest in the document's remaining confidential. Excluding such a document from evidence would keep the court from fulfilling its judicial role, jeopardize public confidence in the administration of justice, and ultimately threaten the rule of law. In such cases, where the probative value of the document is high, the public interest immunity analysis will lead to the same result as the production analysis set out above.

[118] By contrast, the public interest immunity analysis may lead to a different result for a Cabinet document that supports the contention that the government failed to meet one of its constitutional requirements, but whose impact on the *Bodner* review would be limited. The probative value of such evidence might not weigh heavily enough to warrant disclosure, especially if there were strong public interest in its remaining confidential. But such a document's exclusion from the record could hardly keep the reviewing court from adjudicating the issues on their merits. The public interest in disclosure of such a Cabinet document would thus not outweigh the public interest in its remaining confidential.

[119] As a general matter, the notion of "unconscionable behaviour" referred to in *Carey*, at p. 673, will only be pertinent in a limited set of cases. This factor is superadded to more general considerations involving the administration of justice. The conduct in question must be "harsh" or "improper"; though it need not be criminal, it must nevertheless be of a similar degree of seriousness: p. 673. In the *Bodner* context, this factor does little work independent from the factor relating to the interests of the administration of justice. The harshness or impropriety of the government's conduct would be canvassed in assessing whether the government acted with an improper or colourable purpose. A document that demonstrates unconscionable behaviour on the government's part would tend to establish its failure to meet its constitutional requirements in a highly probative manner and, for that reason, the public interest in its disclosure would almost certainly outweigh the public interest in its remaining confidential.

[120] Accordingly, I disagree with the suggestion of the Attorney General of British Columbia and other attorneys general that this Court's public interest immunity case law results in routine, almost inevitable, disclosure of confidential Cabinet documents, and should thus be revisited. Properly applied in the *Bodner* context, public interest immunity requires a careful balancing of the public interests in confidentiality and disclosure. Since the public interest in the confidentiality of documents concerning Cabinet deliberations is often particularly strong, the public interest in their disclosure will usually need to be stronger still to warrant their disclosure.

V. <u>Disposition</u>

[121] I would allow the appeal without costs and quash the master's order for production of the Cabinet submission. The Provincial Court Judges' Association's petition can now be adjudicated on its merits without consideration of the Cabinet submission.

Appeal allowed without costs.

Solicitors for the appellant: Gudmundseth Mickelson, Vancouver.

Solicitors for the respondent: Arvay Finlay, Vancouver.

Solicitor for the intervener the Attorney General of Canada: Attorney General of Canada, Toronto.

Solicitor for the intervener the Attorney General of Ontario: Attorney General of Ontario, Toronto.

Solicitor for the intervener the Attorney General of Quebec: Attorney General of Quebec, Québec.

Solicitor for the intervener the Attorney General of Saskatchewan: Attorney General of Saskatchewan, Regina.

Solicitor for the intervener the Attorney General of Alberta: Attorney General of Alberta, Edmonton.

Solicitors for the intervener the Canadian Superior Courts Judges Association: Norton Rose Fulbright Canada, Montréal.

Solicitors for the intervener the Canadian Bar Association: Borden Ladner Gervais, Toronto.

Solicitors for the intervener the Canadian Association of Provincial Court Judges: Goldblatt Partners, Toronto.

Solicitors for the intervener the Canadian Taxpayers Federation: McCarthy Tétrault, Toronto.

Solicitors for the intervener the Canadian Civil Liberties Association: Paliare Roland Rosenberg Rothstein, Toronto.

TAB 6

Court of Queen's Bench of Alberta

Citation: CM v Alberta, 2022 ABQB 462

Date: 20220704 **Docket:** 2203 04046 **Registry:** Edmonton

Between:

C.M., Litigation Guardian for A.B., S.A., Litigation Guardian for F.S., C.H., Litigation Guardian for G.H., A.B., Litigation Guardian for J.K., R.L., Litigation Guardian for L.M. and Alberta Federation of Labour

Applicants

- and -

Her Majesty the Queen in Right of Alberta

Respondent

Reasons for Judgment of the Honourable Justice G.S. Dunlop

1. Overview

[1] On April 12, 2022 the Honourable Tyler Shandro, QC, Minister of Justice and Solicitor General for Alberta, Deputy House Leader and Member of the Executive Council, signed a certificate pursuant to s. 34 of the *Alberta Evidence Act*, RSA 2000, c A-18, certifying that a PowerPoint presentation and minutes of a February 8, 2022 meeting of Cabinet must be kept confidential and not disclosed.
[2] Minister Shandro's certificate was attached and referred to in a Certified Record of Proceedings of Dr. Deena Hinshaw, Alberta's Chief Medical Officer of Health. According to Dr. Hinshaw's Amended Certified Record of Proceedings, filed June 1, 2022, the PowerPoint presentation and the Cabinet minutes are documents in her possession relevant to her decision in CMOH Order 08-2022, which the Applicants allege was deficient in several respects.

[3] The Applicants applied for disclosure of the PowerPoint presentation and the Cabinet minutes. Both the Applicants and the Respondent, Her Majesty the Queen in Right of Alberta (the "Crown") submitted written briefs and I heard the application on June 27, 2022. I concluded, based on the evidence before me then, that public interest immunity did not apply to the two documents. However, following the procedure set out by the Supreme Court of Canada in *British Columbia (Attorney General) v Provincial Court Judges' Association of British Columbia* 2020 SCC 20 at para 103, I directed that the PowerPoint presentation and the Cabinet minutes be provided to me, to ensure that nothing would be disclosed which should remain confidential in the public interest.

[4] I received the PowerPoint presentation and Cabinet minutes on June 29, 2022. For the reasons set out below, I conclude that nothing in them is immune from production based on the public interest. I direct Dr. Hinshaw to file a further amended Certified Record of Proceeding attaching both documents, without redactions. Based on emails from counsel about a possible application for a stay of my order pending appeal, the deadline for Dr. Hinshaw to do so is one week after the release of these reasons.

2. Public Interest Immunity

[5] In my reasons for decision given orally on June 27, 2022 I reviewed the six factors relevant to public interest immunity which are identified by the Supreme Court of Canada in *Carey v Ontario* [1986] 2 SCR 637 and listed in *Provincial Court Judges*' at para 101. My subsequent review of the PowerPoint presentation and the Cabinet minutes provides me with additional evidence, primarily on the third *Carey* factor, the contents of the documents.

[6] The Crown has the burden of proving that public interest immunity applies and it should put in a detailed affidavit to support its claim: *Provincial Court Judges*' at para 102. In this case the Crown did not file an affidavit. The only evidence I have relevant to public interest immunity is Minister Shandro's certificate and the documents themselves. Minister Shandro has an obligation to "be as helpful as possible in identifying the interest sought to be protected": *Carey* at para 40.

[7] Minister Shandro states in his certificate:

Furthermore, Cabinet prepared an Official Record of Decision ("ORD") consisting of meeting minutes arising from the February 8, 2022 meeting. The ORD arises from <u>confidential discussions and deliberations</u> which occurred within Cabinet, including Dr. Hinshaw.

•••

If <u>Cabinet members' statements</u> were subject to disclosure, this could impede the free flow of discussion and injure the process of democratic governance.

•••

Disclosure of the Power-Point and the ORD would be both (a) not in the public interest, and (b) prejudicial to those not involved in this litigation, as the precedential impact of being compelled to disclose <u>confidential Cabinet</u> <u>discussions</u>, or <u>materials prepared for Cabinet's consideration</u>, could impede the free flow of future Cabinet discussions, or the preparation of materials for Cabinet consideration, thereby negatively impacting the democratic governance of the Province of Alberta.

(underlining added)

[8] The implication of those statements in Minister Shandro's certificate is that the PowerPoint presentation and the Cabinet minutes contain Cabinet members' statements or Cabinet discussions or deliberations. They do not. The minutes set out decisions only, and no statements by or discussions or deliberations among Cabinet members. The PowerPoint presentation contains information about COVID in Alberta and elsewhere in the world, with an emphasis on what other provinces were doing and experiencing and presents options for easing public health measures in Alberta. The PowerPoint presentation contains no statements, discussions or deliberations by individual Cabinet members or Cabinet as a whole.

[9] Although the PowerPoint presentation includes options for easing public health measures, and the Cabinet Minutes set out decisions about that, neither document contains an explicit recommendation about anything, with one exception. Page 38 of the PowerPoint presentation includes a recommendation regarding the Alberta Covid Records verifier apps. According to Minister Shandro's certificate, the PowerPoint presentation was prepared by Dr. Hinshaw, so this may be her recommendation. The document is not clear whose recommendation this is.

[10] As to the materials prepared for Cabinet's consideration, there is no evidence before me to support the conclusion that documents provided by the Chief Medical Officer of Health to Cabinet must be kept secret to ensure she will freely and honestly provide information and recommendations in the future. On the contrary, given her statutory powers and duties under the *Public Health Act*, RSA 2000, c. P-37 and her professional obligations as a physician, I would expect her to be candid and complete, regardless of any potential future public disclosure.

[11] During oral argument on June 27, 2022, I asked counsel for the Crown what public interest would be served by keeping Cabinet decisions secret. Counsel for the Crown submitted that policy decisions of Cabinet may change and for that reason they should be kept secret. He cited no authority in support of that proposition. Counsel for Crown conceded that the argument for public interest immunity is stronger for Cabinet deliberations than for Cabinet decisions. Minister Shandro in the last paragraph of his certificate refers to the prejudicial impact of disclosing Cabinet discussions or materials prepared for Cabinet; he says nothing about any prejudice from disclosing cabinet decisions.

[12] Furthermore, in this case the relationship between Cabinet decisions and Chief Medical Officer of Health decisions is a central issue. The Applicants allege improper delegation by the Chief Medical Officer of Health to the Cabinet whereas the Crown argues that Cabinet makes policy decisions and the Chief Medical Officer of Health implements those policy decisions through her orders. This engages the fifth *Carey* factor: the importance of producing the documents in the interests of the administration of justice. Consequently, even if there is a public interest in keeping Cabinet decisions secret in general, in this case the interests of justice tip the balance in favour of disclosure.

[13] The focus of public interest immunity with respect to Cabinet proceedings is Cabinet deliberations: *Provincial Court Judges*' at para 95 - 97. The documents before me do not reveal Cabinet deliberations. They contain information and options provided by the Chief Medical Officer of Health to Cabinet, one recommendation, and Cabinet decisions. The Crown has not established a public interest requiring that those things be kept secret.

3. Redactions and Stay Pending Appeal

[14] Natural justice and the open courts principle require that litigation be conducted on notice, on the record, and in public. There are limited exceptions for emergencies and to protect children and other vulnerable people. None of the exceptions applies here. In this case, on no or very short notice to the Applicants, the Crown sought redactions of the PowerPoint presentation and the Cabinet minutes, and a stay of my order should I order disclosure of anything.

[15] During oral argument on June 27, 2022, counsel for the Crown proposed that if I were to order disclosure of the PowerPoint presentation and the Cabinet minutes, they should first be redacted to remove references to anything other than masking in schools. This was not addressed in the Crown's written brief. As far as I know, no notice of this proposal was provided to the Applicants' counsel.

[16] On June 29, 2022, counsel for the Crown delivered a letter to me, which does not appear to have been copied to the Applicants' counsel, and an e-mail to my assistant, which was copied to the Applicants' counsel. The letter and the e-mail were not filed so they would not ordinarily form part of the record accessible to the public. The specific communications to me, including the Applicants' counsel's reply are set out below.

Steven Dollansky letter June 29, 2022 received at 2:55 pm

Attention: Honourable Justice Grant S. Dunlop

Re: C.M. Litigation Guardian for A.B. et al v. Her Majesty The Queen In Right of Alberta Action No. 2203 – 04046

Further to your direction of June 27, 2022, we enclose a USB stick that includes:

1. The Power-Point presentation with information regarding the ongoing COVID-19 Pandemic presented to Cabinet; and

2. The Official Record of Decision from the February 8, 2022 meeting of cabinet.

In addition, our client has proposed redactions to the documents for your consideration such that only information that relates to the school masking is disclosed. Accordingly, there are two versions of each file.

The USB is password protected. The password will be provided by email directly to your attention.

We wish to apologize to the Court for the delay in getting these documents to your attention. There were a number of approvals that were required from our client that took longer than initially anticipated. Thank you.

Yours truly,

Steven A.A. Dollansky

Steven Dollansky e-mail June 29, 2022 3:43 pm

Justice Dunlop,

Further to our appearance before you on June 27, 2022, the documents protected by public interest immunity have been delivered to your office this afternoon for review.

We have been advised that if you decide that all or part of the protected documents should be disclosed, our clients may apply for a stay of that decision pending an appeal. Accordingly, we wish to confirm that the documents will not be immediately released in whole or in part until sufficient time is provided for our clients to provide instructions on whether an Application and Appeal will be pursued. Given that these instructions will need to come from senior members of Executive Council, we would request that we be given five (5) business days to either file an Application and Appeal or disclose the records. Further, if an Application and Appeal is filed, we would request that the Court order the documents not be released until the stay Application is heard.

Thank you for your attention to this matter,

Steven

Sharon Roberts e-mail June 29, 2022 3:47 pm

Dear Justice Dunlop:

We write further to Mr. Dollansky's email this afternoon, which we received by way of advance copy very shortly before 3 pm today. Our friends have received a similarly short notice copy of this correspondence.

The Crown (to adopt the Court's language) has had considerable notice of the possibility of disclosure of the records over which it claimed cabinet confidence. A five business day delay from notice of decision is excessive in the circumstances. Presumably instructions have already been or ought to have been sought respecting the potential of a stay / appeal if disclosure is directed. The Respondent is asking by way of email for this Court to grant an interim stay pending it even having instructions to file for a stay and bring an appeal. The Applicants object. If a stay is to be sought, a Civil Notice of Appeal and stay application ought to be filed and served as expeditiously as possible and certainly in less than five business days, which could amount to more than a week given the coming holiday weekend, assuming days begin to count on the day after a direction is made. We suggest two business days to file and serve is ample and otherwise are in the Court's hands to ensure a fair process and avoidance of collateral attacks.

Sincerely,

Sharon Roberts

[17] E-mails to a judge's assistant are appropriate for scheduling and other non-contentious matters. They are not an appropriate way to apply for substantive relief, because they are not on the record and they lack the structure of a filed application which ensures counsel for the opposite party has time to obtain instructions and respond. The Crown could have raised the issue of a stay of proceedings in its written brief submitted June 17, 2022 or during the hearing on June 27, 2022. Doing so by email on June 29, 2022 was irregular and unfair to the Applicants.

[18] I am not prepared to permit the Crown to redact everything from the PowerPoint presentation and the Cabinet minutes except references to school masking for five reasons:

- a) First, the Applicants had either no or inadequate notice of the Crown's application and the specific redactions they seek.
- b) Second, the entire decision, CMOH 08-2022 is under review, and it covers more than masking in schools.
- c) Third, Dr. Hinshaw certified that the PowerPoint presentation and the Cabinet Minutes are relevant to her decision, without limiting that to certain portions of those documents.
- d) Fourth, counsel for the Crown conceded during oral argument on June 27, 2022 that the documents are relevant.
- e) Fifth, the relationship between Cabinet decisions and Chief Medical Officer of Health orders is a central issue in this case, with the Applicants alleging improper delegation by the Chief Medical Officer of Health to the Cabinet, and the Crown arguing that the Cabinet makes policy decisions and Chief Medical Officer of Health implements those policy decisions through her orders. The broader context, beyond just masking in schools, is relevant to that issue.

[19] Given the Applicants' agreement that two business days is sufficient for the Crown to file and serve an application for a stay, I set the deadline for Dr. Hinshaw to file a further amended Certificate of Record attaching the PowerPoint presentation and the Cabinet minutes at one week from the date of this decision, subject to any stay granted by me or the Court of Appeal. I am prepared to hear a stay application at any time on any weekday in the next seven days, except the morning of Friday, July 8, 2022, subject to counsel's agreement on a date and the availability of a WebEx courtroom. Also, if the Crown requires it, I grant leave to the Crown to apply directly to the Court of Appeal for a stay, without first seeking one from me, should the Crown wish to do so.

4. Disposition

[20] The Applicants' application for disclosure of the PowerPoint presentation and the Cabinet minutes is granted. Dr. Hinshaw shall file a further amended Certificate of Record attaching those documents within one week of this decision.

Heard on the 27th day of June, 2022. **Dated** at the City of Edmonton, Alberta this 4th day of July, 2022.

G.S. Dunlop J.C.Q.B.A.

Appearances:

Sharon Roberts and Orlagh O'Kelly Roberts O'Kelly Law for the Applicants

Gary Zimmermann, Steven Dollansky, Stuart Chambers McLennan Ross LLP for the Respondent

TAB 7

BETWEEN:) J.N.) - and) C.G. Respondent) Jesse Herman, Counsel, for the Respondent)) HEARD: February 18, 2022

ONTARIO SUPERIOR COURT OF JUSTICE

JUDGMENT

THE HONOURABLE MR. JUSTICE A. PAZARATZ

- [1] When did it become illegal to ask questions? *Especially in the courtroom*?
- [2] And when did it become unfashionable for judges to receive answers? *Especially when children's lives are at stake?*
- [3] How did we lower our guard and let the words "unacceptable beliefs" get paired together? *In a democracy? On the Scales of Justice?*
- [4] Should judges sit back as the concept of "Judicial Notice" gets hijacked from a *rule* of evidence to a *substitute* for evidence
- [5] And is "misinformation" even a real word? Or has it become a crass, self-serving tool to pre-empt scrutiny and discredit your opponent? To de-legitimize questions and strategically avoid giving answers. Blanket denials are almost never acceptable in our adversarial system. Each party always has the onus to prove their case and yet "misinformation" has crept into the court lexicon. A childish but sinister way of saying "You're so wrong, I don't even have to explain why you're wrong."

- [6] What does *any* of this have to do with family court? Sadly, these days it has *everything* to do with family court.
- [7] Because when society demonizes and punishes anyone who disagrees or even dares to ask really important questions the resulting polarization, disrespect, and simmering anger can have devastating consequences for the mothers, fathers and children I deal with on a daily basis.
- [8] It's becoming harder for family court judges to turn enemies into friends -- when governments are so recklessly turning friends into enemies.
- [9] The motion before me is a typical and frightening example of how far we are drifting from cherished values.
- [10] The father wants two children ages 12 and 10 to receive COVID vaccinations. The mother is opposed.
- [11] Now, answer honestly. Did the previous paragraph give you enough information to form an opinion about how this case should turn out?
- [12] We're all weary. We all wish COVID would just go away. But pandemic fatigue is no excuse for short-cuts and lowering our standards. We all have to guard against the unconscious bias of thinking "Why won't these people just do what the government tells them to do?"
- [13] We have to decide on the basis of the best interests of each particular child in each particular fact situation.
- [14] We have to rely on and insist upon evidence.
- [15] In this case the evidence provided more questions than answers.
 - a. The father filed two affidavits.
 - b. The mother filed one.
 - c. They both relied extensively on unsworn "exhibits", which were basically internet downloads.
 - d. In addition, the father relied on numerous downloads from the mother's social media accounts.
 - e. They both consented to my receiving these materials, to demonstrate the sources of information which each of them is relying on in formulating their respective parenting position.
- [16] The basic facts are not disputed:
 - a. The mother is 34 years old. The father is 35.
 - b. They were married on November 24, 2007 and separated on June 1, 2014.

- c. They have three children, a 14 year old son C.B.G.; a 12 year old daughter L.E.G.; and a ten year old son M.D.G..
- d. C.B.G. resides primarily with the father. L.E.G. and M.D.G. reside primarily with the mother.
- e. Pursuant to final order based on minutes of settlement signed October 5, 2021, the father has sole decision-making authority with respect to the oldest child. The mother has sole decision-making authority with respect to the two children who are the subject of this motion. The order requires the parties to consult with each other prior to making major decisions for the children.
- f. When the parties signed the minutes of settlement, they already knew that they disagreed about the issue of vaccinations. The minutes of settlement specified: "The issue of the children L.E.G. and M.D.G. receiving a COVID-19 vaccine shall remain a live issue and shall be determined at a later date. The child C.B.G. can determine whether or not he wants to be vaccinated now."
- g. In fact, earlier in the pandemic the father went to court complaining the mother was being *too protective* of the children when it came to COVID. In August 2020 the father brought a motion trying to compel the children to attend school in person for the 2020-2021 school year. The mother argued that the risk of COVID exposure was too high; she was particularly concerned about the oldest child's medical vulnerability as a result of his history of asthma; and she proposed remote learning for the children until the pandemic risk subsided. On September 23, 2020 Justice Bale issued a lengthy endorsement dismissing the father's motion, and confirming that the mother's position was appropriate and in the best interests of the children.
- h. In 2020 the father alleged the mother was being *too* protective about COVID. Now he's saying she's not protective enough. He brought a motion dated January 25, 2022 requesting that L.E.G. and M.D.G. receive the COVID vaccine and all recommended booster vaccines. He also asks that he be permitted to arrange the vaccinations and attend with the children, because he doesn't trust that the mother will comply even if she is ordered to do so.
- i. Meanwhile, soon after the parties signed Minutes in October 2021 the older child C.B.G. elected to be vaccinated. Both parents supported his decision. He's had two shots, and the parents agree he has exhibited no adverse effects.
- j. The mother insists the father is misrepresenting her position. She is not opposed to vaccines. She is offended by the pejorative term "anti-vaxxer". She has always ensured that the three children received all of their regular immunizations. She says she's open minded to vaccinating both younger children if safety concerns can be better addressed. But she says her extensive research has left her with well-founded concerns that the potential benefit of the current COVID vaccines for L.E.G. and M.D.G. is outweighed by the serious potential risks. She says there are too many unknowns, and she worries that "once children are vaxed, they can't be unvaxed."
- k. The mother notes that both children have already had COVID with minimal symptoms and they have recovered completely. She refers to medical

research which says that since they have already recovered from COVID, the children now have greater protection from future infection.

- 1. Both parents agree L.E.G. and M.D.G. are in excellent health, with no special medical needs or vulnerabilities.
- m. Neither parent provided any evidence from a medical professional about any potential positive or negative considerations with respect to *these* children receiving COVID vaccines.
- [17] The mother's evidence focused entirely on the medical and scientific issues.
- [18] In contrast, the father focussed extensively on labelling and discrediting the mother as a person, in a dismissive attempt to argue that her views aren't worthy of consideration.
 - a. This odious trend is rapidly corrupting modern social discourse: Ridicule and stigmatize your opponent as a person, rather than dealing with the ideas they want to talk about.
 - b. It seems to be working for politicians.
 - c. But is this really something we want to tolerate in a court system where parental conduct and beliefs are irrelevant except as they impact on a parent's ability to meet the needs of a child?
- [19] For example, the father's affidavits included the following:
 - a. "I am aware that the Applicant has political affiliations with the People's Party of Canada. The Applicant is entitled to her personal beliefs and ideologies, but I am very fearful that it is having a direct, negative impact on the children, especially when it comes to this vaccine issue."
 - b. "I searched the Applicant's recent Facebook postings and was alarmed to see just how involved the Applicant is at perpetuating COVID-related conspiracy theories and vaccine hesitancy."
 - c. He attached "a collection of some of the Applicant's Facebook postings which I believe are indicative of her personal views."
 - d. "The Applicant is a self-proclaimed 'PPC founding member'. In my opinion, she is openly promoting very dangerous beliefs. Surely, these thoughts and feelings are also being promoted in her household, which is where L.E.G. and M.D.G. primarily reside."
 - e. "I looked up what the PPC stance is on the COVID-19 vaccine and was not surprised to read under its website's "FACTS" section that "lockdowns, mask mandates, school closures and other authoritarian sanitary measures have not had any noticeable effect on the course of the pandemic." Unfortunately, no facts are actually provided."
 - f. He attaches a copy of the PPC's COVID Policy taken from its website.
 - g. "I am alarmed that the children are being exposed to the Applicant's unsupported views on the issue of the pandemic, and in particular the efficacy of the available and Government-recommended vaccines."

- h. "The Applicant's anti-vaccination stance is much more severe than that of a regular concerned parent, who is unsure whether or not she wants the children to receive a relatively new vaccine. Rather, the Applicant is leading the charge, attending anti-vaccine rallies and refusing to follow COVID protocols."
- i. He attaches a Facebook posting of the mother not wearing a mask "in a crowd of 10,000 people at a rally."
- j. He makes other references to the mother's Facebook account, and attaches numerous pictures of her social media pages.
- k. He attaches photographs of PPC leader Maxime Bernier addressing an audience.
- [20] Where to begin.
 - a. How is any of this relevant?
 - b. Have we reached the stage where parental rights are going to be decided based on what political party you belong to?
 - c. Is being seen with Maxime Bernier or anyone, for that matter the kiss of death, as far as your court case is concerned?
 - d. Can you simply utter the words "conspiracy theorist" and do a mic drop?
 - e. If you allege that someone is "openly promoting very dangerous beliefs", shouldn't you provide a few details. A bit of proof, maybe?
 - f. And if you presume that a parent believes things they shouldn't believe can you go one step further and also presume that the parent must be poisoning their children's minds with these horrible unspecified ideas? ("Surely, these thoughts and feelings are also being promoted in her household...")
 - g. The father criticizes the mother for something she didn't say. He presumes she doubts the effectiveness of school closures, and then criticizes her for providing no evidence. But on this motion she didn't raise the issue. And back in 2020 *she* was the one who wanted to keep the children out of school, and *he* fought (unsuccessfully) for them to attend. As with other allegations, the father provides no evidence of his own, and fails to address the fact that vigorous community debate led to school closures being abandoned.
 - h. How far are we willing to take "guilt by association"? If you visit a website, read a book, or attend a meeting -- are you permanently tarnished by something someone else wrote or said? At what point do the "thought police" move in?
 - i. And really, how fine is the line between "vaccine hesitancy" and "not taking any chances with your kid"? All of the caselaw says judges have to act with the utmost caution and consider all relevant evidence in determining the best interests of the child. How can we then impose a lesser standard on a demonstrably excellent parent?

- [21] It is of little consequence that an individual litigant chooses to advance such dubious and offensive arguments. Even though the father may not admit it, this is still a free country and people can say what they want. *Including him*.
- [22] But there's a bigger problem here. An uglier problem.
- [23] We're seeing more and more of this type of intolerance, vilification and dismissive character assassination in family court. Presumably we're seeing it inside the courtroom because it's rampant outside the courtroom. It now appears to be socially acceptable to denounce, punish and banish anyone who doesn't agree with you.
- [24] A chilling example: I recently had a case where a mother tried to cut off an equal-time father's contact with his children, primarily because he was "promoting anti-government beliefs." And in Communist China, that request would likely have been granted.
- [25] But this is Canada and our judicial system has an obligation to keep it Canada.
- [26] I won't belabor the point, because I still have to get to my real job: determining what's in the best interests of these two children. But the word needs to get out that while the court system won't *punish* intolerance, it certainly won't reward it either.
- [27] All parenting issues including health issues must be determined based upon the best interests of the child. Last year's amendments to the *Divorce Act* (applicable in this case) and the *Children's Law Reform Act* make it mandatory for the court to include consideration of a child's views and preferences to the extent that those views can be ascertained.
- [28] As Justice Mandhane stated in *E.M.B. v. M.F.B.* 2021 ONSC 4264 (SCJ):

60. The requirement in s. 16(3)(e) to consider the "child's views and preferences" is new and is consistent with Article 12 of the *Child Rights Convention*. In the Legislative Background to the *Divorce Act* amendments, the Department of Justice explains that:

Under Article 12 of the United Nations *Convention on the Rights of the Child*, children who are capable of forming their own views have the right to participate in a meaningful way in decisions that affect their lives, and parenting decisions made by judges and parents affect child directly. The weight to be given to children's views will generally increase with their age and maturity. However, in some cases, it may not be appropriate to involve the children, for example if they are too young to meaningfully participate.

See also: *Official Report of Debates (Hansard)*, 42nd Parl., 1st Sess., No. 326 (26 September 2018) at p. 21866 (Hon. Jody Wilson-Raybould).

61. A human rights-based approach fundamentally recognizes children as subjects of law rather than objects of their parents. Making children more visible in legal proceedings that affect their rights is fundamentally important in Canada because children are not guaranteed legal representation in family law proceedings. Therefore, in my view, even where there is no direct evidence about the child's views and preferences, s. 16(3)(e) still requires the court should make a reasonable effort to glean

and articulate the child's views and preferences wherever possible, considering the child's age and maturity and all the other evidence before it.

- [29] In this case, the children's views have been *independently* ascertained -- *they both don't want to receive the COVID vaccines* but the father is asking me to ignore how they feel and force them to be vaccinated against their will. The background:
 - a. In 2021, in an effort to resolve parenting issues, the parties enlisted a wellrespected local social worker, Michelle Hayes, to prepare a "Voice of the Child Report". The father filed Hayes' comprehensive seven-page report dated June 22, 2021.
 - b. For purposes of that report the children were each interviewed twice once in the care of each parent.
 - c. During the interview period the mother and father had clearly identified their respective positions on vaccination. The report specifically addressed each child's views on the topic.
 - d. L.E.G. advised that she had discussed vaccinations with each parent privately. She knew her father favoured getting the shot and her mother didn't. L.E.G. specifically explained to Hayes the reasons why she didn't want to receive the COVID vaccines. She explained herself in some detail.
 - e. Similarly, M.D.G. had discussed vaccinations with each parent privately. He also knew his father promoted vaccination and his mother didn't. M.D.G. not only told Hayes he didn't want to be vaccinated, but he said he was "fearful that his father would make him." Indeed, M.D.G. told Hayes that "he wanted the judge to know his thoughts about his parenting schedule as well as the vaccine."
 - f. The mother says her children are mature and intelligent, and that they have come to their own conclusions without being pressured by either parent. She feels it is important to respect their clear wishes, comfort level and anxieties. She says she adopted the same position for her older son C.B.G., and when he decided he wanted to be vaccinated she was fully supportive.
 - g. The father says at ages 12 and 10 the children are too young to make an informed decision about this. He admits both children have expressed fear of the COVID vaccine. He suggests the younger child's views are wavering. But he's opposed to either child being interviewed again. No matter what the children say, he doesn't think the court should listen, because he feels the mother has planted these ideas in their minds. But he offered no proof of any coaching, manipulation or inappropriate statement by the mother.
 - h. Hayes' June 22, 2021 report was actually a follow-up to an earlier report she prepared on March 3, 2020. She has worked with the family for a long time and got to know the children quite well. The social worker expressed no concerns or suspicions about either child being manipulated or pressured by either parent. In her summary she stated: "As in the original report, each of the children presented confidently and thoughtfully for both interviews. As they reviewed their thoughts, they each showed consistency in their views and preferences in each interview."

- [30] While I agree with the father that these two children are not old enough to decide this complicated issue for themselves, I disagree with his suggestion that we should completely ignore how they feel about what they experience and what their bodies are subjected to. Rather than simplistically accept or reject what children say they want, the court must engage in a complex and sensitive analysis of the weight to be attributed to each child's stated views.
- [31] In *Decaen v. Decaen*, 2013 ONCA 218 the Court of Appeal set out the factors to consider when assessing a child's wishes:
 - a. Whether both parents are able to provide adequate care;
 - b. How clear and unambivalent the wishes are;
 - c. How informed the expression is;
 - d. The age of the child;
 - e. The maturity level;
 - f. The strength of the wish;
 - g. The length of time the preference has been expressed;
 - h. Practicalities;
 - i. The influence of the parent(s) on the expressed wish or preference;
 - j. The overall context; and
 - k. The circumstances of the preferences from the child's point of view.
- [32] With respect to L.E.G. and M.D.G.:
 - a. They have received all their regular immunizations. At ages 12 and 10 they understand the experience of getting needles. And they understand the purpose of vaccinations is to create a long-term medical consequence in their body.
 - b. They understand the magnitude of the COVID pandemic, and the personal and community health issues involved.
 - c. They understand the extended and ongoing discussion about the COVID vaccine.
 - d. They have both clearly and consistently stated their objection to receiving the COVID vaccine.
 - e. They have both outlined very specific reasons for their decision. Those reasons do not appear to be frivolous, superficial or poorly thought out.
 - f. Both children have sufficient age, intelligence, maturity and independence of thought to understand the issue and formulate their own views, feelings, comfort level, questions, *and fears* about what should or should not happen to their bodies.
 - g. They hold these views very strongly.
 - h. They have maintained these views for an extended period of time.
 - i. Despite the father's speculation, there is no evidence that the mother has inappropriately drawn the children into any sort of personal or political agenda. *Both* parents have equally engaged in appropriate and necessary

discussions with the children about the many aspects of the pandemic – including vaccinations. Both parents have answered the children's questions, provided information, and stated their own beliefs. The social worker's report gives no suggestion that either parent has pressured, manipulated, or unduly influenced either child. Nor did Hayes express any concern about internal inconsistencies or ambiguities with respect to either child's strongly stated views.

- [33] For the past two years *all* children have been bombarded with all sorts of information about the pandemic. It has become an inescapable, oppressive part of their daily lives. Mental health experts regularly warn us that we need to be mindful of the emotional impact of this scary new world on the young mind.
- [34] In this case, the father doesn't like what the children are saying, so he submits their views aren't worthy of consideration just as he submits the mother's views aren't worthy of consideration. *There's a bit of a pattern here.*
- [35] But when a ten-year-old child says he's afraid he'll be forced to take the vaccine and he specifically wants the judge to know it I don't think that's something the court can or should ignore.
- [36] Children may not have wisdom. But they have Charter rights and undeniable emotions.
- [37] Any best interests analysis must take into account all relevant factors, including the impact on a child's mental health if their legitimate and powerful feelings and anxieties are ignored; and if they perceive they are being violated.
- [38] A number of recent court decisions have grappled with this new "COVID vaccine" issue, and in particular with the issue of the weight to be given to children's views on the subject. In most of those cases the children were younger than L.E.G. and M.D.G., so "views and preferences" were either unascertainable or less relevant because of the child's lack of maturity.
- [39] In *McDonald v. Oates* 2022 ONSC 394 (SCJ) the court disregarded a ten-year-old's views, concluding that the child was unable to make an informed choice due to the contradictory information the child was receiving from his parents.
 - a. But unlike the situation with 10-year-old M.D.G., in *McDonald* there was no independent information as to the nature or strength of the child's views, and the court declined to order a Voice of the Child Report, to avoid delay.
 - b. Here I had the benefit of a thorough and highly informative Voice of the Child Report.
 - c. And unlike *McDonald*, as discussed below, I find that the objecting parent's concerns cannot be dismissed as frivolous or uninformed.
 - d. More to the point I find that there is no evidence that either M.D.G. or L.E.G. have been unduly influenced by either their pro-vaccine or anti-vaccine

parent. I am satisfied that they came to their own conclusions, for understandable reasons.

- [40] In *Saint-Phard v. Saint-Phard* 2021 ONSC 6910 (SCJ) the court overruled a 13-year-old's opposition to vaccinations, as conveyed through the child's lawyer.
 - a. Again, the child's situation was quite different from L.E.G. and M.D.G..
 - b. In *Saint-Phard* the child had made inconsistent and ambiguous statements; he had been misinformed by a physician; and the court concluded he was incapable of making an informed decision.
- [41] In *Rouse v. Howard* 2022 ONCJ 23 (OCJ) Justice Hilliard provided a thoughtful analysis of facts more similar to the case at bar even though the child in question was only nine.

17 Although Fiona is only 9, there is evidence before me that she is, at present, opposed to receiving the COVID-19 vaccine. In A.C. v. L.L., [2021] O.J. No. 4992, Justice Charney considered section 4 of the Health Care Consent Act, 1996, S.O. 1996, c. 2 (HCCA), in his analysis as to whether the mother's consent was even required for the children to be vaccinated. Justice Charney noted that the HCCA does not provide any minimum age for capacity to make medical treatment decisions. That finding accords with the Supreme Court of Canada's decision in A.C. v Manitoba (Director of Child and Family Services), 2009 SCC 30, wherein Justice Abella explained the common law "mature minor" doctrine at paragraph 47:

The doctrine addresses the concern that young people should not automatically be deprived of the right to make decisions affecting their medical treatment. It provides instead that the right to make those decisions varies in accordance with the young person's level of maturity, with the degree to which maturity is scrutinized intensifying in accordance with the severity of the potential consequences of the treatment or of its refusal.

18 Unlike in A.C., where the children wanted to be vaccinated, and Saint-Phard where the child only expressed opposition to being vaccinated after the influence of the mother and her doctor, Fiona's views about vaccination appear to be long-standing and in accordance with her mother's beliefs about vaccines in general. An order granting Mr. Rouse decision-making authority would result in Mr. Rouse having the ability to override Fiona's right to withhold her consent to vaccination which may have negative emotional and/or psychological consequences.

[42] The determination of any child's best interests is a fact-specific exercise, based on the evidence presented – *and tested* – in each case. As stated, an important – but not determinative – part of the analysis consideration of each child's views and preferences.

- a. In each of the recent cases where a child's stated opposition to being vaccinated was overridden, the court made unfavourable findings with respect to the objecting parent's rationale and their inappropriate influence over the child.
- b. The court concluded that the pro-vaccine parent had presented more reasonable information to the child, and more compelling arguments to the court in relation to the science.
- c. In each case the court was left with more confidence in the pro-vaccine parent's parental judgment and insight on the issue of vaccinations.
- [43] But that's not at all what I'm dealing with in this case.
 - a. Despite the father's relentless campaign to dismiss the mother as some sort of lunatic, the reality is that the mother presented all her evidence and made all her oral submissions in a calm, mature, articulate, analytical, extensively researched, and entirely child-focussed manner. She is to be commended for her skillful and professional presentation as a self-represented party.
 - b. In contrast, the father came across as somewhat dogmatic, intolerant and paternalistic. He focussed more on discrediting the mother's ideas rather than explaining his own. And his shameless efforts to vilify the mother by ridiculing her personal beliefs bordered on hysterical.
 - c. I mention this to further explain why I have confidence that the mother has not inappropriately influenced the children to adopt their current views.
 - d. If the mother explained herself to the children the way she explained herself to me...and if the father explained himself to the children the way he explained himself to me...then I have absolutely no doubt about which of the parents communicated with the children in a more responsible manner.
- [44] Finally, we have the other "evidence" filed by the parents. And here we have to think carefully about what constitutes proper or sufficient evidence and how we should apply it.
- [45] As with all the other recent COVID vaccine cases, the mother and the father attached dozens of pages of internet downloads to their affidavits. The fact that they both consented to my receiving all this unsworn material doesn't make it properly admissible. But at the very least, it informs me as to the type and quality of research each parent conducted in formulating their respective positions.
- [46] Included among the father's downloads from the internet:
 - a. A November 23, 2021 seven page "Position Statement" from the Canadian Paediatric Society.
 - b. A January 2022 five page "Caring for Kids" information sheet from the Canadian Paediatric Society.
 - c. A December 17, 2021 nine-page "Vaccines for Children: COVID 19" information sheet from the Government of Canada.

- d. A September 24, 2021 five-page "Post COVID-19 Condition" information sheet from the Government of Canada.
- e. A May 18, 2021 seven-page "Vaccines for children: Deciding to Vaccinate" information sheet from the Government of Canada.
- f. A May 6, 2021 three-page "The Facts About COVID-19 Vaccines" information sheet from the Government of Canada.
- g. A January 20, 2022 four-page article entitled "Vaccinated kids half as likely to get Omicron but protection fades fast" from The Times of Israel.
- h. A January 14, 2022 five page article entitled "COVID-19 Cases and Hospitalizations Surge Among Children" from the Canada Communicable Disease Report.
- [47] Included among the mother's downloads from the internet:
 - a. A June 25, 2021 eight-page "Fact Sheet" issued by Pfizer, the manufacturer of one of the vaccines being proposed by the father.
 - b. An August 26, 2021 three-page article from the journal "Science" entitled "Having SARRS-CoV-2 once confers much greater immunity than a vaccine but vaccination remains vital."
 - c. A January 31, 2012 13-page PLOS One peer-reviewed article entitled "Immunization with SARS Coronavirus Vaccines Leads to Pulmonary Immunopathology on Challenge with the SARS virus."
 - d. A July 10, 2021 five-page article in the medical journal "Total Health" entitled "Are people getting full facts on COVID vaccine risks?"
 - e. A September 26, 2018 15 page article in the medical journal "Contagion Live" entitled "High Rates of Adverse Events Linked with 2009 H1N1 Pandemic vaccine".
 - f. A May 28, 2021 two-page article from the Centers for Disease Control and Prevention (CDC) entitled "Clinical Considerations: Myocarditis and Pericarditis after Receipt of mRNA COVID-19 Vaccines Among Adolescents and Young Adults."
 - g. An August 1, 2020 29 page research paper published by eClinicalMedicine entitled "A country level analysis measuring the impact of government actions, country preparedness and socioeconomic factors on COVID -19 mortality and related health outcomes."
 - h. A June 9, 2021 10 page open letter from The Evidence-Based Medicine Consultancy Ltd. research organization entitled "Urgent Preliminary report of Yellow Card data up to May 26, 2021".
 - i. A June 22, 2021 14 page article from the World Health Organization entitled "COVID-19 advise for the public: Get vaccinated".
- [48] Information obtained from the internet can be admissible if it is accompanied by indicia of reliability, including, but not limited to:
 - a. Whether the information comes from an official website from a well-known organization;

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b. Whether the information is capable of being verified;c. Whether the source is disclosed so that the objectivity of the person or organization posting the material can be assessed.

ITV Technologies Inc. v. WIC Television Ltd. 2003 FC 1056: Sutton v. Ramos 2017 ONSC 3181 (SCJ)

- [49] Where the threshold of "admissibility" is met, it is still up to the trier of fact to weigh and assess the information to determine the relevance, if any, with respect to the issues to be decided.
- [50] And since this is a motion proceeding by affidavit, we have the further limitation that even to the extent that the internet downloads are admissible, there is no opportunity for cross-examination or testing.
- [51] To simplify matters, the mother does not deny the authenticity or integrity of the website information submitted by the father.
 - a. It's mostly statements by the Government of Canada and the Canadian Pediatric Society recommending that children should receive COVID vaccinations.
 - b. These are the same types of downloads which courts have considered in other recent COVID vaccine cases.
 - c. The mother doesn't deny that these are reputable organizations. Nor does she deny that the statements and information have been prepared by qualified persons in a responsible, professional manner.
 - d. She doesn't deny that the father has accurately presented *one side of the story*.
 - e. All she asks is that the court equally consider the other side of the story. That the court allow both sides of the story to be equally presented, tested and considered. Before making an irreversible decision for her children.
- [52] *Evidence* and *both sides of the story*. We're in deep trouble if those become antiquated concepts.
- [53] In almost all cases where COVID vaccinations have been ordered the court has made a finding that, on the face of it, the internet materials presented by the objecting parent have been grossly deficient, unreliable and at times dubious. This lack of an equally credible counter-point to government recommendations may well have been determinative in those earlier cases.
- [54] But what if the objecting parent presents evidence which potentially raises some serious questions or doubts about the necessity, benefits or potential harm of COVID vaccines for children?
 - a. Clearly we shouldn't be too quick to embrace the naysayers.
 - b. But should we banish them? Without hearing from them?

- c. Should we stifle and forbid a reasonable opportunity to present and test evidence, and make submissions?
- d. There are obvious public policy reasons to avoid recklessly undermining confidence in public health measures.
- e. But that has to be weighed against our unbridled obligation to leave no stone unturned, when it comes to protecting children.
- [55] For example, the mother presented a detailed fact sheet from Pfizer. This isn't one of the fringe websites dismissed in the other cases. *It's Pfizer!* The people who make the vaccine.
- [56] Under the heading "What Are The Risks of the Pfizer-BioNTech COVID-19 Vaccine", the company says:

There is a remote chance that the Pfizer-BioNTech COVID-19 Vaccine could cause a

severe allergic reaction. A severe allergic reaction would usually occur within a few

minutes to one hour after getting a dose of the Pfizer-BioNTech COVID-19 Vaccine. For

this reason, your vaccination provider may ask you to stay at the place where you

received your vaccine for monitoring after vaccination. Signs of a severe allergic reaction can include:

- Difficulty breathing
- Swelling of your face and throat
- A fast heartbeat
- A bad rash all over your body
- Dizziness and weakness

Myocarditis (inflammation of the heart muscle) and pericarditis (inflammation of the lining

outside the heart) have occurred in some people who have received the Pfizer-BioNTech

COVID-19 Vaccine. In most of these people, symptoms began within a few days following

receipt of the second dose of the Pfizer-BioNTech COVID-19 Vaccine. The chance of having

this occur is very low. You should seek medical attention right away if you have any of the

following symptoms after receiving the Pfizer-BioNTech COVID-19 Vaccine:

- Chest pain
- Shortness of breath
- Feelings of having a fast-beating, fluttering, or pounding heart.

Side effects that have been reported with the Pfizer-BioNTech COVID-19 Vaccine include:

include:

- severe allergic reactions
- non-severe allergic reactions such as rash, itching, hives, or swelling of the face
- myocarditis (inflammation of the heart muscle)
- pericarditis (inflammation of the lining outside the heart)
- injection site pain
- tiredness
- headache
- muscle pain
- chills
- joint pain
- fever
- injection site swelling
- injection site redness
- nausea
- feeling unwell
- swollen lymph nodes (lymphadenopathy)
- diarrhea
- vomiting
- arm pain

These may not be all the possible side effects of the Pfizer-BioNTech COVID-19 Vaccine. Serious and unexpected side effects may occur. Pfizer-BioNTech COVID-19 Vaccine is still being studied in clinical trials.

- [57] It's very hard to fault a parent for being worried about such an ominous list of potentially very serious side effects.
- [58] Several of the earlier decisions requiring children to be vaccinated have noted that the evidence presented by the objecting parent was not reliable because the authors' credentials were either not-established or non-existent.
- [59] But in this case, none of the materials presented by the mother are from fringe organizations or dubious authors. To the contrary, the mother quotes extensively from leaders in the medical and scientific community.
- [60] For example, the article submitted by the mother "Are People Getting Full Facts on COVID Vaccine Risks?" quotes Dr. Robert W. Malone, the inventor of the mRNA vaccine. Whether he is right or wrong about the current use of COVID vaccines is a matter for discussion and determination. But with his credentials, he can hardly be dismissed as a crackpot or fringe author. The mother referred to the following excerpt from the article:

The original inventor of the mRNA vaccine (and DNA vaccine) core platform technology currently used to create the vaccines is Dr Robert W Malone. Dr Malone has been expressing serious concerns about how therapeutic approaches that are still in the research phase are being imposed on an ill-informed public. He says that public health leadership has, "stepped over the line and is now violating the bedrock principles which form the foundation upon which the ethics of clinical research are built".

Dr Malone asks why health leaders seem to be so afraid of sharing the adverse event data. He says, "Why is it necessary to suppress discussion and full disclosure of information concerning mRNA reactogenicity and safety risks?"

He goes onto say that we should be analysing the safety data and risks vigorously. Again he asks, "Is there information or patterns that can be found, such as the recent finding of the cardiomyopathy signals, or the latent virus reactivation signals? We should be enlisting the best biostatistics and machine learning experts to examine these data, and the results should -- no must -- be made available to the public promptly".

For any drug it has always been important to have systems in place for monitoring adverse events. However, for an experimental, genetic modifying approach that has not been fully tested, and where the public are effectively the guinea pigs, this information should be immediately and readily available. As previously reported...the fact that it is so difficult to access and make sense of ...reporting systems - along with low reporting simply raises further concern about what is actually happening.

• • • •

Dr Malone says, "... what is being done by suppressing open disclosure and debate concerning the profile of adverse events associated with these vaccines violates fundamental bioethical principles for clinical research".

With regard to the use and abuse of misinformation, the inventor of these vaccines says that the public have to be given accurate information to allow informed consent. He says, "The suppression of information, discussion, and outright censorship concerning these current COVID vaccines which are based on gene therapy technologies cast a bad light on the entire vaccine enterprise. It is my opinion that the adult public can handle information and open discussion. Furthermore, we must fully disclose any and all risks associated with these experimental research products".

In short, it is simply not possible to arrive at a position of informed consent unless you have access to the full facts around your options and the associated risks and benefits.

- [61] The same article outlines other serious concerns about COVID vaccines expressed by Dr. Bret Weinstein, Dr. Peter McCullough, Dr. Tess Lawrie, Professor Stanley S. Levinson (medicine, endocrinology, diabetes and metabolism) and Professor Sucharit Bhakdi (awarded the Order of Merit for medical microbiology). These are well-known leaders in their fields.
- [62] Several other articles presented by the mother outline similar expressions of concern about the COVID vaccines from equally qualified and reputable sources worldwide.
- [63] For clarity:
 - a. I am not for one moment suggesting that we should presume the mother's experts are *right*.
 - b. But once we determine they're not crackpots and charlatans, how can we presume that they are *wrong*? Or that they couldn't possibly be right about any of their warnings?
 - c. When children's lives are at stake, how can we ignore credible warnings?
- [64] The following paragraphs from *Saint-Phard v. Saint-Phard* 2021 ONSC 6910 (SCJ) illustrate the approach which has been taken in a number of cases in which COVID vaccinations were approved by the court.

4 The decision to be made is governed by the best interests of the child: A.C. v. L.L, 2021 ONSC 6530. It is required to be based on findings of fact made from admissible evidence before the court: O.M.S. v. E.J.S, 2021 CarswellSask 547 (Q.B.); B.C.J.B. v. E.-R.R.R., 2021 CarswellOnt 13242 (S.C.J.).

Judicial notice may be taken

5 Facts may be found by taking judicial notice: B.C.J.B. v. E.-R.R.R., A.P. v. L.K, 2021 ONSC 150, and A.C. v. L.L Each of these cases include findings related to the safety and efficacy of publicly funded vaccines on the basis of judicial notice. For example, in A.C. v. L.L at paragraphs 21, 23 and 25 the court made the following findings by taking judicial notice under the public documents' exception to the hearsay rule :

• The COVID-19 vaccination has been approved for children aged 12-17.

• All levels of government have been actively promoting vaccination against COVID-19 and expending significant resources to make it available to the public.

• The safety and efficacy of the COVID-19 vaccine has been endorsed by governments and public health agencies.

• The Ontario Ministry of Health website states that Pfizer-BioNTech vaccine is now licensed by Health Canada for adolescents aged 12 years and older, has been proven to be safe in clinical trials and provided excellent efficacy in adolescents, and that NACI continues to strongly recommend a complete series with an MNRA vaccine for all eligible individuals in Canada, including those 12 years of age and older, as the known and potential benefits outweigh the known and potential risks.

6 Elyon's father relied on statements made by Dr. Tam, Chief Officer of Health for Canada on the Canadian Government website recommending COVID-19 vaccinations for those between the ages of 12 and 17, stating that thorough testing has determined the vaccines to be safe and effective at preventing severe illness, hospitalization, and death from COVID-19. Dr. Kieran Moore is the Chief Medical Officer for Ontario. The father tendered his recommendation to vaccinate all youth ages 12 to 17 against COVID-19 as set out in a publication by the Ontario COVID-19 Science Advisory Table. Elyon's school is administered under the Ottawa Catholic School Board. That Board released a notice advising that all students over age 12 are eligible to be vaccinated for COVID-19 and stating that the vaccine is key in protecting schools from the virus.

7 Relying on these public documents and the authority of the court in A.C. v. L.L, I find that the applicable government authorities have concluded that the COVID-19 vaccination is safe and effective for children ages 12-17 to prevent severe illness from COVID-19 and have encouraged eligible children to be vaccinated.

- [65] And that's really what many of these cases come down to: After considering all the evidence or often, the lack of evidence can the court just fill in the blanks and take judicial notice of the fact that all children should get vaccinated?
 - a. Because if the answer is "yes", then we're wasting a lot of time and judicial resources.
 - b. If judges just "know" that all children should be vaccinated, then we should clearly say that that's what we're doing.
 - c. But equally, if that's *not* what we're supposed to be doing....then we shouldn't do it.
- [66] In *R.S.P. v. H.L.C.* 2021 ONSC 8362 (SCJ) Justice Breithaupt Smith recently set out a timely warning about the danger of applying judicial notice to cases where expert opinion is unclear or in dispute. It's a warning I whole heartedly adopt:

56 Unfortunately, the recent case of Saint-Phard v. Saint-Phard¹⁴ does not assist in navigating medical treatment for minors because of its fatal flaw regarding judicial notice. In that case, the Court wrote: "Facts may be found by taking judicial notice. [citations omitted] Each of these cases include findings

related to the safety and efficacy of publicly funded vaccines on the basis of judicial notice." This shows a misunderstanding of the purpose of taking judicial notice, which, according to the Supreme Court's definitive decision in R. v. Find 2001 SCC 32 (CanLII) (at paragraph 48) is intended to avoid unnecessary litigation over facts that are:

...clearly uncontroversial or beyond reasonable dispute. Facts judicially noticed are not proved by evidence under oath. Nor are they tested by cross-examination. Therefore, the threshold for judicial notice is strict: a court may properly take judicial notice of facts that are either: (1) so notorious or generally accepted as not to be the subject of debate among reasonable persons; or (2) capable of immediate and accurate demonstration by resort to readily accessible sources of indisputable accuracy.

57 Judicial notice of the facts contained in government publications are "capable of immediate and accurate demonstration by resort to readily accessible sources of indisputable accuracy." Such facts could include, for example, that there are two time zones in the Province of Ontario or that there were two deaths and 39 Intensive Care Unit admissions among Ontario children from January 15, 2020 to June 30, 2021 connected with SARS-CoV-2.

58 Judicial notice cannot be taken of expert opinion evidence. Chief Justice McLachlin for the unanimous Court in R. v. Find underscored that: "Expert evidence is by definition neither notorious nor capable of immediate and accurate demonstration. This is why it must be proved through an expert whose qualifications are accepted by the court and who is available for cross-examination" (at paragraph 49).

59 The acceptance of government-issued statements as evidence renders the facts published by the government agency (presumed to be a source of indisputable accuracy) admissible. Public Health Ontario's statement that two children died of SARS-CoV-2 between January 15, 2020 and June 30, 2021 is therefore admissible as fact. Public Health Ontario's publicly accessible document is admissible as proof of the truth of its contents. In contrast, a statement concerning the safety and efficacy of any medication in the prevention or treatment of any condition is, in and of itself, an opinion. Judicial notice cannot be taken of the opinion of any expert or government official that a medical treatment is "safe and effective." As judicial notice cannot be taken of expert opinion evidence, it is illogical to reason, as was done at paragraph 12 of Saint-Phard, that an expert's "objections raised against the vaccine were directly countered by the judicial notice taken that the vaccine is safe and effective and provides beneficial protection against the virus to those in this age group." To compound the problem, this statement draws a conclusion that is overbroad (i.e. that the vaccine provides beneficial protection to all children and ought therefore to be received by the child in question) without having considered the

comparative analysis of the factors in A.C. v. Manitoba 2009 SCC 30 (CanLII). As a result, reliance upon this reasoning would be misguided.

60 In submissions, I was also referred to the case of A.C. v. L.L. 2021 ONSC 6530 (SCJ) in which both parents agreed that each of their three teenage children would be permitted to make his or her own decision with respect to the COVID-19 vaccination. Two of the three children chose to have it administered and one did not. While the Court made many very concerning and overly broad comments, all are obiter dicta. None were relevant to the result ultimately reached, namely that both parents acknowledged each child's maturity in choosing whether or not to participate in the medical procedure and agreed to allow each child to make his or her own choice. With the parents having agreed upon that point, the Court was no longer obligated to make any finding as to whether receipt of the COVID-19 vaccine was in the best interests of any of the children. As the parents had agreed to respect the decisions made by their children, one of whom declined the COVID-19 vaccine, is that child now in breach of the Court's determination, at paragraph 32, that vaccination is in that child's best interests? Of what utility is the declaration in the Order portion of the decision that "[all three] children ... shall be entitled to receive the COVID-19 vaccine"? In family litigation, unsolicited judicial opinions on parenting questions already solved by the parents serve no one. I am reminded of Justice Abella's warning that: "[the analysis of a child's maturity in making medical decisions] does not mean ... that the standard is a license for the indiscriminate application of judicial discretion" A.C. v. Manitoba (paragraphs 90-91). Thus, while I commend the parents in A.C. v. L.L. for resolving the issue of each child's ability to make his or her own decision, the case itself does not assist this Court.

- [67] Why should we be so reluctant to take judicial notice that the government is always right?
 - a. Did the Motherisk inquiry teach us nothing about blind deference to "experts"? Thousands of child protection cases were tainted and lives potentially ruined because year after year courts routinely accepted and acted upon substance abuse testing which turned out to be incompetent.
 - b. What about the Residential School system? For decades the government assured us that taking Indigenous children away and being wilfully blind to their abuse was the right thing to do. We're still finding children's bodies.
 - c. How about sterilizing Eskimo women? The same thing. The government knew best.
 - d. Japanese and Chinese internment camps during World War Two? The government told us it was an emergency and had to be done. Emergencies can be used by governments to justify a lot of things that later turn out to be wrong.
 - e. Few people remember Thalidomide. It was an experimental drug approved by Canada and countries throughout the world in the late 1950's. It was supposed to treat cancer and some skin conditions. Instead it caused

thousands of birth defects and dead babies before it was withdrawn from the market. But for a period of time government experts said it was perfectly safe.

- f. On social issues the government has fared no better. For more than a century, courts took judicial notice of the fact that it was ridiculous to think two people of the same sex could get married. At any given moment, how many active complaints are before the courts across the Country, alleging government breaches of Charter Rights? These are vitally important debates which need to be fully canvassed.
- g. The list of grievous government mistakes and miscalculations is both endless and notorious. Catching and correcting those mistakes is one of the most important functions of an independent judiciary.
- h. And throughout history, the people who held government to account have always been regarded as heroes not subversives.
- i. When our government serially pays out billions of dollars to apologize for unthinkable historic violations of human rights and security how can we possibly presume that today's government "experts" are infallible?
- j. Nobody is infallible.
- k. And nobody who controls other people's lives *children's lives* should be beyond scrutiny, or impervious to review.
- [68] As well, how can you take judicial notice of a moving target?
 - a. During the past two years of the pandemic, governments around the world and within Canada have constantly changed their health directives about what we should or shouldn't be doing. What works and what doesn't.
 - b. And the changes and uncertainty are accelerating with each passing newscast. Not a day goes by that we don't hear about COVID policies changing and restrictions being lifted.
 - c. Government experts sound so sure of themselves in recommending the current vaccines.
 - d. But they were equally sure when they told us to line up for AstraZeneca. Now they don't even mention that word.
 - e. Even Pfizer has changed its mind. It recently approved vaccines for kids under five. Then more recently the company changed its mind.
 - f. None of this is meant a criticism. Everyone is doing their best with a new and constantly evolving health crisis.
 - g. But how can judges take judicial notice of "facts" where there's no consensus or consistency?
- [69] And then we have the issue of delegation.
 - a. As with almost all these vaccine motions, the father asks for an order that his children receive the current COVID vaccine "and all recommended booster vaccines."
 - b. Which recommended booster vaccines?

- c. When?
- d. How many?
- e. What will they contain?
- f. Who will decide?
- g. Will there be any opportunity for future judicial oversight, or will this simply be a forever commitment controlled by the government.
- h. What are the health implications if children receive the current vaccine, but skip some or all of the boosters?
- i. What future COVID variant will the boosters guard against? We already seem to be using the Delta vaccine to fight the Omicron variant. Will future boosters continue our pattern of using old medicine to fight new viruses?
- j. These are all valid questions, requiring answers which are currently unavailable.
- k. It is improper for the court to pre-determine future medical treatments at unknown times, in unknown circumstances, with decision making authority delegated to unknown persons.
- 1. If you can't take judicial notice of the *present*, you can't take judicial notice of the *future*.
- [70] As well, there is a systemic issue common to most of these COVID vaccine cases.
 - a. The father presented his expert evidence.
 - b. The mother then presented her expert evidence.
 - c. The father responded that the mother's theories have already been "debunked" so we shouldn't waste time talking about them.
 - d. Alleging that your opponent's position has already been debunked is a common tactic these days.
 - e. And quite effective.
 - f. Because unlike *stare decisis* the doctrine of precedent which requires judges to follow specifically cited earlier court decisions there is no such formality to the concept of debunking.
 - g. All you have to do is make the blanket assertion that an opposing view has already been debunked without providing any details and hope that nobody asks for proof.
 - h. In this case, I reject the father's claim that all of the mother's concerns about COVID vaccines have already been properly considered and disproven, in a process adhering to natural justice, conducted by an appropriate judicial body.
 - i. Quite to the contrary, I have not been able to find any indication in the father's evidence or in the body of COVID vaccine case law that allegedly debunked theories have ever been properly considered or tested. In any court. Anywhere.
- [71] In a complex, important, and emotional case like this, it is important to remember the court's mandate:

- a. I am not being asked to make a scientific determination. I am being asked to make a parenting determination.
- b. I am not being asked to decide whether vaccines are good or bad.
- c. I am not being asked to decide if either *parent* is good or bad.
- d. My task is to determine which parent is to have decision-making authority over L.E.G. and M.D.G. with respect to the very specific and narrow issue of COVID vaccinations. Each parent has clearly identified how they would exercise such decision-making authority.
- [72] Pursuant to the recent, final, consent order, the two children reside primarily with the mother.
 - a. She has sole decision-making authority on all issues with the exception that the parties deferred the issue of decision-making in relation to COVID vaccinations.
 - b. The father suggests there should be an inference that the mother was deliberately deprived of authority over this particular issue, because she could not be trusted to make the right decision.
 - c. I am not prepared to make any such an inference.
 - d. Both parents showed commendable maturity and insight in negotiating comprehensive minutes of settlement on all but one of the issues.
 - e. I interpret the minutes of settlement as leaving it open for the court to consider vaccinations as a stand-alone issue, to be determined solely based on the best interests of the children, and without either parent having any presumptive advantage or disadvantage in the determination.
- [73] With respect to the mother and father:
 - a. I find that they are both excellent parents.
 - b. The father has shown excellent parenting skills and familiarity with respect to the oldest child C.B.G. who is doing well in his care.
 - c. The mother has shown excellent parenting skills and familiarity with respect to L.E.G. and M.D.G. who are doing well in her care.
- [74] With respect to the children L.E.G. and M.D.G.:
 - a. I find that they are both intelligent, mature, articulate and insightful with respect to their place both within the family and within the community.
 - b. Both children are healthy. Their medical needs have always been properly addressed.
 - c. I received no professional or other evidence to suggest that there are any specific medical condition or issue which either favours or disfavours vaccination.
 - d. I find that both children have very specific, strongly held and independently formulated views about COVID vaccinations. Those views have been

verified independently by an experienced social worker who would be alive to the possibility of parental influence or interference.

- e. While the mother has strongly held views on the subject, the father has equally strongly held views. It is both understandable and appropriate that each parent has discussed the issue with each child. I find that while each parent has expressed their preference and view on the topic, neither parent has pressured or manipulated the children.
- f. I am confident that each child's view has been clear, consistent, thoughtful, and entirely understandable in all the circumstances.
- [75] Section16(1) of the *Divorce Act* provides that the court shall take into consideration only the best interests of a child when making a parenting order or a contact order.
- [76] Section 16(2) says when considering best interest factors, primary consideration is to be given to the child's physical, emotional and psychological safety, security and well-being. *Pierre v. Pierre*, 2021 ONSC 5650 (SCJ).
- [77] Section 16(3) sets out a list of factors for the court to consider in considering the circumstances of a child and determining best interests:

16(3) Factors to be considered

In determining the best interests of the child, the court shall consider all factors related to the circumstances of the child, including

(a) the child's needs, given the child's age and stage of development, such as the child's need for stability;

(b) the nature and strength of the child's relationship with each spouse, each of the child's siblings and grandparents and any other person who plays an important role in the child's life;

(c) each spouse's willingness to support the development and maintenance of the child's relationship with the other spouse;

(d) the history of care of the child;

(e) the child's views and preferences, giving due weight to the child's age and maturity, unless they cannot be ascertained;

(f) the child's cultural, linguistic, religious and spiritual upbringing and heritage, including Indigenous upbringing and heritage;

(g) any plans for the child's care;

(h) the ability and willingness of each person in respect of whom the order would apply to care for and meet the needs of the child;

(i) the ability and willingness of each person in respect of whom the order would apply to communicate and cooperate, in particular with one another, on matters affecting the child;

(j) any family violence and its impact on, among other things,

(i) the ability and willingness of any person who engaged in the family violence to care for and meet the needs of the child, and

(ii) the appropriateness of making an order that would require persons in respect of whom the order would apply to cooperate on issues affecting the child; and

(k) any civil or criminal proceeding, order, condition, or measure that is relevant to the safety, security and well-being of the child.

- [78] I find that the combination of sections 16(2) ("the child's physical, emotional and psychological safety, security and well-being") and 16(3)(e) ("the child's views and preferences...") require that significant weight should be given to each child's stated views and requests. I would be very concerned that any attempt to ignore either child's views on such a deeply personal and invasive issue would risk causing serious emotional harm and upset.
- [79] With respect to the positions advanced by each parent.
 - a. I respect the father's decision to be guided by government and health protocols.
 - b. I think the father did himself a disservice by focussing so much of his case on dismissive personal attacks on the mother. Those attacks are not only misguided and mean-spirited. They raise doubts about his insight with respect to the vaccine issue – and they also raise doubts about his appreciation of the nature and quality of the important relationship between the mother (as primary resident parent) and the children.
 - c. I equally respect the mother's decision to make exhaustive efforts to inform herself about the vaccination issue.
 - d. I find that the mother took a reasonable approach in acknowledging the strengths of the pro-vaccine materials, while at the same time attempting to reconcile them with contrary viewpoints and warnings issued by equally competent and credible medical professionals.
 - e. I find that the mother's position is more reasonable and helpful in that she invites discussion and exploration of both sides of the story, while the father seeks to suppress it.
 - f. I find that the father has inaccurately and somewhat unfairly characterized both the mother's position and her evidence.
 - g. The father has attempted to dismiss the mother as some sort of crazy antivaxxer. Nothing could be further from the truth. The mother's materials and submissions actually addressed the important and complex issues in more detail and with more comprehension than conveyed by the father. She has made it very clear that she has not completely rejected COVID vaccinations for L.E.G. and M.D.G.. She is simply concerned that in her view there is overwhelming evidence of unresolved safety concerns with respect to the current vaccines being administered. She has come to the conclusion that at this time the risks associated with the vaccines outweigh the benefits.
 - h. As well, the mother's statement that she believes "in personal choice, knowledge, understanding and informed consent" is to be viewed in a reassuring context. She has gone to extraordinary lengths to inform herself,

to maintain an open mind, and to discuss the issue with her children in a balanced, enlightened, and dispassionate manner.

- i. The father has attempted to dismiss the mother's supporting materials as unreliable and less persuasive than his own materials. Once again, I find his attack to be misguided and inaccurate.
- j. Pro-vaccine parents have consistently (and effectively) attempted to frame the issue as a contest between reputable government experts versus a lunatic fringe consisting of conspiracy theorists, and socially reprehensible extremists. This was absolutely the wrong case to attempt that strategy. The professional materials filed by the mother were actually more informative and more thought-provoking than the somewhat repetitive and narrow government materials filed by the father.
- [80] This is not the kind of case where the court can say that either side is necessarily correct. Nor that the same determinations should apply for every child, no matter the circumstances.
- [81] With the mother's materials satisfying me that a legitimate and highly complex debate exists on the efficacy and utilization of COVID vaccines, I am not prepared to apply judicial notice as a method of resolving the issue. Anyone reading even some of the articles presented by the mother would likely conclude that these are complicated and evolving issues, and there can be no simplistic presumption that one side is right and that the other side is comprised of a bunch of crackpots. That's why the court should require evidence rather than conclusory statements.
- [82] The father insists the mother's views have been debunked, but he provides no example of any such determination actually having been made. It would be helpful if, once and for all, the competing positions and science could be properly explored and tested in a public trial.
- [83] On balance, I am satisfied that that mother's request for a cautious approach is compelling, and reinforced by the children's views and preferences which are legitimate and must be respected. The mother has consistently made excellent decisions throughout the children's lives. Her current concerns about the vaccines are entirely understandable, given the credible warnings and commentary provided by reputable sources who are specifically acquainted with this issue.
- [84] The mother has consistently made excellent, informed, and child-focussed decisions. In every respect she is an exemplary parent, fully attuned to her children's physical and emotional needs. She has demonstrated a clear understanding of the science. She has raised legitimate questions and concerns. I have confidence that she will continue to seek out answers to safeguard the physical and emotional health of her children.
- [85] She is not a bad parent *and no one is a bad citizen* simply by virtue of asking questions of the government.

- [86] At a certain point, where you have absolute confidence in a parent's insight and decisionmaking, you have to step back and acknowledge that they love their child; they have always done the right thing for their child...*and they will continue to do the right thing for their child*.
- [87] The father's motion is dismissed.
- [88] The mother shall have sole decision-making authority with respect to the issue of administering COVID vaccines for the children L.E.G. and M.D.G..
- [89] If any issues other than costs need to be addressed, counsel should arrange with the Trial Co-ordinator a time for this matter to be spoken to. This should be arranged within 10 days.
- [90] If only costs need to be determined, the parties should serve and file written submissions on the following timelines:
 - a. Mother's materials (not to exceed three pages of narrative, and not to be more than 12 pages in total including offers, with cases to be hyperlinked) by March 18, 2022.
 - b. Father's materials (not to exceed three pages of narrative, and not to be more than 12 pages in total including offers, with cases to be hyperlinked) by April 1, 2022.
 - c. Any reply by mother (not to exceed two pages) by April 11, 2022.

POSTSCRIPT:

- [91] It's irrelevant to my decision and it's none of anyone's business.
- [92] But I am fully vaccinated. My choice.
- [93] I mention this because I am acutely aware of how polarized the world has become.
- [94] We should all return to discussing *the issues* rather than making presumptions about one another.

Pazaratz J.

Released: February 22, 2022

CITATION: J.N. v. C.G., 2022 ONSC 1198 COURT FILE NO.: 987/18 DATE: 2022-02-22

ONTARIO

SUPERIOR COURT OF JUSTICE

BETWEEN:

J.N.

Applicant

- and -

C.G.

Respondent

REASONS FOR JUDGMENT

Pazaratz J.

Released: February 22, 2022

TAB 8


England and Wales Court of Appeal (Civil Division) Decisions

You are here: <u>BAILII >> Databases >> Empland and Wates Court of Appeal (Civil Division) Decisions</u> >> Ladd v Marshall [1954] EWCA Civ 1 (29 November 1954) URL: http://www.bailii.org/ew/cases/E/WCA/Civ/1954/1 html Cite as: [1954] EWCA Civ 1, [1954] WLR 1489, [1954] 3 All ER 745, [1954] I WLR 1489

[New search] [Buy ICLR report: [1954] 1 WLR 1489] [Help]

STRUCT CONTRACTOR OF TWO IN STRUCT

BAILII Citation Number: [1954] EWCA Civ 1 Case No.

IN THE SUPREME COURT OF JUDICATURE COURT OF APPEAL.

Royal Courts of Justice 29th November 1954

Before:

LORD JUSTICE DENNING LORD JUSTICE HOBSON and LORD JUSTICE PARKER

> Between: LADD

-V-

MARSHALL

(Transcript of the Shorthand Notes of The Association of Official Shorthandwriters, Ltd., Room 392, Royal Courts of Justice, and 2, New Square, Lincoln's Inn, London, WC. 2.)

MR F.W. BENEY, Q.C. and MR T.M. EASTHAM (instructed by Messrs G. Swinburne Raynes, agents for Messrs Atkins, Walter & Locke, Guildford, Surrey) appeared on behalf of the Appellant (Plaintiff). MR EWEN MONTAGU, Q.C. and MR H.W. SABIN (instructed by Messrs White & Catlin, Feltham, Middlesex)

appeared on behalf of the Respondent (Defendant).

HTML VERSION OF JUDGMENT

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LORD JUSTICE DENNING: This is a most unusual case. In the year 1952 Mr Marshall owned a bungalow in Ashgrove Road, Ashford, Middlesex, with a pig holding attached to it It was a new bungalow built under licence and the Local Authority had put a, condition in the licence that if it were resold the limit of price was some £1,500. Mr Marshall determined to offer the bungalow and land for sale. He put it into the hands of agents, who issued Particulars offering it for sale with vacant possession at the figure of £3,600 freehold. One of the people who became interested in this property was Mr James William Ladd. He went to see it. He negotiated with Mr Marshall for the purchase of it. Mr Marshall in the course of the negotiations told him that he would sell it with the addition of two plots of ground. He further told Mr Ladd that the price was controlled at £2,500, but no more. At the beginning of April, 1952, a document was drawn up and signed in which the property was said to be sold for £2,500 freehold and £50 deposit paid. A twopenny stamp was put on it and signed by Mr Marshall. The document was drawn up by Mrs Ladd and was copied by Mrs Marshall at a meeting in the Marshall's bungalow. The matter did not, however, go through, because on the 11th Jane, 1952, Mr Marshall's solicitors wrote to Mr Ladd's policitors saying:

"We have to advise you that our client has instructed us that he does not wish to proceed with the sale of the above business to your client"

About a month later Mr Ladd went to the police and told them that he had paid £1,000 to Mr Marshall as part of the deal and he wanted the £1,000 back and Mr Marshall would not give it to him. Now he has brought this action for the return of the £1,000. He says that at the meeting in April when the document of sale was signed, he paid Mr Marshall an extra sum of £1,000 in notes without anything being put into writing about it. It was paid "under the table" or "under the counter", as the saying is. The reason was because, although the controlled price was £2,500, Mr Marshall still wanted to get the price of £3,600 which he originally asked, or as near as may be. Therefore, he (Mr Ladd) paid Mr Marshall the £1,000 for which he asked.

Mr Ladd at the hearing of the action gave evidence that he had saved up £1,000 in notes. He kept it in a tin box under his bed and on the day in question he went first to a friend of his, a man who had been partner with him, Mr Warren, and they counted out the £1,000 in Mr Warren's house. Indeed, a Miss Andrews, who was Mr Warren's secretary, was there and she helped count. It was all done up in bundles of £100 each, then tied in two lots of £500 each, and all put into a brown paper parcel and taken in a van to Mr Marshall's house. Mr Ladd and Mr Warren went with it. When they got to Mr Marshall's house the money was counted out. The £50 deposit was counted on the table but this £1,000 was counted out on the carpet and was paid over then and there. Mr Ladd said that he asked for a receipt for the £1,000, but Mr Marshall would not give one. His reason was that, as the controlled price was £2,500, if he gave a receipt for the extra £1,000, Mr Land could get it back from him afterwards. Mr Ladd said that he had sire out of us supported by two witnesses. Mr Warren', his friend, who went with him, gave evidence to the sane effect as he and Miss Andrews, the secretary, gave evidence that she was present when the money was counted out in Mr Warren's house. Moreover, they all gave evidence of an earlier occasion in the course of the negotiations when Mr Marshall first asked for the £1,000. Those three witnesses were cross-examined and the Judge seems not to have gained a good impression of them.

Then Counsel for Mr Ladd called into the witness box Mrs Marshall, the wife of the Defendant, Mr Marshall. The hearing was on the 12th March of this year. On the previous day Mrs Marshall had filed a petition for divorce against her husband on the ground of his adultery. She was called into the witness box and this is what she said

"Excuse me, my Lord, I do not wish to give evidence for or against my husband".

It was pointed out that in a civil case a wife can be compelled to give evidence against her husband. So she was sworn and told she had to give evidence. She was asked about the occasion on the 2nd April when she took part in the preparation of the document. She said:

"I was called into the room".

Then she was asked:

(Q) Did you see any money pass on that occasion? Was £1,000 counted out?

(A) I do not remember".

Then Counsel said:

"You must remember",

and the Judge said:

""You cannot cross-examine your own witness. You are not to say, 'You must remember'",

and the Judge did not allow any cross-examination. So she did not help the case at all.

The only witness called for the defence was Mr Marshall himself, who denied that he had received the A1,000 at all.

The Judge then gave a very short Judgment in these words:

"I strongly suspect that taking advantage of the difference between the £3,600 in the first set of particulars, and £2,000, at which the contract was actually entered into, the Plaintiff and Mr Warren endeavoured to try and get £1,1000 or £1,000 out of Mr Marshall, but I am not bound to pronounce any findings about that. This is a pure question of fact, and the decision of the case rests on whether or not the Plaintiff and the witnesses whom he has called have persuaded me that it is true that £1,000 was paid to the Defendant. I am not so persuaded. I prefer on every point where the evidence is in conflict the evidence of the Defendant to the evidence of the Plaintiff and his witnesses. There will therefore be judgment for the Defendant with costs".

Inasmuch as the first sentence in that Judgment was not altogether clear we were invited by Counsel on both sides to see the Judge and ask him exactly what he meant. He told us that what he meant was that he suspected that, after Mr Marshall refused to go on with the sale on the 11th June, the Plaintiff and Mr Darren put their heads together to try and get £1,000 or £1,100 out of Mr Marshall and that Hiss Andrews, the secretary, was implicated in it. This makes the case a very serious one for all these persons.

No appeal was entered by Mr Ladd within the six weeks allowed for doing so. Then on 6th May, 1954, Mrs Marshall obtained a decree nisi of divorce from her husband: whereupon she apparently felt free of him and she made a statement to her solicitors (who were also, as it happened, Mr Ladd's solicitors) in which she said that the evidence she had given at the hearing before Mr Justice Glyn-Jones was false. She said that she did remember what happened at the meeting of April, 1952: that she was there when the money was counted out; and that the £1,000 was counted out and handed over by Mr Ladd to her husband, Mr Marshall. In those circumstances, an application was made on Mr Ladd's behalf to this Court asking for the time for appeal to be extended: and this appeal was accordingly entered by Mr Ladd against the decision of Mr Justice Glyn-Jones and Mr Ladd has also applied for leave to adduce further evidence by Mrs Marshall so that she can say what she now says is the truth, namely, that she was present when the £1,000 was handed over and that it was in fact banded over. She has made an affidavit in which she says that at the trial she was afraid of telling the truth because she was still living in her husband's house. She says he would almost certainly have resorted to physical violence and, that she was in fear not only of him but other members of the family and it was for that reason that she did not tell the truth. There was an affidavit by a notice sergeant as to another interview and by the solicitor, saying that he could not have got this evidence before.

Mr Money, arguing the case for Mr Ladd, has put it on two grounds. First, he says the fresh evidence by Mrs Marshall is so important that it should be received by this Court or a new trial had so that the matter can be fully investigated. Secondly, he says that in all the circumstances the trial was unsatisfactory.

It is very rare that application is made to this Court for a new trial on the ground that a witness has told a lie. The principles to be applied are the same as those always applied when fresh evidence is sought to be introduced. In order to justify the reception of fresh evidence or a new trial, three conditions mast be fulfilled: first, it must be shown that the evidence could not have been obtained with reasonable diligence for use at the trial: second, the evidence most be such that, if given, it would probably have an important influence on the result of the case, though it need not be decisive: thirdly, the evidence must be such as is presumably to be believed, or in other words, it must be apparently credible, though it need not be

We have to apply those principles to the case where a witness comes and says: "I told a lie but nevertheless I now want to tell the truth". It seems to me that the fresh evidence, some good reason must be shown why a lie was told in the first instance: and good ground given for thinking the witness will toll the truth on the second occasion. If it was proved that the witness had been bribed or correct into telling a lie at the trial, and is now anxious to tell the truth, that would, I think, be a ground for a new trial and it would not be necessary to resort to an action to set aside the judgment on the ground of fraud. Again, if it was proved that the witness made a mistake on a most important matter and wished to put it right, and the circumstances were so well explained that his fresh evidence was presumably to be believed, then again there would be ground for a new trial, see <u>Richardson v. Fisher</u>, reported in I Bingham at page 145. But this is not a case of bribery or coercion, nor of a mistake. It seems to me that Mrs Marshall is not a person who in the new situation is personally to be believed. She endeavoured to show that she was coerced by her husband, but on reading through the affidavits on both sides, it seems to me that the suggestion of coercion comes to nothing. She does not seem to have been in fear of husband at all. I am afraid it is simply a case where a witness who has told a lie at the first hearing now wants to say something different. It would be contrary to all principle for that to be the ground for a new trial.

Then it is said that the trial was unsatisfactory. Mr Beney pointed out that Miss Andrews was not cross-examined as to credit. All that was said against her was that she was the secretary to Mr Warren and that she lived in Mr Warren's house. But nevertheless the Judge might disbelieve her because of the bad impression she made on him. Next it was said that the Judge should have allowed Mrs Marshall to have been cross-examined as a hostile witness. But that was a matter for the Judge's discretion. If Counsel had material to show she was hostile, he could have put it before the Judge and made a request that he should be allowed to cross-examine her. He did not make this application, probably because he had no material. Finally it was said that the Judge gave a very short Judgment, but that is not a serious defect. No doubt he thought there was nothing more that needed to be said.

I would only add this: Mr Ladd on his own showing paid this £1,000 "under the counter" in order to get round the law which controlled the price of the premises. He paid the £1,000, not out of any banking account, but in notes which cannot be traced: and he paid it without obtaining a receipt. I cannot think of anything more foolish. It is for him to satisfy the trial Judge that the £1,000 was paid: and, if he and his witnesses do not convince the Judge that it was, then he has only himself to thank: for he obviously ought to have got a receipt. I do not mean for myself to suggest that there was any wicked conspiracy between him and his witnesses. All I say is that he did not prove his case to the satisfaction of the trial Judge, and that is the end of the matter. In my judgment, this appeal should be dismissed and the motion should be dismissed also.

LORD JUSTICE HODSON: This is an appeal from a Judgment of Mr Justice Glyn-Jones given on the 12th March in favour of the Defendant. This Court on the 31st May gave leave to appeal out of time and also gave the Plaintiff leave to seek to adduce fresh evidence. Mr Beney in opening the appeal had first put it in this way. The question in the case being one of fact depending not on documents but on the oral evidence given by witnesses, the Judge's conclusion, having seen those witnesses, was virtually unassailable. He recognised that unless he could succeed in his application to call further evidence he must fail. That position was slightly altered during the course of the hearing in circumstances to which I shall return, but I think, as one would expect, it was a well justified way of putting the case when one has regard to the Judge's Judgment, the second paragraph of which is as follows:

"This is a pure question of fact, and the decision of the case rests on whether or not the Plaintiff and the witnesses whom he has called have persuaded me that it is true that £1,000 was paid to the Defendant. I am not so persuaded. I prefer on every point where the evidence is in conflict the evidence of the Defendant to the evidence of the Plaintiff and his witnesses. There will therefore be judgment for the Defendant with costs".

That really was the effective paragraph of the learned Judge's Judgment. The payment of this $\pounds 1,000$ was the only issue of fact in this case. The day now fixed for the payment is the 2nd April, 1952, when the money is supposed to have been paid over in notes by the Plaintiff at the Defendant's house. The Plaintiff gave evidence himself and called as a corroborative witness present at the time a Mr Warren, who said that he saw the payment of $\pounds 1,000$ made in notes; the Plaintiff also called as a witness a young woman, a Miss Andrews, who, although not actually present when the money was paid over, was present on a previous occasion in Mr Warren's house when the money was said to have been counted. Finally, the Plaintiff called as a witness at the then wife of the Defendant, who was a very reluctant witness, as my Lord has mentioned. It was clear from what she did say that she was present on the material occasion when this money is supposed to have been paid over, but when she was asked the specific question by Counsel examining her in chief:

"Did you see any money pass on that occasion or £1,000 counted out?",

she answered

"I do not remember".

That answer, I suppose, in so far as any answer can be described as such, was manifestly untrue. The Judge would not allow her to be cross-examined. Counsel did not follow up the Judge's intimation that he would not allow cross-examination by a specific application to treat her as a hostile witness, and the Plaintiff therefore closed his case in the position that he had called himself, Mr Warren and Miss Andrews, who had helped him, if their evidence was believed, and a witness who had certainly not helped him. The Defendant denied that there had been anything said about £1,000, much less any £1,000 paid. His evidence, as I have already indicated, was accepted fully and that of the Plaintiff and his witnesses rejected in so far as it was in conflict with his. That left out of account Hiss Andrews, because hiss Andrews was not directly in contact with the Defendant, she having been called to prove that there had at any rate been the counting of £1,000 in notes.

any more than he accepted that of the Plaintiff and Mr Darren. On that being pointed out to Mr Beney, he argued that that really-made it difficult to say that the learned Judge's Judgment was satisfactory, because there was first of all nothing in the cross-examination of this young woman to lead to the conclusion that it was being suggested to her that she was a party to this wicked conspiracy to prove a payment of £1,000 which had never been made. Moreover, he pointed out that there was nothing against her, nothing really sinister to be inferred from the fact that she lived in the same house as Mr Warren and had been said to be his secretary. That, of course, was a serious consideration, which Mr Beney has reinforced in his reply by the argument that, looking at this case as a whole, it ought to be the view of this Court that the learned Judge had taken a premature view in the matter in deciding this question of fact having regard perhaps to the unfavourable view which he took of the Plaintiff's evidence in the first place, followed by the unfavourable view which ho took of Mr Warren's evidence; the tendency of his mind had become hostile to the Plaintiff at an early stage and the evidence of Miss Andrews, which on the face of it ought to be regarded as credible, ought to induce this Court to order a new trial. I do not accept that contention.

So far as this question of conspiracy is concerned, I think the learned Judge was very careful, as the first paragraph of his Judgment shows, not to allow himself to arrive at, or even appear to arrive at, a conclusion as to whether these particular persons, or any of them, had been involved in a criminal conspiracy. Counsel in the exercise of his discretion in crossexamining the witnesses did not specifically suggest to them that they had been engaged in a criminal conspiracy. It was sufficient for him to make it clear that he was challenging their evidence, including in that challenge this young woman, Miss Andrews, and to ask the Judge to reject their evidence. The learned Judge took the view, having seen them and being guided by their demeanour, that he should reject the evidence of all those witnesses. At the end of the case he heard the final speech on behalf of the Plaintiff, though, of course, it is true that the fact that he did not call on the Defendant was a strong indication to the Plaintiff that, this being a question of fact, as indeed the learned Judge indicated to Counsel, his mind was affected by the evidence he had heard and he was not likely to be moved by the final speech of Counsel from the conclusion at which he had at that moment arrived. I think that there is no basis for the contention that this trial was unsatisfactory and that there ought to be a new trial.

That brings me to the matter which really brought this appeal into existence, that is the fact that the wife of the Defendant, the reluctant witness who said she did not remember anything, has now said very shortly after the trial, having divorced her husband, that she told lies at the trial and she now wants to tell the truth, the truth being, as she says, that she was present when this £1,000 was handed over. I think it is somewhat bold to ask this Court to allow fresh evidence to be adduced in circumstances of that kind, because Mr Beney, as one would expect, fairly recognised that here is a woman who, on her own showing, has told lies, and if there was a hearing of her evidence by this Court or at a fresh trial at which her evidence could be heard again she could never be better than a discredited witness on whom it would be very difficult for any Court to place any reliance. But Mr Beney says that Order 53, Rule 4, is wide in its terms and that there is a complete discretion in this Court which ought not to be fettered to receive further evidence if the justice of the case requires it. But that discretion has been always exercised in the light of the maxim <u>interest reliablicae ut sit finis litium</u>. This seems to me to be particularly a case where one might envisage no end to litigation if people who had given evidence were allowed to come again and say "I told lies last time. I want to tell the truth now". The principles on which further evidence is admitted have been recently discussed by this Court in <u>Braddock v. Tillotons Newspapers Limited</u>, reported in 1949, 2 All England Reports, page 306. I would only make a brief reference to the well-known case of <u>Brown v. Dean</u> (1910 Appeal Cases at page 375; where the house of Lords affirmed a decision of the Court of Appeal and gave guidance on this topic. The passage which is often discussed and may be said perhaps to have been modified in part is the portion of the speech of Lord Loreburn where he says:

"When a litigant has obtained a judgment in a court of justice, whether it be a county court or one of the High Courts, he is by law entitled not to be deprived of that judgment without very solid grounds, and where (as in this case) the ground is the alleged discovery of new evidence, it must at least be such as is presumably to be believed, and if believed would be conclusive".

With regard to the word "conclusive", Lord Shaw, who also made a speech in the same case, was doubtful whether he could accept the word "conclusive", and the more modern cases have proceeded on the view that perhaps "conclusive" is too strong a word. But none of their Lordships dissented in any way; in fact, they agreed with the earlier part of the Lord Chancellor's proposition that new evidence must at least be such as is presumably to be believed. It seems to me that the evidence of this young woman is not such as its presumably to be believed. It seems to me that the evidence of this young woman is not such as its presumably to be believed. It seems to me that the evidence of this young woman is not such as its presumably to be believed. It seems to me that the evidence of this young woman is not such as its presumably to be believed. It seems to me that the evidence of this young woman is not such as its presumably to be believed. It seems to me that the evidence of this young woman is not such as its presumably to be believed. It seems to me that the evidence of this young woman is not such as its presumably to be believed. It seems to me that the the evidence of this young woman is not such as its presumably to be believed. It seems to me that the evidence of this young woman is not such as its presumably to be believed. In addition, when one looks at the affidavit which she has made in support of this motion, she seeks to say, on offect, that the Defendant, who is a retired boxer, has on several occasions treated her with violence and attacked her with clenched first and she has been obliged to seek the protection of the police. I suppose the only point of that paragraph was to suggest, if no more, that she refused to give this evidence in the first instance because she was afraid of her husband. But there is no suggestion that she did not give evidence because of any threats that her husband had made to her, nor was there any request for protection made by her at any time. In a further affidavit which s

I have already indicated on the general facts of the case that the question was one of fact and, notwithstanding what has happened since the opening of the case, I remain of the opinion that the Judge's decision on the facts was arrived at properly after a full and patient hearing and really could not be disturbed in this Court. But I think it right to say that I think there is on the face of the evidence a good reason why the evidence of the Plaintiff and, indeed, of Mr Warren, should be scrutinised very closely, if not disbelieved. Mr Montagu, on behalf of the Defendant, pointed out to us that when this claim was first formulated in a letter it was said that the money was handed over in February. Then the Writ was issued and the date is given on the indorsement of the Writ as January. Finally the 2nd April was selected as the date on. which this payment was made. Moreover, for my part I think there is great force in the facts elicited by Mr Montagu and the learned Judge himself from the Plaintiff as to the existence or non-existence of a receipt which had an effect on the credit of the Plaintiff. I am referring to the supposed receipt for £1,000. He said nothing about it in chief at all and if there had been such a document in existence prepared by him for the Defendant to sign one would have thought that would have been an essential part of his case. He eventually tried to say that there was such a document and he had it with him. The way in which that evidence about the receipt for £1,000. He said nothing about it and gave a rather remarkable account first of all with apparent uncertainty and then with apparent certainty as to the existence of the warren, who was very fully cross-examined about it and gave a rather remarkable account first of all with apparent uncertainty and then with apparent certainty as to the existence of the uncertainty and then with apparent certainty as to the existence of the fact of all with apparent uncertainty and then with apparent certainty as to the existence of this unsigned

I say nothing more about the other matter which has been touched on in this action, namely, the aspect of illegality. As my Lord has said, the Plaintiff on his own story knew what he was doing in trying to pay an additional £1,000 on the side because the law would not allow the Defendant to receive more than the controlled price of the house. That matter has not been discussed here and I say nothing more about it. In my judgment, this appeal fails and should be dismissed.

LORD JUSTICE PARKER: I agree. I would only add one word on the application for leave to call further evidence. The further evidence which it is desired to call in this case is the evidence of one of the Plaintiff's witnesses, Mrs Marshall, who, it is said, will now say that what she said at the trial was a lie and that she is now prepared to tell the truth. The circumstances in which the Court on such an application will grant leave to adduce that further evidence must be very, very rare, for the very good reason that such evidence on the face of it does not comply with the test as laid down by Lord Loreburn in Browny. Dean, in 1910 Appeal Cases, page 373, where he said that new evidence must at least be "such as is presumably to be believed". It may be that if it could be shown that the witness told a lie originally because he or she had been bribed or because he or she had been coerced, nevertheless it could be said in those circumstances that her evidence was such as is presumably to be believed. But in this case there is no suggestion that Mr Marshall bribed his wife: there is no suggestion that he coerced his wife to give the evidence which she did give at the trul. All that is said is that Mrs Marshall, whose relations with her husband were strained, was afraid of his hitting her and afraid of physical violence. As regards that, the one thing which the further affidavits clearly show is that this woman was nothing like as afraid of her husband as she has made out, and she has utterly failed to satisfy me that the reason she gave her evidence as she did originally was through fear of her husband. As she has failed to satisfy me that the revidence could be credible. In those circumstances, I would refuse the application and dismiss the appeal

(Appeal dismissed with costs).

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TAB 9

[2014] 2 R.C.S.

Andrew Keewatin Jr. and Joseph William Fobister, on their own behalf and on behalf of all other members of the Grassy Narrows First Nation Appellants

ν.

Minister of Natural Resources, Resolute FP Canada Inc. (formerly Abitibi-Consolidated Inc.), Attorney General of Canada and Goldcorp Inc. Respondents

- and -

Leslie Cameron, on his own behalf and on behalf of all other members of the Wabauskang First Nation Appellant

v.

Minister of Natural Resources, Resolute FP Canada Inc. (formerly Abitibi-Consolidated Inc.), Attorney General of Canada and Goldcorp Inc. *Respondents*

and

Attorney General of Manitoba, Attorney General of British Columbia, Attorney General for Saskatchewan, Attorney General of Alberta, Grand Council of Treaty # 3, Blood Tribe, **Beaver Lake Cree Nation, Ermineskin Cree** Nation, Siksika Nation, Whitefish Lake First Nation # 128, Fort McKay First Nation, Te'mexw Treaty Association, **Ochiichagwe'Babigo'Ining First Nation**, **Ojibways of Onigaming First Nation**, **Big Grassy First Nation, Naotkamegwanning** First Nation, Métis Nation of Ontario, Cowichan Tribes, represented by Chief William Charles Seymour, on his own behalf and on behalf of the members of the Cowichan Tribes, Lac Seul

Andrew Keewatin Jr. et Joseph William Fobister, en leur propre nom et au nom de tous les autres membres de la Première Nation de Grassy Narrows Appelants

с.

Ministre des Ressources naturelles, PF Résolu Canada Inc. (anciennement Abitibi-Consolidated Inc.), procureur général du Canada et Goldcorp Inc. Intimés

- et -

Leslie Cameron, en son propre nom et au nom de tous les autres membres de la Première Nation de Wabauskang Appelant

с.

Ministre des Ressources naturelles, PF Résolu Canada Inc. (anciennement Abitibi-Consolidated Inc.), procureur général du Canada et Goldcorp Inc. Intimés

et

Procureur général du Manitoba, procureur général de la Colombie-Britannique, procureur général de la Saskatchewan, procureur général de l'Alberta, Grand Conseil du Traité nº 3, Tribu des Blood, Nation crie de Beaver Lake, Nation crie d'Ermineskin, Nation Siksika, Première Nation du lac Whitefish nº 128, Première Nation de Fort McKay, Association du traité des Te'mexw, Première Nation Ochiichagwe'Babigo'Ining, Première Nation des Ojibways d'Onigaming, Première Nation de Big Grassy, Première Nation de Naotkamegwanning, Métis Nation of Ontario, Tribus Cowichan, représentées par le chef William Charles Seymour, en son propre nom et au nom des membres des Tribus

First Nation, Sandy Lake First Nation and Assembly of First Nations/National Indian Brotherhood Interveners

INDEXED AS: GRASSY NARROWS FIRST NATION V. ONTARIO (NATURAL RESOURCES)

2014 SCC 48

File No.: 35379.

2014: May 15; 2014: July 11.

Present: McLachlin C.J. and LeBel, Abella, Rothstein, Cromwell, Moldaver and Wagner JJ.

ON APPEAL FROM THE COURT OF APPEAL FOR ONTARIO

Aboriginal law — Treaty rights — Harvesting rights — Interpretation of taking-up clause — Certain lands subject to treaty annexed to Ontario after signature of treaty between Ojibway and Canada — Whether province has authority to take up tracts of that land so as to limit harvesting rights under treaty or whether it requires federal approval to do so — Constitution Act, 1867, ss. 91(24), 92(5), 92A, 109 — Constitution Act, 1982, s. 35 — Treaty No. 3.

In 1873, Treaty 3 was signed by treaty commissioners acting on behalf of the Dominion of Canada and Ojibway Chiefs from what is now Northwestern Ontario and Eastern Manitoba. The Ojibway yielded ownership of their territory, except for certain lands reserved to them. Among other things, they received in return the right to harvest the non-reserve lands surrendered by them until such time as they were "taken up" for settlement, mining, lumbering, or other purposes by the Government of the Dominion of Canada. At the time that Treaty 3 was signed, a portion of land known as the Keewatin area was under the exclusive control of Canada. It was annexed to Ontario in 1912 and since that time, Ontario has issued licences for the development of those lands.

In 2005, the Grassy Narrows First Nation, descendents of the Ojibway signatories of Treaty 3, commenced an action challenging a forestry licence issued by Ontario to a large pulp and paper manufacturer and which authorized clear-cut forestry operations within the Keewatin area. Cowichan, Première Nation du lac Seul, Première Nation du lac Sandy et Assemblée des Premières Nations/Fraternité des Indiens du Canada Intervenants

Répertorié : Première Nation de Grassy Narrows c. Ontario (Ressources naturelles)

2014 CSC 48

Nº du greffe : 35379.

2014 : 15 mai; 2014 : 11 juillet.

Présents : La juge en chef McLachlin et les juges LeBel, Abella, Rothstein, Cromwell, Moldaver et Wagner.

EN APPEL DE LA COUR D'APPEL DE L'ONTARIO

Droit des Autochtones — Droits issus de traités — Droits de récolte — Interprétation d'une clause de prise des terres — Annexion à l'Ontario de certaines terres visées par un traité signé par les Ojibways et le Canada — La province a-t-elle le pouvoir de prendre des éten dues de terres et de restreindre ainsi l'exercice des droits de récolte conférés par le traité ou doit-elle obtenir au préalable l'approbation du gouvernement fédéral? — Loi constitutionnelle de 1867, art. 91(24), 92(5), 92A, 109 — Loi constitutionnelle de 1982, art. 35 — Traité n° 3.

En 1873, le Traité nº 3 a été signé par les commissaires chargés de sa négociation au nom du Dominion du Canada, et par les chefs ojibways de ce qui correspond aujourd'hui au nord-ouest ontarien et à l'est manitobain. Les Ojibways ont cédé la propriété de leur territoire, à l'exception d'une partie qui leur a été réservée. En contrepartie, ils ont notamment obtenu un droit de récolte sur les terres cédées situées à l'extérieur de leur réserve jusqu'à ce que ces terres soient « prises » par le gouvernement du Dominion du Canada à des fins de colonisation, d'exploitation minière, d'exploitation forestière ou autres. Au moment de la signature du traité, le Canada avait le contrôle exclusif d'une partie des terres de la région dite de Keewatin, laquelle a été annexée à l'Ontario en 1912, de sorte que la province a délivré par la suite des permis de mise en valeur des terres en cause.

En 2005, la Première Nation de Grassy Narrows, dont les membres sont les descendants des Ojibways signataires du Traité n° 3, a intenté une action pour contester un permis d'exploitation forestière délivré par l'Ontario à une grande entreprise de pâtes et papiers autorisant la coupe à blanc dans la région de Keewatin. The trial judge held that Ontario could not take up lands within the Keewatin area so as to limit treaty harvesting rights without first obtaining Canada's approval. According to her, the taking-up clause in the treaty imposed a two-step process involving federal approval for the taking up of Treaty 3 lands added to Ontario in 1912.

The Ontario Court of Appeal allowed the appeals brought before it. That court held that s. 109 of the *Constitution Act, 1867* gives Ontario beneficial ownership of Crown lands within Ontario. That provision, combined with provincial jurisdiction over the management and sale of provincial public lands and the exclusive provincial power to make laws in relation to natural resources, gives Ontario exclusive legislative authority to manage and sell lands within the Keewatin area in accordance with Treaty 3 and s. 35 of the *Constitution Act, 1982*.

Held: The appeal should be dismissed.

The central question on this appeal is whether Ontario has the power to take up lands in the Keewatin area under Treaty 3 so as to limit the harvesting rights under the treaty, or whether this is subject to Canada's approval.

Ontario and only Ontario has the power to take up lands under Treaty 3. This is confirmed by constitutional provisions, the interpretation of the treaty, and legislation dealing with Treaty 3 lands.

First, although Treaty 3 was negotiated by the federal government, it is an agreement between the Ojibway and the Crown. Both levels of government are responsible for fulfilling the treaty promises when acting within the division of powers under the Constitution. Sections 109, 92(5) and 92A of the *Constitution Act*, 1867 establish conclusively that Ontario holds the beneficial interest in the Keewatin lands and has exclusive power to manage and sell those lands as well as to make laws in relation to the resources on or under those lands. Together, these provisions give Ontario the power to take up lands in the Keewatin area under Treaty 3 for provincially regulated purposes such as forestry. Further; s. 91(24) of that same Act does not give Canada the authority to take up provincial land for exclusively provincial purposes.

La juge de première instance a statué que l'Ontario ne pouvait prendre des terres de la région de Keewatin et restreindre ainsi les droits de récolte des Ojibways sans obtenir au préalable l'approbation du Canada. À son avis, la clause du traité sur la prise des terres imposait un processus en deux étapes qui supposait l'approbation préalable du gouvernement fédéral de toute prise des terres intégrées à l'Ontario en 1912.

La Cour d'appel de l'Ontario a fait droit aux appels dont elle a été saisie. Elle a statué que l'art. 109 de la *Loi constitutionnelle de 1867* confère à l'Ontario la propriété effective des terres publiques situées dans la province. De pair avec la compétence de la province pour l'administration et la vente des terres publiques et sa compétence exclusive pour légiférer dans le domaine des ressources naturelles, cette disposition confère à la seule province de l'Ontario le pouvoir législatif d'administrer et de vendre des terres de la région de Keewatin conformément au Traité n^m 3 et à l'art. 35 de la *Loi constitutionnelle de 1982*.

Arrêt : Le pourvoi est rejeté.

La question que soulève essentiellement le pourvoi est celle de savoir si l'Ontario a le pouvoir de prendre des terres de la région de Keewatin en application du Traité n° 3 et restreindre ainsi l'exercice des droits de récolte conférés par le traité, ou si elle doit obtenir au préalable l'approbation du gouvernement du Canada.

L'Ontario, et seulement cette province, a le pouvoir de prendre des terres visées par le Traité nº 3, ce que confirment les dispositions d'ordre constitutionnel, l'interprétation du traité et les lois portant sur les terres visées par le traité.

Premièrement, même si le traité a été négocié par le gouvernement fédéral, il s'agit d'un accord entre les Ojibways et la Couronne. Le respect des promesses contenues dans le traité incombe aux deux ordres de gouvernement en conformité avec le partage des pouvoirs opéré par la Constitution. Les articles 109 et 92A, ainsi que le par. 92(5) de la Loi constitutionnelle de 1867, établissent sans l'ombre d'un doute que l'Ontario détient la propriété effective des terres de la région de Keewatin et qu'elle possède une compétence exclusive pour administrer et vendre ces terres, de même que pour légiférer sur les ressources qui s'y trouvent. Considérées ensemble, ces dispositions confèrent à l'Ontario le pouvoir de prendre des terres de la région de Keewatin en application du Traité nº 3 à des fins assujetties au pouvoir de réglementation provincial, telle la foresterie. En outre, le par. 91(24) de la même loi n'investit pas le Canada du pouvoir de prendre des terres provinciales à des fins exclusivement provinciales.

Second, nothing in the text or history of the negotiation of Treaty 3 suggests that a two-step process requiring federal supervision or approval was intended. The text of the taking-up clause supports the view that the right to take up land rests with the level of government that has jurisdiction under the Constitution. The reference in the treaty to Canada merely reflects the fact that the lands at the time were in Canada, not Ontario.

Lastly, legislation subsequent to the signature of the treaty and which dealt with Treaty 3 lands confirmed Ontario's right to take up that land by virtue of its control and beneficial ownership of the territory. It did not amend the terms of Treaty 3.

Ontario's power to take up lands under Treaty 3 is not unconditional. When a government - be it the federal or a provincial government - exercises Crown power, the exercise of that power is burdened by the Crown obligations toward the Aboriginal people in question. Here, Ontario must exercise its powers in conformity with the honour of the Crown, and the exercise of those powers is subject to the fiduciary duties that lie on the Crown in dealing with Aboriginal interests. For Treaty 3 land to be taken up, the harvesting rights of the Ojibway over the land must be respected. Any taking up of land in the Keewatin area for forestry or other purposes must meet the conditions set out by this Court in Mikisew Cree First Nation v. Canada (Minister of Canadian Heritage), 2005 SCC 69, [2005] 3 S.C.R. 388. If the taking up leaves the Ojibway with no meaningful right to hunt, fish or trap in relation to the territories over which they traditionally hunted, fished, and trapped, a potential action for treaty infringement will arise.

Cases Cited

Referred to: Haida Nation v. British Columbia (Minister of Forests), 2004 SCC 73, [2004] 3 S.C.R. 511; R. v. Horseman, [1990] 1 S.C.R. 901; St. Catherine's Milling and Lumber Co. v. The Queen (1888), 14 App. Cas. 46; Dominion of Canada v. Province of Ontario, [1910] A.C. 637; Smith v. The Queen, [1983] 1 S.C.R. 554; Mikisew Cree First Nation v. Canada (Minister of Canadian Heritage), 2005 SCC 69, [2005] 3 S.C.R. 388; Delgamuukw v. British Columbia, [1997] 3 S.C.R. 1010; R. v. Sparrow, [1990] 1 S.C.R. 1075; R. v. Badger, [1996] 1 S.C.R. 771; Tsilhqot'in Nation v. British Columbia, 2014 SCC 44, [2014] 2 S.C.R. 256. Deuxièmement, ni le libellé du Traité n° 3 ni l'historique de sa négociation ne permettent de conclure à la volonté des parties d'établir un processus en deux étapes exigeant la surveillance du fédéral ou son approbation. Le libellé de la clause de prise des terres confirme que le droit de prendre des terres appartient au palier de gouvernement dont la Constitution reconnaît la compétence. La seule mention du Canada dans le traité s'explique par le fait que les terres se trouvaient alors au Canada, et non en Ontario.

Enfin, les dispositions législatives adoptées après la signature du traité et portant sur les terres visées par celui-ci confirment le droit de l'Ontario de prendre les terres du fait de sa possession et de sa propriété effective du territoire. Elles n'ont pas modifié les conditions du Traité n° 3.

Le pouvoir de l'Ontario de prendre des terres visées par le Traité nº 3 n'est pas inconditionnel. Le gouvernement qui exerce un pouvoir de la Couronne --- qu'il s'agisse du gouvernement fédéral ou d'un gouvernement provincial est assujetti aux obligations de la Couronne envers le peuple autochtone concerné. En l'espèce, l'Ontario doit exercer ses pouvoirs conformément à l'honneur de la Couronne et elle est assujettie, dans cet exercice, aux obligations fiduciaires de Sa Majesté à l'égard des intérêts autochtones. Toute prise de terres visées par le Traité nº 3 et situées dans la région de Keewatin doit respecter les droits de récolte des Ojibways sur ces terres. Lorsqu'elle se produit à des fins d'exploitation forestière ou autre, elle doit respecter les conditions énoncées par notre Cour dans l'arrêt Première nation crie Mikisew c. Canada (Ministre du Patrimoine canadien), 2005 CSC 69, [2005] 3 R.C.S. 388. Lorsque la prise de terres a pour effet de dépouiller les Ojibways de tout droit réel de chasse, de pêche ou de piégeage sur leurs territoires traditionnels de pêche, de chasse et de piégeage, une action en violation du traité pourra être intentée.

Jurisprudence

Arrêts mentionnés : Nation haïda c. Colombie-Britannique (Ministre des Forêts), 2004 CSC 73, [2004] 3 R.C.S. 511; R. c. Horseman, [1990] 1 R.C.S. 901; St. Catherine's Milling and Lumber Co. c. The Queen (1888), 14 App. Cas. 46; Dominion of Canada c. Province of Ontario, [1910] A.C. 637; Smith c. La Reine, [1983] 1 R.C.S. 554; Première nation crie Mikisew c. Canada (Ministre du Patrimoine canadien), 2005 CSC 69, [2005] 3 R.C.S. 388; Delgamuukw c. Colombie-Britannique, [1997] 3 R.C.S. 1010; R. c. Sparrow, [1990] 1 R.C.S. 1075; R. c. Badger, [1996] 1 R.C.S. 771; Nation Tsilhqot'in c. Colombie-Britannique, 2014 CSC 44, [2014] 2 R.C.S. 256.

Statutes and Regulations Cited

Act for the settlement of certain questions between the Governments of Canada and Ontario respecting Indian Lands (1891) (U.K.), 54 & 55 Vict., c. 5, Sch., s. 1.
Act for the settlement of questions between the Governments of Canada and Ontario respecting Indian Lands (1891) (Ont.), 54 Vict., c. 3, Sch., s. 1.
Constitution Act, 1867, ss. 91(24), 92A, 92(5), 109.

Constitution Act, 1982, s. 35. Ontario Boundaries Extension Act, S.C. 1912, c. 40, s. 2.

Treaties and Other International Instruments

Treaty No. 3 (1873).

APPEAL from a judgment of the Ontario Court of Appeal (Sharpe, Gillese and Juriansz JJ.A.), 2013 ONCA 158, 114 O.R. (3d) 401, 304 O.A.C. 250, [2013] 3 C.N.L.R. 281, [2013] O.J. No. 1138 (QL), 2013 CarswellOnt 2910, setting aside a decision of Sanderson J., 2011 ONSC 4801, [2012] 1 C.N.L.R. 13, [2011] O.J. No. 3907 (QL), 2011 CarswellOnt 8900. Appeal dismissed.

Robert J. M. Janes and Elin R. Sigurdson, for the appellants Andrew Keewatin Jr. and Joseph William Fobister, on their own behalf and on behalf of all other members of the Grassy Narrows First Nation.

Bruce McIvor and Kathryn Buttery, for the appellant Leslie Cameron, on his own behalf and on behalf of all other members of the Wabauskang First Nation.

Michael R. Stephenson, Mark Crow and *Christine Perruzza*, for the respondent the Minister of Natural Resources.

Christopher J. Matthews, for the respondent Resolute FP Canada Inc. (formerly Abitibi-Consolidated Inc.).

Mark R. Kindrachuk, Q.C., and Mitchell R. Taylor, Q.C., for the respondent the Attorney General of Canada.

Lois et règlements cités

- Act for the settlement of questions between the Governments of Canada and Ontario respecting Indian Lands (1891) (Ont.), 54 Vict., ch. 3, ann., art. 1.
- Acte pour régler certaines questions pendantes entre les gouvernements du Canada et d'Ontario relativement à certaines terres des Sauvages (1891) (R.-U.), 54 & 55 Vict., ch. 5, ann., art. 1.
- Loi constitutionnelle de 1867, art. 91(24), 92A, 92(5), 109.

Loi constitutionnelle de 1982, art. 35.

Loi de l'extension des frontières de l'Ontario, S.C. 1912, ch. 40, art. 2.

Traités et autres instruments internationaux

Traité nº 3 (1873).

POURVOI contre un arrêt de la Cour d'appel de l'Ontario (les juges Sharpe, Gillese et Juriansz), 2013 ONCA 158, 114 O.R. (3d) 401, 304 O.A.C. 250, [2013] 3 C.N.L.R. 281, [2013] O.J. No. 1138 (QL), 2013 CarswellOnt 2910, qui a infirmé une décision de la juge Sanderson, 2011 ONSC 4801, [2012] 1 C.N.L.R. 13, [2011] O.J. No. 3907 (QL), 2011 CarswellOnt 8900. Pourvoi rejeté.

Robert J. M. Janes et Elin R. Sigurdson, pour les appelants Andrew Keewatin Jr. et Joseph William Fobister, en leur propre nom et au nom de tous les autres membres de la Première Nation de Grassy Narrows.

Bruce McIvor et Kathryn Buttery, pour l'appelant Leslie Cameron, en son propre nom et au nom de tous les autres membres de la Première Nation de Wabauskang.

Michael R. Stephenson, Mark Crow et Christine Perruzza, pour l'intimé le ministre des Ressources naturelles.

Christopher J. Matthews, pour l'intimée PF Résolu Canada Inc. (anciennement Abitibi-Consolidated Inc.).

Mark R. Kindrachuk, c.r., et Mitchell R. Taylor, c.r., pour l'intimé le procureur général du Canada.

Thomas F. Isaac, William J. Burden, Linda I. Knol and Brian P. Dominique, for the respondent Goldcorp Inc.

Heather Leonoff, Q.C., for the intervener the Attorney General of Manitoba.

Paul E. Yearwood, for the intervener the Attorney General of British Columbia.

Richard James Fyfe and *Macrina Badger*, for the intervener the Attorney General for Saskatchewan.

Douglas B. Titosky, for the intervener the Attorney General of Alberta.

Zachary Davis, Peter W. Hutchins and Jessica Labranche, for the intervener the Grand Council of Treaty # 3.

Meaghan M. Conroy and Abram B. Averbach, for the interveners the Blood Tribe, the Beaver Lake Cree Nation, the Ermineskin Cree Nation, the Siksika Nation and the Whitefish Lake First Nation # 128.

Written submissions only by *Karin Buss* and *Kirk Lambrecht*, *Q.C.*, for the intervener the Fort McKay First Nation.

Karey Brooks, for the intervener the Te'mexw Treaty Association.

Donald R. Colborne, for the interveners the Ochiichagwe'Babigo'Ining First Nation, the Ojibways of Onigaming First Nation, the Big Grassy First Nation and the Naotkamegwanning First Nation.

Jason Madden and Nuri G. Frame, for the intervener the Métis Nation of Ontario.

David M. Robbins, Dominique Nouvet and Heather Mahony, for the intervener the Cowichan Tribes, represented by Chief William Charles Seymour, on his own behalf and on behalf of the members of the Cowichan Tribes. Thomas F. Isaac, William J. Burden, Linda I. Knol et Brian P. Dominique, pour l'intimée Goldcorp Inc.

Heather Leonoff, c.r., pour l'intervenant le procureur général du Manitoba.

Paul E. Yearwood, pour l'intervenant le procureur général de la Colombie-Britannique.

Richard James Fyfe et Macrina Badger, pour l'intervenant le procureur général de la Saskatchewan.

Douglas B. Titosky, pour l'intervenant le procureur général de l'Alberta.

Zachary Davis, Peter W. Hutchins et Jessica Labranche, pour l'intervenant le Grand Conseil du Traité nº 3.

Meaghan M. Conroy et Abram B. Averbach, pour les intervenantes la Tribu des Blood, la Nation crie de Beaver Lake, la Nation crie d'Ermineskin, la Nation Siksika et la Première Nation du lac Whitefish nº 128.

Argumentation écrite seulement par Karin Buss et Kirk Lambrecht, c.r., pour l'intervenante la Première Nation de Fort McKay.

Karey Brooks, pour l'intervenante l'Association du traité des Te'mexw.

Donald R. Colborne, pour les intervenantes la Première Nation Ochiichagwe'Babigo'Ining, la Première Nation des Ojibways d'Onigaming, la Première Nation de Big Grassy et la Première Nation de Naotkamegwanning.

Jason Madden et Nuri G. Frame, pour l'intervenante Métis Nation of Ontario.

David M. Robbins, Dominique Nouvet et Heather Mahony, pour l'intervenante les Tribus Cowichan, représentées par le chef William Charles Seymour, en son propre nom et au nom des membres des Tribus Cowichan. David G. Leitch, for the interveners the Lac Seul First Nation and the Sandy Lake First Nation.

Joseph J. Arvay, Q.C., and Catherine J. Boies Parker, for the intervener the Assembly of First Nations/National Indian Brotherhood.

The judgment of the Court was delivered by

THE CHIEF JUSTICE -

I. Overview

[1] In the early 1870s, Canada was a young country looking to promote Western expansion and Confederation. Settlers travelled west along an immigrant travel route called the Dawson Route, and British Columbia agreed to join Confederation on the condition that Canada build a transcontinental railway. But the immigrant travel route and the prospective railway to the west ran through traditional Ojibway land in what is now Northwestern Ontario and Eastern Manitoba. Canada was concerned about the security of immigrant travellers and surveyors preparing for the construction of the Canadian Pacific Railway ("CPR"), and feared that it may need to station troops in the area. Securing a safe route through the Ojibway lands was critical for the addition of British Columbia to Confederation and to the development of the West. It was against this historical backdrop that Treaty 3, which is at the heart of this case, was negotiated.

[2] In 1873, Treaty 3 was signed by treaty commissioners acting on behalf of the Dominion of Canada and Chiefs of the Ojibway. The Ojibway yielded ownership of their territory, except for certain lands reserved to them. In return, the Ojibway received annuity payments, goods, and the right to harvest the non-reserve lands surrendered by them until such time as they were "taken up" for settlement, mining, lumbering, or other purposes by the Government of the Dominion of Canada. David G. Leitch, pour les intervenantes la Première Nation du lac Seul et la Première Nation du lac Sandy.

Joseph J. Arvay, c.r., et Catherine J. Boies Parker, pour l'intervenante l'Assemblée des Premières Nations/Fraternité des Indiens du Canada.

Version française du jugement de la Cour rendu par

LA JUGE EN CHEF -

I. <u>Aperçu</u>

[1] Au début des années 1870, le Canada était un jeune pays désireux de promouvoir l'expansion vers l'Ouest et la Confédération. Les colons se déplaçaient vers l'ouest sur une voie empruntée par les immigrants et appelée route Dawson, et la Colombie-Britannique acceptait de se joindre à la Confédération à la condition que le Canada construise un chemin de fer transcontinental. Or, la route des immigrants et le chemin de fer projeté vers l'ouest traversaient les terres traditionnelles des Ojibways situées dans ce qui correspond aujourd'hui au nordouest de l'Ontario et à l'est du Manitoba. Soucieux de la sécurité des immigrants en déplacement et des arpenteurs qui s'affairaient en vue de la construction du chemin de fer Canadien Pacifique, le Canada craignait de devoir stationner des troupes dans la région. La création d'une route sûre qui traverse les terres des Ojibways était essentielle à l'entrée de la Colombie-Britannique dans la Confédération et au développement de l'Ouest. C'est dans ce contexte historique que le Traité nº 3 - qui est au cœur du litige — a été négocié.

[2] En 1873, le Traité nº 3 a été signé par les commissaires chargés de sa négociation au nom du Dominion du Canada, et par les chefs des Ojibways. Les Ojibways ont cédé la propriété de leur territoire, à l'exception d'une partie qui leur a été réservée. Ils obtenaient en contrepartie une rente, des biens et des droits de récolte sur les terres cédées situées à l'extérieur de leur réserve jusqu'à ce que ces terres soient « prises » par le gouvernement du Dominion du Canada à des fins de colonisation, d'exploitation minière, d'exploitation forestière ou autres.

[3] The Treaty 3 lands include the Keewatin area. At the time Treaty 3 was concluded, the Keewatin area was under the exclusive control of Canada. In 1912, it was annexed to Ontario through The Ontario Boundaries Extension Act, S.C. 1912, c. 40 ("1912 Legislation"), and since that time, Ontario has issued licences for the development of lands in the Keewatin area. In 2005, the Grassy Narrows First Nation, descendents of the Ojibway signatories of Treaty 3, commenced an action challenging a forestry licence for lands that fell within the Keewatin area. The legal issue in this case is whether Ontario can "take up" lands in the Keewatin area under Treaty 3 so as to limit the harvesting rights under the treaty, or whether it needs federal authorization to do so.

[4] I conclude that Ontario has the authority to take up lands in the Keewatin area so as to limit the harvesting rights set out in Treaty 3. By virtue of ss. 109, 92A, and 92(5) of the *Constitution Act, 1867*, Ontario alone has the ability to take up Treaty 3 land and regulate it in accordance with the treaty and its obligations under s. 35 of the *Constitution Act, 1982*. A two-step process involving federal approval for provincial taking up was not contemplated by Treaty 3.

II. History of Treaty 3

A. Treaty 3 Territory

[5] The Treaty 3 territory covers approximately 55,000 sq. mi. in what is now Northwestern Ontario and Eastern Manitoba. In 1873, Canada claimed ownership over all the Treaty 3 lands. The Keewatin area was unquestionably under Canada's jurisdiction at that time, but the ownership of the rest of the Treaty 3 territory was disputed with Ontario. Since 1912, all of the Treaty 3 territory, except for a small portion in Manitoba, has been within the borders of [3] La région de Keewatin fait partie des terres cédées par le Traité nº 3. Au moment de la signature du traité, le Canada avait l'autorité exclusive sur cette région. En 1912, la région de Keewatin a été annexée à l'Ontario par la Loi de l'extension des frontières de l'Ontario, S.C. 1912, ch. 40 (« loi de 1912 »), et depuis, la province a délivré des permis pour la mise en valeur des terres de cette région. En 2005, la Première Nation de Grassy Narrows, dont les membres sont les descendants des Ojibways signataires du Traité nº 3, a intenté une action pour contester un permis d'exploitation forestière délivré pour des terres comprises dans la région de Keewatin. La question de droit à trancher est celle de savoir si le Traité nº 3 permet à l'Ontario de « prendre » des terres dans cette région - et de restreindre ainsi les droits de récolte conférés par le traité - ou s'il doit obtenir au préalable l'autorisation du gouvernement fédéral.

[4] Je conclus que l'Ontario a le pouvoir de prendre des terres de la région de Keewatin et de restreindre ainsi les droits de récolte conférés par le Traité n°3. Suivant les art. 109 et 92A et le par. 92(5) de la *Loi constitutionnelle de 1867*, seul l'Ontario a le pouvoir de prendre les terres visées par le Traité n° 3 et de les soumettre à sa réglementation en conformité avec le traité et avec les obligations que lui impose l'art. 35 de la *Loi constitutionnelle de 1982*. Les parties au Traité n° 3 n'ont pas envisagé de processus en deux étapes comportant l'approbation par le gouvernement fédéral de la décision de la province de prendre des terres.

II. Historique du Traité nº 3

A. Territoire visé par le Traité nº 3

[5] La superficie du territoire visé par le Traité n° 3 et situé dans ce qui correspond maintenant au nord-ouest de l'Ontario et à l'est du Manitoba est d'environ 55 000 milles carrés. En 1873, le Canada a revendiqué la propriété de la totalité des terres visées par le Traité n° 3. La région de Keewatin relevait alors incontestablement de la compétence du Canada, mais l'appartenance du reste du territoire cédé dans le traité faisait l'objet d'un différend avec Ontario. This appeal only concerns the Keewatin area.

B. Treaty Negotiations

[6] In 1868, Canada needed to complete a treaty with the Ojibway in order to fulfill its promise to build a transcontinental railway to the west and to establish an immigrant travel route across the Treaty 3 lands.

[7] Treaty negotiations were attempted in 1871 and 1872, but failed. In 1873, intent on securing agreement, Canada appointed three new treaty commissioners: Alexander Morris, a founder of Confederation and the Lieutenant Governor of Manitoba, Joseph Provencher, a federal Indian agent, and Simon Dawson, who supervised the construction of the Dawson Route.

[8] The trial judge found that the Ojibway Chiefs who were key players in the negotiation of Treaty 3 were in no rush to make a deal. They were under no immediate threat, as settlers were only passing through their territory, not settling on it. They were only prepared to cooperate if they could retain their way of life, particularly their traditional hunting, fishing and trapping activities.

[9] The negotiations lasted from October 1 to October 3, 1873. There are several historical accounts of the negotiations leading to the conclusion of the treaty: Morris's official report on the making of the treaty, a record of discussions published in *The Manitoban* newspaper, handwritten notes prepared by Dawson during the negotiations, the notes taken on behalf of the Ojibway Chiefs by a Métis hired by them and a record of negotiations published in *The Manitoba Free Press*.

[10] On October 3, 1873, the parties signed Treaty 3. The Ojibway ceded the Treaty 3 territory

l'Ontario. Depuis 1912, la totalité du territoire visé par le Traité n° 3, sauf une petite partie située au Manitoba, se trouve en Ontario. Le pourvoi ne concerne que la région de Keewatin.

B. Négociations préalables au traité

[6] En 1868, le Canada devait signer un traité avec les Ojibways afin de respecter sa promesse de construire une ligne de chemin de fer transcontinentale qui donnerait accès à l'Ouest et de tracer une route qui permettrait aux immigrants de traverser les terres visées par le Traité n° 3.

[7] Les négociations entamées en 1871 et 1872 ont échoué. Déterminé à parvenir à un accord, le Canada a nommé, en 1873, trois nouveaux commissaires chargés de la négociation. Il s'agissait d'Alexander Morris, l'un des Pères fondateurs de la Confédération et lieutenant-gouverneur du Manitoba, de Joseph Provencher, représentant du gouvernement fédéral auprès des Indiens, et de Simon Dawson, directeur des travaux de construction de la route Dawson.

[8] La juge de première instance conclut que les chefs ojibways qui ont joué un rôle clé dans la négociation du Traité n° 3 n'étaient pas pressés de conclure un accord. Il n'y avait aucune menace immédiate, car les colons ne faisaient que traverser leur territoire sans s'y établir. Ils n'étaient disposés à collaborer que s'ils pouvaient conserver leur mode de vie et, notamment, leurs activités traditionnelles de chasse, de pêche et de piégeage.

[9] Les négociations se sont déroulées du 1^{er} au 3 octobre 1873. Il existe plusieurs récits des négociations qui ont abouti à la signature du traité : le rapport officiel de Morris sur la conclusion du traité, le compte rendu publié dans le journal *The Manitoban*, les notes manuscrites de Dawson durant les négociations, les notes prises pour le compte des chefs ojibways par un Métis dont ils avaient retenu les services et le compte rendu publié dans *The Manitoba Free Press*.

[10] Le 3 octobre 1873, les parties ont signé le Traité n° 3. Les Ojibways cédaient le territoire en to Canada in return for reserves, annuities, and goods. The treaty also provided that the Ojibway would retain harvesting rights on the non-reserve land within the Treaty 3 territory until the land was "taken up".

C. The Harvesting Rights and the Taking-Up Clause

[11] The harvesting rights were set out in the text of the treaty as follows (the "taking-up clause"):

... they, the said Indians, shall have [the] right to pursue their avocations of hunting and fishing throughout the [said] tract surrendered as hereinbefore described ... and saving and excepting such tracts as may, from time to time, be required or taken up for settlement, mining, lumbering or other purposes by Her said Government of the Dominion of Canada, or by any of the subjects thereof duly authorized therefor by the said Government. [p. 6]

[12] At the Court of Appeal, the parties disagreed about the trial judge's interpretation of the scope of the taking-up clause. It was suggested by Ontario and Canada that the trial judge interpreted the treaty so as to restrict the exercise of the takingup clause to the Dawson Route and the CPR line such that other areas within the Treaty 3 territory could not be "taken up". The Court of Appeal rejected this interpretation of the trial judge's findings, concluding that when her reasons are read as a whole, the trial judge found that the taking-up clause permitted the taking up of lands throughout the entire Treaty 3 territory, subject only to the legal limits imposed by the honour of the Crown and s. 35 of the Constitution Act, 1982. The scope of the taking-up power in Treaty 3 is not at issue in this case, and I agree with the Court of Appeal's reading of the trial judge's reasons.

D. Boundary Dispute

[13] Treaty 3 was negotiated amidst a dispute between Ontario and Canada over Ontario's western and northern boundaries. Canada's position was cause au Canada en contrepartie de réserves, de rentes et de biens. Le traité prévoyait également que les Ojibways conservaient leurs droits de récolte sur les terres visées par le Traité n° 3, mais non situées dans leur réserve, tant que ces terres n'étaient pas « prises ».

C. Les droits de récolte et la clause de prise des terres

[11] Les droits de récolte sont formulés comme suit dans le traité (la « clause de prise des terres ») :

... ils, les dits Indiens, auront le droit de se livrer à la chasse et à la pêche dans l'étendue du pays cédé comme décrit ci-haut [...], et excepté telles étendues qui pourront être nécessaires ou requises pour la colonisation, les mines, la coupe du bois ou autres fins par son dit gouvernement du Canada ou par aucun de ses sujets dûment autorisés à cet effet par le dit gouvernement. [p. 6]

[12] En Cour d'appel, les parties ont fait valoir des points de vue opposés quant à la décision de la juge de première instance sur la portée de la clause de prise des terres. L'Ontario et le Canada ont laissé entendre que la juge avait interprété le traité de manière que la clause ne s'applique qu'à la route Dawson et qu'à la voie ferrée du Canadien Pacifique, de sorte que les autres parties du territoire ne pouvaient être « prises ». La Cour d'appel a rejeté cette interprétation des conclusions tirées en première instance. Au vu des motifs considérés dans leur ensemble, elle a estimé que, pour la juge, la clause permettait de prendre des terres sur tout le territoire visé par le traité, sous réserve uniquement des limitations d'ordre juridique découlant de l'honneur de la Couronne et de l'art. 35 de la Loi constitutionnelle de 1982. La portée du pouvoir de prendre des terres conféré par le Traité nº 3 n'est pas en cause dans la présente affaire, et je suis d'accord avec l'interprétation des motifs de la juge de première instance par la Cour d'appel.

D. Différend relatif aux frontières

[13] Lorsque le Traité nº 3 a été négocié, un conflit opposait l'Ontario et le Canada au sujet des limites de la province à l'ouest et au nord. Le Canada that all the Treaty 3 lands were under the control of the Dominion of Canada, while Ontario took the position that its boundaries extended westward to include much of the Treaty 3 lands. The lands that were the object of this dispute are referred to as the "disputed territory". The Keewatin area was not part of this dispute; it was unquestionably under the control of Canada at the time Treaty 3 was negotiated and signed. However, the boundary dispute, and the subsequent legislation that settled the dispute, nonetheless provide insight into the parties' understanding of the taking-up clause in Treaty 3.

[14] In 1874, Canada and Ontario reached a provisional boundary agreement. Under this agreement, Ontario would grant patents and licences for the lands to the east and south of the provisional boundary, while Canada would do so for the lands west and north of the boundary. Ontario's position in the boundary dispute was accepted by a panel of arbitrators in August 1878. The disputed territory was within Ontario's borders. This ruling was endorsed by the Judicial Committee of the Privy Council in 1884, and confirmed in reciprocal legislation in 1891: An Act for the settlement of certain questions between the Governments of Canada and Ontario respecting Indian Lands (1891) (U.K.), 54 & 55 Vict., c. 5; An Act for the settlement of questions between the Governments of Canada and Ontario respecting Indian Lands (1891) (Ont.), 54 Vict., c. 3 (the "1891 Legislation").

[15] The 1891 Legislation incorporated a draft agreement between Canada and Ontario that was ultimately executed in 1894 (the "1894 Agreement"). Article 1 of the 1894 Agreement provided that as the disputed territory belonged to Ontario, "the rights of hunting and fishing by the Indians throughout the tract surrendered, not including the reserves to be made thereunder, do not continue with reference to any tracts which have been, or from time to time may be, required or taken up for settlement, mining, lumbering or other purposes soutenait que la totalité des terres visées par le Traité n° 3 relevait de la compétence du Dominion du Canada, alors que l'Ontario prétendait que ses limites s'étendaient à l'ouest de manière à englober une grande partie de ces terres. Les terres qui faisaient l'objet de ce différend constituent le « territoire disputé ». La région de Keewatin n'en faisait pas partie; nul ne contestait qu'elle relevait de la compétence du Canada au moment de la négociation et de la signature du Traité n° 3. Toutefois, le différend, ainsi que la loi qui l'a ensuite réglé, donnent néanmoins une idée de la manière dont les parties interprétaient la clause du Traité n° 3 sur la prise des terres.

[14] En 1874, le Canada et l'Ontario ont convenu provisoirement que l'Ontario délivrerait des lettres patentes et des permis pour les terres situées à l'est et au sud d'une frontière fixée provisoirement, et que le Canada ferait de même pour les terres situées à l'ouest et au nord de cette frontière. En août 1878, la thèse défendue par l'Ontario dans le cadre du différend a été retenue par une formation d'arbitres. Le territoire disputé se situait à l'intérieur des limites de l'Ontario. La décision a été entérinée par le Comité judiciaire du Conseil privé en 1884, puis confirmée en 1891 par des lois de réciprocité, à savoir l'Acte pour régler certaines questions pendantes entre les gouvernements du Canada et d'Ontario relativement à certaines terres des Sauvages (1891) (R.-U.), 54 & 55 Vict., ch. 5, et l'Act for the settlement of questions between the Governments of Canada and Ontario respecting Indian Lands (1891) (Ont.), 54 Vict., ch. 3 (les « lois de 1891 »).

[15] Les lois de 1891 comprenaient un projet d'accord entre le Canada et l'Ontario que les parties ont finalement signé en 1894 (l'« accord de 1894 »). L'article premier de l'accord de 1894 prévoyait, vu l'appartenance à la province du territoire disputé, que « le droit de chasse et de pêche des Sauvages dans l'étendue du territoire cédé, abstraction faite des réserves à désigner d'après le dit traité, cesse d'exister dans les espaces qui ont été ou pourront être de temps en temps jugés nécessaires, et distraits par le gouvernement d'Ontario ou ses agents by the Government of Ontario" (Schedule to 1891 Legislation (U.K.)). In other words, Ontario was responsible for the "taking up" of Treaty 3 lands within its boundaries.

E. 1912 Transfer of Keewatin

[16] As noted above, the Keewatin area was not part of the boundary dispute between Canada and Ontario. At the time Treaty 3 was concluded, it was part of Canada. There was no suggestion that Ontario had any interest in the Keewatin area at that time.

[17] The 1912 Legislation extended Ontario's borders to include the Keewatin area.

III. Judicial History

A. The Claim

[18] In 1997, Ontario's Minister of Natural Resources issued a licence to Abitibi-Consolidated Inc. (now known as Resolute FP Canada Inc.), a large pulp and paper manufacturer, to carry out clear-cut forestry operations on Crown lands situated within the Keewatin area. In 2005, the Grassy Narrows First Nation, descendents of the Ojibway signatories of Treaty 3, launched an action to set aside the forestry licence on the basis that it violated their Treaty 3 harvesting rights.

[19] In 2006, Spies J. made a case management order dividing the trial into two phases. The first phase consisted of two threshold questions: (1) Does Ontario have the authority to "take up" tracts of land within the Keewatin area so as to limit Treaty 3 harvesting rights? and (2) If the answer to the first question is no, does Ontario have the authority under the *Constitution Act*, 1867 to justifiably infringe the appellants' treaty rights? dûment autorisés, pour la colonisation, les exploitations minières et forestières ou pour d'autres fins » (annexe des lois de 1891 (R.-U.)). En d'autres termes, l'Ontario avait le pouvoir de prendre les terres visées par le Traité nº 3 et situées à l'intérieur de ses limites.

E. Transfert de 1912

[16] Rappelons que la région de Keewatin ne faisait pas l'objet du différend opposant le Canada et l'Ontario au sujet des limites de la province. Au moment de la signature du Traité n° 3, la région de Keewatin faisait partie du Canada. Nul ne laissait entendre que l'Ontario avait alors quelque droit sur la région.

[17] La loi de 1912 a eu pour effet d'étendre les limites de l'Ontario et d'englober la région de Keewatin.

III. Historique judiciaire

A. La demande

[18] En 1997, le ministre des Ressources naturelles de l'Ontario a délivré à Abitibi-Consolidated Inc. (devenue depuis PF Résolu Canada Inc.), une importante société de pâtes et papiers, un permis d'exploitation forestière autorisant la coupe à blanc sur les terres de la Couronne situées dans la région de Keewatin. En 2005, la Première Nation de Grassy Narrows, dont les membres sont les descendants des Ojibways qui ont signé le Traité n° 3, a intenté une action en vue de faire annuler le permis au motif qu'il violait les droits de récolte que leur accordait le traité.

[19] Chargée de la gestion de l'instance, la juge Spies a ordonné en 2006 que le procès se déroule en deux phases. La première a porté sur deux questions préliminaires. (1) L'Ontario a-t-il le pouvoir de « prendre » des étendues de terres dans la région de Keewatin et de restreindre ainsi les droits de récolte accordés par le Traité n° 3? (2) Dans la négative, la *Loi constitutionnelle de 1867* confère-t-elle à l'Ontario le pouvoir de porter atteinte de façon justifiée aux droits des appelants issus du traité? [20] The second phase of the trial has not yet commenced.

B. Judgments Below

[21] In the first phase of the trial, Sanderson J. concluded that the answer to both threshold questions was "no" (2011 ONSC 4801, [2012] 1 C.N.L.R. 13). First, she found that Ontario could not take up lands within the Keewatin area so as to limit harvesting rights without first obtaining Canada's approval. The taking-up clause imposed a two-step process involving federal approval for the taking up of Treaty 3 lands, and neither the 1891 nor the 1912 Legislation altered this process with respect to the Keewatin area. The trial judge then proceeded to answer the second question, concluding that the doctrine of interjurisdictional immunity prevents provinces from infringing treaty rights, even if the infringement can be justified.

[22] The Ontario Court of Appeal allowed the appeals of Ontario, Canada and Resolute FP Canada Inc. ("Resolute") (2013 ONCA 158, 114 O.R. (3d) 401). The court held that the trial judge erred in concluding that Ontario requires Canada's approval to take up the lands in the Keewatin area. Section 109 of the Constitution Act, 1867 gives Ontario beneficial ownership of Crown lands within Ontario. That provision, combined with provincial jurisdiction over the management and sale of provincial public lands and the exclusive provincial power to make laws in relation to natural resources (ss. 92(5) and 92A), gives Ontario exclusive legislative authority to manage and sell lands within the Keewatin area in accordance with Treaty 3 and s. 35 of the Constitution Act, 1982. As the answer to the first question was "yes", the Court of Appeal did not consider the second question of whether interjurisdictional immunity applies to provincial infringements of treaty rights.

[20] La seconde phase du procès n'a pas encore commencé.

B. Jugements des juridictions inférieures

[21] À l'issue de la première phase du procès, la juge Sanderson a répondu par la négative aux deux questions préliminaires (2011 ONSC 4801, [2012] 1 C.N.L.R. 13). Elle a tout d'abord conclu que l'Ontario ne pouvait prendre des terres de la région de Keewatin et restreindre ainsi les droits de récolte sans obtenir au préalable l'approbation du Canada. À son avis, la clause de prise des terres imposait un processus en deux étapes qui supposait l'approbation préalable du gouvernement fédéral pour la prise de terres visées par le Traité nº 3, et ni les lois de 1891 ni celle de 1912 n'avaient modifié ce processus relativement à la région de Keewatin. Elle a ensuite conclu au sujet de la seconde question que la doctrine de l'exclusivité des compétences empêche les provinces de porter atteinte aux droits issus de traités, même lorsque la justification de l'atteinte peut se démontrer.

[22] La Cour d'appel de l'Ontario a fait droit aux appels de l'Ontario, du Canada et de PF Résolu Canada Inc. (« Résolu ») (2013 ONCA 158, 114 O.R. (3d) 401). Elle a décidé que la juge de première instance avait eu tort de conclure que l'Ontario devait obtenir l'approbation du Canada pour prendre des terres situées dans la région de Keewatin. L'article 109 de la Loi constitutionnelle de 1867 confère à l'Ontario la propriété effective des terres publiques situées dans la province. De pair avec la compétence de la province pour l'administration et la vente des terres publiques et sa compétence exclusive pour légiférer dans le domaine des ressources naturelles (par. 92(5) et art. 92A), cette disposition confère à la seule province de l'Ontario le pouvoir législatif d'administrer et de vendre des terres de la région de Keewatin conformément au Traité nº 3 et à l'art. 35 de la Loi constitutionnelle de 1982. Sa réponse à la première question étant affirmative, la Cour d'appel ne se penche pas sur la seconde, celle de savoir si la doctrine de l'exclusivité des compétences s'applique aux atteintes provinciales aux droits issus de traités.

[23] On appeal, there are 2 appellants, 4 respondents, and 13 interveners.

[24] The appellants are the Grassy Narrows First Nation, descendants of the Ojibway, and the Wabauskang First Nation, whose traditional territory includes lands within the Keewatin area.

[25] The first two respondents are the Attorney General of Canada and the Ontario Minister of Natural Resources. The third respondent is Resolute, a company that owns and operates a currently idle paper mill on land subject to Treaty 3, but not in the Keewatin area. Resolute was a defendant in this litigation because it was granted the forestry licence that gave rise to this appeal. The final respondent is Goldcorp Inc., a gold producer with a mine situated in the Keewatin area and whose operations rely in part on permits from the provincial Minister of Natural Resources. Goldcorp was granted status to intervene as a party at the Court of Appeal.

[26] The Attorneys General of Manitoba, British Columbia, Saskatchewan, and Alberta intervene in support of the respondents. The appellants are supported by the following interveners: the Grand Council of Treaty # 3; the Blood Tribe, the Beaver Lake Cree Nation, the Ermineskin Cree Nation, the Siksika Nation, and the Whitefish Lake First Nation # 128, intervening together; the Fort McKay First Nation; the Te'mexw Treaty Association; the Ochiichagwe'Babigo'Ining First Nation, the Ojibways of Onigaming First Nation, the Big Grassy First Nation, and the Naotkamegwanning First Nation, intervening together; the Métis Nation of Ontario; the Cowichan Tribes; the Lac Seul and Sandy Lake First Nations; and the Assembly of First Nations/National Indian Brotherhood.

IV. Parties et intervenants au pourvoi

[23] Deux appelants, quatre intimés et treize intervenants sont parties au pourvoi.

[24] Les parties appelantes sont la Première Nation de Grassy Narrows, dont les membres sont les descendants des Ojibways, et la Première Nation de Wabauskang, dont le territoire traditionnel comprend des terres situées dans la région de Keewatin.

[25] Les deux premiers intimés sont le procureur général du Canada et le ministre des Ressources naturelles de l'Ontario. La troisième partie intimée est Résolu, une société qui possède et exploite une usine de papier actuellement inactive située sur des terres assujetties au Traité nº 3, mais non dans la région de Keewatin. Résolu est défenderesse en l'espèce parce qu'elle s'est vu délivrer le permis d'exploitation forestière qui est à l'origine du pourvoi. La dernière partie intimée est Goldcorp Inc., un producteur aurifère qui possède une mine située dans la région de Keewatin et dont les activités dépendent en partie de la délivrance de permis par le ministre provincial des Ressources naturelles. La société Goldcorp a été autorisée à intervenir à titre de partie par la Cour d'appel.

[26] Les procureurs généraux du Manitoba, de la Colombie-Britannique, de la Saskatchewan et de l'Alberta interviennent à l'appui de la thèse des intimés. Quant aux appelants, ils ont l'appui des intervenants suivants : le Grand Conseil du Traité nº 3; la Tribu des Blood, la Nation crie de Beaver Lake, la Nation crie d'Ermineskin, la Nation Siksika et la Première Nation du lac Whitefish nº 128, qui interviennent collectivement; la Première Nation de Fort McKay; l'Association du traité des Te'mexw; la Première Nation Ochiichagwe'Babigo'Ining; la Première Nation des Ojibways d'Onigaming; la Première Nation de Big Grassy et la Première Nation de Naotkamegwanning, qui interviennent collectivement; la Métis Nation of Ontario; les Tribus Cowichan; la Première Nation du lac Seul et la Première Nation du lac Sandy; l'Assemblée des Premières Nations/Fraternité des Indiens du Canada.

V. Issues

- [27] This appeal raises the following issues:
- 1. Does Ontario have the authority under Treaty 3 to "take up" tracts of land in the Keewatin area?
- Does the doctrine of interjurisdictional immunity preclude Ontario from justifying infringement of Treaty 3 rights?
- VI. Analysis
- A. The Power to Take up Lands Under Treaty 3

[28] The central question on this appeal, simply put, is whether the Province of Ontario has the power to take up lands in the Keewatin area under Treaty 3, or whether this must be done by or in cooperation with the Government of Canada. Ontario's power to take up other Treaty 3 lands is not at issue on this appeal.

[29] The Court of Appeal held that the Province of Ontario has the power to take up the lands. The trial judge, by contrast, held that this could be done only by a two-step procedure involving approval by both the federal and provincial governments.

[30] I agree with the Ontario Court of Appeal that Ontario and only Ontario has the power to take up lands under Treaty 3. This conclusion rests on Canada's constitutional provisions, the interpretation of Treaty 3, and legislation dealing with Treaty 3 lands. First, although Treaty 3 was negotiated by the federal government, it is an agreement between the Ojibway and the Crown. The level of government that exercises or performs the rights and obligations under the treaty is determined by the division of powers in the Constitution. Ontario has exclusive authority under the *Constitution Act*, *1867* to take up provincial lands for forestry, mining, settlement, and other exclusively provincial

- V. Questions en litige
- [27] Le pourvoi soulève les questions suivantes :
- L'Ontario a-t-il le pouvoir, en application du Traité nº 3, de « prendre » des étendues de terres dans la région de Keewatin?
- La doctrine de l'exclusivité des compétences empêche-t-elle l'Ontario de justifier l'atteinte aux droits conférés par le Traité nº 3?
- VI. Analyse

A. Le pouvoir de prendre des terres que confère le Traité n° 3

[28] Formulée simplement, la question que soulève essentiellement le litige est celle de savoir si la province de l'Ontario a le pouvoir de prendre des terres de la région de Keewatin en application du Traité n° 3 ou si ce pouvoir peut seulement être exercé par le gouvernement du Canada ou avec sa collaboration. Le pouvoir de l'Ontario de prendre d'autres terres visées par le Traité n° 3 ne fait pas l'objet du pourvoi.

[29] La Cour d'appel juge que la province de l'Ontario a le pouvoir de prendre les terres en question. À l'opposé, la juge de première instance estime que la prise ne peut intervenir qu'à l'issue d'un processus en deux étapes comportant l'approbation des deux paliers de gouvernement.

[30] Je conviens avec la Cour d'appel que l'Ontario, et seulement cette province, a le pouvoir de prendre des terres visées par le Traité n° 3. Cette conclusion se fonde sur les dispositions d'ordre constitutionnel du Canada, l'interprétation du Traité n° 3 et les lois portant sur les terres visées par le Traité n° 3. Premièrement, même si le traité a été négocié par le gouvernement fédéral, il s'agit d'un accord entre les Ojibways et la Couronne. C'est le partage des compétences prévu par la Constitution qui détermine quel palier de gouvernement est appelé à exercer les droits ou à s'acquitter des obligations qui y sont prévus. Suivant la *Loi constitutionnelle de 1867*, l'Ontario a le pouvoir exclusif de matters. Federal supervision is not required by the Constitution. Second, nothing in the text or history of the negotiation of Treaty 3 suggests that a two-step process requiring federal supervision or approval was intended. Third, legislation dealing with Treaty 3 land confirms that no two-step process was contemplated. I elaborate on each of these points below.

(1) Constitutional Provisions

[31] Once the Keewatin lands came within Ontario's borders in 1912, s. 109 of the *Constitution Act, 1867* became applicable. Section 109 provides:

109. All Lands, Mines, Minerals, and Royalties belonging to the several Provinces of Canada, Nova Scotia, and New Brunswick at the Union, and all Sums then due or payable for such Lands, Mines, Minerals, or Royalties, shall belong to the several Provinces of Ontario, Quebec, Nova Scotia, and New Brunswick in which the same are situate or arise, subject to any Trusts existing in respect thereof, and to any Interest other than that of the Province in the same.

Section 109 establishes conclusively that Ontario holds the beneficial interest in the Keewatin lands and the resources on or under those lands. In addition, s. 92(5) of the *Constitution Act, 1867* gives the Province exclusive power over the "Management and Sale of the Public Lands belonging to the Province and of the Timber and Wood thereon" and s. 92A gives the Province exclusive power to make laws in relation to non-renewable natural resources, forestry resources, and electrical energy. Together, these provisions give Ontario the power to take up lands in the Keewatin area under Treaty 3 for provincially regulated purposes, such as forestry. prendre des terres provinciales à quelque fin relevant exclusivement de la province, dont l'exploitation forestière ou minière et la colonisation. La Constitution n'exige pas de surveillance fédérale. Deuxièmement, ni le libellé du Traité n° 3, ni l'historique de sa négociation ne permettent de conclure à la volonté des parties d'établir un processus en deux étapes exigeant la surveillance du fédéral ou son approbation. Troisièmement, les lois portant sur les terres visées par le traité confirment qu'un tel processus n'a pas été envisagé. Je développe chacun de ces points ci-après.

(1) **Dispositions constitutionnelles**

[31] L'article 109 de la *Loi constitutionnelle de 1867* est devenu applicable aux terres de Keewatin dès l'intégration de celles-ci au territoire de l'Ontario en 1912. Il dispose :

109. Toutes les terres, mines, minéraux et réserves royales appartenant aux différentes provinces du Canada, de la Nouvelle-Écosse et du Nouveau-Brunswick lors de l'union, et toutes les sommes d'argent alors dues ou payables pour ces terres, mines, minéraux et réserves royales, appartiendront aux différentes provinces d'Ontario, Québec, la Nouvelle-Écosse et le Nouveau-Brunswick, dans lesquelles ils sont sis et situés, ou exigibles, restant toujours soumis aux charges dont ils sont grevés, ainsi qu'à tous intérêts autres que ceux que peut y avoir la province.

L'article 109 établit sans l'ombre d'un doute que l'Ontario détient la propriété effective des terres de la région de Keewatin ainsi que des ressources qui s'y trouvent en surface et dans le sous-sol. De plus, le par. 92(5) de la Loi constitutionnelle de 1867 confère à la province une compétence exclusive sur « [1]'administration et la vente des terres publiques appartenant à la province, et des bois et forêts qui s'y trouvent »; l'art. 92A lui confère une compétence exclusive pour légiférer sur les ressources naturelles non renouvelables, les ressources forestières et l'énergie électrique. Considérées ensemble, ces dispositions confèrent à l'Ontario le pouvoir de prendre des terres de la région de Keewatin en application du Traité nº 3 à des fins assujetties au pouvoir de réglementation provincial, telle la foresterie.

[32] The view that only Canada can take up or authorize the taking up of lands under Treaty 3 rests on a misconception of the legal role of the Crown in the treaty context. It is true that Treaty 3 was negotiated with the Crown in right of Canada. But that does not mean that the Crown in right of Ontario is not bound by and empowered to act with respect to the treaty.

[33] The theory of the trial judge, supported by the appellants, was that since the treaty was made with the federal Crown, only the federal Crown has obligations and powers over matters covered by the treaty. But this reasoning does not apply in the treaty context. For example, this Court has held that Crown obligations to First Nations such as the duty to consult are owed by both levels of government (Haida Nation v. British Columbia (Minister of Forests), 2004 SCC 73, [2004] 3 S.C.R. 511) and that a change in the level of government responsible for regulating hunting rights did not constitute a modification of a treaty (R. v. Horseman, [1990] 1 S.C.R. 901). Furthermore, in St. Catherine's Milling and Lumber Co. v. The Queen (1888), 14 App. Cas. 46 (P.C.), Lord Watson concluded that Treaty 3 purported to be "from beginning to end a transaction between the Indians and the Crown", not an agreement between the Government of Canada and the Ojibway people (p. 60). In the same vein,

it is abundantly clear that the commissioners who represented Her Majesty, whilst they had full authority to accept a surrender to the Crown, had neither authority nor power to take away from Ontario the interest which had been assigned to that province by the Imperial Statute of 1867. [*ibid.*]

[34] Similar views were expressed in *Dominion* of Canada v. Province of Ontario, [1910] A.C. 637 (P.C.), at p. 645, and Smith v. The Queen, [1983] 1 S.C.R. 554, at pp. 562-65.

[35] The promises made in Treaty 3 were promises of the Crown, not those of Canada. Both levels of government are responsible for fulfilling these promises when acting within the division of powers [32] La thèse selon laquelle seul le Canada peut prendre des terres visées par le Traité n° 3 ou en autoriser la prise méconnaît le rôle juridique de la Couronne dans le contexte d'un traité. Certes, le Traité n° 3 a été négocié avec la Couronne du chef du Canada, mais il ne s'ensuit pas pour autant que la Couronne du chef de l'Ontario n'est pas liée par le traité, ni habilitée à agir relativement à ce dernier.

[33] Selon la théorie de la juge de première instance, à laquelle se rallient les appelants, la Couronne fédérale étant signataire du traité, elle seule a des obligations et des pouvoirs à l'égard de ce qui fait l'objet du traité. Or, ce raisonnement ne vaut pas dans le cas d'un traité. Par exemple, notre Cour a statué que les obligations de la Couronne envers les Premières Nations, comme celle de les consulter, incombent aux deux paliers de gouvernement (Nation haïda c. Colombie-Britannique (Ministre des Forêts), 2004 CSC 73, [2004] 3 R.C.S. 511) et que le remplacement du palier de gouvernement responsable de la réglementation des droits de chasse par un autre ne constitue pas une modification du traité (R. c. Horseman, [1990] 1 R.C.S. 901). En outre, dans l'arrêt St. Catherine's Milling and Lumber Co. c. The Queen (1888), 14 App. Cas. 46 (C.P.), lord Watson avait auparavant conclu que le Traité nº 3, [TRADUCTION] « du début à la fin, constituait un marché intervenu entre les Indiens et Sa Majesté », et non un accord intervenu entre le gouvernement du Canada et le peuple ojibway (p. 60). Dans le même ordre d'idées, il a ajouté :

[TRADUCTION] Il ne fait aucun doute que même s'ils avaient les pleins pouvoirs pour accepter une cession en faveur de la Couronne, les commissaires qui représentaient Sa Majesté n'avaient ni compétence ni pouvoir pour retirer à l'Ontario les droits que lui avaient conférés la loi impériale de 1867. [*ibid.*]

[34] Des points de vue semblables ont été adoptés dans les arrêts *Dominion of Canada c. Province of Ontario*, [1910] A.C. 637 (C.P.), p. 645, et *Smith c. La Reine*, [1983] 1 R.C.S. 554, p. 562-565.

[35] Les promesses contenues dans le Traité n° 3 étaient celles de la Couronne, non du Canada. Leur respect incombe aux deux ordres de gouvernement en conformité avec le partage des pouvoirs opéré under the *Constitution Act*, 1867. Thus, when the lands covered by the treaty were determined to belong to the Province of Ontario, the Province became responsible for their governance with respect to matters falling under its jurisdiction by virtue of ss. 109, 92(5) and 92A of the *Constitution Act*, 1867, subject to the terms of the treaty. It follows that the Province is entitled to take up lands under the treaty for forestry purposes.

[36] The appellants further argue that s. 91(24) of the *Constitution Act, 1867* grants Canada a residual and continuing role in respect of the taking up of Treaty 3 lands. Section 91(24) provides that Canada has jurisdiction over "Indians, and Lands reserved for the Indians". Thus, the appellants submit that the trial judge's two-step process is merely a restatement of the double aspect doctrine: to the extent that any taking up displaces or limits the federally promised treaty rights, both aspects of the land or resource must be addressed — the provincial aspect of the land *qua* proprietary rights and the federal aspect of the land as subject to a treaty right (Grassy Narrows' factum, at para. 66).

[37] Section 91(24) does not give Canada the authority to take up provincial land for exclusively provincial purposes, such as forestry, mining, or settlement. Thus, s. 91(24) does not require Ontario to obtain federal approval before it can take up land under Treaty 3. While s. 91(24) allows the federal government to enact legislation dealing with Indians and lands reserved for Indians that may have incidental effects on provincial land, the applicability of provincial legislation that affects treaty rights through the taking up of land is determined by *Mikisew Cree First Nation v. Canada (Minister of Canadian Heritage)*, 2005 SCC 69, [2005] 3 S.C.R. 388, and by s. 35 of the *Constitution Act, 1982*. par la Loi constitutionnelle de 1867. Ainsi, lorsqu'il a été déterminé que les terres visées par le traité lui appartenaient, la province de l'Ontario est devenue responsable de leur administration dans les domaines relevant de sa compétence suivant l'art. 109, le par. 92(5) et l'art. 92A de la Loi constitutionnelle de 1867, sous réserve des dispositions du traité. Dès lors, la province peut prendre des terres visées par le traité à des fins d'exploitation forestière.

[36] Les appelants soutiennent par ailleurs que le par. 91(24) de la Loi constitutionnelle de 1867 confère au Canada un rôle résiduel et permanent en ce qui concerne la prise des terres visées par le Traité nº 3. Ce paragraphe dispose que le Canada a compétence sur les « Indiens et les terres réservées pour les Indiens ». Les appelants affirment donc que lorsqu'elle conclut à l'application d'un processus en deux étapes, la juge de première instance ne fait que reformuler la théorie du double aspect : dans la mesure où la prise des terres a pour effet d'écarter ou de restreindre des droits promis dans un traité par le gouvernement fédéral, il faut tenir compte des deux aspects des terres ou des ressources l'aspect provincial des terres en tant qu'objets de droits de propriété, et l'aspect fédéral des terres en tant qu'objets de droits issus de traités (mémoire de Grassy Narrows, par. 66).

[37] Le paragraphe 91(24) ne confère pas au Canada le droit de prendre des terres provinciales à des fins exclusivement provinciales, telles la colonisation ou l'exploitation forestière ou minière. Il n'oblige donc pas l'Ontario à obtenir au préalable l'approbation du gouvernement fédéral de prendre des terres en application du Traité nº 3. Même si cette disposition habilite le gouvernement fédéral à adopter relativement aux Indiens et aux terres réservées pour eux des lois susceptibles d'avoir des effets accessoires sur un territoire provincial, l'applicabilité d'une loi provinciale qui, par la prise de terres, porte atteinte à des droits issus de traités est déterminée selon l'arrêt Première nation crie Mikisew c. Canada (Ministre du Patrimoine canadien), 2005 CSC 69, [2005] 3 R.C.S. 388, et l'art. 35 de la Loi constitutionnelle de 1982.

(2) Interpretation of Treaty 3

[38] The text of the taking-up clause supports the view that the right to take up land rests with the level of government that has jurisdiction under the Constitution. The taking-up clause provides that the Ojibway will have continuing harvesting rights throughout the Treaty 3 lands "saving and excepting such tracts as may, from time to time, be required or taken up for settlement, mining, lumbering or other purposes by Her said Government of the Dominion of Canada, or by any of the subjects thereof duly authorized therefor by the said Government" (p. 6).

[39] The clause does not contemplate a two-step process involving both levels of government. It only refers to the Government of the Dominion of Canada. The treaty, as discussed, was between the Crown — a concept that includes all government power - and the Ojibway. The reference to Canada reflects the fact that the lands at the time were in Canada, not Ontario. Canada and Canada alone had beneficial ownership of the lands and therefore jurisdiction to take up the lands. This said, Treaty 3 was negotiated against the backdrop of a boundary dispute between Ontario and Canada. The possibility of provincial acquisition of the lands was patent. It follows that if the drafters of the treaty wanted Canada to have a continuing supervisory role in taking up lands under the treaty, the treaty would have said this.

[40] Before this Court, the appellants rely on the trial judge's factual findings that the treaty commissioners contemplated and intended a two-step process involving federal approval and supervision. In my view, the Ontario Court of Appeal was correct in concluding that the trial judge's factual findings amounted to overriding and palpable errors (paras. 156-72). First, there is no evidence that Morris communicated to the Ojibway any intention to require a two-step process, or that he intentionally drafted the taking-up clause to require such a process - assuming that Morris's subjective intention is even relevant here. Second, there is no evidence that the Ojibway intended or insisted upon a two-step process. Third, a provisional boundary agreement reached by Canada and Ontario in 1874

(2) Interprétation du Traité nº 3

[38] Le libellé de la clause de prise des terres confirme que le droit de prendre des terres appartient au palier de gouvernement dont la Constitution reconnaît la compétence. La clause prévoit que les Ojibways conservent leurs droits de récolte sur toutes les terres visées par le Traité n° 3, « excepté telles étendues qui pourront être nécessaires ou requises pour la colonisation, les mines, la coupe du bois ou autres fins par son dit gouvernement du Canada ou par aucun de ses sujets dûment autorisés a cet effet par le dit gouvernement » (p. 6).

[39] Il n'est question d'aucun processus en deux étapes qui ferait intervenir les deux ordres de gouvernement. Il n'est fait mention que du gouvernement du Dominion du Canada. Je le répète, le traité est intervenu entre la Couronne - à savoir l'État dans sa globalité - et les Ojibways. La seule mention du Canada s'explique par le fait que les terres se trouvaient alors au Canada, et non en Ontario. Le Canada, et lui seul, avait la propriété effective des terres et, partant, avait compétence pour prendre les terres. Cela étant, le Traité nº 3 a été négocié dans le contexte d'un différend qui opposait l'Ontario et le Canada au sujet de leurs frontières. La possibilité que la province acquière les terres était manifeste. Par conséquent, si ses rédacteurs avaient voulu que le Canada continue d'exercer l'autorité sur les terres prises sous son régime, le traité l'aurait expressément prévu.

[40] Devant notre Cour, les appelants se fondent sur les conclusions factuelles de la juge de première instance suivant lesquelles les commissaires chargés de la négociation du traité envisageaient et voulaient l'établissement d'un processus en deux étapes comportant l'approbation et la surveillance du gouvernement fédéral. À mon avis, la Cour d'appel statue à bon droit que les conclusions de fait de la juge sont entachées d'erreurs manifestes et dominantes (par. 156-172). En premier lieu, nul élément ne prouve que Morris a fait part aux Ojibways de quelque intention d'établir un tel processus ou qu'il a intentionnellement libellé la clause de prise des terres de manière à prescrire un tel processus, si tant est que l'intention subjective de Morris soit même pertinente à cet égard. En deuxième lieu, nul élément to deal with the administration of the treaty lands pending the settlement of the boundary dispute reflects an understanding that the right to take up lands attached to the level of government that enjoyed beneficial ownership of those lands. Indeed, the agreement provided that if the provisional boundary was subsequently determined to be wrong, the government found to have jurisdiction over the lands would ratify any patents that had been issued by the other government. Lastly, while not determinative, I would note that Ontario has exercised the power to take up lands for a period of over 100 years, without any objection by the Ojibway. This also suggests that federal approval was never considered part of the treaty.

(3) Legislation Dealing With Treaty 3 Lands

[41] This result is also consistent with the way subsequent governments dealt with the right to take up land under Treaty 3. The 1894 Agreement between Canada and Ontario, incorporated in the 1891 Legislation, provided that the disputed territory belonged to Ontario and confirmed that as such Ontario would have the power to take up that land under the treaty. The relevant provision says:

1. With respect to the tracts to be, from time to time, taken up for settlement, mining, lumbering or other purposes and to the regulations required in that behalf, as in the said treaty mentioned, it is hereby conceded and declared that, as the Crown lands in the surrendered tract have been decided to belong to the Province of Ontario, or to Her Majesty in right of the said Province, the rights of hunting and fishing by the Indians throughout the tract surrendered, not including the reserves to be made thereunder, do not continue with reference to any tracts which have been, or from time to time may be, required or taken up for settlement, mining, lumbering or other purposes by the Government of Ontario, or persons duly authorized by the said Government of Ontario; and that

ne prouve l'intention des Ojibways d'établir un tel processus ou leur insistance pour qu'il y en ait un. En troisième lieu, l'accord provisoire sur les frontières intervenu en 1874 entre le Canada et l'Ontario pour l'administration des terres visées par le traité jusqu'au règlement du différend relatif aux frontières indique que le droit de prendre des terres appartenait au palier de gouvernement qui avait la propriété effective de celles-ci. D'ailleurs, l'accord prévoyait que si l'on constatait par la suite que le tracé provisoire de la frontière était erroné, le gouvernement à qui serait reconnue la compétence sur les terres en question ratifierait les lettres patentes délivrées par l'autre gouvernement. Enfin, bien que ce ne soit pas déterminant, je fais observer que l'Ontario a exercé le pouvoir de prendre des terres pendant plus de cent ans sans opposition de la part des Ojibways, ce qui donne également à penser que l'approbation du gouvernement fédéral n'a jamais été considérée comme une exigence du traité.

(3) Lois ultérieures portant sur les terres visées par le Traité nº 3

[41] Cette conclusion s'accorde également avec les mesures subséquentes des gouvernements concernant le droit de prendre des terres visées par le Traité n° 3. L'accord de 1894 intervenu entre le Canada et l'Ontario, incorporé dans les lois de 1891, prévoit que le territoire disputé appartient à l'Ontario et il confirme que la province a par conséquent le pouvoir de prendre les terres en question en application du traité. Voici le texte de la disposition applicable :

1. Relativement aux espaces de terres à prendre de temps à autre pour la colonisation, les entreprises minières ou forestières ou pour d'autres fins, et relativement aux règlements à établir à cet égard, comme le mentionne le dit traité, <u>il est par le présent admis et déclaré que</u>, les terres de la Couronne dans le territoire cédé ayant été reconnues appartenir à la province d'Ontario, ou à Sa Majesté pour le compte de la dite province, le droit de chasse et de pêche des Sauvages dans l'étendue du territoire cédé, abstraction faite des réserves à désigner d'après le dit traité, cesse d'exister dans les espaces qui ont été ou pourront être de temps en temps jugés nécessaires, et distraits par le gouvernement d'Ontario ou ses agents dûment autorisés, pour la colonisation, les the concurrence of the Province of Ontario is required in the selection of the said reserves.

[42] This expressly provides that Ontario has the right to take up the lands. Again, there is no mention of any continuing supervisory role for Canada in the process, or any two-step federal/provincial process. I agree with the Court of Appeal that the 1894 Agreement *confirmed* Ontario's right to take up Treaty 3 land by virtue of its control and beneficial ownership of the territory. It did not *amend* Treaty 3.

[43] The 1894 Agreement covered the disputed territory, not the Keewatin lands. In 1912, *The Ontario Boundaries Extension Act* extended Ontario's boundaries to include the Keewatin territory. The 1912 Legislation included the following terms and conditions:

2. . . .

(a) That the province of Ontario will recognize the rights of the Indian inhabitants in the territory above described to the same extent, and will obtain surrenders of such rights in the same manner, as the Government of Canada has heretofore recognized such rights and has obtained surrender thereof, and the said province shall bear and satisfy all charges and expenditure in connection with or arising out of such surrenders;

(b) That no such surrender shall be made or obtained except with the approval of the Governor in Council;

(c) That the trusteeship of the Indians in the said territory, and the management of any lands now or hereafter reserved for their use, shall remain in the Government of Canada subject to the control of Parliament.

[44] The 1912 transfer of lands confirmed that Ontario would stand in Canada's shoes with respect to the rights of the Indians in those lands (s. 2(a)). The reference to the "rights of the Indian inhabitants" in s. 2(a) includes the harvesting rights under Treaty 3. As the Court of Appeal said, "[t]his condition contemplates, therefore, that Ontario could take up Keewatin lands under the treaty only to the same extent that Canada could validly exploitations minières et forestières ou pour d'autres fins; et l'adhésion de la province d'Ontario sera nécessaire pour le choix des dites réserves.

[42] L'accord stipule donc expressément que l'Ontario a le droit de prendre les terres. Il ne fait pas mention d'un quelconque rôle permanent de surveillance du Canada, ni d'un quelconque processus fédéro-provincial en deux étapes. Je conviens avec la Cour d'appel que l'accord de 1894 *confirme* le droit de l'Ontario de prendre les terres visées par le Traité n° 3 du fait de sa possession et de sa propriété effective du territoire. Il ne *modifie* pas le Traité n° 3.

[43] L'accord de 1894 s'appliquait au territoire disputé, et non aux terres de Keewatin. En 1912, la *Loi de l'extension des frontières de l'Ontario* a repoussé les limites de l'Ontario pour englober le territoire de Keewatin. Elle renferme notamment les conditions suivantes :

2. . . .

a) que la province de l'Ontario reconnaîtra les droits des habitants sauvages dans le territoire ci-dessus décrit, dans la même mesure, et obtiendra la remise de ces droits de la même manière, que le Gouvernement du Canada a ci-devant reconnu ces droits et obtenu leur remise, et ladite province supportera et acquittera toutes les charges et dépenses se rattachant à ces remises ou en résultant;

b) que nulle pareille remise ne sera faite ou obtenue qu'avec l'approbation du Gouverneur en conseil;

c) que la tutelle des sauvages dans ledit territoire et l'administration de toutes terres maintenant ou ci-après réservées pour leur usage, restera à la charge du Gouvernement du Canada, subordonnément au contrôle du Parlement.

[44] Le transfert des terres en 1912 a confirmé la substitution de l'Ontario au Canada en ce qui concerne les droits accordés aux Indiens sur les terres en cause (al. 2a)). Les « droits des habitants sauvages » mentionnés à l'al. 2a) englobent les droits de récolte conférés par le Traité n° 3. Comme le fait remarquer la Cour d'appel, [TRADUCTION] « [c]ette condition suppose donc que l'Ontario ne peut prendre les terres de Keewatin en application du traité do so prior to 1912" (para. 198). Section 2(b) provided that Canada's approval was required for the surrender of Aboriginal rights — not the taking up of land pursuant to the taking-up clause. The evidence at trial was that the reference to the surrender of rights is a reference to lands not ceded by treaty (para. 1082). Finally, s. 2(c) provided that the trusteeship of *Indians* and the management of reserved lands would remain with the Government of Canada, subject to the control of Parliament.

[45] In my view, this legislation means that the federal government would remain responsible for Indians and lands reserved to Indians under its power over Indians pursuant to s. 91(24) of the *Constitution Act*, 1867, but that the taking up of other lands within the territory would be for the Province of Ontario alone. Nothing in the legislation contemplates a two-step process involving both levels of government.

[46] This legislation did not constitute a transfer of Crown rights and obligations by Canada to Ontario, as the appellants argue, but a transfer of beneficial interest in land. Having acquired the land, Ontario's constitutional power over lands within its boundaries entitled it to take up lands, subject to the Crown's duties to the Aboriginal peoples who had interests in the land.

[47] It is argued that the 1912 Legislation is not as explicit as the 1894 Agreement with respect to Ontario's power to take up lands under the treaty. While that may be true, there was no need for the 1912 Legislation to use the same language as the 1894 Agreement. I have concluded that the 1894 Agreement *confirmed* Ontario's rights at the time the parties entered into Treaty 3, while the 1912 Legislation transferred beneficial ownership of the Keewatin lands to Ontario along with the responsibilities which attached to those lands. Moreover, as discussed above, the wording of s. 2(a) in the 1912 Legislation constitutes an explicit acknowledgement that Ontario could henceforward do whatever Canada had done before it, i.e. take up que dans la mesure où le Canada pouvait valablement le faire avant 1912 » (par. 198). L'alinéa 2b) prévoit l'obligation d'obtenir l'approbation du Canada pour la *remise* de droits des Autochtones, non pour la prise de terres en application de la clause pertinente. La preuve offerte au procès indique que la mention de la remise des droits se rapporte aux terres non cédées dans le traité (par. 1082). Enfin, l'al. 2c) dispose que la tutelle des *sauvages* et l'administration des terres *réservées* demeurent à la charge du gouvernement du Canada, sous réserve du contrôle du Parlement.

[45] À mon avis, il s'ensuit que le gouvernement fédéral demeurait responsable des Indiens et des terres réservées aux Indiens en vertu du pouvoir sur les Indiens que lui conférait le par. 91(24) de la *Loi constitutionnelle de 1867*, mais que seule la province de l'Ontario pouvait prendre les autres terres du territoire. Nulle disposition de la loi n'envisage un processus en deux étapes faisant intervenir les deux ordres de gouvernement.

[46] Cette loi a transféré à l'Ontario non pas les droits et les obligations de la Couronne comme le prétendent les appelants, mais bien la propriété effective des terres. Une fois les terres acquises, l'Ontario pouvait, de par son pouvoir constitutionnel sur les terres assimilées à son territoire, prendre des terres, sous réserve des obligations de la Couronne envers les peuples autochtones titulaires de droits sur les terres.

[47] On fait valoir que la loi de 1912 n'est pas aussi explicite que l'accord de 1894 en ce qui a trait au pouvoir de l'Ontario de prendre des terres visées par le traité. C'est peut-être le cas, mais il n'était pas nécessaire que la loi de 1912 reprenne le libellé de l'accord de 1894. Je conclus que l'accord de 1894 *confirme* les droits de l'Ontario au moment où les parties ont conclu le Traité n° 3, tandis que la loi de 1912 transfère à l'Ontario la propriété effective des terres de Keewatin de pair avec les obligations afférentes à celles-ci. De plus, comme je l'explique précédemment, le libellé de l'al. 2*a*) de la loi de 1912 reconnaît explicitement que l'Ontario pouvait désormais accomplir tous les actes jusqu'alors accomplis par le Canada, y compris celui de prendre des terres. lands. The fact that the words "taking up" were not used in the 1912 Legislation does not diminish the import of s. 2(a).

[48] Nor did transferring to Ontario the right to take up lands within the Keewatin area amend Treaty 3, as the appellants suggest. The treaty allowed for the taking up of land by the beneficial owner of the land — after 1912, this was Ontario. Changing the beneficial owner of the land and the emanation of the Crown responsible for dealing with the lands conveyed did not amend the treaty.

[49] The 1912 Legislation altered which level of government would have authority in terms of taking up the land. It did not modify the treaty or change its partners. As this Court stated with respect to Treaty 8 in *Horseman*, at pp. 935-36:

The Transfer Agreement of 1930 changed the governmental authority which might regulate aspects of hunting in the interests of conservation. <u>This change of govern-</u> mental authority did not contradict the spirit of the original Agreement [Emphasis added.]

(4) <u>Conclusion With Respect to the Power to</u> <u>Take Up Lands</u>

[50] I conclude that as a result of ss. 109, 92(5) and 92A of the Constitution Act, 1867, Ontario and only Ontario has the power to take up lands under Treaty 3. This is confirmed by the text of Treaty 3 and legislation dealing with Treaty 3 lands. However, this power is not unconditional. In exercising its jurisdiction over Treaty 3 lands, the Province of Ontario is bound by the duties attendant on the Crown. It must exercise its powers in conformity with the honour of the Crown, and is subject to the fiduciary duties that lie on the Crown in dealing with Aboriginal interests. These duties bind the *Crown.* When a *government* — be it the federal or a provincial government — exercises Crown power, the exercise of that power is burdened by the Crown obligations toward the Aboriginal people in question.

L'omission de tout renvoi à la « prise » de terres dans la loi de 1912 ne diminue pas la portée de l'al. 2*a*).

[48] Contrairement à ce que prétendent les appelants, le transfert à l'Ontario du droit de prendre des terres dans la région de Keewatin n'a pas eu pour effet de modifier le Traité n° 3, lequel accordait au propriétaire effectif du territoire — dès 1912, l'Ontario — le pouvoir de prendre des terres. Le changement de propriétaire effectif des terres et d'émanation de la Couronne chargée de l'administration des terres cédées n'a pas eu pour effet de modifier le traité.

[49] La loi de 1912 a remplacé le palier de gouvernement investi du pouvoir afférent à la prise des terres. Elle n'a pas eu pour effet de modifier le traité ou de remplacer les parties contractantes. Comme notre Cour l'explique dans l'arrêt *Horseman* (p. 935-936) au sujet du Traité n°8 :

La Convention de transfert de 1930 a apporté un changement quant au gouvernement qui pourrait réglementer certains aspects de la chasse en vue d'assurer la conservation de la faune. <u>Ce changement n'allait pas à l'encontre</u> de l'esprit de la convention initiale... [Je souligne.]

(4) <u>Conclusion sur le pouvoir de prendre des</u> terres

[50] Je conclus qu'en raison de l'art. 109, du par. 92(5) et de l'art. 92A de la Loi constitutionnelle de 1867, l'Ontario, et lui seul, a le pouvoir de prendre des terres visées par le Traité nº 3. C'est ce que confirment le texte du traité et les lois s'y rapportant. Toutefois, ce pouvoir n'est pas inconditionnel. La province de l'Ontario est liée, dans l'exercice de ce pouvoir, par les obligations qui incombent à la Couronne. Elle doit l'exercer conformément à l'honneur de la Couronne et elle est assujettie aux obligations fiduciaires de Sa Majesté à l'égard des intérêts autochtones. Ces obligations lient la Couronne. Le gouvernement qui exerce un pouvoir de la Couronne — qu'il s'agisse du gouvernement fédéral ou d'un gouvernement provincial - est assujetti aux obligations de la Couronne envers le peuple autochtone concerné.

[51] These duties mean that for land to be taken up under Treaty 3, the harvesting rights of the Ojibway over the land must be respected. Any taking up of the land for forestry or other purposes must meet the conditions set out by this Court in *Mikisew*. As explained by the Ontario Court of Appeal (at paras. 206-12), the Crown's right to take up lands under Treaty 3 is subject to its duty to consult and, if appropriate, accommodate First Nations' interests beforehand (*Mikisew*, at para. 56). This duty is grounded in the honour of the Crown and binds the Province of Ontario in the exercise of the Crown's powers.

[52] Where a province intends to take up lands for the purposes of a project within its jurisdiction, the Crown must inform itself of the impact the project will have on the exercise by the Ojibway of their rights to hunt, fish and trap, and communicate its findings to them. It must then deal with the Ojibway in good faith, and with the intention of substantially addressing their concerns (Mikisew, at para. 55; Delgamuukw v. British Columbia, [1997] 3 S.C.R. 1010, at para. 168). The adverse impact of the Crown's project (and the extent of the duty to consult and accommodate) is a matter of degree, but consultation cannot exclude accommodation at the outset. Not every taking up will constitute an infringement of the harvesting rights set out in Treaty 3. This said, if the taking up leaves the Ojibway with no meaningful right to hunt, fish or trap in relation to the territories over which they traditionally hunted, fished, and trapped, a potential action for treaty infringement will arise (Mikisew, at para. 48).

B. Does the Doctrine of Interjurisdictional Immunity Preclude Ontario From Justifying Infringement of Treaty 3 Rights?

[53] I have concluded that Ontario has the power to take up lands in the Keewatin area under Treaty 3, without federal approval or supervision. Provided it does so in a manner that respects the requirements set out in *Mikisew*, doing this does not breach Treaty 3 harvesting rights. If Ontario's taking up of Keewatin lands amounts to an infringement of the [51] L'existence de ces obligations subordonne la prise de terres au respect des droits de récolte des Ojibways sur ces terres. Toute prise de terres à des fins d'exploitation forestière ou autre doit respecter les conditions énoncées par notre Cour dans l'arrêt *Mikisew*. Comme l'explique la Cour d'appel (par. 206-212), le droit de la Couronne de prendre des terres visées par le Traité n° 3 est assujetti à l'obligation préalable de consulter les Premières Nations et, s'il y a lieu, de trouver des accommodements à leurs intérêts (*Mikisew*, par. 56). Cette obligation découle de l'Ontario lorsqu'elle exerce les

pouvoirs de la Couronne.

[52] Lorsqu'une province compte prendre des terres aux fins d'une entreprise qui relève de sa compétence, il appartient à la Couronne de déterminer quelles conséquences aura cette entreprise sur l'exercice des droits de chasse, de pêche et de piégeage des Ojibways, et d'en informer ces derniers. Elle doit ensuite s'efforcer de traiter avec eux de bonne foi et dans l'intention de tenir réellement compte de leurs préoccupations (Mikisew, par. 55; Delgamuukw c. Colombie-Britannique, [1997] 3 R.C.S. 1010, par. 168). L'effet préjudiciable de l'entreprise de la Couronne - et l'étendue de son obligation de consulter et d'accommoder - est affaire de degré, mais la consultation ne saurait exclure d'emblée l'accommodement. Toute prise de terres ne portera pas atteinte aux droits de récolte énoncés dans le Traité nº 3, mais cela dit, si la prise dépouille les Ojibways de tout droit réel de chasse, de pêche ou de piégeage sur leurs territoires traditionnels de pêche, de chasse et de piégeage, une action en violation du traité pourra être intentée (Mikisew, par. 48).

B. La doctrine de l'exclusivité des compétences empêche-t-elle l'Ontario de justifier l'atteinte aux droits conférés par le Traité n° 3?

[53] J'arrive à la conclusion que l'Ontario a le pouvoir de prendre des terres de la région de Keewatin visées par le Traité n° 3 sans approbation ni surveillance fédérales. Dès lors que, ce faisant, il respecte les exigences énoncées dans l'arrêt *Mikisew*, l'Ontario ne porte pas atteinte aux droits de récolte conférés par le Traité n° 3. Lorsque la treaty, the Sparrow/Badger analysis under s. 35 of the Constitution Act, 1982 will determine whether the infringement is justified (R. v. Sparrow, [1990] 1 S.C.R. 1075; R. v. Badger, [1996] 1 S.C.R. 771). The doctrine of interjurisdictional immunity does not preclude the Province from justifiably infringing treaty rights (Tsilhqot'in Nation v. British Columbia, 2014 SCC 44, [2014] 2 S.C.R. 256). While it is unnecessary to consider this issue, this Court's decision in Tsilhqot'in Nation is a full answer.

VII. Conclusion

[54] I would dismiss this appeal.

[55] Prior to this appeal, the Court ordered Ontario and Canada to pay the appellant the Grassy Narrows First Nation advance costs of this appeal. For that reason, there is no need for a further costs award with respect to the Grassy Narrows First Nation. However, the appellant the Wabauskang First Nation also seeks its costs of this appeal. With the consent of Ontario and in light of the fact that Canada does not oppose such an order, costs of the appeal are now also awarded to the Wabauskang First Nation, on the same basis as the costs order earlier granted to the Grassy Narrows First Nation.

APPENDIX A

[Treaty 3 taking-up clause]

Her Majesty further agrees with Her said Indians that they, the said Indians, shall have [the] right to pursue their avocations of hunting and fishing throughout the tract surrendered as hereinbefore described, subject to such regulations as may from time to time be made by Her Government of Her Dominion of Canada, and saving and excepting such tracts as may, from time to time, be required or taken up for settlement, mining, lumbering or other purposes by Her said Government of the Dominion of Canada, or by any of the subjects thereof duly authorized therefor by the said Government. prise de terres de la région de Keewatin par l'Ontario portera atteinte au traité, l'analyse des arrêts *Sparrow* et *Badger* fondée sur l'art. 35 de la *Loi constitutionnelle de 1982* permettra de statuer sur la justification de l'atteinte (R. c. Sparrow, [1990] 1 R.C.S. 1075; R. c. Badger, [1996] 1 R.C.S. 771). La doctrine de l'exclusivité des compétences n'empêche pas la province de justifier l'atteinte à un droit issu d'un traité (*Nation Tsilhqot'in c. Colombie– Britannique*, 2014 CSC 44, [2014] 2 R.C.S. 256). Bien qu'il ne soit pas nécessaire de se pencher sur ce point, l'arrêt *Nation Tsilhqot'in* apporte une réponse complète.

VII. Dispositif

[54] Je suis d'avis de rejeter le pourvoi.

[55] En amont du pourvoi, la Cour a ordonné que l'Ontario et le Canada versent à l'appelante la Première Nation de Grassy Narrows une provision pour ses dépens en appel. C'est pourquoi il n'y a pas lieu de rendre une autre ordonnance sur les dépens en ce qui concerne cette Première Nation. Toutefois, l'appelante la Première Nation de Wabauskang demande elle aussi l'adjudication de ses dépens en appel. Avec l'accord de l'Ontario et vu l'absence d'opposition du Canada à une ordonnance en ce sens, la Première Nation de Wabauskang se voit également accorder aujourd'hui ses dépens en appel sur la même base que la Première Nation de Grassy Narrows.

ANNEXE A

[Clause de prise des terres du Traité nº 3]

Sa Majesté convient de plus avec les dits Indiens qu'ils, les dits Indiens, auront le droit de se livrer à la chasse et à la pêche dans l'étendue du pays cédé comme décrit ci-haut, sujet à tels règlements qui pourront être faits de temps à autre par son gouvernement du Canada, et excepté telles étendues qui pourront être nécessaires ou requises pour la colonisation, les mines, la coupe du bois ou autres fins par son dit gouvernement du Canada ou par aucun de ses sujets dûment autorisés à cet effet par le dit gouvernement. Constitution Act, 1867

92. [Subjects of exclusive Provincial Legislation] In each Province the Legislature may exclusively make Laws in relation to Matters coming within the Classes of Subjects next hereinafter enumerated; that is to say,

1 1 1

 The Management and Sale of the Public Lands belonging to the Province and of the Timber and Wood thereon.

92A. (1) [Laws respecting non-renewable natural resources, forestry resources and electrical energy] In each province, the legislature may exclusively make laws in relation to

. . .

(a) exploration for non-renewable natural resources in the province;

(b) development, conservation and management of non-renewable natural resources and forestry resources in the province, including laws in relation to the rate of primary production therefrom; and

(c) development, conservation and management of sites and facilities in the province for the generation and production of electrical energy.

(2) [Export from provinces of resources] In each province, the legislature may make laws in relation to the export from the province to another part of Canada of the primary production from non-renewable natural resources and forestry resources in the province and the production from facilities in the province for the generation of electrical energy, but such laws may not authorize or provide for discrimination in prices or in supplies exported to another part of Canada.

(3) [Authority of Parliament] Nothing in subsection (2) derogates from the authority of Parliament to enact laws in relation to the matters referred to in that subsection and, where such a law of Parliament and a law of a province conflict, the law of Parliament prevails to the extent of the conflict.

Loi constitutionnelle de 1867

92. [Sujets soumis au contrôle exclusif de la législation provinciale] Dans chaque province la législature pourra exclusivement faire des lois relatives aux matières tombant dans les catégories de sujets ci-dessous énumérés, savoir :

. . .

 L'administration et la vente des terres publiques appartenant à la province, et des bois et forêts qui s'y trouvent;

92A. (1) [Compétence provinciale] La législature de chaque province a compétence exclusive pour légiférer dans les domaines suivants :

. . .

a) prospection des ressources naturelles non renouvelables de la province;

b) exploitation, conservation et gestion des ressources naturelles non renouvelables et des ressources forestières de la province, y compris leur rythme de production primaire;

c) aménagement, conservation et gestion des emplacements et des installations de la province destinés à la production d'énergie électrique.

(2) [Exportation hors des provinces] La législature de chaque province a compétence pour légiférer en ce qui concerne l'exportation, hors de la province, à destination d'une autre partie du Canada, de la production primaire tirée des ressources naturelles non renouvelables et des ressources forestières de la province, ainsi que de la production d'énergie électrique de la province, sous réserve de ne pas adopter de lois autorisant ou prévoyant des disparités de prix ou des disparités dans les exportations destinées à une autre partie du Canada.

(3) [Pouvoir du Parlement] Le paragraphe (2) ne porte pas atteinte au pouvoir du Parlement de légiférer dans les domaines visés à ce paragraphe, les dispositions d'une loi du Parlement adoptée dans ces domaines l'emportant sur les dispositions incompatibles d'une loi provinciale. (4) [Taxation of resources] In each province, the legislature may make laws in relation to the raising of money by any mode or system of taxation in respect of

(a) non-renewable natural resources and forestry resources in the province and the primary production therefrom, and

(b) sites and facilities in the province for the generation of electrical energy and the production therefrom,

whether or not such production is exported in whole or in part from the province, but such laws may not authorize or provide for taxation that differentiates between production exported to another part of Canada and production not exported from the province.

(5) ["Primary production"] The expression "primary production" has the meaning assigned by the Sixth Schedule.

(6) [Existing powers or rights] Nothing in subsections (1) to (5) derogates from any powers or rights that a legislature or government of a province had immediately before the coming into force of this section.

109. [Property in Lands, Mines, etc.] All Lands, Mines, Minerals, and Royalties belonging to the several Provinces of Canada, Nova Scotia, and New Brunswick at the Union, and all Sums then due or payable for such Lands, Mines, Minerals, or Royalties, shall belong to the several Provinces of Ontario, Quebec, Nova Scotia, and New Brunswick in which the same are situate or arise, subject to any Trusts existing in respect thereof, and to any Interest other than that of the Province in the same.

Constitution Act, 1982

35. (1) [Recognition of existing aboriginal and treaty rights] The existing aboriginal and treaty rights of the aboriginal peoples of Canada are hereby recognized and affirmed.

(2) [Definition of "aboriginal peoples of Canada"] In this Act, "aboriginal peoples of Canada" includes the Indian, Inuit and Métis peoples of Canada. (4) [Taxation des ressources] La législature de chaque province a compétence pour prélever des sommes d'argent par tout mode ou système de taxation :

a) des ressources naturelles non renouvelables et des ressources forestières de la province, ainsi que de la production primaire qui en est tirée;

b) des emplacements et des installations de la province destinés à la production d'énergie électrique, ainsi que de cette production même.

Cette compétence peut s'exercer indépendamment du fait que la production en cause soit ou non, en totalité ou en partie, exportée hors de la province, mais les lois adoptées dans ces domaines ne peuvent autoriser ou prévoir une taxation qui établisse une distinction entre la production exportée à destination d'une autre partie du Canada et la production non exportée hors de la province.

(5) [« Production primaire »] L'expression « production primaire » a le sens qui lui est donné dans la sixième annexe.

(6) [Pouvoirs ou droits existants] Les paragraphes (1)
 à (5) ne portent pas atteinte aux pouvoirs ou droits détenus par la législature ou le gouvernement d'une province lors de l'entrée en vigueur du présent article.

• • •

109. [Propriété des terres, mines, etc.] Toutes les terres, mines, minéraux et réserves royales appartenant aux différentes provinces du Canada, de la Nouvelle-Écosse et du Nouveau-Brunswick lors de l'union, et toutes les sommes d'argent alors dues ou payables pour ces terres, mines, minéraux et réserves royales, appartiendront aux différentes provinces d'Ontario, Québec, la Nouvelle-Écosse et le Nouveau-Brunswick, dans lesquelles ils sont sis et situés, ou exigibles, restant toujours soumis aux charges dont ils sont grevés, ainsi qu'à tous intérêts autres que ceux que peut y avoir la province.

Loi constitutionnelle de 1982

35. (1) [Confirmation des droits existants des peuples autochtones] Les droits existants — ancestraux ou issus de traités — des peuples autochtones du Canada sont reconnus et confirmés.

(2) [Définition de « peuples autochtones du Canada »] Dans la présente loi, « peuples autochtones du Canada » s'entend notamment des Indiens, des Inuit et des Métis du Canada. (3) [Land claims agreements] For greater certainty, in subsection (1) "treaty rights" includes rights that now exist by way of land claims agreements or may be so acquired.

(4) [Aboriginal and treaty rights are guaranteed equally to both sexes] Notwithstanding any other provision of this Act, the aboriginal and treaty rights referred to in subsection (1) are guaranteed equally to male and female persons.

Act for the settlement of certain questions between the Governments of Canada and Ontario respecting Indian Lands (1891) (U.K.), 54 & 55 Vict., c. 5, Sch. [1894 Agreement]

1. With respect to the tracts to be, from time to time, taken up for settlement, mining, lumbering or other purposes and to the regulations required in that behalf, as in the said treaty mentioned, it is hereby conceded and declared that, as the Crown lands in the surrendered tract have been decided to belong to the Province of Ontario, or to Her Majesty in right of the said Province, the rights of hunting and fishing by the Indians throughout the tract surrendered, not including the reserves to be made thereunder, do not continue with reference to any tracts which have been, or from time to time may be, required or taken up for settlement, mining, lumbering or other purposes by the Government of Ontario or persons duly authorized by the said Government of Ontario; and that the concurrence of the Province of Ontario is required in the selection of the said reserves.

Ontario Boundaries Extension Act, S.C. 1912, c. 40 [1912 Legislation]

2. . . .

(a) That the province of Ontario will recognize the rights of the Indian inhabitants in the territory above described to the same extent, and will obtain surrenders of such rights in the same manner, as the Government of Canada has heretofore recognized such rights and has obtained surrender thereof, and the said province shall bear and satisfy all charges and expenditure in connection with or arising out of such surrenders;

(b) That no such surrender shall be made or obtained except with the approval of the Governor in Council;

(c) That the trusteeship of the Indians in the said territory, and the management of any lands now or hereafter (3) [Accords sur des revendications territoriales] Il est entendu que sont compris parmi les droits issus de traités, dont il est fait mention au paragraphe (1), les droits existants issus d'accords sur des revendications territoriales ou ceux susceptibles d'être ainsi acquis.

(4) [Égalité de garantie des droits pour les deux sexes] Indépendamment de toute autre disposition de la présente loi, les droits — ancestraux ou issus de traités — visés au paragraphe (1) sont garantis également aux personnes des deux sexes.

Acte pour régler certaines questions pendantes entre les gouvernements du Canada et d'Ontario relativement à certaines terres des Sauvages (1891) (R.-U.), 54 & 55 Vict., ch. 5 [accord de 1894]

1. Relativement aux espaces de terres à prendre de temps à autre pour la colonisation, les entreprises minières ou forestières ou pour d'autres fins, et relativement aux règlements à établir à cet égard, comme le mentionne le dit traité, il est par le présent admis et déclaré que, les terres de la Couronne dans le territoire cédé ayant été reconnues appartenir à la province d'Ontario, ou à Sa Majesté pour le compte de la dite province, le droit de chasse et de pêche des Sauvages dans l'étendue du territoire cédé, abstraction faite des réserves à désigner d'après le dit traité, cesse d'exister dans les espaces qui ont été ou pourront être de temps en temps jugés nécessaires, et distraits par le gouvernement d'Ontario ou ses agents dûment autorisés, pour la colonisation, les exploitations minières et forestières ou pour d'autres fins; et l'adhésion de la province d'Ontario sera nécessaire pour le choix des dites réserves.

Loi de l'extension des frontières de l'Ontario, S.C. 1912, ch. 40 [loi de 1912]

2. . . .

a) que la province de l'Ontario reconnaîtra les droits des habitants sauvages dans le territoire ci-dessus décrit, dans la même mesure, et obtiendra la remise de ces droits de la même manière, que le Gouvernement du Canada a ci-devant reconnu ces droits et obtenu leur remise, et ladite province supportera et acquittera toutes les charges et dépenses se rattachant à ces remises ou en résultant;

b) que nulle pareille remise ne sera faite ou obtenue qu'avec l'approbation du Gouverneur en conseil;

c) que la tutelle des sauvages dans ledit territoire et l'administration de toutes terres maintenant ou ci-après reserved for their use, shall remain in the Government of Canada subject to the control of Parliament.

Appeal dismissed.

Solicitors for the appellants Andrew Keewatin Jr. and Joseph William Fobister, on their own behalf and on behalf of all other members of the Grassy Narrows First Nation: Janes Freedman Kyle Law Corporation, Vancouver and Victoria.

Solicitors for the appellant Leslie Cameron, on his own behalf and on behalf of all other members of the Wabauskang First Nation: First Peoples Law, Vancouver.

Solicitor for the respondent the Minister of Natural Resources: Attorney General of Ontario, Toronto.

Solicitors for the respondent Resolute FP Canada Inc. (formerly Abitibi-Consolidated Inc.): Aird & Berlis, Toronto.

Solicitor for the respondent the Attorney General of Canada: Attorney General of Canada, Saskatoon and Vancouver.

Solicitors for the respondent Goldcorp Inc.: Osler Hoskin & Harcourt, Calgary; Cassels Brock & Blackwell, Toronto.

Solicitor for the intervener the Attorney General of Manitoba: Attorney General of Manitoba, Winnipeg.

Solicitor for the intervener the Attorney General of British Columbia: Attorney General of British Columbia, Victoria.

Solicitor for the intervener the Attorney General for Saskatchewan: Attorney General for Saskatchewan, Regina.

Solicitor for the intervener the Attorney General of Alberta: Attorney General of Alberta, Edmonton.

Solicitors for the intervener the Grand Council of Treaty # 3: Hutchins Légal inc., Montréal.

réservées pour leur usage, restera à la charge du Gouvernement du Canada, subordonnément au contrôle du Parlement.

Pourvoi rejeté.

Procureurs des appelants Andrew Keewatin Jr. et Joseph William Fobister, en leur propre nom et au nom de tous les autres membres de la Première Nation de Grassy Narrows : Janes Freedman Kyle Law Corporation, Vancouver et Victoria.

Procureurs de l'appelant Leslie Cameron, en son propre nom et au nom de tous les autres membres de la Première Nation de Wabauskang : First Peoples Law, Vancouver.

Procureur de l'intimé le ministre des Ressources naturelles : Procureur général de l'Ontario, Toronto.

Procureurs de l'intimée PF Résolu Canada Inc. (anciennement Abitibi-Consolidated Inc.) : Aird & Berlis, Toronto.

Procureur de l'intimé le procureur général du Canada : Procureur général du Canada, Saskatoon et Vancouver.

Procureurs de l'intimée Goldcorp Inc. : Osler Hoskin & Harcourt, Calgary; Cassels Brock & Blackwell, Toronto.

Procureur de l'intervenant le procureur général du Manitoba : Procureur général du Manitoba, Winnipeg.

Procureur de l'intervenant le procureur général de la Colombie-Britannique : Procureur général de la Colombie-Britannique, Victoria.

Procureur de l'intervenant le procureur général de la Saskatchewan : Procureur général de la Saskatchewan, Regina.

Procureur de l'intervenant le procureur général de l'Alberta : Procureur général de l'Alberta, Edmonton.

Procureurs de l'intervenant le Grand Conseil du Traité nº 3 : Hutchins Légal inc., Montréal. Solicitors for the interveners the Blood Tribe, the Beaver Lake Cree Nation, the Ermineskin Cree Nation, the Siksika Nation and the Whitefish Lake First Nation # 128: MacPherson Leslie & Tyerman, Edmonton and Calgary.

Solicitors for the intervener the Fort McKay First Nation: Henning Byrne, Edmonton; Shores Jardine, Edmonton.

Solicitors for the intervener the Te'mexw Treaty Association: Janes Freedman Kyle Law Corporation, Vancouver.

Solicitor for the interveners the Ochiichagwe'-Babigo'Ining First Nation, the Ojibways of Onigaming First Nation, the Big Grassy First Nation and the Naotkamegwanning First Nation: Donald R. Colborne, Victoria.

Solicitors for the intervener the Métis Nation of Ontario: Pape Salter Teillet, Toronto.

Solicitors for the intervener the Cowichan Tribes, represented by Chief William Charles Seymour, on his own behalf and on behalf of the members of the Cowichan Tribes: Woodward & Company, Victoria.

Solicitors for the interveners the Lac Seul First Nation and the Sandy Lake First Nation: Keshen & Major, Kenora, Ont.

Solicitors for the intervener the Assembly of First Nations/National Indian Brotherhood: Farris, Vaughan, Wills & Murphy, Vancouver. Procureurs des intervenantes la Tribu des Blood, la Nation crie de Beaver Lake, la Nation crie d'Ermineskin, la Nation Siksika et la Première Nation du lac Whitefish nº 128 : MacPherson Leslie & Tyerman, Edmonton et Calgary.

Procureurs de l'intervenante la Première Nation de Fort McKay : Henning Byrne, Edmonton; Shores Jardine, Edmonton.

Procureurs de l'intervenante l'Association du traité des Te'mexw : Janes Freedman Kyle Law Corporation, Vancouver.

Procureur des intervenantes la Première Nation Ochiichagwe'Babigo'Ining, la Première Nation des Ojibways d'Onigaming, la Première Nation de Big Grassy et la Première Nation de Naotkamegwanning : Donald R. Colborne, Victoria.

Procureurs de l'intervenante Métis Nation of Ontario : Pape Salter Teillet, Toronto.

Procureurs de l'intervenante les Tribus Cowichan, représentées par le chef William Charles Seymour, en son propre nom et au nom des membres des Tribus Cowichan : Woodward & Company, Victoria.

Procureurs des intervenantes la Première Nation du lac Seul et la Première Nation du lac Sandy : Keshen & Major, Kenora, Ont.

Procureurs de l'intervenante l'Assemblée des Premières Nations/Fraternité des Indiens du Canada : Farris, Vaughan, Wills & Murphy, Vancouver.

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TAB 10

Annals of Internal Medicine

Effectiveness of Adding a Mask Recommendation to Other Public Health Measures to Prevent SARS-CoV-2 Infection in Danish Mask Wearers

A Randomized Controlled Trial

Henning Bundgaard, DMSc; Johan Skov Bundgaard, BSc; Daniel Emil Tadeusz Raaschou-Pedersen, BSc; Christian von Buchwald, DMSc; Tobias Todsen, MD; Jakob Boesgaard Norsk, MD; Mia M. Pries-Heje, MD; Christoffer Rasmus Vissing, MD; Pernille B. Nielsen, MD; Ulrik C. Winsløw, MD; Kamille Fogh, MD; Rasmus Hasselbalch, MD; Jonas H. Kristensen, MD; Anna Ringgaard, PhD; Mikkel Porsborg Andersen, PhD; Nicole Bakkegård Goecke, PhD; Ramona Trebbien, PhD; Kerstin Skovgaard, PhD; Thomas Benfield, DMSc; Henrik Ullum, PhD; Christian Torp-Pedersen, DMSc; and Kasper Iversen, DMSc

Background: Observational evidence suggests that mask wearing mitigates transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). It is uncertain if this observed association arises through protection of uninfected wearers (protective effect), via reduced transmission from infected mask wearers (source control), or both.

Objective: To assess whether recommending surgical mask use outside the home reduces wearers' risk for SARS-CoV-2 infection in a setting where masks were uncommon and not among recommended public health measures.

Design: Randomized controlled trial (DANMASK-19 [Danish Study to Assess Face Masks for the Protection Against COVID-19 Infection]). (ClinicalTrials.gov: NCT04337541)

Setting: Denmark, April and May 2020.

Participants: Adults spending more than 3 hours per day outside the home without occupational mask use.

Intervention: Encouragement to follow social distancing measures for coronavirus disease 2019, plus either no mask recommendation or a recommendation to wear a mask when outside the home among other persons together with a supply of 50 surgical masks and instructions for proper use.

Measurements: The primary outcome was SARS-CoV-2 infection in the mask wearer at 1 month by antibody testing, polymerase chain reaction (PCR), or hospital diagnosis. The secondary outcome was PCR positivity for other respiratory viruses.

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the cause of coronavirus disease 2019 (COVID-19), has infected more than 54 million persons (1,2). Measures to impede transmission in health care and community settings are essential (3). The virus is transmitted person-to-person, primarily through the mouth, nose, or eyes via respiratory droplets, aerosols, or fomites (4,5). It can survive on surfaces for up to 72 hours (6), and touching a contaminated surface followed by face touching is another possible route of transmission (7). Face masks are a plausible means to reduce transmission of respiratory viruses by minimizing the risk that respiratory droplets will reach wearers' nasal or oral mucosa. Face masks are also hypothesized to reduce face touching (8,9), but frequent face and mask touching has been **Results:** A total of 3030 participants were randomly assigned to the recommendation to wear masks, and 2994 were assigned to control; 4862 completed the study. Infection with SARS-CoV-2 occurred in 42 participants recommended masks (1.8%) and 53 control participants (2.1%). The between-group difference was -0.3 percentage point (95% Cl, -1.2 to 0.4 percentage point; P = 0.38) (odds ratio, 0.82 [Cl, 0.54 to 1.23]; P = 0.33). Multiple imputation accounting for loss to follow-up yielded similar results. Although the difference observed was not statistically significant, the 95% Cls are compatible with a 46% reduction to a 23% increase in infection.

Limitation: Inconclusive results, missing data, variable adherence, patient-reported findings on home tests, no blinding, and no assessment of whether masks could decrease disease transmission from mask wearers to others.

Conclusion: The recommendation to wear surgical masks to supplement other public health measures did not reduce the SARS-CoV-2 infection rate among wearers by more than 50% in a community with modest infection rates, some degree of social distancing, and uncommon general mask use. The data were compatible with lesser degrees of self-protection.

Primary Funding Source: The Salling Foundations.

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reported among health care personnel (10). Observational evidence supports the efficacy of face masks in health care settings (11,12) and as source control in patients infected with SARS-CoV-2 or other coronaviruses (13).

An increasing number of localities recommend masks in community settings on the basis of this observational evidence, but recommendations vary and controversy

See also:

Editorial comment Web-Only Supplement
exists (14). The World Health Organization (WHO) and the U.S. Centers for Disease Control and Prevention (15) strongly recommend that persons with symptoms or known infection wear masks to prevent transmission of SARS-CoV-2 to others (source control) (16). However, WHO acknowledges that we lack evidence that wearing a mask protects healthy persons from SARS-CoV-2 (prevention) (17). A systematic review of observational studies reported that mask use reduced risk for SARS, Middle East respiratory syndrome, and COVID-19 by 66% overall, 70% in health care workers, and 44% in the community (12). However, surgical and cloth masks were grouped in preventive studies, and none of the 3 included non-health care studies related directly to COVID-19. Another systematic review (18) and American College of Physicians recommendations (19) concluded that evidence on mask effectiveness for respiratory infection prevention is stronger in health care than community settings.

Observational evidence suggests that mask wearing mitigates SARS-CoV-2 transmission, but whether this observed association arises because masks protect uninfected wearers (protective effect) or because transmission is reduced from infected mask wearers (source control) is uncertain. Here, we report a randomized controlled trial (20) that assessed whether a recommendation to wear a surgical mask when outside the home among others reduced wearers' risk for SARS-CoV-2 infection in a setting where public health measures were in effect but community mask wearing was uncommon and not recommended.

Methods

Trial Design and Oversight

DANMASK-19 (Danish Study to Assess Face Masks for the Protection Against COVID-19 Infection) was an investigator-initiated, nationwide, unblinded, randomized controlled trial (ClinicalTrials.gov: NCT04337541). The trial protocol was registered with the Danish Data Protection Agency (P-2020-311) (Part 10 of the **Supplement**, available at Annals.org) and published (21). The researchers presented the protocol to the independent regional scientific ethics committee of the Capital Region of Denmark, which did not require ethics approval (H-20023709) in accordance with Danish legislation (Parts 11 and 12 of the **Supplement**). The trial was done in accordance with the principles of the Declaration of Helsinki.

Participants and Study Period

During the study period (3 April to 2 June 2020), Danish authorities did not recommend use of masks in the community and mask use was uncommon (<5%) outside hospitals (22). Recommended public health measures included quarantining persons with SARS-CoV-2 infection, social distancing (including in shops and public transportation, which remained open), limiting the number of persons seen, frequent hand hygiene and cleaning, and limiting visitors to hospitals and nursing homes (23,24). Cafés and restaurants were closed during the study until 18 May 2020. Eligible persons were community-dwelling adults aged 18 years or older without current or prior symptoms or diagnosis of COVID-19 who reported being outside the home among others for at least 3 hours per day and who did not wear masks during their daily work. Recruitment involved media advertisements and contacting private companies and public organizations. Interested citizens had internet access to detailed study information and to research staff for questions (Part 3 of the **Supplement**). At baseline, participants completed a demographic survey and provided consent for researchers to access their national registry data (Parts 4 and 5 of the **Supplement**). Recruitment occurred from 3 through 24 April 2020. Half of participants were randomly assigned to a group on 12 April and half on 24 April.

Intervention

Participants were enrolled and data registered using Research Electronic Data Capture (REDCap) software (25). Eligible participants were randomly assigned 1:1 to the mask or control group using a computer algorithm and were stratified by the 5 regions of Denmark (Supplement Table 1, available at Annals.org). Participants were notified of allocation by e-mail, and study packages were sent by courier (Part 7 of the Supplement). Participants in the mask group were instructed to wear a mask when outside the home during the next month. They received 50 threelayer, disposable, surgical face masks with ear loops (TYPE II EN 14683 [Abena]; filtration rate, 98%; made in China). Participants in both groups received materials and instructions for antibody testing on receipt and at 1 month. They also received materials and instructions for collecting an oropharyngeal/nasal swab sample for polymerase chain reaction (PCR) testing at 1 month and whenever symptoms compatible with COVID-19 occurred during follow-up. If symptomatic, participants were strongly encouraged to seek medical care. They registered symptoms and results of the antibody test in the online REDCap system. Participants returned the test material by prepaid express courier.

Written instructions and instructional videos guided antibody testing, oropharyngeal/nasal swabbing, and proper use of masks (Part 8 of the **Supplement**), and a help line was available to participants. In accordance with WHO recommendations for health care settings at that time, participants were instructed to change the mask if outside the home for more than 8 hours. At baseline and in weekly follow-up e-mails, participants in both groups were encouraged to follow current COVID-19 recommendations from the Danish authorities.

Antibody and Viral PCR Testing

Participants tested for SARS-CoV-2 IgM and IgG antibodies in whole blood using a point-of-care test (Lateral Flow test [Zhuhai Livzon Diagnostics]) according to the manufacturer's recommendations and as previously described (26). After puncturing a fingertip with a lancet, they withdrew blood into a capillary tube and placed 1 drop of blood followed by 2 drops of saline in the test chamber in each of the 2 test plates (IgM and IgG). Participants reported IgM and IgG results separately as

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"1 line present" (negative), "2 lines present" (positive), or "I am not sure, or I could not perform the test" (treated as a negative result). Participants were categorized as seropositive if they had developed IgM, IgG, or both. The manufacturer reported that sensitivity was 90.2% and specificity 99.2%. A previously reported internal validation using 651 samples from blood donors before November 2019 and 155 patients with PCR-confirmed SARS-CoV-2 infection estimated a sensitivity of 82.5% (95% Cl, 75.3% to 88.4%) and specificity of 99.5% (Cl, 98.7% to 99.9%) (26). We (27) and others (28) have reported that oropharyngeal/nasal swab sampling for SARS-CoV-2 by participants, as opposed to health care workers, is clinically useful. Descriptions of RNA extraction, primer and probe used, reverse transcription, preamplification, and microfluidic quantitative PCR are detailed in Part 6 of the Supplement.

Data Collection

Participants received 4 follow-up surveys (Parts 4 and 5 of the **Supplement**) by e-mail to collect information on antibody test results, adherence to recommendations on time spent outside the home among others, development of symptoms, COVID-19 diagnosis based on PCR testing done in public hospitals, and known COVID-19 exposures.

Outcomes

The primary outcome was SARS-CoV-2 infection, defined as a positive result on an oropharyngeal/nasal swab test for SARS-CoV-2, development of a positive SARS-CoV-2 antibody test result (IgM or IgG) during the study period, or a hospital-based diagnosis of SARS-CoV-2 infection or COVID-19. Secondary end points included PCR evidence of infection with other respiratory viruses (Supplement Table 2, available at Annals.org).

Sample Size Calculations

The sample size was determined to provide adequate power for assessment of the combined composite primary outcome in the intention-to-treat analysis. Authorities estimated an incidence of SARS-CoV-2 infection of at least 2% during the study period. Assuming that wearing a face mask halves risk for infection, we estimated that a sample of 4636 participants would provide the trial with 80% power at a significance level of 5% (2-sided α level). Anticipating 20% loss to follow-up in this community-based study, we aimed to assign at least 6000 participants.

Statistical Analysis

Participants with a positive result on an antibody test at baseline were excluded from the analyses. We calculated CIs of proportions assuming binomial distribution (Clopper-Pearson).

The primary composite outcome (intention-to-treat) was compared between groups using the χ^2 test. Odds ratios and confidence limits were calculated using logistic regression. We did a per protocol analysis that included only participants reporting complete or predominant use of face masks as instructed. A conservative sensitivity analysis assumed that participants with a

Prespecified subgroups were compared by logistic regression analysis. In a post hoc analysis, we explored whether there was a subgroup defined by a constellation of participant characteristics for which a recommendation to wear masks seemed to be effective. We included sex, age, type of work, time out of home, and outcome in this calculation.

Two-sided *P* values less than 0.05 were considered statistically significant. Analyses were done using R, version 3.6.1 (R Foundation).

Role of the Funding Source

An unrestricted grant from the Salling Foundations supported the study, and the BESTSELLER Foundation donated the Livzon tests. The funders did not influence study design, conduct, or reporting.

RESULTS

Participants

A total of 17 258 Danish citizens responded to recruitment, and 6024 completed the baseline survey and fulfilled eligibility criteria. The first participants (group 1; n = 2995) were randomly assigned on 12 April 2020 and were followed from 14 to 16 April through 15 May 2020. Remaining participants (group 2; n = 3029) were randomly assigned on 24 April 2020 and were followed from 2 to 4 May through 2 June 2020. A total of 3030 participants were randomly assigned to the recommendation to wear face masks, and 2994 were assigned not to wear face masks (Figure); 4862 participants (80.7%) completed the study. Table 1 shows baseline characteristics, which were well balanced between groups. Participants reported having spent a median of 4.5 hours per day outside the home.

Adherence

Based on the lowest adherence reported in the mask group during follow-up, 46% of participants wore the mask as recommended, 47% predominantly as recommended, and 7% not as recommended.

Primary Outcome

The primary outcome occurred in 42 participants (1.8%) in the mask group and 53 (2.1%) in the control group. In an intention-to-treat analysis, the between-group difference was -0.3 percentage point (CI, -1.2 to 0.4 percentage point; P = 0.38) (odds ratio [OR], 0.82 [CI, 0.54 to 1.23]; P = 0.33) in favor of the mask group (**Supplement Figure 1**, available at Annals.org). When this analysis was repeated with multiple imputation for missing data due to loss to follow-up, it yielded similar results (OR, 0.81 [CI, 0.53 to 1.23]; P = 0.32). Table 2

Figure 1. Study flow diagram.



Inclusion and exclusion criteria are described in the Methods section, and criteria for completion of the study are given in the Supplement (available at Annals.org). SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2.

provides data on the components of the primary end point, which were similar between groups.

In a per protocol analysis that excluded participants in the mask group who reported nonadherence (7%), SARS-CoV-2 infection occurred in 40 participants (1.8%) in the mask group and 53 (2.1%) in the control group (between-group difference, -0.4 percentage point [CI, -1.2 to 0.5 percentage point]; P = 0.40) (OR, 0.84 [CI, 0.55 to 1.26]; P = 0.40). Supplement Figure 2 (available at Annals.org) provides results of the prespecified subgroup analyses of the primary composite end point. No statistically significant interactions were identified.

In the preplanned psensitivity analysis, those who had a positive result on an antibody test at 1 month but had not provided antibody results at baseline were considered to have had positive results at baseline (n = 18)—that is, they were excluded from the analysis. In this analysis, the primary outcome occurred in 33 participants (1.4%) in the face mask group and 44 (1.8%) in the control group (between-group difference, -0.4 percentage point [Cl, -1.1 to 0.4 percentage point]; P = 0.22) (OR, 0.77 [Cl, 0.49 to 1.22]; P = 0.26).

Three post hoc (not preplanned) analyses were done. In the first, which included only participants reporting wearing face masks "exactly as instructed," infection (the primary outcome) occurred in 22 participants (2.0%) in the face mask group and 53 (2.1%) in the control group (between-group difference, -0.2 percentage point [CI, -1.3 to 0.9 percentage point]; P = 0.82) (OR, 0.93 [CI, 0.56 to 1.54]; P = 0.78). The second post hoc analysis excluded participants who did not provide antibody test results at baseline; infection occurred in 33 participants (1.7%) in the face mask group and 44 (2.1%) in the control group (between-group difference, -0.4percentage point [CI, -1.4 to 0.4 percentage point]; P =0.33) (OR, 0.80 [CI, 0.51 to 1.27]; P = 0.35). In the third post hoc analysis, which investigated constellations of patient characteristics, we did not find a subgroup where face masks were effective at conventional levels of statistical significance (data not shown).

A total of 52 participants in the mask group and 39 control participants reported COVID-19 in their household. Of these, 2 participants in the face mask group and 1 in the control group developed SARS-CoV-2 infection, suggesting that the source of most observed infections was outside the home. Reported symptoms did not differ between groups during the study period (**Supplement Table 3**, available at Annals.org).

Secondary Outcomes

In the mask group, 9 participants (0.5%) were positive for 1 or more of the 11 respiratory viruses other than SARS-CoV-2, compared with 11 participants (0.6%) in the control group (between-group difference, -0.1 percentage point [CI, -0.6 to 0.4 percentage point]; P = 0.87) (OR, 0.84 [CI, 0.35 to 2.04]; P = 0.71). Positivity for any virus, including SARS-CoV-2, occurred in 9 mask participants (0.5%) versus 16 control participants (0.8%) (between-group difference, -0.3 percentage point [CI, -0.9 to 0.2 percentage point]; P = 0.26) (OR, 0.58 [CI, 0.25 to 1.31]; P = 0.19).

DISCUSSION

In this community-based, randomized controlled trial conducted in a setting where mask wearing was uncommon and was not among other recommended public health measures related to COVID-19, a recommendation to wear a surgical mask when outside the home among others did not reduce, at conventional levels of statistical significance, incident SARS-CoV-2 infection compared with no mask recommendation. We designed the study to detect a reduction in infection rate from 2% to 1%. Although no statistically significant difference in SARS-CoV-2 incidence was observed, the 95% Cls are compatible with a possible 46% reduction to 23% increase in infection among mask wearers. These findings do offer evidence about the degree of protection mask wearers can anticipate in a setting where others are not wearing masks and where other public health measures, including social distancing, are in effect. The findings, however, should not be used to conclude that a recommendation for everyone to wear masks in the community would not be effective in reducing SARS-CoV-2 infections, because the trial did not test the role of masks in source control of SARS-CoV-2 infection. During the study period, authorities did not recommend face mask use outside hospital settings and mask use was rare in

Table 1. Characteristics of Participants Completing the Study

community settings (22). This means that study participants' exposure was overwhelmingly to persons not wearing masks.

The observed infection rate was similar to that reported in other large Danish studies during the study period (26,30). Of note, the observed incidence of SARS-CoV-2 infection was higher than we had estimated when planning a sample size that would ensure more than 80% power to detect a 50% decrease in infection. The intervention lasted only 1 month and was carried out during a period when Danish authorities recommended quarantine of diagnosed patients, physical distancing, and hand hygiene as general protective means against SARS-CoV-2 transmission (23). Cafés and restaurants were closed through 18 May, but follow-up of the second randomized group continued through 2 June.

The first randomized group was followed while the Danish society was under lockdown. Reopening occurred (18 May 2020) during follow-up of the second group of participants, but it was not reflected in the outcome because infection rates were similar between groups (**Supplement Figure 2**). The relative infection rate between mask wearers and those not wearing masks would most likely be affected by changes in applied protective means or in the virulence of SARS-CoV-2, whereas the rate difference between the 2 groups would probably not be affected solely by a higher–or lower–number of infected citizens.

Although we saw no statistically significant difference in presence of other respiratory viruses, the study was not sufficiently powered to draw definite conclusions about the protective effect of masks for other viral infections. Likewise, the study had limited power for any of the subgroup analyses.

Characteristic	Face Mask Group (n = 2392)	Control Group (n = 2470)
Mean age (SD), y	47.4 (14)	47.0 (13)
Female sex, <i>n</i> (%)	1545 (64.6)	1571 (63.6)
Smoker, <i>n</i> (%)	478 (20.0)	499 (20.2)
Wears eyeglasses daily, <i>n (%)</i>	956 (40.0)	929 (37.6)
Capital Region resident, <i>n</i> (%) [*]	1220 (51.0)	1289 (52.2)
Provided antibody test results at baseline, <i>n</i> (%)	1916 (80.1)	2061 (83.4)
Occupation, n (%)		
Shop employee	108 (4.5)	85 (3.4)
Cashier	101 (4.2)	96 (3.9)
Craftsperson	110 (4.6)	103 (4.2)
Office employee	265 (11.1)	312 (12.6)
Manager	111 (4.6)	108 (4.4)
Transportation employee	617 (25.8)	625 (25.3)
Service employee	107 (4.5)	104 (4.2)
Home care/nursing home employee	197 (8.2)	229 (9.3)
Early childhood care staff	89 (3.7)	88 (3.6)
Salesperson	37 (1.5)	47 (1.9)
Other	650 (27.2)	673 (27.2)

* According to national authority data, the Capital Region had a higher frequency of coronavirus disease 2019 than other Danish regions; see subgroup analyses in **Supplement Figure 2** (available at Annals.org).

Table 2. Distribution of the Components of the Composite Primary Outcome				
Outcome Component	Face Mask Group (<i>n</i> = 2392), <i>n</i> (%)	Control Group (<i>n</i> = 2470), <i>n</i> (%)	Odds Ratio (95% CI)*	
Primary composite end point	42 (1.8)	53 (2.1)	0.82 (0.54-1.23)	
Positive antibody test result [†]				
IgM	31 (1.3)	37 (1.5)	0.87 (0.54-1.41)	
lgG	33 (1.4)	32 (1.3)	1.07 (0.66–1.75)	
Positive SARS-CoV-2 RT-PCR	0 (0)	5 (0.2)	-	
Health care-diagnosed SARS-CoV-2 or COVID-19	5 (0.2)	10 (0.4)	0.52 (0.18-1.53)	

COVID-19 = coronavirus disease 2019; RT-PCR = reverse transcriptase polymerase chain reaction; SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2.

* Calculated using logistic regression. The between-group differences in frequencies of positive SARS-CoV-2 RT-PCR were not statistically significant (P = 0.079).

† 124 participants in the mask group and 140 in the control group registered "not done" or unclear results of the antibody test-i.e., they were included in the analysis because they sent an oropharyngeal swab for PCR.

The primary outcome was mainly defined by antibodies against SARS-CoV-2. This definition was chosen because the viral load of infected patients may be only transiently detectable (31,32) and because approximately half of persons infected with SARS-CoV-2 are asymptomatic (33,26). Masks have been hypothesized to reduce inoculum size (34) and could increase the likelihood that infected mask users are asymptomatic, but this hypothesis has been challenged (35). For these reasons, we did not rely solely on identification of SARS-CoV-2 in oropharyngeal/nasal swab samples. As mentioned in the Methods section, an internal validation study estimated that the point-of-care test has 82.5% sensitivity and 99.5% specificity (26).

The observed rate of incident SARS-CoV-2 infection was similar to what was estimated during trial design. These rates were based on thorough screening of all participants using antibody measurements combined with PCR, whereas the observed official infection rates relied solely on PCR test-based estimates during the period. In addition, authorities tested only a small subset of primarily symptomatic citizens of the entire population, yielding low incidence rates. On this basis, the infection rates we report here are not comparable with the official SARS-CoV-2 infection rates in the Danish population. The eligibility requirement of at least 3 hours of exposure to other persons outside the home would add to this difference. Between 6 April and 9 May 2020, we found a similar seroprevalence of SARS-CoV-2 of 1.9% (Cl, 0.8% to 2.3%) in Danish blood donors using the Livzon point-ofcare test and assessed by laboratory technicians (36). Testing at the end of follow-up, however, may not have captured any infections contracted during the last part of the study period, but this would have been true in both the mask and control groups and was not expected to influence the overall findings.

The face masks provided to participants were highquality surgical masks with a filtration rate of 98% (37). A published meta-analysis found no statistically significant difference in preventing influenza in health care workers between respirators (N95 [American standard] or FFP2 [European standard]) and surgical face masks (38). Adherence to mask use may be higher than observed in this study in settings where mask use is common. Some mask group participants (14%) reported adverse

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reactions from other citizens (**Supplement Table 4**, available at Annals.org). Although adherence may influence the protective effect of masks, sensitivity analyses had similar results across reported adherence.

How SARS-CoV-2 is transmitted-via respiratory droplets, aerosols, or (to a lesser extent) fomites-is not firmly established. Droplets are larger and rapidly fall to the ground, whereas aerosols are smaller ($\leq 5 \mu$ m) and may evaporate and remain in the air for hours (39). Transmission of SARS-CoV-2 may take place through multiple routes. It has been argued that for the primary route of SARS-CoV-2 spread-that is, via droplets-face masks would be considered effective, whereas masks would not be effective against spread via aerosols, which might penetrate or circumnavigate a face mask (37,39). Thus, spread of SARS-CoV-2 via aerosols would at least partially explain the present findings. Lack of eye protection may also have been of importance, and use of face shields also covering the eyes (rather than face masks only) has been advocated to halt the conjunctival route of transmission (40, 41). We observed no statistically significant interaction between wearers and nonwearers of eyeglasses (Supplement Figure 2). Recent reports indicate that transmission of SARS-CoV-2 via fomites is unusual (42), but masks may alter behavior and potentially affect fomite transmission.

The present findings are compatible with the findings of a review of randomized controlled trials of the efficacy of face masks for prevention (as personal protective equipment) against influenza virus (18). A recent meta-analysis that suggested a protective effect of face masks in the non-health care setting was based on 3 observational studies that included a total of 725 participants and focused on transmission of SARS-CoV-1 rather than SARS-CoV-2 (12). Of 725 participants, 138 (19%) were infected, so the transmission rate seems to be higher than for SARS-CoV-2. Further, these studies focused on prevention of infection in healthy mask wearers from patients with a known, diagnosed infection rather than prevention of transmission from persons in their surroundings in general. In addition, identified comparators (control participants) not wearing masks may also have missed other protective means. Recent observational studies that indicate a protective association between mandated mask use in the community and SARS-CoV-2 transmission are limited by study design

and simultaneous introduction of other public health interventions (14, 43).

Several challenges regarding wearing disposable face masks in the community exist. These include practical aspects, such as potential incorrect wearing, reduced adherence, reduced durability of the mask depending on type of mask and occupation, and weather. Such circumstances may necessitate the use of multiple face masks during the day. In our study, participants used a mean of 1.7 masks per weekday and 1.3 per weekend day (Supplement Table 4). Wearing a face mask may be physically unpleasant, and psychological barriers and other side effects have been described (44). "Face mask policing" between citizens might reinforce use of masks but may be challenging. In addition, the wearer of a face mask may change to a less cautious behavior because of a false sense of security, as pointed out by WHO (17); accordingly, our face mask group seemed less worried (Supplement Table 4), which may explain their increased willingness to wear face masks in the future (Supplement Table 5, available at Annals.org). These challenges, including costs and availability, may reduce the efficacy of face masks to prevent SARS-CoV-2 infection.

The potential benefits of a community-wide recommendation to wear masks include combined prevention and source control for symptomatic and asymptomatic persons, improved attention, and reduced potential stigmatization of persons wearing masks to prevent infection of others (17). Although masks may also have served as source control in SARS-CoV-2-infected participants, the study was not designed to determine the effectiveness of source control.

The most important limitation is that the findings are inconclusive, with Cls compatible with a 46% decrease to a 23% increase in infection. Other limitations include the following. Participants may have been more cautious and focused on hygiene than the general population; however, the observed infection rate was similar to findings of other studies in Denmark (26,30). Loss to followup was 19%, but results of multiple imputation accounting for missing data were similar to the main results. In addition, we relied on patient-reported findings on home antibody tests, and blinding to the intervention was not possible. Finally, a randomized controlled trial provides high-level evidence for treatment effects but can be prone to reduced external validity.

Our results suggest that the recommendation to wear a surgical mask when outside the home among others did not reduce, at conventional levels of statistical significance, the incidence of SARS-CoV-2 infection in mask wearers in a setting where social distancing and other public health measures were in effect, mask recommendations were not among those measures, and community use of masks was uncommon. Yet, the findings were inconclusive and cannot definitively exclude a 46% reduction to a 23% increase in infection of mask wearers in such a setting. It is important to emphasize that this trial did not address the effects of masks as source control or as protection in settings where social distancing and other public health measures are not in effect.

Reduction in release of virus from infected persons into the environment may be the mechanism for mitigation of transmission in communities where mask use is common or mandated, as noted in observational studies. Thus, these findings do not provide data on the effectiveness of widespread mask wearing in the community in reducing SARS-CoV-2 infections. They do, however, offer evidence about the degree of protection mask wearers can anticipate in a setting where others are not wearing masks and where other public health measures, including social distancing, are in effect. The findings also suggest that persons should not abandon other COVID-19 safety measures regardless of the use of masks. While we await additional data to inform mask recommendations, communities must balance the seriousness of COVID-19, uncertainty about the degree of source control and protective effect, and the absence of data suggesting serious adverse effects of masks (45).

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TAB 11



TECHNICAL REPORT

COVID-19 in children and the role of school settings in transmission - second update

8 July 2021

What is new in this report?

- This document draws upon and updates evidence presented in the previous reports from ECDC on this topic, which were published in August 2020 and December 2020 [1,2]. This report presents updated scientific findings across all sections, prioritising surveillance data from 2021 and research published in 2021.
- The overall key messages are consistent with the previous ECDC report, but the messaging in this report addresses the current epidemiological context, which is quite different from December 2020. Notably, there is currently increased circulation of the more transmissible Delta variant in the EU/EEA, while at the same time an increasing percentage of adults in the EU/EEA are now fully vaccinated against COVID-19.
- This report presents original ECDC modelling work on the effectiveness of school closures for controlling the transmission of SARS-CoV-2. The models estimate that closing secondary schools has a larger effect on community transmission of SARS-CoV-2 than does closing primary schools or day nurseries.
- ECDC has updated its assessment of the susceptibility of children to SARS-CoV-2 infection, now noting that children appear to be equally susceptible to SARS-CoV-2 infection compared to other age groups (low confidence), although severe disease is much less common in children than in adults.

Key messages

- Increased transmissibility across all age groups has been reported for SARS-CoV-2 variants of concern (VOCs), most notably for the Delta variant. In regions where an increasing percentage of adults are fully vaccinated against COVID-19 but where children are not vaccinated, it may be anticipated that in the coming months increasingly greater proportions of reported SARS-CoV-2 cases will be among children.
- The majority of the studies referred to in this report were conducted prior to the emergence and widespread circulation of the Delta variant. This should be taken into account when interpreting reported study results.
- Children of all ages are susceptible to and can transmit SARS-CoV-2. Cases of SARS-CoV-2 in younger children appear to lead to onward transmission less frequently than cases in older children and adults. Recent increases in the share of reported cases among children probably represents increased case ascertainment of mild cases. Children aged between 1-18 years have much lower rates of hospitalisation, severe disease requiring intensive hospital care, and death than all other age groups, according to surveillance data. The exact burden of COVID-19 and its long-term consequences in the paediatric population is still to be determined and is a priority for further research.
- The general consensus remains that the decision to close schools to control the COVID-19 pandemic should be used as a last resort. The negative physical, mental and educational impacts of proactive school closures on children, as well as the economic impact on society more broadly, would likely outweigh the benefits. Given the likely continued risk of transmission among unvaccinated children, it is imperative that there is a high level of preparedness in the educational system for the 2021/2022 school year.

Suggested citation: European Centre for Disease Prevention and Control. COVID-19 in children and the role of school settings in transmission - second update. 8 July 2021. Stockholm: ECDC; 2021.

- In light of circulating SARS-CoV-2 VOCs, including Delta, combinations of non-pharmaceutical interventions (NPIs) in the form of physical distancing that prevent crowding as well as hygiene and other measures to reduce transmission risks will continue to be essential to prevent transmission in school settings. Measures should be adapted to levels of community SARS-CoV-2 transmission as well as to the educational setting and age group. Implementation of measures should consider the need to provide children with an optimal learning and social environment while also reducing transmission risks.
- It is important that testing strategies for educational settings aiming at timely testing of symptomatic cases are established to ensure isolation of cases and tracing and quarantine of their contacts. When positive cases are identified, the school should be informed, contact tracing should be initiated according to local guidelines, and communication to and the testing of close contacts, ideally with rapid diagnostic tests, should be considered.
- While a measure of last resort, school closures can contribute to a reduction in SARS-CoV-2 transmission, but are by themselves insufficient to prevent community transmission of COVID-19 in the absence of other nonpharmaceutical interventions and the expansion of vaccination coverage. The effectiveness of school closures appears to have declined in the second wave as compared to the first wave of the COVID-19 pandemic, possibly in part due to better hygiene measures in school settings.

Glossary

School structures within European Union/European Economic Area (EU/EEA) countries are heterogeneous, with children entering and moving through educational establishments at different ages [3]. Given this variation, it is not possible to define the age of attendance in EU/EEA educational establishments with complete consistency. Therefore, for the purposes of this report, the following classification has been used:

Adolescents	In this document, older secondary school students are, at times, referred to as adolescents in order to reflect the term used in the literature.
Children	Children are defined as those aged 1-18 years. This report does not explicitly assess infants (0-1 years), although in some cases children less than one year of age may have been included in reports on preschool or childcare settings.
Non-pharmaceutical intervention	Non-pharmaceutical interventions (NPIs) are public health measures that aim to prevent and/or control SARS-CoV-2 transmission in the community. NPIs can also be referred to as mitigation measures and public health responses.
Proactive school closures	Early and planned closure of schools and day-care facilities to limit local virus transmission and spread within schools and into the community. School closure might also include the provision of distance learning.
Reactive school closures	Closure in response to increased community transmission and/or a localised outbreak in a single educational facility and/or due to increased absenteeism among staff and students making it difficult to keep teaching going. School closure might also include the provision of distance learning.
Schools/educational settings	The generic term used to define all educational establishments within the scope of the document. This includes all three categories of schools referred to above, unless otherwise stated. The terms 'school' and 'educational setting' are used interchangeably in this document.
Preschools/day-care	Establishments including childcare and day-care centres, nurseries, and kindergartens for children approximately under five years, although these may include older children in some EU settings.
Primary schools	Establishments providing early-years compulsory education, which in most EU settings include children aged approximately 5–11 years.
Secondary schools	Education establishments for children aged approximately 12–18 years. Adolescents are included in this group.
Staff	Includes teachers, administrators and management, school nurses, janitors, cleaning and kitchen personnel, and other adults working in childcare and educational settings.

Scope of this document

The aim of this document is to provide an update on the knowledge surrounding the role of children in the transmission of SARS-CoV-2 and the role of schools in the COVID-19 pandemic, focusing in particular on the experience in EU/EEA countries since the beginning of the pandemic. This document also addresses transmission to and from staff in school settings, school-related mitigation measures including risk communication, testing, contact tracing, and the effectiveness and impacts of school closures. This document draws upon and updates evidence presented in the previous reports from ECDC on this topic, which were published in August 2020 and December 2020 [1,2]. This report does not consider educational settings related to young adults or adults, such as universities or vocational schools or any school with overnight stays, such as boarding schools.

Target audience

The target audience for this report is public health authorities in EU/EEA countries.

Background

As of 1 July 2021, the incidence of SARS-CoV-2 is declining in nearly all EU/EEA countries and is at the lowest rate since September 2020. Some of the decline in SARS-CoV-2 incidence that has occurred since January 2021, combined with reductions in hospitalisations and deaths, particularly in older age groups, is attributed to COVID-19 vaccines [4]. COVID-19 vaccines are being rolled out across the EU/EEA, however as of 1 July 2021, the majority of the EU/EEA population has not yet been fully vaccinated [5]. Select COVID-19 vaccines have been given conditional marketing authorisation by the European Medicines Agency (EMA) for 12-15-year-olds and adolescents 16 years and older [6], although vaccination roll-out to these age groups in the EU/EEA has thus far been limited. COVID-19 vaccines, as of July 2021, are currently yet to be authorised for use in the EU/EEA for children under 12 years.

The Delta (B.1.617.2) variant of concern (VOC) has been found to be more transmissible than previously dominant variants. ECDC estimates that Delta will represent 90% of all circulating SARS-CoV-2 viruses in the EU/EEA by the end of August 2021 [7]. As Delta can more easily infect unvaccinated individuals, as well as those who are only partially vaccinated, the importance of rapidly ensuring full vaccination coverage among vulnerable individuals while keeping an appropriate level of mitigation measures in place has been emphasised [8]. By the time schools reopen for the autumn 2021 term, children and adolescents will be the age groups with the lowest rates of COVID-19 vaccination coverage in the EU/EEA. Given the expected lower immunity in this population, concentrated circulation of SARS-CoV-2, including outbreaks in children and adolescents, are expected in the absence of strict adherence to effective public health mitigation measures. ECDC has estimated that younger age groups and younger adults (those <25 and 25-49 years) are projected to have the highest number of daily SARS-CoV-2 cases by September 2021 [8]. One implication of the current epidemiological projections is that detection and mitigation of SARS-CoV-2 transmission to and from children in community and educational settings will become increasingly important. In this context, evidence can support countries in outlining approaches to appropriately balance the broader physical and mental health needs of children and adolescents while ensuring adequate SARS-CoV-2 prevention and control in this population [9].

Methodological approach

This document is based on evidence presented in the ECDC report 'COVID-19 in children and the role of school settings in COVID-19 transmission - first update', published on 23 December 2020. In addition to the evidence presented there, this version draws on evidence from the following sources:

- Case-based epidemiological surveillance analysis from The European Surveillance System (TESSy);
- Grey, pre-print and peer reviewed scientific literature, focusing on studies published in 2021; and
- Modelling of the effects of closing schools on community transmission based on data from the ECDC-Joint Research Centre (JRC) Response Measures Database [10].

The main findings are summarised for each section and, where feasible, an assessment of the confidence in the evidence is presented (see Table 1). The overall confidence in the evidence for key summary points has been estimated in the 'summary' sections in this report. ECDC experts assessed key summary statements according to GRADE (Grading of Recommendations, Assessment, Development and Evaluations) criteria as well as the certainty/confidence of evidence (Table 1). Confidence in evidence was deemed to be lower where few empirical studies addressed a given topic or where a wide heterogeneity of study findings has been reported, and higher where multiple studies have consistently reported similar findings.

It is important to note that this document was not developed as a formal GRADE process. However, given the rapidly growing available evidence surrounding SARS-CoV-2 and COVID-19, it was deemed to be important to attempt to provide such assessments. As GRADE more generally notes: 'Quality of evidence is a continuum; any discrete categorisation involves some degree of arbitrariness. Nevertheless, advantages of simplicity, transparency, and vividness outweigh these limitations' [11].

Rating	Definition
High	This research provides a very good indication of the likely effect. The likelihood that the effect will be substantially different is low.
Moderate	This research provides a good indication of the likely effect. The likelihood that the effect will be substantially different is moderate.
Low	This research provides some indication of the likely effect. However, the likelihood that it will be substantially different (a large enough difference that it might have an effect on a decision) is high.
Very Low	This research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different (a large enough difference that it might have an effect on a decision) is very high.

Table 1. GRADE definitions for the ratings of the overall confidence of evidence [11]

1. What is the epidemiology of SARS-CoV-2 in children?

Summary

- Since the start of the vaccination roll-out in EU/EEA countries, children have made up an increasing proportion of weekly case numbers with the most noticeable increase among those aged 5-11 years. Still, children comprise a minority of all reported COVID-19 cases (high confidence). The increase in the share of reported cases among children probably represents increased case ascertainment of mild cases (moderate confidence).
- Since March 2021, case notification rates in children aged 16-18 years have increased more sharply than in other age groups, and this age group has had the highest case notification rate of all age groups since then, mirrored closely by rates in children aged 12-15 years. Increases were less steep and/or started later among the other childhood age groups (high confidence). Higher case ascertainment among this age group and increasing vaccination coverage in adult age groups are likely two of the explanatory factors behind this observation.
- Most children with COVID-19 have mild symptoms and very low risk of death. Although very rare, some children develop significant respiratory disease and require hospital admission. Those children who do require hospitalisation or who have more severe outcomes often have underlying chronic conditions (moderate confidence). There is no evidence of a difference by age or sex in the risk of severe outcomes among children, which contrasts with the strong age-sex association observed among adults (high confidence).
- A very small subset of children experiences paediatric inflammatory multisystem syndrome temporally associated with SARS-CoV-2 (PIMS-TS), also referred to as Multisystem inflammatory syndrome in children (MIS-C), appearing 4-6 weeks after mild COVID-19 infection. The condition shares features with other paediatric inflammatory syndromes such as Kawasaki disease, toxic shock syndrome, and macrophage activation syndrome.
- Post-acute sequelae of SARS-CoV-2 are characterised by persistent symptoms such as fatigue, dyspnoea, chest pain, cognitive impairment, and sleeping disturbances that last up to several months after infection. However, the exact burden of COVID-19 and its long-term consequences in the paediatric population is still to be determined and is a priority for further research.

1.1 Age trends in notifications of COVID-19

Pooled data from over 16 million case-based records from 16 countries submitted to TESSy up to 20 June 2021 show that in the most recent peak of COVID-19 that started in March 2021, case notification rates in children aged 16-18 years increased the most sharply, remaining the highest rate seen among all age groups since then (Figure 1). The trend for this age group is mirrored most closely by rates in children aged 12-15 years. As observed previously, increases were less steep and/or started later among other childhood age groups, with decreasing age leading to shallower gradients and lower peak rates.

Since January 2021, which coincides with the start of the vaccination roll-out in the EU/EEA, children have made up an increasing proportion of weekly case numbers with the most noticeable increase among those aged 5-11 years (Figure 2). Still, children comprise a minority of all reported COVID-19 cases. As children often present with mild symptoms of COVID-19 and are less frequently tested than adults, it remains possible that this is one explanation for the under-representation of children in surveillance data.

Figure 1. 14-day age-specific COVID-19 case notification rate, selected EU/EEA countries, April 2020 to July 2021



Source: TESSy COVID-19 data submitted by Austria, Croatia, Cyprus, Czechia, Denmark, Finland, Germany, Italy, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia and Sweden





We analysed over 4.7 million case-based records for a subset of 10 EU/EEA countries submitted to TESSy with sufficiently complete data on severe outcomes for the reporting period 4 January 2021 to 23 May 2021 (period 2, Table 2) and compared them to the same analysis for cases reported for the period 1 August 2020 to 29 November 2020 (period 1) that was presented in the first update of this report in December [1]:

- A higher proportion of cases was reported among children aged 1-11 years (8.5%) in period 2 than in period 1 (5.5%). This is consistent with the observed increase in Figure 2. In period 2, the proportion of reported cases in children 1-11 years were closer to the population age distribution of children.
- In both periods 1 and 2, the proportion of cases in children aged 12-15 and 16-18 were roughly equal and slightly exceed, respectively, the proportion of the population in these age groups.

- Children remained very under-represented among cases experiencing severe outcomes, accounting for a similar proportion (<0.5% in all age groups) of all cases in periods 1 and 2.
- Age-specific attack rates (AR) for severe outcomes among children were lower in period 2 than in period 1 but were broadly constant among adults. This likely reflects more recent detection of mild cases among children in period 2.
- Crude attack rates for severe disease were higher among males than females in adults, but there was no difference observed by sex among children of the same age in period 2. This is consistent with the findings from period 1.

Age group	Sex	Population distribution	Total cases, n (%)	Hospitalised		Sever hospitalisa	e ation*	Fat	al
(years)		(%)		n (%)	AR %	n (%)	AR %	n (%)	AR %
01-04	F	1.8	56 154 (1.2)	479 (0.2)	0.85	10 (0.0)	0.02	5 (0.0)	0.01
01-04	М	1.9	59 957 (1.3)	651 (0.2)	1.09	14 (0.0)	0.02	1 (0.0)	0.00
05-11	F	3.2	136 701 (2.9)	490 (0.2)	0.36	16 (0.0)	0.01	6 (0.0)	0.00
05-11	М	3.4	147 896 (3.1)	517 (0.2)	0.35	15 (0.0)	0.01	6 (0.0)	0.00
12-15	F	1.8	89 616 (1.9)	444 (0.2)	0.5	15 (0.0)	0.02	7 (0.0)	0.01
12-15	М	1.9	95 362 (2.0)	396 (0.1)	0.42	25 (0.1)	0.03	7 (0.0)	0.01
16-18	F	1.4	79 226 (1.7)	570 (0.2)	0.72	16 (0.0)	0.02	10 (0.0)	0.01
16-18	М	1.5	81 226 (1.7)	451 (0.2)	0.56	31 (0.1)	0.04	6 (0.0)	0.01
19-39	F	12.5	695 915 (14.5)	11 760 (4.0)	1.69	575 (1.4)	0.08	145 (0.2)	0.02
19-39	М	13.1	698 723 (14.6)	10 515 (3.6)	1.5	878 (2.1)	0.13	265 (0.3)	0.04
40-64	F	17.8	958 520 (20.0)	34 663 (11.8)	3.62	4 373 (10.4)	0.46	2 528 (3.2)	0.26
40-64	М	17.6	927 191 (19.4)	58 071 (19.8)	6.26	9 772 (23.3)	1.05	5 818 (7.3)	0.63
65+	F	12.1	420 666 (8.8)	84 310 (28.7)	20.04	10 362 (24.7)	2.46	32 346 (40.4)	7.69
65+	М	9.1	341 794 (7.1)	90 538 (30.8)	26.49	15 777 (37.7)	4.62	38 887 (48.6)	11.38
Total		100	4 788 947 (100)	293 855 (100)	6.14	41 879 (100)	0.87	80 037 (100)	1.67

Table 2. Distribution and attack rates (AR) by age group, sex and severe outcome of cases in TESSy, 4 January 2021 to 20 June 2021

* severe hospitalisation: hospitalised and requiring admission to ICU or respiratory support.

Data were extracted reported up to 20 June 2021. The last four weeks of data were removed to allow for unknown severity or outcome of recently reported cases.

1.2 Severity of COVID-19 among children

Most children with COVID-19 have mild symptoms and a very low risk of death [12]. Very rarely, children develop significant respiratory disease and require hospital admission. Children who do require hospitalisation or who have more severe outcomes often have underlying chronic conditions [13]. The most common comorbidities in hospitalised children are diabetes, gastrointestinal, neurological, cardiac and pulmonary diseases, specifically asthma [14,15]. A significant proportion of hospitalised children with SARS-CoV-2 infection are also obese [16]. However, some of these commonly observed underlying conditions may not necessarily be causally associated with COVID-19 severity, and further research is needed.

Following the initial wave of COVID-19 hospitalisations, a novel syndrome with hyperinflammatory response in children emerged, initially identified by physicians in the United Kingdom (UK) in April 2020. The Royal College of Paediatrics and Child Health defined it as paediatric inflammatory multisystem syndrome temporally associated with SARS-CoV-2 (PIMS-TS), while the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) in the United States (US) refer to it as Multisystem inflammatory syndrome in children (MIS-C) [17,18]. Unfortunately, there is currently no specific test available to diagnose this syndrome and only a

preliminary international case definition in place [17]. Hence, the diagnosis of PIMS-TS/MIS-C is based on clinical signs and symptoms, as well as evidence of a previous SARS-CoV-2 infection or exposure. Children who develop the syndrome are generally previously healthy, and the primary infection with SARS-CoV-2 is usually mild or asymptomatic [19].

PIMS-TS/MIS-C is rare and shares common clinical features with other paediatric inflammatory syndromes such as Kawasaki disease, toxic shock syndrome, and macrophage activation syndrome. Children with PIMS-TS/MIS-C often present four to six weeks after infection, with a wide clinical spectrum including Kawasaki disease-like symptoms, life-threatening shock, and milder forms of illness such as persistent fever, inflammation, and gastrointestinal manifestations [19].

Most children with critical illness due to PIMS-TS/MIS-C have a favourable outcome and recover with intensive care support and appropriate treatment. According to studies, 60% of children with PIMS-TS/MIS-C need to be admitted to an intensive care unit (ICU) with an average length of ICU stay of around five days, while the total average hospital stay is around 10 days [16,20]. In a cohort of 286 children and adolescents from 55 centres across 17 European countries, high incidence (93%) of myocardial involvement was evident [20]. Critical illness is associated with increasing age of children in some studies [21,22]. The mortality associated with PIMS-TS/MIS-C was approximately 1% in a observational cohort study of young people admitted to the hospital with COVID-19 in the UK [15].

Early recognition and prompt treatment of PIMS-TS/MIS-C cases is essential. Limited evidence for treatment options supports intravenous immunoglobulin (IVIG), corticosteroids, inotropes and other biological immunomodulation agents [23,24].

As children often present with mild symptoms of COVID-19 and are less frequently tested than adults, the true proportion of cases that develop PIMS-TS/MIS-C remains unknown. There is no comprehensive overview of PIMS-TS/MIS-C cases in the EU/EEA. Germany and Switzerland have published data on case series of children with severe COVID-19 infection, leading to PIMS-TS/MIS-C and even death [25,26]. The French national surveillance system registered 111 children with PIMS-TS/MIS-C between April 2020 and January 2021, with a median age of eight years. Among them, 67% had a history of admission to a paediatric ICU [27]. In Spain, a paediatric COVID-19 registry, described that among the hospitalised children due to PIMS-TS/MIS-C, 61% developed cardiac complications [28]. Sweden has reported just over 200 children diagnosed with PIMS-TS/MIS-C and no deaths among them as of April 2021 [29]. A recent nationwide cohort study in Denmark estimated the occurrence of PIMS-TS/MIS-C cases among COVID-19-infected children as of one in 4 100 in children younger than 12 years and one in 3 700 in children older than 12 years [30].

Recently, cohorts of children with post-acute sequelae of SARS-CoV-2 (PASC), recognised as post-COVID-19 condition or 'long COVID' have been described in Italy, Sweden, and Russia [31-33]. PASC is characterised by persistent symptoms such as fatigue, dyspnoea, chest pain, cognitive impairment, and sleeping disturbances that last up to several months after infection. Prior history of allergic diseases and age above six years have been associated with a higher risk of developing PASC. In the small case series of children with persistent symptoms in the above countries, the median age was 11.4, 10.4, and 12 years, respectively. Data from the UK's National Statistics Office also shows a significant number of children reporting symptoms several weeks after their initial SARS-CoV-2 infection [34]. A recent national survey in the Netherlands showed that among the 89 children suspected of long COVID, 18% were admitted to the hospital due to their long-term symptoms [35]. The exact burden of the disease and long-term consequences in paediatric population is still to be determined and is a priority for further research.

2. What is known about children and transmission of SARS-CoV-2?

Summary

- SARS-CoV-2 transmission to, from and among children is impacted by multiple factors, including symptom type and severity, viral load and shedding duration, the viral variant, duration of exposure, mitigation measures in place in household, school, and community settings, and host factors that may modulate baseline susceptibility and immune response.
- Children are equally susceptible to SARS-CoV-2 infection compared to other age groups (low confidence), although severe disease is much less common in children. While multiple studies have suggested that children may be less susceptible to SARS-CoV-2 infection than adults, potential reporting biases due to lower-case ascertainment in children may contribute to this interpretation, particularly for studies published during 2020. Recent prevalence and seroprevalence studies have tended to conclude that there are no significant differences across age groups.
- Younger children (preschool- and primary school-aged) appear to transmit SARS-CoV-2 less often than adolescents and adults (low confidence), but younger children may also have been tested for SARS-CoV-2 less frequently than other age groups, while also having fewer opportunities for social mixing during periods of school closures than adolescents.
- Onward transmission by adolescents appears to occur as often as by adults in household and community settings, given similar social mixing patterns (moderate confidence).

2.1 Viral RNA shedding of SARS-CoV-2 among children

Following infection with SARS-CoV-2, the duration and magnitude of viral shedding are key determinants of the duration of infectiousness and onwards transmission risk. In a recent systematic review and meta-analysis of viral RNA shedding time (VST), pooled results of 3,385 participants across 35 studies, revealed that VST is significantly longer in symptomatic infections (19.7 days, 95% CI: 17.2–22.7) than in asymptomatic infections (10.9 days, 95% CI: 8.3–14.3) across all age groups. Sub-group analyses indicate that VST in children (9.9 days, 95% CI: 8.1–12.2, 12 = 85.74%) is significantly shorter than in adults (23.2 days, 95% CI: 19.0–28.4), with adults defined as those aged 18 years and above. Shorter VST was attributed to the higher proportion of asymptomatic infections and milder clinical symptoms widely observed in infected children compared with infected adults. Only two studies in this analysis evaluated non-respiratory tract samples, however, VST was found to be significantly longer in stool specimens (30.3 days, 95% CI: 23.1–39.2) than respiratory tract specimens (17.5 days, 95% CI: 14.9–20.6) across age groups [36]. Prolonged faecal viral RNA shedding has been reported among paediatric SARS-CoV-2 cases [37,38], but there is very limited evidence to support the faecal-oral route as a viable or significant mode for SARS-CoV-2 transmission among children [39].

With respect to the magnitude of viral RNA shedding observed among children infected with SARS-CoV-2, an early tertiary medical centre study with a small SARS-CoV-2 PCR (Polymerase Chain Reaction) positive cohort (n=145) indicated that significantly greater amounts of viral nucleic acid are detected in children younger than five years when compared to older children (5-17 years) and adults (>18 years) [40]. Despite the shorter viral shedding duration observed in children, this raised concerns that young children may pose a greater transmission risk. However, larger studies have now demonstrated no discernible difference in the amount of viral nucleic acid among young children and adults. A community study of 5 554 predominantly asymptomatic or mildly symptomatic SARS-CoV-2 PCR positive children and adults in the US analysed using three age categories – young children aged five years or younger (n=199), children aged five to 17 years (n=665), and adults aged 18 years **and older (n = 4680)** – with no significant differences in cycle threshold (Ct) values (which in a PCR assay indicates how much virus a sample contains) observed between age groups upon comparison of hospitalisation status or symptom status [41]. This finding is further supported by results from another community-based, cross-sectional study of 555 children and adults, where SARS-CoV-2 RNA levels, as determined by Ct values, although significantly higher in symptomatic individuals than in asymptomatic individuals, showed no significant age-related differences [42].

Transmission by children likely depends on multiple factors, including symptom type and severity, viral load and shedding duration, host factors (such as baseline susceptibility and immune responses), as well as the viral variant [43]. Overall, evidence suggests that peak respiratory tract viral load in children infected with SARS-CoV-2 does not differ from adults, but the duration of respiratory tract viral shedding is shorter in children when compared to the adult population. However, there is currently limited comparative data evaluating the impact of different highly transmissible SARS-CoV-2 VOCs on viral load dynamics in children.

2.2 Asymptomatic SARS-CoV-2 infection in children

Asymptomatic SARS-CoV-2 infection in children has been well documented [44,45], as detailed in the previous ECDC report on this topic [1]. A recently published observational study in southeast and south Asia from eight hospitals across seven countries reported an overall asymptomatic rate of 40% among children identified due to contact tracing or screening strategies [46]. In a systematic review of 20 studies from Asia, Europe and US among the 1810 participants (<21 y), 13% were asymptomatic [47]. Another recent meta-analysis described the clinical data from 2874 children with COVID-19 from 37 articles and found that asymptomatic infection accounted for 27.7% (95% CI: 19.7%–36.4%) of patients [48].

Several recent studies in paediatric populations have confirmed a previous infection by the presence of antibodies in serology tests [49]. Seroprevalence studies may facilitate the evaluation of exposure rates and infection characteristics in children. When compared with adult populations, lower seroprevalence in children has been reported in Spain [50], Switzerland [51], and Italy [52]. An Italian paediatric cohort showed that asymptomatic children develop the same immune response as symptomatic ones, in contrast to adults where severity of infection is dependent to antibody titres [53].

Distinguishing between children who remain asymptomatic throughout the course of infection and those that are asymptomatic at the time of testing but who go on to develop symptoms after a positive PCR test (presymptomatic) is extremely challenging, particularly in younger children, because of challenges in reporting or describing mild symptoms and loss to follow-up. Studies that enrol children based upon the presentation of symptoms will under-estimate the extent of asymptomatic infection and over-estimate severe outcomes.

2.3 Susceptibility of children to SARS-CoV-2 infection

It is well established that children and adolescents can be infected by, and transmit, SARS-CoV-2 [1]. While there is some heterogeneity in the literature, and although case ascertainment in children and adolescents may be lower than for other age groups [1,54], multiple studies have indicated an age gradient: children in the range of 10-14 years old and younger have been reported to be less susceptible to SARS-CoV-2 infection than older adolescents and adults [55,56].

However, as children tend to have less severe COVID-19 outcomes than adults (Section 1.1), children positive for SARS-CoV-2 may be under-represented in case-based reporting, particularly during the early portions of 2020, as well as in studies that have not tested asymptomatic contacts. Population-based studies, such as representative sampling, may help to address this knowledge gap. A nationwide seroprevalence study from Spain from April – May 2020 identified an age gradient with a gradual rise in seroprevalence from younger age groups into adulthood [57], although the study period coincided with a national lockdown that included school closures. Conversely and more recently, a prospective cohort study from Austria repeatedly tested over 10,000 staff and students for SARS-CoV-2 infection using a gargling solution and RT-qPCR [57]. The authors concluded that prevalence did not differ across age groups, pupils or teachers, or primary or secondary schools [57], but did observe an association between prevalence and regional community incidence and social deprivation. Similarly, seroprevalence testing in a prospective cohort study of 55 schools in Switzerland found no significant difference in seroprevalence between lower, middle and upper school children (6-9 years, 9-13 years, and 12-16 years, respectively) [58]. A preprint seroprevalence study from India from March-June 2021 has also concluded that children aged 2-17 years had similar seroprevalence rates to adults [59].

It is important to note that there may be a high volatility in SARS-CoV-2 prevalence among children, depending upon whether schools have been open or closed as well as on varying in-school mitigation measures [57]. In England, for example, the highest prevalence rates for any age group were among school-aged children between 13 November-3 December 2020 [60], but this declined sharply among 13-17-year-olds by February 2021 due in part to school closures [61].

Variants of concern show increased transmissibility across all age groups [62], and it is therefore important to note that both susceptibility and infectiousness of children aged between one to six years are substantially higher compared with the pre-VOC period [63]. Most currently published scientific studies were conducted prior to the emergence of SARS-CoV-2 variants such as Alpha and Delta.

The relative prevalence of SARS-CoV-2 infection among children will increasingly depend upon levels of vaccination uptake in older age groups, as well as circulating VOCs [64]. In England, between 20 May 2021 and 7 June 2021, a period in which vaccination roll-out was well underway and the Delta variant was the dominant circulating SARS-CoV-2 variant, there were 5-fold higher SARS-CoV-2 positivity rates among children aged 5-12 and young adults aged 18-24 compared to those 65 years and older [64]. It was hypothesised that these higher rates among younger people reflect increased social mixing as schools opened and lockdowns eased, alongside higher vaccination coverage among older age groups [64].

2.4 Transmission of SARS-CoV-2 by children in household settings

There is a high degree of heterogeneity among studies on household transmission by children, and published studies have been primarily conducted prior to the emergence of the Delta variant, and in periods with lower overall rates of vaccination coverage in the adult population.

Several studies do not identify children and adolescents as index cases or identified them as index cases less often than adults [62,65]. Evidence points towards the possibility for onward transmission by children with an increased likelihood with increasing age. However, there are some mixed results in the literature about whether adolescents are more or less likely to transmit SARS-CoV-2 than younger children or adults.

In a Korean study among 4 048 household clusters, within-age group infection dominated the overall household transmissions. Transmission was more common from adults to children than from children to adults [66]. For index cases 10-19 years, the secondary attack rate (SAR) was 18.6%, the highest rate across age groups in the study, but a follow-up study concluded that transmission was more common from adults to children under 16 years, more children to adults [66]. In a retrospective observational study from Spain among children under 16 years, more than 70% (756/1040) of paediatric cases were secondary to an adult, whereas 7.7% (80/1040) were index cases. The secondary attack rate from paediatric index cases was lower in households during the school period than during the summer (33.3% vs 62.1%, p=0.02). In addition, the SAR was significantly lower in households with paediatric index cases compared to households with adult index cases (59.0% vs 67.6%, p=0.006) [67]. A single-centre retrospective study in the US of paediatric patients positive for SARS-CoV-2 and their household contacts identified no evidence of child to adult transmission [68]. A household study from the Netherlands estimated that secondary attack rates were lowest from 1-11-year-olds (35%), higher from12-17-year-olds (41%), and highest from adults 18 years and older (51%) [69]. A household seroprevalence study from Germany identified significantly higher secondary attack rates for index cases over 18 years than for index cases under 18 years (SAR 0.38 vs 0.15) [70].

In a large cohort with over 300 000 adults living in healthcare worker households in Scotland, adults with children aged 0-11 years were at lower risk of testing positive for SARS-CoV-2 and possibly also of developing COVID-19 requiring hospitalisation than adults living without children, although the identified association was not strong. After schools reopened to all children in August 2020, no association was seen between exposure to young children and risk of any COVID-19 [71]. A similar finding was reached in a cross-sectional study of 4664 healthcare workers in Switzerland, where living with children under 12 years was associated with a decreased risk of SARS-CoV-2 seropositivity (aOR 0.3, 95%CI 0.2-0.6) [72]. One possible explanation for the finding of these studies is that exposure to children may enhance cross-protective immunity through prior exposure to other respiratory viruses [71]. It is also possible that the explanation is due to confounding factors, such as that adults in households without young children behave differently, although the authors of the Scottish study did not find empirical evidence for this explanation [71].

In contrast to the above, studies have suggested relatively similar secondary transmission rates from children as from adults. A household study from the US found high secondary attack rates overall, but in contrast to the aforementioned studies, secondary transmission was found to be higher from index cases under 12 years (53%) than from index cases aged 12-17 years (38%), although this finding was based upon a very low number of index cases in the younger than 12 years age group [73]. Similarly, a national registry-based study from Norway has indicated that, while parents are more likely than children or adolescents to be index cases were children 0-6 years (24%) than they were for when index cases were children 13-16-years (14%) or 17-20 years (11%) [65]. The authors of this study speculated that it may be because very young children cannot reduce contacts with other family members, even if a positive case is detected.

Further research is required to understand the contextual factors driving secondary attack rates from children in household settings. Irrespective of the relative differences in secondary attack rates between children and adults, research from Sweden [74] and from the US [75] has shown an elevated risk of SARS-CoV-2 infection to adults living in households with children attending schools in-person.

Notably, the strength of the association of this elevated risk was shown to increase with the grade that children attended in school, and to decrease according to the number of in-school mitigation measures in place [75]. The study from Sweden suggested that parental exposure to children attending open lower-secondary schools (ages 14-16) rather than closed upper-secondary schools (ages 17-19) resulted in an increase in confirmed SARS-CoV-2 infections (OR 1.17; 95%CI 1.03-1.32) [74]. A modelling study from the US based on self-reporting questionnaires concluded that living in a household with a child having in-person schooling is associated with a 30% increase for having a positive COVID-19 test in the 14 days before (aOR 1.30; 95%CI 1.24 to 1.35). The risk was highest with increasing school grade and was highest with children in grades 9 to 12 [75]. Importantly, however, this study also concluded that the risk to household members of in-school students can be managed through the implementation of mitigation measures within schools (see also Section 4.2) [75].

3. What is known about SARS-CoV-2 transmission in school settings?

Summary

- There is limited spread of SARS-CoV-2 in schools when appropriate mitigation measures are in place (moderate confidence). However, transmission of SARS-CoV-2 in school settings is inherently difficult to assess, particularly when community transmission is ongoing, as transmission attributed to schools could have occurred in community settings or vice-versa.
- With current community transmission of more transmissible SARS-CoV-2 VOCs, the susceptibility and infectiousness of children, adolescents, and educational staff are substantially higher compared with the pre-VOC period, and thus the likelihood of SARS-CoV-2 transmission in school settings is also higher.
- Secondary infections in school settings are more likely to occur if the index case is a teacher than a student, other factors being equal (moderate confidence).
- Educational staff and adults within school settings do not seem to be at increased risk of severe COVID-19 compared to the general population (low confidence), but appropriate measures, including full vaccination, should be taken to minimise the chances of infection of educational staff.

3.1 SARS-CoV-2 transmission in school settings

It has generally been concluded that SARS-CoV-2 transmission in school settings is not a primary determinant of community transmission [1,76]. During first and second waves of the pandemic, research showed limited spread of SARS-CoV-2 in schools. While outbreaks have been documented in preschools, primary schools and secondary schools, it has also been generally observed that there are low secondary attack rates in these settings when appropriate mitigation measures are in place [1,77,78], and that the risk of students affecting family members is also diminished if effective combinations of in-school mitigation measures are in place [75].

Consistent with the general hypothesis that SARS-CoV-2 transmission is more likely by older than younger children and adolescents, it has been assessed that there is likely to be a greater effectiveness in reducing community SARS-CoV-2 rates by temporarily closing secondary schools than primary schools [79-81]. Chapters 5 and 6 cover the impacts and effectiveness of school closures. The majority of studies indicate secondary infections in schools occurring more frequently when the index case is a teacher than a student [76,82].

Variants of concern show increased transmissibility across all age groups [83]. Investigations of German childcare centre outbreaks in March 2021 suggest that, as with other age groups, both susceptibility and infectiousness of children aged between one and six years are substantially higher compared with the pre-VOC period [63]. In the UK, in the four-week period up to 18 June, there were 181 confirmed SARS-CoV-2 outbreaks linked to primary and secondary schools that had at least one variant case linked to them. This represents around 0.8% of all schools [83,84]. By the end of June 2021, COVID-19-related pupil absence in England was increasing and at the highest rate since schools opened in March 2021 [85]. Pupil absence due to COVID-19 includes confirmed or suspected cases, as well as pupils self-isolating or whose schools are closed due to COVID-19. Case rates of the Delta variant in the UK were, as of the second week of June 2021, increasing in all age groups up to 70 years, but at a faster rate among 10-17-year-olds. This age group is one the largest remaining susceptible population groups, given that children have generally not been vaccinated so far. Any observed increase in outbreaks in schools may be due to these factors, alongside increased testing among this age group, the easing of lockdowns, and resultant increases in social mixing [64].

Younger adults and adolescents currently account for a high proportion of cases in many European countries. By the beginning of the 2021 autumn term, children will likely be the largest unvaccinated population. As a result, relatively more SARS-CoV-2 transmission is expected to occur in this group, as well as in school settings.

3.2 COVID-19 among educational staff

The risk of COVID-19 among teachers and other educational staff has been discussed since early on in the pandemic. Generally, there are different types of risks that can be assessed, such as the risk of acquiring a COVID-19 infection and risk of severe COVID-19 (e.g. hospitalisation or death). However, as already stated in ECDC's previous guidance, the transmission of SARS-CoV-2 at the workplace is difficult to assess, particularly when community transmission is ongoing, as transmission among adults could have occurred outside the workplace [1]. Teachers working outside their homes reported up to 80% more COVID-19-related outcomes in a self-reporting questionnaire in the US (aOR, 1.8; 95% CI, 1.5 to 2.2), comparable to percentages reported by healthcare workers [75].

Nonetheless, there is a growing evidence base on the role of educational staff on SARS-CoV-2 transmission in school settings. In a large cross-sectional study of SARS-CoV-2 transmission in educational settings in England, it was reported that staff had higher incidence than students, and that most cases linked to outbreaks were among staff members [78]. An investigation into SARS-CoV-2 transmission in schools in Georgia, US, concluded that educators may play a central role in in-school transmission networks [86], highlighting the importance of appropriate mitigation measures among educators. A preprint study from Germany stated that transmission was more likely from teachers than students, and that teachers caused four times more secondary cases than students [87].

While the likelihood of SARS-CoV-2 transmission appears to be higher from teachers than students in educational settings, studies have not generally revealed a higher occupational risk to educational staff. Evidence from Sweden from the early phase of the pandemic, where primary and lower secondary schools (covering children up to approximately 15 years) were kept open, suggests that teachers were not found to be at increased risk to receive intensive care for COVID-19 [88], while statistics from England and Wales further reveal that death rates in teachers and educational professions were not significantly increased when compared to rate of death among people of same sex and age [89]. Other studies looking at severity indicated that teachers are not at increased risk of severe COVID-19 outcomes. More precisely, two preprints found that teachers were not at increased risk of hospitalisation, even after schools had re-opened [90,91]. In addition, a preprint study from Norway published in January 2021 comparing occupational risk during the first (26/02/2020-17/07/2020) and second (18/07/2020) - 18/12/2020) waves of the pandemic found that, while teachers did not have an increased risk of confirmed SARS-CoV-2 infection during the first wave, they did have a moderate increased risk (~1.25 times) during the second wave compared to people aged 20-70 years without a registered Standard Classification of Occupation code [90]. The authors also report a higher percentage of teachers being tested in the reporting period compared to other occupations, and it cannot be definitively concluded whether all teachers were infected in the school setting. Transmission from school-children to adults was, furthermore, found to be minimal in the primary school setting in Norway [92]. Measures implemented in Norway during the study period included physical distancing and clear messaging to stay at home if symptomatic but did not include face mask usage recommendations. An Italian study supported the finding from Norway, while further adding that compared to an age-matched general population of one Italian region, teachers were not at increased risk of a SARS-CoV-2 infection [76]. As with other studies cited in this report, the aforementioned studies relate to periods prior to the emergence and widespread transmission of the Delta variant.

4. What can be done to prevent and respond to SARS-CoV-2 transmission in school settings?

Summary

- In the context of circulating SARS-CoV-2 variants, including Delta, and given that children will be the largest unvaccinated population group in the EU/EEA by autumn 2021, it is important to ensure that appropriate in-school mitigation measures are in place and to have a high level of preparedness in the educational system so as to minimise the likelihood of SARS-CoV-2 transmission among students and staff.
- Measures implanted in school settings should be adapted according to levels of community SARS-CoV-2 transmission as well as the educational setting and age group. Implementation of measures should also consider balancing the need to prevent transmission with the need to provide children with an optimal learning and social environment.
- Implementing combinations of multiple physical distancing and hygiene measures can significantly reduce the possibility of SARS-CoV-2 transmission in school settings (high confidence).
- Mitigation measures to be considered in school settings include approaches that prevent crowding (class room distancing, staggered arriving times, cancellation of certain indoor activities), especially in older age groups, together with hygiene and measures to minimise transmissions (hand-washing, respiratory etiquette, cleaning, ventilation, face masks in certain circumstances and for certain age groups). Measures should be implemented taking into consideration the age groups and the measures' impact on learning and psychosocial development.
- It is important that testing strategies for educational settings aiming at the timely testing of symptomatic cases are established to ensure isolation of cases and tracing and quarantine of their contacts. When positive cases are identified, the school should be informed, contact tracing should be initiated according to local guidelines, and communication to and the testing of close contacts, ideally with rapid antigen tests, should be considered.
- Risk communication activities should focus on the three key stakeholder populations in schools: staff; parents/caregivers; and the pupils. Messages should emphasise the need for continued adherence to preventive measures in schools, while also acknowledging that outbreaks may still occur and temporary, localised school closures may be needed.
- Community engagement efforts should be based on a true partnership between the public health and educational authorities and the school community. Efforts to build partnerships require the authorities to actively listen to the concerns of the different stakeholder groups, and then responding to any areas of concern that are identified.
- Over the longer term, schools have a key role to play in fostering critical thinking skills as well as science and health literacy as a means of countering misinformation about the pandemic and other health-related issues.
- There is an established set occupational safety and health rules that applies to workplaces, including educational establishments. Employers should carry out a workplace risk assessment and set preventive measures that will protect workers in educational establishments. This includes psychosocial risks and any changes to previously set preventive measures caused by mitigation measures set to prevent SARS-CoV-2 transmission. They should also consult their occupational health services and workers, their representatives, or the health and safety committee on the preventive measures. The workplace risk assessment needs to address vulnerable groups, such as those with chronic diseases and pregnant and breastfeeding workers.

4.1 Preparedness for school openings for the 2021/2022 school year

As noted in other sections in this report, the Delta variant is significantly more transmissible than other known SARS-CoV-2 variants and is expected to be the dominant circulating variant in the EU/EEA by September 2021. Moreover, as COVID-19 vaccines have not yet been recommended for children under 12, and as countries have not prioritised adolescents (12-18 years) over other age and risk groups for COVID-19 vaccines, it is to be expected that vaccination coverage among children and adolescents will be very low, meaning that they will constitute an increasing share of new SARS-CoV-2 cases.

The WHO European Technical Advisory Group for schooling during COVID-19 concluded in June 2021 that keeping schools open should be a key objective [9]. Given the plausible context described above and accounting for the numerous adverse impacts of school closures, it is imperative that there is a high level of preparedness in the educational system, taking into account the measures outlined in the remainder of this section, so as to

minimise the likelihood of SARS-CoV-2 transmission among students and staff. Public health authorities may consider reviewing existing guidance to take into account the latest epidemiological context as well as the latest evidence on the effectiveness of mitigation strategies. Where feasible, identifying good practices and areas for improvement for the control of SARS-CoV-2 in educational settings may be achieved through, for example, targeted in-action reviews (IARs) [93,94].

Measures implemented in school settings should be adapted according to levels of community SARS-CoV-2 transmission as well as the educational setting and age group. Implementation of measures should also consider balancing the need to prevent transmission with the need to provide children with an optimal learning and social environment.

There is an established set of occupational safety and health rules applicable to educational settings, which lay down employer obligations and rights of staff in educational establishments, for example related to the protection from exposure to biological agents at work [95,96]. Employers have to carry out a workplace risk assessment and set preventive measures to protect workers from risks to their occupational safety and health. The workplace risk assessment should be adapted when measures for the control of SARS-Cov-2 are implemented, and it should address psychosocial risks as well as any risk arising for vulnerable groups, such as workers with chronic diseases and pregnant or breastfeeding workers. Preventive measures should be consulted with workers or their representatives and the health and safety committee, if in place, and employers should also consult preventive services on the measures to be taken. The European Agency for Safety and Health at Work provides guidance, for instance on the measures to be taken when returning to work after a lockdown, which is also applicable after a period of absence from school [97].

4.2 Non-pharmaceutical interventions relevant to school settings

There are relatively few studies that have documented the effectiveness of non-pharmaceutical interventions (NPIs) in school settings. However, some initial evidence is starting to emerge. A modelling study assessed the risks of having a positive COVID-19 test in members of households that had a child having full-time in-person schooling. The risk was easily mitigated by implementing layers of NPIs at schools. The study estimated that simple measures like use of face masks, restricted entry to school, daily symptom checking, reduced class size and cancelling extracurricular activities had a dose-dependent effect on mitigating the risk of COVID-19 outcomes in the children's households. Notably, each measure was associated with a 7% decrease of the risk of a COVID-19 positive test (aOR, 0.93; 95% CI, 0.92 to 0.94), with daily symptom checking associated with greater risk reductions than the average measure [75]. Physical barriers and part-time schooling were not associated with significant decreases [75]. A preprint modelling study from the Netherlands suggested that, for secondary schools, twice-weekly screening of students and teachers would be effective at lowering infection rates in this setting [98].

In a recent cross-sectional analysis, school-level prevention measures were assessed in Georgia, USA. After adjusting for levels of community transmission, COVID-19 incidence was 37% lower in schools that required teachers and staff members to wear masks, and 39% lower in schools that worked to improve ventilation [99]. However, the study design, which did not allow for conclusions about causal relationships, could not account for the compliance of mask usage, and relied upon self-reporting of COVID-19 cases.

The WHO European Technical Advisory Group for schooling during COVID-19 has suggested implementing changes in the school environment that are likely to be of overall benefit to infection control and child health [9], while striking a balance between enabling learning and social interactions on the one hand, and infection control on the other.

ECDC's COVID-19 guidelines for non-pharmaceutical interventions present public health measures that aim to prevent and/or control SARS-CoV-2 transmission in the community, many of which will also apply to the school setting [100]. These consist of physical distancing measures as well as safety and hygiene-related measures.

Physical distancing measures can be achieved with different approaches, including:

- cohorting of classes and groups;
- ensuring physical distance in the classroom (e.g. separating tables/chairs);
- reducing class sizes;
- staggering arrival times, as well as meal and break times;
- holding classes outdoors; and
- cancelling, where necessary, extracurricular activities that entail spending a lot of time indoors (e.g. theatre plays, choir practice).

Physical distancing measures should aim at decreasing the number of individuals and contacts in confined or closed spaces while ensuring schooling can take place. The selection of measures should consider the current knowledge of disease transmission in different age groups, and the feasibility and appropriateness of the measures for the age

group, including the need to ensure learning and psychosocial development, as well as potential physical and mental disabilities. It is important to consider the interactions within facilities among children/students, and between educational staff and the children/students, as well as among the educational staff/adults.

Examples of safety and hygiene-related measures include:

- the promotion of a 'stay at home when sick' policy;
- the promotion of respiratory hygiene and hand hygiene among teachers and students, providing sufficient facilities;
- ensuring appropriate cleaning of the facility;
- ensuring appropriate ventilation;
- implementing the use of face masks among educational staff and children. Advice on the use of face masks for children in the community has been issued by WHO [101].

Detailed information on the measures described above, including considerations for their implementation, can be found in dedicated ECDC guidelines and guidance, including ECDC's COVID-19 guidelines for non-pharmaceutical interventions [56,100,102,103]. Furthermore, guidance on school prevention measures are available from a range of public health institutes within the EU/EEA, as well as from international organisations [104-111].

4.3 Testing at schools and other educational settings

Testing methods

The laboratory diagnosis of COVID-19 follows the same principles in children (aged 0 to 17 years) as adults using specimen obtained from upper respiratory tract, for either nucleic acid amplification test (NAAT) or detection of virus-specific antigens by rapid antigen detection tests (RADTs) [112]. Ideally, rapid diagnostic tests should be employed.

Within educational settings, rapid diagnostic tests can be applied in the following ways:

- In the context of contact tracing, rapid diagnostic tests allow for a more rapid identification of infectious contacts. Rapid diagnostic tests have been shown to be more efficient in detecting cases in up to five days after the onset of symptoms and should therefore be used within this window of time, when the viral load is highest. For asymptomatic contacts of cases, tests should be performed as soon as possible after the contact has been traced. If more than seven days have passed since a known exposure, there may be an increased risk of a false negative test result by rapid diagnostic test due to a reduction at the viral load. In such cases, the test should be repeated by RT-PCR as quickly as possible.
- Rapid diagnostic tests can be used for screening staff or students in high-prevalence settings for example a large outbreak in a school setting as part of school-wide testing approach. The validated performance criteria of rapid diagnostic tests, and the importance of considering the overall prevalence of SARS-CoV-2 in the population, should be considered [113]. The first positive cases identified in an outbreak can be confirmed by RT-PCR. It also needs to be noted that in low prevalence settings, the positive predictive value of the RADTs decreases, and therefore positive cases should be confirmed with RT-PCR.

The European Commission and ECDC have published recommendations for the use of rapid antigen tests in different settings [109,110][114]. ECDC has outlined considerations for the use of rapid antigen tests in settings of low and high infection prevalence and the need for confirmatory testing [109].

Ideally, trained healthcare or laboratory staff, or trained operators, should carry out sampling, testing, test analysis and reporting of test results to clinical staff and public health authorities at the local, regional, national and international level. However, under specific circumstances the self-testing approach when using RADTs can be considered for individuals above 10 years. Self-tests may contribute to decreasing the risk of transmission when used by asymptomatic individuals prior to social interactions relevant to specific settings, such as visits to family/friends, appointments, travel and participation in events, as the self-test would identify infectious cases at the time of testing. They may also contribute to decreased transmission risk when frequent testing is done in places with high risk of exposure and those with large numbers of close interactions between individuals (e.g. educational settings). By using self-tests frequently to ensure individuals are negative prior to their attendance at school or other similar setting, together with the continued use of NPIs, the risk of transmission is further decreased [115].

Proper sample collection is one of the most important steps in the laboratory diagnosis of SARS-CoV-2. The sampling approach in children, if performed by a healthcare professional, is the same as in adults. Self-sampling is not recommended in younger children (e.g. age <11 years) and in order to ensure the strict compliance to sampling and safety instructions, sampling should be performed by an instructed adult for these cases. If a specimen is not collected properly, this may cause false negative or inconclusive test results. The detection of viral RNA by NAATs is usually performed on respiratory specimens, especially nasopharyngeal swabs. However, the collection of nasopharyngeal swabs is invasive, ideally requires experience and clear instruction, and has a risk of viral transmission to the sample collector. In a situation where a nasopharyngeal or other upper respiratory specimen is not acceptable and/or to increase the acceptance of children being tested, saliva could be considered as an alternative specimen for RT-PCR testing. However, the available limited data do not give a clear

picture on whether children can be reliably diagnosed based on saliva samples and more studies are needed [116]. Additionally, current limited evidence does not support the use of saliva as an alternative sample material for RADTs. However, samples obtained through gargling saline solution have been successfully used for SARS-CoV-2 RT-PCR testing [57].

If instructions are strictly followed, good quality samples for SARS-CoV-2 detection can be obtained from children, indicating that children can be safely tested at any age. Children can be included in testing strategies given that the performance of diagnostic tests in children is expected to be broadly similar to in adults, assuming the use of the same sample type and sampling time.

Should any staff of educational establishments be involved for example in the process of collecting samples, then occupational safety and health measures would need to be set by their employer and this should be consulted as mentioned above with workers or their representatives and occupational health services. Such tasks need to be addressed through a workplace risk assessment.

Testing strategies

Testing guidelines and how to apply them in schools have been outlined in previous ECDC publications: 'COVID-19 testing strategies and objectives' [117], 'Objectives for COVID-19 testing in school settings – first update' [118], and 'COVID-19 in children and the role of school settings in transmission - first update' [1].

Testing strategies in school settings should aim to keep schools safe and open [9]. ECDC recommends that testing efforts, in community settings generally and in educational settings specifically, are maximised with the aim of offering timely testing to all symptomatic cases in order to ensure isolation of cases and tracing and quarantine of their contacts [117]. Since the aforementioned documents were published, RADTs have been introduced by many EU countries to increase testing capacity or shorten turnaround times for testing. Testing should be part of active surveillance aimed at early detection of all symptomatic cases, and potentially infectious asymptomatic individuals. A strategy for testing should be developed, and adapted through an ongoing assessment of the local epidemiological situation and laboratory capacity [117]. In the context of schools, testing strategies should be developed that aim to minimise the duration of school absences for pupils self-isolating.

Discussions on the appropriate testing strategy should be initiated before their implementation either at school level or at the level of regional authorities, for instance, including employers, workers, occupational safety and health authorities, and public health authorities. When testing strategies are designed and implemented at schools, students and workers (or their representatives) should be consulted and clearly informed about the procedures. The health and safety committee, where available, and the occupational physicians or occupational health services should be involved in designing and implementing it. Furthermore, testing at the workplace should be clearly embedded in the occupational safety and health management approach, and the results of testing should be considered in the regular revision of the workplace risk assessment.

Detection of SARS-CoV-2 positive cases in the school setting

Schools can minimise the spread of SARS-CoV-2 and increase the possibility of remaining open for in-person learning by expecting and planning for the occurrence of individual COVID-19 cases or clusters of cases among students and/or staff. A clear mitigation plan will help schools to respond quickly when one or more cases are detected. When an individual is suspected to have COVID-19 in a given class or school, testing of the suspected case, including confirmatory PCR testing, should occur and the individual should stay home from school until test results are available. If a case is confirmed to be positive, the school should be informed, and contact tracing should be initiated according to section 4.4 below.

An outbreak in a school setting is often defined as two or more PCR-confirmed cases occurring at a school during a 14-day period where transmission is not known to have occurred outside of the school. An outbreak continues until 14 days have passed without detecting any additional cases. If an outbreak is detected, local authorities should be notified to support with outbreak management, including contact tracing and testing. Non-pharmaceutical measures including physical distancing and safety and hygiene measures (see section 4.2) should be strengthened and additional measures, such as enhanced regular testing, information to students and their families, should be considered. Further restricting movement or contact between class groups and limiting student activities to their classroom cohorts may also be considered.

A protocol for the investigation of COVID-19 clusters and outbreaks in schools and other educational settings is available as part of the World Health Organization's Unity studies. It describes the different steps to investigate SARS-CoV-2 transmission following the notification of a COVID-19 case in a school, and provides guidance and links to case definitions, study design, questionnaires for cases and contacts, and contact tracing [119].

4.4 Contact tracing in the school setting

Contact tracing is important in school settings to rapidly identify secondary cases in order to avoid large outbreaks and the interruption of school activities. ECDC has published general guidance for management of persons who have had contact with COVID-19 cases [120,121].

Contact tracing should be carried out by or in close collaboration with local public health authorities, who may work closely with school authorities to define the most appropriate response based on an assessment of the local situation. In the context of schools, contact tracing should be designed so as to have as little disruption as possible on students and staff. Authorities should seek to ensure that decisions are well understood by staff, students and guardians. Contact tracing should be initiated promptly following the identification of a confirmed case and should include contacts in the school (classmates, teachers and other staff), household and other relevant settings, in accordance with ECDC or national guidance. Contacts should be managed based on their exposure category. Table 4 provides a general classification of contacts in line with ECDC contact tracing guidance [120].

Table 4.	Classification of a	contact in school	settings, based	on level of exposure
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High-risk exposure (close contact)	Low-risk exposure
 A person: having had face-to-face contact with a COVID-19 case within two metres for more than 15 minutes over a 24-hour period (even if not consecutive); having had physical contact with a COVID-19 case; having had unprotected direct contact with infectious secretions from a COVID-19 case (for example, by being coughed on); having been in a closed environment (house, classroom, meeting room, hospital waiting room, etc.) with a COVID-19 case for more than 15 minutes; having travelled together with a COVID-19 case for more than 15 minutes using any mode of transport. 	 A person: having had face-to-face contact with a COVID-19 within two metres case for less than 15 minutes; having been in a closed environment (house, classroom, meeting room, hospital waiting room, etc.) with a COVID-19 case for less than 15 minutes; having travelled together with a COVID-19 case for less than 15 minutes using any mode of transport.

All contacts who already have symptoms or develop symptoms during follow-up (high-risk and low-risk exposure contacts) should be tested as soon as possible to allow for case isolation and further contact tracing. Additionally, testing of asymptomatic high-risk exposure contacts allows for prompt isolation of new potential cases and early initiation of contact tracing of these new cases. High-risk contacts in school settings should be quarantined and actively followed up by the school or public health authorities. ECDC guidance on contact tracing provides further details.

Whereas sharing a classroom can be considered a high-risk exposure, the presence of effective mitigation measures that would lower the risk of some children can be taken into account. In view of the increased transmissibility of some VOCs enhanced contact tracing measures should be considered for cases suspected to be infected with a VOC, for example through an epidemiological link or laboratory pre-screening [122]. These enhanced measures are outlined in the ECDC publication 'Risk related to the spread of new SARS-CoV-2 VOCs in the EU/EEA – first update' [62].

As outlined in the ECDC publication 'Interim guidance on the benefits of full vaccination against COVID-19 for transmission and implications for non-pharmaceutical interventions' [123], vaccinated contacts that have been exposed to a confirmed case should continue to be managed according to existing ECDC contact tracing guidance [120]. However, health authorities may consider undertaking a risk assessment on a case-by-case basis and subsequently classify some fully vaccinated high-risk exposure contacts as low-risk contacts. Factors that need to be taken into consideration in such assessments include, for example, the local epidemiological situation **in terms of circulating variants, the type of vaccine r**eceived, the age of the contact, or the risk of onward transmission to vulnerable persons by the contact [123].

4.5 Vaccination in school settings

As of 15 June 2021, one vaccine against COVID-19, Comirnaty by BioNTech/Pfizer, had received a conditional marketing authorisation to be administered to individuals above the age of 12 years [6,124]. BioNTech/Pfizer have also recently started a phase 2/3 trial among children 5-11 years old, using a smaller dose than the one given to individuals 12 years old or older, with results expected in September 2021. A phase 1 study is also

ongoing among children younger than five years and is expected to move to phase 2/3 in the coming weeks [125]. In addition, EMA are currently evaluating the use of COVID-19 Vaccine Moderna for use in individuals aged between 12 and 17 years [126]. A phase 2/3 trial of safety and efficacy of COVID-19 Vaccine Moderna among children aged 6 months to 12 years is ongoing and results are expected after the summer [127]. As of 11 June 2021, five EU/EEA countries are planning to expand vaccination to all adolescents and in 14 countries the vaccination of children younger than 12 years is currently under discussion and decisions will be made at a later time if EMA authorises any COVID-19 vaccines for that age group¹ [128].

On 1 June 2021, ECDC published interim public health considerations for vaccination of adolescents against COVID-19. This report highlighted that vaccination of adolescents against COVID-19 should be considered in the broader context of the COVID-19 vaccination strategy for the whole population, including its overarching goals, the status of implementation, and its priorities. The individual direct benefits from COVID-19 vaccination in adolescents are expected to be limited in comparison to older age groups and the overall direct benefits depends on the epidemiological situation in each country. When vaccination for children (also for those aged below 12 years) is available, it will be important to carefully assess the benefit-risk profile of COVID-19 vaccination in different age groups of children for the different vaccine products available. It will also be important to assess the estimated marginal impact of vaccinating children both in terms of overall SARS-CoV-2 viral circulation and burden of COVID-19 (i.e. overall morbidity and mortality in the population). Another important consideration when deciding on expanding vaccination to low risk groups is equity issues concerning vaccine availability and access, both on a national but also on an international level. The relevance of vaccinating children should also be assessed for its potential impact on the emergence of new vaccine escape variants by reducing viral transmission in this age group [129].

School staff had been indicated among prioritized groups in several EU/EEA countries and by the WHO SAGE group [130]. However, as vaccine roll-out is proceeding, an increasing number of countries either already have or are about to commence to open up vaccination for all adults, which would then include also this group. As of 11 June 2021, ten countries have already opened up vaccination to any adult individual irrespective of age, underlying condition, or priority group [128].

4.6 Risk communication and community engagement

Communication activities related to outbreak prevention and control

As vaccination campaigns progress throughout the EU/EEA and an increasing proportion of the population is vaccinated, a slowdown of the pandemic is expected. With the older, more vaccinated generations now less susceptible to infection, younger generations – who are at lower risk of severe disease – will almost inevitably account for an increasing proportion of those who are infected, even if the absolute numbers do not increase substantially [129,131]. Risk communication activities need to explain this shift to the population, and in particular to the three key target populations in schools: teachers and other school staff; parents and caregivers; and the pupils themselves.

Even as the overall pandemic eases in the EU/EEA, outbreaks in school settings can still be expected. Educational authorities should work together with national and regional public health experts and occupational safety and health authorities to ensure that each of the three key target populations in schools identified above receives messages about any outbreaks that are appropriate for their particular position within the educational system, and that the messages from the different organisations are consistent. Age-specific messages should be developed for pupils.

It is also important to bear in mind that staff, parents/caregivers, and pupils are likely to perceive the threat from COVID-19 in different ways, and they may also respond differently to the various prevention and control measures. Messages should be shaped accordingly, and they should be disseminated through channels that are accessible and well known to the respective target populations.

Risk communication activities should focus on:

- Providing information about the prevention of COVID-19 in schools, with easily accessed materials highlighting national recommendations and protocols (e.g. via dedicated webpages from public health and occupational safety and health authorities) [105,132,133];
- Informing the school community, in language appropriate to age and literacy levels, of the importance of continuing to adhere to personal hygiene and other preventive measures in order to keep their school safe. For this, the use of reminders, stories, videos, can be useful [134-136];
- Raising awareness in the school community about the prevailing risks and the possible need to reinstate more stringent measures should epidemiological conditions deteriorate. Transparent communication is needed to explain that even if prevention measures are implemented, more transmissible variants are

¹ The question was asked before the conditional market authorisation for Comirnaty in individuals aged 12-15 years.

circulating, and there is also the potential for breakthrough infection and onward transmission, including among those vaccinated: the risk of transmission cannot be completely eliminated [137]. In addition, it is important for people to understand that the potential severity of disease for different members of the school community may vary depending on age, overall health, and vaccination status.

• Providing clear, step-by-step instructions regarding what to do in the event of an outbreak. Such instructions could include a checklist or set of standard operating procedures that indicate what school communities may expect to happen over the course of an outbreak; which authorities they should contact and under which circumstances; and a description of any activities they may need to undertake during the outbreak and subsequently [138]. Such information should also be adapted to the specific audiences where applicable (teachers/staff, parents/caregivers, and pupils).

While the primary responsibility for communication during an outbreak of COVID-19 lies with the authorities, it is also essential for schools affected by an outbreak to communicate clearly and regularly with the parents and caregivers, as well as with the pupils. In the event that a school – or specific classes within it – has to be closed, information should be provided by school authorities about the practicalities of any online teaching, and a likely timeframe should be given for when it may be expected that pupils can return to face-to-face lessons [138].

Community and child engagement

The UN Committee on the Rights of the Child (CRC) [139] notes that States parties should ensure that 'adolescents are given a genuine chance to express their views freely on all matters affecting them'. The WHO Technical Advisory Group for schooling during COVD-19 advises that children and adolescents 'should be enabled to participate actively in the decision-making process at school', and that 'children and adolescents from different age groups and all backgrounds, especially those who are more vulnerable, should be asked to provide their perspectives on the measures affecting them and whether they are helping or hindering them' [9].

A key principle for successfully engaging with community partners in the prevention and control of outbreaks is that, since they have a significant stake in the outcome, they want to be seen as genuine partners in the process [9,140]. Within the context of COVID-19 in schools, such partnerships should be built on a transparent, two-way dialogue between the public health, educational and occupational safety and health authorities and the three key stakeholder groups identified above: teachers and other school staff; parents and caregivers; and the pupils themselves. In addition to the authorities providing all necessary information, efforts to build partnership also require the authorities to actively listen to the concerns of the different stakeholder groups, and then respond to any areas of concern that are identified. Such listening – which requires dedicated resources [141] – can be done through, for example, (virtual) meetings of parent-teacher associations, social media monitoring, conducting rapid assessments, or by documenting the topics raised on dedicated telephone hotlines.

Community engagement efforts could also extend to facilitating the vaccination of adolescents, if national strategies include them among the eligible groups, with schools considered as possible settings for vaccination. Studies on vaccine acceptance emphasise the importance of making vaccines available in safe, familiar, and convenient settings [142]. As such, schools are among the venues that may facilitate uptake [143,144].

Key role of schools in health literacy

The challenges of misinformation and disinformation (with the latter defined as the *deliberate* spread of misinformation) circulating online over the course of the COVID-19 pandemic have been widely highlighted by governments and health organisations. There is also recognition that the spread of this 'infodemic' can be as dangerous to human health and security as the pandemic itself [145]. However, schools can play an important role in the multi-stakeholder and multidisciplinary approaches to address this issue. A recent ECDC report [146] on countering online misinformation points to the need for pre-emptive interventions aimed, from an early age, at promoting critical thinking skills and increasing science, health and media literacy. The United Nations Educational, Scientific and Cultural Organization (UNESCO) also highlights the importance of addressing the denial of scientific knowledge and the need to actively fight misinformation, not least through having scientific literacy as a component of the educational curriculum [147]. In addition, health literacy itself is considered a key skill that should be included in a whole school approach and school curricula [148,149].

To this aim, public health authorities could work with educators to develop appropriate school-based curricula based on up-to-date scientific information [146]. Such skills-building, targeting all school age groups, could contribute to developing wider resilience to misinformation and its adverse impacts.

Gamification can act as a complementary approach to teaching such skills. One example, specifically in relation to misinformation about COVID-19, is <u>Go Viral!</u> (recommended for 15-year-olds and older) [150]. Another game, <u>Bad</u> <u>News</u>, teaches the mechanisms behind the spread of disinformation, and has a junior version, recommended for 14-year-olds and older, as well as information for educators who wish to use it as a teaching resource in class [151].

5. What are the social and economic impacts of school closures?

Summary

- School closures are one of the most disruptive measures implemented during the COVID-19 pandemic, as they have multiple adverse social, educational, health and economic impacts.
- The loss of learning due to prolonged school closures are estimated to be very large (high confidence) and include learning loss, reduced educational performance, increased risk of disengagement and school dropout
- Child and adolescent health have been negatively impacted by prolonged school closures (high confidence). Studies indicate an increase in mental health issues such as social isolation, psychological distress, anxiety and depressive symptoms. Screen time, social media use, sedentary behaviour, and unhealthy dietary habits have increased, while physical activity has decreased.
- Prolonged school closures have exacerbated existing inequalities in society, by having a disproportionate impact on more vulnerable children, caregivers, families, and communities (moderate confidence). In the event of future school closures necessitated by outbreaks, it is important that a remote learning infrastructure is designed to reach all students.
- The economic cost of prolonged school closures is estimated to be high (moderate confidence) and includes direct learning loss, lower skills in the labour force, less productivity, and loss of potential future earnings, as well as loss of parental productivity and income.

5.1 Health and educational impact on children due to disruptions in education

School closures are one of the most disruptive measures put in place during the COVID-19 pandemic. School disruptions (full or partial as well as temporary or prolonged closures) have multiple impacts. In 2020, prolonged school closures upended life for children, educators and families generating high social, educational, health and economic impacts for pupils, teachers' families, and society.

Educational impacts

The loss of learning due to prolonged school closures are estimated to be very large (high confidence). Remote learning quality and effectiveness is significantly lower than in school learning and varies greatly by context and learners' background. Educational impacts of school closure include direct loss of learning, reduced educational performance, increased risk of disengagement and school dropout and other challenges due to the interruption in learning [152]. Decreased motivation in school- and homework has also been described [153].

A study based on the eight-week school closure due to the pandemic in the Netherlands, reveal a learning loss equivalent to one-fifth of a school year, the same period that schools remained closed. Losses were up to 60% larger among students from less-educated homes, confirming worries about the uneven toll of the pandemic on children and families [154]. These results are from a setting with favorable conditions with a short lockdown, equitable school funding, and high broadband access. The UCL Institute of Education (US) estimates that children have been spending an average of only 2.5 hours a day on schoolwork, with 71% of state school children receiving no more than one online lesson a day [155,156]. The World Bank estimates that COVID-19 could result in a loss of 0.6 years of schooling adjusted for quality, bringing down the effective years of basic schooling that children achieve during their schooling life from 7.9 years to 7.3 years [157].

Children's learning experiences have been negatively impacted with large disparities across families in the amount of time spent learning, activities undertaken during this time, availability of resources to support learning and an increased dispersion of test scores [158]. Concurrent effects on the economy make parents less equipped to provide support, as they may struggle with economic uncertainty or demands of working from home [159].

The policy implications and measures required to recover learning loss due to the pandemic school closures are considered to be extensive [160].

Health impacts

Children and adolescent health have been negatively impacted by prolonged school closures (high confidence). Viner et al. performed a systematic review [161] on the short-term impacts of school closures on child health and well-being. Based on 72 studies included from 20 countries, results show school closures generate considerable impact on children and adolescent's mental health as between 18-60% of young people were found to be at risk

for psychological distress, particularly anxiety and depressive symptoms. Screen time and social media use increased, physical activity was reduced while sedentary behaviour and unhealthy dietary habits increased.

A study based on the school closure in the UK in the spring and summer of 2020 shows a significant rise in emotional and behavioural difficulties among primary school children, a rise that was greater for children who were not prioritised to return to school for six weeks before the summer holiday. The study found a slight improvement in well-being once schools reopened in September, but not to pre-pandemic levels, and the gap between those who missed out on more versus less time in school during the summer term remained wide. This suggests that the potentially negative impacts of the rounds of school closures on children's mental health are likely to remain for longer time [162]. During the pandemic older children in the UK had much higher levels of emotional difficulties than would be expected at their age [163]. Apart from mental and emotional impact on child health, show negative impacts on parental well-being, stress and health related behaviours [164].

Modelling estimates suggests the school closures in 2020 are associated with a decrease in life expectancy for children in the US due to the reduced educational attainment [165]. Children have also been found to be at increased risk of domestic violence when schools are closed [165].

5.2 School closure and social inequalities

The fundamental challenges relating to social inequalities and the school closures implemented during the COVID-19 pandemic have been highlighted in a previous ECDC report [1]. Overall, school closures are associated with substantial adverse impacts in children, which tend to exacerbate existing inequalities in a society, by having a disproportionate impact on more vulnerable children, caregivers, families, and communities. Evidence has been presented on the unequal burden that school closures have placed on vulnerable populations in relation to food poverty [166], sub-optimal access to reading materials (physical and digital) [166], and limited opportunities for parental support with homework and other activities [167]. The particular burden of school closures on children living with disabilities and/or chronic conditions (and on their caregivers) has also been highlighted [167,168].

Subsequent evidence has confirmed that these core challenges remain essentially unchanged [169,170]. It is therefore important now to consider (i) the re-opening of schools in autumn 2021, bearing in mind that some outbreaks in schools are likely to occur and that localised and temporary school closures may therefore be necessary, with the risk that vulnerable children will likely continue to be disproportionately affected; and (ii) the longer term rebuilding of educational systems, with an aim of addressing the pre-existing inequalities that have been exacerbated over the course of the pandemic [171].

Addressing the first, shorter term issue would require implementation of programmes that ensure equity and that align resources with needs; that provide a remote learning infrastructure which is designed to reach all students; and that support teachers in these aims [171]. culture of innovation in addressing inequalities should also be encouraged, and lessons learned from national and international experiences in this area should be shared and implemented [171].

5.3 Economic impacts of school closures

The economic cost of prolonged school closures is estimated to be high (moderate confidence). The World Bank estimates that the generation of school pupils who suffered from school closures due to COVID-19 during 2020 will forego at least US\$10 trillion in potential future earnings [157]. By this measure, the world could stand to lose as much as 16 percent of the investments that governments make in the basic education of this cohort of students. The estimate is based on a loss of between 0.3 and 0.9 years of schooling, bringing down the effective years of basic schooling that students achieve during their lifetime from 7.9 years to between 7.0 and 7.6 years. On average, students of this cohort face a reduction of 355 to 1 408 US dollars in annual earnings. In present value terms, this amounts to between 6 472 and 25 680 dollars in lost earnings over a typical student's lifetime.

The OECD assessed long-term GDP loss due to learning loss in 2020 of a third of a lost learning year among students in grades 1-12, which would lead to lower skills in the labour force and less productivity. The projected costs were substantial: over 3 087 billion US dollars (~2 546 billion Euros) for Germany and 2 137 billion US dollars (~1 762 billion Euros) for France [172]. Loss of parental productivity and income and the potential impact on job security due to prolonged school closures are also considered substantial which causes continued economic harm to families and to parental economic activity [173,174]. In addition, the impact of school closures on the labour market may differ by sex in some settings, further exacerbating existing inequities: research from the US, for example, found that the closure of state-level childcare facilities (children under 6) were associated with greater reductions in employment in women than men [175].

Implementing in-school mitigation measures for safe schooling in the pandemic is relatively affordable [176]. Investing in mitigation measures, capacity building and other supportive measures for schools and teachers to ensure continued learning is therefore strongly encouraged [160].

Increased use of remote teaching and disruptions caused by confinement measures linked to outbreaks may also put educational staff at strain. The European Agency for Safety and Health at work has published guidance on measures to reduce risks from teleworking and has collected good practice examples and guidance from across Europe to support educational establishments and teachers in protecting their health and safety [177,178]. Support is needed for teachers to implement distance learning and ensure smooth transitions between periods of distance learning and presential education. Educational establishments should include these issues into their workplace risk assessment and design appropriate measures.

6. What evidence is there for the effectiveness of school closures in containing COVID-19?

Summary

- While a measure of last resort, school closures can contribute to a reduction in SARS-CoV-2 transmission (moderate confidence), but by themselves are insufficient to prevent community transmission of COVID-19 in the absence of other non-pharmaceutical interventions (NPIs) and continued vaccination roll-out (moderate confidence).
- Consistent with the general hypothesis that SARS-CoV-2 transmission appears to be more likely by older than younger children in the school setting, there appears to be a greater effectiveness in reducing community SARS-CoV-2 rates by temporarily closing secondary schools than primary schools (moderate confidence).
- The effectiveness of school closures appears to have been higher during the first wave of the pandemic than in subsequent time periods (moderate confidence), perhaps in part because in-school mitigation measures improved with time.
- Modelling to estimate the effects of school closure on overall SARS-CoV-2 community transmission found that the closure of secondary schools had the strongest impact on community transmission (10% reduction of Rt; with 95% credible interval 2%-20%), followed by closure of higher education (8%; 1%-16%). Compared to this, closure of primary schools (4%; 1%-10%) and of day nurseries (2%; 0%-6%) had smaller estimated effects.

6.1 Effectiveness of school closures in containing SARS-CoV-2 transmission

The evidence on effectiveness of school closures have been highlighted in previous ECDC reports [1]. Based on assessments from the first waves of the COVID-19 pandemic in 2020, school closures were generally assessed to contribute to a reduction in SARS-CoV-2 transmission but not deemed sufficient to prevent the spread of COVID-19 [1,179].

The effectiveness of school closures is likely driven by two factors. Firstly, children at home have fewer social contacts, secondly and, potentially more significantly, school closures have the indirect impact of parents needing to stay home with their children and thus curtailing their social mixing. Importantly however, models have not generally been able to decipher between these two factors [180]. Moreover, as school closures have typically occurred alongside a wide range of additional mitigation measures, causal inference is highly challenging [1,76,181].

There appears to be an age gradient in the effectiveness of school closures. An age-structured model from the Netherlands concluded that, with unchanged non-school contacts, closing schools in November 2020 could reduce *Re* by 8% for 10-20-year-olds, 5% for 5-10-year-olds, and by a negligible amount for 0-5-year-olds [81]. The biggest impact on community transmission was thus achieved by reducing contacts in secondary schools. Similarly, a modelling study from England concluded that reopening secondary schools would have a greater impact on SARS-CoV-2 transmission than would reopening primary schools [182].

Effectiveness estimates of closing schools during the first wave were generally measured relative to prepandemic behaviour. Results indicate that in the second wave, with in school mitigation measures in place, the effectiveness of closing schools has been assessed to have been lower than it was during the first wave [76,183]. Nonetheless, in the subsequent waves, with widespread community transmission of SARS-CoV-2 VOCs (with high transmissibility), the risk of onward transmission in schools is increased [184].

6.2 Effectiveness across different waves of the pandemic: ECDC modelling

We used modelling to estimate the effects of closure of four school systems (day nurseries, primary schools, secondary schools, higher education) on community transmission of SARS-CoV-2 in the EU/EEA. In brief, we fitted a Bayesian model of the time changing community transmission (measured as the instantaneous reproductive number, Rt [185,186]) as a function of school closures, while accounting for other non-pharmaceutical interventions (NPIs), between-country differences, and time-evolving effects (fatigue or seasonality). The model makes use of the ECDC-JRC Response Measure Database [10,187], which collates the implementation and timing of NPIs across the EU/EEA. To avoid confounding by different subnational policies, we

included only those Member States where NPIs were implemented mostly on a national level (Austria, Czechia, Finland, Poland, Iceland, Slovenia, and Estonia).

Consistent with the discussion from 6.1, we found that closure of secondary schools compared to other school types had the strongest impact on community transmission (10% reduction of Rt; with 95% credible interval 2%-20%), followed by closure of higher education (8%; 1%-16%). Compared to this, closure of primary schools (4%; 1%-10%) and of day nurseries (2%; 0%-6%) had smaller estimated effects. These effects were estimates for the late part of 2020 (from 1 July until 30 November 2020), while for the early 2020 we find that the effects of school closure were around 1.1-times higher. These effect estimates contain substantial amounts of uncertainty, which is due to limited occurrences of school closures and because they were commonly implemented together with other NPIs. This also means that even as we account for other effects of NPIs, the potential for confounding remains.

These estimates are comparable to the estimates from other modelling studies: Brauner et al. [188] estimated for 41 countries including the EU/EEA that closure of all schools between January – May 2020 reduced Rt by around 37%, although this study could not disentangle the individual effects of closing only schools, or only universities [188]. Davies et al. [189] estimate this effect for the second wave in the UK to be around 13%, and Gandini et al. [76] did not find any conclusive effect of school closure on Rt during the second wave in different regions of Italy.

Many factors could explain a larger effect of school closure in the early part of 2020 as compared to later. In the first period of intense NPIs, apart from schools many other venues were closed. Thus, there were fewer options for social contacts outside of the households as compared to later in 2020, where places like malls or outdoor entertainment venues might have been open. Schools across countries have also implemented various measures to reduce transmission and avoid temporary closure. This baseline level of improved hygiene and social distancing measures may be an important contributor to a reduced effect of school closure in late 2020, highlighting the importance to keep such measures in future.

In the current context, with a greater dominance of more transmissible variants such as Delta, combined with the continued roll-out of vaccination among adult groups, SARS-CoV-2 circulation is expected to be increasingly predominant in younger people, who will remain the largest susceptible unvaccinated population (pending decisions regarding vaccination of adolescent or younger age groups). These factors could increase the relative effectiveness of school closures on community transmission in the future, vis a vis other NPIs which would have less effectiveness among fully vaccinated persons. However, given that vaccination of older age groups is expected to lead to reduced rates of overall community transmission, hospitalisation and mortality, blanket policies of school closures are unlikely to be needed as a measure to reduce overall community transmission under scenarios in which the healthcare burden from COVID-19 is much lesser than it has been thus far. Increased incidence in a given school settings can be addressed through testing, contact tracing and other outbreak management approaches (see Section 4), including time-limited closure of a class or school when transmission within the school is widespread and not possible to control through other means. If large community transmission is not possible to control through other means, temporary reactive school closures may be considered as a last resort.

Limitations

This technical report is based on information and data available to ECDC at the time of publication. Many of the studies referred to in this report were conducted prior to the emergence of new VOCs of SARS-CoV-2, notably Delta.

Most case-based surveillance systems in the EU/EEA countries do not collect information that would allow public health authorities to identify outbreaks or clusters in specific schools without notification from the school itself. A key limitation from currently available household and community studies, particularly for those conducted during 2020, is that many were conducted when lockdowns and school closures were in full or partial effect, meaning that children had fewer than normal social contacts. Case identification in children may also have been limited, particularly during the 'first wave', where children may not have been prioritised for testing or medical care due to significantly less frequent severe outcomes than e.g. older adults. Many countries are not testing asymptomatic cases, so it is difficult to detect and understand transmission among mild or asymptomatic children and teachers. It is difficult to identify all potential routes of transmission within school settings as some activities have been limited (e.g. school sporting events, after-school activities, travel to and from school, children's play dates, mixed mass gatherings of students and adults such as school concerts, performances, and graduations, etc.). The potential impact of allowing such events to take place within the school setting is still unknown. Studies that have modelled and/or assessed the impact of school closures on the control of SARS-CoV-2 transmission are challenged due to the potential overlaps with many other NPIs introduced concomitantly, particularly during the first half of 2020. This document only considers school settings/educational facilities and therefore does not consider other settings where children may commonly gather when away from home.

Conclusions

The role of children and schools in SARS-CoV-2 transmission will continue to be an important area of attention in the 2021/2022 school year. As increasing numbers of adults are becoming fully vaccinated in the EU/EEA, children are expected to be the group with the lowest vaccination coverage – particularly for children under 12 years, for whom no vaccine has thus far been recommended. This context, in combination with the continued circulation of the Delta variant, which is significantly more transmissible than other known SARS-CoV-2 variants and is expected to represent 90% of all circulating SARS-CoV-2 in the EU/EEA by September 2021, means that children and adolescents will likely represent an increasing share of new SARS-CoV-2 cases during the upcoming school year.

Meanwhile, children and adolescents suffer much less frequently from severe outcomes for COVID-19 than do all other age groups, and there are many adverse societal impacts from school closures. Thus the consensus remains that school closures should be a measure of last resort during the COVID-19 pandemic [9]. It is nonetheless acknowledged that situations of high levels of community SARS-CoV-2 transmission, should they be combined with capacity shortages in the healthcare system, could necessitate that all possible NPI measures, including school closures and/or the transition to remote learning, end up being considered for implementation.

To prevent school closures from occurring, and to provide the highest level of protection to students, educational staff, and their family members, appropriate combinations of physical distancing and hygiene measures, as well as occupational safety and health measures, should be implemented in all school settings. Over the summer and prior to the beginning of the autumn school term, there is the possibility to reflect upon and identify good practices and areas for improvement within educational settings, so as to optimise societal prevention, preparedness and response efforts directed at the COVID-19 pandemic.

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TAB 12



Cochrane Database of Systematic Reviews

Measures implemented in the school setting to contain the COVID-19 pandemic (Review)

Krishnaratne S, Littlecott H, Sell K, Burns J, Rabe JE, Stratil JM, Litwin T, Kreutz C, Coenen M, Geffert K, Boger AH, Movsisyan A, Kratzer S, Klinger C, Wabnitz K, Strahwald B, Verboom B, Rehfuess E, Biallas RL, Jung-Sievers C, Voss S, Pfadenhauer LM

Krishnaratne S, Littlecott H, Sell K, Burns J, Rabe JE, Stratil JM, Litwin T, Kreutz C, Coenen M, Geffert K, Boger AH, Movsisyan A, Kratzer S, Klinger C, Wabnitz K, Strahwald B, Verboom B, Rehfuess E, Biallas RL, Jung-Sievers C, Voss S, Pfadenhauer LM. Measures implemented in the school setting to contain the COVID-19 pandemic. *Cochrane Database of Systematic Reviews* 2022, Issue 1. Art. No.: CD015029. DOI: 10.1002/14651858.CD015029.

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[Rapid Review]

Measures implemented in the school setting to contain the COVID-19 pandemic

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ABSTRACT

Background

In response to the spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the impact of coronavirus disease 2019 (COVID-19), governments have implemented a variety of measures to control the spread of the virus and the associated disease. Among these, have been measures to control the pandemic in primary and secondary school settings.

Objectives

To assess the effectiveness of measures implemented in the school setting to safely reopen schools, or keep schools open, or both, during the COVID-19 pandemic, with particular focus on the different types of measures implemented in school settings and the outcomes used to measure their impacts on transmission-related outcomes, healthcare utilisation outcomes, other health outcomes as well as societal, economic, and ecological outcomes.

Search methods

We searched the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, Embase, and the Educational Resources Information Center, as well as COVID-19-specific databases, including the Cochrane COVID-19 Study Register and the WHO COVID-19 Global literature on coronavirus disease (indexing preprints) on 9 December 2020. We conducted backward-citation searches with existing reviews.

Selection criteria

We considered experimental (i.e. randomised controlled trials; RCTs), quasi-experimental, observational and modelling studies assessing the effects of measures implemented in the school setting to safely reopen schools, or keep schools open, or both, during the COVID-19 pandemic. Outcome categories were (i) transmission-related outcomes (e.g. number or proportion of cases); (ii) healthcare utilisation outcomes (e.g. number or proportion of hospitalisations); (iii) other health outcomes (e.g. physical, social and mental health); and (iv) societal, economic and ecological outcomes (e.g. costs, human resources and education). We considered studies that included any population at risk of becoming infected with SARS-CoV-2 and/or developing COVID-19 disease including students, teachers, other school staff, or members of the wider community.

Data collection and analysis

Two review authors independently screened titles, abstracts and full texts. One review author extracted data and critically appraised each study. One additional review author validated the extracted data. To critically appraise included studies, we used the ROBINS-I tool for quasi-experimental and observational studies, the QUADAS-2 tool for observational screening studies, and a bespoke tool for modelling studies. We synthesised findings narratively. Three review authors made an initial assessment of the certainty of evidence with GRADE, and several review authors discussed and agreed on the ratings.

Main results

We included 38 unique studies in the analysis, comprising 33 modelling studies, three observational studies, one quasi-experimental and one experimental study with modelling components.

Measures fell into four broad categories: (i) measures reducing the opportunity for contacts; (ii) measures making contacts safer; (iii) surveillance and response measures; and (iv) multicomponent measures. As comparators, we encountered the operation of schools with no measures in place, less intense measures in place, single versus multicomponent measures in place, or closure of schools.

Across all intervention categories and all study designs, very low- to low-certainty evidence ratings limit our confidence in the findings. Concerns with the quality of modelling studies related to potentially inappropriate assumptions about the model structure and input parameters, and an inadequate assessment of model uncertainty. Concerns with risk of bias in observational studies related to deviations from intended interventions or missing data. Across all categories, few studies reported on implementation or described how measures were implemented. Where we describe effects as 'positive', the direction of the point estimate of the effect favours the intervention(s); 'negative' effects do not favour the intervention.

We found 23 modelling studies assessing *measures reducing the opportunity for contacts* (i.e. alternating attendance, reduced class size). Most of these studies assessed transmission and healthcare utilisation outcomes, and all of these studies showed a reduction in transmission (e.g. a reduction in the number or proportion of cases, reproduction number) and healthcare utilisation (i.e. fewer hospitalisations) and mixed or negative effects on societal, economic and ecological outcomes (i.e. fewer number of days spent in school).

We identified 11 modelling studies and two observational studies assessing *measures making contacts safer* (i.e. mask wearing, cleaning, handwashing, ventilation). Five studies assessed the impact of combined measures to make contacts safer. They assessed transmission-related, healthcare utilisation, other health, and societal, economic and ecological outcomes. Most of these studies showed a reduction in transmission, and a reduction in hospitalisations; however, studies showed mixed or negative effects on societal, economic and ecological outcomes (i.e. fewer number of days spent in school).

We identified 13 modelling studies and one observational study assessing *surveillance and response measures*, including testing and isolation, and symptomatic screening and isolation. Twelve studies focused on mass testing and isolation measures, while two looked specifically at symptom-based screening and isolation. Outcomes included transmission, healthcare utilisation, other health, and societal, economic and ecological outcomes. Most of these studies showed effects in favour of the intervention in terms of reductions in transmission and hospitalisations, however some showed mixed or negative effects on societal, economic and ecological outcomes (e.g. fewer number of days spent in school).

We found three studies that reported outcomes relating to *multicomponent measures*, where it was not possible to disaggregate the effects of each individual intervention, including one modelling, one observational and one quasi-experimental study. These studies employed interventions, such as physical distancing, modification of school activities, testing, and exemption of high-risk students, using measures such as hand hygiene and mask wearing. Most of these studies showed a reduction in transmission, however some showed mixed or no effects.

As the majority of studies included in the review were modelling studies, there was a lack of empirical, real-world data, which meant that there were very little data on the actual implementation of interventions.

Authors' conclusions

Our review suggests that a broad range of measures implemented in the school setting can have positive impacts on the transmission of SARS-CoV-2, and on healthcare utilisation outcomes related to COVID-19. The certainty of the evidence for most intervention-outcome combinations is very low, and the true effects of these measures are likely to be substantially different from those reported here. Measures implemented in the school setting may limit the number or proportion of cases and deaths, and may delay the progression of the pandemic. However, they may also lead to negative unintended consequences, such as fewer days spent in school (beyond those intended by the intervention). Further, most studies assessed the effects of a combination of interventions, which could not be disentangled to estimate their specific effects. Studies assessing measures to reduce contacts and to make contacts safer consistently predicted positive effects on transmission and healthcare utilisation, but may reduce the number of days students spent at school. Studies assessing surveillance and response measures predicted reductions in hospitalisations and school days missed due to infection or quarantine, however, there was



mixed evidence on resources needed for surveillance. Evidence on multicomponent measures was mixed, mostly due to comparators. The magnitude of effects depends on multiple factors. New studies published since the original search date might heavily influence the overall conclusions and interpretation of findings for this review.

PLAIN LANGUAGE SUMMARY

Measures implemented in the school setting to contain the COVID-19 pandemic

What was studied in the review?

In order to reduce the spread of the virus that causes COVID-19, many governments and societies put mitigation measures in place in schools. However, we do not know whether these measures work with regards to reducing the spread of the virus, or how these measures affect other aspects of life, such as education, the economy or society as a whole.

What are measures implemented in the school setting?

Measures in the school setting can be grouped into the following four broad categories.

1. *Measures reducing the opportunity for contacts*: by reducing the number of students in a class or a school, opening certain school types only (for example primary schools) or by creating a schedule by which students attend school on different days or in different weeks, the face-to-face contact between students can be reduced.

2. *Measures making contacts safer*: by putting measures in place such as face masks, improving ventilation by opening windows or using air purifiers, cleaning, handwashing, or modifying activities like sports or music, contacts can be made safer.

3. *Surveillance and response measures*: screening for symptoms or testing sick or potentially sick students, or teachers, or both, and putting them into isolation (for sick people) or quarantine (for potentially sick people).

4. Multicomponent measures: measures from categories 1, 2 and 3 are combined.

What is the aim of the review?

We aimed to find out which measures implemented in the school setting allow schools to safely reopen, stay open, or both, during the COVID-19 pandemic.

What did we do?

We searched for studies that looked at the impact of these types of measures in the school setting on the spread of the virus that causes COVID-19, the impact on the healthcare system (i.e. how many hospital beds are needed), as well as important social aspects (i.e. how often students attended school). The studies could focus on students, teachers and other school staff, as well as on families and the whole community. They could use real-life data (observational studies) or data from computer-generated simulations (modelling studies).

What are the main results of the review?

We found 38 relevant studies. Most of these were modelling studies (33 studies). Five studies used real-world data. Twenty studies were conducted in North or South America, 16 in Europe and two in China.

Below we summarise the main findings by category.

1. Measures reducing the opportunity for contacts

We found 23 modelling studies assessing measures to reduce the opportunity for contacts. All studies showed reductions in the spread of the virus that causes COVID-19 and the use of the healthcare system. Some studies also showed a reduction in the number of days spent in school due to the intervention.

2. Measures making contacts safer

We found 11 modelling studies and two real-world studies looking at measures, such as mask wearing in schools, cleaning, handwashing, and ventilation. Five of these studies combined multiple measures, which means we cannot see which specific measures worked and which did not. Most studies showed reductions in the spread of the virus that causes COVID-19; some studies, however, showed mixed or no effects.

3. Surveillance and response measures



We found 13 modelling studies and one real-world study assessing surveillance and response measures. Twelve studies focused on mass testing and isolation measures, while two looked specifically at symptom-based screening and isolation. Most studies showed results in favour of the intervention, however some showed mixed or no effects.

4. Multicomponent measures

We found three studies that looked at multicomponent interventions, where it was not possible to determine the effect of each individual intervention. These included one modelling study and two real-world studies. These studies assessed physical distancing, modification of activities, cancellation of sports or music classes, testing, exemption of high-risk students, handwashing, and face masks. Most studies showed reduced transmission of the virus that causes COVID-19, however some showed mixed or no effects.

How confident are we in the findings of this review?

Our confidence in these results is limited. Most studies used models, that is, they estimated the effects of the interventions rather than observing outcomes. As the models are built on assumptions about how the virus spreads and how people behave, we lack real-world evidence. Many studies were published as 'preprints' without undergoing rigorous checks of published studies, which further limits our confidence. Also, the studies were very different from each other (for example, with regards to the levels of transmission in the community).

What are the key messages?

Reopening schools or keeping schools open while having a broad range of measures in place can reduce transmission of the virus that causes COVID-19. Such measures can also reduce the number of people who will need to go to hospital due to developing COVID-19. We still know very little about other consequences of these measures, such as those linked to education, resources, and physical or mental health, as this knowledge is mostly based on studies modelling the real world. More studies set in the real world using real-world data are needed.

How up to date is this evidence?

The evidence is up-to-date to December 2020.



SUMMARY OF FINDINGS

Summary of findings 1. Summary of findings: measures reducing the opportunity for contacts

Reducing opportunity for contacts: reducing the number of students and contacts*			
Outcome	Number of studies	Summary of findings	Certainty of evi- dence
Outcome category:	transmission-related o	outcomes	
Number or propor- tion of cases	13 modelling stud- ies (Baxter 2020; Bershteyn 2020; Di Domenico 2020a; Germann 2020; Gill 2020; Head 2020; Jones 2020; Kaiser 2020; Keeling 2020; Mauras 2020; Panovska-Grif- fiths 2020a; Shelley 2020)	All studies except for one predicted that reducing the number of students and thus reducing the number of contacts between students led to a reduction in the number or proportion of cas- es. One study predicted mixed effects (Shelley 2020). The vari- ation in the magnitude of effect might be explained by the lev- el of community transmission, susceptibility of individuals to a SARS-CoV-2 infection as well as implementation of communi- ty-based interventions.	Very low ^{a,c,d,f} ⊕⊖⊃⊖
Risk of infection	2 modelling stud- ies (Cohen 2020; Es- paña 2020)	Both studies predicted that reducing the number of students and thus reducing the number of contacts between students led to a reduction in the risk of infection. In one study, relative to a scenario with operating schools at full capacity and with- out face masks, a reduction in students led to a proportional re- duction in the risk of infection (España 2020). In another study, reducing the number of students to 50% by introducing alter- nating attendance schedules led to a predicted risk of infection in students between 0.2% to 3.1% and 0.4% to 4.3% in teach- ers and staff (Cohen 2020). One study predicted that the low- est risk of infection can be achieved by limiting attendance to primary school students and reducing their cohort size by 50% (risk of infection in teachers: 0.2% to 0.7%; risk of infection in students: 0.1% to 1.0%) (Cohen 2020). The variation in the mag- nitude of effect might be explained by varying levels of suscep- tibility of individuals to a SARS-CoV-2 infection, age of the stu- dents targeted by the intervention as well as the level of com- munity transmission.	Very low ^{b,c,f} ⊕∞∞
Reproduction num- ber	6 modelling stud- ies (Cohen 2020; Keeling 2020; Lan- deros 2020; Lee 2020; Phillips 2020; Zhang 2020)	All but one study predicted that reducing the number of stu- dents and thus reducing the number of contacts between stu- dents led to a reduction in the reproduction number. One study predicted no consistent trend across different scenarios of al- ternating schedules and reduction of students (Cohen 2020). The variation in the magnitude of effect might be explained by the level of community transmission as well as the age of stu- dents targeted by the intervention.	Very low ^{b,c,d,f} ⊕○○○
Number or propor- tion of deaths	5 modelling studies (Baxter 2020; Ger- mann 2020; Head 2020; Keeling 2020; Panovska-Griffiths 2020a)	All studies predicted that reducing the number of students and thus reducing the number of contacts between students led to a reduction in the number or proportion of deaths when com- pared to schools operating without measures in place. In all populations (general population; teachers and staff; students), the number of deaths was reduced by reducing the number of students. The variation in the magnitude of effect might be	Very low ^{b,c,f} ⊕○○○



		explained by the level of community transmission, age of stu- dents, susceptibility of children to a SARS-CoV-2 infection as well as implementation of community-based interventions.	
Risk of death	1 modelling study (España 2020)	One study predicted that reducing the number of students and thus reducing the number of contacts between students led to a reduction in the risk of death in various populations (stu- dents, teachers, general population) when compared to oper- ating schools without any measures. If only 50% of all students attend school, the risk of death can be reduced to 3.0% (95% Cl 3.0% to 3.0%) in teachers, in family members to 0.4% (95% Cl 0.4% to 0.5%) and in the general population to 4.0% (95% Cl 4.0% to 5.0%) if countermeasures such as face masks are in place.	Very low ^{b,c,e,f} ⊕○○○
Shift in pandemic development	5 modelling stud- ies (Alvarez 2020; Germann 2020; Lan- deros 2020; Mauras 2020; Phillips 2020)	All studies predicted that reducing the number of students and thus reducing the number of contacts between students led to a positive shift in the pandemic development when compared to schools operating without measures in place. In all studies, the reduction in the number of students was predicted to slow the pandemic development, reduce the length of an outbreak or time until the maximum intensive care bed capacity would be achieved. The variation in the magnitude of effect might be explained by the implementation of community-based inter- ventions.	Very low ^{b,c,f} ⊕○○○
Number or pro- portion of infected schools	1 modelling study (Aspinall 2020)	One study predicted that reducing the number of students and thus reducing the number of contacts between students led to a reduction in the number of schools with at least one in- fected individual when compared to operating schools with- out any measures. With all students attending, the proportion and number of schools with at least one infected individual on the premises ranged between 4% and 20% (661 to 3310 primary schools); if only a third of all primary school students attending, the risk could be reduced to 1% and 5.5% of primary schools (178 to 924 schools). The variation in the magnitude of effect might be explained by the level of community transmission.	Very low ^{b,c,e,f} ⊕○○○
Risk of transmission to other schools	1 modelling study (Munday 2020)	One study predicted that reducing the number of students and thus reducing the number of contacts between students led to a reduction in the risk of transmission to another school when compared to operating schools without measures in place. While the risk ranged between 0.42% and 3.6% for 100% at- tendance, it was the lowest if only certain grades of primary school attended school, with the risk ranging between 0.01% and 0.09%. The variation in the magnitude of effect might be explained by the level of community transmission.	Very low ^{b,c,e,f} ⊕⊖⊖⊃
Outcome category: h	ealthcare utilisation		
Number or propor- tion of hospitalisa- tions	2 modelling stud- ies (Germann 2020; Head 2020)	Both studies predicted that reducing the number of students and thus reducing the number of contacts between students led to a reduction in the number or proportion of hospitalisa- tions when compared to operating school without any mea- sures. The variation in the effect might be explained by the lev- el of community transmission, susceptibility of individuals to a SARS-CoV-2 infection as well as implementation of communi- ty-based interventions.	Very low ^{b,c,f} ⊕○○○



Number or propor- tion of cases requir- ing intensive care	3 modelling stud- ies (Alvarez 2020; Di Domenico 2020a; Keeling 2020)	All studies predicted that reducing the number of students and thus reducing the number of contacts between students led to a reduction in the number or proportion of cases requiring in- tensive care when compared to operating school without any measures. The variation in effect might be explained by the lev- el of community transmission, age of students, susceptibility of individuals to a SARS-CoV-2 infection as well as implementation of community-based interventions.	Very low ^{b,c,f} ⊕○○○
Outcome category:	societal, economic and	lecological outcomes	
Number of days spent in school	3 modelling stud- ies (Cohen 2020; Gill 2020; Phillips 2020)	Three studies assessed the number of days spent in school. Of these, two studies predicted that reducing the number of students and thus reducing the number of contacts between students led by design to a reduction in the number of planned days spent in school (60% to 83% of all school days to be spent at home as shown by one study) when compared to operating schools without measures in place. In one study, the number of days lost to classroom closures varies between 76.0 \pm 59.5 SD for a ratio of students to teacher of 8:1 and 1157.7 \pm 684.3 SD for a ratio of 30:1. The variation in the magnitude of effect might be explained by the level of community transmission.	Very low ^{b,c,d,f} ⊕∞
Reducing opportuni	ty for contacts: reduci	ng contacts*	
Outcome	Number of studies	Summary of findings	Certainty of evi- dence
Outcome category:	ransmission-related o	utcomes	
Number or propor- tion of cases	3 modelling stud- ies (Cohen 2020; Gill 2020; Head 2020)	All studies predicted that reducing the number of contacts be- tween students led to a reduction in the number or proportion of cases. One study reported a reduction in the cumulative in- fection rate from between 6.4% and 17.2% for students and be- tween 9.5% and 24.6% for teachers and school staff, depending on the level of community transmission (Cohen 2020). The vari- ation in the magnitude of effect might be explained by the level of community transmission and susceptibility of individuals to a SARS-CoV-2 infection.	Very low ^{b,c,f} ⊕∞∞
Reproduction num- ber	3 modelling stud- ies (Cohen 2020; Phillips 2020; Rozh- nova 2020)	Two studies predicted that compared to operating schools without reducing the number of contacts, a reduction in the number of contacts between students led to a reduction in the reproduction number. One study graphically predicted that re- ducing the number of contacts while maintaining the number of students at 100% did not have a large impact on the reduc- tion in the reproduction number (Phillips 2020). The variation in the magnitude of effect might be explained by the susceptibili- ty of individuals to a SARS-CoV-2 infection.	Very low ^{b,c,f} ⊕∞∞
Shift in pandemic development	2 modelling stud- ies (Landeros 2020; Phillips 2020)	One study predicted that reducing the number of contacts be- tween students led to a positive shift in the pandemic develop- ment (Landeros 2020). Implementing an alternating attendance schedule by creating rotating cohorts with a weekly rotating schedule extends the period of instruction from 10 to 12 weeks to 18 to 22 weeks until reaching the stopping rule on cumu- lative prevalence of 5%. With regards to the length of an out- break, one study predicts that an alternating attendance sched- ule, while maintaining the number of students, performs slight- ly better with regards to mean and median outbreak lengths	Very low ^{b,c,d,f} ⊕○○○



than a non-alternating attendance schedule (Phillips 2020), but probably not in a significant way (results presented graphically).

Outcome category: healthcare utilisation				
Number or propor- tion of hospitalisa- tions	2 modelling stud- ies (Germann 2020; Head 2020)	Two studies predicted that reducing the number of contacts between students led to a reduction in the number and propor- tion of individuals requiring hospitalisation. The variation in the magnitude of effect might be explained by the susceptibility of individuals to a SARS-CoV-2 infection, co-interventions, the lev- el of community transmission, as well as the age of students.	Very low ^{b,c,d,f} ⊕∞∞	
Outcome category: s	Outcome category: societal, economic and ecological outcomes			
Number of days spent in school	3 modelling stud- ies (Cohen 2020; Gill 2020; Phillips 2020)	Two studies predicted that reducing the number of contacts by implementing an alternating attendance schedule or enforcing that students remain within their classroom led to more days spent in school than when the number of contacts are not reduced (Gill 2020; Phillips 2020). One study predicted no effect: reducing the number of contacts between cohorts alongside other countermeasures (non-pharmaceutical interventions; screening) predictably leads to an equal percentage of school days spent at home as if no measures would be in place (~5% to 10%) (Cohen 2020).	Very low ^{b,c,d,f} ⊕∞∞	

CI: confidence interval; SARS-CoV-2: severe acute respiratory syndrome coronavirus 2; SD: standard deviation.

*We differentiate between measures *reducing the number of students and contacts* (i.e. reducing the number of students on school premises automatically reduces the number of contacts with or without additional contact-reducing measures being implemented) and measures *reducing contacts* (i.e. contacts between students as well as between students and school staff can also be reduced through forming cohorts with all students present on school premises).

^aDowngraded -2 for risk of bias due to major concerns about the structural assumptions and input parameters in the majority of studies contributing to the outcome.

^bDowngraded -1 for risk of bias due to moderate or major concerns about the structural assumptions and input parameters.

^cDowngraded -1 for indirectness due to moderate or major concerns about the external validation of the model.

^dDowngraded -1 for inconsistency due to mixed or inconsistent effects in the studies contributing to the outcome.

^eDowngraded -1 for imprecision due to only one study contributing to the outcome.

^fDowngraded -1 for imprecision due to moderate or major concerns about the assessment of uncertainty in the studies in the majority of studies contributing to the outcome.

Summary of findings 2. Summary of findings: measures making contacts safer

Intervention subcategory: making contacts safer - face masks			
Outcome	Number of studies	Summary of findings	Certainty of evi- dence
Outcome category: transmission-related outcomes			
Number or propor- tion of cases	3 modelling stud- ies (España 2020; Head 2020; Panovs- ka-Griffiths 2020b)	Three studies look at masks among other measures implement- ed in the school setting, and reduction in the cases avoided due to the intervention, reporting on outcomes such as (cumu- lative) number of cases or attack rates. In the studies that al- low for drawing conclusions with regard to the effect of masks, wearing masks reduced the number of cases. Studies found that full school reopening with high-face-mask adherence/a mandatory mask policy, significantly reduced the increase in community infections due to school reopening (3 times the	Very low ^{b,c,f} ⊕○○○



		number of infections), compared to scenarios with low mask adherence/no mandatory policy (España 2020; Panovska-Grif- fiths 2020b). This included a reduction from 81.7 times to 3.0 times the number of infections in the community (España 2020), and a reduction from 57% to 46% of those with sympto- matic infections needing to be tested in the community under 30% effective coverage of masks (Panovska-Griffiths 2020b). A further study found a reduction in the excess proportion of infections in the school setting at a moderate level of commu- nity transmission with mandatory masks among teachers and staff (1.73, 95% CI 2.32 to 6.29), as well as students (2.51, 95% CI 0.05 to 6.95), compared to reopening with no countermeasures (teachers and staff: 14.83, 95% CI 0.93 to 29.25), students: 14.18, 95% CI 1.63 to 26.77) (Head 2020). Insight from individual stud- ies shows factors which may impact upon the magnitude of ef- fect, such as the initial level of COVID-19 incidence, as well as the assumed compliance with wearing masks.	
Reproduction num- ber	1 modelling study (Sruthi 2020)	One study showed the positive effect of a mask policy on the re- production number. The study showed that wearing masks in secondary schools in Switzerland led to an estimated reduction in the general population of R by 0.011 (95% CI 0.008 to 0.0127). However, there is no consideration of compliance in the model.	Very low ^{a,c,e} ⊕೦೦೦
Number or propor- tion of deaths	2 modelling studies (España 2020; Head 2020)	Two studies examined impact of a mask policy on the number or proportion of deaths as an outcome, finding positive result- s. Head 2020 found a lower proportion of excess deaths experi- enced by students (0 (95% CI 0 to 0)) and school staff and teach- ers (0.44 (95% CI 0 to 0.44)) if schools reopened with mandato- ry mask wearing, compared to school reopening with no coun- termeasures (students: 0.01 (95% CI 0 to 0.01); school staff and teachers: 2.97 (95% CI 0 to 47.17)). These findings assumed moderate community transmission. España 2020 focused on the general population, finding that, under a scenario with high capacity and high face-mask adherence, there would be a de- crease in the ratio of the cumulative number of deaths in the overall population of 1.5 (95% CI 1.5 to 1.6).	Very low ^{b,c,f} ⊕∞∞
Outcome category:	healthcare utilisation		
Number or propor- tion of hospitalisa- tions	1 modelling study (Head 2020)	One study looked at the impact of a mask policy on the num- ber or proportion of hospitalisations and found positive re- sults. The study demonstrated that mandatory mask wearing in schools when reopening would lead to reduced hospitali- sations among students, staff, household members and com- munity members compared to reopening with no measures in place. The study predicts that mandatory mask wearing in schools when reopening all schools would lead to reduced hos- pitalisations among students, staff, household members and community members. For teachers/staff, the excess rate of hospitalisations per 10,000 of the subpopulation would be re- duced to 4.2 (95% CI -47.39 to 48.09) from 40.5 (95% CI -46.95 to 146.64). For students this decreases to 0.07 (95% CI 0.00 to 0.01) from 0.08 (95% CI 0.00 to 0.08). The size of this effect is moder- ated by level of community transmission, type of school and whether children are considered half or equally susceptible as adults. In general, higher transmission, high schools, and in- creased relative susceptibility of children lead to a higher num- ber of cumulative infections across scenarios.	Very low ^{b,c,e} ⊕○○○



Intervention subcat	egory: making contact	s safer - cleaning	
Outcome	Number of studies	Summary of findings	Certainty of evi- dence
Outcome category:	transmission-related o	outcomes	
Reproduction num- ber	1 modelling study (Kraay 2020)	One study assessed the impact of an enhanced cleaning policy on the reproductive number and showed positive results. The study found that compared to eight-hourly and four-hourly sur- face cleaning and disinfection, hourly cleaning and disinfection alone could bring the fomite R below 1 in some office settings, particularly combined with reduced shedding, but would be in- adequate in schools. This study did not take into account direct transmission through droplet spray, aerosols and hand-to-hand contact.	Very low ^{b,c,e} ⊕୦୦୦
Intervention subcat	egory: making contact	s safer - handwashing	
Outcome	Number of studies	Summary of findings	Certainty of evi- dence
Outcome category:	transmission-related o	outcomes	
Reproduction num- ber	1 modelling study (Kraay 2020)	One study assessed the impact of handwashing on the repro- duction number and suggested no impact. While results are on- ly presented in a graphical way, it predicted that handwashing (hourly with 100% effectiveness) compared to no handwashing did not make a difference with regards to the projected repro- duction number from fomite transmission.	Very low ^{b,c,e} ⊕∞∞
Outcome category:	other health outcomes	5	
Physical health	1 observational/experimental study (Simonsen 2020)	One study found that 6.5% (2000 of 30,907; 95% CI 6.2 to 6.8) of children had hand eczema prior to school closures, 14.1% (4363 of 30,907; 95% CI 13.7 to 14.5) of students had hand eczema before reopening of schools on 15 April 2020. This prevalence increased to 50.5% (15,595 of 30,907; 95% CI 49.9 to 51.0) after the children returned to school and the strict hand hygiene regimen (handwashing for 45 to 60 seconds every 2 hours; after arrival, before and after meals, after toilet visits, after coughing or sneezing or whenever hands were visibly dirty) was implemented, which was a statistically significant increase of 36.3% (P < 0001).	Low ^e ##00
Intervention subcat	egory: making contact	s safer - modification of activities	
Outcome	Number of studies	Summary of findings	Certainty of evi- dence
Outcome category:	transmission-related o	outcomes	
Reproduction num- ber	1 modelling study (Lazebnik 2020)	One study assessed the impact of changing the length of the school day and found that keeping schools open with longer school hours (8 to 9 hours) each day would reduce R by 0.83 compared to a policy in which children go to school every other day for five hours.	Very low ^{a,c,e} ⊕○○○
Intervention subcat	egory: making contact	s safer - ventilation	



Outcome	Number of studies	Summary of findings	Certainty of evi- dence
Outcome category:	transmission-related o	outcomes	
Concentration of aerosol particles containing RNA virus in the room and inhaled dose of RNA virus for a sus- ceptible person	1 modelling study (Curtius 2020)	One study assessed the effect of four air purifiers equipped with HEPA filters in a high school classroom in Germany with an in- fected person in the room with regards to the inhaled dose of particles containing RNA virus. This dose is reduced by a factor of six. The density of people in the room can be considered an effect modifier.	Very low ^{a,c,e} ⊕○○○
Intervention subcat	egory: making contact	ts safer - combined measures to make contacts safer	
Outcome	Number of studies	Summary of findings	Certainty of evi- dence
Outcome category:	transmission-related o	outcomes	
Number or propor- tion of cases	4 modelling stud- ies (Cohen 2020; Germann 2020; Gill 2020; Monod 2020)	All studies looked at the impact of combined measures to make contacts safer on the number or proportion of cases and found positive results overall. Those which reported on community level transmission found a reduction in total number of infec- tions, although specific figures were not reported (Gill 2020), and reduction in the number of cases from 59.7 million when schools reopened with no countermeasures to 2.3 million and 2.0 million in 40% partial online learning scenarios, with 'ide- al social distancing' (assumed 50% reduction in contacts due to face masks, hygiene, and distancing measures) (Germann 2020). Those which reported on school level outcomes found that implementing a variety of infection control measures led to a reduction in the cumulative COVID-19 infection rate among students, teachers, and staff over four-fold (Cohen 2020), and a reduction in total number of infections, although specific fig- ures were not reported (Gill 2020).	Very low ^{b,c,f} ⊕⊖⊖⊃
Reproduction num- ber	2 modelling stud- ies (Cohen 2020; Phillips 2020)	Two studies examined effective reproduction number as an outcome, with both studies finding a positive effect. Both studies presented results graphically, making it difficult to determine effect sizes. One study showed that all modelled scenarios with combined measures to make contacts safer would reduce the effective reproduction number to < 1, compared with full school reopening with full attendance and no measures in place (Cohen 2020). The other study compared high with low-transmission settings in primary schools and suggested that the effective reproduction number is consistently lower in a low-transmission setting (Phillips 2020).	Very low ^{a,c,f} ⊕୦୦୦
Number or propor- tion of deaths	2 modelling stud- ies (Germann 2020; Monod 2020)	Two modelling studies assessed combined measures to make contacts safer on the number or proportion of deaths as an out- come, finding mixed results, one positive (Germann 2020), and one unclear result (Monod 2020). One study found that when fewer workplaces were open, all four 40% partial online learn- ing scenarios, with alternating days or weeks of attendance were found to reduce deaths. Although a larger decrease to 25,474 and 27,874 was observed in scenarios where a 50% re- duction in contacts due to mask wearing or reduced social dis- tancing with minimal mask use was assumed within the mod- el, compared to 230,451 deaths during full school reopening	Very low ^{b,c,f} ⊕⊖⊖⊖

Cochran Library	e Trusted evidence. Informed decisions. Better health.	Cochrane Data	pase of Systematic Reviews
		with no countermeasures (Germann 2020). However, the oth- er study estimated a 12.6% (95% CI 7.4% to 22.7%) increase in deaths among children and the general population as a re- sult of schools reopening with countermeasures, compared to keeping schools closed (Monod 2020).	
Shift in pandemic development	1 modelling study (Germann 2020)	One study assessing combined measures to make contacts safer compared high with low-transmission settings in prima- ry schools. With results presented in a graphical way, they im- plied that the mean duration of the outbreak is shorter in low- transmission than high-transmission settings in all student to teacher ratios except for the 30:1 ratio.	Very low ^{b,c,e,f} ⊕○○○
Outcome category:	healthcare utilisation		
Number or propor- tion of hospitalisa- tions	1 modelling study (Germann 2020)	One study looked at the impact of combined measures to make contacts safer on the number or proportion of hospitalisations, and found that when fewer workplaces were open, all partial online learning scenarios, with ideal social distancing (defined as a 50% reduction in contacts due to physical distancing, hy- giene and masks), were found to avert between 543,977 and 1,708,197 hospitalisations. Moreover, for these scenarios, hos- pitalised cases during the peak four weeks ranged from 59,056 to 354,878, compared to a baseline scenario of 685,747 with schools reopening with full attendance and no measures in place.	Very low ^{b,c,e} ⊕○○○
Outcome category:	societal, economic and	d ecological outcomes	
Number of days spent in school	2 modelling studies (Gill 2020; Phillips 2020)	Two studies examined the outcome of number of days spent in school. One study found that at very low community infec- tion rates (10 reported infections per 100,000 population over the last seven days), most students can expect to attend near- ly every day even in schools operating full-time, as long as schools implement multiple interventions. It is not possible to determine effect size due to lack of reporting (Gill 2020). The other study compared high with low transmission settings in primary schools. Except for a ratio of 30:1, the number of stu- dent days lost to closure was consistently higher in low trans- mission settings. The predicted number of student days lost was 76.0 \pm 59.5 for a ratio of 8:1, 270.2 \pm 195.6 for a ratio of 15:1 and 1157.7 \pm 684.3 for a ratio of 30:1 in a low transmission set- ting while it was 111.2 \pm 72.8; 389.9 \pm 202.0 and 1093.9 \pm 396.1 for a high transmission setting (Phillips 2020).	Very low ^{a,c} ⊕000

CI: confidence interval.

^aDowngraded -2 for risk of bias due to major concerns about the structural assumptions and input parameters in the majority of studies contributing to the outcome.

^bDowngraded -1 for risk of bias due to moderate or major concerns about the structural assumptions and input parameters.

^cDowngraded -1 for indirectness due to moderate or major concerns about the external validation of the model.

^dDowngraded -1 for inconsistency due to mixed or inconsistent effects in the studies contributing to the outcome.

^eDowngraded -1 for imprecision due to only one study contributing to the outcome.

^fDowngraded -1 for imprecision due to moderate or major concerns about the assessment of uncertainty in the studies in the majority of studies contributing to the outcome.

Summary of findings 3. Summary of findings: surveillance and response measures

Intervention subcategory: surveillance and response measures - mass testing and isolation



Outcome	Number of studies	Summary of findings	Certainty of evi- dence
Outcome category: t	ransmission-related o	outcomes	
Number or propor- tion of cases	7 modelling stud- ies (Cohen 2020; Di Domenico 2020a; Head 2020; Lyng 2020; Panovs- ka-Griffiths 2020a; Tupper 2020; Williams 2020)	The seven studies that looked at the impact of mass testing and isolation interventions on the number or proportion of cas- es all found positive results. Cohen 2020 found that measures that limit transmission and detect, trace, and quarantine cases within schools could lead to reductions in the cumulative COV- ID-19 infection rate among students, teachers, and staff by over 14-fold. However, these measures were implemented along- side classroom cohorting, face masks, physical distancing, and handwashing protocols in schools, so it is not possible to com- ment on the impact of these measures alone. Head 2020 sug- gested that although testing and isolation strategies could lead to reductions in transmission, their effectiveness on their own was low, and when combined with strict social-distancing mea- sures, and a reduction in community transmission, they could be more effective.	Very low ^{b,c,f} ⊕○○○
Number of cases detected	1 observational/ex- perimental study (Hoehl 2020)	One observational study looked at the impact of mass testing strategies on the number of cases detected due to the interven- tion. The main goal of the study was to evaluate the practical application of a self-performed, high-frequency antigen test in a school setting and 10,768 of these tests (99.37%) were record- ed to have been valid and 113 negative, 47 (0.43%) were record- ed as invalid and 21 (0.19%) as positive (either true or false). The study found that 0.15% of all antigen tests (16 tests) gave false-positive results.	Very low ^{a,c,e} ⊕∞∞
Reproduction num- ber	1 modelling study (Panovska-Griffiths 2020a)	One study looked at two different testing strategies and found that test-trace-isolate strategies would need to test a suffi- ciently large proportion of the population with COVID-19 symp- tomatic infection and trace their contacts with sufficiently large coverage, for R to diminish below 1.	Very low ^{a,c,e} ⊕○○○
Number or propor- tion of deaths	2 modelling stud- ies (Head 2020; Panovska-Griffiths 2020a)	Two studies assessed the impact of testing and isolation strate- gies on the number and proportion of deaths. They showed positive results overall. One study only showed results in a graphical way and suggested that more intense testing and iso- lation measures would lead to fewer deaths than less intense measures (Panovska-Griffiths 2020a). The other study found that, under a testing strategy, the excess proportion of deaths in teachers would be 8.12 (95% CI 0.00 to 47.85), compared to 0 for students and 0.5 (95% CI -2.72 to 3.68) in the community (Head 2020). The effect sizes are moderated by the model para- meters such as relative susceptibility and infectiousness of chil- dren, and extent of community transmission amid reopening. The effect sizes are moderated by the model parameters, such as relative susceptibility and infectiousness of children, and ex- tent of community transmission amid reopening.	Very low ^{b,c,f} ⊕∞∞
Shift in pandemic development	4 modelling stud- ies (Landeros 2020; Panovska-Griffiths 2020a; Panovs- ka-Griffiths 2020b; Williams 2020)	The four studies that assessed the impact of mass testing and isolation strategies on the timing and progression of the epi- demic found that testing and isolation could slow or prevent a second wave of the epidemic. The studies suggest that the tim- ing of the epidemic depends on the degree to which testing and isolation strategies are being implemented and the combina- tion of testing and tracing.	Very low ^{b,c,f} ⊕○○○



Outcome category: I	nealthcare utilisation		
Number or propor- tion of hospitalisa- tions	1 modelling study (Head 2020)	One study found that reopening schools with a weekly or monthly testing strategy for teachers and students would lead to a higher number of hospitalisations compared to reopen- ing under strategies to reduce contacts. The excess proportion of hospitalisations in teachers under a testing strategy would be 162.47 (95% CI 0.00 to 588.24), compared to students 0.58 (95% CI 0.00 to 15.27), and the community 3.68 (95% CI -7.27 to 15.54). The effect sizes are moderated by the model parame- ters, such as relative susceptibility and infectiousness of chil- dren, and extent of community transmission amid reopening.	Very low ^{a,c,e} ⊕∞∞
Outcome category:	societal, economic and	l ecological outcomes	
Numbers of days spent in school	1 modelling study (Gill 2020)	One study found that policies that close the school when in- fections are detected substantially reduce the total number of days that students can attend in person. These effects are larg- er in schools operating full-time than in schools using hybrid approaches. In secondary schools where students are attend- ing daily and the community infection rate is at a moderate lev- el, closing the school for 14 days for each detected infection would be highly disruptive. Even in the absence of a school clo- sure policy, quarantines of the classmates and bus mates of in- fected students are likely to reduce in-person attendance for the typical student.	Very low ^{a,c,e} ⊕○○○
Resource costs	3 modelling studies (Campbell 2020b; Lyng 2020; Williams 2020)	Three studies looked at the cost of testing interventions and showed mixed results. One study used health economic mod- elling to look at the human resource costs of testing strategies. The study found that testing students and employees in pri- mary and secondary schools over 1.5 months would cost CAD 816.0 million, compared to no intervention. Another study iden- tified one high-performing strategy of community-based test- ing with a per person per day cost as low as USD 1.32.	Very low ^{b,c,f} ⊕○○○
Intervention subcate	egory: symptom-based	d screening and isolation	
Outcome	Number of studies	Summary of findings	Certainty of evi- dence
Outcome category: t	ransmission-related o	utcomes	
Number or propor- tion of cases	2 modelling stud- ies (Bershteyn 2020; Burns A 2020)	Two studies found that policies that screen and isolate suspect- ed cases can, overall, decrease the attack rate. The most effec- tive testing and isolation strategies used a combination of ear- ly testing together with symptom screening and isolation of symptomatic cases. These strategies were often implement- ed alongside other transmission mitigation measures, such as physical distancing and cohorting, so it is not possible to assess the impact of symptom screening and quarantine measures alone.	Very low ^{b,c,f} ⊕○○○
Shift in pandemic development	1 modelling study (Burns A 2020)	One study found that implementing a policy of two days of home isolation following the last episode of fever, predicted a reduction in all outcome categories would reduce the peak number of infected people from 148 (interquartile range (IQR) 82 to 213) to 124 (IQR 58 to 184)). The interval between the first and last day with at least two cases would increase to 145 (IQR	Very low ^{a,c,e} ⊕○○○



127 to 157) from 139 (IQR 120 to 154). The effects varied according to the rate of detecting fever.

CAD: Canadian Dollars; CI: confidence interval; IQR: interquartile range; USD: US Dollars.

^{*a*}Downgraded -2 for risk of bias due to major concerns about the structural assumptions and input parameters in the majority of studies contributing to the outcome.

^bDowngraded -1 for risk of bias due to moderate or major concerns about the structural assumptions and input parameters.

^cDowngraded -1 for indirectness due to moderate or major concerns about the external validation of the model.

^dDowngraded -1 for inconsistency due to mixed or inconsistent effects in the studies contributing to the outcome.

 $^{\rm e}\mbox{Downgraded}$ -1 for imprecision due to only one study contributing to the outcome.

^fDowngraded -1 for imprecision due to moderate or major concerns about the assessment of uncertainty in the studies in the majority of studies contributing to the outcome.

Summary of findings 4. Summary of findings: multicomponent measures

Outcome	Number of studies	Summary of findings	Certainty of evi- dence
Outcome category: t	ransmission-related o	utcomes	
Number or propor- tion of cases	2 observational/ex- perimental studies (Isphording 2020; Vlachos 2020)	These two studies showed mixed results on the effectiveness of multicomponent interventions to make contacts safer on the number or proportion of cases. One study found that the intervention reduced cumulative infection rate by 0.55 or 27% of a standard deviation (Isphording 2020), while the other found that exposure to open rather than closed schools resulted in a small to moderate increase in the number of infections among parents and teachers, and their partners (Vlachos 2020).	Low ^{a,b} ⊕⊕⊖⊖
Number or propor- tion of cases	1 modelling study (Naimark 2020)	One study compared a multicomponent intervention consisting of: i) reducing the number of students; ii) reducing the number of contacts; iii) universal masking; iv) alternating attendance schedules in high schools; and v) symptom-based isolation, to full school closures. The study found that there was an in- crease in the predicted number of infections when reopening with measures compared to a full school closure scenario.	Very low ^{c,d,e} ⊕⊖⊖⊖

^aDowngraded -1 for risk of bias due to ROBINS-I rating being moderate.

^bDowngraded -1 for inconsistency due to inconsistent effects in studies contributing to the outcome.

^cDowngraded -1 for risk of bias due to major concerns about the structural assumptions and input parameters.

^dDowngraded -1 for inconsistency due to only one study contributing to the outcome.

^eDowngraded -1 for imprecision due to only one study contributing to the outcome.



BACKGROUND

Description of the condition and intervention

On 11 March 2020, the World Health Organization (WHO) declared a global pandemic of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the associated disease, COVID-19 (WHO 2020a). To contain the spread of SARS-CoV-2, national and subnational governments have implemented a variety of measures (Prem 2020), including many non-pharmaceutical interventions (Smith 2020; WHO 2019).

A multitude of settings, such as workplaces, public spaces, as well as means of transportation were affected by these nonpharmaceutical interventions. One of the most debated settings, however, was schools. In the context of the current pandemic, 192 countries had closed schools in order to reduce transmission of SARS-CoV-2 by mid-April 2020, affecting more than 90% (nearly 1.6 billion) of the world's student population (UNESCO 2021). School closures aim to reduce contacts between students and school staff by preventing them from being in close contact with each other, with the goal of reducing viral transmission between and within these groups - and with the ultimate goal of limiting levels of community transmission. Proactive (closing schools regardless of any identified cases) and reactive (closing schools in reaction to an identified case) school closures have been used historically to contain outbreaks (Chowell 2011; Isfeld-Kiely 2014). While some studies demonstrate that closures can lead to reductions in viral transmission (notably in relation to influenza infections), others suggest that closures alone are not enough to prevent community transmission, in particular in the absence of other measures (Walsh 2021). They may, however, be able to delay the peak of an epidemic and therefore allow time to implement other interventions, such as vaccinations (Fung 2015; Lee 2010). During the COVID-19 pandemic, transmissions within schools as well as school clusters (i.e. one case being responsible for a cluster of cases) have been reported in primary and secondary schools (Otte im Kampe 2020; Stein-Zamir 2020). It has, however, been shown that the incidence in schools was highly dependent on the level of community transmission and that the cases associated with schools did not play a major role in driving the pandemic (Aleta 2020; Gandini 2021; Ismail 2021).

The decision to close schools was fuelled by the uncertain role of children in the transmission of SARS-CoV-2. It is widely acknowledged that children of all ages are susceptible to SARS-CoV-2 infection (Aspinall 2020; Bershteyn 2020; Dong 2020; Han 2021), but younger children appear to be less susceptible to infection (Koh 2020; Viner 2021a). Transmission of SARS-CoV-2 by infected younger children (under approximately 12 years) appears to be lower than transmission by adults, although robust evidence is lacking (Viner 2021a). Adolescents, however, seem to be comparable to adults with respect to transmission of SARS-CoV-2 (Dattner 2020; Fontanet 2020; Park 2020). When infected, most paediatric patients (< 18 years) with COVID-19 present with mild symptoms (Davies 2020; Dong 2020; Han 2021; Laws 2021; Lee 2021), and have lower rates of hospitalisation, severe hospitalisation, and death than other age groups (Castagnoli 2020; Choi 2020; Götzinger 2020; Zimmermann 2021). There is limited evidence that 'long COVID', where various symptoms persist for more than 60 days in symptomatic and even asymptomatic cases, also affects children (Buonsenso 2021).

The evidence on the effectiveness of school closures in reducing transmission is unclear (Bin Nafisah 2018; Rashid 2015), while there is increasing evidence on significant negative implications associated with school closures for children, teachers, other school staff, parents, and for society as a whole (Christakis 2020; Golberstein 2020; Kneale 2020; Smith 2020; UNESCO 2021; Viner 2020). Notably, school closures can have negative impacts on educational outcomes and child development, and on the physical, mental, and social health of children and adolescents (Golberstein 2020, UNESCO 2020a). School closures may even lead to a decrease in gross domestic product due to the loss of economic productivity of parents and others caring for children (Kneale 2020). As well as having implications for economic productivity, school closures may also have implications for community transmission, particularly if closures are implemented before work closures, as there may be transmission from the home to the workplace. This might be particularly important in cases where parents work in healthcare settings.

In light of these negative consequences, most countries have moved beyond general school closures and instead sought ways to safely reopen schools during the pandemic (Bonell 2020; Couzin-Frankel 2020; Dibner 2020; WHO 2020b). In order to ensure that schools can safely reopen, or stay open, or both, countries have implemented a wide range of measures at the national or state level (e.g. legislation), at the level of the school, at the level of cohorts within the school (e.g. grades, classes, or faculty/ school staff), and at the individual level (including among high-risk individuals). These measures include organisational interventions, such as cohorting, staggered attendance, reduced class sizes, maskwearing policies, handwashing policies, and other interventions to either reduce contacts within schools or to make these contacts safer (Aspinall 2020; Isphording 2020; Macartney 2020; Monod 2020). They also comprise structural interventions, such as enhanced cleaning and ventilation practices (Curtius 2020; NCIRS 2020), as well as surveillance and response measures, such as preventative testing, tracing, self-isolation rules for identified cases and quarantine rules for suspected cases and their contacts (Di Domenico 2020a; Head 2020).

Why it is important to do this review

Several reviews have sought to understand the role of children and schools in the transmission of SARS-CoV-2 and their influence on the course of the pandemic (Fadlallah 2020; NCCMT 2021; Public Health Ontario 2020; Viner 2021a). While one review examined the effectiveness of school closures (Walsh 2021), we are not aware of any review that assessed the impacts of the broad range of measures implemented in the school setting in a systematic and comprehensive manner. Also, the reviews conducted to date have not assessed the impacts that these measures have on outcomes not related to SARS-CoV-2 transmission, such as transmission of other viral respiratory diseases, other health outcomes (physical, psychosocial), and broader societal, economic and ecological outcomes (Viner 2021a).

In October 2020, in consultation with the World Health Organization (WHO), the review authors developed a scoping review to map the evidence of various measures implemented in the school setting to safely reopen schools and/or keep schools open during the COVID-19 pandemic (Krishnaratne 2020). The scoping review identified 42 studies assessing a range of measures undertaken globally. Included studies used experimental, quasi-experimental,



and observational designs, as well as various mathematical and epidemiological modelling techniques. It classified measures into three broad intervention categories: organisational measures to reduce transmission of SARS-CoV-2 (e.g. mask-wearing policies, reduced class sizes, and staggered attendance), structural/ environmental measures to reduce transmission of SARS-CoV-2 (e.g. enhanced cleaning and ventilation practices), and surveillance and response measures in relation to SARS-CoV-2 infections (i.e. testing, tracing, self-isolation and quarantine measures). While the review specified four key outcome categories (transmissionrelated outcomes; healthcare utilisation; other health outcomes; and societal, economic and ecological implications), most studies focused on transmission-related outcomes. No studies described outcomes concerned with psychosocial health and well-being among students and school staff, or economic implications for parents and other carers.

The vast majority of the identified studies used various modelling techniques to assess the impact of various measures in schools, each with its own set of data and assumptions that may not have been a true reflection of the real-world setting. The scoping review concluded that there is an urgent need for empirical studies assessing the effectiveness of the measures to reduce contacts and to make contacts safer within the school setting (Krishnaratne 2020).

The scoping review informed the development of this rapid review to synthesise the evidence on the effectiveness of measures implemented in the school setting to contain the COVID-19 pandemic.

OBJECTIVES

To assess the effectiveness of measures implemented in the school setting to safely reopen schools, or keep schools open, or

both, during the COVID-19 pandemic, with particular focus on the different types of measures implemented in school settings and the outcomes used to measure their impacts.

The review aims to address the following key question.

 How effective are different types of measures implemented in the school setting at reducing transmission between students, teachers and other school staff, and in the wider community during the COVID-19 pandemic?

It also seeks to examine the following subquestions.

- What are the implications of these measures for nontransmission-related outcomes (e.g. healthcare utilisation, other health outcomes, and societal, economic and ecological outcomes)?
- · How are these measures implemented within the school setting?

METHODS

In this review, we included studies that quantitatively assess the impact of measures implemented in the school setting to safely reopen schools, or keep schools open, or both, during the COVID-19 pandemic. This rapid review was informed by a preceding scoping review (Krishnaratne 2020) that included a logic model that describes our a priori, evidence-informed understanding of the system in which the various measures are implemented (Figure 1). We used this in planning the data extraction and evidence mapping, and adapted it inductively over the course of the scoping review to include categories and subcategories as they emerged. We used the revised logic model to describe the identified evidence in the scoping review (Figure 2). Together with the resulting evidence gap map (Figure 3), it showed a significant gap in the evidence with regards to non-transmission-related outcomes.



Figure 1. A priori logic model



Figure 2. A posteriori logic model

	Implementation			
		Implementation agents		
		Implementation outcomes		
		Implementation strategies		
	Massures imp Massures to Massures to Massures - Massu - Massures - Massures - Massures - Massures - Massures - Massures - Sympto - Sympto	Measures implemented inside the school setting	Duteomes	
		Measures to reduce transmission of SARS-CoV-2	Transmission-related outcomes	
Population		Measures reducing the opportunity for contacts Measures reducing the number of students and contacts Measures reducing the number of contacts 	Number or preportion of cases Number of cases detected Number of cases detected Number of cases detected Number or preportion of infected Reproduction number schools	
Directly impacted population • Students • School staff • Teachers		Measures making contacts safer Matsu: Cleaning Handwaching Modification of activities	Aumber or proportion of deaths Aumber or proportion of deaths Aumber or proportion of trapitalisations Number or proportion of trapitalisations Number or proportion of cases requiring intensive care Other health outcomes Physical health Satisful errorses;	
Indirectly impacted population Community General population		Ventilation Combined measures to make contains safer		
1		Surveillance and response measures Mass testing and isolation measures Symptom-based screening and quarantine measures		
Measures implemented outside of the school setting		Multicomponent measures	Number of days specifies school Resources (cost)	
guarantine, Bolation) • Travel/mobility restrictions • Workfarst some ne/closes				
Operation of businesses, Limitations on gatherings, number of				



Figure 3. Evidence gap map in which each square represents the case in which a single included study evaluated a type of school measure (rows) against an outcome category (columns); additionally, the study type is provided (colour)



* Phased reopening of schools | Reduced cohort size | Staggered start/end time | Alternating attendance | Schooling in-person for certain grades/students only

** Combination of multiple measures, incl. reduced cohort size, face masks, handwashing, cleaning, modifying activities in the school setting, quarantine

We used the revised logic model as a basis for the a priori logic model informing this rapid review. The criteria for considering studies for this review, described below, are in line with the logic model.

To conduct this review, we largely adhered to the rapid review guidance issued by Cochrane (Garritty 2020), apart from double screening all titles, abstracts and full texts in order to avoid overlooking relevant studies. At least one review author checked all data extractions. One review author conducted risk of bias assessment, but this was checked and validated by at least two review authors. A minimum of two review authors applied GRADE. Moreover, in order to assure the methodological rigour of this review, we created several mechanisms. First, we assigned data extraction, risk of bias assessment and synthesis to very experienced review authors. In addition, we involved a team with extensive experience on modelling studies to support us with the data extraction, synthesis and quality assessment. All steps were piloted with the suggested number of items (i.e. piloting of text/ abstract screening with 50 records; piloting of full-text-screening with 10 studies; piloting of data extraction with five studies). We held regular team meetings and kept a list of rolling questions where we discussed arising questions. The protocol for this rapid review was reviewed and approved by Cochrane and published with the Open Science Framework (Krishnaratne 2021). Where

we adapted these methods, we transparently report on this in the Discussion section.

Criteria for considering studies

Types of studies

We included studies that provide a quantitative measure of impact, including experimental and quasi-experimental studies, observational studies, and mathematical modelling studies. Non-pharmaceutical interventions to respond to the COVID-19 pandemic had to be decided on and implemented very quickly, often without the possibility to plan and conduct high-quality evaluation studies.

Broadly, we included the following types of studies, but considered all studies providing a quantitative measure of impact, regardless of whether they fell specifically under one of the following categories.

1. Experimental and quasi-experimental studies:

- randomised controlled trials (RCTs) including cluster-RCTs;
- interrupted time series studies;
- controlled before-after studies and difference-in-differences studies;
- instrumental variable studies;
- regression discontinuity studies.
- 2. Observational studies:
- cohort studies;
- case-control studies.
- 3. Mathematical modelling studies:
- compartmental models (e.g. SEIR-type models comprising multiple compartments, such as S: susceptible, E: exposed, I: infectious, R: recovered);
- agent-based models;
- Bayesian hierarchical models (i.e. models comprising several submodels to integrate observed data as well as uncertainty);
- spatial models (i.e. modelling disease transmission spatially).

We included mixed methods studies that allowed for extraction of quantitative impact measures. For certain measures, e.g. symptom screening or testing within schools, we expected to identify a wide range of diagnostic test accuracy studies; we included such studies only if their implementation as part of a school-related measure and the resulting impact was evaluated.

We considered studies published in journals as well as those published on preprint servers.

We excluded the following types of studies and publications.

- Studies not providing a quantitative measure of impact (e.g. studies providing only a graphical summary of the development of the number of cases over time in relation to the introduction of control measures, qualitative studies).
- Diagnostic studies that did not provide a quantitative measure of impact beyond sensitivity and specificity (e.g. test accuracy studies assessing the sensitivity and specificity of different screening or diagnostic tests).

- Non-empirical studies (e.g. commentaries, editorials, literature reviews not reporting primary empirical data).
- Systematic reviews (although these were used for backward and forward citation tracking; Appendix 1).
- Conference abstracts and reports.

Setting

For this review, we considered schools as any setting with the primary purpose to provide regular education to children between 4 and 18 years of age. Most countries distinguish between primary or elementary education and secondary education. The school could be either an institution where students live on the premises (e.g. boarding school) or a day school. We defined the school setting as the school, the school grounds, vehicles to arrive at, return from or move around in or between school premises, or any setting related to any activity organised by or linked to the school. Measures might affect activities carried out in the classroom, during breaks, during dining, in hallways, in bathrooms, in faculty rooms, or during transportation and movement around the campus. Further, by measures 'in and around' the school, we refer to activities such as public transportation to and from the school, as well as activities between students, staff, and other populations that take place before/after school, which would not have taken place if schools were not open. These include structured activities, such as the participation in sports or other extracurricular activities, as well as informal activities, such as leisure time before and after school, long lunch breaks for older students, and businesses/cafés visited by students and staff throughout the school day. The context surrounding schools was also considered in the synthesis and interpretation of results. Whilst setting refers to the physical location of an intervention, context has been defined as "a set of characteristics and circumstances that consist of active and unique factors within which the implementation is embedded" (Pfadenhauer 2017). In addition, implementation has been defined as, "an actively planned and deliberately initiated effort with the intention to bring a given intervention into policy and practice within a particular setting" (Pfadenhauer 2017). Thus, we also considered how the intervention interacts with the setting, as well as context and implementation aspects to produce various outcomes.

Types of participants

Different groups of people are impacted by measures implemented in the school setting. These include those directly impacted in the school setting, such as students, their teachers, and other school staff. Other populations impacted less directly and outside of the school setting include carers, families and friends of students, as well as members of the wider community in which schools are embedded. Specifically, we included studies that described populations at risk of becoming infected with SARS-CoV-2, or developing COVID-19 disease, or both.

Particular populations of interest in this review were:

- students between 4 and 18 years of age (selected studies that include participants outside of this age range, e.g. studies of a German school which also included some 19-year-old students, were included);
- · teachers working in the school setting;
- other staff working in the school setting; and

• individuals indirectly impacted by the school setting (i.e. general population, parents/carers).

We excluded studies targeting non-human transmission.

Types of interventions

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We included studies that assessed the effectiveness of measures implemented in the school setting and the wider community during the COVID-19 pandemic. These can be implemented at: (i) the macro level (e.g. national or regional legislation); (ii) the school level; (iii) the level of groups, including student cohorts, classes, grades or faculty/school staff; and (iv) the level of the individual, including students and teachers at elevated risk of infection or adverse health consequences of COVID-19, as well as students with special learning needs, or from disadvantaged families, or both.

In the scoping review, we categorised interventions into three broad categories, i.e. organisational measures to reduce transmission of SARS-CoV-2; structural/environmental measures to reduce transmission of SARS-CoV-2; and surveillance and response measures in relation to SARS-CoV-2 infections. In the process of conducting this review, we found that most studies focus on transmission-related outcomes, and that many interventions are being implemented in combination with each other. As a result, we arranged these a priori intervention categories into the following four broad intervention categories.

- Measures reducing the opportunity for contacts: policies addressing the timing and organisation of school activities (e.g. cohorting, alternating physical presence, and staggered arrival/departure, breaks, and extracurricular activities, blended learning).
- **Measures making contacts safer**: policies addressing the behaviour of students, or school staff, or both (e.g. mask mandates, distancing regulations, and handwashing guidelines). Measures altering the physical environment (e.g. enhanced cleaning and ventilation practices, adding physical barriers to help individuals avoid contact, and adaptations to transportation).
- Surveillance and response measures: strategies to screen, or test, or both, individuals, or groups, or both (e.g. polymerase chain reaction (PCR) testing of students or staff with symptoms, antigen testing of students or staff without any symptoms) and subsequent action (e.g. reactive dismissal of potentially infected individuals, stay-at-home orders for students or staff who have come into contact with an infected individual).
- Multicomponent measures: strategies using a combination of at least two of the aforementioned categories.

In Table 1, the intervention categories as well as the respective subcategories are described in detail.

We excluded studies if:

- they only described interventions not directly intended to reduce the transmission of SARS-CoV-2 (e.g. improvements to online learning platforms); or
- they only described interventions not implemented in the school setting (as defined above), including a range of containment and mitigation measures (e.g. community-based quarantine, personal protective measures, hygiene measures, bans on mass gatherings and other social-distancing measures).

Types of outcomes

Based on the categories used in the scoping review, we searched for and classified outcomes into four broad categories, i.e. transmission-related outcomes; healthcare utilisation; other health outcomes; and societal, economic and ecological outcomes. Therefore, we considered the following primary outcomes under these categories.

- 1. Transmission-related outcomes:
- cases avoided due to the intervention (e.g. number, proportion, rate of cases observed or predicted with and without the intervention)
- number or proportion of deaths;
- shift in pandemic development due to the intervention (e.g. probability of pandemic, time to or delay in pandemic arrival or peak, size of pandemic peak, change in the effective reproduction number);
- other transmission-related outcomes (e.g. risk of transmission between schools, number of reactive closures due to cases, number of schools with cases).

2. Healthcare utilisation outcomes:

- number or proportion of hospitalisations;
- number or proportion of cases requiring intensive care.
- 3. Other health outcomes:
- physical, social and mental health outcomes directly related to school measures, both positive and negative.
- 4. Societal, economic and ecological outcomes:
- costs, human resources and capacity, educational outcomes (e.g. days spent in school).

We did not consider studies reporting on other outcomes (e.g. diagnostic test accuracy).

Search methods for identification of relevant studies

Our search strategy was structured around two main search components focused on: (i) SARS-CoV-2/COVID-19; and (ii) control measures implemented in the school setting. We largely followed the search strategy that was used for the scoping review of school measures; this was developed for MEDLINE and adapted for other databases. We limited results to the year 2020, the point at which publications about schools and the COVID-19 pandemic began to appear. We did not apply a study design filter as we considered a wide range of study types for inclusion.

An experienced information specialist adapted and ran systematic searches on 9 December 2020 in the following electronic databases.

- Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily and Versions(R) (1946 to present).
- Ovid Embase (1996 to present).
- Cochrane Central Register of Controlled Trials (CENTRAL) in the Cochrane Library (inception to present).
- Educational Resources Information Center (ERIC) via the Institute of Education Science at the US Department of Education (2002 to present).



We also searched the following COVID-19-specific databases on 9 December 2020.

- The Cochrane COVID-19 Study Register (covid-19.cochrane.org), which contains study references from ClinicalTrials.gov, WHO International Clinical Trials Registry Platform (ICTRP), PubMed, Embase, CENTRAL, medRxiv and other handsearched articles from publishers' websites.
- The WHO COVID-19 Global literature on coronavirus disease (search.bvsalud.org/global-literature-on-novelcoronavirus-2019-ncov), which contains primarily research (published and/or prepublication) journal articles from PubMed, Web of Science, Global Index Medicus, Embase, and the CDC Database of COVID-19 Research Articles. MedRxiv, BioRxiv, ChemRxiv and SSRN also include prepublications. In addition, Lanzhou University submits on a daily basis citations from CNKI as well as a number of Chinese journal publishers.

Moreover, we searched Google to identify relevant items not captured in any of the six databases. See Appendix 2 for the search strategies used.

We performed a further top-up search in August 2021 and added those results to Studies awaiting classification; we will incorporate these studies into the review at the next update.

Inclusion of non-English language studies

We did not impose any restrictions with regards to languages. Due to the language skills represented on the team, we considered studies published in Armenian, English, French, German, Italian, Russian and Spanish. Where necessary, we sought help with translation for any other languages. We, however, did not identify any study meeting our inclusion criteria published in a language other than English.

Data collection and analysis

Selection of studies

After deduplication, we used standardised title and abstract screening guidance to calibrate the screening procedures with all review authors involved with the screening using the same 50 titles and abstracts. We discussed and resolved all issues and revised the screening guidance accordingly. Two review authors then screened all titles and abstracts in duplicate, excluding only those studies which were clearly irrelevant. Studies that were marked as unclear were moved forward to the next stage.

We conducted a pilot of the full-text screening; all review authors involved with full-text screening assessed a set of 10 full-text studies at the outset (Garritty 2020). The team discussed any open questions or issues, as well as how to harmonise screening across all review authors. Two review authors then screened the remaining full texts in duplicate. Any discrepancies were discussed by the two screening review authors, and any unclear cases were discussed with a third review author and/or the review team. At this stage, a final decision regarding inclusion/exclusion was made.

We used EndNote X9 to manage the collection and deduplication of records. For title and abstract screening, we used Rayyan, a webbased application, designed for citation screening for systematic reviews (Ouzzani 2016). We documented and reported reasons for the exclusion of full texts using Microsoft Excel (Microsoft 2018) We recorded reasons for excluding studies during full-text screening.

Data extraction and management

Two review authors (shared among ShK, HL and LMP) independently extracted study characteristics and data from all included studies using a data extraction form in Microsoft Excel.

We extracted the following main categories of data; relevant subcategories can be found in the full data extraction form (see Appendix 3):

- study information;
- study design;
- population and setting;
- intervention;
- outcomes and results;
- implementation;
- context.

We piloted and accordingly revised the data extraction form using five purposively selected heterogeneous studies meeting the inclusion criteria.

Assessment of risk of bias in and quality appraisal of included studies

For experimental/quasi-experimental and observational studies, one review author (from LMP, HL, ShK) assessed the risk of bias of each included study, using the appropriate tool, and a second review author checked the assessment. The same process was followed for modelling studies, undertaken by review authors with modelling expertise (TL, ClK, AB). Conflicts, questions, or uncertainties were discussed between these review authors, or among the larger review team, or both.

We assessed risk of bias for effects reported for all outcomes, using multiple tools.

For experimental studies, we had planned to use the Cochrane RoB 2 tool (Higgins 2021); however, we did not find any relevant studies and therefore did not use this tool.

For quasi-experimental and observational studies, we used ROBINS-I for the assessment of non-randomised studies of interventions (Sterne 2016); given that we identified different types of quasi-experimental and observational studies, we also referred to the Cochrane Handbook for Systematic Reviews of Interventions for additional guidance on assessing risk of bias of different types of non-randomised studies (Sterne 2021). We treated the effect of assignment (intention-to-treat) as the effect of interest and assessed risk of bias for the following domains: confounding, selection of participants into the study, classification of interventions, deviation from intended interventions, missing data, measurement of outcomes, and selection of reported result. We judged each domain as low, moderate, serious or critical risk of bias based on a series of signalling questions. In applying ROBINS-I, important confounding factors that each study would ideally be controlled for should be defined a priori. Given the measures implemented in the school setting, we expected that relevant studies would be conducted at the cluster level. Based on the body of evidence identified in the scoping review (Krishnaratne

Measures implemented in the school setting to contain the COVID-19 pandemic (Review) Copyright © 2022 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.


2020), important confounding factors would be related to betweengroup differences (where multiple groups/cohorts are assessed) such as age, sex and socioeconomic status. Further, we anticipated that many of the studies would include co-interventions that could differ between intervention groups and have an impact on outcomes. Such co-interventions can be implemented in the school setting (e.g. handwashing and mask policies) and in the wider community (e.g. stay-at-home policies, social-distancing measures, travel restrictions). We managed ROBINS-I assessments using Google Sheets (https://docs.google.com/spreadsheets/). Due to the nature of the results presented, we applied the ROBINS-I tool to the study as a whole rather than to specific outcome results, as recommended in the guidance. We followed ROBINS-I and Cochrane Handbook guidance regarding studies at critical risk of bias, meaning that we excluded any study at critical risk of bias from the analysis.

For observational screening studies that assessed the effect of screening and intervention beyond just looking at diagnostic accuracy, we used the QUADAS-2 tool developed for studies assessing diagnostic accuracy (Whiting 2011). The tool assesses risk of bias in each of the following four key domains: patient selection, index test, reference standard, and flow and timing. Risk of bias is assessed as to whether the selection of patients could have introduced any bias into the study, whether the conduct or interpretation of the index test could have introduced bias, whether the reference standard, its conduct, or its interpretation could have introduced bias, and whether the patient flow could have introduced bias. We only assessed one study using this tool, the criteria for which can be found in Appendix 4.

There is currently no standardised method for assessing the risk of bias or appraising the quality of modelling studies within the systematic review community. In the rapid review of travel-related control measures, Burns A 2020 describe the challenge of critically appraising modelling studies by referring to a rapid review of the methodological literature that sought to identify and summarise studies describing criteria for assessing the quality of mathematical modelling studies). This review suggested that an assessment of the quality of a modelling study should capture the aspects of: (i) model structure; (ii) input data; (iii) different dimensions of uncertainty; (iv) transparency; and (v) validation. Based on these findings, Burns A 2020 developed a tool for the assessment of modelling studies which we applied in this review (Appendix 5). The tool comprises 10 questions, each of which can be given a rating of 'no to minor concerns'; 'moderate concerns' or 'major concerns'. This tool does not combine multiple criteria into a summary score. Therefore, we used this tool in our assessment of modelling studies, including studies that used only modelling as well as experimental studies with a modelling component.

Contacting study authors

In our review protocol, we had specified that we would contact study authors in case of missing information. The overall reporting of studies was reasonable, and it was therefore not necessary to contact study authors.

Data synthesis

Based on the very heterogeneous evidence base identified in the scoping review, we anticipated that meta-analyses would likely not be possible in most or all cases. We considered the published Synthesis Without Meta-analysis (SWIM) guidance as a basis for the reporting of results (Campbell 2020a). We summarised and reported the extracted data for each of the four broad intervention categories and the specific interventions contained within them. We used these categories for our synthesis and we present findings in a tabular, narrative or graphical manner. We analysed and presented findings from empirical studies and modelling studies separately. A third review author double-checked all data presented in the tables, text and graphics. When assessing observational studies which reported adjusted and unadjusted outcomes, we aimed to assess adjusted outcomes as much as possible.

Assessment of heterogeneity and subgroup analyses

In the absence of meta-analyses, we did not conduct a statistical assessment of heterogeneity, nor did we statistically assess differences between subgroups. We narratively explored the influence of potentially important sources of heterogeneity on the impact of interventions. In modelling studies, we did this by examining multiple scenarios presented using varying key parameters. We focused on heterogeneity in terms of population, intervention, or outcomes, and across contexts. We considered the following sources of heterogeneity.

- School type (i.e. primary, secondary), or age group of students, or both.
- Class size.
- Community transmission at the time at which the intervention was implemented (i.e. impacts of measures are likely to be different in countries or regions according to the disease prevalence or transmission patterns within communities, regions or countries).
- Other local or national measures implemented (e.g. workplace closure, travel-related control measures).
- Level of the intervention (i.e. intervention implementation at the macro, school, or individual level).
- Intervention trigger (i.e. cause for the initiation of implementation within or outside of the school setting).
- Geographical location (i.e. region or country).
- Socioeconomic status of target population.

The scoping review findings suggested that it would likely not be possible to undertake most of these subgroup analyses, due to the information rarely being reported.

Assessment of the certainty of the evidence

We used the GRADE approach to assess the certainty of evidence for bodies of evidence within four broad intervention categories (Hultcrantz 2017). An initial assessment jointly made by ShK, HL, and LMP was shared with other review authors (TL, ClK, AB, JB) and a joint decision regarding the certainty of evidence ratings was made. The completed GRADE tables for each intervention category can be found in (Summary of findings 1; Summary of findings 2; Summary of findings 3; Summary of findings 4).

The certainty of evidence is defined in GRADE as the extent to which one can be confident that the true effect of an intervention lies on one side of a specified threshold, or within a chosen range (Hultcrantz 2017). In this rapid review, we considered 'difference from the null' as the most relevant threshold, assuming that even



small effect sizes may be relevant for school measures applied to large populations.

The certainty of evidence rating in GRADE yields four possible levels of evidence: high certainty (i.e. the estimated effect lies close to the true effect), moderate certainty (i.e. the estimated effect is probably close to the true effect), low certainty (i.e. the estimated effect might substantially differ from the true effect), and very low certainty (i.e. the estimated effect is probably substantially different from the true effect) (Hultcrantz 2017).

We rated bodies of evidence from quasi-experimental/ observational and modelling studies separately.

In GRADE, evidence from RCTs enters the rating as high certainty, as does evidence from observational studies whose risk of bias has been assessed using ROBINS-I (Sterne 2016). Five domains are then used to further downgrade evidence, including study limitations, inconsistency, indirectness, imprecision, and publication bias, and three domains are used to upgrade evidence, including plausible confounding, large estimates of effect, and presence of a dose-response relationship. The ROBINS-I judgements for empirical studies informed the GRADE criterion on study limitations.

To apply GRADE in the specific context of modelling studies, we used the recent guidance developed by the GRADE Working Group (Brozek 2021). Evidence from modelling studies also entered the assessment as high certainty, and all the GRADE domains described above were then used to assess certainty of the model outputs. The quality assessment of the studies using the bespoke tool informed our GRADE assessment of GRADE, the quality assessment ratings for the model structure and input data were used to downgrade bodies of evidence if studies raised concerns in either of these aspects. This was partially operationalised by considering major concerns in input data or structure as a definite indicator for downgrading. If the decision about downgrading once or twice or not downgrading at all was on the edge, we used the external validation category as a tiebreaker. To assess the imprecision

in the bodies of evidence from modelling studies, we rated the analyses conducted to assess the variability and uncertainty of the outcomes and critically examined these against the aspects of uncertainty that should have been considered in the models. Where only one study contributed to the body of evidence, we downgraded the evidence for imprecision. A modelling study might for example report tight confidence intervals, which arise from an incomplete consideration of all the important underlying sources of uncertainty. To assess indirectness, we focused on the external validity of the model as an important indicator for a credible model. We assessed inconsistency based on a consistent or inconsistent direction of effect across studies for any given outcome category.

RESULTS

Description of studies

Results of the search

We identified 2687 unique records from database searches and identified 4043 additional records from snowball searches. Of these, 152 studies entered full-text screening. After a comprehensive screening process, detailed in the PRISMA flow diagram (Figure 4), we included 38 studies in the rapid review, comprising 31 preprints, four peer-reviewed studies (Campbell 2020b; Lee 2020; Panovska-Griffiths 2020a; Simonsen 2020), and three reports (Alvarez 2020; Gill 2020; Isphording 2020). Of these preprints, 16 studies have been published after the analysis had been completed. A comparison of the differences between the preprint and the peer-reviewed publication can be found in Appendix 6. While we do not include a list of ongoing studies in this review, this is available upon request by contacting the study authors. We excluded 114 studies from this review. We have provided a list of 20 of these studies which we felt would be of most interest/relevance to readers and have provided reasons for exclusion at the full-text level in Excluded studies. Broad reasons for exclusions (i.e. population, disease, outcome) are provided in Figure 4.

Figure 4. PRISMA flow chart



Based on our findings, we adapted the a priori logic model that informed the development of the rapid review protocol (Krishnaratne 2021).

Given the delay between the initial search and the publication of this review, we conducted a top-up search on the Cochrane Covid-19 Study Register in August 2021 in order to identify studies published since the original search. The goal of this search was to identify eligible studies, and not to conduct any data extraction or quality assessment. The search was conducted exactly as it had been run in December 2020 but with search dates from 9 December 2020 to 5 August 2021. The search identified 1379 unique records. Of these, 118 studies entered full-text screening. After a comprehensive screening process, we added 16 novel study reports to Studies awaiting classification. A detailed PRISMA flow diagram documenting this top-up search can be found in Figure 5.



Figure 5. PRISMA flow chart: top-up search



Included studies

The characteristics of each of the included studies are described in the characteristics of included studies table (Table 2). In the following, summary information is provided according to their setting, population, intervention, comparison, outcome(s), and study design. The evidence gap map summarises the distribution of studies related to the study types, intervention and outcome categories (Figure 3).

Setting

While the majority of studies either did not differentiate between different school types or assess measures in any school type, four studies specifically assessed the implementation of measures



within a secondary school setting (Curtius 2020; Panovska-Griffiths 2020b; Sruthi 2020; Vlachos 2020), while four assessed measures implemented in the primary school setting (Aspinall 2020; Monod 2020; Phillips 2020; Simonsen 2020).

Context

Studies were carried out in a range of countries: 15 studies in the USA (Baxter 2020; Bershteyn 2020; Burns A 2020; Cohen 2020; España 2020; Germann 2020; Gill 2020; Head 2020; Jones 2020; Kraay 2020; Landeros 2020; Lyng 2020; Monod 2020; Shelley 2020; Williams 2020), four in Canada (Campbell 2020b; Naimark 2020; Phillips 2020; Tupper 2020), three in Germany (Curtius 2020; Hoehl

Figure 6. Geographical distribution of included studies

2020; Isphording 2020), five in the UK (Aspinall 2020; Keeling 2020; Munday 2020; Panovska-Griffiths 2020a; Panovska-Griffiths 2020b), two in France (Di Domenico 2020a; Mauras 2020), two in China (Lee 2020; Zhang 2020), one in Chile (Alvarez 2020), one in Denmark (Simonsen 2020), one in Israel (Lazebnik 2020), one in the Netherlands (Rozhnova 2020), one in Sweden (Vlachos 2020), and one in Switzerland (Sruthi 2020). One study referred to multiple countries (Kaiser 2020). Studies assessed measures implemented both in primary and secondary school settings. Therefore, 20 studies have been conducted in the WHO Region of the Americas (AMR), 16 in the WHO European region (EUR) and two in the WHO Western Pacific Region (WPR) (Figure 6).



As in the scoping review, reporting on other contextual aspects was scarce. One study outlined that the economic consequences, such as an increase in unemployment and a decrease of gross domestic product may have led to a relaxation of multiple measures in Canada, including the reopening of schools (Campbell 2020b). Weather conditions, such as temperate and precipitation, were mentioned as a factor affecting sufficient ventilation in Germany, with warmer temperatures and less precipitation being mentioned as a beneficial factor (Isphording 2020).

Population

We differentiated between populations targeted by the intervention and populations in which outcomes were assessed. Most studies focused on outcomes among populations in the school setting (i.e. students and teachers); in some instances, outcomes were also assessed among parents and carers as well as the wider community.

Study designs

Overall, included studies comprised 33 modelling studies, two observational studies (Simonsen 2020; Vlachos 2020), one observational screening study (Hoehl 2020), one quasiexperimental study (Isphording 2020), and one experimental study with modelling components (only the modelling component was assessed in this review) (Curtius 2020). Modelling studies varied in the employed modelling approaches, including compartmental models, agent-based models, and Susceptible-Exposed-Infectious-Removed (SEIR) models. Details are presented in the characteristics of included studies table (Table 2). As indicated above (Methods), when assessing observational studies which reported adjusted and unadjusted outcomes, our aim was to assess adjusted outcomes as much as possible.

Interventions

We identified a wide range of interventions across four broad intervention categories: (i) measures reducing the opportunity for

contacts; (ii) measures making contacts safer; (iii) surveillance and response measures; and (iv) multicomponent measures.

Measures reducing the opportunity for contacts

We identified 23 modelling studies on measures reducing opportunity for contacts (Alvarez 2020; Aspinall 2020; Baxter 2020; Bershteyn 2020; Burns A 2020; Cohen 2020; Di Domenico 2020a; España 2020; Germann 2020; Gill 2020; Head 2020; Jones 2020; Kaiser 2020; Keeling 2020; Landeros 2020; Lee 2020; Mauras 2020; Munday 2020; Panovska-Griffiths 2020a; Phillips 2020; Rozhnova 2020; Shelley 2020; Zhang 2020). We differentiate between *measures reducing the number of students and contacts* (i.e. reducing the number of students on school premises automatically reduces the number of contacts with or without additional contact-reducing measures being implemented) and *measures reducing contacts* (i.e. contacts between students as well as between students and school staff can also be reduced through forming cohorts with all students present on school premises).

We identified 22 modelling studies addressing measures reducing the number of students and contacts (Alvarez 2020; Aspinall 2020; Baxter 2020; Bershteyn 2020; Burns A 2020; Cohen 2020; Di Domenico 2020a; España 2020; Germann 2020; Gill 2020; Head 2020; Jones 2020; Kaiser 2020; Keeling 2020; Landeros 2020; Lee 2020; Mauras 2020; Munday 2020; Panovska-Griffiths 2020a; Phillips 2020; Shelley 2020; Zhang 2020). Measures reducing the number of students can be implemented on a macro level (phased reopening of certain school types), school level (in-schooling of certain classes), or class level (reduction of number of students per class). With modelling studies mostly simulating a percentage reduction in the total number of students (i.e. 0 to 100% of students attending school in person), some studies reported how this reduction was achieved: by implementing a phased reopening of certain school types (Baxter 2020; Munday 2020; Zhang 2020), inschooling of certain classes only (Aspinall 2020; Lee 2020; Munday 2020), or a reduction of the number of students per class (Bershteyn 2020; Head 2020; Phillips 2020). Where models reported on how this reduction in student numbers was achieved, they referred to implementing an alternating attendance schedule (e.g. one cohort attends school in week one; another cohort attends school in week two) (Baxter 2020; Bershteyn 2020; Burns A 2020; Cohen 2020; Germann 2020; Gill 2020; Head 2020; Jones 2020; Phillips 2020; Shelley 2020).

Among these studies, six allowed for a separate assessment of *measures that onlyreduced contacts* while maintaining the same number of students (Cohen 2020; Germann 2020; Gill 2020; Head 2020; Landeros 2020; Phillips 2020). In all six studies, a reduction in contacts was achieved by simulating alternating attendance of cohorts without reducing the number of students.

One study exclusively looked at the reduction of contacts (simulating a range of contact reduction between 0 to 100%) without assessing a scenario in which the number of students was also reduced (Rozhnova 2020).

Measures making contacts safer

We identified 12 studies examining the impact of interventions aimed at making contacts safer (Cohen 2020; Curtius 2020; España 2020; Germann 2020; Gill 2020; Head 2020; Kraay 2020; Lazebnik 2020; Monod 2020; Panovska-Griffiths 2020b; Sruthi 2020; Cochrane Database of Systematic Reviews

Simonsen 2020). All but one study (Simonsen 2020), used modelling to assess the effects of the measures. Among these, studies focused on interventions promoting mask wearing in schools (España 2020; Head 2020; Panovska-Griffiths 2020b; Sruthi 2020), handwashing interventions (Kraay 2020; Simonsen 2020), cleaning interventions (Kraay 2020), modifying activities in the school setting (Lazebnik 2020), and ventilation interventions (Curtius 2020). Five studies assessed combined measures to make contacts safer, where it was not possible to disaggregate the effects of each individual intervention (Cohen 2020; Germann 2020; Gill 2020; Monod 2020; Phillips 2020).

Surveillance and response measures

Fourteen modelling studies reported outcomes on interventions of mass testing and isolation measures, and symptom-based screening and quarantine measures (Bershteyn 2020; Burns A 2020; Campbell 2020b; Cohen 2020; Di Domenico 2020a; Gill 2020; Head 2020; Hoehl 2020; Landeros 2020; Lyng 2020; Panovska-Griffiths 2020a; Panovska-Griffiths 2020b; Tupper 2020; Williams 2020). Twelve studies looked at measures involving mass testing and isolation (Campbell 2020b; Cohen 2020; Di Domenico 2020a; Gill 2020; Head 2020; Hoehl 2020; Landeros 2020; Lyng 2020; Panovska-Griffiths 2020a; Panovska-Griffiths 2020b; Tupper 2020; Williams 2020), while two studies looked specifically at symptombased screening and isolation (Bershteyn 2020; Burns A 2020). The distinction between these two categories is that testing and isolation measures refer to mass/routine testing (i.e. testing all students or teachers), whereas symptom-based screening involves screening symptomatic cases only.

Multicomponent measures

We identified three additional studies that reported outcomes relating to multicomponent measures (Isphording 2020; Naimark 2020; Vlachos 2020), where it was not possible to disaggregate the effects of each individual intervention. One modelling study assessed a multicomponent measure consisting of reducing the number of students, reducing the number of contacts, universal masking, alternating attendance schedules in high schools, and symptom-based isolation (Naimark 2020). One quasi-experimental study assessed an intervention consisting of mask wearing, fixed cohorts, testing, quarantine measures, modification of sports and music classes, isolation of at-risk students, reduced cohort size, ventilation, staggered school hours, and spacing in the school yard (Isphording 2020). One observational study assessed an intervention including a handwashing policy, physical distancing measures, increased outdoor activities, cancellation of large gatherings, and enhanced cleaning protocols (Vlachos 2020).

A breakdown of the different broad intervention categories and the specific interventions within them is presented in Table 1.

Comparisons

We encountered the following comparisons.

 Measures to safely open schools versus keeping schools closed. Here, authors compared scenarios in which schools were opened with various measures in place to scenarios in which schools were closed completely. While reporting on the comparator was often suboptimal, authors usually made a reference to substituting face-to-face teaching with virtual teaching.

- Measures to safely open schools versus opening schools with no measures in place. Here, authors compared a scenario with various measures in place to a scenario in which schools were open without any measures in place (e.g. prepandemic status).
- Intense versus least intense measures under which schools are opened. Here, authors compared interventions that were implemented more or less intensely (i.e. testing all versus only some students) with schools open.
- Single-component measure versus multicomponent measures. Here, a single measure (i.e. schools opening with a testing strategy only) was compared with multiple measures (i.e. schools opening with testing, mask wearing and measures to reduce contacts).

In the modelling studies - 33 studies constituting the majority of our evidence base - the interventions and comparisons were conceptualised as scenarios. Many studies included more than two scenarios. In most modelling studies, the comparison was a scenario in which no measure was implemented (i.e. schools open without any measures in place or prepandemic status), which we considered to be the main comparison. Therefore, we used only one summary of findings table per intervention category and used this main comparator as a basis for developing narrative summaries and GRADE ratings. If the study only allowed for comparing operating schools with measures in place to school closures, we used this comparison as a basis for the evidence synthesis and signalled this clearly.

In the observational studies - three studies only - two studies compared measures to a scenario in which schools were closed completely. One study compared more intense measures to the least intense measures. In the experimental study with a modelling component, the comparison was made with full school reopening with no measures in place. In the observational screening study, the comparison was made with the least intense measure.

Outcomes

We included studies that assessed outcomes in four broad categories:

- 1. transmission-related outcomes;
- 2. healthcare utilisation outcomes;
- 3. other health outcomes;
- 4. societal, economic and ecological outcomes.

Within **category 1**, we identified outcomes, such as the number or proportion of cases in the school or general population, the number of cases detected by a measure, the number of schools having one infected student present, the number or proportion of deaths, the progression of the pandemic, and the reproduction number.

Within **category 2**, we identified outcomes related to the utilisation of the healthcare system. This might have been the number or proportion of cases requiring intensive care.

In **category 3**, we identified outcomes related to health beyond transmission-related outcomes. This refers to outcomes such as hand eczema.

Category 4 was rarely addressed in the included studies. The only outcome we identified was the number of days spent in school. The number of days spent in school differs across the studies for

Risk of bias and quality of included studies

The quality of modelling studies (including the experimental study with a modelling component), the risk of bias in observational/ quasi-experimental studies, as well as the quality of the observational screening study are summarised in Table 3, Table 4 and Table 5.

The ratings for modelling studies according to our bespoke quality assessment tool can be found in Table 3 and Appendix 7. We observed a general lack of external and internal validation across studies. Internal validity describes whether the model calculations and results are consistent with the model's specifications, i.e. whether it works as intended. Although this is necessary for the model results to be reliable, it was often not explicitly checked or reported, but is likely given due to the iterative model-building process. External validity is an important aspect of a model pertaining to the agreement of model predictions and real-world data. Successful validation on independent data awards a large amount of credibility to any model predictions. However, in the context of measures implemented in schools, external validation is often only possible to a very limited extent, given the short time frame in which COVID-19-related data have been gathered, and sometimes even impossible, given a specific model structure or scope. Due to this lack of external validation, credibility of the models was difficult to compare based only on their structure and input data, as there was no true or best reference model. However, a wide range of ratings of the structure and input data aspects allowed for detection of problematic studies, which led to downgrading for risk of bias in such instances. Only a few studies achieved a rating of minor concerns for their uncertainty analysis, arising from the fact that many studies did not address all crucial sources of uncertainty, which likely would impact the model results and lead to an overestimation of the accuracy of the outcomes.

All quasi-experimental or observational studies had one or several moderate or serious risk of bias ratings in important domains, notably due to potential confounding, deviations from intended interventions, and missing data (Table 4).

Using the QUADAS-2 tool, we assessed the one observational screening study as having a high risk of bias (Hoehl 2020; Table 5). This study assessed the effect of screening and intervention with respect to the number of cases detected as well as diagnostic accuracy.

Effects of interventions/results of the synthesis

In the following, we provide a narrative summary of the impact of the four categories of measures implemented in the school setting. Within each intervention category, we distinguish between different types of specific measures (Table 1) and report on each of the four predefined outcome categories (i.e. transmission-related outcomes; healthcare utilisation outcomes; other health outcomes; societal, economic and ecological outcomes). Where we describe effects as 'positive,' we mean that the direction of the point

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Measures implemented in the school setting to contain the COVID-19 pandemic (Review)

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estimate of the effect favours the intervention(s); 'negative' effects do not favour the intervention(s). 'Mixed effects' are when there is evidence in favour of and against the intervention(s).

For each intervention-outcome combination we present 'Summary of findings' tables (Summary of findings 1; Summary of findings 2; Summary of findings 3; Summary of findings 4), including a narrative summary of the effects, potential effect moderators as derived from the individual studies, as well as certainty of evidence ratings, and a more concise description and synthesis of these findings. A study-by-study overview of the individual studies informing these summaries can be found in the corresponding appendices (Appendix 8; Appendix 9; Appendix 10; Appendix 11; Appendix 12; Appendix 13; Appendix 14; Appendix 15).

Given that potential effect moderators were generally only assessed in individual studies (for modelling studies) or were based on limited data (for observational studies), these data should be interpreted with caution. Although we could not explicitly assess how methodological and contextual differences across studies impacted the results, we consider these very important, and they should be kept in mind when interpreting the results described below.

Measures reducing the opportunity for contacts

For all studies in this category, an overview of the study-bystudy evidence can be found in Appendix 8; Summary of findings 1 presents the GRADE summary of findings for this body of evidence. The studies were largely consistent in predicting positive effects on transmission-related outcomes (e.g. a reduction in the number or proportion of cases, reproduction number) and healthcare utilisation outcomes (i.e. fewer hospitalisations) and mixed or negative effects on societal, economic and ecological outcomes (i.e. fewer number of days spent in school). We assessed the certainty of evidence for all outcomes as very low due to risk of bias/study quality, indirectness and imprecision encountered in the body of evidence.

Measures reducing the number of students and contacts

Among the 22 modelling studies examining measures reducing the number of students and contacts (Alvarez 2020; Aspinall 2020; Baxter 2020; Bershteyn 2020; Burns A 2020; Cohen 2020; Di Domenico 2020a; España 2020; Germann 2020; Gill 2020; Head 2020; Jones 2020; Kaiser 2020; Keeling 2020; Landeros 2020; Lee 2020; Mauras 2020; Munday 2020; Panovska-Griffiths 2020a; Phillips 2020; Shelley 2020; Zhang 2020), the percentage of students attending school was reduced to 80% (Germann 2020), 55% (Jones 2020), 50% (Baxter 2020; Bershteyn 2020; Burns A 2020; Di Domenico 2020a; Gill 2020; Head 2020; Kaiser 2020; Keeling 2020; Mauras 2020; Panovska-Griffiths 2020a; Shelley 2020), 40% (Germann 2020), and 20% (Shelley 2020). All of these studies assessed at least one transmission-related outcome. Five studies assessed outcomes with regards to healthcare utilisation (Alvarez 2020; Di Domenico 2020a; Germann 2020; Head 2020; Keeling 2020), and three studies assessed a societal outcome (Cohen 2020; Gill 2020; Phillips 2020).

Transmission-related outcomes

Number or proportion of cases

Thirteen modelling studies reported on the number or proportion of cases (Baxter 2020; Bershteyn 2020; Burns A 2020; Di Domenico 2020a; Germann 2020; Gill 2020; Head 2020; Jones 2020; Kaiser Cochrane Database of Systematic Reviews

2020; Keeling 2020; Mauras 2020; Panovska-Griffiths 2020a; Shelley 2020). Two of the studies contributing to this outcome compared implementation of more intense with less intense measures (Bershteyn 2020; Kaiser 2020), while the others compared a reduced number of students and contacts with schools being fully open with no measures in place. Twelve of these studies showed reductions in the number or proportion of cases. One study showed inconsistent results with two scenarios (2day alternating attendance schedule; morning - afternoon shift alternating attendance schedule), associated with more cases than fully opening schools, and with full attendance associated with fewer cases than if 100% of the students did distance learning (Shelley 2020). The findings of these studies suggested potential influencing factors, such as the level of community transmission (Gill 2020; Head 2020; Jones 2020; Kaiser 2020; Keeling 2020; Mauras 2020; Panovska-Griffiths 2020a; Shelley 2020), co-interventions implemented in the community (Bershteyn 2020; Germann 2020; Panovska-Griffiths 2020a), susceptibility or transmission probabilities (Di Domenico 2020a; Head 2020; Shelley 2020), as well as the age of students (Baxter 2020; Di Domenico 2020a; Gill 2020; Keeling 2020; Mauras 2020). We assessed the certainty of evidence for this outcome as very low.

Risk of infection

Two modelling studies reported on the risk of infection with SARS-CoV-2 (Cohen 2020; España 2020). Reducing the number of students to 50% by introducing alternating attendance schedules and enforcing measures, such as face masks, would lead to a predicted reduction in the risk of infection. In one study (Cohen 2020), the risk of infection in students varied between 0.2% and 3.1% and in teachers and school staff between 0.4% and 4.3%, when the measures were applied. In contrast, when operating schools without any measures, the risk of infection ranged between 6.4% and 17.2% for students and between 9.5% and 24.6% for teachers and school staff, depending on the level of community transmission. The same study predicted that the lowest risk of infection can be achieved by reducing attendance in primary schools to 50% (Cohen 2020), while keeping secondary schools in remote learning (risk of infection in teachers: 0.2% to 0.7%; risk of infection in students: 0.1% to 1.0%). In another study, relative to a scenario with operating schools at full capacity and without face masks, a reduction in students led to a proportional reduction in the risk of infection across all populations (students, teachers, general population) (España 2020). The variation in the effect estimates within studies might be explained by varying levels of adherence to wearing face masks (España 2020), susceptibility of individuals to a SARS-CoV-2 infection, age of the students targeted by the intervention (primary versus secondary school students), as well as the level of community transmission (Cohen 2020). We assessed the certainty of evidence for this outcome as very low.

Reproduction number

Six modelling studies reported on the reproduction number (Cohen 2020; Keeling 2020; Landeros 2020; Lee 2020; Phillips 2020; Zhang 2020). All but one study predicted that reducing the number of students, and thus reducing the number of contacts between students, would lead to a reduction in the reproduction number when compared to operating schools with no measures in place. The discrepant study (Cohen 2020), which presented results on the effective reproduction number in a graphical way, predicted no consistent trend across different scenarios of alternating schedules

and reduction of students. The variation in the magnitude of effect within studies might be explained by the level of community transmission (Cohen 2020; Keeling 2020; Landeros 2020; Lee 2020; Phillips 2020), co-interventions implemented in the community (Zhang 2020), as well as the age of students targeted by the intervention (Cohen 2020; Keeling 2020). We assessed the certainty of evidence for this outcome as very low.

Number or proportion of deaths

Five modelling studies reported on the number or proportion of deaths (Baxter 2020; Germann 2020; Head 2020; Keeling 2020; Panovska-Griffiths 2020a). All studies predicted that reducing the number of students, and thus reducing the number of contacts between students, would lead to a reduction in the number or proportion of deaths (among students, teachers and staff, and the general population) when compared to schools operating without measures in place. The variation in the magnitude of effect within studies might be explained by the level of community transmission (Keeling 2020), age of students (Baxter 2020; Head 2020; Keeling 2020), susceptibility of children to a SARS-CoV-2 infection (Head 2020), as well as implementation of community-based interventions (Germann 2020; Head 2020; Panovska-Griffiths 2020a). We assessed the certainty of evidence for this outcome as very low.

Risk of death

One modelling study reported on the risk of death (España 2020). The study predicted that reducing the number of students, and thus reducing the number of contacts between students, would lead to a reduction in the risk of death in various populations when compared to operating schools without measures. If only 50% of all students attended school, the risk of death could be reduced to 3.0% (3.0% to 4.0%) in teachers, 0.4% (0.4% to 0.5%) in family members, and 4.0% (4.0% to 5.0%) in the general population if measures, such as face masks, were also in place. The study assesses the variation in effect dependent on the level of adherence to co-interventions such as mask adherence. We assessed the certainty of evidence for this outcome as very low.

Shift in pandemic development

Five modelling studies assessed six different outcomes describing potential shifts in pandemic development (Alvarez 2020; Germann 2020; Landeros 2020; Mauras 2020; Phillips 2020). Specific outcomes assessed by these studies were time to peak intensive care unit (ICU) occupancy (Alvarez 2020), time to peak incidence (Germann 2020), time to peak prevalence (Germann 2020), time to stopping rule (i.e. a rule that urges schools to close fully when prevalence among students reaches a certain number; Landeros 2020), time to outbreak (Mauras 2020), and outbreak length (Phillips 2020). All studies predicted that reducing the number of students, and thus reducing the number of contacts between students, would slow pandemic development when compared to schools operating without measures in place. The variation in the magnitude of effect might be explained by the implementation of community-based interventions (Alvarez 2020; Germann 2020), transmissibility (Landeros 2020), the level of community transmission (Landeros 2020), as well as the age of students targeted by the intervention (Mauras 2020; Phillips 2020). We assessed the certainty of evidence for this outcome as very low.

Number or proportion of infected schools

One modelling study assessed the proportion of primary schools with at least one infected person on the premises (Aspinall 2020). The study predicted that reducing the number of students, and thus reducing the number of contacts between students, would lead to a reduction in this outcome when compared to all students attending. With all students attending, the proportion of primary schools with at least one infected individual on the premises would range between 4% and 20% (661 to 3310 schools); if only one-third of all students were attending, the risk could be reduced to between 1% and 6% of primary schools (178 to 924 schools). Besides, the magnitude of effects varied by time point of opening, which may serve as a proxy for the level of community transmission; with increasing levels of community transmission, effect estimates are assumed to increase. We assessed the certainty of evidence for this outcome as very low.

Risk of transmission to other schools

One modelling study assessed the risk of transmission from one school to other schools (Munday 2020). When compared to operating schools without measures in place, the study predicted that reducing the number of students, and thus reducing the number of contacts between students, would lead to a reduction in the risk of transmission to another school. For 100% attendance, the risk ranged between 0.42% and 3.6%; it was lowest if only certain grades of primary school students attended school, with the risk ranging between 0.01% and 0.09%. The level of community transmission appeared to influence the risk of transmission from one school to another. We assessed the certainty of evidence for this outcome as very low.

Healthcare utilisation outcomes

Number or proportion of hospitalisations

Two modelling studies reported on the number or proportion of cases requiring hospitalisation (Germann 2020; Head 2020). While Germann 2020 reported on the number of cases, Head 2020 reported on the excess hospitalisations per 10,000 students, teachers and staff, household members and community members. Both studies predicted that reducing the number of students, and thus reducing the number of contacts between students, would lead to a reduction in the number or proportion of hospitalisations when compared to operating schools without measures in place. Factors influencing the effect were co-interventions implemented in the community (Germann 2020), the level of community transmission, as well as varying degrees of susceptibility (Head 2020). We assessed the certainty of evidence for this outcome as very low.

Number or proportion of cases requiring intensive care

Three modelling studies reported on the number or proportion of cases requiring intensive care (Alvarez 2020; Di Domenico 2020a; Keeling 2020). All studies predicted that reducing the number of students, and thus reducing the number of contacts between students, would lead to a reduction in the number or proportion of cases requiring intensive care when compared to operating schools without any measures. Factors that might influence the range of predicted effects are the level of community transmission (Keeling 2020), the age of students targeted by the interventions (Di Domenico 2020a; Keeling 2020), as well as co-interventions

implemented in the community (Alvarez 2020). We assessed the certainty of evidence for this outcome as very low.

Societal, economic and ecological outcomes

Number of days spent in school

Three modelling studies assessed these outcomes (Cohen 2020; Gill 2020; Phillips 2020). Cohen 2020 and Gill 2020 assessed the number of days spent in school, while Phillips 2020 assessed the number of student days lost to classroom closure. Two studies predicted that reducing the number of students, and thus reducing the number of contacts between students, would lead to a reduction in the number of planned days spent in school when compared to operating schools without measures in place. However, the interventions would increase the number of intended days spent in school due to their ability to prevent school days lost to classroom closures due to guarantine or isolation. In one study, the number of days spent in school increased due to a reduction of students leading to a lower number of days lost to classroom closures. For a ratio of students to teachers of 8:1, the number of school days lost was standard deviation (SD) 76.0 \pm 59.5 and for a ratio of 30:1 SD 1157.7 \pm 684.3. Factors that might influence the variation in the effects assessed in the studies were the level of community transmission (Cohen 2020; Gill 2020; Phillips 2020), as well as the age of students targeted by the intervention (Cohen 2020). We assessed the certainty of evidence for this outcome as very low.

Measures reducing contacts

Seven modelling studies assessed measures that reduced the number of contacts between individuals (Cohen 2020; Germann 2020; Gill 2020; Head 2020; Landeros 2020; Phillips 2020; Rozhnova 2020). Six of these studies assessed a transmission-related outcome (Cohen 2020; Gill 2020; Head 2020; Landeros 2020; Phillips 2020; Rozhnova 2020). Two studies assessed outcomes with regards to healthcare utilisation (Germann 2020; Head 2020; Gill 2020; Phillips 2020; Studies assessed a societal outcome (Cohen 2020; Gill 2020; Phillips 2020).

Transmission-related outcomes

Number or proportion of cases

Three modelling studies reported on the number or proportion of cases (Cohen 2020; Gill 2020; Head 2020). All studies predicted that reducing the number of contacts between students would lead to a reduction in the number or proportion of cases when compared to operating schools without measures. One study reported a reduction in the cumulative infection rate for teachers and school staff from between 9.5% and 24.6% to between 0.8% to 5.5%, and a reduction for students from between 6.4% and 17.2% to between 0.6% to 4.1% (Cohen 2020). The magnitude of effects varied according to the level of community transmission (Gill 2020; Head 2020), and susceptibility of individuals to a SARS-CoV-2 infection (Cohen 2020). We assessed the certainty of evidence for this outcome as very low.

Reproduction number

Three modelling studies assessed the reproduction number (Cohen 2020; Phillips 2020; Rozhnova 2020). Two studies predicted that compared to operating schools without reducing the number of contacts, a reduction in the number of contacts between students would lead to a reduction in the reproduction number. One study graphically predicted that reducing the number of contacts, while

maintaining the number of students at 100%, did not have a large impact on the reproduction number (Phillips 2020). The magnitude and direction of effects varied according to the susceptibility of individuals to a SARS-CoV-2 infection (Cohen 2020). We assessed the certainty of evidence for this outcome as very low.

Shift in pandemic development

Two modelling studies assessed outcomes related to a shift in pandemic development (Landeros 2020; Phillips 2020). One study reported on the time to a stopping rule (Landeros 2020), and one study reported on the outcome length (Phillips 2020). One study predicted that reducing the number of contacts between students would lead to a positive shift in pandemic development (Landeros 2020). Implementing an alternating attendance schedule by creating rotating cohorts with a weekly rotating schedule, the model predicts a longer period of instruction (18 to 22 weeks) compared to a simulation in which all students attended at once (10 to 12 weeks) until reaching the stopping rule at a cumulative prevalence of 5%. With regards to the length of an outbreak, one study predicts that an alternating attendance schedule, while maintaining the number of students, performs slightly better with regards to mean and median outbreak lengths than a nonalternating attendance schedule (Phillips 2020), but probably not in a significant way (results presented graphically). We assessed the certainty of evidence for this outcome as very low.

Healthcare utilisation outcomes

Number or proportion of hospitalisations

Two modelling studies reported on the number or proportion of individuals requiring hospitalisation due to a SARS-CoV-2 infection (Germann 2020; Head 2020). Both studies reported that the number or proportion of cases requiring hospitalisation was reduced by reducing the contacts between students through implementing an alternating attendance schedule. In one study (Germann 2020), the model predicts that if schools reopened without measures in place, the cumulative number of hospitalisations during the peak four weeks of the pandemic would be 1,798,188 in the USA. Implementing a weekly alternating attendance schedule, while maintaining the number of students at 40%, predicted a number of hospitalisations of 67,090 in the USA. Implementing a two-day alternating attendance schedule, while maintaining the number of students at 40%, the number could be further reduced to 59,056. The second study predicts that with a reduction of contacts (Head 2020), the number of hospitalisations would decrease. Compared to a baseline scenario in which the excess rate of hospitalisations per 10,000 subpopulation would be 40.5 (95% confidence interval (CI) -46.95 to 146.64) in teachers; 0.08 (0.00 to 0.08) in students; 6.86 (95% CI -14.32 to 30.11) in household members; and 4.2 (95% CI -7.33 to 16.32) in community members, these numbers can be reduced to 2.14 (95% CI -47.39 to 47.85) in teachers; 0.00 (95% CI 0.00 to 0.00) for students; 0.73 (95% CI -17.97 to 18.49) in household members and to 0.49 (95% CI -9.94 to 10.04) in the general population, when contacts are reduced by 75%. The magnitude of effects varied according to the level of community transmission (Head 2020), co-interventions implemented in the community (Germann 2020), and susceptibility of individuals to a SARS-CoV-2 infection (Head 2020). We assessed the certainty of evidence for this outcome as very low.

Societal, economic and ecological outcomes

Numbers of days spent in school

Three modelling studies assessed the number of days spent in school (Cohen 2020; Gill 2020; Phillips 2020). The studies reported mixed effects. Two studies predicted that reducing the number of contacts by implementing an alternating attendance schedule, or enforcing that students remain within their classroom, would lead to more days spent in school than when the number of contacts was not reduced (Gill 2020; Phillips 2020). One study predicted no effect: reducing the number of contacts between cohorts alongside other countermeasures (non-pharmaceutical interventions; screening) predictably led to an equal percentage of school days spent at home as if no measures were in place (~5% to 10%) (Cohen 2020). Effects varied according to the level of community transmission (Cohen 2020; Gill 2020; Phillips 2020), and co-interventions implemented in the community (Baxter 2020). We assessed the certainty of evidence for this outcome as very low.

Measures making contacts safer

For all studies in this category, an overview of the study-by-study evidence can be found in Appendix 9 and Appendix 10; Summary of findings 2 presents the GRADE summary of findings for this body of evidence. Here we have separated bodies of evidence that reported on the different measures and outcomes. While we observed a mostly consistent and positive direction of effect, we assessed the overall certainty of evidence for all outcomes as either low or very low due to risk of bias/study quality, indirectness and imprecision encountered in the body of evidence.

Measures making contacts safer - wearing masks in school

Four modelling studies were concerned with wearing masks in school (España 2020; Head 2020; Panovska-Griffiths 2020a; Sruthi 2020). Overall, studies considering masks did not define or specify the type of mask they were referring to, i.e. cloth masks or medicalgrade masks. Three studies reported on the number of cases avoided due to the measure (España 2020; Head 2020; Panovska-Griffiths 2020a), two studies reported on the number or proportion of deaths (España 2020; Head 2020), and one study looked at the reproduction number (Sruthi 2020). Additionally, one study looked at the number and proportion of hospitalisations (Head 2020).

Transmission-related outcomes

Number or proportion of cases

Three modelling studies examined cases avoided due to the intervention (España 2020; Head 2020; Panovska-Griffiths 2020b). The comparators in these studies varied, with two comparing outcomes to the least intense measure (España 2020; Panovska-Griffiths 2020b), and one comparing outcomes to schools being fully open with no measures. Overall, studies showed reductions in the number or proportion of cases resulting from mandatory mask policies. This included a reduction from 81.7 times to 3.0 times the number of infections in the community (España 2020), and a reduction from 57% to 46% of those with symptomatic infections needing to be tested in the community under 30% effective coverage of masks (i.e. high mask adherence and proper face coverage with masks) (Panovska-Griffiths 2020b). A further study found a reduction in the excess proportion of infections in the school setting at a moderate level of community transmission with mandatory masks among teachers and staff (1.73, 95% CI 2.32 to 6.29), as well as students (2.51, 95% CI 0.05 to 6.95), compared to reopening with no countermeasures (teachers and staff: 14.83, 95% CI 0.93 to 29.25), students: 14.18, 95% CI 1.63 to 26.77) (Head 2020). Factors influencing the effect were the level of community transmission as well as varying degrees of susceptibility (Head 2020). We assessed the certainty of evidence for this outcome as very low.

Reproduction number

One modelling study examined the reproduction number (R) (Sruthi 2020). The study found that opening schools with mask requirements led to a reduction in R, with an estimated reduction in the general population of R by 0.01 (95% Cl 0.00 to 0.01) (Sruthi 2020). We assessed the certainty of evidence for this outcome as very low.

Number or proportion of deaths

Two modelling studies examined the number or proportion of deaths (España 2020; Head 2020), finding consistent reductions in the outcome. Head 2020 found that at a moderate level of community transmission, school reopening with mandatory mask wearing and assuming children were 50% as susceptible to COVID-19 as adults, predicted reductions in excess proportion of deaths among students and school staff and teachers compared with school reopening with no countermeasures. With schools opening at full capacity with no measures in place, at a moderate level of community transmission, with children assumed to be half as susceptible as adults, the study predicts that the excess number of deaths per 10,000 of the subpopulation would be 10.3 (95% CI 0.47 to 20.66) for teachers/staff and 2.98 (95% CI 0.33 to 5.83) for students. España 2020 focused on the general population, finding that, under a scenario with high capacity and high face-mask adherence, there would be a decrease in the ratio of the cumulative number of deaths in the overall population of 1.5 (95% CI 1.5 to 1.6). Factors influencing the effect were the level of community transmission as well as varying degrees of susceptibility (Head 2020). We assessed the certainty of evidence for this outcome as very low.

Healthcare utilisation outcomes

Number or proportion of hospitalisations

One modelling study examined the number of hospitalisations (Head 2020). It predicts that with schools opening at full capacity with no measures in place, at a moderate level of community transmission, with children assumed to be half as susceptible as adults, the excess rate of hospitalisations per 10,000 of the subpopulation among students would be 0.08 (95% CI 0.00 to 0.08) and school staff and teachers would be 40.5 (95% CI -46.95 to 146.64), compared to the intervention scenarios. The study predicts that mandatory mask wearing in schools when reopening all schools would lead to reduced hospitalisations among students, staff, household members and community transmission as well as varying degrees of susceptibility. We assessed the certainty of evidence for this outcome as very low.

Measures making contacts safer - cleaning

Transmission-related outcomes

Reproduction number

One modelling study assessed the impact of an enhanced cleaning policy on the reproduction number (Kraay 2020). The study found

that compared to the least intense measure of eight-hourly and four-hourly surface cleaning and disinfection, hourly cleaning and disinfection alone could bring the fomite R below 1 in some office settings, particularly combined with reduced shedding, but would be inadequate in schools. This study did not take into account direct transmission through droplet spray, aerosols and hand-to-hand contact. We assessed the certainty of evidence for this outcome as very low.

Measures making contacts safer - handwashing

We identified two studies that assessed the impact of handwashing (Kraay 2020; Simonsen 2020). One used a modelling design (Kraay 2020), the other was observational (Simonsen 2020).

Transmission-related outcomes

Reproduction number

One modelling study assessed the impact of handwashing on the reproduction number and suggested that the intervention had no impact when compared to full school reopening with no measures in place (Kraay 2020). While results are only presented in a graphical way, it predicted that handwashing (hourly with 100% effectiveness) compared to no handwashing showed no effect with regards to the projected reproduction number from fomite transmission. We assessed the certainty of evidence for this outcome as very low.

Other health outcomes

Incidence of hand eczema

One study (Simonsen 2020), using an observational design, found an increase in the prevalence of hand eczema among students in reopened schools with a handwashing intervention. The comparator in this study was full school reopening with no measures in place. We assessed the certainty of evidence for this outcome as low.

Measures making contacts safer - modification of activities

Transmission-related outcomes

Reproduction number

One modelling study assessed the impact of changing the length of the school day (Lazebnik 2020), and found that increasing the school day to between 8 and 9 hours each day for five days would reduce R by 0.83 compared to the least intense measure of a policy in which children go to school every other day for five hours. We assessed the certainty of evidence for this outcome as very low.

Measures making contacts safer - ventilation

Transmission-related outcomes

Inhaled dose of aerosol particles containing RNA virus in the room and inhaled dose of RNA virus for a susceptible person

One modelling study assessed the effect of four air purifiers with an air exchange rate of 5.7 L/h and equipped with HEPA filters in a single high school classroom (Curtius 2020). Using air purifiers, for a person spending two hours in a room with an infectious person, the inhaled dose of particles containing RNA virus is predicted to be reduced by a factor of six, compared to a closed classroom with no air purifiers. We assessed the certainty of evidence for this outcome as very low.

Measures making contacts safer - combined measures to make contacts safer

We identified five modelling studies assessing multicomponent interventions aimed at making contacts safer (Cohen 2020; Germann 2020; Gill 2020; Monod 2020; Phillips 2020), where it was not possible to disaggregate the effects of each individual intervention. These studies employed different combinations of mask wearing, hand hygiene, respiratory etiquette, enhanced cleaning, modification of activities, physical distancing, and exclusion of high-risk students from attending school. Findings showed a reduction in the number of cases, but there were mixed effects regarding changes to the reproduction number and the number of hospitalisations. Three of the studies used full school reopening with no measures in place as the comparator (Cohen 2020; Gill 2020; Monod 2020), and two studies used the least intense measure (Germann 2020; Phillips 2020).

Transmission-related outcomes

Number or proportion of cases

Four modelling studies looked at cases avoided (Cohen 2020; Germann 2020; Gill 2020; Monod 2020). Three studies reported the (cumulative) number of cases or the attack rate. All but one of the studies predicted that multicomponent interventions reduced the number of cases in the community (Gill 2020; Germann 2020), and in the school (Cohen 2020; Gill 2020). For the study that reported on community-level transmission, it was found that implementing a variety of infection control measures would lead to a reduction in the total number of infections, although specific figures were not reported (Gill 2020). Studies also showed a reduction in the number of cases in scenarios where schools reopened with partial online learning and 'ideal social distancing' (assumed 50% reduction in contacts due to face masks, hygiene, and distancing measures) compared to scenarios with no countermeasures (Germann 2020). Studies that reported on school-level outcomes found that implementing a variety of infection control measures led to a four-fold reduction in the cumulative COVID-19 infection rate among students, teachers, and staff (Cohen 2020), and a reduction in the total number of infections, although specific figures were not reported (Gill 2020). For one study, the direction of effect was unclear due to reporting (Monod 2020). We assessed the certainty of evidence for this outcome as very low.

Reproduction number

Two modelling studies examined the reproduction number (Cohen 2020; Phillips 2020). Both studies found a reduction in R, however, results were only presented graphically, making it difficult to determine effect sizes. Findings from one study showed that implementing countermeasures that limit transmission and detect, trace, and quarantine cases within schools, compared to reopening with no countermeasures, reduces the effective reproduction number to <1 (Cohen 2020). The other study only presented results pertaining to the reproduction number in a graphical way. With this limited evidence, the study implied that the effective reproduction number would be lower in low-transmission settings. We assessed the certainty of evidence for this outcome as very low.

Number or proportion of deaths

Two modelling studies examined the number or proportion of deaths (Germann 2020; Monod 2020), finding mixed results. One

study found that when fewer workplaces were open, all four 40% partial online learning scenarios with alternating days or weeks of attendance, were found to reduce deaths (Germann 2020). Full school reopening with no countermeasures was predicted to result in 230,451 deaths. In contrast, this decreased to 25,474 deaths where a 50% reduction in contacts due to mask wearing was modelled and to 27,874 deaths with reduced social distancing with minimal mask use. The other study estimated a 12.6% (95% CI 7.4% to 22.7%) increase in deaths among children and the general population as a result of schools reopening with countermeasures, compared to keeping schools closed (Monod 2020). We assessed the certainty of evidence for this outcome as very low.

Shift in pandemic development

One modelling study examined the shift in pandemic development (Germann 2020), reporting positive results. Findings showed that when fewer workplaces were open, 40% partial online learning scenarios, with 'ideal social distancing' (a 50% reduction in contacts due to face masks, hygiene, and distancing measures) increased the time to peak prevalence from 66 days when schools were fully reopened with no countermeasures in place to 178 days. The study found the results of its simulations to be highly dependent on the number of workplaces assumed to be open for in-person business, as well as the initial COVID-19 incidence within the community. We assessed the certainty of evidence for this outcome as very low.

Healthcare utilisation outcomes

Number or proportion of cases requiring hospitalisation

One modelling study examined the number or proportion of cases requiring hospitalisation (Germann 2020). The study predicted that when fewer workplaces were open, all four 40% partial online learning scenarios, with ideal social distancing (defined as a 50% reduction in contacts due to physical distancing, hygiene and masks), were found to avert between 543,977 and 1,708,197 hospitalisations. Moreover, for these scenarios, hospitalised cases during the peak four weeks ranged from 59,056 to 354,878 compared to a baseline scenario of 685,747 with schools reopening with full attendance and no measures in place. We assessed the certainty of evidence for this outcome as very low.

Societal, economic and ecological outcomes

Numbers of days spent in school

Two modelling studies examined the impact of the intervention on the number of days spent in school (Gill 2020; Phillips 2020). One study found that at very low community infection rates (10 reported infections per 100,000 population over the last seven days), most students can expect to attend nearly every day even in schools operating full-time, as long as schools implement multiple interventions. It is not possible to determine effect size due to lack of reporting (Gill 2020). The other study compared high with low transmission settings in primary schools. Except for a ratio of 30:1, the number of student days lost to closure was consistently higher in low transmission settings (Phillips 2020).

Surveillance and response measures

For all studies in this category, an overview of the study-by-study evidence can be found in Appendix 11, Appendix 12 and Appendix 13; Summary of findings 3 presents the GRADE summary of findings for this body of evidence. Here, we have separated bodies of evidence that reported on the different measures and outcomes. While we observed a mostly consistent and positive direction of effect, we assessed the overall certainty of evidence for all outcomes as very low due to risk of bias/study quality, indirectness and imprecision encountered in the body of evidence.

Mass testing and isolation measures

Among studies looking at mass testing and isolation, 11 studies used modelling study designs (Campbell 2020b; Cohen 2020; Di Domenico 2020a; Gill 2020; Head 2020; Landeros 2020; Lyng 2020; Panovska-Griffiths 2020a; Panovska-Griffiths 2020b; Tupper 2020; Williams 2020), and one study used an observational design (Hoehl 2020). Nine studies assessed transmission-related outcomes (Cohen 2020; Di Domenico 2020a; Head 2020; Landeros 2020; Lyng 2020; Panovska-Griffiths 2020a; Panovska-Griffiths 2020b; Tupper 2020; Williams 2020), one study assessed healthcare utilisation outcomes (Head 2020), and four studies examined societal outcomes (Campbell 2020b; Gill 2020; Lyng 2020; Williams 2020). One study assessed the number of cases detected (Hoehl 2020). Overall, the studies yielded positive outcomes. However, these measures were often implemented alongside other transmission mitigation measures, such as physical distancing and cohorting strategies which may have moderated the effects of the testing and isolation strategies. Furthermore, the effectiveness of measures was also dependent on the level of community transmission. Outcome measures were also not reported consistently, making it difficult to pool estimates of effect sizes across studies.

Transmission-related outcomes

Number or proportion of cases

Seven modelling studies looked at the number or proportion of cases (Cohen 2020; Di Domenico 2020a; Head 2020; Lyng 2020; Panovska-Griffiths 2020a; Tupper 2020; Williams 2020). All studies showed positive results, however all studies assessed testing and isolation strategies alongside other countermeasures. For example, Cohen 2020 found that measures that limit transmission and detect, trace and quarantine cases within schools could lead to reductions in the cumulative COVID-19 infection rate among students, teachers and staff by over 14-fold. However, these measures were implemented alongside classroom cohorting, face masks, physical distancing and handwashing protocols in schools, so it is not possible to comment on the impact of these measures alone. Head 2020 suggested that although testing and isolation strategies could lead to reductions in transmission, their effectiveness on their own was low, and when combined with strict social-distancing measures and a reduction in community transmission, they could be more effective. Di Domenico 2020a assessed the impact of several different reopening strategies from partial, progressive, or full school reopening coupled with moderate social-distancing interventions and largescale testing, tracing, and isolation measures. It is therefore impossible to comment on the effectiveness of testing and isolation strategies alone in this study.

The comparators used for these studies varied, with two studies comparing outcomes to full school reopening with no measures in place (Cohen 2020; Di Domenico 2020a), four studies comparing outcomes to the least intense measure (Lyng 2020; Panovska-Griffiths 2020a; Tupper 2020; Williams 2020), and one study comparing outcomes to a single intervention component (Lyng 2020). Moderating factors for the impact of outcomes included relative susceptibility and infectiousness of children and extent of

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community transmission amid opening (Head 2020; Lyng 2020). We assessed the certainty of evidence for this outcome as very low.

Number of cases detected

One observational study looked at the impact of testing strategies on the number of cases detected due to the intervention (Hoehl 2020). The study evaluated the application of a self-testing strategy. Compared to the least intense measure of no testing, the strategy found an increase in detected cases. It also found that 10,768 (99.4%) antigen tests were recorded to have been valid, 47 (0.43%) were recorded as invalid, and 16 (0.15%) gave false-positive results. We assessed the certainty of evidence for this outcome as very low.

Reproduction number

One modelling study looked at the impact of two different testing strategies on the reproduction number in schools (Panovska-Griffiths 2020a), and found that test-trace-isolate strategies would need to test a sufficiently large proportion of the population with symptomatic COVID-19 infection and trace their contacts with sufficiently large coverage, for R to diminish below 1. The comparator used in this study was the least intense measure or the least intense testing strategy. We assessed the certainty of evidence for this outcome as very low.

Number or proportion of deaths

Two modelling studies assessed the impact of testing and isolation strategies on the number and proportion of deaths and found positive results overall (Head 2020; Panovska-Griffiths 2020a). One study only showed results in a graphical way and suggested that more intense testing and isolation measures would lead to fewer deaths than less intense measures (Panovska-Griffiths 2020a). The other study predicted that there would be a lower proportion of deaths for teachers, students, and in the community, if a testing strategy was implemented, compared to full school reopening with no measures in place (Head 2020). The effect sizes are moderated by the model parameters, such as relative susceptibility and infectiousness of children, and extent of community transmission amid reopening. We assessed the certainty of evidence for this outcome as very low.

Shift in pandemic development

The four modelling studies that assessed the impact of testing and isolation strategies on the timing and progression of the epidemic (Landeros 2020; Panovska-Griffiths 2020a; Panovska-Griffiths 2020b; Williams 2020), found that testing and isolation could slow or prevent a second wave of the epidemic compared to full reopening with no measures in place, or to a less intense testing and isolation intervention. The studies suggest that the timing of the epidemic depends on the degree to which testing and isolation strategies are being implemented and the combination of testing and tracing, with one study suggesting that daily testing levels of between 8% and 11% would be required in order to avoid a second wave of the pandemic (Panovska-Griffiths 2020b). Landeros 2020 demonstrated that reopening schools with a surveillance programme in place may provide 10 to 12 weeks of continuous instruction with low infection risk. Infections after the closure of schools are driven by a lack of interventions outside of school. It was therefore suggested that testing and isolation in this context, can curtail this growth within schools, in order to counter the lack of interventions in the community.

Across studies, the level of community transmission of SARS-CoV-2 seemed to impact the magnitude of the effect of the testing and isolation strategies employed. Further, measures such as masks, and hygiene policies, and compliance with these measures, also seemed to influence outcomes. We assessed the certainty of evidence for this outcome as very low.

Healthcare utilisation outcomes

Number or proportion of hospitalisations

One modelling study found that reopening schools with a weekly or monthly testing strategy for teachers and students would lead to a higher number of hospitalisations compared to reopening under strategies to reduce contacts (Head 2020). The effect sizes are moderated by the model parameters, such as relative susceptibility and infectiousness of children, and extent of community transmission amid reopenings. We assessed the certainty of evidence for this outcome as very low.

Societal, economic and ecological outcomes

Number of days spent in school

One modelling study looked at the number of days spent in the classroom in scenarios where testing and isolation measures were implemented (Gill 2020), and found that policies closing the school (for 3 days or 14 days) upon detection of infections, substantially reduced the total number of days that students can attend in person compared to fully reopening schools with no measures in place. These effects are larger in schools operating full-time than in schools using hybrid approaches because schools using hybrid approaches experienced fewer infections that led to quarantines or closures. Therefore, although isolation measures will inevitably lead to days lost in school, the number of days will be influenced by other countermeasures that are being implemented at the same time, as well as the length of quarantine/school closure upon detection of cases. We assessed the certainty of evidence for this outcome as very low.

Resource costs

Three modelling studies looked at the impact of testing and isolation strategies on resources and found mixed effects (Campbell 2020b; Lyng 2020; Williams 2020). The studies all compared the impact of the intervention as compared to the least intense testing strategy. One study used health economic modelling to look at the human resource costs of testing strategies (Campbell 2020b). The study found that testing of at-risk groups, in particular testing all 6,012,144 students and employees in primary and secondary schools over 1.5 months would require an additional 20,956 healthcare professionals, 22,950 administrative staff and 22,462 laboratory staff, costing CAD 816.0 million, compared to no intervention, demonstrating that the intervention had an overall negative impact on resources. One study found that frequent testing strategies can reduce the rate of new infections compared to scenarios where there is no testing at all (Lyng 2020). The study found that a 98% sensitive test, with no delay in results, administered every three days with pooling, and no confirmatory test offered by the institution costs less than USD 1.50 per person per day, with high performance. Another study looking at different testing strategies found no effect on resources. It is difficult to compare or synthesise findings across these studies due to the fact that they all assess different strategies in terms of intensity and type

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of testing. We assessed the certainty of evidence for this outcome las very low.

Symptom-based screening and quarantine measures

Two modelling studies looked at symptom-based screening and quarantine measures and showed a reduction in the number of cases due to the intervention (Bershteyn 2020; Burns A 2020). These studies found that policies that screen and isolate suspected cases can, overall, decrease the attack rate compared to fully reopening schools with no measures in place. As predicted by the studies, the most effective testing and isolation strategies used a combination of early testing together with symptom screening and isolation of symptomatic cases. Bershteyn 2020 assessed the proportion of cases that could be reduced due to the intervention, and found an overall reduction of in-school transmission from 26% to 71.1%, depending on the level and timing of testing. Burns A 2020 assessed the impact of symptom-based testing and isolation on the attack rate and found that symptom-based detection and isolation could reduce the attack rate by up to 15%.

Transmission-related outcomes

Number or proportion of cases

The two studies that looked at symptom-based screening and quarantine found that policies that screen and isolate suspected cases can, overall, decrease the attack rate compared to full school reopening with no measures in place (Bershteyn 2020; Burns A 2020). The studies found that the most effective testing and isolation strategies used a combination of early testing, together with symptom screening and isolation of symptomatic cases. These strategies were often implemented alongside other transmission mitigation measures, such as physical distancing and cohorting, so it is not possible to assess the impact of symptom screening and quarantine measures alone. We assessed the certainty of evidence for this outcome as very low.

Shift in pandemic development

One modelling study found that with no testing policy in place (Burns A 2020), the peak number of infected school staff and students is assumed to be 148 (interquartile range (IQR) 82 to 213), and the interval between the first and last day, with at least two cases, would be 139 (IQR 120 to 154). Implementing a policy of two days of home isolation, following the last episode of fever, predicted a reduction in all outcome categories: the peak number of infected people is predicted to sink to 124 (IQR 58 to 184). The interval between the first and last day, with at least two cases, would increase to 145 (IQR 127 to 157). The study measured a strategy that was implemented alongside other transmission mitigation interventions, such as cohorting and physical distancing, so it is not possible to assess the impact of symptom-based screening and quarantine measures alone. We assessed the certainty of evidence for this outcome as very low.

Multicomponent measures

For all studies in this category, an overview of the study-by-study evidence can be found in Appendix 14 and Appendix 15; Summary of findings 4 presents the GRADE summary of findings for this body of evidence. Here, we have separated bodies of evidence that reported on the different measures and outcomes. While we observed a mostly consistent and positive direction of effect, we assessed the overall certainty of evidence for all outcomes as very low due to risk of bias/study quality, indirectness and imprecision encountered in the body of evidence.

Transmission-related outcomes

Number or proportion of cases

Three studies assessed the number or proportion of cases (Isphording 2020; Naimark 2020; Vlachos 2020).

One experimental study showed a positive effect that multicomponent measures reduced the number of cases (Isphording 2020), and found that implementing a variety of infection control measures led to a reduced cumulative infection rate (Isphording 2020). The observational study showed a negative effect (Vlachos 2020), finding that exposure to open rather than closed schools resulted in a small increase in PCR-confirmed infections. We assessed the certainty of evidence for this outcome as low.

One modelling study compared a multicomponent measure consisting of: i) reducing the number of students; ii) reducing the number of contacts; iii) universal masking; iv) alternating attendance schedules in high schools; and v) symptom-based isolation, to full school closures. The study found that there was an increase in the predicted number of infections when reopening with measures compared to a full school closure scenario. We assessed the certainty of evidence for this outcome as very low.

Implementation

With regards to context, reporting on implementation of the respective measures has been scarce. Some studies accounted for adherence to the intervention in their models (e.g. España 2020; Keeling 2020; Lee 2020; Panovska-Griffiths 2020b; Rozhnova 2020), or was referred to as a relevant aspect influencing the effectiveness of measures implemented in the school setting.

As implementation agents, actors at multiple levels have been referred to as: agents at the national or subnational level (e.g. health authorities; Simonsen 2020); agents at the school level (e.g. teachers conducting self-testing; Hoehl 2020); household members (e.g. parents); as well as actors outside of the school setting (e.g. healthcare professionals; Campbell 2020b).

As in the scoping review, we identified very little information on exactly how these measures are implemented within the school setting or the strategies used to implement an intervention (e.g. enforcement). One study reported enforcement and facilitating strategies for surveillance measures. These included remote monitoring of isolation, penalty for non-compliance, help in maintaining home isolation, as well as provision of thermometers for screening (Burns A 2020). One study reported training of teachers conducting self-testing (Hoehl 2020). In another study, the strictness of measures implemented in the community was described as mild (Vlachos 2020).

DISCUSSION

Summary of main results

Our primary objective was to assess the effectiveness of measures implemented in the school setting to safely reopen schools, or keep schools open, or both, during the COVID-19 pandemic. This rapid review found studies that focused on the effectiveness



of school measures on several SARS-CoV-2/COVID-19-related outcomes across four broad intervention categories including: i) measures reducing the opportunity for contacts; ii) measures making contacts safer; iii) surveillance and response measures; and iv) multicomponent measures. While studies used various study designs, the majority of them used modelling. Overall, while studies showed variable reductions in transmission and healthcare utilisation-related outcomes, the evidence available at the time the searches were conducted was of limited quality. Thus, there is much uncertainty regarding the true effect of most measures. Thus, it is likely that the true effects of most measures remain unknown. Most studies, regardless of the intervention category in which they were included, assessed the effects of a combination of interventions, which could not be disentangled to examine individual effects, making the interpretation of the results, and the ability to comment on the effectiveness of individual measures difficult. Across all intervention types and outcome measures, there were a number of factors that could potentially explain the variation in the direction and/or magnitude of results, including the level of community transmission, the susceptibility of target populations, and type of schooling (i.e. primary versus secondary). Below, we describe studies identified within the four broad intervention categories.

measures reducing the opportunity for contacts, we In summarised measures to reduce contacts between individuals, or cohorts, or both, as well as measures to reduce the number of students in attendance, which ultimately lead to a reduction of contacts by design. Overall, the studies included in this category consistently predicted outcomes in a positive direction with regards to transmission-related outcomes and healthcare utilisation outcomes; they also showed a reduction in the number of days spent in school due to the intervention, but in some cases, the initial reduction in days spent in school was offset by an increase the number of intended days spent in school due to their ability to prevent days lost due to guarantine or isolation. There were some differences in the direction of the effect for different types of interventions to reduce the opportunity for contacts (i.e. alternating attendance schedules, staggered start/finish times). Overall, very low-certainty evidence showed a reduction in the number of cases, reproductive number, hospitalisations, and ICU admissions, as well as days of school missed.

Under *measures making contacts safer*, we summarised findings with regards to policies and practices ensuring safe contacts between individuals. These include measures such as maskwearing policies, handwashing policies, and enhanced cleaning and ventilation procedures and systems. We found several modelling studies and one observational study that fit into this category. Overall, the evidence showed a reduction in the number of cases, reproduction number, hospitalisations, and ICU admissions, as well as days of school missed, but the certainty of evidence was very low for studies assessing mask-wearing policies, modification of activities, and cleaning and ventilation procedures and systems. Two studies assessing handwashing policies showed either negative or no effects, with one study of low certainty showing an increase in hand eczema due to a handwashing policy introduced once schools reopened and another study of very low certainty showing no effect, although results were only presented graphically. Evidence on interventions combining multiple measures to make contacts safer was of very low certainty and showed mixed results in terms of a reduction in the number of cases, reduction in the number of deaths, shift in pandemic development, as well as days of school missed, however, they did show a reduction in the reproduction number and the number or proportion of hospitalisations.

We identified several modelling studies, one quasi-experimental and one observational study focused on surveillance and response measures, including testing and isolation, and symptomatic screening and isolation. Overall, very low-certainty evidence showed that implementing measures to detect, trace, and quarantine cases within schools could lead to reductions in the COVID-19 infection/transmission rate among students, teachers, and staff, and could also slow or prevent a second wave of the epidemic, and reduce the reproduction number and number or proportion of deaths. The most effective testing and isolation strategies used a combination of early testing together with symptom screening and isolation of symptomatic cases, with one study finding that opening schools was likely to more rapidly increase the death count if asymptomatic testing and tracing strategies were not implemented. There was mixed evidence on the costs and human resource costs of surveillance measures, but there was generally evidence that surveillance and response measures could reduce the number of hospitalisations and the number of school days missed. Studies that assess symptom-based screening and isolation measures also showed some evidence to suggest that such measures could reduce the number or proportion of infections and could reduce the peak number of people infected during the pandemic, however the certainty of evidence was very low.

We found three additional studies assessing **multicomponent measures** that combined measures to make contacts safer or reduce the opportunity for contacts with measures reducing the number of contacts and surveillance and response measures. Two observational/quasi-experimental studies with very low-certainty evidence, showed mixed results on the impact of these measures on reducing the number or proportion of cases, but this is likely due to the fact that the comparator used in both studies was full school closure. One modelling study with very low-certainty evidence, showed that reopening schools with such measures in place would still lead to a higher number or proportion of cases as compared to when schools were closed.

Overall completeness and applicability of the evidence

Consistent with the scoping review on which this rapid review is based (Krishnaratne 2020), we identified studies assessing a broad range of measures implemented in the school setting to safely reopen schools, or keep schools open, or both, during the COVID-19 pandemic. We identified studies examining outcomes across all categories identified in the scoping review. To that end, we identified sufficient studies to address the objectives of this review. Our findings within this rapid review mostly aligned with the scoping review (Krishnaratne 2020). As in Krishnaratne 2020, we identified some gaps in the evidence base relating to setting, socioeconomic inequality, study design, and outcomes. Additionally, it should be noted that in modelling the population, setting, context and interventions, modelling studies all make a series of assumptions; some of these are closer to real-world conditions than others. Our evidence gap map visualises the areas in which more evidence is needed (Figure 3).

While we used the logic model resulting from the scoping review to inform the protocol for this rapid review (Krishnaratne 2021), we adapted the logic model based on what we found in our

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analysis (Figure 2). The major change was the restructuring of the intervention categories: while analysing the pathways between measure and effect, we felt that the intervention categories did not fully grasp the mechanisms of interest. We also removed the levels of interventions because our analyses showed that the line between intervention levels was often blurry, in particular with regards to measures which were only modelled and not implemented in a real-world setting. Lastly, we updated the outcome box of the logic model integrating the outcomes we encountered during data extraction.

Population

Regarding the populations assessed, most modelling studies across all intervention categories considered outcomes in the general population, but not always within the population in which the measure was implemented, that is students and school staff. Observational and quasi-experimental studies used data on the populations being targeted by the intervention, including teachers and students.

Setting

We identified evidence from several different countries, however most of these were high-income countries in North America and Europe, with limited evidence from Asia, Australia, and South America, and no evidence from Africa. This is likely to have implications with regards to the transferability and generalisability of these findings to other countries, in particular with regards to low- and middle-income settings. In terms of the actual school setting, studies assessed measures implemented both in primary and secondary school settings but also looked at outcomes in the wider community. Most studies did not differentiate between different school types (i.e. primary and secondary) and if they did, they focused on the primary school setting. There are various differences in contextual conditions between school types, such as changing classrooms, size of the buildings, commuting styles, and children's age, whereby studies have reported lower levels of transmission among younger compared to older children (Cohen 2020; Gill 2020; Lazebnik 2020). Thus, evidence which separates findings according to school type would be useful to inform decision-making. Given the publication dates of the studies included, much of the identified evidence relates to early stages of the pandemic. Therefore, there is a need for more data from the later stages of the pandemic.

Intervention

We found a range of different interventions which all aligned with the three main categories described in the a posteriori model of our scoping review. Most included studies assessed measures to reduce the opportunity for contacts in schools, followed by surveillance and response measures to make contacts safer, and lastly multicomponent measures. With regards to reducing the opportunity for contacts, the way in which the number of contacts was reduced differed across the included studies, comprising reduction of students on the level of an entire school versus reduction of students on the level of a single class. As stated, the majority of studies identified used modelling designs which is why the reporting on the components of the measures was mostly scarce. Interestingly, the category on multicomponent measures includes two real-world studies and only one modelling study. While the real-world studies would have offered valuable insight on the impact of measures such as masks, the way in which the measures were reported and presented, made it impossible to draw conclusions with regards to single intervention components. While we did identify more observational and quasi-experimental studies in the rapid review than in the scoping review, the vast majority of studies used modelling. Further, as will be discussed in more detail below, the certainty of the evidence was often very low, so the ability for interpretation of findings from these studies is limited. Also, the evidence in some intervention categories was sparse and did not allow for a comprehensive or robust synthesis. This was particularly the case for interventions aimed at making contacts safer, including mask-wearing and handwashing policies, modification of activities, and enhanced cleaning and ventilation policies. Therefore, the current synthesis is mainly focused on interventions to reduce the opportunity for contacts and surveillance and response measures.

Outcomes

Studies presented findings across four broad outcome categories including: i) transmission-related outcomes; ii) healthcare utilisation outcomes; iii) other health outcomes; and (iv) societal, economic and ecological outcomes. As with the scoping review (Krishnaratne 2020), most studies identified in this rapid review focused on transmission-related outcomes, including the number or proportion of cases, number of detected cases, the reproduction number, the size or timing of the epidemic, or the number or proportion of deaths. Less commonly reported outcomes included healthcare utilisation outcomes, such as the number or proportion of hospitalisations or ICU beds needed. Other health outcomes included physical health, namely hand eczema as a result of increased handwashing. Societal, economic and ecological outcomes included human resource costs and financial costs of the intervention, as well as the intended and unintended number of days spent in school or the number of school days lost due to the intervention. No included studies assessed unintended outcomes concerned with potential adverse effects in terms of psychosocial health (e.g. isolation and lack of social interaction), educational outcomes (e.g. school grades, passing of final exams, graduation to next grade, learning outcomes, scores on standardised tests) or broader societal implications (e.g. employment). This represents a major limitation regarding the completeness of the evidence, as this information is important to assess the benefits and harms of the measures.

Context and implementation

There were some gaps in the evidence in terms of context, specifically regarding the geographic focus of the studies. Overall, studies fell short in reporting on contextual aspects, such as cultural, legal or socioeconomic factors. When it comes to transferring these measures to other contexts, the lack of reporting on these aspects has implications on the assessment of feasibility, acceptability and transferability of measures, as well as the need for their adaptation. Further, as the majority of studies included in the review were modelling studies, there is a lack of empirical, realworld data, which means that there are very little data on the actual implementation of interventions - one of the key objectives of this review. Some included studies acknowledged that adherence to or compliance with interventions might influence implementation (Bershteyn 2020; Burns A 2020; Landeros 2020; Panovska-Griffiths 2020b). The one study that assessed a ventilation intervention mentioned cost, noise, size, and position of the ventilation device as factors influencing implementation (Curtius 2020), and one



study suggested that intervention fidelity may have influenced the effect of the intervention (Simonsen 2020).

Study design

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Most included studies used modelling study designs (N = 33). Modelling studies become necessary to address the complex phenomena investigated and there are no generally agreedupon principles of how such studies need to be conducted, although several studies have offered guidance in this regard (Ramos 2015). Consequently, various study designs and types of models have been encountered, ranging from simple deterministic compartmental models described by ordinary differential equations or highly detailed agent-based simulations. The quality of each model has been assessed case-by-case, but some general concerns with regards to the usefulness of models emerged in this review. Most studies investigated combined interventions that could not be disentangled to examine individual effects, such that results are difficult to apply in the context of this review. Also, the way in which measures have been implemented in a model differs. For example, the way in which the measure "mask" is implemented in a model can express itself in the same way as the measure "contact reduction". While this makes no difference to the equation, this has implications with regards to the transferability of these findings to the real world, the design of the measure as well as its actual implementation. Additionally, results are difficult to compare across the included modelling studies as these assumed a heterogeneous set of settings and scopes, which is only directly applicable within the well-defined context of the respective model, hindering generalisation of the results. Furthermore, there are appreciable quality concerns in some studies, which limits their usefulness in contributing to the body of evidence established in this review. This highlights the importance of generating more high-quality modelling studies in order to contribute to the body of evidence in a meaningful way. Whilst modelling studies do have their merits in predicting complex outcomes, it is especially important that primary data are collected and reported going forwards.

Sources of heterogeneity

As part of the narrative synthesis, we carefully documented and assessed potential sources of heterogeneity. In both the modelling and observational studies, assumptions with regards to co-interventions in place, level of community transmission, context, as well as implementation, differed widely. Measures likely varied in effectiveness according to the stage of the pandemic, the number and type of co-interventions in place in the community, school contextual differences, and the level of community transmission. Whilst co-interventions and the level of community transmission were reported in most studies, this allowed the results to be interpreted according to context but not to be systematically compared through subgroup analysis. Modelling studies across all intervention categories differed in the methodologies they employed and assessed a broad range of potential factors, generally relating to properties of the pandemic, the broader community context, and the presence or absence of other measures being implemented in the communities, such as:

• COVID-19 pandemic: studies suggest that the level of community transmission and the proportion of asymptomatic cases play a role;

- susceptibility of the target population: studies suggest that the susceptibility of the target population of the intervention to the pandemic may influence the effectiveness of the intervention (i.e. younger students being less susceptible than older students);
- other public health measures: whether other public health measures, such as a stay-at-home order and testing and contact tracing, are in place in the communities where school measures are implemented;
- implementation of the intervention: factors related to the earlier or later timing of implementation of the intervention, and compliance with the measures influenced effectiveness.

Certainty of the evidence

Overall, the GRADE process found the certainty of evidence to be low or very low for each intervention category and outcome combination; we can therefore not be confident in the findings. The true effects may be or are likely to be substantially different from the estimates of effect described in the studies. Across all outcomes, we downgraded the evidence to 'very low' mainly due to risk of bias and indirectness. We also downgraded some outcomes due to inconsistencies and imprecision.

In observational studies, we downgraded for risk of bias if we assessed any of the studies contributing to a body of evidence as having an overall rating of moderate or serious risk of bias in ROBINS-I (Sterne 2016). Across all observational studies, risk of bias was most often introduced due to deviations from intended interventions or due to missing data. We assessed one study using QUADAS-2 (Whiting 2011), as it assessed the effect of screening and intervention with respect to how many cases could be identified. We also downgraded this study for risk of bias due to lack of clarity about strategies to mitigate bias in the study.

Modelling studies contributed evidence to all four intervention categories. Although modelling studies differed in quality, we downgraded most bodies of evidence comprising modelling studies due to serious concerns about the quality of the modelling in at least some aspects. The frequent lack of external validation procedures warranted concerns about the validity of predictions in most studies. Other quality concerns varied across studies, but most often had to do with the inappropriate or unrealistic assumptions related to structural elements of the model or the model input data, and an inappropriate or insufficient assessment of uncertainty.

Further, across modelling studies, we consistently downgraded the evidence for imprecision if only a single study contributed to one outcome, as this limited our confidence that the predictions in that study were a precise estimate of true effects. We also downgraded for imprecision when models had high levels of uncertainty, and when multiple studies showed unclear effects. Some of the modelling studies provided no estimates of effect (e.g. data presented in a graphical way), and many studies provided estimates of effect (e.g. number of deaths avoided) with insufficient information on the precision (e.g. confidence intervals). Given the nature of the data and models, it is plausible that the uncertainty in estimates is wide, and such information would be necessary for an appropriate interpretation of the study findings. We therefore downgraded for imprecision as well. We also downgraded studies for indirectness due to concerns about the external validation of the model. Specifically, we downgraded evidence for indirectness

when there was no external validation of the model(s), as it created uncertainties in assessing how directly the model outputs relate to our review question. Despite the challenges of external validation, particularly within the context of an ongoing pandemic, it is important that findings are generalisable to a wider population; the lack of external validity reduced our confidence. In some cases, we downgraded for inconsistency due to inconsistent effects in the studies contributing to the outcome (i.e. when effect estimates across studies varied).

Potential biases in the review process

There are several limitations to this review. We followed transparent and systematic rapid review conduct throughout the review process, whilst keeping to a tight timeline. The protocol was approved by Cochrane in January 2021 (Krishnaratne 2021). The search, according to the approved search strategy was conducted in December 2020. We only included the data from studies published before 8 December 2020 in this review. We conducted a search of the Cochrane COVID-19 Study Register in August 2021; however, we did not conduct data extraction or risk of bias assessment on the 16 studies awaiting classification (Studies awaiting classification). This constitutes a potential source of bias. We will, however, consider these studies in a future update of this rapid review.

Whilst most aspects of the review were completed in accordance with systematic reviewing according to Cochrane standards, we followed the Cochrane guidance on conducting rapid reviews (Garritty 2020). Potential biases related to the rapid nature of the review were mitigated through regular team meetings, piloting and calibration at each screening and the data extraction stages, and maintaining a list of rolling questions to ensure consistency. This rapid review also built upon a preceding scoping review (Krishnaratne 2020).

In order to mitigate bias in decision-making and interpretation and synthesis of findings, the inclusion criteria covered a large range of study designs and included preprint publications due to the novel nature of the COVID-19 challenges and the associated young and rapidly growing body of literature. We also applied GRADE to assess the certainty of evidence according to each potential category of intervention and outcome, and assessed studies for risk of bias/ quality using appropriate risk of bias assessment tools according to study design. This included an adapted tool for modelling studies which was recently designed for a rapid review of international travel-related control measures to contain COVID-19 (Burns J 2021).

Our comprehensive search strategy was designed and undertaken by an information specialist in line with Cochrane guidance for rapid reviews. The search incorporated databases to capture preprints. Inclusion of more databases may have captured further relevant studies but may also have lengthened the time needed to carry out the review, whereas the current situation demands timely evidence to inform policy-makers' decisions around school measures.

The dominance of modelling studies is a potential source of bias within this rapid review. As most of the included studies handle complex questions and phenomena, mathematical models make use of a combination of epidemiological knowledge and modelling assumptions in an attempt to answer these questions. Such modelling studies are prone to introducing risk of bias due to many implicit or explicit assumptions and a usually considerable amount of input data or parameters that have to be specified. However, it is typical of a global pandemic that evidence is needed rapidly, and data collection is often difficult and complex, such that modelling studies are used as a method of prediction to inform policy decisions in lieu of primary data. A further issue is that many modelling studies did not clearly describe the hypothetical interventions implemented and did not allow for the separate analysis of how individual intervention components of multicomponent or combined interventions exerted effects on the respective outcomes. Further, the assumptions made within the models varied across studies, adding another source of heterogeneity.

As mentioned previously, many of the studies that we identified assessed the impact of measures implemented within the school setting on outcomes within the broader community, even if they did not have any direct connection with the school setting. This was a limitation that we identified in the scoping review (Krishnaratne 2020), and we were thus aware of it ahead of conducting this review. Allowing for extraction of data pertaining to the general population allowed us to capture studies looking at broader population impacts, and to assess whether or not they also looked at impacts on populations directly affected by the school setting.

A key limitation to this review was the lack of focus on the unintended consequences of measures implemented in the school setting to control the COVID-19 pandemic. When we developed the protocol for this review (Krishnaratne 2021), we decided that the most pressing question was the effectiveness of measures implemented in the school setting and that this review should thus focus primarily on studies assessing the effectiveness of measures; if included studies also reported on harms, we decided we would also examine these data, but that would not be a primary focus of the review. A separate scoping review of the unintended consequences of school measures and potential adverse health effects and broader social harms of school measures is currently ongoing (Kratzer 2021).

Another potential limitation to this review is that we limited the setting to primary and secondary schools, and did not consider early childhood or university settings. These settings are important in their own right, however, given the differences in the ages of these target groups and the non-compulsory nature of childcare and education in these settings, we anticipated that the measures implemented in these settings would be very different from those implemented in the school setting, as defined in the protocol for this review.

A further limitation to this review is that the risk of bias assessment was conducted by a single review author, with a second review author verifying the ratings. While this is in accordance with the Cochrane interim guidance on rapid reviews (Garritty 2020), it has to be acknowledged that this is prone to more subjectivity than an assessment in duplicate.

In terms of language, we did not consider databases in other languages, and might therefore have missed some studies. Lastly, most of the studies included in this review are preprints, which did not undergo peer review. While we endeavoured to mitigate this through thorough quality appraisal by the review authors, these studies may nevertheless be more prone to bias and quality concerns than peer-reviewed studies.

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Finally, a major limitation of this review is the fact that we identified all the included studies in December 2020, almost one year ago. We conducted a top-up search in August 2021 and identified 16 new studies (Characteristics of studies awaiting classification), but we have not carried out data extraction on these studies. Therefore, this review reflects the state of the literature in December 2020, and it is highly likely that the effects of these interventions would be very different now, especially given the rapid and widespread advancements in prevention and containment measures, most notably, the COVID-19 vaccines and increases in testing capacity, as well as the rise of more transmissible variants of the virus. An update to this review is imminent and will include those studies identified in the top-up search, as well as additional studies identified through a newer search.

Agreements and disagreements with other studies or reviews

Overall, this review, whilst mainly comprising modelling studies, suggests that measures to reduce transmission in schools can have a positive impact on a number of outcomes. This is supported by primary quantitative data in Wales (Thompson 2021), which has shown that with mitigation strategies in place, the occurrence of positive COVID-19 cases was shown to not increase the risk of staff to subsequently test positive. The occurrence of positive cases in a students' year group also did not lead to an increased risk for these students. However, the specific measures in place in the schools studied have not been investigated; further investigation is called for (Thompson 2021). The safe reopening of schools is particularly important due to the well-documented adverse effect of school closures, including impacts on nutrition, physical activity, mental health and overall well-being (Engzell 2021; Golberstein 2020; UNESCO 2021). There is also evidence that vulnerable children are more at risk without the safety net of the school setting, and that health and educational inequalities are widened (Viner 2020).

AUTHORS' CONCLUSIONS

Implications for practice

While there are some limitations with the evidence that we identified, and the overall certainty of evidence was generally very low, our review suggests that many measures implemented in the school setting can have positive impacts on the transmission of SARS-CoV-2, and on healthcare utilisation outcomes related to COVID-19. We identified a range of different interventions that worked in different ways to achieve intended outcomes.

The most commonly assessed measure in this review was reducing the opportunity for contacts in and on the way to schools. While showing largely positive effects with regards to transmissionrelated outcomes, none of the included studies in the review reported on adverse effects in terms of psychosocial health, educational outcomes or socioeconomic inequality. For studies that focused on phased reopening, this was a key strategy to reduce cases, transmission number and hospitalisations. A key detail for the implementation of this is distinguishing by age groups, with opening/reopening of primary schools consistently showing a smaller impact on these outcomes, thus suggesting it may be safer to open primary, versus secondary schools. We are unable to draw conclusions on the practicalities of such measures as most studies fell short of providing any insights into the reality of implementing such measures.

Studies focusing on measures to make contacts safer provided less clear evidence. Whilst studies that focused on the effect of masks were often multicomponent interventions, results suggested that mask wearing may be an important strategy for facilitating reopening of schools going forwards. A recent review has concluded that the benefit of public mask wearing is highest when compliance is high (Howard 2021), and that public compliance to mask wearing was associated with lower SARS-CoV-2/COVID-19 rates (Fischer 2021). However, these studies did not look specifically at the school setting. There were insufficient studies in this review to draw conclusions with regards to the effectiveness of ventilation interventions. Whilst it was shown within one study that air purifiers do reduce the dose of particles containing RNA virus in an experimental scenario (Curtius 2020), the quality of this evidence was low. Installing air purifiers in schools might entail significant costs and resources (e.g. energy, disposal of used filters), whilst at the same time contributing to widening inequalities with regards to some districts, states or nations being unable to afford ventilators/air purifiers.

Among studies looking at measures to detect, trace, and quarantine cases within schools it was found that such interventions could lead to reductions in the COVID-19 infection/transmission rate among students, teachers, and staff. The most effective testing and isolation strategies used a combination of early testing together with symptom screening and isolation of symptomatic cases. Students attending schools employing a hybrid approach were found to miss fewer days of school due to quarantines. This suggests that surveillance and isolation measures may need to be tailored to the specific context in which they are implemented and should take community-level factors into account in their design. There were also important findings relating to cost, and days lost in the classroom, which will need to be considered within future policy decisions, suggesting that surveillance testing of atrisk populations is cheaper than universal testing.

The 16 studies in the 'Studies awaiting classification' category may alter the conclusions of the review once assessed. There are a number of studies that we have identified, but that have not yet been incorporated in this review. If these studies are deemed to be important in terms of sample size or direction of effect, there may be a degree of change in the results and conclusions of this review. This is particularly important given the rapid and widespread advancements in prevention and containment measures, such as the COVID-19 vaccines and increases in testing capacity, as well as the rise of more transmissible variants of the virus. Like the current review, the majority of the studies awaiting classification used modelling study designs (n=8), followed by observational studies (n=7); one study used a randomized controlled study design. Nine studies were based in the USA and two were in Canada, with one study each in Belgium, Brazil, Italy, Israel, and the United Kingdom.

Implications for research

Future research should continue to refine the assessment of interventions and the factors that influence their effectiveness, such as the level of community transmission and adherence to measures. For example, while studies focused on reducing contacts within schools found that a smaller cohort was consistently associated with a lower level of transmission and fewer days of education lost, further primary research is required to be conducted in real-world settings to help to determine the exact effect of this measure, as well as the extent to which it is

practical within schools in various countries where resources, such as teaching staff and classroom space are varied and finite. In regards to mental and social health, and educational outcomes, these need to be at the forefront of future research to ensure that interventions aimed at reducing transmission do not do so to the detriment of these other important outcomes for students. The previously mentioned scoping review on unintended consequences of measures implemented in the school setting will address this to some extent (Kratzer 2021).

A major gap in the evidence that we identified is the fact that very few of the studies included here accounted for contextual factors in their assessment of intervention effectiveness. The largest intervention category we identified was 'measures to reduce contacts'. This often meant that interventions required only some students to attend school on certain days while others stayed at home and studied online. It also often meant that there needed to be significant space between students in classrooms. This is important, as many of the interventions described would require financial resources to provide virtual learning tools and infrastructure, and the availability of space for effective implementation. Indeed, most of the studies we identified either used data from, or were focused on, high-income countries, but regional differences, or even school-level differences relating to socioeconomic status, might influence how interventions are implemented and taken up, and this was rarely examined within the identified studies.

Also, while we acknowledge the challenge of collecting realworld data in the context of a pandemic, and the benefits of using modelling studies to provide insight into situations where empirical data collection is not easy, future research should employ observational and/or experimental and quasiexperimental study designs. This is essential for understanding how these interventions work, for whom, and in what contexts. Despite the strengths and value of modelling studies, real-world data will best be able to answer these key research questions, and the pandemic presents an opportunity to use internally valid experimental or quasi-experimental approaches to understand a complex and rapidly changing situation.

Further, many of the studies we identified described interventions that were multifaceted, and employed different types of measures at the same time. In future research, it would be helpful to go beyond presenting findings about multiple measures together and to pull apart the effects of individual intervention components. This will also have implications for practice as it will allow decision makers to understand which components of the interventions are most effective. Also, importantly, when we ran the original search for this rapid review, no vaccines against SARS-CoV-2 had been developed. The development and subsequent implementation of these vaccines will have greatly changed the evolution of the pandemic, particularly in the school setting, and especially now as use of the vaccines in younger populations is not yet widely approved. The implications of the vaccine on future practices surrounding the control of the pandemic in the school setting will need to be evaluated in future research.

With the evidence base on COVID-19 and the impact of measures implemented in the school setting to control the pandemic rapidly expanding and constantly changing, and with the anticipation that modelling studies will continue to form the bulk of the evidence base, it is critical that future modelling studies improve reporting and technical documentation to allow for adequate assessment of their quality. Finally, to ensure that the best available evidence informs decision-making about safely keeping schools open in the context of the pandemic, future research should employ a range of epidemiological designs and assessment tools to assess the broad impacts of these measures, including all potential benefits and harms in terms of education, and social and mental health. Given the growing evidence base and the developments in the control of the pandemic, particularly the introduction of vaccines, as well as in anticipation of new studies that will be published in the near future, we plan to update this review again in 2022.

The majority of studies were conducted or based in high-income countries. This may have implications for low- and middle-income countries, which have been shown to have more varied and expansive detrimental effects linked to school closures, such as widening inequalities, children missing out on vaccinations, parents losing vital income and children dropping out of school entirely (Viner 2021b). Thus, there is a need for further research to investigate the effect of non-pharmaceutical interventions on safe school reopening within low- and middle-income countries.

It is important to note that this is a fast-moving research field. Since December 2020, when we conducted our searches, 16 more studies examining school measures have been published (Asgary 2021; Bilinski 2021; Bosslet 2021; Cruz 2021; Ertem 2021; Gandini 2021; Lessler 2021; Liu 2021; Miller 2021; Pavilonis 2021; Reinbold 2021; Somekh 2021; van den Berg 2021; Willem 2021; Young 2021; Yuan 2021). They highlight, however, that the evidence base is growing further, and that a future update to this review will be important.

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Cochrane Public Health supported the development of this review. The following people conducted the editorial process for this review:

- Sign-off Editor (final editorial decision): Luke Wolfenden, The University of Newcastle
- Managing Editor (selected peer reviewers, collated peerreviewer comments, provided editorial guidance to authors, edited the article): Joey Kwong, Cochrane Editorial & Methods Department
- Editorial Assistant (conducted editorial policy checks and supported editorial team): Leticia Rodrigues, Cochrane Editorial & Methods Department
- Copy Editor (copy-editing and production): Clare Dooley, c/o Cochrane Copy Edit Support
- Peer-reviewers (provided comments and recommended an editorial decision*): Archana Koirala, National Centre for Immunisation Research and Surveillance, Sydney, Australia (clinical review); Emma Dobson, School of Education at Durham University (clinical review); Sebastian Walsh, Cambridge Public Health, University of Cambridge (clinical review); Ian Shemilt, EPPI Centre, University College London (UCL), UK (methods review); Gautham Suresh, Baylor College of Medicine; Texas



Children's Hospital, Houston, Texas (DTA review); Robert Walton, Cochrane UK (summary versions review); Jennifer Hilgart, Cochrane Editorial & Methods Department (methods review); Theresa Moore, Cochrane Editorial & Methods Department; the National Institute for Health Research Applied Research Collaboration West (NIHR ARC West), University Hospitals Bristol NHS Foundation Trust; Population Health Sciences, Bristol Medical School, University of Bristol, UK (methods review); Ruth Foxlee, Cochrane Editorial & Methods Department (search review). One additional peer reviewer provided consumer peer review but chose not to be publicly acknowledged. *Lisa Bero, Senior Editor of Cochrane Public Health and Health Systems, provided comments on this review, but was not otherwise involved in the editorial process or decision-making for this review.



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CHARACTERISTICS OF STUDIES

Characteristics of included studies [ordered by study ID]

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Krishnaratne 2020

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Study characteristics		
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Aspinall 2020		
Study characteristics		
Aspinall 2020 Study characteristics	 	

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Alvarez 2020

Baxter 2020

Study characteristics

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Bershteyn 2020

Study characteristics



Bershteyn 2020 (Continued)

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Burns A 2020

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Campbell 2020b

Study characteristics

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Cohen 2020

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Curtius 2020

Study characteristics

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Di Domenico 2020a

Study characteristics

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España 2020

Study characteristics

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Germann 2020

Study characteristics



Germann 2020 (Continued)

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Gill 2020

Study characteristics

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Head 2020

Study characteristics

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Hoehl 2020

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Isphording 2020

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Jones 2020

Study characteristics

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Kaiser 2020

Study characteristics

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Keeling 2020

Study characteristics



Keeling 2020 (Continued)

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Kraay 2020

Study characteristics

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Landeros 2020

Study characteristics

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Lazebnik 2020

Study characteristics

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Lee 2020

Study characteristics

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Lyng 2020

Study characteristics

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Mauras 2020

Study characteristics

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Monod 2020

Study characteristics



Monod 2020 (Continued)

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Munday 2020

Study characteristics

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Naimark 2020

Study characteristics

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Panovska-Griffiths 2020a

Study characteristics

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Panovska-Griffiths 2020b

Study characteristics

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Phillips 2020

Study characteristics

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Rozhnova 2020

Study characteristics

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Shelley 2020

Study characteristics



Shelley 2020 (Continued)

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Simonsen 2020

Study characteristics

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Sruthi 2020

Study characteristics

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Tupper 2020

Study characteristics

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Vlachos 2020

Study characteristics

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Williams 2020

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Zhang 2020

Study characteristics

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Characteristics of excluded studies [ordered by study ID]


Study	Reason for exclusion
Anchordoqui 2020	Irrelevant intervention
Balabdaoui 2020	Irrelevant study design
Bracis 2020	Irrelevant setting
Brooks-Pollock 2021	Irrelevant study design
Buonsenso 2020	Irrelevant study design
Coletti 2020	Irrelevant study design
Di Domenico 2020b	Irrelevant intervention
Ehrhardt 2020	Irrelevant study design
Gandolfi 2021	Irrelevant intervention
Garchitorena 2020	Irrelevant intervention
Johnson 2020	Irrelevant intervention
Kim 2020	Irrelevant intervention
Macartney 2020	Irrelevant study design
McBride 2020	Irrelevant intervention
McBryde 2020	Irrelevant intervention
Sneppen 2020	Irrelevant intervention
Stage 2021	Irrelevant intervention
Stein-Zamir 2020	Irrelevant study design
Wibbens 2020	Irrelevant intervention
Yoon 2020	Irrelevant study design

Characteristics of studies awaiting classification [ordered by study ID]

Asgary 2021

Notes

Objectives: to develop an agent-based model and simulation tool to evaluate testing strategies and scenarios in schools with various number of classrooms and class sizes in the Province of Ontario, Canada.



Bilinski 2021

Notes

Objectives: to develop an agent-based network model, simulating transmission in elementary and high school communities, including home, school, and interhousehold interactions, for assessment of transmission risk in elementary and high school communities in the US.

Bosslet 2021

Notes	Objectives: to determine the county-level effect of in-person primary and secondary school re- opening on daily cases of SARS-CoV-2 in Indiana, USA, by a panel data regression analysis of the proportion of in-person learning

Cruz 2021

Notes	
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Objectives: to analyse different strategies to reopen schools in the São Paulo Metropolitan Area, including one similar to the official reopening plan, through a computer simulation based on a stochastic compartmental model

Ertem 2021

Notes	Aims: a national, retrospective cohort study to evaluate the impact of school mode and opening to
	in a second diversitient on a whole accent allowed in a second with the side of a second s
	In-person education on subsequent changes in community incidence of SARS-Cov-2 in the USA.

Gandini 2021 Notes Aims: a cross-sectional and prospective cohort study to investigate the overall incidence of SARS-CoV-2 infection among students and teachers and to explore if there is an association between the increase in transmissibility of SARS-CoV-2 and dates of school openings in different Italian Regions.

Lessler 2021	
Notes	Aims: to investigate how different mitigation measures influenced COVID-19 transmission rates in the wider community in the US using data from the COVID-19 Symptom Survey, which collects and analyses data on schooling behaviours and SARS-CoV-2–related outcomes from households throughout the US.

Liu 2021

Notes

Aims: a retrospective cohort study based on a crowdsourcing data set from the National Education Association (NEA) of reopened K-12 public schools in the US to assess the spread of COVID-19 cases among the 3 reopening models (remote, hybrid, and in person) at the school district level.



Miller 2021

Notes

Objectives: using the COVIDTracer Advanced tool to model the transmission of SARS-CoV-2 in a school of 596 individuals, a scenario-based analysis to investigate the risk of transmission and adherence to mitigation measures.

Pavilonis 2021

Notes	Objectives: to estimate the risk of potential aerosol transmission of SARS-CoV-2 transmission among New York City public school students and teachers under steady-state conditions using previously collected classroom CO ₂ concentrations (from a large indoor air quality survey).

Reinbold 2021

Notes

Aims: to determine whether differences in K-12 instruction types at the beginning of the 2020-2021 school year in Illinois school districts were related to differences in COVID-19 cases, hospitalizations, and deaths in Illinois counties.

Somekh 2021

Notes	Aims: to investigate the effects of school reopening and easing of social-distancing restrictions on
	severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections in Israel.

van den Berg 2021	
Notes	Objectives: to conduct a retrospective analysis of data from traditional public schools in Massa- chusetts that opened with any in-person learning in order to evaluate the effectiveness of different physical distancing policies on the incidence of SARS-CoV-2 infections among students and school staff after school reopening.

Willem 2021	
Notes	Objectives: a stochastic individual-based model to analyse the effect of repetitive leisure contacts in extended household settings on the transmission of SARS-Cov-2 and explore contact tracing strategies based on the open-source IBM "STRIDE", fitted to COVID-19 data from Belgium.

Young 2021

Notes

Aims: an open-label cluster RCT in students and staff from secondary schools and further education colleges in England to investigate the effects of self-isolation vs. voluntary daily lateral flow device (LFD) testing for control of COVID-19 transmission.

Yuan 2021

Notes

Objectives: a Susceptible-Exposed-Asymptomatic-Infectious-Recovered-Hospitalised-Isolated model to explore school reopening scenarios using data from the city of Toronto.

ADDITIONAL TABLES

Table 1. Overview of intervention categories **Included interventions Broad intervention category** Measures reducing the oppor-• Phased reopening of schools tunity for contacts • Reduced cohort size Staggered start/end time • Alternating attendance • Only allowing schooling in person for certain grades/students Measures making contacts Face masks safer Handwashing interventions **Cleaning interventions** • Modifying activities in the school setting Ventilation interventions Combined measures to make contacts safer • Surveillance and response • Mass testing and isolation measures measures • Symptom-based screening and quarantine measures Multicomponent measures • Multiple measures including: reduced cohort size, face masks, handwashing interventions, modifying activities in the school setting, cleaning, testing, and quarantine

Study ID	Study design	Population (populations; school type; age group)	Country im- plementing the measure	School measure	Comparison	Outcome(s)	Notes - funding source as reported in the study
Alvarez 2020	Compartmen- tal SEIR mod- el	Population in which inter- vention is implemented: general school population; all school types Population in which out- come is assessed: general population; unspec- ified school types; unspeci- fied age group	Chile	Reducing the opportuni- ty for contacts: reducing the number of students and reducing the num- ber of contacts *Reduction of number of students and contacts: 100%, 75%, 50% and 25% *Reduction of contacts: implicit	Full opening of schools with no mea- sures in place	Transmis- sion-related outcome: shift in pandemic de- velopment Healthcare util- isation out- come: number or proportion of cases requiring intensive care Follow-up: 1 month (May to Jun 2020)	Not reported
spinall 2020	Bayesian Be- lief Network (stochastic uncertain- ty modelling tool -Unitet)	Population in which inter- vention is implemented: general school popula- tion; primary schools; age groups: 20 to 60 years (teachers, school staff); stu- dents Population in which out- come is assessed: general school popula- tion; primary schools; age groups: 20 to 60 years (teachers, school staff); stu- dent	UK	Reducing the opportuni- ty for contacts: reducing the number of students and reducing the num- ber of contacts *Reduction of number of students and contacts (35% to 41%/49% capac- ity; phased reopening for specific grades) *Reduction of contacts: implicit	Full opening of schools with no mea- sures in place	Transmis- sion-related outcome: num- ber or propor- tion of infected schools Follow-up: un- clear	The study was part of the RAMP initiative of the Royal Society.
Baxter 2020	Agent-based modelling study	Population in which inter- vention is implemented: general school popula- tion; kindergarten, prima- ry school and K-12; unspec- ified age group (cut-off for younger children at 10 years) Population in which out- come is assessed: general population	USA	Reducing the opportuni- ty for contacts: reducing the number of students and reducing the num- ber of contacts *Reduction of number of students in school (phased reopening of primary schools; 50% capacity)	Full opening of schools with no mea- sures in place	Transmis- sion-related outcomes: number or pro- portion of cas- es; number or proportion of deaths Follow-up: ~5 months (Jul to Nov 2020)	Supported by the William W George and by the Virginia C and Joseph C Mello endow ments at Georgia Tech This research was sup- ported in part by NSF grant MRI 1828187 and research cyberinfra- structure resources and services provid-

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				*Reduction of contacts: alternating attendance schedule (daily)			ed by the Partnership for an Advanced Com- puting Environment (PACE) at the Georgia Institute of Technolo- gy.
Bershteyn 2020	Simulation model	Population in which inter- vention is implemented: general school popula- tion; Kindergarten, prima- ry school and K-12; unspeci- fied age group Population in which out- come is assessed: student population; un- specified school type; un- specified age group	USA	Reducing the opportuni- ty for contacts: reducing the number of students and reducing the num- ber of contacts *Reduction of number of students in school (50% capacity in schools) *Reduction of number of students in class (9 versus 13 students per class) *Reduction of contacts: alternating attendance schedule (daily, weekly) Surveillance and re- sponse measures: symp- tom-based screening and quarantine mea- sures	Least intense measure	Transmis- sion-related outcome: num- ber or propor- tion of cases Follow-up: not specified	Not reported
Burns A 2020	Determinstic SEIR modifi- cation	Population in which inter- vention is implemented: general school population; unspecified school type; un- specified age group Population in which out- come is assessed: general school population; unspecified school types; unspecified age group	USA	Reducing the opportuni- ty for contacts: reducing the number of students and reducing the num- ber of contacts *Reduction of number of students (50% capacity) *Reduction of contacts: alternating attendance schedule Surveillance and re- sponse measures: symp- tom-based screening and quarantine mea- sures	Full opening of schools with no mea- sures in place	Transmis- sion-related outcomes: number or pro- portion of cas- es; shift in pan- demic develop- ment Follow-up: 8 months (Jan to Aug 2020)	One author was spon- sored by US NIH grant R01GM121600.

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Table 2. Characteristics of included studies (Continued)

Campbell	Health eco-	Population in which inter-	Canada	Surveillance and re-	Least intense	Societal, eco-	Directly funded by an
2020b	nomic model	vention is implemented: general school population; primary and secondary schools; unspecified age group Population in which out- come is assessed: general school population; unspecified school types; unspecified age group		sponse measures: mass testing and isolation	measure	nomic and ecological outcome: re- sources Follow-up: 42 days (1 com- plete round of testing)	operating grant (ECRF- R1-30) from the McGill Interdisciplinary Ini- tiative in Infection and Immunity (MI4), a philanthropic sci- entific-granting or- ganisation with peer- reviewed competi- tion; Dick Menzies was the Principal Investi- gator and Jonathon Campbell the co-Prin- cipal Investigator. The grant also supports the salaries of Aash- na Uppal and Mer- cedes Yanes-Lane. Jonathon Camp- bell (Award #258907, Award #287869) and Stephanie Law (Award #258467) are fund- ed by a postdoctoral fellowship from the Fonds de Recherche du Québec—San- té. Nicholas Winters (Award #284837) is funded by a doctor- al fellowship from the Fonds de Recherche du Québec, Santé. W Alton Russell is fund- ed by a Stanford In- terdisciplinary Gradu- ate Fellowship. Mayara Bastos, Federica Fre- gonese, Nicholas Win- ters, Jonathon Camp- bell and Olivia Oxlade are funded through a Canadian Institutes of

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							(#FRD143350). Gior- gia Sulis is funded by a Richard H Tomlinson Doctoral Fellowship.
Cohen 2020	Agent-based model (Cov- asim)	Population in which inter- vention is implemented: general school population; primary, middle, and high schools; students of 5 to 18 years old Population in which out- come is assessed: general population; unspec- ified age group	USA	Reducing the opportuni- ty for contacts: reducing the number of students and reducing the num- ber of contacts *Reduction of number of students (50% capacity) *Reduction of contacts: alternating attendance schedule Making contacts safer: combined measures to make contacts safer Surveillance and re- sponse measures: mass testing and isolation	Full opening of schools with no mea- sures in place	Transmis- sion-related outcomes: number or pro- portion of cas- es; reproduc- tion number; risk of infection Societal, eco- nomic and eco- logical out- come: numbers of days spent in school Follow-up: 3 months (Sep to Dec 2020)	Not reported
Curtius 2020	Experimen- tal study with modelling component	Population in which inter- vention is implemented: general school population; high school; unspecified age group (note: typical high school students in Germany are 10 to 19 years) Population in which out- come is assessed: general school population; high school; unspecified age group (note: typical high school students in Germany are 10 to 19 years)	Germany	Making contacts safer: ventilation	Full opening of schools with no mea- sures in place	Transmis- sion-related outcomes: oth- er (inhaled dose) Follow-up: 2 hours	Conducted without ex- ternal financial sup- port
Di Domenico 2020a	Stochastic discrete age- structured epidemic model	Population in which inter- vention is implemented: general school population; primary schools, middle schools, high schools; un- specified age group	France	Reducing the opportuni- ty for contacts: reducing the number of students and reducing the num- ber of contacts	Full opening of schools with no mea- sures in place	Transmis- sion-related outcome: num- ber or propor- tion of cases Healthcare util- isation out-	Partially funded by: ANR projects SPHINX (ANR-17- CE36-0008-05) and DATAREDUX (ANR-19- CE46-0008-03); EU H2020 grants RECOV-



ſable 2. Char	acteristics of in	cluded studies (Continued) Population in which out- come is assessed: general population; unspec- ified age group		*Reduction of number of students (75%, 50%, 25% capacity) *Reduction of contacts: implicit Surveillance and re- sponse measures: mass testing and isolation		come: number or proportion of cases requiring intensive care Follow-up: 2 months (May to Jun 2020)	ER (H2020-101003589) and MOOD (H2020-874850); RE- ACTing COVID-19 mod- elling grant
España 2020	Meta-popula- tion model *based on FRED	Population in which inter- vention is implemented: school students, staff and parents; elementary, middle and high; 5 to 18 years Population in which out- come is assessed: schools and general popu- lation; elementary, middle and high; all ages	USA	Reducing the opportuni- ty for contacts: reducing the number of students and reducing the num- ber of contacts *Reduction of number of students (75%, 50% ca- pacity) *Reduction of contacts: implicit Making contacts safer: face masks	Least intense measure Full opening of schools with no mea- sures in place	Transmis- sion-related outcomes: number or pro- portion of cas- es; number or proportion of deaths; risk of infection; risk of death Follow-up: 4 months (Aug to Dec 2020)	Supported by a NSF RAPID grant (DEB 2027718), an Arthur J Schmitt 313 Fellow- ship and Eck Institute for Global Health Fel- lowship, and a Richard and Peggy 314 No- tabaert Premier Fel- lowship
Germann 2020	Agent-based community simulation	Population in which inter- vention is implemented: students, teachers and staff; elementary, middle and high schools; 5 to 18 years Population in which out- come is assessed: general population	USA	Reducing the opportuni- ty for contacts: reducing the number of students and reducing the num- ber of contacts *Reduction of number of students (80% capacity) * Reduction of contacts: alternating attendance schedule (weekly, 2 days) Making contacts safer: combined measures to make contacts safer *Face masks *Hand-hygiene policy *Other 'distancing mea- sures'	Least intense measure Full opening of schools with no mea- sures in place	Transmis- sion-related outcomes: number or pro- portion of cas- es; number or proportion of deaths; shift in pandemic de- velopment Healthcare util- isation out- come: number or proportion of hospitalisations Follow-up: 8 months	Sponsored by the Unit- ed States Centers for Disease Control and Prevention. Los Alam- os National Laborato- ry, an affirmative ac- tion/equal opportuni- ty employer, is operat- ed by Triad National Security, LLC, for the National Nuclear Se- curity Administration of the United States Department of Ener- gy under contract # 19FED1916814CKC. Approved for public re- lease: LA-UR-20-27982
Gill 2020	Agent-based model	Population in which inter- vention is implemented:	USA	Reducing the opportuni- ty for contacts: reducing the number of students	Least intense measure	Transmis- sion-related outcome: num-	Not reported

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Measures implemented in the school setting to contain the COVID-19 pandemic	Table 2. Chara	acteristics of ind	cluded studies (Continued) students, teachers and school staff; primary and secondary schools; 5 to 18 years Population in which out- come is assessed: students, teachers and school staff; elementary, middle and high school population		and reducing the num- ber of contacts *Reduction of number of students (50% capacity) *Reduction of contacts: alternating attendance schedule (1 to 4 days per week) Making contacts safer: combined measures to make contacts safer *Face masks in school and on school bus *Lunch is eaten in class- room *Elementary students remain with the same class all day, while older students take six classes during the day Surveillance and re- sponse measures: mass testing and isolation *Testing and quarantine	Full opening of schools with no mea- sures in place	ber or propor- tion of cases Societal, eco- nomic and eco- logical out- come: numbers of days spent in school Follow-up: not specified	
Review) 6	Head 2020	Meta-popula- tion model	Population in which inter- vention is implemented: students, staff and teach- ers; elementary, middle and high schools; 5 to 18 years Population in which out- come is assessed: students, staff and teach- ers; household members; community members; ele- mentary, middle and high schools; all age groups	USA	Reducing the opportuni- ty for contacts: reducing the number of students and reducing the num- ber of contacts *Reduction of number of students (50% capacity in class (high school: 10 students; 20 students in elementary schools)) *Reduction of contacts: alternating attendance schedule Making contacts safer: face masks Surveillance and re- sponse measures: mass testing and isolation	Full opening of schools with no mea- sures in place Single inter- vention com- ponent Least intense measure	Transmis- sion-related outcomes: number or pro- portion of cas- es; number or proportion of deaths Healthcare util- isation out- come: number or proportion of hospitalisations Follow-up: 12 months (Jan to Dec 2020)	JVR, JRH, QC, PAC, SP, AKH, CMH, and KC were supported in part by National Science Foundation grant no. 2032210, National Institutes of Health grants nos. R01A1125842, R01TW010286 and R01A1148336, and by the University of Cal- ifornia Multicampus Research Programs and Initiatives award # 17-446315. JAL re- ceived support from the Berkeley Popu- lation Center (grant number P2CHD073964 from the National In-

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							stitute of Child Heal & Human Develop- ment, National Insti tutes of Health).
Hoehl 2020	Observational test accuracy study	Unspecified	Germany	Surveillance and re- sponse measures: mass testing and isolation	Least intense measure	Transmis- sion-related outcome: num- ber of cases de- tected due to measure Follow-up: 7 weeks	The study was com- missioned and fund- ed by the Hessian Mi istry of Education ar the Hessian Ministry Integration and Soci Affairs.
Isphording 2020	Quasi-experi- mental study	Population in which inter- vention is implemented: students and teachers; primary and secondary schools; 6 to 18 years Population in which out- come is assessed: general population; age groups: 0 to 14, 15 to 34 and 35 to 59, 60 to 79, 80+ years	Germany	Multicomponent mea- sures *Reduction of contacts: alternating attendance schedule; staggered ar- rival and departure *Face masks *Testing and quarantine	School clo- sures	Transmis- sion-related outcome: num- ber or propor- tion of cases Follow-up: 3 Aug to 14 Sep 2020	Discussion paper pu lished by the IZA Inst tute of Labor Econor ics (an independent economic research i stitute that conducts research in labor eco nomics and offers ev idence-based policy advice on labor mar- ket issues). Supporte by the Deutsche Pos Foundation
Jones 2020	Poisson re- gression mod- el	Population in which inter- vention is implemented: students and staff at prima- ry, middle and high school Population in which out- come is assessed: students and staff at prima- ry, middle and high school; all age groups	USA	Reducing the opportuni- ty for contacts: reducing the number of students and reducing the num- ber of contacts *Reduction of number of students (55% capacity) *Reduction of contacts: implicit	Full opening of schools with no mea- sures in place	Transmis- sion-related outcome: num- ber or propor- tion of cases Follow-up: ~3 months (Aug to Oct 2020)	No funding was se- cured for this study.
Kaiser 2020	Network model: sim- ulating the transmission of COVID-19 in classrooms	Population in which inter- vention is implemented: general school population; all school types; contact da- ta from 14 to 15 year-olds	UK, Germany, the Nether- lands, Swe- den	Reducing the opportuni- ty for contacts: reducing the number of students and reducing the num- ber of contacts	Least intense measure	Transmis- sion-related outcome: num- ber or propor- tion of cases	Supported by the sta of Baden-Württem- berg through bwHPC and the German Re- search Foundation (DFG) through grant

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able 2. Char	acteristics of i	Continued) Population in which out- come is assessed: general school population; all school types; all age groups		*Reduction of number of students (50% capacity) *Reduction of contacts: alternating attendance schedule		Follow-up: 7 weeks	INST 35/1134-1 FUGG. CILS4EU research project funded in the NORFACE ERA NET Plus Migration in Eu- rope-programme
Keeling 2020	Complex SEIR-based ordinary differential equation model	Population in which inter- vention is implemented: general school population; all school types; 0 to 19 year olds Population in which out- come is assessed: general population; unspec- ified school types; unspeci- fied age group	UK	Reducing the opportuni- ty for contacts: reducing the number of students and reducing the num- ber of contacts *Reduction of number of students (50% capacity) *Reduction of contacts: implicit	Full opening of schools with no mea- sures in place	Transmis- sion-related outcomes: number or pro- portion of cas- es; number or proportion of deaths; repro- duction num- ber Healthcare util- isation out- come: number or proportion of cases requiring intensive care Follow-up: 3 weeks (Jun 2020)	This work was fund- ed by the Engineering and Physical Sciences Research Council through the 423 Math- Sys CDT (grant number EP/S022244/1) and by the Medical Research Council through the 424 COVID-19 Rapid Response Rolling Call (grant number MR/ V009761/1).
Kraay 2020	SIR-based modelling study	Population in which inter- vention is implemented: school staff (cleaning); un- specified school types; un- specified age group Population in which out- come is assessed: general population; unspec- ified school types; unspeci- fied age group	USA	Making contacts safer: cleaning Making contacts safer: handwashing	Least intense measure Full opening of schools with no mea- sures in place	Transmis- sion-related outcome: re- production number Follow-up: not specified	Not reported
Landeros 2020	SEIR-based ordinary differential equation model	Population in which inter- vention is implemented: general school population; K-12; K-12 age (5 to 18 years) Population in which out- come is assessed:	USA	Reducing the opportuni- ty for contacts: reducing the number of students and reducing the num- ber of contacts	Full opening of schools with no mea- sures in place	Transmis- sion-related outcomes: re- production number; shift in pandemic de- velopment	KLL and JSS are sup- ported by the Nation- al Institute of Gener- al Medical Sciences of the National Insti- tutes of Health under award number R01G-

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Measures implemented in the school setting to contain the C Copyright © 2022 The Cochrane Collaboration. Published by Jol	Table 2. Chara	icteristics of ind	cluded studies <i>(Continued)</i> general school population; K-12; K-12 age (5 to 18 years)		*Reduction of number of students (50% and 33% capacity) *Reduction of contacts: alternating attendance (parallel and rotating co- horts) Making contacts safer: combined measures to make contacts safer *Masks *Desk shields *Frequent surface clean- ing *Outdoor instruction Surveillance and re- sponse measures: mass testing and isolation		Follow-up: 6 months	M053275. MES is supported by the Susan G Komen Career Catalyst Award CCR16380478. JX is supported by the National Science Foun- dation under grant number DMS-2030355.	Cochrane Trusted evidence. Library Better health.
COVID-19 pandemic (Review) hn Wiley & Sons, Ltd.	Lazebnik 2020	Hybrid mod- el: SIRD type temporal dy- namics and spatial dy- namics for home, school, workplace (Addition- al compart- ments: age classes chil- dren (< 13 years) and adults)	Population in which inter- vention is implemented: general school population; not specified; average age 13 years Population in which out- come is assessed: general population; unspec- ified school types; unspeci- fied age group	Israel	Making contacts safer: modification of activities	Least intense measure	Transmis- sion-related outcome: re- production number Follow-up: two weeks	No external funding was received.	Coch
7	Lee 2020	Age-stratified estimation for R0 based on assumed SIR- model	Population in which inter- vention is implemented: general school population; not specified; 0 to 14 years Population in which out- come is assessed: general population; unspec- ified school types; unspeci- fied age group	China	Reducing the opportuni- ty for contacts: reducing the number of students and reducing the num- ber of contacts *Reduction of number of students (33% capacity in high schools) *Reduction of contacts: implicit	Full opening of schools with no mea- sures in place	Transmis- sion-related outcome: re- production number Follow-up: not specified	None	hrane Database of Systematic Review

Table 2. Characteristics of included studies (Continued)

asures implemented in the school settin	Lyng 2020	SIR model analysing dif- ferent test/ suveillance strategies	Population in which inter- vention is implemented: general school population; unspecified school types; unspecified age group Population in which out- come is assessed: general population; unspec- ified school types; unspeci- fied age group	USA	Surveillance and re- sponse measures: mass testing and isolation	Least intense measure	Transmis- sion-related outcome: num- ber or propor- tion of cases Societal, eco- nomic and ecological outcome: re- sources Follow-up: not specified	Not reported
g to contain the COVID-19 pandemi	Mauras 2020	Agent-based SEIR with con- tact networks	Population in which inter- vention is implemented: general school population; primary and high school; unspecified age group Population in which out- come is assessed: general population; unspec- ified school types; unspeci- fied age group	France	Reducing the opportuni- ty for contacts: reducing the number of students and reducing the num- ber of contacts *Reduction of number of students (50% capacity) *Reduction of contacts: implicit	Full opening of schools with no mea- sures in place	Transmis- sion-related outcomes: number or pro- portion of cas- es; shift in pan- demic develop- ment Follow-up: not specified	LO received research funding from Pfizer (through her research unit) on research relat- ed to meningococcal epidemiology and an- timicrobial resistance.
c (Review) 72	Monod 2020	Bayesian model for transmission dynamics in the USA	Population in which inter- vention is implemented: school students and staff; kindergarten and elemen- tary schools; 0 to 11 years Population in which out- come is assessed: students; kindergarten and elementary schools; 0 to 11 years	USA	Making contacts safer: combined measures to make contacts safer *Masks *Other NPIs	Full opening of schools with no mea- sures in place	Transmis- sion-related outcomes: number or pro- portion of cas- es; number or proportion of deaths Follow-up: 90 days	This study was sup- ported by the Imper- ial College COVID-19 Response Fund, the Imperial College Re- search Computing Ser- vice DOI:10.14469/ hpc/2232, the Bill & Melinda Gates Foun- dation, and the EPSRC through the EPSRC Centre for Doctoral Training in Modern Statistics and Statis- tical Machine Learn- ing at Imperial and Ox- ford, the UK Medical Research Council un- der a concordat with the UK Department for International De-

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							velopment, the NIHR Health Protection Re- search Unit in Model- ling Methodology and Community Jameel.
1unday 2020	Network model de- scribing trans- mission be- tween schools	Population in which intervention is implemented: general school population; school type; 4 to 18 years Population in which out- come is assessed: schools; all school types; 4 to 18 years	UK	Reducing the opportuni- ty for contacts: reducing the number of students and reducing the num- ber of contacts *Reduction of number of students (phased reopening of primary schools; grades) *Reduction of contacts: implicit	Full opening of schools with no mea- sures in place	Transmis- sion-related outcome: risk of transmission to other schools Follow-up: not specified	This project received funding from the Eu- ropean Union's Hori- zon 2020 research and innovation pro- gramme - project Epi- Pose (101003688: WJE). This research was partly funded by the National Institute for Health Research (NIHR) using UK aid from the UK Govern- ment to support glob- al health research. The views expressed in this publication are those of the author(s) and not necessarily those of the NIHR or the UK Department of Health and Social Care (PR- OD-1017-20002: WJE). Health Protection Re- search Unit for Immu- nisation NIHR200929: AJVH, JDM, KEA. UK MRC (MC_PC_19065: WJE). Wellcome Trust (210758/Z/18/Z: JDM, JH, KS, NIB, SA, SFunk, SRM). Nakajima Foun- dation (AE). DFID/ Wellcome Trust (Epi- demic Preparedness Coronavirus research programme 221303/ Z/20/Z: CABP). This research was partly funded by the Bill &

Table 2. Chara	acteristics of in	cluded studies (Continued)					Melinda Gates Founda- tion (INV-001754: MQ; INV-003174: KP, MJ, YL; NTD Modelling Con- sortium OPP1184344: CABP). NTD Mod- elling Consortium OPP1184344: CABP. No funding (JW)
Naimark 2020	Agent-based SEIR-based simulation model	Population in which inter- vention is implemented: general school population; daycare, primary, elemen- tary and high school; 2 to 17 years Population in which out- come is assessed: school and general popula- tion; daycare, primary, ele- mentary and high school; all age groups	Canada	Multicomponent mea- sures *Reduction of number of students (15 to 23 stu- dents per class) *Face masks	School clo- sure	Transmis- sion-related outcome: num- ber or propor- tion of cases Follow-up: 2 months (Sep to Oct 2020)	This research was sup- ported by COVID-19 Rapid Research Fund- ing (C-291-2431272- SANDER through the Ontario Ministry of Health, Ontario To- gether grant. This re- search was support- ed, in part, by a Cana- da Research Chair in Economics of In- fectious Diseases held by Beate San- der (CRC-950-232429). Sharmistha Mishra is supported by a Tier 2 Canada Research Chair in Mathematical Mod- elling and Programme Science.
Panovs- ka-Griffiths 2020a	Agent-based SEIR-model (Covasim)	Population in which inter- vention is implemented: general school population; all school types; 4 to 18 years Population in which out- come is assessed: general population; unspec- ified school types; unspeci- fied age group	UK	Reducing the opportuni- ty for contacts: reducing the number of students and reducing the num- ber of contacts *Reduction of number of students (50% capacity) *Reduction of contacts: 20 contacts per day Surveillance and re- sponse measures: mass testing and isolation	Least intense measure Full opening of schools with no mea- sures in place	Transmis- sion-related outcomes: number or pro- portion of cas- es; number or proportion of deaths; repro- duction num- ber; shift in pandemic de- velopment	None

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fable 2. Chai	acteristics of ind	cluded studies (Continued)				Follow-up: 2 years (Dec 2019 to Dec 2021)	
Panovs- ka-Griffiths 2020b	Agent-based model (based on Covasim)	Population in which inter- vention is implemented: school population; sec- ondary school; 12 to 19 years Population in which out- come is assessed: general population; sec- ondary school; all age groups	UK	Making contacts safer: face masks Surveillance and re- sponse measures: mass testing and isolation	Least intense measure	Transmis- sion-related outcomes: number or pro- portion of cas- es; shift in pan- demic develop- ment Follow-up: 9 months (Jul 2020 to Mar 2021)	Not reported
Phillips 2020	Agent-based simulation of one school/ child care fa- cility embed- ded in the community	Population in which inter- vention is implemented: students, teachers, school staff; primary schools; 0 to 9 years; 25 to 44 years Population in which out- come is assessed: general population; unspec- ified school types; unspeci- fied age group	Canada	Reducing the opportuni- ty for contacts: reducing the number of students and reducing the num- ber of contacts *Reduction of number of students (30 versus 15 versus 8 students per class) *Reduction of contacts: alternating attendance schedule (weekly) Making contacts safer: combined measures to make contacts safer *Face masks *Social distancing *Disinfection protocols	Least intense measure Full opening of schools with no mea- sures in place	Transmis- sion-related outcomes: re- production number: shift in pandemic de- velopment Societal, eco- nomic and eco- logical out- come: numbers of days spent in school Follow-up: 120 days	Not reported
Rozhnova 2020	Model for the Netherlands (effect of opening/clos- ing schools on informative epidemic da- ta)	Population in which inter- vention is implemented: students; all school types; 0 to 20 years (0 to 5; 5 to 10; 10 to 20) Population in which out- come is assessed:	the Nether- lands	Reducing the opportuni- ty for contacts: reducing the number of contacts *Reduction of contacts between students (100% to 0%)	Full opening of schools with no mea- sures in place	Transmis- sion-related outcome: re- production number Follow-up: 1 month (Dec 2020)	Did not report on cases without symptoms. The contribution of CHvD was under the auspices of the US Department of Ener- gy (contract number

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Measures implemented in the school setting to contain the C	Table 2. Char	acteristics of in	cluded studies (Continued) general population; unspec- ified school types; unspeci- fied age group					89233218CNA000001) and supported by the National Institutes of Health (grant num- ber R01-OD011095). MEK was supported by ZonMw grant num- ber 10430022010001, ZonMw grant number 91216062, and H2020 project 101003480 (CORESMA). MJMB and PB-V were support- ed by H2020 project 101003589 (RECOV- ER). GR was support- ed by FCT project 131_596787873.
OVID-19 pandemic (Review)	Shelley 2020	Deterministic SEIR model stratified in- to town and different co- horts within a school	Population in which inter- vention is implemented: general school population; unspecified school types; unspecified age group Population in which out- come is assessed: general population; all school types; all age groups	USA	Reducing the opportuni- ty for contacts: reducing the number of students and reducing the num- ber of contacts *Reduction of number of students (50% and 25% capacity) *Reduction of contacts: alternating attendance schedule	Full opening of schools with no mea- sures in place	Transmis- sion-related outcome: num- ber or propor- tion of cases Follow-up: 10 weeks	Not reported
	Simonsen 2020	Uncontrolled before-after study	Population in which inter- vention is implemented: students; primary schools; 5 to 13 years Population in which out- come is assessed: students; primary schools; 5 to 13 years	Denmark	Making contacts safer: handwashing	Full opening of schools with no mea- sures in place	Other health outcomes: physical health Follow-up: not specified	None
F	Sruthi 2020	Machine Learning algo- rithm to dis- entangle ef-	Population in which inter- vention is implemented: general school population; secondary school; 11 to 18 years	Switzerland	Making contacts safer: face masks	Full opening of schools with no mea- sures in place	Transmis- sion-related outcome: re- production number	Not reported

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able 2. Char	acteristics of ind fects of differ- ent NPIs	Population in which out- come is assessed: general population; not specified; all age groups				Follow-up: 26 weeks (Mar to Sep 2020)	
Tupper 2020	Stochas- tic individ- ual-based model with the states susceptible (S), exposed (E), presymp- tomatic (P), symptomatic (Sym), and re- covered (R)	Population in which inter- vention is implemented: students; elementary and high school; age groups: el- ementary and high school students Population in which out- come is assessed: students; elementary and high school; age groups: el- ementary and high school students	Canada	Surveillance and re- sponse measures: mass testing and isolation; testing and quarantine *Weekly or every three days testing or environ- mental monitoring cov- ering all individuals in the class *Isolation/quarantine	Least intense measure	Transmis- sion-related outcome: num- ber or propor- tion of cases Follow-up: 50 days	Funding from the Nat- ural Sciences and En- gineering Research Council of Canada (NSERC) grant RG- PIN-2019-06911 and from Genome British Columbia (COV-142)
Vlachos 2020	Difference-in- difference study	Population in which inter- vention is implemented: general school population; lower secondary school (school years 7 to 9, typical age 14 to 16). Authors fo- cus on final year; upper sec- ondary school (school years 10 to 12, typical age 17 to 19) Population in which out- come is assessed: general population; unspec- ified school types; unspeci- fied age group	Sweden	Multicomponent mea- sures *Handwashing policy *Physical distance *Modification of ac- tivities (open house, parental meetings, out- door activities, large gatherings cancellation) *Cleaning protocols	School clo- sure	Transmis- sion-related outcome: num- ber or propor- tion of cases Follow-up: not specified	Financial support from Handelsbankens forskningssiftelser
Williams 2020	COVID agent- based model	Population in which inter- vention is implemented: general school population; unspecified school types; unspecified age group Population in which out- come is assessed: general population; unspec- ified school types; unspeci- fied age group	USA	Surveillance and re- sponse measures: mass testing and isolation *Testing: sampling (sim- ple random sampling, cluster sampling, and pooled sampling strate- gies) *Quarantine (isolation of positive cases)	Least intense measure	Transmis- sion-related outcomes: number or pro- portion of cas- es; shift in pan- demic develop- ment Societal, eco- nomic and ecological	Department of Sociol- ogy at the University of Washington funded support programming efforts for this study

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Table 2. Characteristics of included studies (Continued) outcome: re-sources sources Follow-up: ~8 months outcome: re-sources							
Zhang 2020	SIR model and with con- tact matrices based on di- aries/ques- tionaires via phone	Population in which inter- vention is implemented: general school population; all school types; age groups: 0 to 6 yrs; 7 to 19 yrs Population in which out- come is assessed: general population; unspec- ified school types; unspeci- fied age group	China	Reducing the opportuni- ty for contacts: reducing the number of students and reducing the num- ber of contacts *Reduction of number of students (phased re- opening of high schools) *Reduction of contacts: implicit	Full opening of schools with no mea- sures in place	Transmis- sion-related outcome: re- production number Follow-up: not specified	Not reported

FRED: framework for reconstructing epidemic dynamics; NPI: non-pharmaceutical intervention; R0: basic reproduction number; SEIR: Susceptible-Exposed-Infectious-Removed; SIR: susceptible, infectious-asymptomatic, infectious-symptomatic, removed; SIRD: Susceptible-Infectious-Recovered-Deceased model

Table 3.	Summary of	f quality appr	aisal for mo	delling studies
----------	------------	----------------	--------------	-----------------

Study ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Alvarez 2020	Yes	No/minor concerns	Moderate concerns	Major con- cerns	Partial	Moderate concerns	No	Moderate concerns	Major con- cerns	Moderate concerns
Aspinall 2020	Partial	Moderate concerns	No/minor concerns	No/minor concerns	No	Major con- cerns	Partial	No/minor concerns	No/minor concerns	No/minor concerns
Baxter 2020	Partial	Moderate concerns	No/minor concerns	Moderate concerns	No	Major con- cerns	Partial	Moderate concerns	Major con- cerns	Major con- cerns
Bershteyn 2020	No	Major con- cerns	Major con- cerns	Major con- cerns	No	Major con- cerns	No	Major con- cerns	Major con- cerns	Major con- cerns
Burns A 2020	Partial	Major con- cerns	Moderate concerns	Major con- cerns	Partial	Major con- cerns	No	Moderate concerns	Moderate concerns	Moderate concerns
Campbell 2020b	Yes	No/minor concerns	No/minor concerns	No/minor concerns	No	Major con- cerns	No	Moderate concerns	No/minor concerns	No/minor concerns

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Cohen 2020	Partial	Moderate concerns	Moderate concerns	Moderate concerns	No	Major con- cerns	Partial	Moderate concerns	Moderate concerns	Major con- cerns
Curtius 2020	Partial	Major con- cerns	Moderate concerns	Moderate concerns	Partial	Moderate concerns	No	Moderate concerns	Moderate concerns	Moderate concerns
Di Domenico 2020a	Partial	Moderate concerns	No/minor concerns	Moderate concerns	Partial	Moderate concerns	Partial	Moderate concerns	Moderate concerns	Major con- cerns
España 2020	Yes	No/minor concerns	No/minor concerns	No/minor concerns	Yes	Moderate concerns	Partial	Moderate concerns	Moderate concerns	Moderate concerns
Germann 2020	Partial	No/minor concerns	Moderate concerns	No/minor concerns	No	Major con- cerns	Partial	Moderate concerns	Major con- cerns	Major con- cerns
Gill 2020	Yes	No/minor concerns	No/minor concerns	No/minor concerns	No	Major con- cerns	Partial	Moderate concerns	Moderate concerns	No/minor concerns
Head 2020	Yes	No/minor concerns	Moderate concerns	Moderate concerns	Yes	Moderate concerns	No	Moderate concerns	Moderate concerns	Major con- cerns
Jones 2020	Partial	No/minor concerns	No/minor concerns	Major con- cerns	Partial	Moderate concerns	No	Moderate concerns	Moderate concerns	Moderate concerns
Kaiser 2020	Yes	No/minor concerns	No/minor concerns	Moderate concerns	No	Major con- cerns	No	Moderate concerns	No/minor concerns	Moderate concerns
Keeling 2020	Partial	No/minor concerns	Moderate concerns	No/minor concerns	Partial	Moderate concerns	Partial	Moderate concerns	Moderate concerns	Major con- cerns
Kraay 2020	Partial	Moderate concerns	No/minor concerns	Moderate concerns	No	Major con- cerns	No	Moderate concerns	Major con- cerns	Moderate concerns
Landeros 2020	Yes	Major con- cerns	No/minor concerns	Major con- cerns	No	Major con- cerns	No	Moderate concerns	Moderate concerns	No/minor concerns
Lazebnik 2020	Partial	Moderate concerns	No/minor concerns	Major con- cerns	Yes	Moderate concerns	Partial	Moderate concerns	Major con- cerns	Major con- cerns
Lee 2020	Yes	Moderate concerns	Moderate concerns	Moderate concerns	No	Major con- cerns	No	Moderate concerns	Moderate concerns	No/minor concerns

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Lyng 2020	Yes	Major con- cerns	No/minor concerns	Major con- cerns	No	Major con- cerns	Partial	Moderate concerns	Major con- cerns	No/minor concerns
Mauras 2020	Yes	No/minor concerns	No/minor concerns	No/minor concerns	Partial	No/minor concerns	Partial	No/minor concerns	No/minor concerns	No/minor concerns
Monod 2020	Yes	No/minor concerns	No/minor concerns	No/minor concerns	Yes	Moderate concerns	No	Moderate concerns	No/minor concerns	No/minor concerns
Munday 2020	Yes	Major con- cerns	No/minor concerns	No/minor concerns	No	Major con- cerns	No	Moderate concerns	Moderate concerns	Major con- cerns
Naimark 2020	Yes	No/minor concerns	No/minor concerns	No/minor concerns	Partial	Moderate concerns	No	Moderate concerns	Moderate concerns	No/minor concerns
Panovs- ka-Grif- fiths 2020a	Yes	Moderate concerns	No/minor concerns	Moderate concerns	Partial	Moderate concerns	Partial	Moderate concerns	Moderate concerns	No/minor concerns
Panovs- ka-Grif- fiths 2020b	Yes	Moderate concerns	No/minor concerns	Moderate concerns	Partial	Moderate concerns	Partial	Moderate concerns	Moderate concerns	No/minor concerns
Phillips 2020	Yes	Major con- cerns	No/minor concerns	Moderate concerns	No	Major con- cerns	No	Moderate concerns	Moderate concerns	Moderate concerns
Rozhnova 2020	Yes	No/minor concerns	No/minor concerns	No/minor concerns	No	Moderate concerns	No	Moderate concerns	No/minor concerns	No/minor concerns
Shelley 2020	Partial	Major con- cerns	Moderate concerns	Major con- cerns	No	Major con- cerns	No	Moderate concerns	Moderate concerns	Moderate concerns
Sruthi 2020	Partial	Major con- cerns	No/minor concerns	No/minor concerns	Yes	Moderate concerns	Partial	Moderate concerns	Moderate concerns	No/minor concerns
Tupper 2020	Partial	Moderate concerns	No/minor concerns	Moderate concerns	No	Major con- cerns	No	Moderate concerns	Major con- cerns	Moderate concerns
Williams 2020	Partial	Moderate concerns	Major con- cerns	Moderate concerns	No	Major con- cerns	Partial	Major con- cerns	Major con- cerns	No/minor concerns

Table 3. Summary of quality appraisal for modelling studies (Continued)

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Zhang 2020	Yes M	oderate oncerns	No/minor concerns	Major con cerns	- Partial Majo cerr	or con- No Is	Moderate concerns	Moderate concerns	Moderate concerns
able 4. Su	mmary of asses	ssment usi	ng the ROBI	NS-I tool					
Study	Bias due to co founding	on- Bias i of pa into t	in selection rticipants the study	Bias in clas- sification of interven- tions	Bias due to deviations from the intended inte vention	Bias due to r- missing data	Bias in mea- surement of outcomes	Bias in selection of the reported result	Overall ris of bias
Curtius 2020	Moderate	Low		Low	Low	Low	Low	Moderate	Moderate
	Low risk of bia due to appro- priate analysis methods to co trol for confou ing domains	as N/A s on- ind-		N/A	N/A	Outcome data available for nearly all par- ticipants. Oth- er outcomes N/A	Outcome as- sessors were aware of the intervention received by participants. Methods of outcome as- sessment N/A	Results unlike- ly to be select- ed from multiple measurements. Results unlike- ly to be select- ed from different subgroups	Two do- mains at moderate risk of bias No domain at serious risk of bias
Isphording 2020	Low	Low		Low	Moderate	Moderate	Moderate	Low	Moderate
	Low risk of bia due to appro- priate analysis methods to co trol for confou ing domains a reliable mea- surement of co founding do- mains	as Low r due t s based on- pants ind- istics nd after the ir on- and r ipant from the ir	risk of bias o selection d on partici- s character- observed the start of ntervention most partic- ts followed the start of ntervention	Interven- tion groups clearly de- fined	Deviations from intende interventions unclear. U clear whether deviations were unbalanced betwe groups. Unclear if co-in- terventions were balance across groups	d Outcome data n- available for s nearly all par- en ticipants but exclusion of/ ed missing par- ticipants un- clear	Outcome as- sessors were aware of the intervention received by participants. Methods of outcome as- sessment comparable across groups	Results likely to be selected from multiple mea- surements. Re- sults likely to be selected from dif- ferent subgroups	Three do- mains at moderate risk of bias No domair at serious risk of bias
Simonsen 2020	Moderate	Low		Low	Moderate	Serious	Low	Low	Moderate
	Low risk of bia due to appro-	as Low r due t	risk of bias o selection	Interven- tion groups	Deviations from intende interventions unclear. U	d Unclear if out- n- come data	N/A	Results likely to be selected from	One do- main at se

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Table 4.	priate analysis methods to con- trol for confound- ing domains	based on partici- pants character- istics observed after the start of the intervention and most partic- ipants followed from the start of the intervention	clearly de- fined	clear whether deviations were unbalanced between groups. Unclear if co-in- terventions were balanced across groups	available for nearly all par- ticipants; ex- clusion of/ missing par- ticipants un- clear		multiple mea- surements. Re- sults likely to be selected from dif- ferent subgroups	rious risk of bias. Two domains at moderate risk of bias
Vlachos 2020	Serious	Moderate	Low	Moderate	Moderate	Low	Low	Serious
	Low risk of bias due to appro- priate analysis methods to con- trol for confound- ing domains and confounding do- mains not mea- sured reliably	Participant selec- tion procedures unclear	Interven- tion groups clearly de- fined	Deviations from intended interventions unclear. Un- clear whether deviations were unbalanced between groups. Unclear if co-in- terventions were balanced across groups	Outcome data available for nearly all par- ticipants but exclusion of/ missing par- ticipants un- clear	Knowledge of outcome as- sessors of the intervention received by participants N/A. Methods of outcome assessment comparable across groups	Results likely to be selected from multiple mea- surements. Re- sults likely to be selected from dif- ferent subgroups	One domain at serious risk of bias. Three do- mains at moderate risk of bias

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Table 5. Summary of assessment using the QUADAS-2 tool

Study informa- tion	Domain 1: patient selection	Domain 2: index test(s)	Domain 3: reference test	Domain 4: flow and timing
Hoehl 2020	High	Unclear	Low/high: high for positive, low for negative	High

APPENDICES

Appendix 1. List of existing (systematic) reviews and guidelines for forward and backward searches

- 1. D'Angelo D, Coclite D, Napoletano A, Fauci AJ, Latina R, Iacorossi L, et al. Strategies for exiting COVID-19 lockdown for workplace and school: a scoping review protocol. medRxiv. 2020:2020.09.04.20187971.
- 2. Chinese Center for Disease Control and Prevention. Health protection guideline of schools and other educational institutions during COVID-19 outbreak. 2020 Apr 6;54(4):348-350.
- 3. Strategy and Policy Working Group for NCIP Epidemic Response, Chinese Center for Disease Control and Prevention. Interim guidelines for prevention and control of COVID-19 for students back to school. Pubmed.gov. 2020.08.10;41(8):1195-1196.
- 4. Araújo LA, Veloso CF, Souza MC, Azevedo JM, Tarro G. The potential impact of the COVID-19 pandemic on child growth and development: a systematic review. J Pediatr (Rio J). 2020 Sep 23: 10.1016/j.jped.2020.08.008.
- 5. Cohena R, Delacourtb C, Gras-Le Guenc C, Launayc E. COVID-19 and schools. Guidelines of the French Pediatric Society. ScienceDirect. j.arcped.2020.09.001.
- 6. Fardin MA. COVID-19 and anxiety: a review of psychological impacts of infectious disease outbreaks. Archives Clinical Infectious Disease. 10.5812/archcid.102779.
- 7. Kneale D, O'Mara-Eves A, Rees R, Thomas J. School closure in response to epidemic outbreaks: systems-based logic model of downstream impacts. F1000Res. 2020;9:352. 10.12688/f1000research.23631.1.
- 8. Nussbaumer-Streit B, Mayr V, Dobrescu AI, Chapman A, Persad E, Klerings I, et al. Quarantine alone or in combination with other public health measures to control COVID-19: a rapid review. Cochrane Database Syst Rev. 2020;4(4):CD013574. 10.1002/14651858.CD013574.
- 9. Abadio de Oliveira W, Luiz da Silva J, Monezi Andrade AL, De Micheli D, Carlos DM, Silva MA, et al. Adolescents' health in times of COVID-19: a scoping review. Cad. Saúde Pública. 2020, vol.36, n.8, 10.1590/0102-311x00150020.
- 10.Viner RM, Mytton OT, Bonell C. Susceptibility to SARS-CoV-2 infection among children and adolescents compared with adults: a systematic review and meta-analysis. JAMA Pediatrics. 2020;e204573. 10.1001/jamapediatrics.2020.4573.
- 11.Viner RM, Russell SJ, Croker H, Packer J, Ward J, Stansfield C, et al. School closure and management practices during coronavirus outbreaks including COVID-19: a rapid systematic review. The Lancet Child & Adolescent Health. Vol 4, Issue 5. 2020:10.1016/S2352-4642(20)30095-X.
- 12.WHO. Considerations for school-related public health measures in the context of COVID-19. 202.09.14. WHO/2019-nCoV/ Adjusting_PH_measures/Schools/2020.2.
- 13. Juneau CE, Pueyo T, Bell M, Gee G, Collazzo P, Potvin L. Evidence-based, cost-effective interventions to suppress the COVID-19 pandemic: a systematic review. medRxiv. 2020.04.20.20054726.
- 14.Brooks SK, Smith LE, Webster RK, Weston D, Woodland L, Hall I, et al. The impact of unplanned school closure on children's social contact: rapid evidence review. Euro Surveillance. 2020;25(13):2000188. 10.2807/1560-7917.ES.2020.25.13.2000188.
- 15.New York State Education Department. Recovering, Rebuilding, and renewing: the spirit of New York's schools reopening guidance.
- 16.Simon A, Huebner J, Berner R, Munro AP, Exner M, Huppertz H-I, et al. Measures to maintain regular operations and prevent outbreaks of SARS-CoV-2 in childcare facilities or schools under pandemic conditions and co-circulation of other respiratory pathogens. GMS Hyg Infect Control. 2020;15:Doc22. Published 2020 Sep 15. 10.3205/dgkh000357.
- 17.Walger P, Heininger U, Knuf M, Exner M, Popp W, Fischbach T, et al. Children and adolescents in the CoVid-19 pandemic: Schools and daycare centers are to be opened again without restrictions. The protection of teachers, educators, carers and parents and the general hygiene rules do not conflict with this. GMS Hygiene and Infection Control. 2020;15:Doc11. Published 2020 May 28. 10.3205/dgkh000346.
- 18.CDC www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/schools.html
- $19. {\tt CDC}\ www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/k-12-testing.html$
- 20.Leclerc QJ, Fuller NM, Knight LE, Funk S, Knight GM. What settings have been linked to SARS-CoV-2 transmission clusters? Wellcome Open Research. 2020;5:83. 5 June 2020. 10.12688/wellcomeopenres.15889.2.
- 21.National Collaborating Centre for Methods and Tools. Rapid Evidence Review: What is the specific role of daycares and schools in COVID-19 transmission? Update 8.5 October 2020.



- 22.Viner RM, Russell SJ, Croker H, Packer J, Ward J, Stansfield C, et al. School closure and management practices during coronavirus outbreaks including COVID-19: a rapid systematic review. Lancet Child Adolescent Health. 2020;4(5):397-404. 10.1016/ S2352-4642(20)30095-X.
- 23.Viner RM, Mytton OT, Bonell C, Melendez-Torres GJ, Ward JL, Hudson L, et al. Susceptibility to and transmission of COVID-19 amongst children and adolescents compared with adults: a systematic review and meta-analysis. medRxiv. 2020.05.20.20108126.

Appendix 2. Search strategies

Database: Ovid MEDLINE(R) ALL 1946 to December 08, 2020

Date search conducted: 9 December 2020

Strategy:

- 1 Coronavirus/ (4179)
- 2 Coronavirus Infections/ (44000)
- 3 COVID-19/ [MeSH 2021 Included for future updates] (0)
- 4 SARS-CoV-2/ [MeSH 2021 Included for future updates] (0)
- 5 COVID-19.rs. (39029)
- 6 severe acute respiratory syndrome coronavirus 2.os. (33023)
- 7 (2019 nCoV or 2019nCoV or 2019-novel CoV).tw,kf. (1365)
- 8 (corona vir* or coronavir* or neocorona vir* or neocoronavir*).tw,kf. (45701)

9 COVID.mp. (78541)

10 COVID19.tw,kf. (937)

- 11 (nCov 2019 or nCov 19).tw,kf. (99)
- 12 ("SARS-CoV-2" or "SARS-CoV2" or SARSCoV2 or "SARSCoV-2").mp. (26538)
- 13 ("SARS coronavirus 2" or "SARS-like coronavirus" or "Severe Acute Respiratory Syndrome Coronavirus-2").mp. (37903)
- 14 or/1-13 [Set 1: SARS-CoV-2] (96498)
- 15 School Teachers/ (1606)
- 16 Schools/ (39273)
- 17 Students/ (60547)

18 ((campus* or class* or employee* or pupil* or staff* or student\$1 or teacher\$1) adj3 (college\$1 or elementary or junior or middle* or primary or secondary)).tw,kf. (54031)

- 19 educational setting\$1.tw,kf. (1544)
- 20 (gradeschool* or highschool* or kindergarten* or school* or schoolbus*).tw,kf. (296102)
- 21 or/15-20 [Set 2: Primary or secondary school settings] (368794)
- 22 and/14,21 [Sets 1 & 2] (1530)

23 ((clos* or open* or re entry or re open* or re start* or reopen* or restart* or resum* or suspen*) and (highschool\$1 or kindergarten* or school\$1)).ti. (854)

24 22 or 23 [Concept searches combined with specific title search] (2256)

25 limit 24 to "humans only (removes records about animals)" (2251)

26 limit 25 to yr="2020-Current" (1521)

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27 remove duplicates from 26 (1476)

Database: Ovid Embase 1974 to 2020 December 07

Date search conducted: 9 December 2020

Strategy:

1 coronaviridae/ (1064)

2 exp coronavirinae/ (22562)

3 exp coronavirus infection/ (24193)

4 (2019 nCoV or 2019nCoV or 2019-novel CoV).ti,ab,kw. (1353)

5 (corona vir* or coronavir* or neocorona vir* or neocoronavir*).ti,ab,kw. (44994)

6 COVID.af. (72428)

7 COVID19.ti,ab,kw. (947)

8 (nCov 2019 or nCov 19).ti,ab,kw. (68)

9 ("SARS-CoV-2" or "SARS-CoV2" or SARSCoV2 or "SARSCoV-2").af. (25308)

10 ("SARS coronavirus 2" or "SARS-like coronavirus" or "Severe Acute Respiratory Syndrome Coronavirus-2").af. (22762)

11 or/1-10 [Set 1: SARS-CoV-2] (105031)

12 elementary student/ (1557)

13 high school/ (21166)

14 high school student/ (8046)

15 kindergarten/ (2934)

16 middle school/ (1838)

17 middle school student/ (1405)

18 primary school/ (13129)

19 *school/ (17931)

20 school teacher/ (1646)

21 *student/ (26634)

22 ((campus* or class* or employee* or pupil* or staff* or student\$1 or teacher\$1) adj3 (college\$1 or elementary or junior or middle* or primary or secondary)).ti,ab,kw. (67575)

23 educational setting\$1.ti,ab,kw. (1801)

24 (gradeschool* or highschool* or kindergarten* or school* or schoolbus*).ti,ab,kw. (360655)

25 or/12-24 [Set 2: Primary or secondary school settings] (431646)

26 and/11,25 [Sets 1 & 2] (1341)

27 ((clos* or open* or re entry or re open* or re start* or reopen* or restart* or resum* or suspen*) and (highschool\$1 or kindergarten* or school\$1)).ti. (646)

28 26 or 27 [Concept searches combined with specific title search] (1872)

29 (animal experiment/ or exp animal/) not exp human/ (5055006)

30 28 not 29 (1863)



31 limit 30 to yr="2020-Current" (1238)

32 remove duplicates from 31 (1216)

Database: Cochrane Central Register of Controlled Trials (CENTRAL; 2020, Issue 11) in the Cochrane Library

Date search conducted: 9 December 2020

Strategy:

- #1 [mh ^Coronavirus] 2
- #2 [mh ^"Coronavirus Infections"] 506
- #3 [mh ^"COVID-19"] 0
- #4 [mh ^"SARS-CoV-2"] 0
- #5 ("2019 nCoV" or 2019nCoV or "2019 novel CoV"):ti,ab,kw 10
- #6 ((corona next vir*) or coronavir* or (neocorona next vir*) or neocoronavir*):ti,ab,kw 2093
- #7 COVID:ti,ab,kw 3420
- #8 COVID19:ti,ab,kw 228
- #9 ("SARS-CoV-2" or "SARS-CoV2" or SARSCoV2 or "SARSCoV-2"):ti,ab,kw 1317
- #10 ("SARS coronavirus 2" or "SARS-like coronavirus" or "Severe Acute Respiratory Syndrome Coronavirus-2"):ti,ab,kw 250
- #11 {or #1-#10} 3696
- #12 [mh ^"School Teachers"] 118
- #13 [mh ^Schools] 1994
- #14 [mh ^Students] 2686

#15 ((campus* or class* or employee* or pupil* or staff* or student* or teacher*) near/2 (college* or elementary or junior or middle* or primary or secondary)):ti,kw 2968

- #16 (educational next setting*):ti,ab,kw 116
- #17 (gradeschool* or highschool* or kindergarten* or school* or schoolbus*):ti,kw 20924
- #18 {or #12-#17} 24604

#19 #11 and #18 15

#20 ((clos* or open* or "re entry" or (re next open*) or (re next start)* or reopen* or restart* or resum* or suspen*) and (highschool* or kindergarten* or school*)):ti,ab 390

#21 #19 or #20 405

#22 #19 or #20 in Trials 180

#23 #19 or #20 with Publication Year from 2020 to 2020, in Trials 26

Database: Cochrane COVID-19 Study Register

URL: https://covid-19.cochrane.org/ (searched via the Cochrane Register of Studies: https://crsweb.cochrane.org/)

Date search conducted: 9 December 2020

Strategy:

1 ((campus* OR class* OR employee* OR pupil* OR staff* OR student* OR teacher*) ADJ3 (college* or elementary OR junior OR middle* OR primary OR secondary)):TI,AB AND INREGISTER 148

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2 (educational NEXT setting*):TI,AB AND INREGISTER 2

3 (gradeschool* OR highschool* OR kindergarten* OR school* OR schoolbus*):TI,AB AND INREGISTER 597

4 #1 OR #2 OR #3 708

Contents note: The Cochrane COVID-19 Study Register contains study references from ClinicalTrials.gov, WHO International Clinical Trials Registry Platform (ICTRP), PubMed, Embase.com, medRxiv and other hand-search articles from publishers' websites.

Database: Ovid ERIC 1965 to September 2020

Date search conducted: 9 December 2020

Strategy:

1 ("2019 nCoV" or 2019nCoV or "2019 novel CoV" or coronavirus or COVID or COVID19 or "nCov 2019" or "nCov 19" or "SARS-CoV-2" or "SARS-CoV2" or SARSCoV2 or "SARSCoV-2" or "SARS coronavirus 2" or "SARS-like coronavirus").ti,ab. (134)

2 limit 1 to yr="2020-Current" (133)

Database: WHO COVID-19 Global literature on coronavirus disease

URL: https://search.bvsalud.org/global-literature-on-novel-coronavirus-2019-ncov/

Date search conducted: December 09, 2020

Strategy:

(tw:(school* AND (elementary OR grade* OR high* OR junior OR kindergarten* OR middle* OR primary OR secondary))) OR (tw: (highschool*)) (1629)

Source: Google

URL: https://www.google.com/

Date search conducted: 10 December 2020

Strategy: (coronavirus | covid | SARS-CoV-2) (children | pupil | staff | student | teacher) ("educational setting" | "educational settings" | gradeschool | highschool | kindergarten | school)

Searched the first 10 pages of results (n=100)

Kept 53

Top up Search conducted in August 2021

Database: Cochrane COVID-19 Study Register

URL: https://covid-19.cochrane.org/ (searched via the Cochrane Register of Studies: https://crsweb.cochrane.org/)

Date search conducted: 5 August 2021

Strategy:

1 ((campus* OR class* OR employee* OR pupil* OR staff* OR student* OR teacher*) ADJ3 (college* or elementary OR junior OR middle* OR primary OR secondary)):TI,AB AND 09/12/2020_TO_05/08/2021:CRSCREATED AND INREGISTER 360

2 (educational NEXT setting*):TI,AB AND 09/12/2020_TO_05/08/2021:CRSCREATED AND INREGISTER 15

3 (gradeschool* OR highschool* OR kindergarten* OR school* OR schoolbus*):TI,AB AND 09/12/2020_TO_05/08/2021:CRSCREATED AND INREGISTER 1163

4 #1 OR #2 OR #3 1431

Contents note: The Cochrane COVID-19 Study Register contains study references from ClinicalTrials.gov, WHO International Clinical Trials Registry Platform (ICTRP), PubMed, Embase.com, medRxiv and other hand-search articles from publishers' websites.



Appendix 3. Data extraction form

Study information

- Study ID
- Study title
- Publication year
- Study source (journal, report, preprint publication)
- For preprint publication only: date of publication

Study design

- Study type (e.g. modelling study, cross-sectional study, econometric study)
- Data type (e.g. modelling versus observational data)
- Verbal summary of study (e.g, stochastic discrete event simulation model)
- Comments

Population and setting

- Population group targeted by intervention (students, teaching staff, school staff, parents, other family members, other individuals outside school)
 - Type of population (i.e. students versus teachers versus school staff)
 - Age
 - Risk profile (e.g. elevated risk of infection, adverse health effects due to COVID-19, students with special learning needs, students from disadvantaged families)
- Characteristics of school (e.g. socioeconomic status of school location or student's families, catchment area)
- Study setting (e.g. primary school, high school, other school forms)
- Comments

Intervention

- Broad measure category
 - Measures reducing the opportunity for contacts
 - Measures making contacts safer
 - Surveillance and response measures
 - Multicomponent intervention
- Verbal summary of the measures
- Duration of the intervention
- Level of intervention (i.e. individual, cohort, school, macro, multiple)
- Comments

Outcomes (repeated for each outcome) and results

- Outcome category
 - Transmission-related outcomes,
 - Healthcare utilisation,
 - Other health outcomes and
 - Societal, economic and ecological implications.
- Description of outcome
- Outcome attributable to measures (yes/no)
- Level on which outcome is assessed (i.e. students, teachers, staff, wider community, general population)
- Length of follow-up
- Estimate related to the impact of measure(s) implemented in the school setting
- Summary of overall impact of measure(s) implemented in the school setting
- Comments

Implementation



- Implementation outcomes (e.g. adherence, fidelity)
- Implementation strategies (e.g. enforcement, communication and feedback)
- Implementation agents (e.g. parents, teachers, bus drivers)

Context

- · Country in which measure is implemented
- Co-interventions
- Other relevant contextual factors (geographical, sociocultural, socioeconomic, ethical, political, legal, and epidemiological context on the macro (e.g. international, national or state level) and meso level (e.g. community)
- Comments

Appendix 4. QUADAS-2 domains as applied in the rapid review

Domain		Signalling question	Application in this review
Domain 1: partici- pant selection	A. Risk of bias	1.1 Was a consecutive or random sample of partic-ipants enrolled?	Assess how the individuals screened and/or quarantined as part of the study were determined; where all individu- als were screened (e.g. as part of a blanket screening) or where a random sample was selected, a risk of bias is not likely.
		1.2 Was a case-control design avoided?	If disease status was used to determine the sample, a risk of bias should be considered.
		1.3 Did the study avoid inappropriate exclu- sions?	Any exclusions to screening/quarantine programmes should be justified; however even with justification, exclu- sions could lead to bias, especially where the screening and disease status of those excluded are unknown. Thus, if no exclusion criteria were applied, the risk of bias is low.
		Comments	-
		1. Could the selection of participants have intro- duced bias?	Consider whether bias may have arisen from 1.1 to 1.3
	B. Concerns regard- ing applicability	Describe included partic- ipants (prior testing, pre- sentation, intended use of index test and setting)	Consider those individuals screened, and whether they are representative of individuals likely to be screened during the COVID-19 pandemic. These studies should be therefore regarded as having a low external validity.
		Is there concern that the included participants do not match the review question?	See above
Domain 2: index test(s)	A. Risk of bias	2.1 Can we be sure that those identified in index test (true and false pos- itive screening results) were identified by the in- dex test (e.g. automat- ed fever scanner) rather than any other means (e.g. self-reporting)?	Consider how those screened positive were determined – all 'positives' should stem from the symptom screening and not from any other procedures (e.g. self-reporting of cases missed by the screening intervention; based on res- piratory symptoms).



(Continued)			
		2.2 Were the index test results interpreted with- out knowledge of the results of the reference standard?	Consider whether, for example, the results of the PCR test were known when symptom or fever screening was ap- plied to individuals.
		2.3 If a threshold was used, was it prespeci- fied?	Consider for temperature screening, whether the cut-off for determining acceptable/high temperature was pre- defined; for symptom screening, consider whether any symptom or a certain threshold of symptoms was used in defining whether an individual was symptomatic and whether this was predefined.
		Comments on risk of bias	-
		2. Could the conduct or interpretation of the in- dex test have introduced bias?	Consider whether bias may have arisen from 2.1 to 2.3
	B. Concerns regard- ing applicability	Describe the index test and how it was conduct- ed and interpreted	Consider the screening/quarantine programme assessed, and whether it is representative of one likely to be applied as part of screening programmes during the COVID-19 pandemic.
		Is there concern that the index test, its conduct, or interpretation differ from the review question?	See above
Domain 3: ap- proach to identify cases and timing	A. Risk of bias	3.1 Is the reference stan- dard (the approach to identify and classify 'cas- es') likely to correctly classify the target condi- tion (is there active infec-	Consider whether the approach to identify cases may have missed relevant cases or classified individuals not in- fected with SARS-CoV-2 as a case. Any method other than positive PCR test results can be considered at high risk of bias.
		tion with SARS-CoV-2)?	For the studies using a case-classification based on a posi- tive PCR test, we assumed the risk of bias due to false pos- itives as low due to the high specificity of the PCR test (in particular if the population is assumed to have a high risk of infection).
			However, there is a considerable risk of false negatives for the PCR test, primarily due to the course of infection (e.g. very low probability of detection in the first days after in- fection), but also due to inadequate procedures for speci- men collection, handling, transportation, or storage (e.g. if only a single test shortly after an infection is applied to a swab sample, the viral load in the individual may not have been high enough for detection, leading to a false-nega- tive test).
			We therefore assume a high risk of bias in studies, where asymptomatic individuals do not receive at least two PCR



			tests and symptomatic individuals did not receive at least two PCR tests after symptom onset.
		3.2. Were the reference standard results inter- preted without knowl- edge of the results of the index test?	Consider whether, for example, the results of the symp- tom screening were known when the classification was conducted. For PCR tests, where the risk of subjective judgements to have led to a risk of erroneously classifying a test result as negative or positive is regarded as low, this knowledge of the outcome of the index test is still regard- ed as leading to a low risk of bias.
		Comments on risk of bias	-
		3. Could the reference standard, its conduct, or its interpretation have in- troduced bias?	Consider whether bias may have arisen from 3.1 to 3.2
		Describe the reference standard and how it was conducted and interpret- ed	Consider the procedure for determining who receives the reference standard (the PCR test used to identify cases), and whether it is representative of that likely to be ap- plied as part of screening programmes during the COV- ID-19 pandemic.
	B. Concerns regard- ing applicability	Is there concern that the target condition as de- fined by the reference standard does not match the review question?	See above
Domain 4: flow and timing		4.1. Did all participants	Consider whether all individuals received the reference
		receive the reference standard?	test (the respective approach to identify and classify 'cas- es'; in most cases likely the PCR test).
		receive the reference standard?	test (the respective approach to identify and classify 'cas- es'; in most cases likely the PCR test). For example, if only those who were screened positive (positive index test) and those who developed symptoms during a quarantine observational period were given a PCR test, as this would have led to a high risk of bias due to cases being missed).
		receive the reference standard?	test (the respective approach to identify and classify 'cas- es'; in most cases likely the PCR test). For example, if only those who were screened positive (positive index test) and those who developed symptoms during a quarantine observational period were given a PCR test, as this would have led to a high risk of bias due to cases being missed). If individuals declined to or for other reasons receive the reference standard (e.g. PCR test), this could lead to cases being missed, which puts the study at a high risk of bias.
		receive the reference standard?	test (the respective approach to identify and classify 'cas- es'; in most cases likely the PCR test). For example, if only those who were screened positive (positive index test) and those who developed symptoms during a quarantine observational period were given a PCR test, as this would have led to a high risk of bias due to cases being missed). If individuals declined to or for other reasons receive the reference standard (e.g. PCR test), this could lead to cases being missed, which puts the study at a high risk of bias. Note: this is independent from 3.1, which evaluates the appropriateness of the approach to classify individuals as cases.
	A. Risk of bias	 receive the reference standard? 4.2. Did all participants receive the same refer- ence standard? 	test (the respective approach to identify and classify 'cas- es'; in most cases likely the PCR test). For example, if only those who were screened positive (positive index test) and those who developed symptoms during a quarantine observational period were given a PCR test, as this would have led to a high risk of bias due to cases being missed). If individuals declined to or for other reasons receive the reference standard (e.g. PCR test), this could lead to cases being missed, which puts the study at a high risk of bias. Note: this is independent from 3.1, which evaluates the appropriateness of the approach to classify individuals as cases. Consider whether the procedure for identifying cases was the same across all individuals or whether it was applied differently without an adequate justification (e.g. individ- uals with symptoms receiving a different testing proce- dure).



(Continued)

	Studies in which the classification of cases is based on multiple PCR tests, we consider a high risk of bias if some symptomatic individuals were treated differently from other symptomatic individuals (e.g. some received more PCR tests than others) and if some of the asymptomatic individuals were treated differently from asymptomatic individuals.
4.3. Were all participants included in the analysis?	Consider whether some individuals may have been ex- cluded from the analysis; this would lead to a high risk of
Is there likely no or a very low risk of attrition bias?	. 5163.
4.4. Is it possible that the true disease status could have changed between the application of the in- dex test and the refer- ence standard?	Consider whether individuals may have become infected after the initial screening, e.g. if being quarantined among other infected individuals led to some initially non-infect- ed individuals becoming infected. If there is a high risk that individuals who were classified as cases were not cas- es (i.e. not infected with SARS-CoV-2) at the time when the index test was applied, this would lead to a high risk of bias.
Comments on risk of bias	-
4. Could the participants flow have introduced bias?	Consider whether bias may have arisen from 4.1 to 4.4

Appendix 5. Tool for criteria used for assessing the quality of individual modelling studies, developed from Burns J 2021

Aspect	Source	Questions	Application in this review	Examples
Model structure	Philips 2006	1. Are the struc- tural assump- tions transparent and justified?	1. Assess whether all structural mod- el assumptions are explicitly stated and whether the authors substantiate these assumptions, either through theoretical reasoning or through pri- or knowledge from the literature.	Description of model type and defining equations
				Comprehensible explanation of model variables and equa- tions
				Description of features of the disease captured by the mod- el, e.g. a randomly distributed incubation time
		Explanations of model struc- ture implications by text or graphical representations vi- sualising the simulation path- way, e.g. a scheme of the con- text being modelled		



(Continued)

Description of model limitations and simplifying assumptions

				tions
		2. Are the struc- tural assump- tions reason- able, given the overall objec- tive, perspective and scope of the model?	2. Consider whether the structural as- sumptions are consistent with what is known about the phenomenon of interest in the literature. In case of disagreement, assess to what extent these discrepancies undermine the overall validity of results and conclu- sions.	
Input data	Caro 2014	3. Are the in- put parameters transparent and justified?	3. Assess whether the values of all in- put parameters are explicitly stated and whether the authors substantiate these values, either through theoreti- cal reasoning or through prior knowl- edge from the literature.	Epidemiological characteris- tics known from other studies
				Inputs to data calibration algo- rithms
				Table with input parameters and probability distributions used for probabilistic model- ling
				Explanation and discussion of choice of parameter values with appropriate citations
		4. Are the input parameters rea- sonable?	4. Consider whether the input pa- rameter values are consistent with what is known about the phenom- enon of interest in the literature. In case of disagreement, assess to what extent these discrepancies under- mine the overall validity of results and conclusions.	
Validation (ex- ternal)	Caro 2014	5. Has the exter- nal validation process been de- scribed?	5. Assess whether there was a formal process of comparing the predictions of the model with: i) the data source that was used to build the model (de- pendent validation); ii) a data source that was not used to build the mod- el, e.g. an independent country (inde- pendent validation); or iii) future val- ues that did not intervene in model building (predictive validation).	Calibration of SEIR model to case data (dependent valida- tion)
				Prediction of a subset of ob- served data points based on training data set and compar- ison with validation data set (dependent validation)
				Prediction of data points of country/region that was not part of the model fitting and calibration process and com- parison with observed data (independent validation)
		6. Has the mod- el been shown to be externally valid?	6. Consider the extent to which mod- el predictions agree with the data sources that were selected for the ex- ternal validation process.	Prediction of future values that were not used in model building (predictive validation)

(Continued)				
Validation (in- ternal)	Caro 2014	7. Has the inter- nal validation process been de- scribed?	7. Assess whether there was a for- mal process of verifying the extent to which the mathematical calculations are consistent with the model's spec- ifications, e.g. in the form of a simu- lation study in which the mathemat- ical calculations are applied to data that were simulated according to the model with known parameter values.	Application of the model on simulated data to establish that analyses work as intend- ed
				Code review process conduct- ed by authors or by an inde- pendent source to ensure cor- rect implementation of mathe- matical structure
		8. Has the mod- el been shown to be internally valid?	8. Consider the extent to which the results of the internal validation process indicate that the mathemat- ical calculations are consistent with the model's specifications.	Independent replication of model
Uncertainty	Caro 2014	9. Was there an adequate assess- ment of the ef- fects of uncer- tainty?	9. Consider whether the robustness of results to alternative input para- meter values or model assumptions was assessed, either by reporting the results of specific sensitivity analyses or through an app in which readers can themselves explore the effects of varying these model assumptions and input parameter values.	Structural and parameter sen- sitivity analyses
				Inherent stochasticity due to simulation nature of model
				Reporting of an app in which effects of input changes can be tracked
				Propagation of present uncer- tainties to outcomes
				Was the model probabilistic, i.e. were parameter values fixed or sampled from a distri- bution?
				Is uncertainty transparently reported, described and justi-fied?
Transparency	Caro 2014	10. Was techni- cal documen- tation, in suffi- cient detail to al- low (potentially) for replication, made available openly or under agreements that protect intellec- tual property?	10. Assess whether the description of the analyses (including model struc- ture, input parameters, data sources and methods) is sufficiently detailed to allow for the replication of results. In particular, consider whether the code that was used to obtain the re- sults is freely available and well docu- mented.	Description of model which is qualitatively extensive enough to allow for scrutiny of other researchers (e.g. supplemen- tary material)
				Do authors encourage replica- tion by clarifying a procedure to obtain code?
				Do the authors only refer to other, similar models for justi- fication and detailed method- ological description or do they provide their own documenta- tion?

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Appendix 6. Comparison between preprints and published peer-reviewed articles

Preprint ID	Full publication ID	Differences
Burns A 2020	Burns A 2021	 Title: changed Methods: more details on model, its validation and parameters Results: The authors focus on the two outcomes: outbreak duration and attack rate (less outcomes as presented in the preprint); results have been restructured to reduction in attack rate. The results do not seem to correspond to the ones reported in the preprint. The figure axes have been adapted to make the graphs more comparable. Discussion: in the first paragraph, the results are reported differently now (preprint: "For influenza, a 15% and 25% reduction in the attack rate is expected with one and two days of isolation" versus peer-reviewed article: "For influenza, requiring isolation for fever is expected to reduce the typical attack rate by 29 (13–59)% and 70 (55–85)% with 1 and 2 days of post-fever isolation, respectively."); for covid-19, it is the same (preprint: "For COVID-19, we find that one day of post-fever isolation would reduce the attack rate by 8% in the conservative scenario where only 50% of the cases detect fever" versus peer-reviewed article: "Indeed, we found that a 1-day post-fever isolation policy would reduce the attack rate in schools by 7 (5–14)%, and with 14 days of fever isolation we estimated that the attack rate would change by 14 (5–26)%."
Curtius 2020	Curtius 2021	Title: not changed Methods: one additional section in methods, some sections moved from re- sults (Curtius 2020) to methods (Curtius 2021); number of particles emitted per hour changed from 68.400 to 198.000; estimated risk of one infection in the classroom 70% (Curtius 2021), instead of 33% (Curtius 2020); no implication for results (unless we misunderstood) Results: few smaller new sections (i.e. p9: "from the average", "The OPS total number"; added comparison with venting a room (p.10 and supple- ments); no change in overall results/conclusion: the overall conclusion "in- haled dose via airborne transmission is reduced by a factor of six when using air purifiers with an air exchange rate of 5.7/h" remains the same but there is one changed measurement in the results section: total aerosol mass (p.9, up- per right): "56 mg/m3 at the beginning of the lesson to about 9 mg/m3" in- stead of reduction from 35 mg/m ³ to 6 mg/m ³ (Curtius 2020) Discussion: minor changes
Di Domenico 2020a	Di Domenico 2021	Title: not changed
		Background/intro: appears to be differences because of additional data that became available after the preprint was written: "This study was conducted in the lockdown phase, before its end in May, and was therefore based on a scenario analysis. Here, we also provide an ex-post assessment of the epidemic situation reported by data that became available after the initial submission."
		Methods: different parameters described in preprint versus peer-reviewed:
		• Preprint: "Intervention measures are modeled through modifications of the contact matrices, accounting for a reduction of the number of contacts engaged in specific settings. For example, the lockdown matrix is constructed assuming 70% of workers not going to work (because of telework, closure of activity, caring for children not going to school, and other cases), school closure, 90% reduction of contacts established by seniors, and closure of non-essential activities"
		 Peer-reviewed: "Intervention measures were modeled through modifica- tions of the contact matrices, accounting for a reduction of the number of contacts engaged in specific settings. The lockdown matrix was constructed assuming a certain fraction of workers not going to work (because of tele-

(Continued)

work, closure of activity, caring for children not going to school, and other cases), school closure, 50% reduction of contacts established by seniors, and closure of non-essential activities"

Results: major differences in numerical findings, probably because of different dates/parameters used to construct model.

Examples:

- Preprint: "Calibrating the model in the lockdown phase to ICU admission data up to April 28, 2020, we estimate a drop of the reproductive number from R' =3.0 [2.8, 3.2] (95% confidence interval) prior to lockdown to R+, =0.53 [0.49, 0.58] during lockdown, in agreement with recent estimates."
 Peer-reviewed: "Calibrating the model in the lockdown phase to hospital and
 - Peer-reviewed: "Calibrating the model in the lockdown phase to nospital and ICU admission data up to April 26, 2020, we estimated a drop of the reproduction number from R0 = 3.28 [3.20, 3.39] (95% confidence interval) prior to lockdown 4 to RLD = 0.71 [0.69, 0.74] during lockdown, in agreement with prior estimates"
 - Preprint: "model projections indicate that by May 11 the region may experience 350 [268, 421] new clinical cases per day (corresponding to 710 [555, 869] new infections), 18 [10, 28] new admissions in ICUs, with an ICU system occupied at 42% [33, 52]% of currently strengthened capacity (Figure 1). Estimated fluctuations refer to 95% probability ranges from simulations parameterized with R+, =0.53."
 - Peer-reviewed: "Model projections indicate that by May 11 the region would experience 945 [802, 1076] new clinical cases per day (corresponding to 2391 [2025, 2722] new infections), 18 [11, 29] new admissions in ICUs, with an ICU system occupied at 47% [37, 57]% of strengthened capacity"

Discussion: no major changes

Head 2020	Head 2021	 Title: changed Abstract: While the results remain the same, the authors add one important sentence: "However, we found that reopening policies for elementary schools that combine universal masking with classroom cohorts could result in few within school transmissions, while high schools may require masking plus a staggered hybrid schedule." Methods: no major changes Results: no major changes Discussion: stronger focus on effectiveness of reopening strategies "Some reopening strategies can result in few in-school transmissions among students and teachers alike, according to our findings. Most notably, our model found that reducing in-school mixing via classroom cohorts or hybrid scheduling is an effective means of reducing the risk of school-attributable illness across all levels of education, especially when combined with universal masking. These findings concur with observations of schools that reopened with universal masking, social distancing and a hybrid or cohort approach and avoided large outbreaks"
Kaiser 2020	Kaiser 2021	Title: changed Abstract: substantially condensed Background: substantially shortened Methods: mean of out-of-school student contacts as per CILS4EU data cited 3.58 in preprint and 3.15 in peer-reviewed version; no implications for model as average number of out-of-school interactions still 4.2 in both preprint and peer-reviewed version (daily/weekly contact probabilities) Model parameters: baseline probabilities of infection: same (modelled for 5%, 15%, 25%); proportion of subclinical infections modelled for 20%, 40%, 60% and 80% in preprint and 20%, 50%, 80% in peer-reviewed version Results: section on the superiority of cohorting versus not cohorting short- ened (fig 3 adapted, fig 4 removed in the peer-reviewed version); reductions

(Continued)		of cross-cohort ties for different cohorting strategies: same (preprint versus peer-reviewed); figure 6 (preprint) simplified (= fig 5 in peer-reviewed version); performance of different cohorting strategies: same in preprint versus peer-reviewed version, however, the numbers cited in the example on page 7, line 6 onwards differ slightly in peer-reviewed version; sensitivity analyses reported in supplements; short section added that reports on performance of the gender-split versus other models in individual classrooms (as opposed to aggregated results) – while network-chain cohorting performs better than gender-split cohorting in the majority of classrooms, gender-split cohorting performs better in a minority of classrooms (e.g. in very gender-segregated inschool and out-of-school cohorts); short section added reporting on another cohorting model: attendance for one cohort on Monday/Tuesday and for the other on Wednesday/Thursday – more effective when overall transmission is
		low (due to less time spent in school overall), less effective compared to week- ly rotation when transmission is high (less "cool-down"/natural quarantine time) Discussion: minor changes
Keeling 2020	Keeling 2021	Title: not changed Abstract: not changed Methods: no major changes (just rearrangement of presentation of figures) Results: no major changes Discussion: no changes to the Discussion but the authors have added an 'In context' section which puts the paper into context of simulated versus actual reopening. The authors acknowledge that the Delta variant has changed the context in which schools have reopened. The authors state that in their sim- ulations, return to schools was unlikely to push R above 1, but that the Delta variant may cause R to go above 1 upon reopening. The authors also conduct- ed a retrospective analysis and found that in many regions, there was a pos- itive correlation between cases in the community and cases in schools, with weak evidence suggesting that cases in schools lag behind cases in the sur- rounding community. Ultimately, the authors conclude that reopening schools (especially secondary schools) is associated with an increased risk of trans- mission both within the school-aged pupils and in the wider community. The scale of this increase will inherently depend on the strength of control mea- sures within the classroom and the compliance with mass testing as well as measures in the local community.
Landeros 2020	Landeros 2021	 Title: not changed Abstract: slightly changed, more details on methods, results and implications Methods: method section more detailed, e.g. more details on the simulation of prevalence tresholds; they also conduct an analysis of different test sensitivities Results: the way the results are presented graphically was revised; the assessment of test sensitivity which was only a parameter in the preprint is now specifically reported ("Compared to this ideal scenario, an imperfect test with 50% detection leads to a slightly later stopping time owing to infections spread by undetected cases and greater overall paediatric infections. The effect is less pronounced in the adult population due to high adult-adult transmission." They adapted the natural transmission rates and reran the model, resulting in different results for the reproduction number: Preprint: "The combined impacts of these risk reduction strategies are modeled as 20%, 40%, 60%, and 80% reductions in the transmission rates β11 and β12 relative to reference values. We particularly examine the changes in infection levels under each scenario, taking care in selecting the adult values β21 and β22 to account for simultaneous risk reduction strategies among



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		 adults. Specifically, we take β11 = 0.1 and β12 = β21 = β22 = 0.5 as natural rates. Under a baseline model reducing transmission rates in adults to β21 = β22 = 0.2, we achieve an R0 ≈ 1.8 when schools remain closed. We choose to model increased contact rates β11(t) = c × 0.1 by taking c = 10, which corresponds to R0 ≈ 3.3 under the full capacity reopening scenario. This necessarily represents an extreme that illustrates effects in a poor situation." Peer-reviewed article: "Combined impacts of these strategies are modeled as 20%, 40%, 60%, and 80% reductions in the transmission rates β11 and β22 relative to reference values. Specifically, we take β11 = 0.12, β12 = 0.3, β21 = 0.18, and β22 = 0.6 as natural rates and apply a 40% reduction factor to adults by setting β21 = 0.072 and β22 = 0.24. This implies R0 ≈ 1.7 prior to reopening. Increased contact is modeled by taking c = 10 so that β11 = 1.2, which corresponds to R0 ≈ 2.2 under the full capacity reopening scenario."
		Discussion : in the conclusion, the authors now conclude: "We find that measures reducing class density by rotating cohorts between in-person and remote schooling are likely to have greater impact in reducing the spread of SARS-CoV-2 than policies such as mask wearing, handwashing, and physical distancing in the classroom. Nevertheless, the latter policies combined with a reduction in class density are still quite effective in reducing effective transmission" versus "As already mentioned, our simulations suggest that measures that reduce class density by rotating cohorts between in-person and online schooling are likely to have the greatest impact in reducing the spread of SARS-CoV-2 brought on by the resumption of in-person instruction."
Lazebnik 2020	Lazebnik 2021	Title: not changed Abstract: shortened; message remains the same Methods: minor changes Results: 3.3. Lockdown policies - added paragraph: "The lockdown policy is similar to the schooling-working hours policy in the manner that both modify the spatial dynamics of the population. Nevertheless, the schooling-working hours policy defined the number of hours all the children and working adults populations go to school and work, respectively, while the lockdown policy keeps part (or all) the population at home all day long alongside the remain part of the population keeps the regular working and schooling hours. In ad- dition, the lockdown policy isolates individuals at home, which is expressed by the fact that individuals can contact with them but they can not initial an contact with other individuals while this constraint does not take place in the working-schooling hours policy." Discussion: minor changes
Lyng 2020	Lyng 2021	Title: not changed
		Methods : refer more specifically to classical epidemiological susceptible, in- fectious-asymptomatic, infectious-symptomatic, removed (SIR) model in their peer-reviewed version. In the peer-reviewed version, they justify why they did not add the exposed category to the model ("We do not include an "exposed" category as is often done for compartmental models but account for the short- er time a person is infectious rather than the longer period of time they are infected."); add justification about choice of Miami-Dade as one scenario for their forcing ("It should be noted that the case counts in Miami-Dade County over this time period are outliers compared to case save chosen for illustration to show the widest array of possible scenarios.")
		Results: peer-reviewed paper: "At the most lenient frequency considered, every 14 days, the number of infections is reduced approximately 21-56% (versus 31% to 98% in preprint) compared to no testing at all."
		• "For example, at a test sensitivity of 80%, testing every day reduces the num- ber of cumulative infections relative to no testing by 95.9–99.9% while test-

Munday 2021

(Continued)

Munday 2020

ing every 14 days reduced the number of cumulative infections at day 100 relative to no testing by only 26.0–27.1% (versus preprint: for example, at a test sensitivity of 80%, the effect of testing every day in a population of 1500 compared to testing every 14 days reduced the number of cumulative infections at day 100 by 364 in the low prevalence community and by 958 in the high prevalence community)"

 "Importantly, at sensitivities of 98% our models predict that a two-day delay in results (by send-out PCR, for example) will result in just a 31% reduction (versus 59% in preprint) in infections experienced at a 14-day testing frequency; however, as the testing frequency is increased, even with the twoday delay, the number of missed infections goes down rapidly to a 99% reduction from no testing at all to a daily testing frequency."

Discussion: peer-reviewed paper: additional information: "Even with a highly specific (99.5%) test such as a PCR, in a low prevalence community with large pools, false positives may still become an issue. The previous example results in 253 false positives over 100 days, highlighting the importance of confirmatory testing."

Title: not changed

Methods: minor changes

Results: peer-reviewed paper - added information:

- Networks of household-based contact between schools. "We constructed a set of seven networks of schools using individual-level de-identified data of pupils attending state-funded schools in England. Links between schools were defined by the number of unique contact opportunities (pupil to pupil) formed through shared households. First, we constructed a network with schools fully open (all pupils attending school) and included 21,583 schools, attended by 4.6 million primary school children and 3.4 million secondary school children in attendance, living at 4.9 million unique addresses (Fig. 1). The remaining six networks each represented a reopening scenario relevant to policy in England, illustrated in Fig. 2. In each scenario different combinations of year-groups return to school: early-years education (Reception and Year 1, i.e. 4-6-year-olds) and time-sensitive groups in transition, e.g. through exam certifications or transitional years (Year 6, i.e. 10–11-year-olds, Year 10, i.e. 14–15-year-olds and Year 12, i.e. 16–17-year-olds). These contained between 21 and 100% of all schools and between 35 and 66% of all households (Table 2)." (reported numerical data did not change)Degree distributions of the transmission probability network: "From the contact networks, we estimated the probability of transmission between each pair of schools to assign as edge weights in a transmission probability network for each reopening scenario."
- Connected components of binary outbreak networks: "Using the transmission probability networks, we generated 1000 realisations of binary outbreak networks for each scenario, where the edges between schools were weighted either 1, with probability equal to the transmission network, or 0. If schools were linked by an edge of weight 1, transmission occurred between the schools in that realisation, edges of weight 0 indicated no transmission between the schools they linked. Connected components on these net-works formed groups of schools that would be infected in an outbreak initiated in the same group, for that realisation."

Discussion: peer-reviewed paper - added paragraphs:

 "Since reopening in September there has been mixed evidence of transmission of SARS-CoV-2 in schools. However, because evidence of school outbreaks is largely based on passive case detection, the true risk of school transmission may be substantially underreported as children have a lower (Continued)

risk of developing symptoms after infection. Moreover, UK prevalence surveys show 11–18-year-olds routinely have the second-highest prevalence after 18–29-year-olds. Further, school children are estimated to be several times more likely to introduce infection into the household than adults—a rate which has increased since schools reopened in September, suggesting that transmission in schools may have been an important factor in driving the outbreak since school reopening. Consensus on this matter remains elusive, and our results should therefore be considered in light of the most recent available evidence to the reader." (versus preprint: "Scientific consensus on this matter remains elusive, and our results should therefore be considered in light of the most recent in light of the most recent available evidence to the reader.")

- "Our model presupposes that the expected outbreak risk within the school network is closely related to the risk within the wider community. That is, the risk of an infectious pupil seeding a school outbreak is proportional to the prevalence of infection in the community. Therefore, the transmission risks associated with opening schools would be expected to increase as prevalence in the surrounding community increases."
- "This framework also implies a well-mixed contact network within each school, final sizes are likely to be smaller due to preferential mixing within school years, classes and by gender. In addition, if schools implement social bubbles to introduce community structure in the contact network and therefore reduce the probability of a school-wide outbreak. This is partly reflected in the low values of R that have been chosen relative to those estimated early in the outbreak of 2.0–3.1) but our estimates of the number of households impacted may still be an overestimate compared to any real situation which would include mitigation measures (e.g., improved hand hygiene and use of face masks) and reactive interventions in response to cases detected in schools." (versus preprint: "This framework also implies a well-mixed contact network within each school, final sizes are likely to be smaller if schools implement social bubbles to introduce community structure in the contact network and therefore reduce the probability of a school wide outbreak. The reproduction number was assumed to be invariant between schools, this approach was chosen to maintain the parsimony of the approach, as modelling internal transmission dynamics of individual schools would increase complexity considerably.")
- "Our framework assumes no presence of immunity, however, there is evidence of immunity to SARS-COV-2 in children. The true immunity in schools is likely to vary both by region and between schools, however, the resolution of data on immunity in England is poor and certainly cannot be resolved at a school level. Similarly, the reproduction number was assumed to be invariant between schools, this approach was chosen to maintain the parsimony of the approach, as modelling internal transmission dynamics of individual schools would considerably increase the complexity. In light of these simplifications, our results should be interpreted as the maximal risk posed by transmission within and between schools. We assumed child-to-child transmission within households occurs with probability q = 0.15, which is consistent with estimates of the household secondary attack rate. To assess the robustness of the results to this assumption, we re-ran the analysis with q = 0.3 and q = 0.08 (Supplementary Figs. 2–5), and although the sizes of the connected components changed, the relative impact of scenarios remained comparable to the main analysis. In the absence of more robust evidence, however, we cannot rule out that transmission between children might be different from general transmission patterns to a degree that would fundamentally affect our results." (versus preprint: "We assumed transmission between members of the same household to occur with probability q = 0.15, which is consistent with estimates of the household secondary attack rate. To assess the robustness of the results to this assumption, we re-ran the analysis with q = 0.3 and q = 0.08 (supplementary material), where although the sizes of the connected components changed, the relative impact of scenarios remained comparable to the main analysis.")



(Continued)		 "Furthermore, such restrictions may be essential for suppressing transmission. While our results should not be considered as realistic epidemiological projections, our simulations provide an indication of the relative impact of each scenario, using highly resolved schools data." (versus preprint: "Furthermore, such restrictions will be essential for suppressing transmission in the event that all secondary schools are opened.") "If detailed projections were desired, the framework could be extended to include within-school contact structure, however, this would greatly increase the network size and therefore computational effort required. The principles highlighted in our analyses are not constrained to SARS-CoV-2 and may be considered when evaluating interventions for any epidemic in which children are known to transmit infection."
Naimark 2020	Naimark 2021	Title: changed Abstract: no major changes Methods: no major changes Results: authors have added a paragraph about a sensitivity analysis stating that when NPIs were implemented and their effectiveness held at the base case value, as the effectiveness of mitigation efforts within schools diminished, the difference in mean estimated cumulative case numbers by October 31, 2020, between keep- ing schools closed or reopening them increased. When school mitigation ef- fectiveness was held at the base case value, as the effectiveness of communi- ty-based NPIs decreased, the difference in mean estimated cumulative case numbers between keeping schools closed vs reopening them did not increase. Discussion: no major changes - authors add a bit more detail about how their study compares to other similar studies and what it adds to the evidence base
Panovska-Griffiths 2020b	Panovska-Griffiths 2021	Title: not changed Abstract: slightly changed Methods: not changed Results: no major changes Discussion: no major changes
Phillips 2020	Phillips 2021	Title: not changed Methods: minor changes Results: peer-reviewed paper: the maximum mean level of exposure (E) is 5.03% in the 15:2 RA scenario (on average) 12 days into the the simulation, with peak 3.18% presymptomatic (P) and 1.63% asympto-matic (A) propor- tions of attendees at days 12 and 19 respectively. Meanwhile, peak mean expo- sure in scenario 7:3 ST occurs on day 2, with 2% attendees exposed to the dis- ease and presymptomatic cases never exceeding that of the start of any sim- ulation; very detailed sensitivity analyses added to main paper (suppose that was in supplementary material before parameter a is now α C (foot c) Discussion: peer-reviewed paper: In the most unfavorable scenario (15:2 RA), there were cumulatively 539 and 324 student-days missed in high versus low- transmission settings, respectively. Conversely, in the best scenario (7:3, sib- lings together), there were only 62 and 51 student-days missed. • More information on bias and limitations added to discussion • Simplifying assumptions added to model description
Rozhnova 2020	Rozhnova 2021	Title: not changed
		Methods: minor changes
		Results: peer-reviewed paper:
		• Epidemic dynamics - added paragraph: "The joint posterior density of the estimated parameters reveals strong positive and negative correlations between some of the parameters (Supplementary Fig. 5). For instance, the ini-

(Continued)

tial fraction of infected individuals is negatively correlated with the probability of transmission per contact and the hospitalization rate, as a small initial density can be compensated by a faster growth rate or a larger hospitalization rate. For that reason, the age-specific hospitalization rates are all positively correlated. These correlations highlight the necessity of complementing the hospitalization time series data with seroprevalence data, even if the sample size of the latter is small. Without the seroprevalence data many parameters would be difficult to identify."

School and non-school-based measures - rephrased paragraph: "For other (non-school-related) contacts in society in general we assumed that (1) the number of contacts increased after April 2020 (full lockdown) but was lower than before the pandemic, and that (2) reduction in probability of transmission per contact due to mask wearing and hygiene measures was lower in August as compared to April (due to decreased adherence to measures. The starting point of our analyses is an effective reproduction number of 1.31 (95% Crl 1.15–2.07) in accordance with the state of the Dutch pandemic in August 2020 (Supplementary Fig. 4c). Figure 6a demonstrates that in August 2020 other contacts in society in general would have to be reduced by at about 60% to bring the effective reproduction number to 1 (if school-related contacts do not change))." (versus "For the non-school related contacts we assumed that 1) the number of contacts increased after April 2020 (full lockdown) but was lower than before the pandemic, and that 2) the transmission probability per contact was lower due to general physical distancing and hygiene measures. The starting point of our analyses is an effective reproduction number of 1.31 (95% Crl 1.15–2.07) in accordance with the situation in August 2020 (Figure S4 C). Specifically, to achieve Re = 1.31 we fixed $\zeta 2$ at 0.67 (decrease in adherence to contact-reduction measures in August as compared to April, when $\zeta 1$ is estimated at 0.51) and g at 0.5 (half-way in the relaxation of non-school contacts). Assuming the state of the Dutch pandemic in August 2020, Figure 6a demonstrates that non-school related contacts would have to be reduced by at least 50% to bring the effective reproduction number to 1 (if school related contacts do not change.")

Discussion: peer-reviewed paper:

- Added paragaph: "To our knowledge, our modeling study is the first that uses this method to address the role of school-based contacts in the transmission of SARS-CoV-2. Previous studies (e.g. refs. 21–25) used individual-based or network models that were not fit to epidemiological data using formal statistical procedures. Due to uncertainties in key model parameters, predictions of these models vary widely."
- Added paragaph: "Therefore, more children may have had an infection than indicated by the seroprevalence survey because the proportion of asymptomatic in children is believed to be high. As a consequence, our study potentially underestimates the role of children in transmission."

Vlachos 2021

Vlachos 2020

Title: changed

Methods: minor changes

Results:

- Robustness: "Excluding covariates (except age and sex) in SI Appendix, Table S3 leads to a reduction in the esti- mates for parents [OLS 1.01, SE 0.43]." (versus OLS 0.91, SE 0.43 in preprint)
- Robustness: "The OLS estimates with controls [1.09, SE 0.42] and when only controlling for age and sex [1.02, SE 0.42] are similar to those for the main sample. ORs for both samples of parents are similar when only controlling for age and when excluding all controls (SI Appendix, Fig. S4). SI Appendix, Fig. S5 shows the ORs including all controls for the main sample (SI Appendix, Fig. S5A) as well as when non-EU migrants are included (SI Appendix, Fig.



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(Continued)		S5B). 2)" (versus "The OLS estimates with controls [1.09, se 0.42] and without controls [0.90, se 0.42] are similar to those for the main sample" in preprint) Discussion: minor changes
Zhang 2020	Zhang 2021	Title: not changed Abstract: minor changes Methods: minor changes Results: more info added here but no change to numerical results Discussion: they added some limitations to their modelling approach ("In particular, it is possible that the difference in mixing patterns observed in the prepandemic, outbreak, and post-lockdown phase would be less marked for symptomatic individuals (especially for severe ones). Therefore, our estimates of SARS-CoV-2 transmission in the post-lockdown phase may be slightly under- estimated.")

Appendix 7. D	etailed qualit	y assessment of	f modelling studie

Study ID	Study de- sign	1. Are the struc- tural as- sump- tions trans- parent and jus- tified?	2. Are the structur- al assump- tions rea- sonable given the overall ob- jective, per- spective and scope of the mod- el?	3. Are the input pa- rameters transpar- ent and justified?	4. Are the input pa- rameters reason- able?	5. Has an ex- ternal vali- dation process been de- scribed?	6. Has the mod- el been shown to be ex- ternally valid?	7. Has an inter- nal val- idation process been de- scribed?	8. Has the mod- el been shown to be in- ternally valid?	9. Was there an adequate assessment of the effects of uncertain- ty?	10. Was techni- cal doc- umenta- tion, in sufficient detail to al- low (po- tential- low (po- tential- ly) for repli- cation, made avail- able openly or under agree-	Further com- ments con- cern- ing bias and evi- dence
											that protect intel- lectual proper- ty?	
Alvarez 2020	Compart- mental SEIR model with additional states * Model is extend- ed by mild symptoms, presympto- matic trans- mission, hospitalised cases, ICU cases and	Yes Model equa- tions are clear- ly stat- ed and scheme is visu- alised; one of multiple reports	No/minor concerns The model structure as employed is generally sensible	Moderate concerns Most in- put para- meters are not stat- ed explic- itly or ex- plained, but in- stead with reference to other	Major concerns There are concerns with re- gards to some im- portant parame- ters em- ployed, as found in their	Partial Calibrat- ed pre- dictions to case data and death data and similar data sets	Moder- ate con- cerns Calibrat- ed curve fits the data, but only weak de- pendent valida- tion as there are	No inter- nal vali- dation	Moder- ate con- cerns No inter- nal vali- dation	Major con- cerns There have been no un- certainty analyses re- ported; only analysis for different scenarios	Moder- ate con- cerns Code has not been report- ed, but repli- cation might be feasible	

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(Continued)	* Age-strat- ification by context-de- pendent contact ma- trices * Includes contact tracing and symp- tom-based isolation * Models Chilean Population	similar method- ology, but suf- ficient- ly ex- plained in this report (but ref- erences to other reports which may contain further justifica- tions); structure is most- ly moti- vated by intuitive reason- ing		Not entire- ly clearly laid out which pa- rameters were used, especial- ly with re- spect to parame- ters which have been calibrated; calibrated; calibration data have been giv- en with source and also visualised	#3 (e.g. sympto- matic con- tact rate, relative in- fectious- ness be- tween compart- ments have been assumed). Contact matrices are critical		rather simple data sets inde- pendent of each other				
Aspinall 2020	Bayesian Belief Net- work (BBN) *Primary schools in England *Focus on number of schools with ≥ 1 infection depending on preva- lence	Partial There is a justifi- cation, however not con- vincing; no ar- gument why BBN is appro- priato	Moderate concerns BBN/hazard model can- not track in- dividuals	No/minor concerns They are transpar- ent and justified rather well	No/minor concerns Popula- tion para- meters are known or distribu- tions in- cluding uncertain- ties were assumed	No exter- nal vali- dation	Major con- cerns No exter- nal vali- dation	Partial Authors refer to a well- estab- lished tool (UNINET)	No/mi- nor con- cerns UNINET should be well tested	No/minor concerns Comprehen- sive Monte- Carlo ap- proach, partly expert judge- ment	No/mi- nor con- cerns Compre- hensive informa- tion, ref- erence to an unpub- lished pro-

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easures implemented in the schoo	Baxter 2020	Agent-based modelling study * Outcome at popula- tion level in Georgia, USA	Partial Only ref- erence to previ- ous pub- lications which do not	Moderate concerns Justifica- tion in refer- ences seems rather con- vincing, but based on	No/minor concerns Only ref- erence to previ- ous pub- lications which do	Moderate concerns Justifica- tion in ref- erences seems rather convinc	No exter- nal vali- dation	Major con- cerns No exter- nal vali- dation; Decline (it sooms	Partial No in- ternal valida- tion de- scribed. Howev- or ma	Moder- ate con- cerns No inter- nal vali- dation	Major con- cerns Not reported	Major con- cerns No code, descrip- tion on- ly via ref- ornoc	Limited number of sus- ceptibles ≥ unreal- istic
ol setting to contain the COVID-19 pandemic (Review)			do not seem relevant	based on previous models for influenza	which do not seem relevant	convinc- ing, but based on previous models for influen- za, decline because of missing suscepti- bles seem unrealistic		(It seems to oc- cur be- cause of limited number of sus- ceptibles which is unrealis- tic.	er ma- jor parts seem to be based on an estab- lished frame- work.			erences, it is un- clear which parts are from with ref- erence. Unclear how many times model was run. Paper written in the style of a quick tech re- port	
	Bershteyn 2020	Some kind of simula- tion model,	No	Major con- cerns	Major concerns	Major concerns	No	Major con- cerns	No	Major con- cerns	Major con- cerns	Major con- cerns	
106		ly clear what was done * Some parts may be purely observa- tional re- sults with- out use of model,	Some mathe- matical model details are scat- tered around the pa- per,	Lack of model structure descriptions justifies ma- jor concerns	Input pa- rameters are de- scribed every now and then, but their role in the model is	As it is un- clear how model pa- rameters are used in the mod- el, there are major concerns	No exter- nal vali- dation	No exter- nal vali- dation	No inter- nal vali- dation	No inter- nal vali- dation. Major concerns due to lack of trans-	There are some uncer- tainty analy- ses on the simulation parts, but un- clear which uncertain- ties are cov-	Replica- tion is impossi- ble giv- en the available descrip- tions	

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	which may be applica- ble	but the general model structure is mainly unclear		mainly un- clear	to whether they are reason- able. The sec- ondary at- tack rate seems to be an im- portant parame- ter, but unclear how it is used.				paren- cy of ap- proach	ered by these analyses	
Burns A 2020	Determin- istic SEIR- Modification	Partial	Major con- cerns	Moderate concerns	Major concerns	Partial	Major con- cerns	No	Moder- ate con- cerns	Moderate concerns	Moder- ate con- cerns
	* Accounts for cohorts (age groups) * Investi- gates symp- tom-based isolation strategies * Time-de- pendent in- fectiousness	Model is roughly justified with ref- erence to pre- vious studies in the same field. Special prop- erties of this model are justi- fied on base of reason- ing. The exact structure of co-	State equa- tions seem question- able, for ex- ample: "Re- turn to iso- lation" para- meter con- trols flux out of and into isolation. Although not really mechanis- tic, model makes a lot of detailed but not well- founded as- sumptions which, for example, are based on influen-	There is a table of input pa- rameters with some references to sources and if they were cali- brated. The trans- parency of input pa- rameter values is of some concern, as not all are clearly stated in the man- uscript (e.g. rela- tive con-	There are major con- cerns of the valid- ity of in- puts as there are a lot of dif- ferent pa- rameters needed in the model, but their values and their appear- ance in the model are not al- ways clear. A 30-day period of infectious- ness for	The au- thors men- tioned "valida- tion", but da- ta were only cali- brated.	Descrip- tion of cali- bration process and the illus- tration bare- ly suffi- cient to establish that cal- ibration is suc- cessful	No inter- nal vali- dation	No inter- nal vali- dation	There is a hint to some kind of parameter uncertainty analysis, but the details are hidden in a reposito- ry which was not accessed, should be re- ported in doc- ument due to its impor- tance; results have been present- ed with uncer- tainty which arises from uncertain pa- rameters	There are links to some reposito- ries with refer- ence to data, but it is not entire- ly clear whether they con- tain the study code
		horting	za behav-	tact rate),	COVID-19						

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(Continues implemented in the school s	nued)	is men- tioned, but nev- er eluci- dated in detail. Relation- ships of parame- ters and states	iour; model seems a bit over-para- metrised. A determin- istic model can be prob- lematic in the context of smaller systems like	some with refer- ence to a repository which has not been checked further.	is at least question- able. As some inputs have been supposed- ly calibrat- ed from influenza data, the							Cochrane Library Better he
etting to contain the COVID-19 pandemic (Review)		mignt bene- fit from more vi- sual rep- resenta- tions	scnools with rather small age cohorts, since sto- chastic ef- fects may become im- portant (su- perspread- ing and sim- ilar occur- rences)		validity of values is compro- mised. Sources and re- porting do not award enough credibili- ty to the many in- put pa- rameters needed for the model.							vidence. Idecisions. alth.
Cam bell 2020	 Simple health eco- nomic mod- el to calcu- late the cost of passive and active surveillance testing * Considers Canadian population * Compris- es a testing scenario for schools 	Yes Struc- tural as- sump- tions are mech- anis- tic and well ex- plained	No/minor concerns The study structure is mostly clear and its as- sumptions are reason- able; partial sur- veillance scenario with some question- able as-	No/minor concerns	No/minor concerns No con- cerns about va- lidity of in- put para- meters	No exter- nal vali- dation	Major con- cerns No exter- nal vali- dation	No inter- nal vali- dation	Moder- ate con- cerns No inter- nal vali- dation	No/minor concerns Most para- meters (es- pecially im- portant ones) have been analysed in one-way sen- sitivity analy- ses and visu- alised in Tor- nado Plot	No/mi- nor con- cerns Model is well de- scribed and some code is given in the ap- pendix	Cochrane Database of Systematic Review

(Continued)			sumptions (e.g. about test fre- quency and necessity). Study cov- ers PCR, point-of- care tests that are in- creasingly more rele- vant								
Cohen 2020	Agent-based model (CO- VASIM) for COVID-19 transmis- sion * Combina- tion with model of school net- work struc- ture for King County, USA, * Seven school re- opening strategies and three different values for infectious cases in the two weeks prior to school re- opening are simulated	Partial Model structure is based on CO- VASIM which is rough- ly de- scribed. There is not enough informa- tion to under- stand the school network model	Moderate concerns Majority of model as- sumptions seem rea- sonable; school net- work: only qualitative information provided to understand the assump- tions; reference to COVASIM is given, but not enough information is provided concerning COVASIM	Moderate concerns Parameter values are not stated explicitly but with reference to the method- ological paper (CO- VASIM). Parame- ter table would have been helpful, some pa- rameters obtained by calibra- tion	Moderate concerns	No exter- nal vali- dation	Major con- cerns No exter- nal vali- dation	Partial COVASIM is an estab- lished frame- work; no inter- nal val- idation for the student network model	Moder- ate con- cerns Besides the use of COV- ASIM no internal valida- tion	Moderate concerns Many as- sumptions based on CO- VASIM are not checked by uncertainty analysis; parametre uncertain- ties: sensitivi- ty analysis for the infectivi- ty of children, susceptibility of children; stochastic un- certainty is presented for the effective reproductive number	Major con- cerns Code for COVASIM is avail- able, no code for the school network mod- el, repli- cation seems impossi- ble



					parame- ter would have been good							
Curtius 2020	Measure- ment of the aerosol con- centration in two dif- ferent class- rooms: * first class- room with- out air puri- fiers * second classroom with air pu- rifiers In order to calculate the risk of onward in- fection in the two dif- ferent class- rooms and comparison the infection risk model by Lelieveld 2020 is used as a base for the model	Partial Two parts of the mod- el: 1. model by Lelievelo 2020: model seems reason- able but based on ques- tionable assump- tions; 2. mea- sure- ment of aerosol in the two class- rooms: clear- ly de- scribed. For the model- ling part, they just take the model of Lelieveld 2020	Major con- cerns Many as- sumptions based on Lelieveld's model (Lelieveld 2020) but not de- scribed in detail; some figures are not compre- hensible	Moderate concerns	Moderate concerns Question- able input parame- ters, espe- cially pa- rameters concern- ing the in- fection risk	Partial Exper- imen- tal ap- proach in order to assess their as- sump- tions of the particle concen- tration levels; no ex- ternal valdia- tion for the oth- er part of the mod- el	Moder- ate con- cerns The con- ducted exper- iment suggests some ex- ternal validity for a part of the model	No inter- nal vali- dation	Moder- ate con- cerns No inter- nal vali- dation	Moderate concerns	Moder- ate con- cerns No code avail- able, with the data available replica- tion of results seems feasible	It is rather an ex- perimen- tal ap- proach, the mod- elling part is small and based on refer- ences.

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Measures imp Copyright © 2	(Continued) Di Domeni- co 2020a	Author de- scription: stochas-	Partial	Moderate concerns	No/minor concerns	Moderate concerns	Partial	Moder- ate con- cerns	Partial	Moder- ate con- cerns	Moderate concerns	Major con- cerns
1 1022 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.		tic discrete age-struc- tured epi- demic mod- el * In its core, the struc- ture is a bit unclear * Models possible lle- de-France school opening scenarios from May to summer holidays	Although there are many details about the mod- el de- scribed, the core of the utilised mathe- matical model is seem- ingly nev- er de- scribed explicit- ly, mak- ing as- sess- ment of quality difficult. There seem- ingly is anoth- er paper from the author in which the same ap- proach is utilised, but al- so com- plete de-	With the available model de- scriptions and justi- fications the mod- el seems to make rea- sonable and justified as- sumptions. But as the core mod- el structure is unclear, there is a possible risk of bias as some parts cannot be scrutinised	Neces- sary pa- rameters presum- ably stat- ed with referenced sources and by a parame- ter table; some pa- rameters are cali- brated. Contact matrices would have been nice to have in the paper. Calibra- tion da- ta are not presented in paper, but pre- sumably in other paper.	Parameter values are mostly not a direct cause of concern. Specula- tion about R value during lockdown phase question- able but probably important. Due to ob- scured structure, it is un- clear if all inputs are stated.	Model calibra- tion suc- cessful for some data, but no true external valida- tion in this pa- per	No true external valida- tion re- ported	No inter- nal vali- dation	No inter- nal vali- dation	Uncertainties and sensitivi- ty analyses of results gener- ally reported. Sensitivity to parameter values was analysed for the relative infectious- ness of young children, ef- fectiveness of case isola- tion and the expected R value during lockdown. Stochastic un- certainties have been considered and visu- alised. Structural un- certainties presumably not consid- ered and also unclear struc- ture.	Code has not been made available and it might not be possible to repli- cate re- sults giv- en the descrip- tions
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Quanti-
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but
mostly
not ex-
plicitly
stated in
this con-
text

España 2020	Meta-popu- lation mod- el	Yes	No/minor concerns	No/minor concerns	No/minor concerns	Yes	Moder- ate con- cerns	Partial	Moder- ate con- cerns	Moderate concerns	Moder- ate con- cerns
	* Based on FRED (Framework for Recon- structing Epidemic Dynamics) * Models population of Indiana * Adjusted for proper- ties of COV- ID-19 * Investi- gates ef- fects of face- mask adher- ence and school oper-	Although based on an exist- ing tool, there is a detailed sum- mary of model struc- ture and modifi- cations to ac- count for COV- ID-19. Struc- tural as- sump-	Overall, model structure is reasonable. There are some minor concerns due to in- explicit de- scription of incorpora- tion of face mask and school oper- ating capac- ity effect. Assuming that com- munity lev-	COVID-19 relevant parame- ters are described in paper and ref- erenced with sources. For other parame- ters FRED is refer- enced, but they are mostly not explicitly stated.	Stated in- puts are mostly reason- able. Authors make use of age-de- pendent suscepti- bility, may be ques- tionable given the extent of justifica- tion and its impor- tance.	Data cal- ibrations are visu- alised. Results were val- idated on sero- logical results of cumu- lative propor- tions of infect- ed indi- viduals and al- so strat- ified for	Although there are inde- pendent assess- ments of external validity present- ed, the extent of vali- dation is still rather small with re- gards	Estab- lished tool has been used	Authors used an estab- lished tool, but no spe- cific in- ternal valida- tion	Results were presented with credible intervals in all instances and uncertainty has also been visualised. However, due to inherent complexity of the model many struc- tural/parame- ter uncertain- ties are not considered which rais- es concerns	Study- specific code has not been made avail- able. But struc- ture and meth- ods are other- wise de- scribed in suffi- cient de- tail to

(Continued)	ating capac- ity	tions are most- ly rea- sonable as the model is mecha- nistic. Not ful- ly clear how face masks and school operat- ing ca- pacity are in- corpo- rated struc- turally.	el reproduc- tion num- ber does not change is question- able, but appropri- ate assump- tion if only school ef- fect should be assessed.	Data used for cali- bration is clear- ly stated and refer- enced.		differ- ent age groups.	to their quality and their agree- ment. Data cal- ibrations were mostly success- ful with- in the present- ed un- certain- ties, al- though there are some con- cerns.			about the ad- equateness of presented credible inter- vals.	possibly replicate results by mod- ifying the base FRED
Ger- mann 2020	Agent-based community simulation of USA * Two levels of working	Partial Major parts of	No/minor concerns There are	Moderate concerns	No/minor concerns Informa-	No No exter- nal vali-	Major con- cerns	Partial No in- ternal	Moder- ate con- cerns	Major con- cerns No uncertain-	Major con- cerns
	nine levels of schooling * Some sce- narios on- ly for the Chicago re- gion	the mod- el struc- ture are taken from lit- erature, however the de- scription is incom- plete	no obvi- ous prob- lematic as- sumptions, however as- sumptions not com- pletely list- ed	tion in- complete, no list of all para- meters	tion in- complete but no obvious problems	dation	No exter- nal vali- dation	valida- tion de- scribed. Howev- er, major parts are based on an estab- lished frame- work	No in- ternal valida- tion de- scribed. Howev- er, major parts are based on an estab- lished frame-	ty analyses performed	No code avail- able, de- scription is incom- plete

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Mea	(Continued)											
asures impl	Gill 2020	Agent-based model of schools	Yes	No/minor concerns	No/minor concerns	No/minor concerns	No	Major con- cerns	Partial	Moder- ate con- cerns	Moderate concerns	No/mi- nor con- cerns
emented in the school setting to contain the COVID-19 pandemic (Review)		(children + others) and transport of children	No con- cerns	No specific concerns	Compre- hensive justifica- tion		No exter- nal vali- dation	No exter- nal vali- dation	No exter- nal vali- dation	No in- ternal valida- tion de- scribed. Howev- er, major parts are based on an estab- lished frame- work. In ad- dition, the sim- ulation results seem more smooth than ex- pected	Some sensi- tivity analy- ses conduct- ed. They refer to a previous similar study where robust- ness has been shown	No code avail- able, de- scription is com- prehen- sive
	Head 2020	Meta-popu- lation mod- el for San	Yes	No/minor concerns	Moderate concerns	Moderate concerns	Yes	Moder- ate con- cerns	No	Moder- ate con- cerns	Moderate concerns	Major con- cerns
114		Francisco Bay area * Especially concerned with effec- tiveness of school mea- sures * Describes time-dis- crete sto- chastic	Struc- tural as- sump- tions are well de- scribed and most- ly justi- fied or at least	Structure is mostly ac- ceptable; stochas- tic courses of disease rightfully included; force of in- fection rea-	Critical as- sumption about chil- dren sus- ceptibility is well jus- tified by literature. Other pa- rameters	There are some concerns about the gener- al mean transmis- sion rate and the relative	Mod- el has been val- idated in vari- ous in- stances: * com- pari- son with case da-	Although external valida- tion is given, the qual- ity and extent of vali-	No inter- nal vali- dation	No inter- nal vali- dation	Uncertainty in the suscep- tibility of chil- dren and the transmission context dur- ing the evalu- ated scenar- ios has been assessed.	Code has not been made avail- able but would likely be neces- sary to

Moder- ate con- cerns Code has not been made avail- able. Data is sup- posedly stored in reposi- tory and the mod-	
	Code has not been made avail- able. Data is sup- posedly stored in reposi- tory and the mod- el is de-

	(Continued)		simple); almost no refer- ences	nificant im- pact	reposito- ries.	been con- sidered. This might introduce major bias.		values for para- meters suggest reason- ability of structure				scribed in suffi- cient de- tail to replicate analysis.
the extension to contain the COVID-10 nandemic (Beview)	Kaiser 2020	Network model: sim- ulating the transmis- sion of COV- ID-19 in classrooms: * dividing each class in two cohorts which are taught sepa- rately; * four differ- ent cohort- ing strate- gies: randomly splitting, splitting, splitting by gender, sep- aration op- timised by minimis- ing interco- hort-con- tact out of school, net- work-based chains for the out-of- school con- tact as a ba- sis of the separation	Yes Model structure seems reason- able	No/minor concerns	No/minor concerns Sample: 507 class- rooms in Eng- land, Ger- many, the Nether- lands and Sweden, data for student interac- tion by a model of 2010/11 (CILS4EU), this data might be outdated; most of the data with refer- ence to lit- erature; just one source for important parame- ters Davies 2020	Moderate concerns	No exter- nal vali- dation	Major con- cerns	No exter- nal vali- dation	Moder- ate con- cerns No inter- nal vali- dation	No/minor concerns Stochastic un- certainty: 300 simulations for each class- room were performed and the av- erage result is given, no further eval- uation of sto- chastic uncer- tainty; parameter uncertainties are checked for transmis- sion, out-of- school inter- action and proportion of infections by using dif- ferent plau- sible values; uncertain- ties for para- meters con- cerning the infection are not assessed; structural un- certainties are	Moder- ate con- cerns No code avail- able, de- scription rather compre- hensive, replica- tion of model might be difficult

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(Continued)										not assessed but network plausible	
Keeling 2020	Complex SEIR-based ODE model	Partial	No/minor concerns	Moderate concerns	No/minor concerns	Partial	Moder- ate con- cerns	Partial	Moder- ate con- cerns	Moderate concerns	Major con- cerns
	for UK with: *fine- grained age stratifica- tion *school/ work/ household transmis- sion *undetect- ed/detected cases *compli- ance-depen- dent effect on contact matrices	Larg- er ODE model makes it diffi- cult to examine the com- plete dy- namics, visual- isation would have been helpful. It is not always clear how analyses exact- ly have been conduct- ed. There are ref- erences to a pre- vious pa- per with more de- tailed method- ology, but al- so not	No direct concerns about spe- cific points. General- ly, an over- whelming amount of implicit as- sumptions to consider due to com- plexity of model and some lack of descriptions	Sources of data and pa- rameters seem to be mostly stated. Parame- ter table is given, mix- ing matri- ces and age-de- pendent parame- ters as fig- ures. Many pa- rameters calibrated from da- ta, but cal- ibration data are not shown and not entirely clear.	There are some concerns since it is not clear which da- ta fitting calibrat- ed the pa- rameters (there are some de- scriptions, but lack of reporting).	There is depen- dent val- idation due to model calibra- tion, but there is limited infor- mation about how well model is calibrat- ed to da- ta. The model calibra- tion is done in another paper.	Calibra- tion in refer- enced paper by same au- thor	There is some valida- tion by authors report- ed at the end of paper, but no process- es re- ported	No inter- nal val- idation conduct- ed, but model is com- plex so it would be nec- essary to check	Uncertain- ties have been partially re- ported from parameter posterior dis- tributions, covering sto- chastic and parameter uncertainties. However, un- certainty for some para- meters seem rather small. There are some in- stances in which possi- bly important values are as- sumed to be fixed (age-de- pendent mix- ing matrix, ef- fect of lock- down on mix- ing matrices). Due to its spe- cific mod- el structure, study would have bene- fited from an analysis by use of a dif-	Code has not been made available and the way da- ta that are pre- sented will pre- sumably com- plicate replica- tion at- tempts

(Continued)		perfectly detailed.								ferent model structure		
Kraay 2020	SIR-based modelling study	Partial	Moderate concerns	No/minor concerns	Moderate concerns	No	Major con- cerns	No	Moder- ate con- cerns	Major con- cerns	Moder- ate con- cerns	
	*Focus on transmis- sions via hands and fomite (sur- face) touch- ing	Stated "previ- ously de- scribed" but no refer- ence provided	Only deter- ministic, very simpli- fied struc- ture	Mainly jus- tified by influenza and rhi- novirus values	Partly tak- en from influen- za/rhi- novirus	No exter- nal vali- dation	No exter- nal vali- dation	No inter- nal vali- dation	No inter- nal vali- dation	Sensitivity analysis for only a few pa- rameters	No code avail- able, de- scription rather compre- hensive	
Lan- deros 2020	SEIR-based ODE model for the USA	Yes	Major con- cerns	No/minor concerns	Major concerns	No	Major con- cerns	No	Moder- ate con- cerns	Moderate concerns	No/mi- nor con- cerns	Wide range for the input
	* Three different school opening scenarios: reopening at full ca- pacity, al- lowing half of the stu- dents to at- tend school, rotating co- hort (stu- dents are di- vided into 3 cohorts and 2 of them are allowed to attend school at the same time)	Model structure is clear- ly stat- ed and justified; equa- tions are based on mathe- matical reason- ing	Model as- sumptions are simplis- tic; cohorting strategies for children because of school re- opening strategies, but it is un- reasonable to have dif- ferent co- horts in the model for adults as well; model is stated to apply to school com-	Input pa- rameters are justi- fied, lit- erature is given for most of them; child-to- child con- tact rate at school is given without any source	Latent, in- fectious and incu- bation pe- riod are justified by litera- ture. Weak jus- tification for other parame- ters such as same values for children and adults for trans- mission and their latent and infectious period and	No exter- nal vali- dation	No exter- nal vali- dation	No inter- nal vali- dation	No inter- nal vali- dation	Parameter uncertainty for transmis- sion rate is assessed by large range of different val- ues for said rate. Structural un- certainties are not dis- cussed, al- though prob- ably impor- tant	Code available from the author by re- quest; descrip- tion is compre- hensive	ters ≥ no signifi- cant re- sult

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Measures implemented in the school setting to contain the COVID Copyright © 2022 The Cochrane Collaboration. Published by John Wi	(Continued)	* Effect on the repro- duction number (R) and preva- lence is sim- ulated un- der these three pos- sibilities and com- pared to the impact of people > 18 years on R and cu- mulative prevalence of COVID-19		munities rather than states		no source for the multipli- er for in- creased child-to- child-con- tact c = 10. Input pa- rameters for the transmis- sion rate are highly unspecific, they have a wide range.						
- 19 pandemic ley & Sons, Ltd.	Lazebnik 2020	Hybrid mod- el: SIRD type temporal dynamics	Partial	Moderate concerns	No/minor concerns	Major concerns	Yes	Moder- ate con- cerns	Partial	Moder- ate con- cerns	Major con- cerns	Major con- cerns
(Revi		and spatial	i nere is a good	Generally,	Input pa-	There are	from da-		i nere are some		Uncertainty	
ew)		for home,	overview of other	the model	rameters are stated	significant	ta was	lt was shown	sani- tv-check	Not con-	has mostly	Code has
		school, workplace	studies	tures which	with their	about the	pared	that the	type	validat-	sessed, even if	made
		* Addition-	and their results	possibly could pro-	respective	model in- puts due	with R0 from	model can in	analysis from a	ed	it would have been impor-	avail- able
		al compart- ments: age	moti-	duce sensi-	most cas-	to their	mod-	some	mathe-		tant due to	Descrip-
		- children	vating the an-	ble results	es. The num-	signifi- cance in	el for a two-	way ap- proxi-	matical stand-		nature of the forward sim-	tion of spatial
		(< 13 years) and adults	proach.	stratifica-	ber of	generat-	week	mately	point		ulation type	stochas-
			ODE part is de-	tion and dif- ferences in	meeting events is	ing the model re-	span before	repro- duce	concern- ing the		model. Stochastic	tic mod- el part
			scribed	mixing pat-	set to one	sults. The	and after	the case	equa-		Uncertainty	lacks in-
			exten-	terns due	per hour, without	inputs are	school	num- bors in	tions, but from		was partially	depth
			ly and	physical lo-	further	rameters	ciosure.	a small	a com-		some R ² val-	nation
			trans-	cations.	commen-	from oth-		time	puta-		ues for result	such
			parently. Spa-	But accord- ing to the	tary.	er stud- ies, such		trame. It is not re-	tional stand-		tits have been	that it might
ы			tial part	model, chil-		that their		ported	point		Parameter	not be
.19			seems	dren above		reliabili-		to which	it is un-		uncertainty	possi-

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(Continued)

to be a 13 years ty in this stochaswould have study are tic simthe propnot guarulation. erties of anteed as but deadults, i.e. they are scription go to work, not callacks 2 class ibrated depth to age stratagainst ification underdata. stand might not Some pathe mebe enough. rameters chanics Model is just seem odd: involved. a forward why would simulation children of input panot be rameters, able to inwhich refect other adults, but quires great other chilcare concerning the dren? (beinputs and ta_ac,betheir applicta_cc) This ability as should well as a represumliable modably be el structure. property of the Regarding this aspect, spatial there are structure, not of the concerns about the transmisvalidity of sion parathe model. meter. Spatial part The derivation of can not really be fulbeta ca as ly assessed reported is with the questionavailable inable, since formation. beta incorporates infection as well as contact probability, but the

this is rewhether ally an the imindepenplemendent valtation is idation. right Although better than simple calibration, this

clear

extent

is still

a weak

valida-

tion.

There

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to oth-

er modellers'

results.

compar-

has not been assessed. ble to reproduce Structural uncertainties were not considered, although there has been a discussion of other model

structures.

(Continued)					derivation only cov- ers infec- tion prob- ability reli- ably							
Lee 2020	Simple age- stratified estimation for basic re- production number (R0) based on as- sumed SIR model * Consider- ing different frequencies of contacts among age groups * Impact of different susceptibili- ties among age groups is assessed	Yes Model clear- ly de- scribed.	Moderate concerns Within the limits of SEIR model	Moderate concerns Sparse de- tails.	Moderate concerns Sparse details.	No de- scription of exter- nal vali- dation.	Major con- cerns No de- scrip- tion and based on hy- potheti- cal situa- tion, not a partic- ular con- text.	Not de- scribed	Moder- ate con- cerns Not de- scribed.	Moderate concerns Tested 5 dif- ferent sce- narios of chil- dren's % sus- ceptibility from 35 to 60%	No/mi- nor con- cerns Model avail- able on Github.	Simple model, but large influ- ence of the con- tact ma- trix on the out- come. Con- tact ma- trix just rough- ly de- scribed
Lyng 2020	SIR model analysing different test/surveil- lance strate- gies * Linked to two ob- served prevalences in popula- tion * No sto- chasticity, no agents,	Yes Informa- tion in paper and sup- plement seem to be com- plete	Major con- cerns Determin- istic with fixed R0, very simpli- fied model structure, scope: one initial con- dition (1.35 infections) and two	No/minor concerns Justifica- tion suf- ficient, however only very few para- meters re- quired	Major concerns Decrease due to lim- ited num- ber of sus- ceptibles, R0=2.5	No exter- nal vali- dation	Major con- cerns No exter- nal vali- dation	Partial No in- ternal valida- tion de- scribed, but code (partly) and on- line sim- ulator available for test-	Moder- ate con- cerns No in- ternal valida- tion de- scribed, but code (partly) and on- line sim- ulator	Major con- cerns The weakest part of the study is miss- ing analysis of uncertain- ty. Predicting costs and ef- fectiveness at an absolute level without uncertainty	No/mi- nor con- cerns Code is part- ly avail- able, on- line sim- ulator available	Limited number of sus- ceptibles ≥ unreal- istic

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Measures implemented in	(Continued)	basic re- production number (R0) = 2.5, insti- tution = sub- set of 1500 people		prevalence scenarios					ing va- lidity	available for test- ing va- lidity	or sensitivity analysis poses a serious risk.			Cochrane Library
1 the school setting to contain the COVID-19 pandemic (Review)	Mauras 2020	Agent-based SEIR with contact net- works: * investi- gates prob- abilities of outbreaks after one in- dex case	Yes Good and con- vincing	No/minor concerns Comprehen- sive justifi- cation, real- istic struc- ture	No/minor concerns	No/minor concerns	Partial Compar- ison with some specific findings in other studies	No/mi- nor con- cerns External valida- tion as good as possible done by compar- ing with litera- ture	Partial No ex- plicit inter- nal val- idation proce- dure but a very compre- hensive set of analy- ses were done that indi- cate va- lidity	No/mi- nor con- cerns No ex- plicit inter- nal val- idation proce- dure but a very compre- hensive set of analy- ses were done that indi- cate va- lidity	No/minor concerns Sufficient analyses by evaluating pa- rameter sen- sitivity and dependency on model as- sumptions	No/mi- nor con- cerns Code avail- able on github, results seem repro- ducible	The model focus is on temporal evolution of single index cases within school/ work-place. They consider the probability of getting an outbreak (≥ 5 secondary cases). The effect to the population is not the primary scope of the model.	Trusted evidence. Informed decisions. Better health. Cochrane Database of Systematic R
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Measures implemented in the school setting to contain the COVID-19 Convright © 2022 The Cochrane Collaboration Published by John Wiley &	(Continued) Monod 2020	Bayesian model for transmis- sion dynam- ics in the USA * Age-strat- ified con- tact-and- infection model, * Impact of different age groups to infection dynamics is estimated * Interaction for different age groups is based	Yes Relative mobili- ty levels for the differ- ent age groups: mobility between Febru- ary and August com- pared to a base- line; mo- bility is	No/minor concerns Model as- sumptions are justified; limitations: population structure except age is not com- pletely ac- counted for, young chil- dren with- out phone cannot be followed up, but source	No/minor concerns Reference for input parame- ters is giv- en; two sources for net- work data are given	No/minor concerns	Yes Valida- tion for the in- teraction of indi- viduals by da- ta of a second mobile phone provider; predic- tions of the model are com-	Moder- ate con- cerns Age- stratified death data closely matches the mod- el pre- dictions; num- ber of report- ed COV- ID-19 cases	No inter- nal vali- dation	Moder- ate con- cerns No inter- nal vali- dation	No/minor concerns Credible in- tervals for key outcomes are given (e.g. R0, on- ward spread, contribution to infection transmission); parameter uncertain- ties: sensitivi- ty analysis for the age-strati- fied infection fatality ratio;	No/mi- nor con- cerns Code avail- able on Github, MIT li- cense is needed
D-19 pandemic (Review)		age groups is based on mobile phone data, then SARS- CoV-2 trans- mission, in- fections and deaths are estimated	bility is attrib- uted to mortal- ity da- ta to fit the mod- el; math- emati- cal ap- proach is clear- ly de- scribed	but source for their mo- bility input data is giv- en; mobil- ity of pop- ulation de- pends on a lot of exter- nal factors			are com- pared to report- ed cases of COV- ID-19; calibra- tion for the cu- mulative num- ber of deaths seems reason- able	cases com- pared to the pre- diction of the model increas- es, but expla- nation is giv- en (in- creased testing); calibra- tion as kind of depen- dent val- idation			fatality ratio; one reference to a similar model, be- sides that no assessment of structural un- certainties	
123	Munday 2020	Network model describ- ing trans-	Yes	Major con- cerns	No/minor concerns	No/minor concerns	No	Major con- cerns	No	Moder- ate con- cerns	Moderate concerns	Major con- cerns

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Measures implemented in the school setting to contain the COVID-19 pandemic (Review)	(Continued)	mission between schools * Transmis- sion proba- bility mod- el showing the inter- action of schools and households in England * Outbreak probability for six differ- ent school reopening scenarios is modelled	Majority of model assump- tions are stated through equa- tions, visuali- sations might have been helpful	Model as- sumptions seem ide- alistic, be- cause the network is simplistic: it accounts for household and schools, other popu- lation struc- tures are neglect- ed. Spread between schools is seemingly mediated by infection between siblings in house- holds which seems ques- tionable	Source of informa- tion for the net- work of schools in England is given. Parame- ters are complete, but on- ly a small amount of input pa- rameters are used.	Input pa- rameters are rea- sonable	No exter- nal vali- dation, but ref- erence to oth- er stud- ies who came to similar qualita- tive re- sults	No exter- nal vali- dation	No inter- nal vali- dation	No inter- nal vali- dation	Parameter uncertain- ty: sensitivi- ty analysis for the reproduc- tive number (R) and for the within-house- hold trans- mission prob- ability; stochastic uncertainty: credible inter- vals are given, 100 simula- tions in order to account for stochastic un- certainty; no structur- al uncertain- ty analysis, al- though this is needed to jus- tify the struc- ture	No code avail- able, with the data available replica- tion of results might be difficult
	Naimark 2020	Agent-based SEIR-based simulation	Yes	No/minor concerns	No/minor concerns	No/minor concerns	Partial	Moder- ate con- cerns	No	Moder- ate con- cerns	Moderate concerns	No/mi- nor con- cerns
124		model * Model to calculate cumulative COVID-19 cases for six differ- ent scenar- ios: schools remain- ing closed and schools being re- opened in combina-	Model structure is stated with ref- erence to the supple- mentary materi- al; clear visual- isation in the supple-	In general it seems rea- sonable to combine school re- opening and schools remaining closed with different NPI measure- ments; in- fectiousness	Input pa- rameters are trans- parent and jus- tified, ta- ble for key parame- ters with sources is given	Input pa- rameters seem to be reason- able, parame- ters are calibrat- ed or with reference to litera- ture	Calibra- tion and recali- bration for the first and second wave of COV- ID-19 (depen- dent val- idation)	Besides the da- ta used for cali- bration, no proof that the model fits to ex- ternal data as well	No inter- nal vali- dation	No inter- nal vali- dation	Stochastic un- certainties are checked by several simu- lations, cred- ible intervals are given for stochastic un- certainties; parameter uncertainties are checked by the differ-	No code avail- able, de- scription rather compre- hensive

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Measures implemented in the school setting to contain the COVID-19 pandem	(Continued)	tion with three dif- ferent non- pharmaco- logical in- tervention (NPI) mea- sures; * Hypothet- ical popula- tion of one million in- dividuals based on the charac- teristics of the popula- tion of On- tario, Cana- da, calibrat- ed for the first and second COV- ID-19 wave	mentary materi- al; refer- ence to a similar model in another study	of children might be different to adult's in- fectiousness							ent scenarios, besides that they are not checked	
c (Review)	Panovs- ka-Grif- fiths 2020a	Agent-based SEIR-model (COVASIM) * Analysed impact of	Yes Model	Moderate concerns	No/minor concerns	Moderate concerns	Partial Depen-	Moder- ate con- cerns	Partial COVASIM	Moder- ate con- cerns	Moderate concerns	No/mi- nor con- cerns
125		two differ- ent school opening scenarios and three ways of test- ing on re- production number (R), incidence and death of COVID-19 * Second simulation with 50% infectious-	is clear- ly stated and jus- tified, used CO- VASIM as a basis of model (briefly de- scribed)	able that re- opening of schools is proportion- al to return to work- places, ef- fect of deci- sions of pol- icy makers on this topic is neglected; 14-days complete isolation of	ta are stat- ed and source is publicly available for con- firmed cases and deaths, referring to COVA for other model pa- rameters;	al the in- put para- meters are reason- able; it is referred to the UK Govern- ment's COVID19 dash- board; cal- ibration of some parame-	valida- tion for the con- firmed cas- es and deaths, with da- ta of UK Govern- ment's COV- ID-19 dash- board;	Apart from the depen- dent val- idation no ex- ternal valida- tion de- scribed	estab- lished frame- work	COVASIM is an estab- lished frame- work, no other in- ternal valida- tion	Assessment for the ef- fects of un- certainties for deaths, R and incidence of COVID-19; several sim- ulations in order to ac- count for sto- chastic er- rors, shown by 10% and 90% quantiles (but only 10	With the given da- ta, repli- cation of results seems possible, Code for COVASIM is avail- able

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Measures implemented in the school setting to contain the COVID-19 pan	(Continued)	ness of chil- dren com- pared to older ages * Two pos- sible strate- gies for re- opening schools: full- and part- time with 50% atten- dance, com- bined with three types of testing		people test- ed positive might be idealistic; prediction until end of 2021 ques- tionable	updates of COV- ASIM are integrat- ed into the model	ters; some concerns because model has a lot of pa- rameter inputs	but these data were al- so used to build the mod- el, no other ex- ternal valida- tion				simulations); different sce- narios for test-tracing and school re- opening seem reasonable; parameter uncertainties: two differ- ent parame- ters for chil- dren's infec- tiousness, be- sides that pa- rameter un- certainties are not assessed; structural un- certainties are not further as- sessed	
ndemic (Review) 126	Panovs- ka-Grif- fiths 2020b	Agent- based mod- el based on COVASIM, evaluating the impact of face cov- erings in the UK, num- ber of new infections for different scenarios: * no mask wearing at schools but community mask wear- ing * mask wearing at secondary schools and	Yes Model structure seems reason- able, ex- tensions to CO- VASIM suffi- cient- ly de- scribed; not enough infor- mation about COVASIM	Moderate concerns	No/minor concerns	Moderate concerns Some con- cerns be- cause of the many input pa- rameters of COV- ASIM	Partial There is no ex- ternal valida- tion but model calibra- tion for the COV- ID-19 cases with case da- ta and death data for the UK	Moder- ate con- cerns Data have been cal- ibrated; calibra- tion c	Partial COVASIM is an estab- lished frame- work	Moder- ate con- cerns COVASIM is an estab- lished frame- work, no other in- ternal valida- tion	Moderate concerns Stochastic uncertain- ties: several simulations are done and 10%/90% quantiles are given, sto- chastic uncer- tainty is ex- tremely large; uncertainty of input para- meters: differ- ent values for effectiveness of mask wear- ing;	No/mi- nor con- cerns Code for COVASIM is avail- able, code for the rest of the model is avail- able on github

Measures implemented in the sc	(Continued)	community mask wear- ing Considered two differ- ent levels of effective mask cover- age									no assess- ment of struc- tural uncer- tainty	
hool settin	Phillips 2020	Agent-based simula- tion of one	Yes	Major con- cerns	No/minor concerns	Moderate concerns	No	Major con- cerns	No	Moder- ate con- cerns	Moderate concerns	Moder- ate con- cerns
g to contain the COVID-19 pandemic (Review)		school/ childcare facility em- bedded in the commu- nity * Basic sim- ulation ap- proach, homoge- neous mix- ing based on house- hold/class/ school * Investi- gates alloca- tion of chil- dren and educators to classes	The model structure is documented and justified in most instances. Unclear whether transmission probability is understood correctly, beta as well as contact matrices have been described as the probability of transmission.	Model as- sumptions might be too sim- plistic as small scale of model highlights importance of network effects. Homoge- neous mix- ing is ar- gued by aerosol transmis- sion, how- ever this would con- tradict the assumption of strong- ly age-de- pendent transmis- sion proba- bilities. As under- stood by reviewer:	Input pa- rame- ters have been stat- ed with sources and some were ad- ditional- ly clari- fied with explana- tions. For com- munity transmis- sion an under-as- certain- ment fac- tor of 8.45 has been assumed without justifica- tion. Although hinted at in the text, differ- ent infec-	Transmis- sion prob- abilities were cali- brated to produce a household attack rate of 15% based on only one study, for the class/ school the transmis- sion rate has been scaled down somewhat arbitrarily or at least not con- vincing	No exter- nal vali- dation	No exter- nal vali- dation	No inter- nal vali- dation	No inter- nal vali- dation	There were several sensi- tivity analyses on important parameters. Uncertain- ties have been generally visualised, in some in- stances it is not clear whether stan- dard error of the mean or standard de- viation of re- sults is given. Error bands which lead to negative pro- portions of in- fected individ- uals indicate flawed uncer- tainty analy- sis. Uncertain- ties general- ly large, in- dicates that	Code not avail- able, but data and method might be suf- ficient- ly de- scribed to allow for repli- cation

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Measures implemented in t	(Continued)			transmis- sion prob- ability ap- proximate- ly propor- tional to class size, might not	tiousness of chil- dren com- pared to adults has seemingly not been analysed.						choice of out- come vari- ables is not perfect (frac- tions between strategies more relevant than absolute		Cochrane Library
he school setting to contain the COVID-19 pandemic (Review)				be expect- ed as con- tacts of chil- dren might not increase proportion- ally with larger class size. Immediate detection of sympto- matic in- dividuals and per- fect compli- ance with no house- hold trans- mission in isolation is question- able (on- ly 5 class- rooms and 1 school)							values)		Trusted evidence. Informed decisions. Better health.
	Rozhno- va 2020	Model for the Nether- lands, ef- fect of open-	Yes	No/minor concerns	No/minor concerns	No/minor concerns	No	Moder- ate con- cerns	No	Moder- ate con- cerns	No/minor concerns	No/mi- nor con- cerns	rane Databas
128		ing/closing schools on effective reproduc- tion num- ber (Re), in- formative	Justifi- cation is compre- hensive	The as- sumptions are reason- able	Justifica- tion is suf- ficient	Estima- tion of parame- ters using Bayesian approach	No exter- nal vali- dation, some lit- erature men- tioned	No inde- pendent external valida- tion, but	No inter- nal vali- dation	No inter- nal vali- dation, but the method-	Reliable methodolo- gy for uncer- tainty analy- ses applied	Code avail- able on github, repro-	e of Systematic Reviews

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Measures implemented in the school setting	(Continued)	epidemic data (ran- dom cross- section, not reported cases with symptoms)				(priors seems rea- sonable), reliable methodol- ogy, nega- tive bino- mial ob- servations assumed		real and very in- forma- tive da- ta used for pa- rameter fitting, agree- ment of model and data shown		ology was ap- plied previ- ously		ducibili- ty seems given
to contain the COVID-19 pandemic (Review)	Shelley 2020	Determin- istic SEIR model strat- ified into town and different co- horts within a school * Adds pre- clinical and subclinical infectious states	Partial Model structure is most- ly clear, some lack of justifica- tions. Exact imple- men- tation of test- ing and quaran- tine in the mod- el not total- ly clear and ne- glect- ed in re- sults/dis- cussion	Major con- cerns It is doubt- ful if this de- terministic model of such a non- closed sys- tem start- ing from one seed in- fection can properly de- scribe infec- tion dynam- ics; mass test- ing fraction is random- ly drawn between 0 and 1; high sensitivity of results to the first seeded in- fection im- plies prac- tical lack of	Moderate concerns	Major concerns	No exter- nal vali- dation	Major con- cerns No exter- nal vali- dation	No No inter- nal vali- dation	Moder- ate con- cerns No inter- nal vali- dation	Moderate concerns Parameter uncertainty has been in- vestigated probabilisti- cally. Transmission matrices have not been sub- ject to uncer- tainty analy- ses. There are con- cerns that the simple mod- el structure can not de- scribe the re- al dynamics, so an analysis of alternative model struc- ture would have been ad- equate.	Moder- ate con- cerns Code has not been made avail- able but model is com- para- bly sim- ple. Giv- en infor- mation might enable replica- tion of model, but un- clear im- plemen- tation of test- ing and quaran- tine.

(Continued)			robustness of deter- ministic ap- proach; be- ta has seem- ingly not been adjust- ed for the change of magnitude introduced by transmis- sion matri- ces								
Sruthi 2020	Ma- chine-learn- ing algo- rithm to dis- entangle ef- fects of dif- ferent non- pharmaco- logical in- terventions (NPIs) in Switzerland cantons	Partial Much of the structure is hidden away in an Al- type al- gorithm	Major con- cerns As far as it can be ad- dressed the assumed structure seems rea- sonable. Many of the assump- tions are im- possible to assess given the informa- tion in the study.	No/minor concerns Algorithm parame- ters are specified; not many more pa- rame- ters as it seems.	No/minor concerns Since model inputs are fairly straight- forward, there are barely any problems. A minor concern would be the input of recov- ery time which scales the reproduc- tion rate.	Yes Five-fold cross valida- tion	Moder- ate con- cerns Cross- validity seems to sug- gest that weekly infection rates can be predict- ed well if case numbers are high enough. No other forms of valida- tion re- ported.	Partial No in- ternal valida- tion, but cross- valida- tion	Moder- ate con- cerns Func- tionality of cross- valida- tion sug- gests that model is func- tional in some sense	Moderate concerns	No/mi- nor con- cerns Code and source data available
Tupper 2020	Agent- based/sto- chastic SEIR model of in-	Partial	Moderate concerns	No/minor concerns	Moderate concerns	No	Major con- cerns	No	Moder- ate con- cerns	Major con- cerns	Moder- ate con- cerns

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Veasures implemented in the scho c	(Continued)	class trans- missions: * focus on large clus- ters (su- per-spread- ing events)	Weak- ly justi- fied, but based on a rather wide- ly used model structure	Only chil- dren, only within class- room con- sidered	Mostly jus- tified by literature	No obvi- ous issues, but weak justifica- tions for many pa- rameters	No exter- nal vali- dation	No exter- nal vali- dation	No inter- nal vali- dation	No inter- nal val- idation done, results look plausible	Only sensitiv- ity analysis for few para- meters. These show large impact on re- sults.	No code avail- able, de- scription rather compre- hensive
l setting to	Williams 2020	COVID meta- population model for	Partial	Moderate concerns	Major concerns	Moderate concerns	No	Major con- cerns	Partial	Major con- cerns	Major con- cerns	No/mi- nor con- cerns
o contain the COVID-19 pandemic (Review) 1		Seattle * Based on CORVID which is based on FluTe which simulated influenza * Analysis of differ- ent test and isolation strategies	Justifi- cations are shift- ed to the method papers, but mostly under- stand- able there. Descrip- tions could have been more techni- cal and detailed. Unclear how tests/ symp- tomatic cases averted was cal- culated	There are some con- cerns as structure is ultimate- ly based on influenza model, with some nat- ural history of disease modifica- tions intro- duced for COVID-19. Because model is meta-popu- lation mod- el, it is diffi- cult to verify that struc- ture is rea- sonable, mechanistic to a high de- gree. Simulation of results until end	It is dif- ficult to gather all model in- puts, as most of it is not con- tained in this paper. Addition- ally, it is difficult to see how much of up-to-date parame- ter knowl- edge was used in the simu- lations	There are no obvi- ous flaws, but given the paper informa- tion this is impossi- ble to as- sess with- out look- ing into code files	No exter- nal vali- dation	No exter- nal vali- dation	Model is based on exist- ing pub- lished frame- work	Model is based on exist- ing pub- lished frame- work. But the given outputs are not explicitly validat- ed. The al- most equal in- fection peaks for differ- ent sim- ulations are atyp- ical for agent- based models.	Minimal as- sessments were provid- ed, some in- stances of dif- ferent seeds and different R0 analysed. But model still contains a great deal of uncertainties with respect to structural assumptions and implicit model para- meters which are hidden.	Code and data are avail- able in reposito- ry
131				until end of epidem-								

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(Continued)			ic is rather unreason- able for as- sessing out- comes, as this creates a large de- gree of un- certainty.									
Zhang 2020	Modelling of four Chinese cities; SIR model and with contact matrices based on di- aries/ques- tionnaires via phone; analysis on- ly based on reported contacts; most of the information is from re- ported con- tacts not from mod- elling; on- ly "schools open with- out any contain- ment mea- sures" ver- sus "schools closed" con- sidered	Yes Justifi- cation is suffi- cient	Moderate concerns Self-report- ed contacts of study par- ticipants play a major role in the model	No/minor concerns Contact matrices are justi- fied, SIR model pa- rameters only part- ly justified (it seems to be used only for calcula- tion of R0 not for simulating the epi- demics)	Major concerns Self-re- ported contact matrices might be strongly biased, es- timation of some parame- ters of SIR model is not de- scribed	Partial Compar- ison with mobility	Major con- cerns No ex- ternal valida- tion for the im- portant results, i.e. pre- diction of R0 or report- ed infec- tions	No inter- nal vali- dation	Moder- ate con- cerns No in- ternal valida- tion, but compre- hensive analy- ses that partly in- dicate reliabil- ity, no compar- ison of SIR mod- el with data about in- fections	Moderate concerns Uncertainty of count matri- ces is reliable, uncertainty from SIR mod- el not consid- ered	Moder- ate con- cerns No code avail- able, role of SIR mod- el not entire- ly clear, other parts are suf- ficient- ly de- scribed	Trans- fer of results from China to Western coun- tries un- clear. Most in- forma- tion is from re- port- ed con- tacts. These report- ed con- tacts (via phone calls) might be unreli- able.

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Appendix 8. Measures reducing the opportunity for contacts: study-by-study overview of the evidence contributing to each outcome (modelling studies)

Outcome Number of stud- Overview of effect by study ies	Comparison used in each study	Effect direc- tion per study (positive ▲; negative ▼; no change/mixed effects/con- flicting findings ◀►)
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Intervention subcategory: reducing opportunity for contacts - reducing the number of students and reducing the number of contacts

Outcome category: transmission-related outcomes

Number or proportion of cases	13 modelling studies (Baxter 2020; Bershteyn 2020; Burns A 2020; Di Domeni- co 2020a; Ger- mann 2020; Gill 2020; Head 2020; Jones 2020; Kaiser 2020; Keeling 2020; Mauras 2020; Panovska-Grif- fiths 2020a: Shel-	Baxter 2020: under a regular schedule, the predict- ed number of cases in adults would be 3,600,338 (1,491,000 cases in children). When implement- ing an alternating attendance schedule in prima- ry schools with 50% attendance only, the num- ber of infections in adults would be 3,098,000 and 1,072,000 in children. When implementing the same schedule on all school levels, the number of infections in adults would be 3,166,000 and 1,134,000 in children. If only primary school chil- dren (< 10 years) attend school, the predicted cu- mulative number of infections in adults would be 3,242,000 and 1,183,000 in children.	Full opening of schools with no measures in place	Positive
	ley 2020)	Bershteyn 2020: among other measures, the study assessed the effect of reducing the number of stu- dents per class as well as an alternating atten- dance schedule compared to a remote learning op- tion, widespread testing at the beginning of the work week, and daily symptom screening and self- isolation. Reducing the number of students by 50% predicted a 75% reduction in the secondary at- tack rate. If there are several choices for schools for how to schedule rotating cohorts, the decision for smaller cohorts (e.g. 9 students per group at- tending one-third of days instead of 13 students at- tending one-half of days) reduces transmission risk as well (results presented in a graphical way on- ly). The effectiveness of the measure was assessed alongside other measures (e.g. testing, symptom screening and subsequent isolation).	Least intense measure	Positive
		Burns A 2020: compared to reopening under symp- tom-based isolation and full capacity, reducing the number of students by 50% was predicted to lead to a reduction in the attack rate by 16%.	Full opening of schools with no measures in place	Positive 🛦
		Di Domenico 2020a: across all scenarios, opening schools fully (100% capacity) on 11 May 2020 would lead to the largest increase in new daily cases. With results presented in a graphical way only, they im- ply that all measures assessed lead to benefits, and	Full opening of schools with no measures in place	Positive
Measures implement	ed in the school setting	g to contain the COVID-19 pandemic (Review)		133

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(Continued)

these are generally similar across measures. However, for some scenarios progressive reopening of schools over four weeks (with 25%, 50%, 75% and 100% capacity in weeks 1, 2, 3 and 4) is less beneficial than both the partial reopening of schools to 50% capacity immediately and progressive reopening over two weeks (with 25% and 50% capacity in weeks 1 and 2). The magnitude of the effect depends strongly on what types of schools are involved in reopening: if only pre-schools and primary schools are reopened much fewer cases occur than if middle and high schools or all schools are reopened. Additionally, the effect is moderated by the relative transmissibility of pre-school and primary school children: in scenarios with lower transmissibility in these younger children, fewer cases occur with each measure in place. Full opening of Positive 🛦 Germann 2020: alongside measures to make conschools with tacts safer (face masks, hygiene, and distancing measures), the study asesses the impact of reducno measures in ing the number of students (80%, 40%) and introplace ducing alternating attendance schedules (weekly, 2 days). With schools opening at full capacity with no measures in place, the study predicts that the cumulative number of cases during the peak four weeks of the pandemic would be 59,664,577 in the USA. Reducing the number of students by 20% decreases the number of cases to 12,346,146 during this period. Further reducing the number of students to 40% and implementing an alternating attendance schedule further decreases the number of deaths in this period: with a weekly alternating schedule the number of deaths would be 2,263,045, while it would be 1,997,647 for a twoday alternating schedule. With more workplaces open, the numbers of cases was consistently higher across all scenarios. Gill 2020: compared with schools reopening at full Full opening of Positive 🛦 capacity with no measures in place, the study preschools with dicts that strategies that reduce the number of stuno measures in dents in schools (rotating 2 days per week; weekplace ly 4-day rotation; rotating 1 day per week) all lead to reduced cumulative infections among students and staff. This includes both strategies based on alternating attendance (rotating 1 to 4 days per week) as well as strategies based on in-school cohorting (class cohorting; class cohorting and block scheduling for older students; complete class podding). The size of this effect is moderated by school type, with the rate in primary schools the lowest across scenarios, followed by typical secondary schools then large secondary schools. While all of the strategies are effective, those built on alternating attendance are more effective and rotating one day per week may be slightly more effective than other alternating attendance strategies at a higher community incidence. The size of this effect is moderated by community incidence, with a higher



(Continued)

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community incidence leading to a higher number of cumulative infections across scenarios. It is not possible to disaggregate effects or determine effect size due to co-interventions and lack of reporting. Full opening of Positive Head 2020: the study predicts that strategies that schools with reduce the number of students and thus reducing contacts between students lead to reduced exno measures in cess proportion of infected students, teachers and place staff, household members and community members. This includes strategies based on alternating attendance (reduction of number of students on school or on class level). With schools reopening at full capacity with no measures in place, at a moderate level of community transmission and with children being half susceptible as compared to adults, the study predicts an excess proportion of infected teachers of 14.83 (95% CI 0.93 to 29.25), 14.18 (95% CI 1.63 to 26.77) of students, 2.04 (95% CI -0.77 to 5.07) of household members and 1.16 (95% CI -0.9 to 3.28) of community members. When reducing the number of students on the school level (maintaining class sizes, half the school attends two staggered days each week according to grade groups), the proportion of cases can be reduced. For teachers, the excess proportion of cases per 10,000 is reduced to between 0.68 (95% CI -2.78 to 4.13); for students, this decreases to 0.55 (95% CI -0.32 to 1.66); for family members, the proportion decreases to 0.15 (95% CI -1.65 to 1.92). For the general population, the excess rate would be reduced to 00.09 (95% CI -1.48 to 1.46). When reducing the number of students on the class level (50% or 10 students; each half attends 2 different days each week), the proportion of cases can be further reduced in students, family members and the general population. For teachers, the excess proportion of cases per 10,000 is slightly higher than for the strategy that reduced the number of students on the school level to 0.7 (95% CI -2.38 to 3.85); for students, the proportion decreases to 0.4 (95% CI -0.44 to 1.31); for family members, to 0.09 (95% CI -1.59 to 1.8) and for the general population, the excess rate would be reduced to 0.04 (95% CI -1.42 to 1.55). In general, higher transmission, high schools, and increased relative susceptibility of children lead to a higher number of cumulative infections across scenarios. Jones 2020: this is an observational study that ob-Full opening of Positive 🛦 served a reduced cohort, with 55% of all students schools with in the counties returning to in-person instruction, no measures in with 45% enrolling in virtual learning programmes. place A one percentage-point increase of in-person students (e.g. 60% to 61%) would have an estimated increase in district-wide student and staff case rates of about 2.1%. School staff appear to be more affected than students in all school types except high schools. Regarding levels of community transmission, each increase in one case per 1000 per

Positive

Least intense

measure

(Continued)

week in the community leads to an increase in the average rate within schools by more than 41%.

Kaiser 2020: compared to opening schools with no measures in place, forming random cohorts to reduce the number of students by 50% predicts a ~50% reduction in classroom-level proportion of infections (results only presented graphically). Cohorting that considers out-of-school contact between classmates can lower the frequency of spread by 39% to 79% relative to random cohorting. The average proportion of infections at the same time falls from 11% (random cohorting) to about 10% in gender split (where separate cohorts are based on gender), network chain (where cohorts are based on reported social networks, accounting for out-of-school contacts) and optimised cohorting (where 2 equal cohorts are formed), with reductions of 4% (gender split strategy), 5% (network chain strategy) and 7% (optimisation strategy). Consistently through all studies, weekly alternating attendance schedules always reduces infections relative to same-day instruction. The results of the simulations are highly dependent on the level of community transmission and out-of-school interaction.

Keeling 2020: the study assessed the impact of cer-Full opening of tain grades attending school on the increase in schools with number of cases. With results being presented in a no measures in graphical way only they predict that the increase place in number of cases can be reduced if only certain grades attend school. The effect is predicted to be largest when only the years 1, 2 and 6 attend school. The increase in cases is predicted to be larger when only secondary school students attend compared to when only primary school students attend. Implementing an alternating attendance schedule and having only 50% of the students attend class leads to a reduction in the increase in cases when compared to having 100% of the respective year groups attending school. The effects are moderated by the level of community transmission, with higher levels of community transmission leading to a larger increase in cases.

Mauras 2020: in a primary school, with a baseline reproduction number of 1.25, no specific measure implemented would lead to 50 cases (SD = 1.6); implementing an alternating attendance schedule and an on-off model (presence versus absence of all students) is predicted to lead to a reduction in the number of cases. The cumulative number of cases in the population according to this strategy would reduce the number of cases to 19.2 (SD = 0.9) in an on-off daily scenario; 16.8 (SD = 0.7) in an on-off weekly scenario; 12.7 (SD = 0.6) in a rotating daily scenario. In the long run, weekly alternation is predicted to perform better than daily al-

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Full opening of

no measures in

schools with

place

Positive 🛦



(Continued)	ternation, both for on-off (15.6 versus 17.4) and for rotating (12.0 versus 12.4) strategies. Although the magnitude varies compared to a primary school, similar effects are seen in a high school. Panovska-Griffiths 2020a: while results are only	Full opening of	Positive 🛦
	presented in a graphical way they imply that un- der different testing/tracing scenarios, an alternat- ing attendance schedule compared to full reopen- ing leads to fewer new infections. With improved testing and tracing in place, the number of infec- tions can be reduced in both cases. The study al- so assumed that reopening of schools would cor- respond to increases in workplace and commu- nity transmission probabilities, to account for in- creased social mixing with reopening of schools and relaxation of the physical distancing restric- tions that have applied to work, leisure, and com- munity activities.	schools with no measures in place	
	Shelley 2020: opening schools with 100% of the students attending school five days in a row is pre- dicted to lead to a total of 56,009 (95% CI 47,295 to 64,723) cases in the general population and 5263 (95% CI 3565 to 6961) cases in children in a com- munity of 100,000 individuals. Reducing the num- ber of students by 50% and implementing alter- nating attendance schedules leads to inconsistent effects: when implementing an A/B daily alternat- ing attendance schedule (50% students attend- ing school in the morning; 50% students attending school in the afternoon), this is predicted to lead to 59,948 (95% CI 51,118 to 68,777) cases in the gen- eral population and 8994 (95% CI 7654 to 10,333) cases in children; when implementing a two-day per week alternating attendance schedule (50% of students attending Thursday; Wednes- day off; 50% of students attending Thursday and Friday), this is predicted to lead to 59,917 (95% CI 53,182 to 66,653) of cases in the general population and 8985 (95% CI 7927 to 10,044) of cases in chil- dren. The lowest number of cases is predicted for a scenario when a weekly alternating attendance schedule is implemented (50% of students attend- ing one week; 50% of students attending the oth- er week), this is predicted to lead to 16.72 (95% CI 8.31 to 33.63) cases in the general population and 1.42 (95% CI 0.77 to 2.63) cases in children. When reducing the number of students to 20%, this is predicted to lead to 16.72 (95% CI 7.08 to 97.94) cases in children. With 100% of the students being in distance learning, number of pre- dicted cases would be 59,942.76 (95% CI 50,767.00 to 69,118.52) in the general population and 8958.000 (95% CI 6808.34 to 11,107.66) in children. These numbers vary according to level of community transmission as well as co-interventions in place: with mitigation measures in place that lead to a re-	Full opening of schools with no measures in place	No change/ mixed ef- fects/conflicting findings ◀►



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(Continued)		duced R of 1.01 to 1.40 compared to R0 of 2.5 to 3.0, the numbers are consistently lower		
Risk of infection	2 modelling studies (Cohen 2020; España 2020)	España 2020: the study compares schools operat- ing with 50% 75%, and 100% of students attend- ing school in person and under different levels of face-mask adherence (50%, 75%, 100% adherence) and its effect on the proportional reduction in risk of infection when compared to operating schools at full capacity and without face masks. When com- pared to operating schools at 100% capacity and no face masks, the risk of infection in all population groups is predicted to decrease if fewer students attend school. With 75% of students attending, the risk of infection in teachers decreases by 7.9% (95% CI 7.5% to 8.3%) under a low-mask adher- ence (high adherence: 0.7% (95% CI 0.6% to 0.7%) compared to the baseline scenario; with only 50% of students attending, the risk decreases by 0.6% (0.6% to 0.7%) (high-mask adherence: 0.4 (95% CI0.4% to 0.4%)). In students, the risk is reduced by 8.5% (95% CI8.1% to 8.8%) (high adherence: 0.4% (95% CI0.4% to 0.4%)) in a 75% attendance sce- nario and 0.5% (95% CI0.2% to 0.2%)) in a 50% capac- ity scenario. In the general population, the risk of infection can be reduced by 10% (9% to 10%) (high adherence: 1% (95% CI1.0% to 1.0%)) if only 75% of students attend school, and by 1% (95% CI1.0% to 1.0%) (high adherence: 1% (95% CI1.0% to 1.0%)) when only 50% attend school.	Full opening of schools with no measures in place	Positive
		Cohen 2020: if schools open at full capacity and no countermeasures in place, the cumulative risk of an infection for individuals in schools would range between 9.5% and 24.6% for teachers and school staff and between 6.4% and 17.2% for students, depending on the level of community transmission. Reducing the number of students predictably leads to a reduction in the cumulative infection rate for individuals in schools. The lowest risk of an infection is predictably achieved by implementing an alternating attendance schedule in primary schools (thus reducing the number of students by 50%) while keeping middle and high schools remote. The risk of infection for school teachers and staff is predicted to range between 0.2% and 0.7% and the risk for students between 0.1% and 1.0%, depending on the level of community transmission. Teaching all primary school students in person with countermeasures in place (non-pharmaceutical interventions, cohorting, screening) and middle and high school students remotely leads to a predicted increase in risk of an infection (teachers/school staff = 0.3% to 2.1%; students 0.2% to 1.2%). Keeping high school students remote while teaching primary and middle school staff = 0.5% to 3.4%; students 0.3% to 2.4%). Teaching all stu-	Full opening of schools with no measures in place	Positive A



(Continued)		dents in person with countermeasures in place and implementing an alternating attendance sched- ule leads to predicted risk of an infection of 0.6% to 4.3% in teachers/school staff while increasing the rate in students to 0.4% to 3.1%. Teaching all students in person with countermeasures in place without implementing an alternating attendance schedule leads to predicted risk of an infection of 0.8% to 5.5% in teachers/school staff while increas- ing the rate in students to 0.6% to 4.1%. A sensitiv- ity analysis showed that an increasing susceptibili- ty of children had a significant impact on the infec- tion rate for people in schools. The effect varies ac- cording to the level of transmission in the commu- nity.		
Reproduction number	6 modelling studies (Cohen 2020; Keeling 2020; Landeros 2020; Lee 2020; Phillips 2020; Zhang 2020)	Cohen 2020: compared to schools opening with full capacity and no countermeasures, reducing the number of students in schools by opening primary and middle schools only as well as implementing an alternating attendance schedule is predicted to reduce the effective reproduction number to below 1 (results presented graphically). The results vary according to the level of community transmission, with no consistent trend across the different sce- narios.	Full opening of schools with no measures in place	No change/ mixed ef- fects/conflicting findings ◀►
		Keeling 2020: the study assessed the impact of cer- tain grades attending school on the reproduction number in four regions of the UK. With results be- ing presented in a graphical way only they predict that the increase in R can be reduced if only certain grades attend school. The effect is predicted to be largest when only years 1, 2 and 6 attend school. The increase in R is predicted to be larger when on- ly secondary school students attend compared to when only primary school students attend. Imple- menting an alternating attendance schedule and having only 50% of the students attend class leads to a reduction in the increase in R when compared to having 100% of the respective year groups at- tending school. The effects are moderated by the level of community transmission, with higher levels of community transmission leading to a larger in- crease in R.	Full opening of schools with no measures in place	Positive
		Landeros 2020: splitting a school community in- to two or three even rotating cohorts substantial- ly reduces R0 under a wide range of parameter val- ues, and slows viral spread in cases of moderate transmissibility. Moving from full capacity to two cohorts reduces R0 by 50%, using three cohorts fur- ther reduces R0, by an unspecified amount.	Full opening of schools with no measures in place	Positive A
		Lee 2020: the study found that reopening schools for all children would return postintervention transmission levels to baseline R0, despite strict physical distancing in the rest of the community. Compared to this, reopening schools only for chil- dren < 10 years, even without reduction in daily	Full opening of schools with no measures in place	Positive A



(Continued)		contacts, is predicted to maintain postintervention R0 < 1 up to a baseline R0 of ~4.5. The addition of school reopening with reduction in daily contacts for children aged 10 to 19 years to 33% of baseline is predicted to keep postintervention R0 < 1 up to a baseline R0 of ~3.3.		
		Phillips 2020: while results are only presented in a graphical way, decreasing the number of students in the classroom decreases the effective reproductive rate (Re) for both low and high rates of transmission, with numbers being lower under a low-transmission setting.	Full opening of schools with no measures in place	positive 🛦
		Zhang 2020: with very strict community measures in place where very little workplace and commu- nity contacts take place (e.g. lockdown), opening high schools would lead to an R(t) of just above 1, compared to an R(t) of approximately 1.75 if schools were completely open. This is moderated strongly by the proportion of 'normal' contacts tak- ing place in the workplace and community: as this proportion approaches 100%, the R(t) value be- comes very similar regardless of whether only high schools or all schools are open.	Full opening of schools with no measures in place	Positive
Number or pro- portion of deaths	5 modelling studies (Baxter 2020; Germann 2020; Head 2020; Keeling 2020; Panovska-Grif- fiths 2020a)	Baxter 2020: under a regular schedule, the pre- dicted number of deaths would be 21,980 in the- general population of the state of Georgia, USA. If only primary school children (< 10 years) attend school, the predicted cumulative number of deaths would be 18,977. When implementing an alternat- ing attendance schedule with 50% attendance on all school levels, the number of deaths would be reduced to 18,385. When implementing an alter- nating attendance schedule in primary schools, the number of deaths would be further reduced to 18,075. If all students receive online instruction, the number of deaths would be 17,417.	Full opening of schools with no measures in place	Positive
		Germann 2020: alongside measures to make con- tacts safer (face masks, hygiene, and distancing measures), the study assessed the impact of reduc- ing the number of students (80%, 40%) and intro- ducing alternating attendance schedules (weekly, 2 days). With schools opening with full attendance and no measures in place, the study predicts that the number of deaths during the peak four weeks of the pandemic would be 107,322 in the gener- al population of the USA. Reducing the number of students by 20% decreases the number of deaths to 20,900 during this period. Further reducing the number of students to 40% and implementing an alternating attendance schedule further decreases the number of deaths in this period: with a weekly alternating schedule the number of deaths would be 4108, while it would be 3624 for a two-day alter- nating schedule. With more workplaces open, the number of deaths was consistently higher across all scenarios.	Full opening of schools with no measures in place	Positive A



(Continued)

Head 2020: with schools reopening at full capacity with no measures in place, at a moderate level of community transmission and with children being half susceptible as compared to adults, the study predicts an excess total death rate of 0.56 (95% CI -1.88 to 3.13) per 10,000, corresponding to 434 (95% CI -1451 to 2418) deaths across the Bay area, of which 287 would be among the general population (0.54, 95% CI -2.73 to 3.66), 114 amonghousehold members of students (0.87, 95% CI -3.8 to 7.48), and 31 among teachers (2.97, 95% CI 0.00 to 47.17); only one death was expected among students (0.01, 95% CI 0.00 to 0.01). The study predicts that strategies that reduce the number of students, and thus reduce contacts between students, lead to reduced excess rate of deaths in students, teachers and staff, household members and community members. This includes strategies based on alternating attendance (reduction of number of students on school or on class level). The study predicts that strategies that reduce the number of students lead to reduced proportion of deaths among students, staff and teachers, household members and community members. This includes both strategies based on alternating attendance (reduction of number of students on class level, reduction of number of students on school level). When reducing the number of students on the school level (maintaining class sizes, half the school attends 2 staggered days each week according to grade groups), the proportion of deaths can be reduced. For teachers, the excess proportion of cases per 10,000 is reduced to -0.05 (95% CI -0.05 to 0.00); for students, this would be reduced to 0.00 (95% CI 0.00 to 0.00); for household members, the proportion decreases to 0.12 (95% CI -3.79 to 7.24). For the general population, the excess rate would be reduced to 0.04 (95% CI -2.76 to 3.6). When reducing the number of students on the class level (10 students per class, 2-day attendance per week), the excess rate of deaths in teachers per 10,000 is further reduced to -0.18 (95% CI -0.18 to 0.00). For students, this remains unchanged at 0.00 (95% CI 0.00 to 0.00). For household members, it decreases to 0.06 (95% CI -3.8 to 4.01). For the general population, the excess rate would be reduced to 0.01 (95% CI -2.74 to 2.75). In general, higher transmission, high schools, and increased relative susceptibility of children lead to a higher number of cumulative infections across scenarios.

Keeling 2020: the study assessed the impact of certain grades attending school on the increase in number of deaths in the general population of England. With results being presented in a graphical way, they predict that the increase in number of deaths can be reduced if only certain grades attend school. The effect is predicted to be largest when only grades 1, 2 and 6 attend school. The increase in deaths is predicted to be larger when only secFull opening of schools with no measures in place Positive 🛦

Measures implemented in the school setting to contain the COVID-19 pandemic (Review)

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Full opening of schools with no measures in place Positive

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(Continuea)		ondary school students attend compared to when only primary school students attend. Implement- ing an alternating attendance schedule and having only 50% of the students attend class leads to a re- duction in the increase in deaths when compared to having 100% of the respective year groups at- tending school. The effects are moderated by the level of community transmission, with higher levels of community transmission leading to a larger in- crease in deaths.		
		Panovska-Griffiths 2020a: with results presented in a graphical way, they imply that under differ- ent testing/tracing scenarios, an alternating atten- dance schedule compared to a full reopening (as- suming that 90% of the students attend) leads to an equal number of deaths in the general popula- tion of the UK. With improved testing and tracing in place, the number of deaths can be decreased in both cases. The study also assumed that reopen- ing of schools would correspond to increases in workplace and community transmission probabili- ties, to account for increased social mixing with re- opening of schools and relaxation of the physical distancing restrictions that have applied to work, leisure, and community activities.	Full opening of schools with no measures in place	Positive
Risk of death	1 modelling study (España 2020)	España 2020: the study compares schools oper- ating at 50%, 75%, and 100% capacity under dif- ferent assumptions of adherence to wearing face masks (50%, 75%, 100% adherence) compared to operating schools at full capacity and without face masks and its effect on risk of death. In teach- ers, the risk of death can be reduced by reduc- ing capacity to 75% (high adherence: 4.0% (4.0% to 5.0%); low adherence: 3.8% (3.6% to 4.0%) or 50% (high: 3.0% (3.0% to 3.0%); low: 4.0% (4.0% to 4.0%). In the family, the risk of death can be re- duced to 0.4% (0.4 to 0.5%) (low adherence: 4.2% (3.9% to 4.4%)) if only 75% of students attend school, and 0.3% (0.3% to 0.3%) (low adherence: 0.4% (0.4% to 0.5%)) when only 50% attend school. In the general population, the risk of death can be reduced to a 5.0% (5.0% to -5.0%) (low adherence: 11.0% (11.0% to 11.0%)) if only 75% of students at- tend school, and 4.0% (4.0% to 5.0%) (low adher- ence: 5.0% (5.0% to 5.0%)) when only 50% attend school.	Full opening of schools with no measures in place	Positive
Shift in pandem- ic development	5 modelling studies (Alvarez 2020; Germann 2020; Landeros 2020; Mauras 2020; Phillips 2020)	Alvarez 2020: when reducing the capacity of stu- dents attending school, the peaks in ICU capacity occurred later compared with higher rates of stu- dent attendance (results presented in graphical way). The effects varied based on the intensity of the contact tracing and isolation strategy that was in place	Full opening of schools with no measures in place	Positive
		Germann 2020a: alongside measures to make con- tacts safer (face masks, hygiene, and distancing measures), the study assessed the impact of reduc-	Full opening of schools with	Positive



(Continued)

ing the number of students (80%, 40%) and introducing alternating attendance schedules (weekly, 2 days). With schools opening at full capacity with no measures in place, the study predicts that the time to peak incidence would be 62 days in the USA. Reducing the number of students by 20% increases the number of days to peak incidence in the USA to 118. Further reducing the number of students to 40% and implementing an alternating attendance schedule further increases the number of days to peak incidence to 174 days. There was no difference between the two alternating attendance schedules (174 days for both weekly versus 2 days alternating attendance). With more workplaces open, the time to peak incidence would be consistently shorter, with also no difference shown for the two different alternating attendance schedules.

Germann 2020b: alongside measures to make contacts safer (face masks, hygiene, and distancing measures), the study assessed the impact of reducing the number of students (80%, 40%) and introducing alternating attendance schedules (weekly, 2 days). For time to peak prevalence the effects are similar. With schools opening at full capacity with no measures in place, the study predicts that the time to peak prevalence would be 66 days in the USA. Reducing the number of students by 20% increases the number of days to peak prevalence in the USA to 122. Further reducing the number of students to 40% and implementing an alternating attendance schedule further increases the number of days to peak prevalence to 178 days. There was no difference between the two alternating attendance schedules (178 days for both weekly versus 2 days alternating attendance). With more workplaces open, the time to peak prevalence would be consistently shorter, with also no difference shown for the two different alternating attendance schedules.

Landeros 2020: using a stopping rule on cumulative prevalence of 5%, the model predicts closures within a month if all students attend school in person and with no mitigation. With results being presented in a graphical way only, they show that reducing the number of students predictably increases the time until the stopping rule is reached. Reducing the number of students to 50% by implementing alternating attendance schedules (2 parallel cohorts versus 2 rotating cohorts) is predicted to lead to 6 to 8 weeks to reach the stopping point (2 rotating cohorts) or 8 to 10 weeks under two parallel cohorts. Reducing the number of students to 33% by implementing an alternating attendance schedule (3 cohorts) further extends the period of time (length not reported). Effects vary according to the assumed transmission rate in children and adults.

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no measures in place

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(Continued)				
		Mauras 2020: in a primary school, with a baseline reproduction number of 1.25, no specific measure implemented would mean 12.7 days (SD = 0.3) un- til an outbreak (≥ 5 secondary cases); all measures are effective in reducing the time to outbreak: on- off daily: 13.6 days (SD = 0.4); on-off weekly: 13.4 days (SD = 0.4); rotating daily: 14.5 days (SD = 0.5); rotating weekly: 14.6 (SD = 0.5). Although the mag- nitude varies compared to a primary school, similar effects are seen in a high school.	Full opening of schools with no measures in place	Positive
		Phillips 2020: with results presented in a graphical way, they imply that a ratio of 15:1 (student-educa- tor) also results in shorter mean and median out- break lengths in the entire population in both low- and high-transmission cases in primary schools. Higher student-educator ratios facilitate faster dis- ease spread through the school than smaller ones.	Full opening of schools with no measures in place	positive ▲
Number or pro- portion of infect- ed schools	1 modelling study (Aspinall 2020)	Aspinall 2020: if all schools are open to 100% in- person teaching, the percentage of primary schools with at least one infected person on the premis- es was predicted to be between 4% and 20% (661 to 3310 primary schools); with certain grades re- turning to school, the percentage was predicted to range between 2% and 11% (336 to 1873 primary schools), while for ~33% of all primary school stu- dents returning to schools, between 1% and 5.5% of primary schools (178 to 924 schools) would have at least one infected person on the premises. The effects varied by time point of school reopening. If all primary schools return to 100% in-person teach- ing three months later, the percentage of schools with at least one infected person on the premises would be between 3.6% and 19.8% of schools (612 to 3310 schools). With increasing levels of commu- nity transmission, effect estimates are assumed to increase by 30%.	Full opening of schools with no measures in place	Positive
Risk of trans- mission to other school	1 modelling study (Munday 2020)	Munday 2020: with all students attending school, the risk of transmission to other schools varied be- tween 0.42 and 3.6 depending on the level of com- munity transmission. With certain grades return- ing to primary school (reception (children aged 4 to 5); year 1 (children aged 5 to 6) and year 6 (chil- dren aged 10 to 11), the predicted risk of transmis- sion between schools was lowest (0.01 to 0.09, de- pending on the level of community transmission). The additional attendance of Year 10 students (14 to 15 and 16 to 17-year olds) resulted in an increase in the risk of transmission between schools to 0.03 to 0.34. When letting Year 12 students return, the number increased to 0.01 to 0.15. With both Year 10 and 12 students returning, the number would be 0.04 to 0.44. when all secondary school students attended school the predicted number was high- est 0.26 to 2.6). With all primary school students at- tending school, the number was 0.05 to 0.45. The	Full opening of schools with no measures in place	Positive



(Continued)

effect varied by level of community transmission (R = 1.1 to R = 1.5)

Outcome category:	healthcare	util	isation
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Number or proportion of hospitalisations	2 modelling studies (Ger- mann 2020; Head 2020)	Germann 2020: alongside measures to make con- tacts safer (face masks, hygiene, and distancing measures), the study assessed the impact of reduc- ing the number of students (80%, 40%) and intro- ducing alternating attendance schedules (weekly, 2 days). With schools opening at full capacity with no measures in place (prepandemic scenario), the study predicted a cumulative number of hospitali- sations during the peak four weeks of the pandem- ic of 1,798,188 in the USA. With community inter- ventions in place, the number of hospitalisations in that period is predicted to be 685,746. Reducing the number of students by 20% reduced the num- ber of hospitalisations to 354,878 during this pe- riod. Further reducing the number of students to 40% and implementing an alternating attendance schedule further decreases the number of deaths in this period: with a weekly alternating schedule the number of deaths would be 67,090, while it would be 59,056 for a two-day alternating sched- ule. With more workplaces open, the numbers of cases was consistently higher across all scenarios.	Full opening of schools with no measures in place	Positive A
		Head 2020: the study predicts that strategies that reduce the number of students and thus reducing contacts between students lead to reduced excess hospitalisations per 10,000 students, teachers and staff, household members and community mem- bers. This includes strategies based on alternat- ing attendance (reduction of number of students on school or on class level). With no measures in place, the excess rate of hospitalisations per 10,000 subpopulation would be 40.5 (95% CI -46.95 to 146.64) for teachers, 0.08 (95% C 10.00 to 0.08) for students, 6.86 (95% CI- 14.32 to 30.11) for house- hold members and 4.2 (95% CI- 7.33 to 16.32) for community members. When reducing the number of students on the class level (50% or 10 students; each half attends 2 different days each week), the proportion of hospitalisations can be further re- duced. For teachers, the excess proportion of hos- pitalisations per 10,000 is reduced to 2.12 (95% CI- 47.62 to 47.85, 47.85); for students, this decreases to 0.01 (0.00 to 0.01); for household members, the proportion decreases to 0.9 (95% CI-18.34 to 18.7); for the general population the rate of hospitalisa- tions decreases to 0.18 (95% CI -9.98 to 9.96). When reducing the number of students on the school lev- el (maintaining class sizes, half the school attends 2 staggered days each week according to grade groups), the proportion of hospitalisations can be reduced. For teachers, the excess proportion of hospitalisations per 10,000 is reduced to 2.12 (95% CI -47.62 to 47.85; for students, this decreases to 0.01 (95% CI 0.00 to 0.01); for household members,	Full opening of schools with no measures in place	Positive A



(Continued)		the proportion decreases to -0.9 (95% CI -18.34 to 18.7); for the general population the rate of hospitalisations decreases to -0.03 (95% CI -10.03 to 9.87). In general, higher transmission, high schools, and increased relative susceptibility of children lead to a higher number of cumulative infections across scenarios.		
Number or pro- portion of cases requiring inten- sive care	3 modelling studies (Alvarez 2020; Di Domeni- co 2020a; Keel- ing 2020)	Alvarez 2020: compared with opening schools with full attendance (100%), opening schools with de- creased attendance (25%) predicted reductions in demands on ICU beds, with effects varying due to concurrent contract tracing and isolation. Com- pared to a scenario in which 0% of the students at- tended school (baseline ICU demand in metropoli- tan region: n = 2013; Antofogasta region n = 1362; Valparaiso region n = 70), the demand for ICU beds increased by 121% to 1221% when 100% of stu- dents attended school (metropolitan region: n = 4452 (increase of 121%); Antofogasta region n = 708 (increase of 165%); Valparaiso region n = 925 (in- crease of 1221%)). The effects varied according to the intensity level of contact tracing and isolation strategies outside of the school setting: with in- creased contact tracing and isolation, the demand for ICU beds was consistently lower across all sce- narios.	Full opening of schools with no measures in place	Positive A
		Di Domenico 2020a: reopening schools fully on 11 May 2020 with no measures in place predicted the largest demand in ICU occupancy. Reopening of schools over four weeks (with 25%, 50%, 75% and 100% capacity in weeks 1, 2, 3 and 4, respec- tively) was found less beneficial than both the par- tial reopening of schools to 50% capacity immedi- ately and progressive reopening over two weeks (with 25% and 50% capacity in weeks 1 and 2, re- spectively). The magnitude of effect varied de- pending on the types of schools operated: if on- ly pre-schools and primary schools are operated, the overall ICU occupancy remains under capacity and lower than if secondary schools or all schools are operated. Additionally, the effect varied by the relative transmissibility of pre-school and primary school children: in scenarios with lower transmissi- bility in these younger children, ICU occupancy was generally lower.	Full opening of schools with no measures in place	Positive A
		Keeling 2020: the study assessed the impact of cer- tain grades attending school on the increase in ICU admissions. With results being presented in a graphical way only they predict that ICU admis- sions increase can be reduced if only certain grades attend school. The effect is largest when only years 1, 2 and 6 attend school. The increase in ICU ad- mission is predicted to be larger when only sec- ondary school students attend compared to when only primary school students attend. Implement- ing an alternating attendance schedule and hav- ing only 50% of the students attend class leads to a	Full opening of schools with no measures in place	Positive A



(Continued)

lower increase ICU admissions when compared to having 100% of the respective year groups attending school. The effects are moderated by the level of community transmission, with higher levels of community transmission leading to a larger increase in ICU admissions.

Outcome category: societal, economic and ecological outcomes

Numbers of days spent in school	3 modelling studies (Cohen 2020; Gill 2020; Phillips 2020)	Cohen 2020: while numbers are only reported in a graphical way, reducing the number of students would reduce the number of days spent at school to 17% to 40% due to planned school closure or a SARS-CoV-2 infection, depending on the cumu- lative infection rate. The lowest number of days spent at school (~17%) is under a measure which only teaches primary students in person and with an alternating attendance schedule (i.e. middle and high school students are taught remotely). When either (i) teaching primary school students in person with countermeasures in place (non- pharmaceutical interventions, cohorting, screen- ing) and middle and high school students remote- ly or (ii) teaching all students in person with coun- termeasures in place and implementing an alter- nating attendance schedule, the percentage of days spent at school would be around 40%. Teach- ing primary and middle school students in person with countermeasures in place while teaching high school students remotely would lead to ~65% of school days spent at home. With all students being taught in person with no countermeasures in place, the percentage of days spent at school would pre- dictably be at around 90% to 95%. The results vary according to the level of community transmission, with higher levels of community transmission lead- ing to a higher percentage of school days lost.	Full opening of schools with no measures in place	Negative ▼
		Gill 2020: compared with schools reopening at full capacity with no measures in place, the study pre- dicts that strategies that reduce the number of stu- dents in schools (rotating 2 days per week; weekly 4-day rotation; rotating 1 day per week) all lead to a lower proportion of school days attended in per- son by design. With results presented in a graphical way only, they imply that the number of unplanned days spent at home is larger in schools operating full-time than in schools using hybrid approaches because schools using hybrid approaches experi- ence fewer infections that lead to quarantines or closures. The number of days attended in person remains constant for all strategies that reduce the number of students in schools, regardless of the community incidence.	Full opening of schools with no measures in place	Negative ▼
		Phillips 2020: the study results imply that for re- ducing the class size from 30 to 15 and 8 reduced the predicted number of student days lost to clo- sure, thus increasing the number of days spent in school. The predicted number of student days lost	Full opening of schools with no measures in place	Positive A



(Continued)

was 76.0 \pm 59.5 for a ratio of 8:1, 270.2 \pm 195.6 for a ratio of 15:1 and 1157.7 \pm 684.3 for a ratio of 30:1. These effects were moderated by the level of community transmission. For all but the ratio 30:1, the number of student days lost to closure were consistently higher in a higher transmission setting.

Intervention subcategory: reducing opportunity for contacts - reducing number of contacts

Outcome	Number of stud- ies	Summary of findings	Certainty of evi- dence	Comments
Outcome categor	y: transmission-rela	ited outcomes		
Number or proportion of cases	3 modelling studies (Cohen 2020; Gill 2020; Head 2020)	Cohen 2020: if schools operate under full capaci- ty and no countermeasures are in place, the pre- dicted cumulative infection rate for individuals in schools would range between 9.5 and 24.6 for teachers and school staff and between 6.4 and 17.2 for students, depending on the level of com- munity transmission. Implementing countermea- sures such as mask wearing, detecting, tracing, and quarantining cases within schools alongside a re- duction of contacts between cohorts is predict- ed to decrease the cumulative infection rates to 0.8 to 5.5 in teachers/school staff and 0.6 to 4.1 in students. A sensitivity analysis showed that an in- creasing susceptibility of children had a significant impact on the infection rate for people in schools.	Full opening of schools with no measures in place	Positive A
		Gill 2020: compared with schools reopening at full capacity with no measures in place, the study pre- dicts that strategies that employ precautions, in- cluding mask wearing for students and staff on the bus and throughout the school day, as well as re- duce the number of contacts between students in schools (class cohorting; class cohorting and block scheduling for older students; complete class podding) all lead to reduced cumulative infections among students and staff (results presented graph- ically). The size of this effect is moderated by com- munity incidence, with a higher community inci- dence leading to a higher number of cumulative in- fections across scenarios. While all the strategies that reduce the number of contacts in schools are similarly effective, class cohorting may be slightly more effective at higher community incidence.	Full opening of schools with no measures in place	Positive A
		Head 2020: the study predicts that strategies that reduce contacts (by 50% and by 75%) between stu- dents lead to reduced excess proportion of infect- ed students, teachers and staff, household mem- bers and community members. With schools re- opening at full capacity with no measures in place, at a moderate level of community transmission and with children being half susceptible as com- pared to adults, the study predicts an excess pro- portion of infected teachers of 14.83 (95% CI 0.93 to 29.25), 14.18 (1.63 to 26.77) of students, 2.04 (-0.77 to 5.07) of household members and 1.16 (-0.9 to	Full opening of schools with no measures in place	Positive A



(Continued)		3.28) of community members. When reducing the number of contacts by 50%, the proportion of cases can be reduced. For teachers, the excess proportion of cases per 10,000 is reduced to between 3.16 (-1.42 to 8.74); for students, this decreases to 2.92 (0.19, 6.96); for household members, the proportion decreases to 0.5 (-1.23 to 2.5). For the general population, the excess rate would be reduced to 0.29 (-1.18 to 1.8). When reducing the number of contacts by 75%, the proportion of cases can be further reduced in all subpopulations. For teachers, the excess proportion decreases to 1.3 (0.05 to 3.41); for household members, to 0.22 (-1.55 to 2.08) and for the general population, the excess rate would be reduced to 0.15 (-1.33 to 1.54). In general, higher transmission, high schools, and increased relative susceptibility of children lead to a higher number of cumulative infections across scenarios.		
Reproduction number	3 modelling studies (Cohen 2020; Phillips 2020; Rozhnova 2020)	Cohen 2020: the study found that implementing countermeasures that limit transmission and de- tect, trace, and quarantine cases within schools, compared to reopening with no countermeasures, reduces the effective reproduction number to below 1 (results presented graphically). Howev- er, these measures were implemented alongside classroom cohorting, symptomatic screening, test- ing and tracing in schools, so it is not possible to assess the effect size of the reduction of contacts separately. The results vary according to the as- sumptions made in the model, such as susceptibili- ty and transmission in children.	Full opening of schools with no measures in place	Positive 🛦
		Phillips 2020: while results are only presented in a graphical way, they imply that an alternating atten- dance schedule while keeping the number of stu- dents in the classroom unchanged leads to a small effect with regards to changes to the reproduction number	Least intense measure	No change/ mixed ef- fects/conflicting findings ◀►
		Rozhnova 2020: based on different values for Re as a function of the reduction of school contacts in different age groups (0 to 20-year olds), the study varied the number of school contacts in one age group while keeping the number of school contacts in the other two age groups constant. The model predicts a maximum impact on Re from reducing contacts of 10- to 20-year old children. The level of community transmission is assumed to mirror the pandemic situation in the Netherlands in Novem- ber (R = 1, 95% Crl 0.94 to 1.33)	Full opening of schools with no measures in place	Positive
Shift in pandem- ic development	2 modelling studies (Lan- deros 2020; Phillips 2020)	Landeros 2020: implementing an alternating atten- dance schedule by creating rotating cohorts with a weekly rotating schedule, the model predicts a longer period of instruction (18 to 22 weeks) with the parallel strategy compared to the previous sim- ulation with all students attending at once (10 to 12	Least intense measure	Positive



(Continued)		weeks) until reaching the stopping rule on cumula- tive prevalence of 5%.		
		Phillips 2020: the study compared different stu- dent to teacher ratios (15:1 and 8:1) and the dif- ference between alternating and non-alternating attendance schedules in primary schools. With results presented in a graphical way, they imply that an alternating attendance schedule performs slightly better with regards to mean and median outbreak lengths than non-alternating schedules, however probably not in a significant way.	Least intense measure	No change/ mixed ef- fects/conflicting findings ◀►
Outcome categor	y: healthcare util	isation		
Number or proportion of hospi- talisations	2 modelling studies (Ger- mann 2020; Head 2020)	Germann 2020: alongside measures to make con- tacts safer (face masks, hygiene, and distancing measures), the study assessed the impact of reduc- ing the number of students (40%) and introduc- ing alternating attendance schedules (weekly, 2 days). With schools opening at full capacity with no measures in place (prepandemic scenario), the study predicted a cumulative number of hospitali- sations during the peak four weeks of the pandem- ic of 1,798,188 in the USA. With community inter- ventions in place, the number of hospitalisations in that period is predicted to be 685,746. When imple- menting a weekly alternating attendance schedule while maintaining the number of students at 40%, the number of hospitalisations would be 67,090. Implementing a two-day alternating attendance schedule while maintaining the number of hospitali- sations would be 59,056. With more workplaces open, the numbers of cases was consistently higher across all scenarios.	Least intense measure	Positive A
		Head 2020: the study predicts that strategies that reduce contacts (by 50% and 75%) between stu- dents lead to a reduction in excess hospitalisations per 10,000 of the respective subpopulation. With schools reopening at full capacity with no mea- sures in place, at a moderate level of communi- ty transmission and with children being half sus- ceptible as compared to adults, the study predicts an excess rate of hospitalisations per 10,000 sub- population would be 40.5 (95% CI -46.95 to 146.64) in teachers; 0.08 (95% CI 0.00 to 0.08) in students; 6.86 (95% CI -14.32 to 30.11) in household mem- bers; and 4.2 (95% CI -7.33 to 16.32) in communi- ty members. When reducing the number of con- tacts by 50%, the excess hospitalisations can be reduced across all populations. For teachers, the excess proportion of hospitalisations per 10,000 is reduced to 8.46 (95% CI -47.39 to 91.76); for stu- dents, this decreases to 0.03 (95% CI 0.00 to 0.03); for household members, the proportion decreas- es to 2.19 (95% CI -15.29 to 22.34). For the gener- al population, the excess rate would be reduced to 0.92 (95% CI -9.08 to 11.86). When reducing the	Least intense measure	Positive A



(Continued)

number of contacts by 75%, the proportion of cases can be further reduced in all subpopulations. For teachers, the excess proportion of hospitalisations per 10,000 is reduced to 2.14 (-47.39 to 47.85); for students, this decreases to 0.00 (0.00 to 0.00); for household members, the proportion decreases to 0.73 (95% CI -17.97 to 18.49). For the general population, the excess rate would be reduced to 0.49 (95% CI -9.94 to 10.04). In general, higher transmission, high schools, and increased relative susceptibility of children lead to a higher number of cumulative infections across scenarios.

Outcome category: societal, economic and ecological outcomes

Numbers of days spent in school	3 modelling studies (Cohen 2020; Gill 2020; Phillips 2020)	Cohen 2020: while numbers are only reported in a graphical way, reducing the number of contacts be- tween cohorts alongside other countermeasures (non-pharmaceutical interventions; screening) pre- dictably leads to an equal percentage of school days spent at home as if no measures would be in place (~5% to 10%). The results vary according to the level of community transmission, with high- er levels of community transmission leading to a higher percentage of school days lost.	Full opening of schools with no measures in place	No change/ mixed ef- fects/conflicting findings ◀►
		Gill 2020: compared with schools reopening at full capacity with no measures in place, the study pre- dicts that strategies that reduce the contacts be- tween students by limiting interaction to class- mates only ("podding"), and providing lunch in the classroom negative impact on the number of days spent in school in a secondary school in Pennsylva- nia. Compared to the school operating without any measures in place, the proportion of school days attended in person by a typical student in a typi- cal Pennsylvania secondary school is consistently higher under various closure policies (0 day closure after positive case in class; 3-day closure; 14-day closure). The typical student in a secondary school open full-time with measures reducing contacts might be sent home for about 15% of possible days due to quarantines. Even without a closing policy, the number of days spent in school when measures reducing contacts are implemented are reduced by about 10% due to quarantines of the classmates and bus mates of infected students. The size of this effect is moderated by community incidence, with a higher community incidence leading to a higher number of cumulative infections across scenarios. At 100 reported community infections per 100,000 per week, the typical student in a secondary school open full-time with precautions (scenario B) might be sent home for about 15% of possible days due to quarantines.	Full opening of schools with no measures in place	Positive
		Phillips 2020: the study results imply that introduc- ing an alternating attendance schedule leads to less student days lost to closure. When implement- ing an alternating attendance schedule in the 8:1	Least intense measure	Positive 🛦



scenario, the predicted number of student days lost was 73.3 \pm 65.7 compared to 76.0 \pm 59.5. For a ratio of 15:1, the number of days lost to closure was 264.6 \pm 204.9 when an alternating attendance schedule was introduced as compared to 270.2 \pm 195.6 for a ratio of 15:1. These effects were moderated by potential co-interventions implemented (low versus high transmission setting), with number of student days lost to closure being consistently higher in high transmission settings.

Appendix 9. Measures making contacts safer: study-by-study overview of the evidence contributing to each outcome (modelling studies)

Outcome	Number of stud- ies	Overview of effect by study	Comparison used in each study	Effect direc- tion per study (positive ▲; negative ▼; no change/mixed effects/con- flicting findings ◀▶)
Outcome catego	ry: transmission-rela	ated outcomes		
Number or pro- portion of cases	3 modelling studies (España 2020; Head 2020; Panovska-Grif- fiths 2020a)	España 2020: with schools open at full capacity (100% of students) with low-face-mask adherence, the study predicts an increase of 81.7 times the number of infections in the general population. With schools reopening at full capacity with high- face-mask adherence there would be a predict- ed proportional increase of 3.0 times the number of infections. With schools reopening at reduced capacity (75% and 50% of all students) with high- face-mask adherence there would be an increase of 1.4 and 2.6 times the number of infections for 50% and 75% capacity, respectively.	Least intense measure	Positive
		Head 2020: at a moderate level of community, school reopening with mandatory mask wearing and assuming children were 50% as susceptible to SARS-CoV-2 as adults, predicted reductions in excess proportion of infections and symptomatic infections among students and school staff and teachers compared with school reopening with no countermeasures. With schools opening at full ca- pacity with no measures in place, at a moderate level of community transmission, with children assumed to be half as susceptible as adults, the study predicts that the excess percentage of teach- ers experiencing symptomatic illness would be 10.27% (95% CI 0.47 to 20.66) for teachers/staff and 2.98% (95% CI 0.33 to 5.83) for students. The study predicts that mandatory mask wearing in schools	Full opening of schools with no measures in place	Positive



(Continued)		when reopening, all lead to reduced percentage of symptomatic infections among students, staff, household members and community members. For teachers/staff, the percentage experiencing symptomatic illness, the magnitude of effect varied based on model parameters, such as relative sus- ceptibility and infectiousness of children, and ex- tent of community transmission amid reopening.		
		Panovska-Griffiths 2020a: under current testing and tracing levels (24% testing, 47% tracing) and masks' effective coverage of 30%, the predicted second SARS-CoV-2 wave in the general popula- tion would be less than half of the original wave if masks were mandatory in secondary schools, as well as used in community settings. The min- imum testing levels necessary to avoid a second wave, under scaled up testing, tracing, and isolat- ing, is 8% to 11% less when masks are mandatory in schools than if they are not, depending on the effective coverage of masks (76% and 57% com- pared to 68% and 46%). If masks were mandatory in secondary schools, assuming that current trac- ing levels of 47% continue, 68% or 46% of those with symptomatic infection would need to be test- ed, respectively under scenarios of 15% and 30% mask effective coverage. If masks were not manda- tory at secondary schools, the respective numbers would be 76% and 57% for 15% and 30% effective coverage of masks in the relevant community set- tings.	Least intense measure	Positive
Reproduction number	1 modelling study (Sruthi 2020)	Sruthi 2020: mask requirements led to a reduction of R in the general population of R 0.01 (95% CI 0.01 to 0.01), compared to school opening with no mask requirements. Compared to the no-mask require- ment from the prelockdown period, a mandatory mask in public transport contributed to a reduction of 0.0139 (95% CI 0.0132 to 0.0144). An additional requirement of wearing masks in shops when a re- quirement in public transport is already mandated did not reduce Rt further. The combined effect of the use of masks in public transport and at schools is thus a reduction in Rt of 0.025 (95% CI 0.018 to 0.030).	Full opening of schools with no measures in place	Positive
Number or pro- portion of deaths	2 modelling studies (España 2020; Head 2020)	España 2020: under a scenario with 100% of stu- dents and low-face-mask adherence, the study predicts an increase in the ratio of the cumulative number of deaths in the overall population by 13.4 (95% Crl 12.8 to 14.0). Under a scenario with 100% of students in school and high-face-mask adher- ence, there would be a predicted decrease in the ratio of the cumulative number of deaths in the overall population of 1.5 (95% Crl 1.5 to 1.6). Due to their older ages, teachers and families experienced a much higher risk of death under scenarios with 100% of students in school and moderate or low- face-mask adherence, as compared with a scenario with remote instruction.	Least intense measure	Positive



Positive 🛦

Full opening of

no measures in

schools with

place

Head 2020: with schools opening at full capacity with no measures in place, at a moderate level of community transmission, with children assumed to be half as susceptible as adults, the study predicts that the excess rate of deaths compared to school closure would be 2.97 (95% CI 0.00 to 47.17) for teachers/staff and 0.01 (95% CI 0.00 to 0.01) for students. The study predicts that mandatory mask wearing in schools when reopening all lead to reduced deaths among students, staff, household members and community members. For teachers/staff, the excess rate of deaths per 10,000 of the subpopulation is reduced to 0.44 (95% CI 0.00 to 0.44). For students this decreases to 0.00 (95% CI 0.00 to 0.00). The size of this effect is moderated by level of community transmission, type of school and whether children are considered half or equally susceptible as adults. In general, higher transmission, high schools, and increased relative susceptibility of children lead to a higher number of cumulative infections across scenarios.

Outcome category: healthcare utilisation

Number or pro- portion of hospi- talisations	1 modelling study (Head 2020)	Head 2020: with schools opening at full capacity with no measures in place, at a moderate level of community transmission, with children assumed to be half as susceptible as adults, the study predicts an excess proportion of hospitalisations among students (0.08, 95% CI 0.00 to 0.08) and school staff and teachers (40.5, 95% CI -46.95 to 146.64). The study predicts that mandatory mask wearing in schools when reopening will lead to reduced hospi- talisations among students, staff, household mem- bers and community members. For teachers/staff, the excess rate of hospitalisations per 10,000 of the subpopulation is reduced to 4.2 (95% CI -47.39 to 48.09) For students this decreases to 0.07 (95% CI 0.00 to 0.01). The size of this effect is moderated by level of community transmission, type of school and whether children are considered half or equal- ly susceptible as adults. In general, higher trans- mission, high schools, and increased relative sus- ceptibility of children lead to a higher number of	Full opening of schools with no measures in place	Positive
		cumulative infections across scenarios.		

Intervention subcategory: making contacts safer - cleaning

Outcome	Number of stud- ies	Overview of effect by study	Comparison used in each study	Effect direc- tion per study (positive ▲; negative ▼; no change/mixed effects/con- flicting findings ◀►)

Outcome category: transmission-related outcomes



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1 modelling study (Kraay 2020)	Kraay 2020: compared to 8-hourly and 4-hourly surface cleaning and disinfection, hourly cleaning and disinfection alone could bring the fomite R0 below 1 in some office settings, particularly com- bined with reduced shedding, but would be inad- equate in child daycares and schools. This study does not take into account direct transmission through droplet spray, aerosols and hand-to-hand contact.	Least intense measure	Positive 🛦
category: making co	ntacts safer - handwashing		
Number of stud- ies	Overview of effect by study	Comparison used in each study	Effect direc- tion per study (positive ▲; negative ▼; no change/mixed effects/con- flicting findings ◀►)
y: transmission-rela	ited outcomes		
1 modelling study (Kraay 2020)	Kraay 2020: while results are only presented in a graphical way, it predicts that handwashing (hourly with 100% effectiveness) compared to no handwashing did not make a difference with regards to the projected reproduction number from fomite transmission.	Full reopening of schools with no measures in place	No change/ mixed ef- fects/conflicting findings ◀►
y: other health outc	omes		
1 observational study (Simonsen 2020)	Simonsen 2020: this study found that 6.5% (2000 of 30,907, 95% CI 6.2 to 6.8) of children had hand eczema prior to school closures, 14.1% (4363 of 30,907, 95% CI 13.7 to 14.5) of students had hand eczema before reopening of schools on 15 April 2020. This prevalence increased to 50.5% (15,595 of 30,907, 95% CI 49.9 to 51.0) after children re- turned to school and the strict hand hygiene reg- imen (handwashing for 45 to 60 seconds every 2 hours; after arrival, before and after meals, after toilet visits, after coughing or sneezing or when- ever hands were visibly dirty) was implemented, which was a statistically significant increase of 36.3% (P < 0001).	Full opening of schools with no measures in place	Negative ▼
category: making co	ntacts safer - modification of activities		
Number of stud- ies	Overview of effect by study	Comparison used in each study	Effect direc- tion per study (positive ▲; negative ▼; no change/mixed effects/con- flicting findings
	1 modelling study (Kraay 2020) category: making co Number of stud- ies ry: transmission-rela 1 modelling study (Kraay 2020) ry: other health outco 1 observational study (Simonsen 2020) ry: other health outco 1 observational study (Simonsen 2020)	1 modelling study (Kraay 2020) Kraay 2020: compared to 8-hourly and 4-hourly surface cleaning and disinfection, hourly cleaning and disinfection alone could bring the fomite R0 below 1 in some office settings, particularly com- bined with reduced shedding, but would be inad- equate in child daycares and schools. This study does not take into account direct transmission through droplet spray, aerosols and hand-to-hand contact. category: making contacts safer - handwashing Number of stud- Overview of effect by study ies y: transmission-related outcomes 1 modelling study (Kraay 2020) Kraay 2020: while results are only presented in a study (Kraay 2020) y: transmission-related outcomes 1 modelling study (Kraay 2020) Kraay 2020: while results are only presented in a study (Kraay 2020) y: other health outcomes 1 observational study (Simonsen 2020) Simonsen 2020: this study found that 6.5% (2000 align of the study of a color son 15 April 2020) 1 observational study (Simonsen 2020) Simonsen 2020: this study found that 6.5% (2000 align of 30,907, 95% Cl 4.9. to 51.0) after children re- turned to school closures, 14.1% (4363 of 30,907, 95% Cl 4.9. to 51.0) after children re- turned to school and the strict hand hygine reg- imen (handwashing for 45 to 60 seconds every 2 hours; after arrival, before and after meals, after toilet visits, after coughing or sneezing or when- ever hands were wisibly dirty) was implemented, which was a statistically significant increase of 36.3% (P < 0001).	1 modelling study (Kraay 2020) Kraay 2020; compared to 8-hourly and 4-hourly and disinfection alone could bring the fomite R0 below 1 in some office settings, particularly com- bined with reduced shedding, but would be inad- quate in child daycares and schools. This study does not take into account direct transmission through droplet spray, aerosols and hand-to-hand contact. Least intense measure category: making contacts safer - handwashing Comparison used in each study y: transmission-related outcomes Comparison used in each study 1 modelling study (Kraay 2020) Kraay 2020; while results are only presented in study (Kraay 2020) Full reopening of schools with onessures in washing did not make a difference with regards to the projected reproduction number from fomite transmission. Full reopening of schools with no measures in place 1 observational study (Simonsen 2020) Simonsen 2020; this study found that 6.5% (200 of 30,907, 95% C1 6.2 to 6.8) of children had hand creame prior to school closures, 14.1% (4363 of 30,907, 95% C1 2.5 to 15.0 of students had hand creame before reopening of schools on 15 April 2020. In this prevalence increased to 30.5% (15,959 30,907, 95% C1 42.9 to 51.0) after children re- tured to school and the strict hand hygiene reg- minen (handwashing for 45 to 60 seconds every 2 hours; after arrival, before and after meals, after tolet visits, after coupling or sneering or when- ever hands were visibly dirty) was implemented, which was a statistically significant increase of 36.3% (P < 0001).

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(Continued)

Outcome category: transmission-related outcomes

Reproduction number	1 modelling study (Lazebnik 2020)	Lazebnik 2020: keeping schools open while pre- venting the infection rate from increasing signifi- cantly is possible if schooling hours are longer (8 to 9 hours each day). The influence of this policy in Israel during school opening on 1 September, shows that the R0 can be reduced by 0.83 in com- parison to a policy in which children go to school every other day for five hours. Also, if at least half of the adult population will be in lockdown, the in- fluence of schools on the infection rate will be rela- tively small.	Least intense measure	Positive A
Intervention sub	category: making co	ontacts safer - ventilation		
Outcome	Number of stud- ies	Overview of effect by study	Comparison used in each study	Effect direc- tion per study (positive ▲; negative ▼; no change/mixed effects/con- flicting findings ◀▶)
Outcome catego	ry: transmission-rela	ated outcomes		
Concentration of aerosol particles containing RNA virus in the room and inhaled dose of RNA virus for a susceptible per- son	1 experimental study with mod- elling compo- nent (Curtius 2020)	Curtius 2020: this study comprised an experimen- tal design, combined with elements of modelling to test the efficiency and practicability of operat- ing four air purifiers equipped with HEPA filters in a high school classroom in Germany while reg- ular classes were taking place. Using air purifiers with an air exchange rate of 5.7 h-1 and equipped with HEPA filters (H13 or H14), for a person spend- ing two hours in a room with an infectious person, the inhaled dose of particles containing RNA virus is predicted to be reduced by a factor of six, com- pared to a closed classroom with no air purifiers. Other factors which need to be considered include noise levels of the air purifiers and their mainte-	Full opening of schools with no measures in place	Positive A

Outcome	Number of stud- ies	Overview of effect by study	Comparison used in each study	Effect direc- tion per study (positive ▲; negative ▼; no change/mixed effects/con- flicting findings ◀▶)
Outcome catego	ry: transmission-rel	ated outcomes		
Number or pro- portion of cases	4 modelling studies (Cohen	Cohen 2020: if schools open at full capacity and no countermeasures in place, the cumulative infection	Full opening of schools with	Positive 🔺

2020; Germann rate for individuals in schools would range between



(Continued)				
	2020; Gill 2020; Monod 2020)	9.5% and 24.6% for teachers and school staff and between 6.4% and 17.2% for students, depend- ing on the level of community transmission. Imple- menting countermeasures such as mask wearing, detecting, tracing, and quarantining cases within schools alongside a reduction of contacts between cohorts is predicted to decrease the cumulative in- fection rates to 0.8% to 5.5% in teachers/school staff and 0.6% to 4.1% in students. The results vary according to the level of community transmission, with higher levels of community transmission lead- ing to a higher percentage of school days lost.	no measures in place	
		Germann 2020: alongside reducing the number of students (80%, 40%) and alternating attendance schedules (weekly, 2 days), the authors compare two different degrees of intensity of measures such as masks, hygiene and physical distancing for the Chicago area during the peak four weeks of the pandemic. More intense measures consistently predicted a reduction in the number of cases: with 80%, 40% (weekly alternating schedule) and 40% (2-day alternating schedule), the number of cases were 527,005, 82,602 and 70,226, respectively. With less intense measures, the number of cases would be 660,681 (80% attendance), 134,122 (40% attendance, weekly alternating attendance) and 119,614 (40% attendance, 2-day alternating attendance). With more workplaces open, the number of cases was consistently higher across all scenarios.	Least intense measure	Positive
		Gill 2020: compared with schools reopening at full capacity with no measures in place, the study pre- dicts that strategies that employ precautions such as mask wearing and lunch in classrooms substan- tially reduce total infections in the school popula- tion. It is not possible to determine effect size due to lack of reporting.	Full opening of schools with no measures in place	Positive ▲
		Monod 2020: the study compares different levels of transmission reduction obtained through masks and other non-pharmaceutical interventions (re- duction of transmission by 0 to 80%) across all 37 states and metropolitan areas. Compared to a sce- nario in which schools were closed, reopening the school without masks or other non-pharmaceuti- cal interventions lead to an increase in infections in children from 0 to 11 years by 1788.5% (95% CrI 994.9% to 3401.1%). With masks and other mea- sures leading to a reduction of transmission of 80%, the increase was 39.6% in infections in chil- dren (95% CrI 33.5% to 49.5%). Compared to a sce- nario in which schools were closed, infections in the general population increased by 248.3% (95% CrI 112.3% to 571.9%) if schools were reopened with no measures in place. With masks and other measures leading to a reduction of transmission of 80%, the increase was 5.6% (95% CrI 3.4% to 9.4%).	Full opening of schools with no measures in place	No change/ mixed ef- fects/conflicting findings ◀►



(Continued)				
Reproduction number	2 modelling studies (Cohen 2020; Phillips 2020)	Cohen 2020: the study found that implementing countermeasures that limit transmission and de- tect, trace, and quarantine cases within schools, compared to reopening with no countermea- sures, reduces the effective reproduction number to below 1 (results presented graphically). How- ever, these measures were implemented along- side classroom cohorting, symptomatic screening, testing and tracing in schools so it is not possible to comment on the effect size of these measures alone. The results vary according to the assump- tions made in the model, such as susceptibility and transmission in children.	Full opening of schools with no measures in place	Positive A
		Phillips 2020: the study compared high with low- transmission settings in primary schools. With re- sults presented in a graphical way, they imply that the effective reproduction number is consistently lower in a low-transmission setting.	Least intense measure	Positive ▲
Number or proportion of deaths	2 modelling studies (Ger- mann 2020; Mon- od 2020)	Germann 2020: alongside reducing the number of students (80%, 40%) and alternating attendance schedules (weekly, 2 days), the authors compare two different degrees of intensity of measures such as masks, hygiene and physical distancing for the Chicago area during the peak four weeks of the pandemic. More intense measures consistently predicted a reduction in the number of deaths: with 80%, 40% (weekly alternating schedule) and 40% (2-day alternating schedule), the number of cases were 787, 138 and 117 respectively. With less intense measures, the predicted number of deaths would be 965 (80% attendance), 220 (40% atten- dance, weekly alternating attendance) and 185 (40% attendance, 2-day alternating attendance). With more workplaces open, the number of deaths was consistently higher across all scenarios.	Least intense measure	Positive A
		Monod 2020: the study compares different levels of transmission reduction obtained through masks and other non-pharmaceutical interventions (re- duction of transmission by 0 to 80%) across all 37 states and metropolitan areas. When no mea- sures were in place, the excess COVID-19 attribut- able deaths in children aged 0 to 11 years would be 137 (65; 287). With 66% reduction in transmission, excess COVID-19 attributable deaths in children would be 10 (5; 17) excess deaths and with 80% re- duction excess deaths would be 4 (2; 7).	Full opening of schools with no measures in place	No change/ mixed ef- fects/conflicting findings ◀►
Shift in pandem- ic development	2 modelling studies (Ger- mann 2020; Phillips 2020)	Germann 2020a: alongside reducing the number of students (80%, 40%) and alternating attendance schedules (weekly, 2 days), the authors compare two different degrees of intensity of measures such as masks, hygiene and physical distancing for the Chicago area. More intense measures predicted mixed effects with regards to the <i>time to peak inci- dence</i> : with 80%, 40% (weekly alternating sched- ule) and 40% attendance (2-day alternating sched- ule), the time to peak incidence would be 129, 205	Least intense measure	No change/ mixed ef- fects/conflicting findings ◀►



(Continued)		and 206 days, respectively. With less intense mea- sures, the predicted number of days to peak inci- dence would be 118 (80% attendance), 188 (40% attendance, weekly alternating attendance) and 188 days (40% attendance, 2-day alternating at- tendance). With more workplaces open, the effects were also mixed. There was no difference in time to peak incidence for the scenarios of 80% and 40% attendance, with weekly alternating attendance, while more intense measures lead to 117 days to peak incidence as compared to 110 with less in- tense measures.		
		Germann 2020b: alongside reducing the number of students (80%, 40%) and alternating attendance schedules (weekly, 2 days), the authors compare two different degrees of intensity of measures such as masks, hygiene and physical distancing for the Chicago area. With regards to <i>time to peak prevalence</i> , more intense measures predicted a longer time to peak prevalence: with 80%, 40% (weekly alternating schedule) and 40% (2-day alternating schedule), the time to peak incidence would be 129, 205 and 206 days, respectively. With less intense measures, the predicted number of days to peak prevalence would be 122 (80% attendance), 192 (40% attendance, weekly alternating attendance) and 192 days (40% attendance, 2-day alternating attendance). With more workplaces open, the effects were mixed. There was no difference in time to peak prevalence for the scenarios of 80% and 40% attendance with weekly alternating attendance, while more intense measures lead to 119 days to peak incidence as compared to 115 with less intense measures.	Least intense measure	No change/ mixed ef- fects/conflicting findings ◀►
		Phillips 2020: the study compared high- with low- transmission settings in primary schools. With re- sults presented in a graphical way, they imply that the mean duration of the outbreak is shorter in low-transmission than high-transmission settings in all student to teacher ratios except for the 30:1 ratio.	Least intense measure	No change/ mixed ef- fects/conflicting findings ◀►
Outcome category	y: healthcare utilisa	ation		
Number or pro- portion of hospi- talisations	1 modelling study (Germann 2020)	Germann 2020: alongside reducing the number of students (80%, 40%) and alternating attendance schedules (weekly, 2 days), the authors compare	Least intense measure	Positive ▲

two different degrees of intensity of measures such as masks, hygiene and physical distancing for the Chicago area. With regards to the number of people hospitalised, more intense measures predicted a reduction in the number of people hospitalised. With 80%, 40% (weekly alternating schedule) and 40% (2-day alternating schedule), the number of people hospitalised would be 14,501, 2348 and 1990, respectively. With less intense measures, the predicted number of people hospitalised would be 18,117 (80% attendance), 3773 (40% attendance,



(Continued)

weekly alternating attendance) and 3392 (40% attendance, 2-day alternating attendance). With more workplaces open, the predicted number of hospitalised persons was consistently higher.

Outcome category: societal, economic and ecological outcomes

Numbers of days spent in school	2 modelling studies (Gill 2020; Phillips 2020)	Gill 2020: compared with schools reopening at full capacity with no measures in place, the study pre- dicts that at very low community infection rates (10 reported infections per 100,000 population over the last 7 days), most students can expect to attend nearly every day, even in schools operating full- time, as long as schools implement precautions such as mask wearing. It is not possible to disag- gregate effects or determine effect size due to co- interventions and lack of reporting.	Full opening of schools with no measures in place	Positive
		Phillips 2020: the study compared high- with low- transmission settings in primary schools. Except for a ratio of 30:1, the number of student days lost to closure was consistently higher in low-trans- mission settings. The predicted number of student days lost was 76.0 \pm 59.5 for a ratio of 8:1, 270.2 \pm 195.6 for a ratio of 15:1 and 1157.7 \pm 684.3 for a ra- tio of 30:1 in a low-transmission setting while it was 111.2 \pm 72.8; 389.9 \pm 202.0 and 1093.9 \pm 396.1 for a high-transmission setting.	Least intense measure	No change/ mixed ef- fects/conflicting findings ◀►

Appendix 10. Measures making contacts safer: study-by-study overview of the evidence contributing to each outcome (observational/experimental studies)

Outcome	Number of stud- ies	Overview of effect by study	Comparison used in each study	Effect direc- tion per study (positive ▲; negative ▼; no change/mixed effects/con- flicting findings ◀►)
Outcome categor Number or pro- portion of cases	ry: transmission-rela 2 observation- al/experimental study (Isphord- ing 2020; Vlachos 2020)	Isphording 2020: compared to school closures, three weeks after school openings, cases per 100,000 people decreased by 0.55 or 27% of a SD within the experimental group where co-interven- tions included mask wearing, hand-hygiene pol- icy, respiratory etiquette, general physical dis- tancing policy, modification of activities and ex- emption of high-risk students. These were imple- mented alongside testing and quarantine and co-	School closure	Positive 🛦
 Measures implement	ted in the school settin	horting measures. The effect is strongest in the youngest age group of 0 to 14 year-old cases where		160

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Appendix 11. Surveillance and response measures - mass testing and isolation: study-by-study overview of the evidence contributing to each outcome (modelling studies)

Outcome	Number of stud- ies	Overview of effect by study	Comparison used in each study	Effect direc- tion per study (positive ▲; negative ▼; no change/mixed effects/con- flicting findings ◀►)
Outcome categor	y: transmission-rela	ited outcomes		
Number or pro- portion of cases	7 modelling studies (Cohen 2020; Di Domeni- co 2020a; Head 2020; Lyng 2020; Panovska-Grif- fiths 2020a;	Cohen 2020: in the absence of any countermea- sures in schools, 6% to 25% of teaching and non- teaching staff and 4% to 20% of students would be infected with COVID in the first three months of school, depending upon the case detection rate. Implementing countermeasures that limit trans- mission and detect, trace, and quarantine cases within schools would lead to reductions in the cu-	Full opening of schools with no measures in place	Positive

(Continued)	Tupper 2020; Williams 2020)	mulative SARS-CoV-2 infection rate among stu- dents, teachers, and staff over 14-fold. Surveillance measures were implemented alongside classroom cohorting, face masks, physical distancing, and handwashing protocols in schools, so it is not pos- sible to comment on the impact of these measures alone.		
		Di Domenico 2020a: the authors provide no effect estimates for testing, tracing and isolation, but provide results in a graphical way for both assump- tions (25% and 50% case isolation through a 90% reduction of their contacts, simulating the result of rapid and efficient tracing and testing of cases). A sensitivity analysis performed indicates that a 25% case isolation compared to a 50% case iso- lation leads to a reduction in the daily number of new clinical cases under moderate social-distanc- ing interventions in all scenarios, except for the 100% reopening with no measures in place. Ad- ditionally, the effect is moderated by the relative transmissibility of pre-school and primary school children: in scenarios with lower transmissibility in these younger children, fewer cases occur with each measure in place.	Full opening of schools with no measures in place	Positive A
		Head 2020: when faculty and/or students are test- ed (85% sensitivity, 100% specificity) on a weekly or monthly basis, with positive cases isolated, and their class quarantined for 14 days, the study pre- dicted that in the absence of other interventions, testing and isolation/quarantine strategies have low effectiveness. When combined with strict so- cial-distancing measures, a modest reduction in community cases is possible as infectious individ- uals and their contacts identified in the school en- vironment are quarantined (i.e. have their commu- nity contacts reduced by 75% for 14 days). The ex- cess proportion of infections in teachers when only testing is employed is 37.77 (95% CI 10.64 to 53.31) compared to a scenario in which testing is com- bined with cohorting and mask wearing 1.45 (95% CI -2.36 to 5.69), compared to students where it is 52.07 (16.82 to 69.12) and 3.18 (95% CI 0.2 to 7.16), respectively. The excess proportion of infections in the community is 1.01 (95% CI -0.78 to 2.97). The effect sizes are moderated by the model parame- ters such as relative susceptibility and infectious- ness of children, and extent of community trans- mission amid reopening. For weekly versus month- ly testing, results are presented only in graphical form, but indicate that there would be a higher pro- portion of students with symptomatic infection with a monthly testing strategy than with a weekly testing strategy.	Single interven- tion component	Positive
		Lyng 2020: at sensitivities of 98%, the models pre- dict that a 2-day delay in results will result in a just a 59% reduction in infections experienced at a 14- day testing frequency. As the testing frequency	Least intense measure	Positive 🛦



(Continued)		is increased, the number of missed infections re- duces rapidly by > 99% from no testing at all to a daily testing frequency, even with the 2-day delay. Increasing testing frequency was associated with a non-linear positive effect on cases averted over 100 days. While precise reductions in cumulative number of infections depended on community dis- ease prevalence, testing every 3 days versus every 14 days (even with a lower sensitivity test) reduces the disease burden substantially.		
		Panovska-Griffiths 2020a: the study suggests that it might be possible to avoid a second pandemic wave if enough people with symptomatic infection can be tested, and contacts of those diagnosed can be traced and effectively isolated. Assuming 68% of contacts could be traced, the study estimates that 75% of those with symptomatic infection would need to be tested and isolated if schools return full time in September, or 65% if a part-time rota sys- tem were used. If only 40% of contacts could be traced, these figures would increase to 87% and 75%, respectively.	Least intense measure	Positive
		Tupper 2020: in all scenarios, if individuals have not already been identified through the relevant protocol, transmission stops when symptoms be- gin, as symptomatic individuals do not attend (or they leave when symptoms arise). In scenario 4, the mean cluster size was reduced from 11.9 to 6.5 in the asymptomatic case, whereas the group and two group protocols reduce it to 8.3 and 7.5 students, respectively. Over all the scenarios, the whole class protocol reduced cluster sizes roughly in half, with the contact and two-group protocols performing slightly worse.	Least intense measure	Positive
		Williams 2020: isolating household members of in- dividuals who experience symptoms is estimat- ing to avert 2.22 times more symptomatic cases than not isolating them. The multiplicative effect is slightly higher for surveillance/test/quarantine sce- narios and highest for cluster sampling on schools, where 3.37 times more symptomatic cases are averted by isolating household members.	Least intense measure	Positive
Reproduction number	1 modelling study (Panovs- ka-Griffiths 2020a)	Panovska-Griffiths 2020a: across two scenarios of school reopening and different tracing levels, the test-trace-isolate strategy would need to test a suf- ficiently large proportion of the population with COVID-19 symptomatic infection and trace their contacts with sufficiently large coverage, for R to diminish below 1.	Least intense measure	Positive
Number or pro- portion of deaths	2 modelling studies (Head 2020; Panovs- ka-Griffiths 2020a)	Head 2020: the excess proportion of deaths in teachers when only testing is employed is 8.12 (95% CI 0.00 to 47.85), compared to 0 for students and 0.5 (95% CI -2.72 to 3.68) in the community. The effect sizes are moderated by the model pa- rameters, such as relative susceptibility and infec-	Full opening of schools with no measures in place	Positive



(Continued)		tiousness of children, and extent of community transmission amid reopening.		
	-	Panovska-Griffiths 2020a: while results are only presented in a graphical way, they imply that more intense test, trace, and isolate strategies would lead to lower death rates than less intense strate- gies.	Least intense measure	Positive A
Shift in pandem- ic development	4 model- ling studies (Landeros 2020; Panovs- ka-Griffiths 2020a; Panovs- ka-Griffiths 2020a (Preprint); Wi 2020)	Landeros 2020: the study found that reopening with a surveillance programme in place may pro- vide 10 to 12 weeks of continuous instruction with low-infection risk. Infections after closing are dri- ven by a lack of interventions outside of school; testing and isolation in this context can curtail this growth. In general, the results support the impor- iltance of testing and complete school closure in preventing a major disease outbreak after reopen- ing. Overall, this model also shows that reduction of class density and the implementation of rapid viral testing, even with imperfect detection, have greater impact than moderate measures for trans- mission mitigation.	Full opening of schools with no measures in place	Positive A
	-	Panovska-Griffiths 2020a: the time point at which R diminishes depends on the degree to which the test-trace-isolate strategy had been implemented and the combination of testing and tracing.	Least intense measure	Positive 🛦
		Panovska-Griffiths 2020a: test-trace-isolate mod- els, combined with mask wearing in the communi- ty and secondary schools were modelled. Results suggest that there is a greater benefit of mandato- ry masks in secondary schools if the effective cov- erage of masks is high (30%). Under current test- ing and tracing levels (24% testing, 47% tracing) and masks' effective coverage of 30%, the predict- ed second COVID-19 wave would be less than half of the original wave if masks were mandatory in secondary schools, as well as used in community settings. The minimum testing levels necessary to avoid a second wave, under scaled up test-trace- isolate strategies is 8% to 11% less when masks are mandatory in schools than if they are not, depend- ing on the effective coverage of masks. The simu- lations suggest that the time point at which R di- minishes depends on the degree to which the test- trace-isolate strategy had been implemented and the combination of testing and tracing.	Least intense measure	Positive
		Williams 2020: isolation of symptomatic, asympto- matic individuals, and their household members can delay the peak prevalence. As with numbers of cases, the largest delays in peak prevalence oc- cur when household members are isolated along with symptomatic and known asymptomatic cases. When all known infected cases and their household members are isolated, this delays the peak preva- lence by 74 days.	Least intense measure	Positive



(Continued)

Outcome category: healthcare utilisation

Number or pro- portion of hospi- talizations	1 modelling study (Head 2020)	Head 2020: reopening schools with a weekly or monthly testing strategy for teachers and students would lead to a higher number of hospitalisations than reopening under strategies to reduce con- tacts, such as stable cohorts or alternating atten- dance. The excess proportion of hospitalisations in teachers when only testing is employed is 162.47 (95% CI 0.00 to 588.24), compared to students 0.58 (95% CI 0.00 to 15.27), and the community 3.68 (95% CI -7.27 to 15.54). The effect sizes are moder- ated by the model parameters, such as relative sus- ceptibility and infectiousness of children, and ex- tent of community transmission amid reopening.	Full opening of schools with no measures in place	Positive A
Outcome categor	y: societal, econom	ic and ecological outcomes		
Numbers of days spent in school	1 modelling study (Gill 2020)	Gill 2020: in the absence of a school closure poli- cy, quarantine of classmates and bus mates of in- fected students are likely to reduce in-person at- tendance for the typical student by about 10% in a school open full-time with precautions. High-com- munity infection rates were predicted to be more disruptive to schools operating full-time in person than to schools using hybrid approaches. Even at 100 reported community infections per 100,000 per week, the typical student in a hybrid secondary school can expect to miss only a very few days due to quarantine, while the typical student in a sec- ondary school open full-time with precautions might be sent home for about 15% of possible days due to quarantine. Delays in testing would have large effects in schools implementing no precau- tions: as testing turnaround time increases from zero to 10 days. Policies that close the school (for 3 days or 14 days) when infections are detected sub- stantially reduce the total number of days that stu- dents can attend in person. These effects are larger in schools operating full-time than in schools using hybrid approaches because schools using hybrid approaches experience fewer infections that lead to quarantines or closures. In secondary schools where students attend daily, and the community infection rate is at a moderate level (50 per 100,000 per week), closing the school for 14 days for each detected infection would be highly disruptive, such that the typical student would be able to attend only about half of all school days.	Least intense measure	Negative ▼
Resources	3 modelling studies (Camp- bell 2020b; Lyng 2020; Williams 2020)	Campbell 2020b: the study predicts that univer- sal testing for at-risk populations would cost CAD 1.3 billion for each round of testing. The status quo testing approach from 8 to 17 July 2020 was predicted to require 41,751 tests per day and re- quired 755 nurses, 213 nursing assistants, 172 oth- er healthcare professionals, 3261 clerical and non- clinical staff, and 721 laboratory staff (5122 per- sonnel total). Testing of at-risk groups, in particu- lar testing all 6,012,144 students and employees	Least intense measure	Negative ▼

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(Continued)	in primary and secondary schools over 1.5 months would require an added 20,956 healthcare profes- sionals, 22,950 clerical staff and 2462 laboratory staff, costing CAD 816.0 million. A strategy of active- ly testing large population groups who are at in- creased risk of acquiring SARS-CoV-2 is feasible and affordable in Canada.		
	Lyng 2020: frequent testing strategies can reduce the rate of new infections compared to scenarios where there is no testing at all. A 98% sensitive test with no delay in results administered every 3 days with pooling, and no confirmatory test offered by the institution costs less than USD 1.50 per person per day, with high performance. The model demon- strates that frequency of testing, test sensitivity, turn-around time, and the external community prevalence are all important factors to consider, and there is often more than one testing strategy to achieve the desired level of performance.	Least intense measure	Positive
	Williams 2020: if household members of symp- tomatic cases are also isolated (without testing them), a much lower eight tests are required to avert each one symptomatic case. Moving to the symptomatic testing and quarantine (STQ) scenar- ios, using simple random sampling and isolating only the cases that test positive with STQ, results in 145 tests required to avert one symptomatic case. This decreases to a low of 16 tests to avert one symptomatic case for pooled sampling of 5- person pools and seven tests for pooled sampling of 5-person pools if household members are also isolated. Notably, the STQ scenario of pooled sam- pling of 5-person pools is slightly more efficient than the current status quo of testing and isolating symptomatic cases. All other STQ scenarios are less efficient than the status quo. However, instituting even these less efficient STQ scenarios is likely to avert a substantial number of cases (as described above) and could be more cost-effective than the emergency room visits, long-term care, lost labour, and other economic costs of symptomatic cases and deaths.	Least intense measure	No change/ mixed ef- fects/conflicting findings ◀►

Appendix 12. Surveillance and response measures - mass testing and isolation: study-by-study overview of the evidence contributing to each outcome (observational/experimental studies)

Outcome	Number of stud- ies	Overview of effect by study	Comparison used in each study	Effect direc- tion per study (positive ▲; negative ♥; no change/mixed effects/con- flicting findings ◀►)
Measures implemented in the school setting to contain the COVID-19 pandemic (Review)				166

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(Continued)

Outcome category: transmission outcomes

Number of cases detected	1 observational screening study (Hoehl 2020)	Hoehl 2020: the study aims to evaluate the prac- tical application of self-performed high-frequen- cy antigen tests in a school setting. 10,768 of these tests (99.4%) were recorded to have been valid and 113 negative, 47 (0.43%) were recorded as invalid and 21 (0.19%) as positive (either true or false). The study found that 0.15% of all antigen tests (16 tests) gave false-positive results. False-positive re- sults were seen predominantly when the local in- cidence in the general population was low. In four cases, the study participant reported that a PCR had detected a SARS-CoV-2 infection, but the anti- gen test was negative, indicating a false negative. No asymptomatic infection was detected in this study.	Least intense measure	Negative ▼
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Appendix 13. Surveillance and response measures - symptom-based screening and quarantine: study-by-study overview of the evidence contributing to each outcome (modelling studies)

negative ♥; no change/mixed effects/con- flicting finding
change/mixed effects/con- flicting finding

Outcome category: transmission-related outcomes

Number or proportion of cases	2 model- ling studies (Bershteyn 2020; Burns A 2020)	Bershteyn 2020: policies include daily symptom screening, and monthly or weekly testing of 10%, 20%, or 100% of attendees, with testing occurring either on the most optimal day (the first week day of a 5-day work week, which is Monday for USA public schools) or the least optimal day (the last week day of a 5-day week, which is Friday for USA public schools). Compared to no testing or isola- tion, a policy requiring index cases to self-isolate if they develop symptoms, in-school transmission is predicted to occur during presymptomatic infec- tion (days 1 through 4) and asymptomatic infec- tion (26% to 39% of index cases). In the absence of additional testing for asymptomatic individu- als, this policy predictably reduced transmission by 34.8% to 41.8% relative to no isolation. The im- pact of weekly testing varied according to the day of the week in which testing was deployed, due to the lack of in-school transmission over the two- day weekend. The first week day (Monday) was the most optimal day for testing, while the last week- day (Friday) was the least optimal. Testing on Mon- day averted 27.1% to 34.0% more infections than	Full opening of schools with no measures in place	Positive
		testing on Friday, and could reduce transmission		

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(Continued)		by 61.8% to 64.2% without symptom-based isola- tion. The most effective testing and isolation strat- egy used a combination of testing 100% of atten- dees on the first week day together with symp- tom screening and isolation of all those who are symptomatic, for an overall transmission reduction of 68.6% to 71.1% relative to no testing or symp- tom-based screening.		
		Burns A 2020: in the baseline scenario of no intervention, the study predicted a median attack rate of 0.79 (IQR 0.56 to 0.9). The estimated attack rates were 0.79 (IQR 0.56 to 0.9), 0.71 (IQR 0.43 to 0.86), and 0.72 (IQR 0.43 to 0.86) at 1 and 2 days of isolation following fever in the scenario of 50% fever detection. The effects varied according to the rate of detecting fever. Applying an 88% detection rate compared to a 50% detection rate, implementing a one fever-free day predicts an 8% reduction in the attack rate. At this higher rate of symptom detection, increasing the isolation to 6 days predicts a 15% reduction in the median attack rate to 0.43 (0.03 to 0.82) compared to no policy.	Full opening of schools with no measures in place	Positive A
Shift in pandem- ic development	1 modelling study (Burns A 2020)	Burns A 2020: with no policy in place, the peak number of infected people is assumed to be 148 (IQR 82 to 213) and the interval between the first and last day with at least two cases would be 139 (IQR 120 to 154). Implementing a policy of two days of home isolation following the last episode of fever predicted a reduction in all outcome cate- gories: peak number of infected people is predict- ed to sink to 124 (IQR 58 to 184). The interval be- tween the first and last day with at least two cas- es would increase to 145 (IQR 127 to 157). The ef- fects varied according to the rate of detecting fever. If the rate of detecting fever is a higher rate of 88%, implementing a 1 fever-free day achieves a 20% re- duction in the peak concurrently infected and a 7- day increase in the interval between the first and last day with at least two cases.	Full opening of schools with no measures in place	Positive A

Appendix 14. Multicomponent measures: study-by-study overview of the evidence contributing to each outcome (modelling studies)

Outcome	Number of stud- ies	Overview of effect by study	Comparison used in each study	Effect direc- tion per study (positive ▲; negative ▼; no change/mixed effects/con- flicting findings ◀►)
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Outcome category: transmission-related outcomes

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(Continued)				
Number or proportion of cases	1 modelling study (Naimark 2020)	Naimark 2020: the study assesses the effect of mul- tiple interventions on the cumulative number of confirmed COVID-19 cases after 2 months. The measures are: i) reducing the number of students (primary and elementary class sizes were capped at 23, and high school classes were capped at 15 students); ii) reduction of contacts (students re- mained in their assigned classrooms for the school day rather than moving among classrooms); iii) universal masking; iv) alternating attendance schedules in high schools; and v) if more than two confirmed cases of COVID-19 occurred in a daycare or classroom less than two weeks apart, the day- care or classroom was closed for 14 days with the children in the class excluded from school rather than moved to another classroom. These measures were implemented alongside community-based in- terventions. With no community-based interven- tions being implemented, the cumulative num- ber of confirmed COVID-19 cases after 2 months with schools opening without co-interventions in place would be 82,379 if schools are closed and 86,507 when schools are open. With communi- ty-based interventions being implemented, the cumulative number of confirmed COVID-19 cases after 2 months with schools opening without co- interventions in place would be 45,112 if schools are closed and 45,068 when schools are open. The study found a large impact of co-interventions: The mean difference in cumulative COVID-19 cases by 31 October 2020, for the scenarios in which com- munity-based co-interventions were not imple- mented versus scenarios in which they were imple- mented versus scenarios in which they were imple- mented was 39,355 cases. In contrast, the mean difference in cumulative COVID-19 cases for the scenarios in which schools were reopened versus scenarios in which they were not was 2040 cases.	School closure	Negative ▼

Appendix 15. Multicomponent measures: study-by-study overview of the evidence contributing to each outcome (observational/experimental studies)

Outcome	Number of stud- ies	Overview of effect by study	Comparison used in each study	Effect direc- tion per study (positive ▲; negative ▼; no change/mixed effects/con- flicting findings ◀►)
Outcome catego	ry: transmission-rela	ated outcomes		
Number or pro- portion of cases	2 observation- al/experimental studies (Isphord-	Isphording 2020: compared to school closures, three weeks after school openings, cases per 100,000 people decreased by 0.55 or 27% of a SD within the experimental group where co-interven-	School closure	Positive 🛦
Measures implement	ted in the school settin	g to contain the COVID-19 pandemic (Review)		169

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(Continued)				
	ing 2020; Vlachos 2020)	tions included mask wearing, hand-hygiene pol- icy, respiratory etiquette, general physical dis- tancing policy, modification of activities and ex- emption of high-risk students. These were imple- mented alongside testing and quarantine and co- horting measures. The effect is strongest in the youngest age group of 0 to 14-year-old cases where the end of summer break is associated with a sig- nificant reduction in cases per 100,000 population of about 1.4 cases after 3 weeks for individuals up to 14 years (42% of a SD). Reductions for older age groups are smaller and insignificant: 0.82 cases in the group of 15 to 34 years (21% of a SD) and 0.43 cases in the group of 35 to 59 years (16% of a SD). The more vulnerable population of 60+ years ap- pears to be unaffected by school openings. Levels of community transmission were relatively low at the time point at which schools were reopened, while compliance and agreement with social dis- tance measures decreased strongly. It was not pos- sible to disaggregate the effect of co-interventions.		
		Vlachos 2020: among parents, exposure to open rather than closed schools resulted in a small in- crease in PCR-confirmed infections (odds ratio (OR) 1.17, 95% CI 1.03 to 1.32]. Among lower secondary teachers the infection rate doubled relative to up- per secondary teachers (OR 2.01, 95% CI 1.52 to 2.67). This spilled over to the partners of lower sec- ondary teachers who had a higher infection rate than their upper secondary counterparts (OR 1.29, 95% CI 1.00 to 1.67). When analysing COVID-19 di- agnoses from healthcare visits and the incidence of severe health outcomes, results are similar for teachers but weaker for parents and teachers' part- ners. The results for parents indicate that keeping lower secondary schools open had minor conse- quences for the overall transmission of SARS-COV-2 in society. The results for teachers suggest that measures to protect teachers could be considered.	School closure	Negative ▼

WHAT'S NEW

Date	Event	Description
31 January 2022	Amended	Minor edits to title

HISTORY

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CONTRIBUTIONS OF AUTHORS

Co-ordination of review process: ShK, HL, LMP

Protocol development: ShK, HL, ER, LMP

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DECLARATIONS OF INTEREST

RB: grant/contract from Bundesministerium für Bildung und Forschung

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KG: grant/contract from German Federal Ministry of Education and Research; Board Member of the German Public Health Association

CJS: German Federal Ministry of Education and Research; I work as a physician (primary tasks: education and research) at the Chair of Public Health, LMU Munich

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JR: grant/contract from German Federal Ministry of Education and Research; I declare being first author of a study on the psychosocial burden in parents of school-aged children during different phases of the Covid-19 pandemic in Germany, that was submitted to, but is not yet published by the Journal "Bundesgesundheitsblatt" and might be eligible in future updates of the review. Data for this study were derived from the Covid-19 Snapshot Monitoring (COSMO) project (https://projekte.uni-erfurt.de/cosmo2020/web/). COSMO is a joint project by the University of Erfurt, the Robert-Koch-Institute, the German Federal Agency for Health Education (BZgA), the Leibniz Institute for Psychology, the Science Media Centre, the Bernhard Nocht Institute for Tropical Medicine and the Yale Institute for Public Health. Besides funding from these institutions, funding of the COSMO project derives from the Klaus Tschira Foundation, the Ministry of Economy, Research and Digital Society of Thuringia as well as the state chancellery of Thuringia.

ER: grant/contract from Bundesministerium für Bildung und Forschung; a member of the scientific advisory board of the Robert Koch Institute and the Bavarian Health and Food Safety Authority that have both issued guidance on schooling during COVID-19, but have not been involved with developing this guidance; a member of the WHO Regional Office for Europe's Technical Advisory Group on Schooling during COVID-19 and, in this role, is involved with advising the WHO Regional Office for Europe on the issue

KS:grant/contract from German Federal Ministry of Education and Research

 ${\tt BS: grant/contract from \ German \ Federal \ Ministry \ of \ Education \ and \ Research}$

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SV: grant/contract from German Federal Ministry of Education and Research

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KW: grant/contract from German Federal Ministry for Education and Research

RB, KG, CaK, SuK, AM, LMP, JR, ER, KS, BS, JS, BV, SV, KW declare being part of the scientific secretariat that supports the development of a living interdisciplinary, evidence-based and consensus-based guideline on measures to prevent and control SARS-CoV-2 transmission in schools, registered with the Association of the Scientific Medical Societies (AWMF) in Germany (www.awmf.org/en/clinical-practice-guidelines/detail/anmeldung/1/ll/027-076.html).

CJS, AM and ER are involved in the conduct of an ongoing study that, after completion, is likely to be eligible for inclusion in the review (COVID Kids Bavaria, funded by the State of Bavaria, Germany).

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Internal sources

• No sources of support provided

External sources

• Ministry of Education and Research, Germany

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DIFFERENCES BETWEEN PROTOCOL AND REVIEW

There were no differences between the protocol and the review in terms of the search for, and inclusion of studies, however, given the time between the initial search and the publication of this review, the authors were advised by Cochrane to run a top-up search for studies in August 2021 using the Cochrane Covid-19 Study Register. The search was performed exactly as it had been conducted in December 2020 but with search dates from 9 December 2020 to 5 August 2021. The studies identified through this search are listed in Characteristics of studies awaiting classification. We have not performed any quality assessment nor data extraction on these studies.

The protocol stated that we would use the Cochrane RoB 2 tool (Higgins 2021), adapted for cluster-RCTs, to assess risk of bias in RCTs. However, as we did not identify any RCTs, we did not use this tool. The protocol also stated that where appropriate, we would use the synthesis without meta-analysis (SWiM) guidance as a basis for the reporting of results when exploring heterogeneity between studies (Campbell 2020a). However, we did not use this guidance as the majority of studies included in this review are modelling studies that do not lend themselves to using the SWiM guidance.

INDEX TERMS

Medical Subject Headings (MeSH)

*COVID-19; Observational Studies as Topic; *Pandemics; Quarantine; SARS-CoV-2; Schools

MeSH check words

Humans

TAB 13

SARS-CoV-2 seroprevalence among Vancouver public school staff in British Columbia, Canada

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Key Points

<u>Question:</u> What was the prevalence of COVID-19 infections in school staff who maintained in-person schooling during the 2020/21 school year in Vancouver, British Columbia, and how does it compare to the risk of COVID-19 infection in the community.

<u>Findings</u>: As of March 4, 2021, the incidence of COVID-19 cases among school staff was 13 per 1,000 (N = 7,071 school staff) since the beginning of the pandemic. In a cross-sectional seroprevalence analysis from February 10 to May 15, 2021, the adjusted seroprevalence among a sample of school staff (N = 1,556) was 2.3% [95%CI: 1.6 - 3.2%], compared to 2.3% [95%CI: 1.7 - 3.0%] in 1:2 age, sex and geographical location (by postal code)-matched reference group of blood donors.

<u>Meaning</u>: We found no detectable increase in seroprevalence among school staff above the community seroprevalence. These findings corroborate claims that, with appropriate mitigation strategies in place, in-person schooling is not associated with significantly higher risk for school staff.

Abstract

<u>Importance</u>: Contact-tracing studies suggest minimal secondary transmission in schools. However, there are limited school data accounting for asymptomatic cases, particularly late in the 2020/21 school year, and in the context of uninterrupted in-person schooling and widespread community transmission.

<u>Objectives:</u> To determine the SARS-CoV-2 seroprevalence in a sample of school staff, compared to the community, and to COVID-19 rates among all students and staff within the same school population.

<u>Design</u>: Incident COVID-19 cases among students and school staff using public health data, with an embedded cross-sectional serosurvey among school staff sampled from February 10 to May 15, 2021, comparing to age, sex and geographic location-matched blood donors sampled in January 2021.

Setting: Vancouver School District (British Columbia, Canada) from kindergarten to grade 12.

Participants: Active school staff enrolled from February 3 to April 23, 2021.

<u>Main outcome measures</u>: SARS-CoV-2 antibodies in a sample of school staff using spike (S)-based testing (unvaccinated staff) or N-based serology testing (vaccinated staff).

<u>Results:</u> The incidence of COVID-19 cases among students attending in-person was 9.8 per 1,000 students during the 2020/21 school year (N = 47,280 students), and among staff was 13 per 1,000 since the beginning of the pandemic (N = 7,071 active school staff). In total, 1,689 school staff (64% elementary, 28% secondary, 8.3% school board staff or multiple grades) completed the questionnaire, 78.2% had classroom responsibilities, and spent a median of 17.6 hours in class per week [IQR: 5.0 - 25 hours]. Although 21.5% (363/1,686) reported close contact with a COVID-19 case, only 1.4% (24/1688) of the school staff reported having had a positive viral nucleic acid test. Of this group, five believed they acquired the infection at school. The adjusted seroprevalence in staff who gave blood (1,556/1,689, 92.1%) was 2.3% [95%CI: 1.6 - 3.2%] compared to 2.3% [95%CI: 1.7 - 3.0%] in blood donors.

<u>Conclusion and relevance</u>: Despite high reported COVID-19 cases among students and staff, and frequent within-school exposures, we found no detectable increase in seroprevalence among school staff above the community seroprevalence. These findings corroborate claims that, with appropriate mitigation strategies, in-person schooling is not associated with significantly increased risk for school staff.

Introduction

SARS-CoV-2 forced over a billion students out-of-school globally in the Spring 2020. Decisions to close schools, motivated by high case mortality in populations, had serious implications for children's emotional, social, physical and educational outcomes¹. The risk of secondary SARS-CoV-2 transmission within schools has been heavily debated. On one hand, viral culture studies suggest that children may be less infectious than adults², contact tracing studies show low rates of in-school transmission³⁻¹³, and surveillance studies demonstrate little increased transmission when schools re-opened¹⁴⁻¹⁹. On the other hand, seroprevalence studies have been conducted to account for asymptomatic transmission, but many studies have reported data early in the pandemic, or in the setting of partial school closure^{15,20-22}.

In the spring of 2020, Public Health authorities in British Columbia (BC) ordered a cessation of in-person schooling provincially, with a transition to remote learning from home. Like most of the world, the province went under a nearly complete lockdown between March and early June when most sectors of the economy were paused. While BC reported relatively low community viral transmission early in the first pandemic wave, roughly >50 times more COVID-19 cases were reported (121,762 cases reported in a population of 5,017,000) between July 1, 2020 and April 23, 2021, compared to February to May 2020. Despite increasing cases in late summer, BC was unique within Canada in that it maintained in-person schooling for the entire duration of the 2020/2021 school year starting September 8, 2020, except for winter (December 18, 2020 to January 4, 2021) and spring (March 12 to March 29, 2021) breaks.

The main goal of this study was to determine the SARS-CoV-2 seroprevalence in school staff in Vancouver public schools during the 2020/21 school year. The secondary objectives were to compare the seroprevalence in school staff to a reference population of matched Canadian blood donors, and to report on the incidence of COVID-19 cases among all students and school staff. We hypothesized that with mitigation measures the occupational risk of SARS-CoV-2 infection among school staff would remain low and comparable to the community risk.

Methods

<u>Study design:</u> The baseline questionnaire and serology data collected among active school staff of the Vancouver School District (the District) who are being followed for one year, was used to determine SARS-CoV-2 seroprevalence. Seroprevalence in school staff was compared to an age, sex and geographic location-matched sampled of blood donors collected in January 2021. In addition, we obtained retrospective data on COVID-19 cases in all staff and students attending the District from Vancouver Coastal Health (VCH, detailed below).

<u>Participants:</u> *School staff* self-enrolled from February 3 to April 23, 2021 after receiving an introduction email from school principals from the District in early February 2021, inviting them to register online at: <u>https://www.bcchr.ca/COVIDatschools</u>, for both a questionnaire and to provide blood for serology testing. A flyer was posted on the District website, and reminder emails were also sent. Interested participants completed a screener to identify whether they met eligibility criteria. Staff were included if they were a current, full or part-time staff member (confirmed by District email address). Staff who reported being temporary staff, on-leave, or on-call with no reported classroom time were excluded. Informed consent was obtained from all school staff. The study was approved by the University of British Columbia Children's and Women's Research Ethics Board (H20-03593).

Blood donors were screened prior to donation to ensure they were in good health, including questions about COVID-19. People were ineligible to donate blood if they had a recent COVID-19 infection two weeks after symptoms resolved, or were hospitalized within 3 weeks before.

<u>Study setting</u>: The District is a large, urban school district with 89 elementary schools and 18 secondary schools (47,280 students and 7,071 school staff) located in the city of Vancouver (BC, Canada ~600,000 population in the city of Vancouver with 2.6 million population in the urban area). Following a complete closure in March 2020, schools opened in a limited fashion, except for students who use English as a second language and those with complex learning needs who were able to attend in-person 5 days/week until June 30, 2020. On September 8, 2020 schools reopened for the 2020/21 school year, except for a winter break from December 18, 2020 to January 4, 2021, and spring break from March 12 to 29, 2021. COVID-19 mitigations measures implemented in District schools as well as indications for viral testing are detailed in **Appendix 1**.

<u>Data Collection</u>: Data was collected from school staff using a questionnaire that asked, among others, about risk factors for COVID-19, household structure, physical distancing behavior, close contacts with COVID-19 cases (defined by asking: *"someone diagnosed with COVID-19 with whom you'd been within two meters of for greater than two minutes"*), history of viral testing (including dates and symptoms) and vaccination, etc.²³ A second questionnaire about mental health and vaccine perception was also administered but not reported in this paper. COVID-19 vaccination in blood donors was collected by asking at the time of blood donation.

To estimate the degree of exposure to known COVID-19 cases, we obtained data from VCH's Case and Contact Management Interface. The District provided student and staff lists to VCH, which linked the data to determine the incidence of SARS-CoV-2 infection among students and staff in District schools. Adult education staff were excluded. Staff and students affiliated with Vancouver Alternate Secondary School programs were counted as attending a single school for the purposes of incidence calculations.

Given that the history of viral testing in the prospective school staff sample was obtained via questionnaires, we selected the median date of questionnaire completion (March 4, 2021) as the end date for data extraction. We extracted all lab-confirmed, probable, and epidemiologically-linked COVID-19 cases reported to VCH. To assess the incidence of known infection among staff over the course of the pandemic, we calculated the incidence of reported staff cases from January 15, 2020 (corresponding to the first case reported to VCH) to March 4, 2021. Similarly, exposure to student cases during the school year was estimated by calculating the incidence from September 8, 2020 to March 4, 2021.

<u>Serology testing:</u> Blood samples were collected from February 10 to May 15 2021, at clinics set-up in various participating Vancouver schools, at the BC Children's Hospital or outpatient clinical laboratories in metro Vancouver. The presence of antibodies against SARS-CoV-2 was used as a marker of prior COVID-19 infection, using dual S- and N-based serology testing, where S-based serology was used in unvaccinated participants and N-based serology testing was used with vaccinated participants (**Supplemental Figure 1**).

Antibodies directed against the spike (S1) protein were detected using the Ortho T *VITROS*TM Anti-SARS-CoV-2 *Total antibody assay* (Ortho IgG; Ortho Clinical Diagnostics, Rochester, NY), a Health Canada and FDA-licensed qualitative assay which detects all types of antibodies (IgA, IgG and IgM). S-based serology testing was done on a Vitros 5600 analyser at the BC Children's & Women's Hospital Laboratory, which is accredited for clinical testing. Literature and in-house validation demonstrated this assay can identify both symptomatic and asymptomatic infected individuals >7 days post illness onset with a sensitivity between 90.7% and 97.7%, and specificities between 99.4% and 100% ^{24,25}. Specimens were considered reactive at a cut-off index ≥1.00. All S-tested negative samples with S-antibody indexes >99th centile were also confirmed to be negative on the Roche assay. Testing for anti-nucleocapsid (N) protein SARS-CoV-2 antibodies was performed using the Roche ElecsysTM Anti-SARS-CoV-2 (Roche T; Roche, USA). This qualitative total antibody assay is Health Canada and FDA-licensed with reported

sensitivity of 88.5% - 100% at least 14 days post-COVID-19 onset and specificity of 99.8% - 100% ²⁶⁻²⁸. Testing was performed on a Cobas e601 analyzer at St. Paul's Hospital Laboratory.

Blood donors were tested for both SARS-CoV-2 spike and N antibodies using the Roche ElecsysTM Anti-SARS-CoV-2 S and Anti-SARS-CoV-2 (Roche, USA) assays, respectively, on a Cobas e801 analyzer, and assigned using a similar S/N strategy for vaccinated / unvaccinated cases (**Supplemental Figure 1**).

<u>Statistical analyses:</u> Blood donors were identified to match study participants by age and sex ± 2 years and two donors randomly selected without replacement for each study participant. As not all participants could be matched, criteria were relaxed to include additional donors (**Supplemental Data**). The Rogan-Gladen estimator was used to calculate the true prevalence adjusting for test specificity and sensitivity, with 95% confidence intervals estimated using Blaker's method.²⁹ For seroprevalence in school staff and blood donors, sensitivities of 95.3% and 96.6%, and specificities of 100% were used for the two S-based assays, respectively.^{25,30}

Results

<u>COVID-19 cases from VCH contact tracing data in District schools (N = 47280 students and N = 7071 school staff)</u>: During the 2020-2021 school year 46879 students attended District schools in-person, and 401 students attended an Alternate District School (total of 47280 students). As shown in **Figure 1**, the overall weekly rates of reported COVID-19 cases among staff and students during the pandemic followed a trend similar to the weekly rates among Vancouver residents.

The population-level incidence of COVID-19 cases among students (including Vancouver Alternate Secondary Schools) during the 2020/21 school year was 9.8 cases per 1000 students, ranging from 0 to 63 cases per 1000 between schools (**Supplemental Figure 2**). Among schools with at least 1 student case, the median number of student cases was 3, and the median school population was 376 students.

In addition, 67 out of the 107 schools (62.6%) had no staff members diagnosed as confirmed, probable, or epidemiologically-linked COVID-19 cases since the beginning of the pandemic. Twenty-six of the 40 schools (65%) with staff cases had only one staff case. Including staff of Vancouver Alternate Secondary Schools, the incidence of reported cases from January 15, 2020 to March 4, 2021 among staff within specific schools ranged from 0 cases per 1000 staff to a maximum of 167 COVID-19 cases per 1000 staff. Among schools with at least 1 staff case, the median number of staff cases was 1, and the median size of each school's staffing complement was 46.5 staff members. All schools with incidences higher than 80 COVID-19 cases per 1000 staff had only 1 or 2 staff cases among a staffing complement of under 25 staff. The incidence of reported COVID-19 cases from January 15, 2020 to March 4, 2021 was 13 cases per 1000 classroom staff, and 14 cases per 1,000 non-classroom staff (**Supplemental Table 1**).

<u>COVID-19 cases self-reported in school staff sample (N = 1689)</u>: Staff COVID-19 cases reported to VCH were compared to questionnaire data. In total, there were 2162 access to the screener, of which 1743 staff identified themselves, provided contact information and consented on-line (**Figure 2**). The characteristics of 1689 staff who completed the questionnaire, corresponding to 23.9% of eligible staff (**Table 1**).

Notably, 63.7% of study participants were elementary school staff and 28.1% were secondary school staff (**Table 1**), which align with District data (not shown). Overall, a majority (78.2%; n = 1320) of school staff were classroom staff, and spent a median of 17.6 hours of contact time with students per week (**Table 1**). The District estimated that 5091 staff have classroom responsibilities. Therefore, we estimate that the study enrolled at least ~26% of all staff with classroom responsibilities.

About one third (37%) of school staff lived with an essential worker, predominantly in the social services, education/research/healthcare, construction, maintenance and skilled trades, and food sectors (**Table 2**). Among the school staff who completed the questionnaire, 51 reported a positive viral test among their household members (**Table 2**). In total, 363 (21.5%) reported a history of close contact with a COVID-19 case at or outside school, but only 24 reported ever testing positive by nucleic acid testing (**Table 2**). Four (16.7%) tested positive by nucleic acid testing prior to the beginning of classes in September 2020.

In total, 24 of 1689 school staff self-reported a positive viral test which represents an incidence rate of COVID-19 case of 1.4%. Of the 24 school staff who reported a positive viral test, 5 (21%) reported close contact with a student or co-worker case, including one who required hospitalization during the 2020/21 school year. Seven (29%) reported close contact with a friend or family member with COVID-19, and one reported close contact with both a co-worker and family member with COVID-19. Eleven had unknown sources of acquisition and were not aware of any close contact with a COVID-19 case.

<u>SARS-CoV-2</u> seroprevalence in school staff (N = 1556): Of 1689 school staff with prospective questionnaire data, 1556 completed serology testing (median date: March 11, 2021). Serology results for vaccinated and SARS-CoV-2-infected staff are shown in **Supplemental Table 2** and **3**, respectively. In total, 35 tested positive for SARS-CoV-2 by serology. Therefore, the unadjusted prevalence was 2.2% (95%CI: 1.6 - 3.1%), and the seroprevalence after adjusting for the sensitivity and specificity of the test was 2.3% (95%CI: 1.6 to 3.2%). Of the 35 school staff who seroconverted, 29 worked in a classroom setting and one did not work in a classroom setting, but reported more than 20 hours of contact time with students per week, for a seroprevalence also of 2.3% (95%CI: 1.5 - 3.1%). The proportion of staff who tested positive for SARS-CoV-2 by serology between secondary and elementary schools (**Table 3**) corresponded to the proportion of staff in each school level (**Table 1**). In comparison, the unadjusted seroprevalence in age, sex and geography-matched blood donors was 2.0% (95%CI: 1.5 - 2.7%), and 2.3% (95%CI: 1.7 - 3.0%) after adjusting for the sensitivity and specificity of the serology test.

Discussion

To the best of our knowledge, this study is one of the largest to report seroprevalence estimates in the school setting in the later phases of the pandemic in the context of in-person schooling and widespread viral transmission. This study found that the seroprevalence among staff in Vancouver public schools was low after a period of widespread community transmission. Results were consistent with both self-reported infection as well as COVID-19 cases reported by VCH. Findings are in keeping with modelling studies ^{31,32} and data from the UK where low seroprevalence was also measured in teachers, but this was earlier in the pandemic¹⁵. Moreover, despite that the seroprevalence in this study represents an approximately three-fold increase relative to previous estimates of 0.55% to 0.6% obtained from Vancouver residents in spring 2020³³⁻³⁵, it remained comparable to age/sex and area of residency-matched blood donors.

A major advantage of the current study is that it was conducted in BC, one of the few, if not only (as far as we are aware) jurisdictions in North America that maintained in-person schooling during the 2020/21 school year. Study results are drawn from a large sample of staff, including a majority of those exposed to COVID-19 in the classroom. The use of S-based serology assays identified COVID-19 cases up to a year before. The study utilized sensitive serology testing to identify cumulative SARS-CoV-2 cases that may have not come to clinical attention, but could still contribute to the transmission chain³⁶. Conversely, the N-based serology test allowed us to account for vaccinated staff towards the end of recruitment.

Among our study participants, 21.5% (363) of school staff reported a close contact with a COVID-19 case, and the majority (76.6%, 278/363) identified contact with a COVID-19 case at school. These data alone could reinforce the perception that schools are a risky environment. However, we could not find

evidence to substantiate the perception that a large number of asymptomatic infections have been missed through contact tracing, and thus we were able to provide a more accurate depiction of viral transmission. Despite the high frequency of school staff who reported symptoms (**Table 2**), 90.1% (598/664) had no serological evidence of infection using a conservative testing strategy. Under-ascertainment by viral testing could have been related to the use of targeted testing up until April 2020. However, the relatively high proportion (60%) of cases diagnosed by nucleic acid testing who tested positive via serology suggests good access to viral testing in this specific testing, during the study period.

Mitigation strategies employed in BC schools have been shown elsewhere to minimize risk in educators to a level comparable to the risk in the community ^{37,38}. Although non-medical masks were encouraged, but not required in schools until February 2021 (grades 8-12) and end of March 2021 (grades 4-12) (**Appendix**), and are still not required for K-3 students – a situation that is unique in Canada - we also did not detect any meaningful difference in seroprevalence between elementary and secondary school staff.

This study has limitations. First, study volunteers are typically healthier, raising a possibility that seroprevalence estimates were underestimated. To estimate this bias, the incidence of COVID-19 cases based on self-report (1.4%) was compared to the contact tracing data in classroom staff across the entire District (1.3%) and suggests that we did not under sampled those who are in direct contact with students. Second, the seroprevalence of school staff was compared to matched blood donors which may underestimate the community prevalence as the blood donors serology were taken in January 2021, prior to sampling of the school cohort, which could only reinforce our conclusions. As others have found, serologic testing in blood donors in general does reflect overall seroprevalence in the community³⁹⁻⁴² and we would expect the seroprevalence in the reference group of blood donors for the same period to be higher, which reinforces our study conclusion. Consistent with this, seroprevalence estimates based on anonymized, residual specimens collected by the BC Centre for Disease Control in January 2021 from working age adults (attending one of ~80 diagnostic service centres in the only outpatient laboratory network in the greater Vancouver area) ranged from 3-4% (DM Skowronski, personal communication). Second, the study had limited power to detect small differences between seroprevalence in school staff and the community. However, it is unlikely that small differences would drastically change the public health recommendations that can be made from the data. Third, exposure risks may differ between school and community settings, which needs to be taken into account when attempting to generalize our findings.

In conclusion, this study shows no detectable increase in SARS-CoV-2 infections in school staff working in Vancouver public schools following a period of widespread community transmission (October – May 2021). The combination of population-level COVID-19 data based on nucleic acid testing in symptomatic cases and sensitive serology testing among school staff provide strong evidence that their risk of COVID-19, in the context of mitigation strategies, is not substantially higher than the community.

Authors' contributions: LCM and PML obtained funding as Co-PIs; DMG, AW, MAI, DC, PML and LCM designed the original study concept; SH was involved in the earliest stages of the study, helping with funding applications, study design, ethics applications and data interpretation; MS also advised initial study design; FR helped review the literature; EB constructed and managed the data collection database with support from LCM and AW; LM set-up and coordinated the recruitment of participants; SS and HRR processed all blood samples; VEB supervised the collection of blood samples; AC supervised the analysis of VCH case data among students and school staff; MAI advised statistical study design and analyzed the main seroprevalence estimates; SO provided and analysed matched data from Canadian blood donors; AW performed all other data analyses; CO facilitated communications within the District during the study; DMG & PML drafted the first manuscript with specific sections written by AW, SH, VEB, MAI, AC, CO and LCM. All authors revised the manuscript and approved its final version.

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Conflicts of interest: CO is an employee of the Vancouver School District, but the District was not involved in the design, analysis, interpretation of the data, or the drafting of this manuscript; MS has been an investigator on projects funded by GlaxoSmithKline, Merck, Pfizer, Sanofi-Pasteur, Seqirus, Symvivo and VBI Vaccines. All funds have been paid to his institute, and he has not received any personal payments; Authors declare no relevant conflicts of interest.

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Variable	n [#]	Completed	n [#]	Completed
		questionnaire		serology testing
		(n=1689)		(n=1556)
Age (mean \pm SD)	1684	45.4 ± 10.4	1556	45.7 ± 10.3
Sex, % female, n (%)	1681	1355 (80.6%)	1550	1257 (81.1%)
Canadians of indigenous origin, n (%)	1688	31 (1.8%)	1555	31 (2.0%)
Ethnicity, n (%)	1689		1556	
White, Caucasian		1175 (69.6%)		1084 (69.7%)
South Asian		65 (3.9%)		57 (3.7%)
Chinese		277 (16.4%)		257 (16.5%)
Black		12 (0.7%)		12 (0.8%)
Filipino		35 (2.1%)		33 (2.1%)
Latin American		26 (1.5%)		26 (1.7%)
Arab		4 (0.2%)		3 (0.2%)
Southeast Asian		32 (1.9%)		27 (1.7%)
West Asian		1 (0.1%)		1 (0.1%)
Korean		11 (0.7%)		9 (0.6%)
Japanese		39 (2.3%)		36 (2.3%)
Other/no answer		62 (3.7%)		57 (3.7%)
Classroom workers*, n (%)	1688	1320 (78.2%)	1555	1212 (77.9%)
Contact time with students (hrs/wk, median	1684	17.6 [5.0-25.0]	1552	17.5 [4.6-25.0]
[IQR])				
School level, n (%)	1689		1556	
Elementary		1076 (63.7%)		992 (63.8%)
Secondary		474 (28.1%)		436 (28.0%)
Work at multiple levels		55 (3.3%)		48 (3.1%)
School district office only		84 (5.0%)		80 (5.1%)
No. people living in household (median [IQR])	1685	3 [2-4]	1552	3 [2-4]
No. people in household is essential worker	1671	0 [0-1]	1541	0 [0-1]
(median [IQR])				
At least one co-morbidity [¶] , n (%)	1689	409 (24.2%)	1556	379 (24.4%)
Smoker, n (%)	1686	46 (2.7%)	1553	41 (2.6%)
Travelled outside BC since Jan '20, n (%)	1687	278 (16.5%)	1554	252 (16.2%)

Table 1: Baseline characteristics of school staff sample

[#]N with data available.

* Those who reported being a Teacher, Teacher Librarian, Resource Teacher, Student Support Worker, or Family and Youth Worker in response to the question: *What is your job title? Teacher/Teacher Librarian/Resource Teacher/Student Support Worker/Family and Youth Worker/Administrator (Principal, Vice Principal)/Administrative Assistant/Maintenance Staff/School Board Office Staff/Other.*

[¶]<u>any the following:</u> hypertension, diabetes, asthma, chronic lung disease, chronic heart disease, chronic kidney disease, liver disease, cancer, chronic blood disorder, immunosuppressed, chronic neurological disorder.

Variable	n [#]	Completed CITF
		questionnaire (n=1689)
COVID-19-like symptoms*, n (%)	1688	664 (39.3%)
Number tested for COVID-19 (PCR), n (%)	1688	760 (45.0%)
At least one positive COVID-19 viral test		24 (1.4%)
More than one positive COVID-19 viral test		1 (0.01%)
All negative COVID-19 viral test		715 (42.4%)
Did not know/could not remember test result		21 (1.2%)
Hospitalized for COVID-19, n (%)	1683	3 (0.2%)
Type of occupation for essential worker living in household, n (%)	1671	619 (37.0%)
Agriculture & food production		7 (0.4%)
Community services (sewage & water treatment, waste disposal)		10 (0.6%)
Construction, maintenance, skilled trades		77 (4.6%)
Consumer products (hardware, safety, vehicle, sales, garden cent	res)	9 (0.5%)
Financial services (banking, real estate, insurance)		19 (1.1%)
Food (grocery, convenience, liquor, restaurant)		67 (4.0%)
Health care		99 (5.9%)
Social services, education, research	244 (14.6%)	
Manufacturing, resources, energy, utilities		21 (1.3%)
Services (pharmacy, gas station, delivery, funeral, vet, etc.)		13 (0.8%)
Sports (professional)		0
Supply chain & transportation		19 (1.1%)
Telecommunications & IT (including the media)		16 (1.0%)
Other		84 (5.0%)
COVID-19 case among other household members, % Yes, n (%) ^{δ}	1688	51 (3.0%)
Reported close contact with a COVID-19 case outside household	1686	363 (21.5%)
(within 2 meters and for >2 minutes), n (%)		
Another school staff member / work colleague		133 (7.9%)
Student in classroom setting	145 (8.6%)	
Family (non-household member)		46 (2.7%)
Friend		84 (5.0%)
Unknown		26 (1.5%)
Completed serology testing, n (%)	1689	1556 (92.1%)

Table 2: Reported COVID-19 exposures and PCR outcomes among school staff

[#]N with data available.

*<u>Any of the following:</u> cough, fever, shortness of breath, sore muscles, headache, sore throat, diarrhea, decrease sense of smell [specify period]. "Did you have any of the following symptoms between January 2020 and present?".

^δ"Has anyone in your household (not counting yourself) ever tested positive for COVID-19? ([Yes], [Not applicable, I live alone], [No one has been tested], [No, they tested negative], [Not sure, waiting for the result])".

Table 3: Seropositive cases according to school education level where school staff teaches/assists

School	Frequency	Percent cases
Elementary	19	54.3
Secondary	9	25.7
Multiple / mixed	3	8.57
School board office	4	11.4

Supplemental Figure 1: Seroprevalence case assignment strategy



To distinguish between antibodies due to COVID-19 versus antibody responses to vaccination, a dual, stepwise serology testing strategy was employed, where more sensitive S-based testing (using ORTHO assay) was used in unvaccinated school staff who composed the majority of our study sample, and virus-specific N-based antibody testing (using Roche assay) was used in vaccinated school staff.

*One case reported PCR positive testing had subthreshold S-based serology reactivity of 0.39.

Supplemental Figure 2: Incidence of reported COVID-19 cases (Vancouver Coastal Health) per students (n = 47,280) and staff (n = 7,071) between schools of the Vancouver School District (21 of 107 schools had zero COVID-19 cases among students and staff, and are not included in this graph).



Supplemental Table 1: Reported positive viral testing among entire Vancouver School District staff

Reporting period	Classroom staff*	Non-classroom staff**	Other school staff***	Overall
	N = 5091	N = 1408	N = 572	N = 7071
Up to and including September 9 th , 2020	7	1	1	9
Between September 10 th 2020 and March	58	18	8	84
4 th 2021 inclusive (median date of				
completion of study questionnaires)				
Between March 5 th 2020 and April 23 rd	34	8	4	46
2021				

*Teachers, Teacher Librarians, Resource Teachers, Student Support Workers, Family and Youth Workers, and Counsellors, including staff who are on call for these positions.

**Principals/VPs, Office Administrative Assistants, Facilities Staff, Building Engineers, and Custodians, including staff who are on call for these positions.

***Food services, Supervision Aides, and District staff, including staff who are on call for these positions.

Supplemental Table 2: Results of ORTHO (Spike-based) or ROCHE (N-based) serology testing, and according to self-reported viral PCR, for Spike-POSITIVE, VACCINATED cases (n=35)

Antibody detection				Self-reported	Days between	Final case
Spike	Spike	Ν	N (index)	COVID-19	vaccine and	assignment
reactivity	(index)	reactivity		PCR result?	serology	
R	4.8	NR	0.082	Not tested	16	Negative
R	73.6	NR	0.089	No	14	Negative
R	252	R	150.7	Yes	1	Positive
R	142	NR	0.088	No	24	Negative
R	69.9	R	99.09	Yes	20	Positive
R	31.1	NR	0.084	Not tested	20	Negative
R	279	NR	0.144	Not tested	15	Negative
R	27.8	NR	0.09	Not tested	15	Negative
R	13.7	NR	0.088	Not tested	56	Negative
R	47.3	NR	0.087	No	32	Negative
R	163	NR	0.089	Not reported	11	Negative
R	10.5	NR	0.091	No	2	Negative
R	2.64	NR	0.09	Not tested	17	Negative
R	15.3	NR	0.092	Not tested	16	Negative
R	285	NR	0.082	Not tested	16	Negative
R	7.95	NR	0.085	No	?	Negative
R	16.8	NR	0.086	Not tested	31	Negative
R	114	NR	0.087	Not tested	17	Negative
R	90	NR	0.082	Not tested	16	Negative
R	15.9	NR	0.096	Not tested	18	Negative
R	486	R	44.52	Yes	88	Positive
R	63.5	NR	0.09	Not tested	?	Negative
R	1.07	NR	0.093	No	14	Negative
R	3.78	NR	0.095	Not tested	20	Negative
R	20.5	NR	0.212	No	21	Negative
R	132	NR	0.088	No	57	Negative
R	20.7	NR	0.095	Not tested	20	Negative
R	147	NR	0.085	No	21	Negative
R	61.5	NR	0.093	Not tested	24	Negative
R	106	NR	0.096	Not tested	23	Negative
R	73.6	NR	0.091	Not tested	?	Negative
R	79.9	NR	0.094	No	35	Negative
R	2.47	NR	0.095	Not tested	16	Negative
R	9.71	NR	0.098	No	15	Negative
R	8.56	NR	0.094	Not tested	28	Negative

R: reactive; NR: non-reactive; the only 3 vaccinated staff that tested positive by both S- and N-based assays also reported a history of COVID-19 by positive PCR viral test, and none of the vaccinated school staff who tested negative by the N-based serology assay reported a positive PCR viral test. All spike (S)-reactive cases were contacted by phone or email to confirm the date they received a COVID-19 vaccine between the date of survey completion and blood sampling. Three participants indicated that they had received a COVID-19 vaccine, but omitted to indicate the date in the questionnaire or email response.

Supplemental Table 3: Results of ORTHO (Spike-based) or ROCHE (N-based) serology testing, and according to self-reported viral PCR, for seropositive, **INFECTED** cases (n=35)

Antibody detection		Self-reported	Time between	Vaccinated? [days		
Spike	Spike	Ν	Ν	COVID-19	PCR test and	between vaccine
reactivity	(index)	reactivity	(index)	PCR result?	serology	and serology]
R	6.2	R	1.44	Yes	2 months	No
R	224	R	57.99	Not tested	-	No
R	129	R	5.99	Not tested	-	No
R	112	R	127	Yes	1.9 month	No
R	226	R	125.3	Yes	3.2 months	No
R	433	R	64.64	Not tested	-	No
R	270	R	166.7	Yes	2.5 months	No
R	8.73	NR	0.483	Yes	3 weeks	No
R	272	R	6.41	Yes	3 months	No
R	3.22	NR	0.074	Not tested	-	No
NR	0.39	R	8.61	Yes	11.25 months	No
R	445	R	2.84	No	-	No
R	242	R	1.99	Not tested	-	No
R	52.4	R	4.58	Yes	5.5 months	No
R	138	NR	0.564	Not tested	-	No
R	318	R	42.54	Not tested	-	No
R	2.27	R	117.6	Yes	2.75 months	No
R	562	R	28.92	Yes	~7 months	No
R	216	R	119.3	Yes	2.3 months	No
R	381	R	193.3	Not tested	-	No
R	142	R	11.03	Yes	1.5 month	No
R	331	R	3.54	Not tested	-	No
R	69.7	R	16.88	Not tested	-	No
R	252	R	150.7	Yes	2 months + 6 days	Yes [1]
R	69.9	R	99.09	Yes	4.25 months	Yes [20]
R	4.44	R	4.26	Not tested	-	No
R	45.1	R	4.22	Not tested	-	No
R	581	R	44.07	Yes	1 year + 2 weeks	No
R	503	R	45.95	Yes	6.75 months	No
R	10.3	R	1.01	Yes	2.75 months	No
R	211	R	130.5	Yes	1.84 month	No
R	310	R	80.05	Yes	4.5 months	No
R	224	R	15.64	Not tested	-	No
R	327	R	57.04	Yes	4 months $+ 2$ days	No
R	486	R	44.52	Yes	3.75 months	Yes [8]

R: reactive; NR: non-reactive; One school staff who tested positive for COVID-19 by PCR viral test tested negative by serology ~5 months later both by S- and N-based assays. Another who reported a positive PCR test did not complete the serology testing.

SUPPLEMENTAL DATA: Matching scheme of school workers with Canadian blood donors

1537 observations were matched from school workers, with 24 missing postcode, 6 missing sex.

In January, seroprevalence data were available from 4910 adults in the lower mainland of British Columbia west of Kamloops and Kelowna.

A multiple step procedure aiming for 1:2 matching was employed as shown below.

		Seropositive Canadian			
			blood donors N (%)		
Matching criteria	Number of school	Number of	Roche N,	Roche S,	
	staff with 2 matched	matched blood	N (%)	N (%)	
	donors found	donors			
Age \pm 2 years, same sex, and first	671	1342			
two digits of postal code					
Age ± 2 years and same sex	429	858			
Age \pm 5 years and same sex	18	36			
Age \pm 10 years and same sex	63	126			
Age \pm 15 years and same sex	70	140			
Total	1251	2502	51	51*	
			(2.03%)	(2.03%)	

*23 vaccinated, S-based assay positive, N-based assay-negative were moved to negative group.

APPENDIX 1: COVID-19 mitigations measures in Vancouver schools (2020/21 school year)

Prior to reopening, the District implemented COVID-19 safety plans consistent with the British Columbia Centre for Disease Control (BCCDC) COVID-19 Public Health Guidance for K-12 School Settings: <u>http://www.bccdc.ca/Health-Info-Site/Documents/COVID_public_guidance/Guidance-k-12-schools.pdf</u>. and Provincial COVID-19 Health & Safety Guidelines for K-12 Settings: <u>https://www2.gov.bc.ca/assets/gov/education/administration/kindergarten-to-grade-12/safe-caring-orderly/k-12-covid-19-health-safety-guidlines.pdf</u> with support from Public Health.

COVID-19 safety plans included public health measures (e.g., protocols for testing and contact tracing), environmental measures (e.g., maximization of distance in classrooms, enhanced cleaning and disinfection, improved fresh air intake), administrative measures (e.g., staggered scheduling, assigning students and staff cohorts), personal measures (e.g., daily symptom checks, physical distancing, hand hygiene, respiratory etiquette), and personal protective equipment.

At the beginning of the school year (late August/September), parents were given the option of: 1) full time in-person schooling, 2) home schooling, 3) online learning and 4) a temporary online learning with return to full time schooling with re-entry dates offered later in fall and in January 2021.

Daily health assessments were required by all staff and students (via parents) prior to arriving at school and again upon arrival. Anyone with even minor symptoms of cold or flu-like illness was to stay home or go home if these symptoms developed mid-day. Classrooms and other spaces were arranged to maximize distance between students and staff. Class sizes were set by grades: 20 students / class for kindergarten; 22 for grades 1 to 3; 30 for grades 4 to 12. School staff and their students were assigned specific classrooms which were between 75 m² – 83 m² for elementary students (K to grade 7) and 75 m² – 80 m² for secondary students (grades 8 to 12) with larger spaces available for elective courses (e.g., physical education, food studies, metal, woodworking, automotive). In addition, secondary classrooms were divided into two separate groupings (AM and PM) of 15 students.

The plan also included revising school schedules and learning groups where students also had staggered recess and lunch breaks, and were assigned specific outside areas. Elementary students (K-7) received full day in-class instruction in their assigned learning groups/cohorts. Secondary students (grades 8 to 12) had both in-class instruction and remote learning and their schedules shifted to a quarter system with maximum two in-person classes a day with further instruction given remotely.

Ventilation measures included opening windows to promote fresh air flow to classrooms as well as indoor air ventilation improved with the HVAC systems running longer during the day, recirculating less air and the filters changed to higher efficiency (MERV13) filters.

Other measures included, the addition of hand sanitizer to classrooms and common areas, directional traffic flow within the school, provision of plexiglass as needed for certain staff roles, and the training of all staff on the safety plan and protocols. In addition to the regular daily cleaning by custodial staff, twice daily disinfection of all high touch frequency items was conducted. Shared items in classrooms were limited and the teachers, or if in secondary school, the students disinfected those used. Initially, masking was encouraged, but not required. Non-medical mask use was encouraged but not required early in the school year, and then in February 2021 masks were required for all staff and students in grades 6-12 in common spaces, and ultimately from April onward for students grades 4-12 at all times while indoors at school. This guidance did not apply if staff or students did not tolerate a mask for health or behavioural

reasons. Masks remained recommended for K-3 students. Two reusable cloth masks were distributed to all staff and students in September 2020 and again in January 2021.

SARS-CoV-2 nucleic acid amplification (PCR) was available for anyone with symptoms through the provincial health system, and advised for students or staff with fever or new symptoms which persisted for over 24 hours. Tests were generally processed within 24 hours, and positive tests were automatically reported to Public Health which investigated cases within 24 hours, and initiated contact tracing. Symptomatic close contacts were asked to seek testing; asymptomatic testing was not used to release contacts from isolation on an earlier timeline. All close contacts, including close contacts at school, were isolated for at least 14 full days. Entire classes were not isolated unless all members were identified as close contacts. School closures to control transmission were not required during the study period. Also, at the time, vaccination programs had not substantially reached working-age people until April 14, and the majority of school staff vaccinations occurred in May.

TAB 14

Morbidity and Mortality Weekly Report

Clusters of SARS-CoV-2 Infection Among Elementary School Educators and Students in One School District — Georgia, December 2020–January 2021

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In-person learning benefits children and communities (1). Understanding the context in which transmission of SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19), occurs in schools is critical to improving the safety of inperson learning. During December 1, 2020-January 22, 2021, Cobb and Douglas Public Health (CDPH), the Georgia Department of Public Health (GDPH), and CDC investigated SARS-CoV-2 transmission in eight public elementary schools in a single school district. COVID-19 cases* among educators and students were either self-reported or identified by local public health officials. Close contacts (contacts)[†] of persons with a COVID-19 case received testing. Among contacts who received positive test results, public health investigators assessed epidemiologic links, probable transmission directionality, and the likelihood of in-school transmission.§ Nine clusters of three or more epidemiologically linked COVID-19 cases were identified involving 13 educators and 32 students at six of the eight elementary schools. Two clusters involved probable educator-to-educator transmission that was followed by educator-to-student transmission and resulted in approximately one half (15 of 31) of school-associated cases. Sixty-nine household members of persons with schoolassociated cases were tested, and 18 (26%) received positive results. All nine transmission clusters involved less than ideal physical distancing, and five involved inadequate mask use

by students. Educators were central to in-school transmission networks. Multifaceted mitigation measures in schools, including promotion of COVID-19 precautions outside of school, minimizing in-person adult interactions at school, and ensuring universal and correct mask use and physical distancing among educators and students when in-person interaction is unavoidable, are important in preventing in-school transmission of SARS-CoV-2. Although not required for reopening schools, COVID-19 vaccination should be considered as an additional mitigation measure to be added when available.

During the investigation period, which included 24 inperson school days during December 1, 2020–January 22, 2021, approximately 2,600 students (approximately 80% of the district's elementary school students) and 700 staff members attended elementary school in person. During this period, COVID-19 incidence (7-day moving average number of cases per 100,000 persons) in Cobb County, Georgia, increased almost 300%, from 152 to 577 cases. COVID-19 cases among educators and students attending in-person school were either self-reported to the school district or identified by local public health officials through laboratory results. Contacts who were exposed to persons with COVID-19 in school were identified by school officials, advised to quarantine based on local health department guidelines,** and referred to the investigation team.

Reverse transcription–polymerase chain reaction (RT-PCR) testing^{††} of anterior nasal swab specimens was offered free of charge to all contacts who were exposed in school, within 5–10 days of their last documented in-school exposure; 60% of identified contacts received testing, and 40% either declined testing or could not be reached. Semistructured

^{*}A COVID-19 case was defined as a positive SARS-CoV-2 reverse transcription– polymerase chain reaction or antigen test result in a person who attended school in person.

[†]Close contacts were defined as persons exposed to an index patient at school within 6 ft for >15 minutes per day during a 24-hour period while the index patient was infectious (48 hours before to 10 days after symptom onset or, if asymptomatic, 48 hours before to 10 days after specimen collection).

[§] To be classified as having a school-associated COVID-19 case, a person had to meet three criteria: 1) the timing of symptom onset (if symptoms were present) and testing must have been consistent with acquisition of SARS-CoV-2 infection from the index patient or a person with a school-associated case in the school setting based on the known incubation period, 2) the person must have had close contact at school with the school index patient or another person with a school-associated case according to GDPH guidelines and during that patient's infectious period, and 3) the person must nave had known community or household contact with anyone with confirmed COVID-19 in the 2 weeks before receiving a positive test result, including with the index patient or another person with a school-associated case outside of school.

Incidence was calculated as a 7-day moving average per 100,000 persons and included persons with SARS-CoV-2 infection confirmed by reverse transcription–polymerase chain reaction or antigen testing.

^{**} Students and staff members exposed to a COVID-19 patient were advised to quarantine for a minimum of 7 days if a specimen collected ≥5 days after exposure was negative for SARS-CoV-2 and they remained asymptomatic or for 10 days if they were not tested and remained asymptomatic. Persons with positive SARS-CoV-2 test results were advised to self-isolate for a minimum of 10 days after their positive test date or date of first symptom onset. https:// dph.georgia.gov/contact; https://dph.georgia.gov/isolation-contact (accessed February 17, 2021)

^{††} Testing was performed at the Georgia Public Health Laboratory using the PerkinElmer COVID assay (Extraction-Chemagic, PCR-7500FastDx).

virtual interviews with parents, educators, and principals were conducted to characterize the settings in which transmission likely occurred. Interviews included a review of symptom onset dates; possible exposures to persons with COVID-19 outside of school; and information on seating charts, classroom layouts, physical distancing, and compliance with recommended mask use during specific classroom interactions. Public health investigators visited four of six schools where SARS-CoV-2 transmission had been identified to observe adherence to recommended mitigation strategies and provide technical assistance. For contacts who received positive test results, epidemiologic links, probable transmission directionality, and the likelihood of in-school transmission were assessed by using interview data, testing dates, and symptom onset dates. Clusters were defined as epidemiologic links between an index patient and two or more persons who likely acquired SARS-CoV-2 infection in school (i.e., school-associated cases). Two contacts with positive test results were excluded because they likely acquired SARS-CoV-2 from household members outside of school. Household members of persons with school-associated cases were offered free RT-PCR testing. This activity was reviewed by CDPH, GDPH, and CDC and was conducted consistent with applicable Georgia law, federal law, and CDC policy.§§

During the investigation period, nine clusters of COVID-19 cases were identified, involving 13 educators and 32 students at six of the eight investigated elementary schools (Figure). The median cluster size, including household members, was six persons (range = 3-16). An educator was the index patient in four clusters (B, E, F, and I), a student was the index patient in one cluster (H), and in four clusters (A, C, D, and G), whether the index patient was the student, the educator, or both (i.e., two index cases occurred) could not be determined. Eight clusters (all except H) involved at least one educator and probable educator-to-student transmission. Four clusters (A, D, G, and H) involved probable student-to-student transmission, and three (A, C, and D) involved probable student-toeducator transmission. Two clusters (F and I) involved probable educator-to-educator transmission during in-person meetings or lunches, which was followed by educator-to-student transmission in the classroom and resulted in 15 of 31 (48%) school-associated cases. Sixty-nine household members of persons with school-associated cases were tested, and 18 (26%) received positive results.

Public health investigators identified several COVID-19 mitigation challenges. Although plastic dividers were placed on desks between students, students sat <3 ft apart. Physical distancing of >6 ft was not possible because of the high number







^{*} The presence of two index cases within a cluster indicates that the index patient could not be determined or that two index patients might have occurred. Arrows indicate epidemiologic links between cases and probable transmission direction, determined by in-depth interviews of persons with cases, exposures outside of school, and symptom onset data.

of in-person students and classroom layouts. In seven clusters (A, B, C, D, E, F, and I), transmission among educators and students might have occurred during small group instruction sessions in which educators worked in close proximity to students. The school district mandated in-classroom mask use except while eating, and both reported and observed compliance during site visits was high. However, information obtained during interviews indicated that specific instances involving lack of or inadequate mask use by students likely contributed to spread in five clusters (A, C, E, G, and I). Students ate lunch in their classrooms, which might have facilitated spread. Opportunities to decrease nonessential in-person interactions among staff members during lesson planning and lunches were noted.

Discussion

These findings suggest that educators can play an important role in in-school transmission and that in-school transmission can occur when physical distancing and mask compliance

Summary

What is already known about this topic?

In-person learning provides important benefits to children and communities. Understanding SARS-CoV-2 transmission in schools is critical to improving the safety of in-person learning.

What is added by this report?

An investigation of SARS-CoV-2 transmission in a Georgia school district during December 1, 2020–January 22, 2021, identified nine clusters of COVID-19 cases involving 13 educators and 32 students at six elementary schools. Two clusters involved probable educator-to-educator transmission that was followed by educator-to-student transmission in classrooms and resulted in approximately one half (15 of 31) of school-associated cases.

What are the implications for public health practice?

Educators might play a central role in in-school transmission networks. Preventing SARS-CoV-2 infections through multifaceted school mitigation measures and COVID-19 vaccination of educators is a critical component of preventing in-school transmission.

are not optimal. Previous investigations in other U.S. school districts found that low transmission rates in schools can be maintained in the setting of high community incidence (2,3). To ensure safer in-person learning during the COVID-19 pandemic, schools should implement multicomponent mitigation strategies, including efforts to prevent infection among educators, and promoting consistent, correct mask use and physical distancing wherever possible, especially during mealtime when masks are not being worn.

The finding that educators play an important role in inschool transmission is consistent with findings from other investigations. A large prospective study of SARS-CoV-2 transmission in schools in the United Kingdom found that the most common type of transmission event was from educator to educator (4); in another large prospective study of transmission in German schools, in-school transmission rates were three times higher when the index case occurred in an educator than when the index case occurred in a student.⁵⁵ Measures to prevent SARS-CoV-2 infection among educators, including promotion of COVID-19 precautions outside of school, minimizing in-person adult interactions at school, ensuring mask compliance and physical distancing among educators when in-person interaction is unavoidable, and COVID-19 vaccination, when available, will likely reduce in-school transmission, particularly if implemented in a multifaceted approach. Messaging to improve awareness among educators about the risk for acquiring SARS-CoV-2 infections from colleagues in addition to students is needed. The school district has already implemented many of these measures, including administrative changes to prevent nonessential in-person interactions among educators.

The findings in this report are subject to at least three limitations. First, distinguishing in-school transmission from community transmission was challenging, particularly when the 7-day community incidence exceeded 150 cases per 100,000 persons and was increasing. Second, certain clusters and cases within clusters might not have been detected because not all contacts received testing. Finally, because adults with SARS-CoV-2 infection are more likely to have symptoms and be tested (5), index cases might have been more frequently identified in educators than in students, possibly resulting in missed instances of student-to-student and student-to-educator transmission.

Consistent with findings from international studies, this report found that initial infections among educators played a substantial role in in-school SARS-CoV-2 transmission and subsequent chains of infection to other educators, students, and households, highlighting the importance of preventing infections among educators in particular. Preventing SARS-CoV-2 infections in educators and students through multifaceted school mitigation measures is a critical component of preventing in-school transmission. Although not a requirement for reopening schools, adding COVID-19 vaccination for educators as an additional mitigation measure, when available, might serve several important functions, including protecting educators at risk for severe COVID-19-associated illness (6), potentially reducing in-school SARS-CoV-2 transmission, and minimizing interruptions to in-person learning, all of which have important implications for educational equity and community health. Because most children are not yet eligible for vaccination, continued implementation of multifaceted COVID-19 mitigation strategies in schools, including universal and correct mask use and physical distancing, even after educators are vaccinated, will be critical given the limited available evidence on reduction of transmission postvaccination and vaccine-related long-term protection (7).

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^{\$\$} https://www.medrxiv.org/content/10.1101/2021.02.04.21250670v1

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TAB 15


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Research paper

A cross-sectional and prospective cohort study of the role of schools in the SARS-CoV-2 second wave in Italy

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ABSTRACT

Background: During COVID-19 pandemic, school closure has been mandated in analogy to its effect against influenza, but it is unclear whether schools are early COVID-19 amplifiers.

Methods: We performed a cross-sectional and prospective cohort study in Italy during the second COVID-19 wave (from September 30, 2020 until at least February 28, 2021). We used databases from the Italian Ministry of Education, the Veneto region systems of SARS-CoV-2 cases notification and of schools' secondary cases tracing to compare SARS-CoV-2 incidence in students/school staff and general population and incidence across age groups. Number of tests, secondary infections by type of index case and ratio cases/ tests per school were estimated using an adjusted multivariable generalized linear regression model. Regional reproduction numbers R_t were estimated from Italian Civil Protection daily incidence data with a method of posterior distribution using a Markov Chain Monte Carlo algorithm.

Findings: SARS-CoV-2 incidence among students was lower than in the general population. Secondary infections at school were <1%, and clusters of \geq 2 secondary cases occurred in 5–7% of the analysed schools. Incidence among teachers was comparable to the population of similar age (*P* = 0.23). Secondary infections among teachers were rare, occurring more frequently when the index case was a teacher than a student (37% vs. 10%, *P* = 0.007). Before and around the date of school opening in Veneto, SARS-CoV-2 incidence grew maximally in 20–29- and 45–49-years old individuals, not among students. The lag between school opening dates in Italian regions and the increase in the regional COVID-19 Rt was not uniform. Finally, school closures in two regions where they were implemented before other measures did not affect Rt decrease.

Interpretation: This analysis does not support a role for school opening as a driver of the second COVID-19 wave in Italy, a large European country with high SARS-CoV-2 incidence.

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1. Introduction

School closures represent a widespread nonpharmacological intervention (NPI) in the context of the current Coronavirus Disease 2019 (COVID-19) pandemic. In Italy, schools have been closed for half of the 2019–2020 school year and, during the

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second COVID-19 wave, high schools have been closed again, students switching to "integrated digital learning" nationwide since November 6, 2020. The rationale for such a NPI has mostly been drawn from the reported beneficial effect of school closure during influenza pandemics [1], even if the debate was still open [2]. However, while children's immune system is naïve to influenza antigens, making them a known reservoir of influenza infection, they do not appear to be as affected by COVID-19 as adults, representing a small fraction of documented COVID-19 cases. Like SARS-CoV and MERS-CoV, SARS-CoV-2 indeed affects children less, causing fewer symptoms, a less severe disease and much lower case-fatality rates [3-5].

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Research in context

Evidence before this study

The role of schools and at large of children as amplifiers of the COVID-19 pandemics was debated. Despite biological and epidemiological evidence that children play a marginal role in SARS-CoV-2 spread, policies of school closures have been predicated, mostly based on the temporal coincidence between school reopening in certain countries and COVID-19 outbreaks. Whether schools contributed to the so called "second COVID-19 wave" was uncertain. Italy's regional calendar of school reopening and databases of positivity at school allowed to estimate the impact of schools on the increase of SARS-CoV-2 incidence that occurred in autumn 2020.

Added value of this study

We found that incidence among students was lower than in the general population and that incidence among teachers was comparable to that among individuals of the same age bracket. Moreover, secondary infections and clusters at school were rare. When the secondary case was a teacher, the index case was more frequently a teacher than a student. In Veneto Region, during the first phase of the second wave, incidence among school age individuals was low as opposed to the sustained incidence among individuals of 45-49 years. Finally, the time lag between school opening and Rt increase was not uniform across Italian regions with different school opening dates, with lag times shorter in regions where schools opened later. Thus, SARS-CoV-2 infections rarely occur at school and transmission from students to teachers is infrequent. Moreover, a role for school age individuals and school openings as a driver of the COVID-19 second wave is not supported.

Implications of the available evidence

Our findings could inform policy initiatives of school openings during the current COVID-19 pandemic.

Several biological factors might contribute to the reduced COVID-19 risk in children: first, children express significantly fewer ACE2 receptors - the entry point of SARS-CoV-2 into human cells - compared to adults [6]: second, they are commonly exposed to other seasonal coronaviruses and develop both humoral and cellular crossimmunity [7]. Children appear therefore less susceptible to the infection, and when infected may have a preformed arsenal of neutralizing cross-reactive antibodies that might reduce the likelihood of transmitting the virus. This biological evidence is mirrored in several epidemiological studies. A meta-analysis of 32 studies from different countries suggests that children are less susceptible to SARS-CoV-2 infection compared with adults [8]. An age-structured mathematical model applied to epidemic data from China, Italy, Japan, Singapore, Canada and South Korea estimates that individuals younger than 20 years of age display half the chance of being infected than adults [9]. In the context of households (the most common route of secondary infection), chances of transmission from children to adults are low and the spread seldom starts from children. In a large study including 15,771 children (age 1-18) living in Germany, almost twothirds of children living with virus-positive family members were negative for SARS-CoV-2 antibodies and virus tests, suggesting that transmission to children is infrequent [10]. The child represented the index case in only three families (9.7%) among 31 household transmission chains that involved children in China, Singapore, USA,

Vietnam, and South Korea [11]. In a meta-analysis of all contact-tracing studies up to May 16 2020, children were 56% less susceptible to SARS-CoV-2 than adults [Pooled OR=0.44 (95%CI 0.29, 0.69)] [8]. In the Italian town of Vo' Euganeo, where 70% of the population was screened twice and 2.6% of the population resulted positive, no child below 10 years of age was found positive, even if these children lived in the same household with a positive individual [12]. In a large cohort study on 12 million people in the UK, the risk of infecting and becoming infected with SARS-COV-2 grew with age [13]. In the same study, risk of contracting SARS-CoV-2 for >9 million adults living with children up to 11 years of age was not higher than that of the rest of the population. The risk increased slightly for those who lived with adolescents aged 12 to 18, but this risk did not correspond to a greater lethality in case of infection. Indeed, there was no significant effect of the school closure on the epidemic trend in the families analysed, when compared to the rest of the population [13].

Despite evidence indicating a marginal role for children in COVID-19 pandemic, school openings (or re-openings) have been considered as potential drivers of surges of cases in the general population [14]. This concept has been based on clinical, epidemiological, modeling studies and by systematic reviews that however show conflicting results on whether school closures efficaciously curtailed the incidence of infection [15, 16]. Adolescents were reported to spread the virus as likely as adults [17], and in one study, levels of SARS-CoV-2 genetic material in the upper respiratory tract of children <5 year old with mild to moderate COVID-19 were higher than in children 6-17 year old and adults [18]. Furthermore, in a COVID-19 outbreak at a summer camp in Georgia, children of all ages were found to be highly susceptible to infection: 51% of the 6-10 years old campers tested positive, as did 44% of those aged 11 to 17 [19]. In Israel, schools fully reopened on May 17, 2020 and ten days later a major outbreak of COVID-19 occurred in a high school; temporal correlation between school openings and the second wave was interpreted as a causal link [20]. By extension, policymakers (as well as the lay public) attribute to school openings a key role in amplifying infection rates in the general population [14]. This opinion is particularly widespread in Italy, where schools remained closed from February 25, 2020 in Northern Italian regions (from March 9, 2020 nationwide) until September, when they reopened in different days across the 20 different Italian regions and two autonomous Provinces.

According to the Italian National Statistical Institute (ISTAT), 9,150,518 students attended the different school cycles in 2019 in Italy. These cycles include kindergarten (scuola dell'infanzia, attended by 3-5 years old children), elementary (scuola primaria attended by 6-10 years old children), middle (scuola secondaria di primo grado attended by 11-13 years old children) and high school (scuola secondaria di secondo grado attended by 14-18 years old children). Education is compulsory from 6 to 16 years of age. Pre-elementary school education that includes kindergarten as well as nurseries (asili nido, attended by children 0-2 years old) is not compulsory. On average, students represented 15% of the population of each of the 20 Italian regions and two autonomous Provinces (range: 10.7%-19%; Table 1). In 2020, while kindergartens and nurseries started nationwide on September 1st, the calendarized opening day of all other schools differed among regions. In most regions, schools started on September 14; in a second group of regions, schools opened on September 24; in two other regions, on September 16 or 22 (Table 2). The Italian Government mandated a protocol to minimize risk of COVID-19 diffusion that followed most of the strictest recommendations [21]. Measures included non-compulsory temperature control and hand hygiene at the school entrance; unidirectional flows of students; mask mandate for all personnel and students in common areas and for high school students also when seated at their desks (and always for teachers, combined with face-shields in certain settings; this mask mandate was then extended to students also when seated starting from November 6, 2020), compulsory 1 m seat to seat distance, frequent

Table 1

Demographics of Italian Regions and autonomous Provinces. Data are from the National Statistical Institute (ISTAT). In Italy, elementary school starts at 6, middle school at 11, high school at 14 years of age.

Region	Population	Preschool stu	idents (%)	Elementary school students (%)		Middle school students (%)		High school students (%)		Students/ population (%)
Abruzzo	1,305,770	48,397	3.7%	55,893	4.3%	34,881	2.7%	58,308	4.5%	15.1%
Apulia	4,008,296	181,674	4.5%	178,761	4.5%	115,152	2.9%	205,348	5.1%	17.0%
Basilicata	556,934	19,710	3.5%	14,110	2.5%	14,696	2.6%	26,640	4.8%	13.5%
Bolzano	532,080	27,742	5.2%	27,592	5.2%	17,097	3.2%	28,846	5.4%	19.0%
Calabria	1,924,701	80,534	4.2%	85,450	4.4%	54,642	2.8%	77,850	4.0%	15.5%
Campania	5,785,861	254,097	4.4%	232,042	4.0%	183,729	3.2%	324,049	5.6%	17.2%
Emilia-Romagna	4,467,118	207,566	4.6%	203,083	4.5%	87,735	2.0%	200,680	4.5%	15.6%
Friuli-Venezia Giulia	1,211,357	34,169	2.8%	50,546	4.2%	22,584	1.9%	43,230	3.6%	12.4%
Lazio	5,865,544	239,656	4.1%	223,071	3.8%	168,949	2.9%	270,075	4.6%	15.4%
Liguria	1,543,127	59,214	3.8%	48,338	3.1%	38,327	2.5%	64,141	4.2%	13.6%
Lombardy	10,103,969	256,204	2.5%	475,220	4.7%	208,087	2.1%	477,029	4.7%	14.0%
Marche	1,518,400	66,271	4.4%	66,740	4.4%	29,095	1.9%	68,507	4.5%	15.2%
Molise	302,265	12,214	4.0%	11,544	3.8%	7484	2.5%	10,903	3.6%	13.9%
Piedmont	4,341,375	137,009	3.2%	151,981	3.5%	117,142	2.7%	156,974	3.6%	13.0%
Sardinia	1,630,474	51,318	3.1%	63,957	3.9%	40,501	2.5%	19,189	1.2%	10.7%
Sicily	4,968,410	247,970	5.0%	190,547	3.8%	147,430	3.0%	259,111	5.2%	17.0%
Tuscany	3,722,729	135,146	3.6%	130,853	3.5%	101,638	2.7%	135,178	3.6%	13.5%
Trento	542,739	19,206	3.5%	26,771	4.9%	16,483	3.0%	27,833	5.1%	16.6%
Umbria	880,285	37,363	4.2%	31,048	3.5%	24,520	2.8%	39,075	4.4%	15.0%
Valle D'Aosta	125,501	4647	3.7%	5740	4.6%	3662	2.9%	4758	3.8%	15.0%
Veneto	4,907,704	225,722	4.6%	223,780	4.6%	142,348	2.9%	233,716	4.8%	16.8%
Italy	60,244,639	2345,829	4%	2497,067	4%	1576,182	3%	2731,440	5%	15%

classroom natural ventilation, ban or reduction of school sports and music, reduced duration of school hours and reduced school duration [22]. In case staff members are diagnosed as COVID-19 positive, they must promptly inform the school Principal. Similarly, parents must promptly report to the schools any case of COVID-19 positivity in their children, and Principals must coordinate with local units of the National Health System to perform secondary screenings among staff/students, or to mandate guarantine for 14 days with a swab to all quarantined students/personnel before re-admitting them to the school premises. From October 13, 2020 quarantine was reduced to 10 days with a negative swab or remained of 14 days if a swab was not performed. Notwithstanding these rules, school opening has been accounted as the driver of the second COVID-19 wave by the popular press, as well as by opinion makers and their closure has been predicated by several data analysts [14]. Consequently, high schools nationwide and, in certain regions, the second and third year of middle schools have been closed since November 6. In other regions (Campania and Apulia), closure of all schools including elementary and kindergarten has been mandated since October 16 and 30, respectively. In Lombardy, high schools have been closed since October 26. However, whether school openings played a crucial role in the second wave of COVID-19 infections remains to be ascertained. Italy was in a privileged position to investigate this possibility: school calendars are regional and starting dates are staggered among different regions by up to 17 days.

The aims of this study were to investigate the overall incidence of SARS-CoV-2 infection among students and teachers, as well as whether there was an association between the increase in transmissibility of SARS-CoV-2 (measured as reproduction number R_t) and dates of school openings in different Italian Regions. We also estimated the incidence of SARS-CoV-2 by age in Veneto and the incidence of SARS-CoV-2 positive students, teachers, and non-teaching staff members in public and private schools in two weeks between the end of November and beginning of December in the Italian regions. We calculated the rate of secondary infections per number of swab tests and frequency of clusters identified during contact tracing activity in a large sample of Italian Schools. We also estimated the frequency of secondary infections in teachers by type of index case (student, teacher, or non-teaching staff member).

2. Methods

2.1. Study design

This was a cross-sectional and prospective cohort study. The cross-sectional cohort study [23] was designed to compare incidence of COVID-19 among students and teaching and non-teaching school staff versus that in the general population. We used the following cohorts: students, teachers, non-teaching school staff and general population, stratified by class of age where indicated. In these

	~
Table	2

Dates of School opening in the 21 Italian Regions and autonomous Provinces (Trento and Bolzano).

School Opening	Sept. 7	Sept. 14	Sept. 16	Sept. 22	Sept. 24
Region/Autonomous Province	Bolzano	Emilia-Romagna Lazio Liguria Lombardy Marche Molise Piedmont Sicily Tuscany Trento Umbria Valle D'Aosta Veneto	Friuli Venezia Giulia	Sardinia	Abruzzo Apulia Basilicata Calabria Campania

cohorts, we calculated SARS-CoV-2 incidence in the September 12 to November 8, 2020 period.

The prospective cohort studies were designed to address four questions: (i) whether concomitant to school opening COVID-19 incidence increased earlier among students than in the general population; (ii) whether COVID-19 positive students or school staff (teaching and non-teaching) resulted in COVID-19 outbreaks in schools; (iii) whether secondary cases in school settings were predominantly associated with student index cases; (iv) whether the increase in regional SARS-CoV-2 reproduction number Rt followed the different school opening dates at a constant time interval. As for the first question, we stratified incidence of newly reported COVID-19 cases for age from August 28 to October 24, 2020 by analysing datasets extracted from the Veneto Region system of SARS-CoV-2 cases notification. As for the second question, we analysed data collected by the Italian Ministry of Education (Ministero dell'Istruzione -MI) from contact tracing in monitored schools from November 23 to December 5, 2020. As for the third question, we extracted information from the province of Verona (Veneto Region) database of secondary infections among students, teachers, and non-teaching staff in 339 schools in the November 25 to December 21, 2020 period. Last, as for the fourth question, we calculated the transmission number R_t, in each Italian region from the new daily cases in the period August 6 to December 2, 2020.

2.2. Databases

2.2.1. Calculation of SARS-CoV-2 incidence among students, school staff and general population

For the calculation of incidence among students and teaching and non-teaching staff, we accessed data collected within the comprehensive, national reporting system put in place by MI. This database gathers information from school Principals every week for each comprehensive private and state institute and contains the number of new positive SARS-CoV-2 cases per school per week (Monday to Sunday) from September 12 (two days before school openings in most regions) to November 8, 2020. This database reports the incidence in the first (kindergarten, elementary and middle school) and second cycle of education (high school) by region. Data (available as supplementary material) were retrieved from 7976 public school institutes (97% of total), accounting for 7,376,698 students, 775,451 teachers and 206,120 non-teaching staff members. We also analysed data of SARS-CoV-2 incidence in schools in the period 23-28 November 2020 in a sample of 6827 public institutes (81.6% of the total) and 7035 private institutes (55.6% of the total institutes). SARS-CoV-2 incidence rates were calculated irrespective of whether the infection was acquired within or outside the educational setting. Attendance denominators for educational settings were obtained from the MI open database (https://dati.istruzione.it/opendata/ accessed on December 3, 2020). For incidence rates calculations, denominators were drawn from MI enrolment figures.

To calculate regional SARS-CoV-2 incidence, we used the public national database of COVID-19 positivity determined as SARS-CoV-2 RT-PCR swab positivity and available at https://github.com/pcm-dpc/COVID-19 (accessed on December 3, 2020), from September 12 to November 8, 2020. Regional population was estimated from the Office for National Statistics (Istituto Nazionale di Statistica, ISTAT, http://demo.istat.it/ accessed on December 3, 2020).

2.2.2. Calculation of SARS-CoV-2 incidence in Veneto region students and general population

We used datasets extracted from the Veneto Region system of SARS-CoV-2 cases notification. We stratified incidence of newly reported COVID-19 cases for age from August 28 to October 24, 2020, when overall COVID-19 incidence in Veneto increased from $\sim 2/10,000$ to $\sim 35/10,000$. We stratified incidence of newly reported

COVID-19 cases for age by using the classic demographic brackets (we used one single group of 75+ years old individuals as we did not find differences in incidence in groups above age 75) and calculated daily incidence of newly reported cases in these age categories. Denominators were from ISTAT, http://demo.istat.it/ (accessed on December 3, 2020).

2.2.3. Analysis of contact tracing

We analysed data collected by MI from contact tracing in the monitored schools (from November 23 to December 5, 2020). Information was retrieved from 5971 (45%) public and private institutes in the week 23-28 November 2020, and 7035 (55.6%) institutes in the week 30 November-5 December 2020, accounting for 423,516 and 496,289 students in the first and second week, respectively. For outbreaks, direction of transmission from the index case to secondary cases was inferred based on the date of symptom onset for symptomatic individuals and date of testing for asymptomatic individuals. We evaluated associations between event measures in educational settings, regional COVID-19 incidence, and other regional characteristics to identify possible predictors for cases and outbreaks. When Institutes suspect or identify a case or outbreak of COVID-19, they must inform the Department of Prevention of the local unit (AULSS) of the National Health System responsible for contact tracing and the MI. AULSS then performs risk assessment and decides on any additional investigation and infection control measure, based on factors such as the number of new positive subjects, disease severity, and potential of transmission at school. AULSS records each event in an online national database of public health management. MI and AULSS have legal permission to process these information (https://istruzioneve neto.gov.it/wp-content/uploads/2020/10/Informativa-sul-tratta mento-dei-dati-Test-screening.pdf).

To determine whether secondary cases in school settings were predominantly associated with student index cases, we extracted information regarding secondary infections among students, teachers, and non-teaching staff in 339 schools in the province of Verona (Veneto Region) from November 25 to December 21, by type of index case.

2.2.4. Calculation of SARS-CoV-2 transmission number R_t

To calculate the regional transmission number R_t , new daily SARS-CoV-2 cases in the period August 6 to December 2, 2020 were retrieved from the database of the Italian Civil Protection (https://github.com/pcm-dpc/COVID-19). The period August 6 to December 2, 2020 was chosen to include in the analysis the new daily cases one month before the earliest school openings (Bolzano, September 7, 2020) and until this paper was prepared. Because of the stability (i.e., lack of recalculations) of the data communicated by Campania and Lombardy, in Fig. 5 we could estimate R_t on the positives at a RT-PCR for SARS-CoV-2 in swabs prescribed by a physician (*sospetto diagnostico*, i.e., clinical indication). Of note, no qualitative difference was found with R_t estimated from all new daily SARS-CoV-2 cases in these two regions in the timeframe of our analysis.

2.3. Statistical methods

Mean (standard deviations), median values (inter-quartile ranges), and boxplots for continuous variables and absolute and relative frequencies for categorical variables are presented. Differences among groups for continuous variables were tested by means of the non-parametric Wilcoxon-rank sum test and differences for categorical variables were tested by means of the Chi-square test.

Rates of secondary infections were defined as number of cases/ number of tests occurring the same week after a SARS-COV-2 positive student or teacher was found. Least Square means (LSM), 95% confidence intervals (CI) and P-values of rate of secondary infections and number of positive tests per institute and week are estimated with a multivariable generalized linear regression model adjusted for week of test and density of the region, weighted for the number of tests released in each institute to trace close contacts. Square root transformations were carried out to achieve normality of residuals of full models.

Incidence rates were calculated as the sum of all new positives in each week, divided by the size of the population. We work out the cases per 10,000 (a standard epidemiological way of presenting incidence) by dividing the number of cases by the population in each age group (estimates are from ISTAT, 2019).

To generate the incidence heatmap, a matrix of the weekly incidence referred to individual age ranges was calculated. By using Excel, individual cells were color-coded in a 3-color scale (greenbeige-red) of increasing weekly incidence rate. To generate the heatmap of distance between age brackets, the same matrix was fed to the Heatmapper algorithm (www.heatmapper.ca) and we selected to calculate the distance between rows and columns using the Euclidean Distance Measurement Method.

Transmissibility was measured by the reproduction number R_t , as the average number of secondary cases caused by an infected individual. We estimated R_t over the months incorporating uncertainty in the distribution of the serial interval (the time between the onset of symptoms in a primary case and the onset of symptoms in secondary cases) [24]. R_t was computed by using EpiEstim [24] with parameters from the first COVID-19 wave in Italy as defined by Merler and coworkers [25] (serial interval: 6.6, gamma: 4.9). R_t was computed using the number of new cases/day in each region. In all graphs, R_t values are reported as median values for a 7-day posterior timeframe with 95% credible intervals. When an NPI was introduced and school opening occurred, their effect on R_t was referred to the first day of the corresponding 7-day period. For example, if schools opened on September 14, their effect on R_t was introduced from the period September 14–20.

We computed the cross-correlation analysis between time series of incidence in the population of students 6–13 and 14–18 years old, as well as in the general population using the cross-correlation function of OriginPro 2021 (OriginLab, Northampton, MA, USA)

All statistical analyses were performed with Statistical Analysis System Version 9.4 (SAS Institute, Cary, NC, USA) except those in Figs. 4 and 5 that were performed with OriginPro 2021 (OriginLab, Northampton, MA, USA).

2.4. Role of the funding source

The Italian Ministry of Health with Ricerca Corrente and 5×1000 funds (to SG) did not support study design, data collection, data analysis, interpretation, and writing of the report. Fondazione MITE funds (to SG, FC, and LS) had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

2.5. Declaration of interest

LS received advisory honoraria on behalf of Astellas Pharmaceuticals and sits on the advisory board of Mitochondria in Motion, Inc.

3. Results

3.1. Incidence of COVID-19 among students is lower than in the general population

To first gain insight into the diffusion of COVID-19 in Italian Schools, we compared the incidence of new SARS-CoV-2 positives in the period and per week among students, teachers, and non-teaching staff members of elementary, middle, and high schools to the incidence of SARS-CoV-2 positivity in the general population for each region. The incidence of positives among students was lower than that in the population (overall incidence: 108/10,000), irrespective of whether we analysed elementary and middle schools (incidence: 66/ 10,000), or high schools (incidence: 98/10,000). Incidence of new positives among elementary and middle school students was on average 38.9% lower than in the general population in all Italian regions but Lazio (Fig. 1A). In the case of high schools, incidence of new positives among the students was 9% lower to that of the general population (Fig. 1B). In the three regions of Lazio, Marche, and Emilia-Romagna, it was higher than in the general population. Among teachers and non-teaching staff incidence was 2-fold higher than that observed in the general population (approx. 220/10,000, Fig. 1C). These data indicate that students are largely protected from



Fig. 1. Incidence of SARS-CoV-2 is lower among students than in the general population.

Bubble graphs of SARS-CoV-2 incidence between September 12 and November 7 among 6–13 years old (A) and 14–18 years old (B) students and among teaching and nonteaching staff members (C) in Italian regions and autonomous provinces compared to the incidence in the general population. Size of bubbles is proportional to the measured incidence in the analysed school populations. The 45° line indicates equivalence between general population and school population incidence. Bubbles are color-coded in a green-yellow-red gradient proportional to the value of the ratio between the analysed population and the general population. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Table 3

Rates of secondary infections identified by contact tracing in Italian Schools (from November 23 to December 5, 2020). We calculated rates of secondary infections as number of cases over the number of tests performed up to a week after a SARS-COV-2 positive student or teacher was found. LSM, 95% Confidence Interval (95%CI) and P-values of secondary infections rates per institute and week were estimated with a multivariable generalized linear regression model. P-value refers to Student vs. Teachers as index case.

	Student as index case LSM 95%Cl	Teacher as index case LSM 95%CI	P-value
Kindergarten	0.78% (0.45%, 1.20%)	0.71% (0.33%, 1.22%)	0.81
Elementary school	0.68% (0.48%, 0.91%)	0.98% (0.64%, 1.39%)	0.22
Middle school	0.74% (0.53%, 0.97%)	0.90% (0.51%, 1.40%)	0.50

SARS-CoV-2 infection, irrespective of their school cycle. Conversely, infection appears to be more widespread among teachers and non-teaching staff members of schools than in the general population. Of note, while teachers share classrooms for several hours with students, non-teaching staff members include administrative personnel and janitors who seldom interact with students.

We next used a second database in which MI collected the number of new cases in the period 23–28 November. This database offers a snapshot of the distribution of new cases in a limited timeframe during the peak of the second COVID-19 wave. New positive subjects were found mostly among teachers and non-teaching staff members: SARS-CoV-2 positives were 0.32% of students, 1.52% of teachers and 1.96% of non-teaching staff members (Table S1, Fig. S1). The highest rate was found in Molise and the lowest in Calabria. Incidences of new cases in kindergarten were 0.21% in pupils and 2.35% among teachers (P<0.001); in elementary schools were 0.35% among children and 1.83% among teachers (P<0.001). In middle schools, 0.45% students and 1.60% teachers were found positive (P<0.001, Tables S2 and S3). Similar incidence rates were found in private schools (Tables S4-S6), except for a slightly lower rate among non-teaching staff members (1.67%, Table S4). This database allowed us to also investigate how often the communication of a positive case elicited quarantine for students/staff members. A guarantine period was requested for 1.92% of students, 2.30% of teachers and 2.56% of non-teaching staff members of the analysed public schools (Table S7). In private schools, rates of guarantines were very similar, except for a slightly higher rate for children (2.65%, Table S8). These data indicate that even during the peak of the second COVID-19 wave, students were less infected than adults in school establishments, and that -overall, the quarantine system was widespread, vis-à-vis a very low rate of positivity among students.

Finally, to compare the degree of infection transmission from students and teachers to their close contacts, we analysed data collected by MI from contact tracing in the monitored schools from November 23 to December 5, 2020. The Least Square Means (LSM) estimates of the incidence of secondary cases over the number of tests carried out on close contacts of a positive subjects in school was less than 1% per school and week for teachers and students, in kindergarten, elementary and middle schools. Estimates of rates when the index case was a student or a teacher were not statistically different (P = 0.81 in Kindergartens, P = 0.22 in elementary schools, P = 0.50 in middle schools; Table 3). The number of tests per institute per week ranged from an average of 7 in kindergarten to 18 in middle schools (Table 4), even though the distribution was very skewed and reached up to 100–200 swab tests. Twenty-seven schools carried out more than 100 tests in a week. We did not notice any difference in the number of tests per school if the index case was a student or a teacher (Fig. S2). Clusters, defined as >2 SARS-CoV-2 positive subjects identified in one week following contact tracing of index cases, were found in 5% to 7% of schools (Fig. S3). On average, 49%–56% of all close contacts of a positive student or teacher were placed in quarantine for 10 days, with the need of a negative swab at the end of the period to be readmitted at school.

3.2. Increases in R_t in Italian regions with different school opening dates

We reasoned that if school openings had played a role in the second wave of COVID-19 in Italy, the reproduction number R_t shall have increased earlier in the regions where schools started earlier. We first tested this hypothesis by analysing the case of the two provinces of Bolzano, where schools started on September 7, and Trento, where they started on September 14 (Table 2). Given the similarities between these two alpine territories in terms of orography, population density (72 inhabitants/km² in Bolzano; 87 in Trento), climate and lifestyle, they represent a very useful case scenario to investigate the role of schools in the local spread of COVID-19. We computed R_t ²⁵ on the incidence of the positives at a RT-PCR for SARS-CoV-2 genetic material test from an oro/nasopharyngeal swab. Notwithstanding that schools in Trento opened 7 days later than in Bolzano, the increase in R_t (defined as an increase sustained for >3 moments and leading to $R_t > 1$) occurred in Trento from the period September 23–30, whereas in Bolzano Rt started to increase from the period September 29-October 6, suggesting that there was no temporal relation between schools opening and surge in Rt (Fig. 2A).

We extended our analyses to larger areas of the country, by applying them to different pairs of Regions, where schools opened on different days. We thus compared the temporal distribution of Rt in Abruzzo and Marche, two bordering regions of central-eastern Italy. In Marche, schools opened on September 14, in Abruzzo on September 24. In both regions, R_t started to increase from the 25/9-2/10period (Fig. 2B). We repeated the same exercise for the pair Sicily-Calabria, where schools started on September 14 and 24, respectively. Again, we found no difference in the period when Rt started to increase (Fig. 2C). Finally, even in the case of the pair Veneto-Apulia, where schools opened on September 14 and 24 respectively, we did not appreciate any difference in the period when Rt started to increase (Fig. 2D). Altogether, these data indicate that the increase in SARS-CoV-2 reproduction number in different Italian regions occurred indeed after school openings, but that at the same time the delay between school opening and Rt rise was not constant as it would be expected if it were the only driver of COVID-19 diffusion. Indeed, this lag time appeared shorter in those regions where schools opened on September 24, and longer in those regions where schools

Table 4

Activity of contact tracing following a positive case among students and teachers in Italian Schools (from 23 of November to 5 of December 2020). Mean and standard deviation of number of tests per institute.

	Type of school	n. of schools	Mean number of tests	Standard deviation	Absolute range
Student Index case	Kindergarten	531	9	13	0-87
	Elementary	873	16	20	0-150
	Middle schools	753	17	21	0-87
Teacher Index case	Kindergarten	465	7	15	0-180
	Elementary	540	13	25	0-232
	Middle schools	338	12	26	0-117



Fig. 2. Increases in R_t are not univocally correlated with school opening times in different Italian territories. Pairwise comparison of median R_t in the indicated 7 days periods (±5–95% Credible Intervals) in the provinces of Bolzano and Trento (A) and in the indicated regions (B-D). The periods of school opening are highlighted by a box shaded in the same color of the respective province or region.

opened on September 14. We further corroborated this finding by calculating the number of days from the date of the school opening to the R_t increase across all Italian regions (Fig. S4). The average delay from school opening to R_t increase was 5.7 days (CI95%: 3.4–8.0) in regions where schools opened on September 22 or 24, 12.4 days (CI95%: 10.2–14.6) in regions where schools opened on September 14 or 16 (Fig. 3A, P<0.05 in a Kolmogorov-Smirnov test). Conversely, the average delay between the R_t rise and the national election day held on September 21 was comparable in all regions: the mean was 8.6 (CI95%: 6.7–10.6) in regions where schools opened on September 22/24 and 5.2 (CI95%: 3.4–7.0) in regions where schools opened on September 7 or 14/16 (Fig. 3B). In conclusion, we did not find an unequivocally constant delay between school opening and R_t rise.

3.3. Early increase in COVID-19 incidence among adults, not school age individuals during the second wave in the Veneto region

Because we did not find a strong temporal relation between school openings and the second COVID-19 wave in Italy, we decided to explore whether SARS-CoV-2 positivity circulated early in individuals different than children. To this end, we performed a prospective study on datasets extracted from the Veneto Region system of SARS-CoV-2 cases notification from August 28 to October 24, 2020, when overall COVID-19 incidence in Veneto increased from ~2/10,000 to ~35/10,000. In the period August 28- September 6, 2020 incidence increased among individuals 45 to 49-year-old and 25 to 39-year-old, albeit to a lower extent. Conversely, incidence remained very low in the other analysed age groups. Incidence increased again in the last decade of September in the age groups 45–49 and to a lower extent in the age groups 20–24 and 25–29 (Fig. 4A). These data suggested that at least in Veneto the earliest increase in SARS-CoV-2 positivity occurred in adults, followed by younger individuals, but not in

adolescents that were often deemed as potential spreaders because of their high number of social contacts and their presumed laxity in adhering to the infection risk mitigation protocols. We therefore further inspected the temporal distribution of incidence among age classes. Visual inspection of a heatmap of the incidence of COVID-19 cases in every age group in the 8 weeks under consideration confirmed that the earliest increase in incidence occurs not among children or adolescents, but among individuals 20-49 years of age. These individuals appeared to be the drivers of the second wave, as incidence then propagated to individuals of other age categories (Fig. 4B). Indeed, by applying a Euclidean distance algorithm to the same matrix used to generate the heatmap, we found that children and adolescents are ranked as the groups closest to the least affected groups by this second COVID-19 wave (60-64 and 65-69 years of age). Conversely, individuals 20 to 29, and 45 to 49 years old are the most distant from the protected 60-69 years old individuals (Fig. S5).

We also compared the incidence of SARS-CoV-2 from September 19 to October 18 among teachers and among the general population of the age group 25-65 in Veneto. We selected this age group because teachers' age is comprised between these two extremes, given the required tertiary education to be enrolled, and the legal retirement age of teachers. Interestingly, incidence among teachers started to increase after the general population of the same age; moreover, at the end of the period under consideration, incidence among teachers and among the general population aged 25-65 was not significantly different (12/10,000 vs. 11.1/10,000, P = 0.36, Fig. S6).

Finally, we investigated the frequency of secondary infections at schools in Verona and province from November 25 to December 21 on datasets extracted from the Veneto Region system of SARS-CoV-2 cases notification. We found 380 students, 30 non-teaching staff



Fig. 3. Increases in R_t are not univocally correlated with school opening times across Italian regions.

Box plots of the indicated quantiles for the days of delay between school openings (A) and September 20-21 national election day (B) and R_t increase in Italian regions clustered by their school opening dates. Date of R_t increase was calculated as the first day of the period when median R_t started an increase sustained in time (>3 consecutives periods).

members and 114 teachers index cases in 339 schools for which contact tracing was performed. From this contact tracing and testing, a total of 76 secondary cases were identified (Table 5). The frequency of secondary cases was higher among students than among teachers and non-teaching staff members (71%, 22.4% and 6.6%, respectively).

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A secondary case among teachers was more frequent when the index case was a teacher than when it was a student (37% vs. 10%, P = 0.007, Fig. S7). Secondary cases among non-teaching staff members were exclusively due to contacts with other non-teaching staff members.



Fig. 4. During the second COVID-19 wave incidence of SARS-CoV-2 rises initially among young adults and 45-49 years old individuals in Veneto region.

(A, B) Daily incidence and 7 days adjacent average (7DMA) of SARS-CoV-2 positivity among individuals of the indicated age range. Consistency of the population in each age bracket was from ISTAT and is detailed in Table 6.

(C) Heatmap of weekly incidence of SarsCoV2 in individuals of the indicated age ranges in the Veneto region during the indicated timeframe. The color scale goes from green (low incidence) to beige (medium incidence) and to red (high incidence). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Table 5

Index and secondary cases in 339 schools of the Province of Verona (from November 25 to December 21, 2020). Note that in the case of one teacher index case, 2 secondary cases among other teachers were identified. Frequency of teachers and students is significantly different by index case: P = 0.007 students vs. teachers.

Index cases		Secondary cases				
		Total	Students	Teachers	Staff	
Students	355	60 (100%)	54 (90%)	6 (10%)	0 (0%)	
Students <13 years old		38 (100%)	33 (87%)	5 (13%)	0 (0%)	
Students 13–18 years old		22 (100%)	21 (95%)	1 (5%)	0 (0%)	
Teachers	112	16 (100%)	10 (63%)	6 (37%)	0 (0%)	
Non-teaching Staff members	25	5 (100%)	0 (0%	0 (0%)	5 (100%)	
Total	492	81	64	12	5	

Altogether, these analyses indicate that in the Italian Veneto region, children and adolescents were not early drivers of the second wave, which was conversely associated with an early increase in incidence among 20–29- and 45–49-years old individuals. Importantly, teachers were not at greater risk of SARS-CoV-2 infection than the age matched general population. Finally, even when teachers were infected at school, infections were mainly due to other teachers.

3.4. School closures did not alter the rate of R_t decline in Lombardy and Campania

Since we did not find a correlation between school opening and the rise in R_t , we wished to understand whether the opposite, i.e., school closures, impacted on R_t . Again, the territorial differences in the mandate of different NPI in Italy offered a useful paradigm to investigate this possibility. We considered the two cases of Lombardy, where the President of the Region mandated closure of high schools from October 26; and Campania, where the closure of all school grades (including kindergartens) was mandated from October 16. Lombardy and Campania together account for 25% of Italy's population, being the first and second most populous regions. These school closures occurred before the national Government implemented a regional risk stratification system to modulate lockdown, according to the local epidemiological and hospital stress status (November 6), but after the mandate for universal mask wearing

Table 6		
Population	distributior	n per
and in Vend	to Data are	from

ISTAT.							
Age bracket	Population						
0-4	184,725						
5-9	217,931						
10-14	236,205						
15-19	234,882						
20-24	239,341						
25-29	245,517						
30-34	256,481						
35-39	281,868						
40-44	343,714						
45-49	223,416						
50-54	418,076						
55-59	385.088						

321.876

283,649

268 762

540,129

60 - 64

65 - 69

70 - 74

75+

outside home (October 14) and, in the case of Lombardy, after the closure of restaurants, cafes, and bars at 6PM with a nationwide curfew at 10PM (October 23). Interestingly, Rt decline started before high school closures in both regions: in Lombardy in the period October 8–15 (Fig. 5A for absolute Rt values and 5B for its first order derivative); in Campania, in the period September 30-October 7 (Fig. 5C for absolute R_t values and 5D for its first order derivative). Noteworthy, the same pattern was observed if we analysed Rt computed over total SARS-CoV-2 positivity albeit, in the case of Campania, Rt decline started only three periods before implementation of school closures (Fig. S3, red lines in the plots of Campania and Lombardy). In the case of Campania, we could also extend our analysis to the overall incidence among students and general population. We found that, while incidence dropped among students, probably because they were no longer attending schools and therefore tested, incidence in the general population continued to increase (Fig. S8A), reflecting the fact that R_t remained >1 until the period 5–11 November. Moreover, a cross-correlation analysis between the time series of incidence among students and the general population confirmed that incidence increased simultaneously among students and general population (Fig. S8B). Altogether, these data indicate that school closures did not impact on the speed of Rt decline in Lombardy and Campania. Furthermore, the increasing trend of COVID-19 incidence in the general population observed in Campania was concomitant to that observed among students and not curtailed by school closures.

4. Discussion

Whether school reopening contributed to the second wave of COVID-19 in Italy was unclear. Here, by analysing data from Italian regions and schools, we did not find a significant association between school opening and rise of infection in the general population. Our conclusion is based (i) on the finding of lower incidence of SARS-CoV-2 positivity among students than in general population; (ii) on the lack of a fixed temporal association between school reopening dates in different Italian regions and R_t increase in the same region; (iii) on the analysis of the temporal changes in incidence among different age classes in the Veneto region during the initial phases of the second wave.

At variance with influenza, in which younger individuals seem to represent a reservoir of virus and contribute to its propagation to general population, [26-30] SARS-CoV-2 seems to spare school age children and adolescents: clinically, they are mostly paucisymptomatic [5]; from the epidemiology of infection perspective, they are very rarely accounted for as the index case [11], indicating that not only they are largely spared from the clinical consequences of the infection, but they also are less likely to transmit it. Overall, these data suggest that spread of COVID-19 within school settings may be limited [31, 32]. Indeed, our data indicate that infection incidence is lower in students of any education cycle, compared to the general population. Moreover, at least in the case of elementary school children, contact tracing in schools confirms that they are less likely to transmit the virus to adults, as evidenced by a 73% lower number of secondary cases among teachers when the index case is a student (10%), compared to secondary cases elicited by a teacher index case (37%). These epidemiological data are in line with the finding that children harbor antibodies against the other common coronaviruses, and that these antibodies are cross reactive and neutralizing against SARS-CoV-2 [7]. Our findings are also consistent with several other reports of very limited spread of COVID-19 between children and from children to adults. In Australia (New South Wales), following COVID-19 positivity of 9 students in primary and high schools and 9 staff members, only 2 of the 735 students, and 0 of the 128 staff members with whom they had contact were identified as secondary cases [33]. In Ireland, during the first wave, 6 COVID-19 cases were identified in schools (three children and three adults). Among their



Fig. 5. School closures do not affect Rt decrease in Lombardy and Campania.

(A, C) Median R_t in the indicated 7 days periods ($\pm 5-95\%$ Credible Intervals) in Lombardy (A) and Campania (C). Days of school opening and closure are indicated. (B, D) First order derivative of R_t in Lombardy (B) and Campania (D). Days of school opening and closure are indicated.

1155 school contacts, zero infections were recorded [34]. In the Netherlands, 10 COVID-19 cases aged <18 had 43 contacts, but nobody was infected, whereas 221 patients older than 18 were associated with 8.3% of infections [35].

Of note, we found higher rates of incidence in teachers and nonteaching staff members compared to the general population. One possible explanation for this finding is that teachers might become infected at school because of their prolonged proximity to students. However, by judging from contact tracing activity in schools of the populous province of Verona (Veneto region), secondary infections at school are rare: only 13 teachers were identified as secondary cases from 524 traced index cases. Among these rare events, frequency of secondary infections among teachers was higher when the index case was a teacher rather than a student. In the Campania region, where schools were open for 17 days (from September 24 to October 16; school week of 5 days), incidence among teachers and non-teaching staff members in the period September 12-November 7 was still higher than that in the general population. It would be difficult to ascribe this difference to 17 days of school over a total of 56 days. We also performed an important, often overlooked normalization and compared incidence among teachers from the Veneto region with incidence in the general population of similar age: incidences were comparable, and differences not significant. Thus, while incidence among teachers is similar to that in the age-matched general population, teachers are allegedly perceived at greater risk. Perhaps this perception stems from the fact that in Italy the school environment is meticulously and continuously controlled, as confirmed by our finding of very high number of tests performed for each positive case, especially when the index case is a student. This remarkable system of monitoring unveils a large proportion of perhaps asymptomatic infections among teachers, resulting in the apparently higher incidence among this type of workers. It cannot be argued that teachers and non-teaching staff members are more susceptible to infection

than the general population. In fact, this increase in the incidence of test positives is not mirrored by an increase in mortality-morbidity that would mark a more susceptible population [36]. In sum, our analysis of data collected by the MI indicates that in Italy students are less infected than the general population and the overall protocols for contact tracing work well, questioning whether schools played a role as amplifiers of the second COVID-19 wave.

Decision makers, popular press and public opinion in Italy ascribed the second wave of COVID-19 to school reopening [14]. This was often accompanied by deprecating comments on "individual behavior" of adolescents especially, who would not follow the strict rules at school or outside them. However, our data suggest that this common sentiment is not evidence-based, but perhaps grounded on the temporal correlation between school opening (in September) and second wave (in October-November). Rather, our data do not identify a constant temporal association between school reopening and rise in R_t analysed on a regional basis. Because of the staggered school reopening calendar in Italy, we were well positioned to address whether there was such an association between the date of school opening and the date of reproduction number increase. Conversely, a constant association was present when we analysed the temporal distance between R_t rise and the election day, held in Italy on September 20 (and morning of 21), 2020.

Interestingly, other reports are in line with our findings: in Great Britain, incidence among staff members was higher than among students (27 cases [95% Cl 23–32] per 100,000 per day among staff; 18 cases [14–24] in early-year students, 6.0 cases [4.3–8.2] in primary schools students, and 6.8 cases [2.7–14] in secondary school students); further, most cases linked to outbreaks were in staff members (154 [73%] staff vs. 56 [27%] children of 210 total cases). The median number of secondary cases in outbreaks was one (IQR 1–2) for student index cases and one (1–5) for staff index cases [37]. In Spain, the evolution of the global incidence does not suggest significant

effects of school reopening. In most cases, there was slight if any increase in pediatric cases, consistent with the diagnostic efforts in schools [38]. In Germany, data collected from 53,000 schools and day-cares in autumn indicate that only circa 32 schools had more than two positives per week [39]. Finally, a recent report by the ECDC summarizes the available knowledge and reaches conclusions very similar to ours. While ECDC concludes with high confidence that transmission of SARS-CoV-2 can occur within school, they also note with moderate confidence that prevalence of COVID-19 within schools is influenced by the community prevalence especially when community transmission is sustained. Most importantly, transmission in schools account for a minority of all COVID-19 cases in a given country and school staff are generally at no higher risk of infection than other occupations [40]. ECDC recommends a variety of NPI to mitigate the risk of school COVID-19 transmission [40] that are even less stringent than the rules currently implemented in Italy. For example in Italy children from 6 years of age must always wear face masks at school including when sitting at their desk or playing in outdoor playgrounds [22], irrespective of the local epidemiological condition that WHO [41] and ECDC [40] take into consideration when advising on schools NPIs.

A current concern is that the SARS-CoV-2 variant B.1.1.7, becoming largely diffuse and predicted to display a greater Rt ⁴², might be more transmissible especially among children It shall be noted that the possibility that this variant become predominant because of a greater susceptibility of school age individuals (0-19) was duly took into consideration. However, modeling predicts that individuals of this age group should be twice as susceptible to the B.1.1.7 variant as compared to the wild-type virus to support its observed widespread diffusion [42]. Furthermore, transmission of this variant by school age individuals appears to be lower also in the real world. The most recent Public Health England report on the transmissibility of the variants of concern contains datasets of contact tracing activity performed on individuals infected with wild-type and B.1.1.7 SARS-CoV-2. The report concludes that transmissibility of B.1.1.7 is 30-35% higher than that of wild-type SARS-CoV-2 [43]. From this report, we extrapolated secondary infection rates stratified by age of the index case (0-19 or 20+). In the case of 0-19 years old index cases carrying wild-type SARS-CoV-2, secondary cases were reported in 279 of the 3479 contacts (8.0%) and in 317 of the 3004 contacts of an index case carrying the B.1.1.7 SARS-CoV-2 variant (10.6%). These proportions were respectively 14.1% (891 secondary cases out of 6298 contacts) and 19.7% (968 out of 4920) when the index case was 20 years and older. Thus, the increase in transmissibility of the B.1.1.7 SARS-CoV-2 variant is 39.7% if the index case is 20 years or older, and 32.5% if the person is 0–19 years old. Even with this variant, transmission by school age individuals remains therefore 46% lower than by older persons. Thus, while we were not able to investigate the role of school opening and closure in a time of widespread diffusion of B.1.1.7 SARS-CoV-2 variant, these real-world data on lower transmissibility by school age individuals support that again, 0–19 years old individuals are less prone to transmit it forward than adults.

A different question is whether closing schools is efficacious in curtailing viral spread. In some Italian regions analysed here, school closure was mandated by local authorities and eventually in certain regions by the National Government. However, this closure had no effect on the incidence of COVID-19 in the general population or in R_t decline, which had started before the mandated school closure and that continued with the same speed, irrespective of school closures in Lombardy (partial) and Campania (total). This finding is in line with a literature review of all available studies (n = 16) on the efficacy of school closures and other social distancing practices in schools in China and Hong Kong, where the rapidly implemented school closures did not substantially contribute to the control of the spread [16]. In Australia, by comparing data from 25 schools of different grades with those of the general population, it was found that

students and school staff did not contribute to the spread of the virus more than the general population [44]. On the other hand, an analysis of the impact of different NPI on the reproduction number R_t across 131 countries found that school closures alone could reduce R_t by 15% (R ratio: 0.85, 95%CI: 0.66–1.10), whereas school reopening could increase it by 24% (R ratio: 1.24, 95%CI: 1.00-1.52) twentyeight days after their implementation. However, these measured R_t changes are not statistically significant, as evidenced by the very large and overlapping confidence intervals of the R ratios [45]. Moreover, authors warn on the limitations of their estimates: for example, they could not consider the different precautions related to the reopening of schools taken by some countries, such as physical distancing within classrooms and masking procedures; they did not consider the impact of school holidays and the effect of reopening different school levels (e.g., elementary and middle schools). Finally, authors analysed the impact of given NPIs by comparing Rt from two arbitrarily drawn periods before and after the implementation of the given NPI [45]. While this approach might be more practical when comparing multiple countries, it is less informative than our analysis, performed over the whole Rt curve.

In our analyses, R_t started declining even before the implementation of any NPI in all regions analysed. These results, while perhaps surprising, are in line with findings from the group of Merler [46] who analysed the impact of the national March-May strict lockdown on R_t in Italy. While they concluded that this lockdown reduced R_t and brought it below 1, they admitted that the decline in R_t had started well before the national lockdown was implemented. Indeed, visual inspection of their published R_t curves confirms that this NPI did not affect the slope of R_t decline. Whether our findings can be generalized to other countries, in which the use of NPI might be less extensive than in Italy, remains unclear and admittedly requires further studies.

Of the highest importance, our study is strengthened by the several sources of data used. Longitudinal data of regional incidence of SARS-COV-2 positives subjects deposited in the public repository of the Italian Civil Protection, incidence from the Veneto Region system of COVID-19 case notification with information by age, and incidence in schools from MI with information for students, teachers and nonteaching staff members. A systematic review investigated sources of bias in observational studies trying to assess the role of school closures in the reduction of COVID-19 community transmission [47]. Several studies were found at risk of confounding factors and collinearity from other NPI implemented around the time of school closures. We believe that our study is a low risk of bias because we compared community transmission of SARS-CoV-2 before and after school closure/re-opening in single geographical units (regions and provinces). This approach, as commented by the authors of this review, controls for confounding from population sociodemographic factors [47]. We also compared transmission in different regions opening schools at different dates and this analysis is not confounded by inclusion of other NPIs because while school calendar in Italy is regionalized, NPIs are mandated nationwide, in schools and outside schools. Furthermore, we analysed several prospective cohorts. This type of study design reduces the risk of bias, as opposed to the crosssectional study design of previous publications on this topic that analysed data at a single cut-off date. Indeed, Walsh and colleagues essentially conclude that while most studies show effects, higher quality studies tend not to [47], probably a consequence of the strong study design in the latter.

The limitations of our study include: (i) Information on SARS-CoV-2 positive individuals in schools are retrieved by school Principals and can be partial; (ii) these data represent a global snapshot of the whole school, not of individual classes; (iii) data on number of SARS-COV-2 positives subjects deposited in the public repository of the Italian Civil Protection might suffer from delays in reporting or -even worse, from differences in reporting criteria by different regions; (iv)

comparisons across regions of the impact of school opening dates on R_t changes suffer from ecological bias. However, it shall be noted that the nationwide R_t computed on the total positives and that on the cases by diagnostic suspicion are very similar and that their temporal trends are superimposable, thus reinforcing the strength of the analysis presented here.

In conclusion, our analysis does not find an association in Italy between dates of school opening and the increase in SARS-CoV-2 Rt. Reciprocally, school closures did not affect the rate of Rt decline. Also, the incidence of SARS-CoV-2 among students is lower than that in the general population; In addition, the incidence among teachers is comparable to that recorded in the general population of the same age. Finally, contact tracing in schools resulted in very low frequency of secondary infections found per test, and low frequency of clusters despite a high number of tests every week. Our analysis provides evidence that school openings are not to be considered as a relevant factor influencing the spread of the COVID-19 epidemics and that school closures did not improve the already occurring decline in the reproduction number of COVID-19, at least in two populous Italian regions. Closure of schools has dire consequences on children and adolescents motor activity [48], social interaction, psychological well-being [49, 50] and psychopathological problems [51, 52], on the risk of obesity [53] and screen addiction [54], on the protection from situations of domestic abuse [55], and on learning performance. Our data add further support to the consolidating notion that risks of school closures are not outweighed by benefits. They moreover suggest that the conclusion that school openings favoured COVID-19 spread is correlative at best, and hence it does not help in the identification of the best NPIs to curtail SARS-CoV-2 diffusion.

Author Contributions

SG, FC and LS designed the study. MLI, LS and SG collected data. SG, MR, MLI and LS performed data analysis. SG, FC and LS led manuscript writing. SG, FB, FC, and LS reviewed the literature. All authors contributed to final draft.

Declaration of Interests

LS received SAB honoraria from Astellas Pharmaceuticals and sits on the SAB of Mitochondria in Motion, Inc. All other authors have no interests to declare.

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Data sharing statement

Sources of publicly searchable databases are indicated in the paper or available as supplementary material. The remaining data may be made available from the corresponding authors upon reasonable request.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.lanepe.2021.100092.

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TAB 16

Morbidity and Mortality Weekly Report

Low SARS-CoV-2 Transmission in Elementary Schools — Salt Lake County, Utah, December 3, 2020–January 31, 2021

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School closures affected more than 55 million students across the United States when implemented as a strategy to prevent the transmission of SARS-CoV-2, the virus that causes COVID-19 (1). Reopening schools requires balancing the risks for SARS-CoV-2 infection to students and staff members against the benefits of in-person learning (2). During December 3, 2020-January 31, 2021, CDC investigated SARS-CoV-2 transmission in 20 elementary schools (kindergarten through grade 6) that had reopened in Salt Lake County, Utah. The 7-day cumulative number of new COVID-19 cases in Salt Lake County during this time ranged from 290 to 670 cases per 100,000 persons.[†] Susceptible[§] school contacts[¶] (students and staff members exposed to SARS-CoV-2 in school) of 51 index patients** (40 students and 11 staff members) were offered SARS-CoV-2 reverse transcriptionpolymerase chain reaction (RT-PCR) testing. Among 1,041 susceptible school contacts, 735 (70.6%) were tested, and five of 12 cases identified were classified as school-associated; the secondary attack rate among tested susceptible school contacts was 0.7%. Mask use among students was high (86%), and the median distance between students' seats in classrooms was 3 ft. Despite high community incidence and an inability to maintain ≥ 6 ft of distance between students at all times, SARS-CoV-2 transmission was low in these elementary schools.

The results from this investigation add to the increasing evidence that in-person learning can be achieved with minimal SARS-CoV-2 transmission risk when multiple measures to prevent transmission are implemented (3,4).

On August 24, 2020, a school district in Salt Lake County, Utah, reopened schools for in-person learning.^{††} Elementary schools restricted school-related extracurricular activities and large group gatherings, placed students in cohorts by classroom, and implemented other COVID-19 strategies to limit spread.^{§§} During December 3, 2020–January 31, 2021, CDC was invited by the Utah Department of Health to investigate SARS-CoV-2 transmission in a convenience sample of 20 elementary schools in partnership with the school district, the University of Utah's Health and Economic Recovery Outreach (HERO) Project,^{¶¶} Utah Department of Health, and Salt Lake County Health Department.

School contacts of identified index patients completed a questionnaire about symptoms and exposures and received SARS-CoV-2 testing. Written consent was provided by participants (or by a parent or guardian for minors). Persons not susceptible to SARS-CoV-2 infection were excluded. Saliva samples (or nasal swabs if saliva was unobtainable) were collected for SARS-CoV-2 RT-PCR testing 5–10 days postexposure; turnaround time for results was typically 1–2 days. Household members of school contacts with a positive SARS-CoV-2 test result were interviewed and offered SARS-CoV-2 RT-PCR testing. The Utah Public Health Laboratory performed whole

^{*} These authors contributed equally to this report.

[†] The 7-day cumulative number of new COVID-19 cases in Salt Lake County was obtained from the Utah Department of Health and the Salt Lake County Health Department.

Susceptible persons were defined as those with no record of previous positive test results for SARS-CoV-2 or whose date of laboratory-confirmed infection onset was at least 90 days earlier (https://www.cdc.gov/coronavirus/2019-ncov/ hcp/duration-isolation.html).

⁹ A school contact was defined as a student or staff member who was in contact with the index patient for a cumulative total of 15 minutes or more during a 24-hour period in a classroom, cafeteria, school bus, or recess space during an index patient's infectious period.

^{***} An index patient was defined as a student or staff member with laboratoryconfirmed SARS-CoV-2 infection who had attended in-person school while infectious for at least 1 day. Infectious period was estimated as 2 days before to 10 days after date of symptom onset (if symptomatic) or date of first positive specimen collection (if asymptomatic) (https://www.cdc.gov/coronavirus/2019ncov/php/contact-tracing/contact-tracing-plan/investigating-covid-19-case.html).

^{††} This school district consists of approximately 67,000 K–12 students and 7,500 employees at 63 elementary schools, 15 junior high schools, eight high schools, and other special schools. Once schools reopened, students were given the option to participate in a hybrid model (four days of in-person school and one day of online learning) or all online learning. Winter break occurred during December 21, 2020–January 1, 2021; in total, the investigation period encompassed 21 days of in-person learning.

^{§§} Students were placed in cohorts by classroom whenever possible to reduce interactions between classes. Most schools staggered lunch, gym classes, and special activities, such as library use or art classes. At some schools, classes would mix by grade level at recess. Schools limited nonessential extracurricular in-person events, and other events (e.g., sports, assemblies, performances, and field trips) were held virtually when feasible.

⁵⁵ The University of Utah's HERO Project is sponsored by the Governor's Office of Management and Budget and aims to provide data to aid in decision-making that allows a safe return to normal for Utah's citizens and economy (https:// eccles.utah.edu/utah-hero/).

genome sequencing (WGS) for available positive specimens. A school contact who received a positive test result was considered not to have a school-associated case of COVID-19 when one of the following occurred: 1) illness onset preceded the first date of school exposure, 2) a household member had illness onset during the 14 days preceding the school contact's illness onset (for symptomatic school contacts) or before the last date of school exposure (for asymptomatic school contacts), or 3) WGS demonstrated that the lineage of the index patient's isolate differed from that of the school contact.*** To understand school mitigation measures and classroom characteristics, principals and teachers of each index patient were surveyed. Classroom seat distances between students and between the teacher and nearest student were measured. SAS (version 9.4; SAS Institute) was used for descriptive statistics. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.^{†††}

The 20 elementary schools included 1,214 staff members and 10,171 students, 81% of whom attended school in person and 56% of whom were eligible for free or reduced-price meal programs. Among the student population, 53% were non-Hispanic White persons, 31% were Hispanic or Latino persons, 5% were Asian persons, 5% were Native Hawaiian or Other Pacific Islander persons, and 4% were Black or African American persons. Fifty-one index patients (40 students, median age = 9.5 years [range = 5-12 years] and 11 staff members, median age = 50 years [range = 26-62 years]) were identified from 48 classrooms (Table 1). These index patients were infectious at school for a median of 2 days (range = 1-4 days), and 16 (31%) were asymptomatic. A total of 1,083 school contacts (943 students and 140 staff members) were identified; 42 (4%) were not susceptible to SARS-CoV-2 infection.^{§§§} Among the 1,041 susceptible school contacts (student median age = 9 years [range = 5-18 years]; staff member median age = 39.5 years [range = 19-83 years]), 144 (14%) were quarantined (Table 2). Among the 735 (71%) tested school contacts (participation range = 44%-100% across schools), testing was completed a median of 8 days after the school exposure (range = 6-15 days). Overall, 103 of 133 (77%) staff member contacts and 632 of 908 (70%) student contacts were tested; among 303 Hispanic or Latino contacts and 566 non-Hispanic White contacts, 237 (78%) and 382 (67%) respectively, were tested.

Among all 735 tested contacts, 12 (1.6%) (11 students, one teacher) had a positive SARS-CoV-2 test result, seven of whom were determined not to have school-associated cases because of epidemiologic evidence (four) or because WGS suggested community acquisition based on lineage differences (three) (Supplementary Figure, https://stacks.cdc.gov/ view/cdc/104112). WGS was only available for three pairs of index patients and their associated contacts (Table 3). After exclusion, five cases from five separate classrooms were classified as school-associated, for a secondary attack rate of 0.7% (five of 728). No outbreaks were detected.⁵⁵⁵ Three of five persons with school-associated cases had been quarantined (the secondary attack rate among quarantined persons who were tested was 3.0% [three of 101]); the remaining two persons with school-associated cases had not been guarantined and were isolated only after a positive test result (secondary attack rate among nonquarantined contacts who were tested = 0.3%[two of 627]).**** Among the five persons with school-associated cases, three persons were asymptomatic, and three persons were exposed to asymptomatic index patients; four cases were attributed to student-to-student transmission, and one was attributed to student-to-teacher transmission. Four of the five school-associated transmission events occurred because the contact sat <6 ft from the index patient during class (two) or during lunch (two), or the index patient or contact had poor mask use (two) or physical distancing behavior (two) (Table 3). All five households of persons with school-associated cases were tested. Tertiary transmission was detected in three households; within those households, six of eight household members received positive SARS-CoV-2 test results.

On December 17, 2020, Utah modified its quarantine recommendations for school contacts (students or staff members) who were identified as close contacts (persons within 6 ft of the index patient for a cumulative total of \geq 15 minutes during a 24-hour period). Previously, school contacts who were close contacts were quarantined^{††††} regardless of mask use; afterwards, they were only quarantined when the index patient or the contact did not wear a mask during the interaction. The school district implemented this recommendation on January 4, 2021, after a holiday break, and 158 students who were close contacts continued attending in-person school. Among these 158 students, 111 (70%) were tested; no school-associated cases were detected.

^{***} SARS-CoV-2 genome sequences were assigned to global lineages with pangolin (v.2.1.10, pangoLEARN v.2021–02–01; https://github.com/covlineages/pangolin).

⁺⁺⁺ 45 C.F.R. part 46; 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d), 5 U.S.C. Sect. 552a, 44 U.S.C. Sect. 3501 et seq.

^{§§§} An additional 52 school contacts had at least one household member with laboratory-confirmed SARS-CoV-2 during the preceding 90 days; these school contacts were still considered susceptible and eligible for inclusion, although they might have been previously infected and already immune.

⁵⁵⁵ An outbreak was defined as two or more cases epidemiologically linked to the same index patient classroom.

^{****} The secondary attack rate excludes seven nonschool-associated cases from the numerator and the denominator. Among 105 quarantined school contacts who were tested, the secondary attack rate excludes four nonschoolassociated cases. Among 630 non-quarantined school contacts who were tested, the secondary attack rate excludes three nonschool-associated cases.

^{*****} Persons could return to school without SARS-CoV-2 testing after a 10-day quarantine. Those who received a negative SARS-CoV-2 test result on quarantine days 7–9 could return to school early.

TABLE 1. Characteristics of index and school-associated	patients with laborator	ry-confirmed COVID-19 ii	n 20 elementary schools —
Salt Lake County, Utah, December 3, 2020–January 31, 2021			

	No. (%) of persons with COVID-19				
Characteristic	Index (n = 51)*	School-associated $(n = 5)^{\dagger}$			
Cases per school, median (range)	2 (1–9)	0 (0–2)			
School contacts, median (range)	20 (5–53)	§			
Close contacts, median (range)	6 (0–23)	—			
Other school contacts, median (range)	13 (0–52)	_			
Median age, yrs (range)					
Students (index: $n = 40$; school-associated: $n = 4$)	9.5 (5–12)	10.5 (10–12)			
Staff members (index: $n = 11$; school-associated: $n = 1$)	50 (26–62)	43 (43–43)			
Sex					
Male	24 (47.1)	2 (40.0)			
Female	27 (52.9)	3 (60.0)			
Race/Ethnicity					
White, non-Hispanic	30 (58.8)	1 (20.0)			
Hispanic/Latino	15 (29.4)	2 (40.0)			
Black/African American	1 (2.0)	0 (0.0)			
Asian	1 (2.0)	1 (20.0)			
Native Hawaiian/Other Pacific Islander	2 (3.9)	0 (0.0)			
American Indian or Alaska Native	0 (0.0)	0 (0.0)			
Multiracial	2 (3.9)	1 (20.0)			
Grade in school [¶]					
Kindergarten	5 (12.5)	0 (0.0)			
1	3 (7.5)	0 (0.0)			
2	2 (5.0)	0 (0.0)			
3	6 (15.0)	0 (0.0)			
4	6 (15.0)	2 (50.0)			
5	8 (20.0)	0 (0.0)			
6	10 (25.0)	2 (50.0)			
Role in school					
Students	40 (78.4)	4 (80.0)			
Head teachers	6 (11.8)	1 (20.0)			
Paraeducators**	0 (0.0)	0 (0.0)			
Other teachers ^{††}	4 (7.8)	0 (0.0)			
Other staff members ⁹⁹	1 (2.0)	0 (0.0)			
Days in school while infectious, median (range)	2 (1–4)	0 (0–2)			
Symptom status					
Ever symptomatic	35 (68.6)	2 (40.0)			
Asymptomatic	16 (31.4)	3 (60.0)			
One or more underlying medical condition ¹¹	9 (20.9)	0 (0.0)			
Quarantine status after exposure to index patient***					
Under quarantine	_	3 (60.0)			
Notified, close contact	—	0 (0.0)			
Notified, not close contact	—	2 (40.0)			

Abbreviation: IQR = interquartile range.

* An index patient was defined as a student or staff member with laboratory-confirmed SARS-CoV-2 infection who had attended in-person school while infectious for at least 1 day. Infectious period was estimated as 2 days before to 10 days after symptom onset (if symptomatic) or first positive specimen collection date (if asymptomatic).

⁺ School-associated transmission was excluded if 1) the school contact had an illness onset (if symptomatic, symptom onset, if asymptomatic, first positive test date) before the last date of school exposure, 2) a household member had an illness onset (if symptomatic, symptom onset, if asymptomatic, first positive test date) within 14 days of the positive school contact's illness onset (if school contact was symptomatic) or before the last date of school exposure (if the school contact was asymptomatic) or 3) whole genome sequencing supported nonschool-associated transmission.

[§] Dashes indicate that data are not applicable.

[¶] Restricted to students. For index patients, n = 40, for secondary cases, n = 4.

** Includes teacher aides and interns.

⁺⁺ Includes ethics teachers, instructional coaches, learning support teachers, special education teachers, and substitute teachers.

§§ Includes administrators, bus drivers, and health specialists.

[¶] Missing data: Underlying medical conditions: eight index patients, one school-associated patient.

**** Starting January 4, 2021, the school district changed its quarantine policy based on changes to state recommendations and only students and staff members identified as close contacts (i.e., within 6 ft of the index patient for a cumulative total of ≥15 minutes over a 24-hour period) of the index patient were quarantined when both were maskless; previously, all close contacts would have been quarantined regardless of mask use. Any close contacts identified in January who met the criteria to not quarantine were categorized as "Notified, close contact." Those who shared a classroom space with the index patient but were not identified as close contacts were categorized as "Notified, not close contact."

TABLE 2. Characteristics of COVID-19–susceptible school contacts* in 20 elementary schools — Salt Lake County, Utah, December 3, 2020– January 31, 2021

	No. (%) of school contacts			
Characteristic	Total (N = 1,041)	Tested (n = 735)		
Overall participation	t	735 (70.6)		
Median percent participation across 20 schools (range)	—	69.7 (44.4–100.0)		
Median age, yrs (range) [§]				
Students (n = 908)	9.0 (5.0–18.0)	9.0 (5.0–18.0)		
Staff members (n = 112)	39.5 (19.0–83.0)	39.0 (19.0–83.0)		
Sex				
Male	487 (47.7)	352 (47.9)		
Female	535 (52.3)	383 (52.1)		
Race/Ethnicity				
White, non-Hispanic	566 (55.9)	382 (52.0)		
Hispanic/Latino	303 (29.9)	237 (32.2)		
Black/African American	28 (2.8)	25 (3.4)		
Asian	33 (3.3)	29 (3.9)		
Native Hawaiian/Other Pacific Islander	28 (2.8)	15 (2.0)		
American Indian or Alaska Native	8 (0.8)	7 (1.0)		
Multiracial	47 (4.6)	40 (5.4)		
Grade [¶]				
Kindergarten	110 (12.1)	61 (9.7)		
1	107 (11.8)	79 (12.5)		
2	139 (15.3)	108 (17.1)		
3	113 (12.4)	78 (12.3)		
4	134 (14.8)	95 (15.0)		
5	118 (13.0)	86 (13.6)		
6	182 (20.0)	121 (19.1)		
≥7	5 (0.6)	4 (0.6)		
Role in school				
Students	908 (87.2)	632 (86.0)		
Head teachers	77 (7.4)	61 (8.3)		
Paraeducators**	24 (2.3)	13 (1.8)		
Other teachers ^{††}	14 (1.3)	12 (1.6)		
Other staff members ⁹⁹	18 (1.7)	17 (2.3)		
Days between school exposure and test date, median (range) $^{ m I\!I}$	8 (6–15)	8 (6–15)		
Quarantine status after exposure to index patient***				
Quarantined	144 (13.8)	105 (14.3)		
Notified, close contact	183 (17.6)	131 (17.8)		
Notified, not close contact	714 (68.6)	499 (67.9)		

* School contact was defined as a student or staff member who was in contact with the index patient for a total of ≥15 minutes in a classroom, cafeteria, school bus, or recess space during an index patient's infectious period. This includes any contacts who received positive SARS-CoV-2 test results but were not determined to have school-associated cases.

[†] Dashes indicate that data are not applicable.

[§] Missing data (also applies to Sex and Race/Ethnicity categories): Age: 21 nonparticipating staff members; Sex: 19 nonparticipating staff members; Race/Ethnicity: 28 nonparticipants.

¹ Restricted to students (n = 908). Students in grade 7 or higher were contacts of an elementary school student on the school bus. All five students in grade 7 or higher were contacts of the same index patient. Bus contacts were not routinely included on the list of school contacts for all 51 index patients.

** Includes teacher aides and interns.

⁺⁺ Includes ethics teachers, instructional coaches, learning support teachers, special education teachers, and substitute teachers.

§§ Includes administrators, bus drivers, and health specialists.

^{¶¶} All classroom testing occurred 6–10 days after exposure. One contact was tested on day 8 and offered a follow-up repeat testing on day 15.

*** Starting January 4, 2021, the school district changed its quarantine policy based on changes to state recommendations, and only students and staff members identified as close contacts (i.e., within 6 ft of the index patient for a cumulative total of ≥15 minutes over a 24-hour period) of the index patient were quarantined when both were maskless; previously, all close contacts would have been quarantined regardless of mask use. Any close contacts identified in January who met the criteria to not quarantine were categorized as "Notified, close contact." Those who shared a classroom space with the index patient but were not identified as close contacts were categorized as "Notified, not close contact."

	Index patient		School contact [†]		School-associated transmission			Factors associated with transmission			
Positivo					Basis for exclus school-assoc transmissi	sion of iated on	School-	Close contact	Contact cat	Poor adł distancing or neithe	nerence to g, mask use, r at school
contact ID	School role	Symptoms reported	School role	Symptoms reported	Epidemiologic data	WGS data	transmission hypothesized	patient and contact [†]	<6 ft from index patient	Index patient	Contact
11	Student	Ν	Student	Ν	Ν	NA	Y	Y	Class	Distancing	Mask use, distancing
J2	Student	Ν	Student	Y	Ν	NA	Y	Y	Class	Neither	Mask use
Х3	Student	Y	Student	Ν	Ν	NA	Y	Ν	Lunch	Neither	Distancing
AA4	Student	Y	Student	Ν	Ν	NA	Y	Y	Lunch	Neither	Neither
EE5	Student	Ν	Teacher	Y	Ν	NA	Y	Ν	Neither	Neither	Neither
A6	Student	Y	Student	Y	Ν	Y	Ν	Y	§	_	_
A7	Student	Y	Student	Ν	Ν	Y	Ν	Y	_	_	_
L8	Student	Ν	Student	Y	Ν	Y	Ν	Y	_	_	_
09	Teacher	Ν	Student	Y	Y	NA	Ν	Y	_	_	_
T10	Student	Y	Student	Y	Y	NA	Ν	Y	_	_	_
RR11	Teacher	Y	Student	Y	Y	NA	Ν	Y	_	_	_
VV12	Student	Y	Student	Y	Y	NA	Ν	Y	_	_	_

TABLE 3. Characteristics of 12 contacts who received positive SARS-CoV-2 test results and summary of evidence for school-associated transmission in five contacts across 20 elementary schools — Salt Lake County, Utah, December 3, 2020–January 31, 2021*

Abbreviations: ID = identifier; Y = yes; N = no; NA = not available; WGS = whole genome sequencing.

* School-associated transmission was excluded by epidemiologic data if 1) the school contact had an illness onset (if symptomatic, symptom onset; if asymptomatic, first positive test date) before the last date of school exposure, or 2) a household member had an illness onset (if symptomatic, symptom onset; if asymptomatic, first positive test date) within 14 days of the positive school contact's illness onset (if school contact was symptomatic) or before the last date of school exposure (if the school contact was asymptomatic). School-associated transmission was excluded by WGS data if the index patient isolate was found to be a different lineage from the positive school contact isolate.

⁺ Persons were determined to be close contacts if they were <6 ft from the index patient for a cumulative total of ≥15 minutes during a 24-hour period at school. All other school contacts were students or staff members who were in contact with the index patient for a cumulative total of ≥15 minutes in a classroom, cafeteria, school bus, or recess space during an index patient's infectious period.

§ Dashes indicate that data are not applicable.

Students in 42 classrooms^{\$\$\$\$} (median class size = 22 students [range = 3-33 students]) sat a median of 3 ft (range = 1-5 ft) apart within the classroom, with a median of eight students (range = 1-16 students) sitting within a radius of 6 ft (Supplementary Table 1, https://stacks.cdc.gov/view/ cdc/104112). Among 37 teachers with available data, 23 (62%) were seated ≥ 6 ft from the closest student (median = 6 ft, range = 2-10 ft), but all teachers reported daily one-on-one or small group instruction in close proximity to students, almost always without using plexiglass or physical barriers. Among 42 teachers, 36 (86%) reported that students always wore masks indoors except when eating or drinking. Nineteen of 20 (95%) principals reported using staggered mealtimes to increase spacing between students during lunch in the cafeteria (although still <6 ft apart). All schools reported implementing multiple measures to decrease in-school SARS-CoV-2 transmission (Supplementary Table 2, https://stacks.cdc.gov/view/ cdc/104112).

Discussion

Despite high community incidence and an inability to space students' classroom seats ≥ 6 ft apart, this investigation found low SARS-CoV-2 transmission and no school-related outbreaks in 20 Salt Lake County elementary schools with high student mask use and implementation of multiple strategies to limit transmission. Other U.S. studies have also detected minimal school-associated transmission when implementing strict mitigation measures, although testing was limited to symptomatic close contacts (3,4). Because children with COVID-19 are frequently asymptomatic (5), the expanded testing to all school contacts regardless of symptom status in this investigation strengthens the evidence for low elementary school transmission.

In addition to implementation of multiple strategies to reduce in-school transmission, school-related activities that increase the risk for SARS-CoV-2 transmission, such as school-based team sports (6), were suspended. Although most teachers were seated ≥ 6 ft from students, CDC's recommendation at the time of the study of ≥ 6 ft student distancing within the classroom (7) was not possible because of limited space. A recent study in Massachusetts found no difference in student and staff member case rates from school districts

Some the 51 index patients, 42 classroom teachers were surveyed. Six index patients did not have traditional classroom exposures and were excluded; five were teachers or staff members who circulated among multiple classrooms a day and interacted with students one-on-one or in small groups, and one was a student in a class for children with special health care needs. Three classrooms had two index patients; only one teacher's survey was used to avoid double counting the classrooms.

Summary

What is already known about this topic?

Data suggest that school-associated SARS-CoV-2 transmission is low.

What is added by this report?

SARS-CoV-2 testing was offered to 1,041 school contacts of 51 index patients across 20 elementary schools in Salt Lake County, Utah. In a high community transmission setting, low school-associated transmission was observed with a 0.7% secondary attack rate. Mask adherence was high, but students' classroom seats were <6 ft apart and a median of 3 ft apart.

What are the implications for public health practice?

These findings add to evidence that in-person elementary schools can be opened safely with minimal in-school transmission when critical prevention strategies including mask use are implemented, even though maintaining ≥ 6 ft between students' seats might not be possible.

with ≥ 3 feet physical distancing requirements compared with school districts with ≥ 6 feet physical distancing requirements (8). The study detected no teacher-driven transmission; other school investigations have identified teachers and staff members as being central to in-school transmission⁵⁵⁵⁵ (9,10). Although school-associated transmission was rare in this investigation, most cases did lead to household transmission, highlighting the importance of reducing school transmission to prevent infected children from transmitting SARS-CoV-2 to household members.

The modified quarantine policy, allowing contacts to continue attending in-person school if both the index patient and the contact were wearing a mask, did not lead to additional schoolassociated transmission and resulted in over 1,200 student in-person learning days saved.***** Among the five schoolassociated cases, the contact or index patient often had poor mask compliance, or they sat near one another during lunch. Findings suggest that quarantine determinations based on mask use of the index patient and close contacts might be adequate for preventing additional school-associated transmission in schools implementing multiple critical prevention strategies.

The findings in this report are subject to at least four limitations. First, WGS to differentiate school-associated from

community transmission in a high incidence setting was not always available. Second, some infected contacts might have been missed because not all contacts received testing and the winter break mid-investigation might have interrupted additional school-associated transmission. Third, misclassification of susceptibility might have occurred as immunity status was unknown. Finally, these findings are specific to the current circulating SARS-CoV-2 variant distribution; as variant distribution shifts to new variants, more transmission might occur.

In an urban county with high SARS-CoV-2 community incidence, comprehensive testing of contacts detected low school-associated transmission in elementary schools, with a secondary attack rate of 0.7%. These results suggest that when ≥ 6 ft distancing is not feasible, schools in high-incidence communities can still limit in-school transmission by consistently using masks and implementing other important mitigation strategies.

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⁵⁵⁵⁵ https://www.medrxiv.org/content/10.1101/2021.02.04.21250670v2.full ***** This calculation assumes that each student would have missed 8 in-person school days because the students attended in-person learning four out of five school days a week. In addition, it also assumes that all 158 students who would have been quarantined in December but were not quarantined in January were not school-associated cases, although only 111 of 158 were tested for SARS-CoV-2.

¹CDC COVID-19 Response Team; ²Epidemic Intelligence Service, CDC; ³Utah Department of Health; ⁴Granite School District, Salt Lake City, Utah; ⁵Health and Economic Recovery Outreach (HERO) Project, University of Utah Health Sciences, Salt Lake City, Utah; ⁶Utah Public Health Laboratory, Taylorsville, Utah; ⁷General Dynamics Information Technology, Falls Church, Virginia; ⁸Salt Lake County Health Department, Salt Lake City, Utah.

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TAB 17

COVID-19 Mitigation Practices and COVID-19 Rates in Schools: Report on Data from Florida, New York and Massachusetts

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Abstract: This paper reports on the correlation of mitigation practices with staff and student COVID-19 case rates in Florida, New York, and Massachusetts during the 2020-2021 school year. We analyze data collected by the COVID-19 School Response Dashboard and focus on student density, ventilation upgrades, and masking. We find higher student COVID-19 rates in schools and districts with lower inperson density but no correlations in staff rates. Ventilation upgrades are correlated with lower rates in Florida but not in New York. We do not find any correlations with mask mandates. All rates are lower in the spring, after teacher vaccination is underway.

I. Introduction

This paper uses data from the COVID-19 School Response Dashboard¹ to report on mitigation practices in school and their correlation with staff and student COVID-19 rates over the 2020-2021 school year. The report focuses on three states with comprehensive data: Florida, New York and Massachusetts. The data are limited to public schools and districts.

We summarize several COVID-19 mitigation strategies adopted by school districts and correlate a subset of these mitigation strategies with COVID-19 case rates. The primary mitigation factors we focus on in the analysis are student in-person density levels, reported ventilation improvements and student and staff mask mandates. We differentiate between the pre- and post-vaccine availability period.

For students, COVID-19 rates are higher in schools and districts with lower in-person density. Staff rates are largely uncorrelated with student density, although in New York staff rates are higher in December in higher density districts. In the spring period, after vaccination is more widely available to teachers, we see little correlation between case rates and density in either direction in either population.

Ventilation improvements are correlated with lower COVID-19 rates in Florida in earlier periods but are not correlated in New York. These improvements vary, and we do not have detailed information on them. In the spring, there is little correlation between case rates and ventilation.

Mask mandates only vary across Florida. Some districts require masks for students and staff, some for staff only and some for neither. In terms of raw means, staff rates are higher in districts which do not have mask mandates for staff or students, although these differences are small. The differences are not significant in analyses which adjust for community rates. In all analyses, rates are similar for staff in districts with mask mandates for both students and staff versus those with staff-only mandates. Further,

¹ (https://covidschooldashboard.com/)

we do not see a correlation between mask mandates and COVID-19 rates among students in either adjusted or unadjusted analyses.

We caution that our analysis focuses only on correlations and it is challenging to make causal statements. In the case of masking in particular, we focus on *mandates* and not on actual behavior. Masking is likely correlated with mask mandates, but it is also likely that some individuals mask even in the absence of a mandate and that there is imperfect compliance even with a mandate. In addition, while we control for community rates, we do not control for community mitigation practices, which would also impact behavior and rates in schools.

This paper adds to our understanding of the relationship between COVID-19 mitigation and school safety in the US (Lessler et al., 2021; Varma et al., 2021; Zimmerman et al., 2021; van den Berg et al., 2021). We would emphasize that in general this literature suggests in-person school can be operated safely with appropriate mitigation, which typically includes universal masking. It would be premature to draw any alternative conclusions about this question based on this preliminary data.

This document is organized as follows: first, we describe the data collection approach for each state. Second, we summarize the analysis methods we use. Third, we summarize the mitigation approaches taken by each state. Finally, we discuss the relationship between mitigation and COVID-19 cases observed in the data.

II. Data Collection Methods

For all states in our analysis (Florida, Massachusetts, and New York), we draw from data on public school- or district-level student enrollment (overall and in-person enrollment), COVID-19 case counts separated by students and teachers/staff, and mitigation practices. We collect these data directly from states, reviews of state websites, reviews of online school district reopening plans, and phone calls to districts without information online. We provide state-specific information about these data sources below.

Florida

Florida data used for our analyses are publicly available online. COVID-19 case data are reported separately for students, teachers, and staff at the school-level each week and are available from the Florida Department of Health (<u>https://floridahealthcovid19.gov/</u>). Enrollment data are available at the school level from the Florida Department of Education (<u>https://edstats.fldoe.org</u>). These data are collected twice per school year, to measure fall and spring enrollment, and include the number of students who are enrolled in in-person, hybrid, and remote instruction. In-person teacher counts are from the school-level 2018-2019 NCES CCD, and the non-teacher staff counts are estimated from district-level counts.

Mitigation data come from systematic review of school district reopening plans performed by the COVID-19 School Dashboard team. Reviewers searched district plans to determine if each district reported using any of 13 different mitigation strategies across several areas. This included screening and testing, social distancing requirements, masking and ventilation requirements.

Reviewers then coded each school district as either using the given mitigation strategy or not (yes/no). In cases where school district plans did not include mitigation plans, reviewers emailed and made phone calls to school districts to clarify what mitigation practices were required.

New York

Both COVID-19 case data and enrollment data are publicly posted online at the school-level from the New York COVID-19 Report Card (<u>https://schoolcovidreportcard.health.ny.gov/#/home</u>) on a weekly basis. The data were collected by the COVID-19 School Dashboard team on a biweekly basis by scraping the website. The state requires all schools to report COVID-19 test results separately for students and teachers/staff daily to the NY State Department of Health. These are reported as totals over the last 7 or 14 days.

Mitigation data were obtained through a systematic review of district plans following the same procedure as Florida.

Massachusetts

Massachusetts district-level data on COVID-19 cases are reported weekly and publicly available from the Massachusetts Department of Elementary and Secondary Education (DESE) (https://www.doe.mass.edu/covid19/positive-cases/). The DESE also provides enrollment data to the COVID-19 School Response Dashboard on a weekly basis. These data include the number of students who are enrolled in in-person, hybrid, and remote instruction. In-person teacher and staff counts are from the district-level 2018-2019 NCES CCD.

No additional district specific mitigation data are used in this analysis as enrollment density is calculated from enrollment data and masking in schools is a universal requirement across the state. Evaluation of physical distancing practices in Massachusetts has been done previously with these data (van den Berg et al., 2021).

III. Methods

We perform several analyses. First, we summarize mitigation strategies used by schools in each state. We report summary statistics weighting the data by enrollment. These summary data exclude fully remote districts. For Massachusetts we report these figures based on van den Berg et al. (2021).

Second, we show case rates for students and staff across all three states over time. These case rates are reported as daily case rates per 100,000 people. The case rates for students are cases as a share of inperson students.

Third, we explore correlations between mitigation strategies and COVID-19 case rates in students and staff. These analyses are limited to schools and districts with at least some in-person attendance and all analyses are weighted by total student enrollment.

We first show graphs of case rates over time by mitigation groups.

In-person student density is categorized into three groups based on the share of in-person student enrollment compared to total enrollment: 10%-49%, 50-79%, and 80% or more. Schools with in-person student density of less than 10% are defined as fully remote and excluded from the analysis. Schools in New York that are reported as "fully remote" are also excluded from the analysis regardless of reported density. This divides each state into roughly thirds, although Florida has greater in-person density in general. We note that density may be capturing various underlying policies, including distancing and

hybrid school structures. We argue this is a useful measure, as it speaks directly to the ability of schools to open with close to full or full enrollment.

Ventilation is divided into two groups based on whether the districts reported ventilation improvements or not. Unfortunately, we do not have details about the specific improvements they may have made, and reported improvements may have been as simple as opening more windows.

For masking, we use data from Florida only (masking is universal in New York and Massachusetts). We report case rates in three groups: (1) Districts with mask mandates for all (22 districts, an average of 844,341 in-person students); (2) Districts with mask mandates only for staff (5 districts, 127,772 students); (3) Districts with no mask mandates (37 districts, 644,792 students). There are no districts with mandates for only students.

In addition to showing case rates over for students and staff in each state and mitigation group, we show effects adjusting for differences in community case rate and demographics.

To do this, we run regressions of the form below:

Case. *Rate*_{*it*} = α + Π (Mitigation_i * *Wave*_{*t*})_{*it*} + Γ (Comm. Case. Rate_{*it*}) + τ_t + βX_i + ϵ_{it}

These regressions represent a standard "event-study" style analysis. We will graph coefficients over time for the groups, and report standard errors clustered by school districts.

In addition to graphical analyses, we will report effects aggregated over time in Appendix Tables, including a number of robustness checks and alternative functional forms.

IV. Summary Statistics: Mitigation Strategies and Overall Case Rates

In Table 1, we report the population-weighted mitigation strategies used in each state. Student and staff masking requirements are universal in New York and Massachusetts, and occur in about half of Florida's school districts. New York and Massachusetts have greater use of other mitigation practices as well, including a higher likelihood of student distancing requirements and more ventilation improvements in schools.

Student density ranges from less than 10% (which we define as remote) through greater than 90%. Florida has higher density schools than either Massachusetts or New York, on average.

Figure 1 reports overall case rates in each state among staff and students over the bi-weekly time periods in the data. The patterns are broadly consistent across all three states. Case rates increase over the fall, especially in December, and then fall rapidly in the spring. In New York and Massachusetts, student rates are lower than staff rates, although the converse is true in Florida. In the spring, staff rates fall more rapidly than student rates, likely reflecting vaccination among teachers.

The case rates in New York are higher than in Massachusetts or Florida, which may reflect in part significantly higher testing among school participants in New York State.

V. Correlation between Mitigation and Case Rates

We now turn to correlation between mitigation and case rates. The subsections below discuss in-person student density, ventilation improvements, and masking in turn.

In discussing these results, it is crucial to keep in mind that these data represent correlations and we cannot make strong causal claims. Notably, we expect school mitigation practices to reflect community mitigation practices: areas in which schools take more precautions will also take more precautions in other areas of society, making it difficult to attribute effects directly to the school behavior. In addition, these represent policies and may not necessarily reflect behavior. For example: masking may be widespread in schools even in the absence of a mandate. Conversely, even in the presence of a mask mandate, individuals may unmask in areas such as staff rooms, which may be higher risk.

In-Person Student Density

Figure 2a shows student and staff means case rates by in-person student density. Figure 2b shows coefficients from regressions; the omitted category is the lowest density category (10% to 49%).

Across all three states, in both unadjusted means and coefficient estimates, a higher in-person student density is consistently associated with equal or *lower* school case rates among students. The lower rates among higher density districts are most pronounced in Florida, and most pronounced in the period of higher case rates in the winter.

In-person student density is uncorrelated with staff rates in either Florida or Massachusetts. In New York, we see higher case rates among staff in more dense districts in the pre-Christmas period.

The regression estimates in Table 2 confirm these results. Higher density is consistently associated with lower student case rates in all three states. The overall impacts on staff rates are insignificant in all three states.

One interpretation of this finding for students is reflect differences in out of school activities. Places where density is lower are more likely to have students engaging with other groups (other childcare, family members, learning pods) when they are not in school. The extended groups may be a risk. A related interpretation is that families engaged in more extracurricular activities out of school when students had less in-school time.

Ventilation

In New York and Florida, we are also able to look at ventilation improvements. Districts were coded as having ventilation improvements if their reopening plan mentioned any change in ventilation, including actions as simple as opening more windows.

Figure 3a shows staff and student rates by ventilation status in overall means. Figure 3b shows coefficients from regressions; the omitted category is the "no ventilation improvements" category.

In unadjusted analyses, districts in Florida which do not report ventilation improvements have slightly higher case rates among staff. These differences do not persist in the adjusted analyses, or in the regressions in Table 2.

In New York we do not see evidence of variation in case rates based on ventilation.

It is important to note that given the wide range of possible ventilation improvements, it is difficult to be concrete here about which improvements might or might not matter.

Masking

Figure 4a shows the overall case rates in the three masking groups in Florida (staff and student masks required, only staff masks required, no masks required); Figure 4b shows coefficients from regressions which adjust for case rates. Note that in Figure 4b the omitted category is "Mask Mandate for All" so the coefficients and significance are interpreted as relative to that group.

In Figure 4a we see higher staff COVID-19 rates in areas without mask mandates for either students or staff. Student COVID-19 rates do not appear to vary with mask mandates.

The results in Figure 4b are similar, although we find that the differences for staff are not significant once we adjust for community rates and other demographics. Community case rates appear to be higher in areas without mask mandates in schools, likely reflecting a lack of mask mandates in general.

The regressions in Table 2 are consistent with the figures; staff rates are slightly higher in areas without any mask mandates, but these results are not significant at conventional levels and are small.

It is important to note that this does not imply masks are ineffective, as these results focus only on masking in schools and do not take community behavior into consideration. Additionally, as noted above, we focus only on mask mandates and not actual masking behavior.

VI. Discussion

We report here on correlations derived from data in the COVID-19 School Response Dashboard, which was combined with information on mitigation strategies recorded by school districts.

In all three states, we observe greater in-person density associated with lower case rates among students. One interpretation of this may reflect out-of-school activities. If student and teachers who are out of school engage in higher risk activities, more time in school could in principle be protective. This would be consistent with some existing literature (e.g. Mulligan, 2021; von Bismarck-Osten, Borusyak, & Schönberg, 2021). It is beyond the scope of these data to illustrate this mechanism directly.

Notably, in the spring period after vaccination is more widespread, we see very little variation across schools in staff or student case rates across any of these mitigation measures. Looking to the fall, this suggests that schools can operate safely in-person full-time.

This represents a preliminary analysis and carries limitations. First, we have comprehensive data for only three states, which are not representative of students across the U.S. as a whole. Second, there is variation in masking only in Florida, meaning that the data may be even less generalizable to all U.S. students. Third, our data only represent cases among people associated with schools, *not* cases spread in schools. Careful contact tracing would be helpful in focusing on the latter, but is not widely available. Finally, we do not focus on possible community spread as a result of schools opening, which is a separate consideration and has been considered in other work (Courtemanche et al., 2021; Harris et al., 2021; Harril & Lieberman, 2021).

Future work with these data, and updated versions, may help shed more light on these issues. Given the challenges of virtual schooling (Diliberti & Kaufman, 2020), there is significant policy pressure to open fully in the fall and to establish the best approaches to doing so. The data here indicates higher density is at least not correlated with higher COVID-19 rates in schools. It may also suggest a more limited need for various mitigation measures in the fall, especially when staff and some older students are vaccinated.

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	Florida	Massachusetts	New York
Mitigation Practice	(<i>n</i> =1,453,464)	(<i>n</i> =485,790)	(<i>n</i> =1,223,327)
Student masks required	0.54	1.00	1.00
Staff masks required	0.61	1.00	1.00
Ventilation improvements	0.64	0.80	0.92
Students maintain 6 ft.	0.79	0.72	0.98
Students maintain 3 ft.		0.98	
Student density (% of total enrollment)			
Less than 10%	0.02	0.17	0.04
10-49%	0.25	0.12	0.39
50-79%	0.47	0.41	0.33
80% or more	0.26	0.30	0.24
Staff testing prior to first day of school	0.00		0.02
Daily at-home symptom screening	0.90	/	0.98
Temperature check upon school entry	0.75	/	0.85
Symptom check upon school entry	0.64	/	0.72
Students stay in fixed cohorts during day	0.53	0.88	0.87
Groups restricted to under 25 people	0.07	0.88	0.10
Students stay in classroom and teachers rotate	0.39	/ -	0.69
Move some class time outdoors	0.29		0.74

Table 1. Proportion of Students in Schools Utilizing Mitigation Practices in Florida, Massachusetts, and New York

Note: This table reports student-weighted mitigation practices using coded mitigation practices from district reopening plans weighted by total student enrollment. Other than density, mitigation practices are summarized only for districts which are not virtual. Coded mitigation practices for FL and NY did not included 3 ft. distancing.

Midian Duration	Main Model		No Community Case Rate		Poisson	
whiligation Fractice,			Controls			
by State	Student Rate	Staff Rate	Student Rate	Staff Rate	Student Rate	Staff Rate
Florida						
Staff masks only required	0.383	2.395	-0.862	1.165	0.990	1.171
	(2.131)	(1.760)	(2.186)	(2.091)	(0.111)	(0.169)
No masks required	2.318	2.103	2.396	2.337	1.116	1.142
	(2.167)	(2.094)	(2.511)	(2.550)	(0.117)	(0.164)
Ventilation improvements	-2.691	-2.661	-3.162	-4.088	0.858	0.855
	(2.297)	(2.445)	(2.360)	(2.820)	(0.0976)	(0.136)
Student density						
50-79%	-6.136**	-0.103	-7.008**	-0.568	0.773***	0.981
	(2.436)	(1.125)	(2.644)	(1.486)	(0.0751)	(0.0822)
80% or more	-11.02***	-0.731	-12.84***	-1.944	0.576***	0.916
	(2.755)	(1.818)	(2.838)	(2.331)	(0.0705)	(0.117)
Observations	34,020	34,020	34,020	34,020	34,020	34,020
Massachusetts	-	-	-			
Student density						
50-79%	-5.729**	-1.416	-4.981*	0.788	0.655**	0.941
	(2.508)	(3.437)	(2.551)	(3.854)	(0.112)	(0.126)
80% or more	-6.129**	-5.979*	-5.116**	-3.169	0.627***	0.777*
	(2.557)	(3.555)	(2.593)	(3.693)	(0.108)	(0.110)
Observations	3.080	3.080	3.080	3.080	3.080	3,080
New York	-)	- , /	/	-)	-)	-)
Ventilation improvements	-1.915	-2.527	-2.686	-2.929	0.938	0.943
1	(2.095)	(2.466)	(2.447)	(2.905)	(0.0542)	(0.0542)
Student density	(1000)	((,)	(21) (2)	(0.00)	(0.00.12)
50-79%	-10.79**	1.970*	-9.316*	3.182***	0.708***	1.050*
	(5.437)	(1.010)	(5.036)	(1.094)	(0.0627)	(0.0295)
80% or more	-15.56***	0.972	-13.73***	2.379	0.628***	1.019
	(5.364)	(1.330)	(4.901)	(1.604)	(0.0586)	(0.0350)
Observations	43,733	43,733	43,733	43,733	43,733	43,733

 Table 2. Regression Coefficient Estimates on Mitigation Practices for Student and Staff Case Rates,

 by State

*p-value < 0.05; **p-value < 0.01; ***p-value < 0.001

Note. Regressions are weighted by total student enrollment and standard errors are clustered by school districts. Columns 1, 2, 5 and 6 include controls for community case rates, time fixed effects, racial demographics and school level. Columns 3 and 4 exclude community case rate controls but include all other controls. Columns 5 and 6 use a Poisson model and report coefficients as Incidence Rate Ratios. The omitted category for density is 10-49%; remote schools (defined as <10% density or reported as remote) are excluded from the analysis.



Figure 1. Cases Rates Among Staff and Students in Florida, Massachusetts, and New York

Note. These figures present the overall means of daily COVID-19 case rates per 100,000 in each state among staff and students over the bi-weekly time periods from October 2020 through April 2021. Mean daily case rate is calculated by group per biweekly wave in the data. Means do not control for community case rates or population demographics.



Figure 2a. Mean Student and Staff Case Rates by Student Density in Florida, Massachusetts, and New York

Note. In-person student density is categorized into three groups based on the share of in-person student enrollment compared to total enrollment: 10%-49%, 50-79%, and 80% or more. Schools with in-person student density of less than 10% are defined as fully remote and excluded from the analysis. Case rates are reported as daily COVID-19 case rates per 100,000. Mean daily case rate is calculated by group per biweekly wave in the data. Means do not control for community case rates or population demographics.



Figure 2b. Regression Coefficients of Student and Staff Case Rates on Student Density in Florida, Massachusetts, and New York

Note. The regression coefficients are from regressions of student density groups interacted with each biweekly wave on student and staff case rates. Density of 10%-49% is used as the comparison group in all regressions. Regressions control for community case rates, time fixed effects, racial demographics and school level. The Florida regression also controls for masking groups (i.e. staff-only masks required and no masks required) and ventilation upgrades. The New York regression controls for ventilation upgrades. Regressions are weighted by total student enrollment and standard errors are clustered by school districts.



Figure 3a. Mean Student and Staff Case Rates by Ventilation in Florida and New York

Note. Districts were coded as having ventilation improvements for any plan that mention changes in ventilation (e.g., opening more windows, installing new ventilation systems). Case rates are reported as daily COVID-19 case rates per 100,000. Mean daily case rate is calculated by group per biweekly wave in the data. Means do not control for community case rates or population demographics.



Figure 3b. Regression Coefficients of Student and Staff Case Rates on Ventilation in Florida and New York

Note. The regression coefficients are from regressions of ventilation interacted with each wave on student and staff case rates. Regressions control for community case rates, time fixed effects, racial demographics, density groups, and school level. The Florida regression also controls for masking groups (i.e. staff-only masks required and no masks required). Regressions are weighted by total student enrollment and standard errors are clustered by school districts.


Figure 4a. Mean Student and Staff Case Rates by Masking Requirements in Florida

Note. Florida masking practices are categorized into three groups: masks required for both students and staff, masks required for staff only, and no masks required for either students or staff. Case rates are reported as daily COVID-19 case rates per 100,000. Mean daily case rate is calculated by group per biweekly wave in the data. Means do not control for community case rates or population demographics.



Figure 4b. Regression Coefficients of Student and Staff Case Rates on Masking Requirements in Florida

Note. The regression coefficients are from regressions of masking groups (i.e. staff-only masks required and no masks required) interacted with each biweekly wave group on student and staff case rates. The comparison is masks required for both students and staff. Regressions control for community case rates, time fixed effects, racial demographics, density groups, ventilation upgrades, and school level. Regressions are weighted by total student enrollment and standard errors are clustered by school districts.

TAB 18

Household COVID-19 risk and in-person schooling

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In-person schooling has proved contentious and difficult to study throughout the SARS-CoV-2 pandemic. Data from a massive online survey in the United States indicates an increased risk of COVID-19-related outcomes among respondents living with a child attending school in-person. School-based mitigation measures are associated with significant reductions in risk, particularly daily symptoms screens, teacher masking, and closure of extra-curricular activities. A positive association between in-person schooling and COVID-19 outcomes persists at low levels of mitigation, but when seven or more mitigation measures are reported, a significant relationship is no longer observed. Among teachers, working outside the home was associated with an increase in COVID-19-related outcomes, but this association is similar to other occupations (e.g., healthcare, office work). While in-person schooling is associated with household COVID-19 risk, this risk can likely be controlled with properly implemented school-based mitigation measures.

The role of schools in transmission, and the value of school closure, has been one of the most contentious issues of the COVID-19 pandemic. There is ongoing debate about exactly how much SARS-CoV-2 risk is posed to individuals and communities by in-person schooling. While there is general consensus that it should be possible to open schools safely with adequate mitigation measures, there is little data and even less agreement as to what level of mitigation is needed.

Many ecological studies have shown an association between in-person schooling and the speed and extent of community SARS-CoV-2 transmission (1-3), though these results have not been uniform (4). While there have been numerous outbreaks in schools and school-like settings (5-7), studies outside of outbreak settings have suggested that, when mitigation measures are in place, transmission within schools is limited and infection rates mirror that of the surrounding community (8, 9).

However, the ways in which in-person schooling influences community SARS-CoV-2 incidence are complex. Schools play a unique role in the social fabric of the United States and other countries, and often create potential transmission connections between otherwise disparate communities. Even if transmission in classrooms is rare, activities surrounding in-person schooling, such as student pick-up and drop-off, teacher interactions, and broader changes to behavior when school is in session could lead to increases in community transmission.

There is also a growing body of evidence that younger children (e.g., those under 10 years) are less susceptible to

infection when exposed (10), though it is unclear if they are less likely to pass on the virus once infected (11, 12), or if this reduced susceptibility is offset by increases in number of contacts during school (13). Even when school-aged children are infected, their risk of severe disease and death is low (14). This means that one of the main reasons for a focus on schools is not the risk to students, but the risk that in-person schooling poses to teachers and family members (15), and its impact on the overall epidemic. Yet, few studies have focused on the risk in-person school poses to household members (15).

Different interpretations of the evidence and local politics have led to massive heterogeneity in approaches to schooling across the United States during the 2020-21 school year (*16*), running the gambit from complete cessation of in-person learning to opening completely with no mitigation measures. Most schools that have opened have made some efforts to mitigate transmission, but there is much diversity in the approaches adopted.

This hodgepodge of approaches to schooling creates a natural experiment from which we can learn about what does, and does not, work for controlling school-associated SARS-CoV-2 spread. However, there is no central repository of the measures implemented across the over 130,000 schools in the United States, or health outcomes in these schools. Where data are available, they are often restricted to traditional public-school systems, though 28% of Pre-K through 12th grade students are in private or charter schools, and rarely can data be linked with individual- or household-level outcomes. The COVID-19 Symptom Survey provides a unique opportunity to collect and analyze data on schooling behaviors and SARS-CoV-2 related outcomes from households throughout the United States. This survey is administered through Facebook in partnership with Carnegie Mellon University and yields approximately 500,000 survey responses in the United States weekly (*17*). It includes questions on symptoms related to COVID-19, testing and, since late November 2020, the schooling experience of any children in the household [survey details and questionnaires are available at (*18*)]. Analysis weights adjust for non-response and coverage bias (see materials and methods).

We analyzed data collected over two time periods during the 2020-2021 school year (Nov. 24, 2020-Dec. 23, 2020 and Jan. 11 2021-Feb. 10, 2021). Of 2,142,887 total respondents in the 50 US states and Washington DC during this period, 576,051 (26.9%) reported at least one child in Pre-K through high school living in their household (tables S1 and S2, Fig. 1A, and fig. S1). While larger states have more responses, the per-capita response rate was fairly consistent across states (20 per 100,000, range 10-29 per 100,000) and slightly higher states S2). Forty-nine in smaller (fig. percent (284,789/576,051) of these respondents reported a child living in the household engaged in either full- (68.8%) or part-time (46.0%) in-person schooling, with substantial variation both within and between states (Fig. 1 and table S3). Overall, inperson schooling increased between the two periods from 48% to 52%, though decreases were observed in some states (e.g., Arizona) (fig. S1 and table S3). Previous work has shown that household-reported rates of in-person schooling collected through the COVID-19 Symptom Survey track well with administrative data (19).

After adjusting for county-level incidence and other individual- and county-level factors (but not school-based mitigation measures; tables S1 and S2 and fig. S3), living in a household with a child engaged in full-time in-person schooling is associated with a substantial increase in the odds [adjusted odds ratio (aOR) 1.38, 95% CI 1.30-1.47] of reporting COVID-19 like illness (CLI, fever of at least 100°F, along with cough, shortness of breath, or difficulty breathing), loss of taste or smell (aOR 1.21, 95% CI 1.16-1.27), or a positive SARS-CoV-2 test result within the previous 14 days (aOR 1.30, 95% CI 1.24-1.35) (Fig. 2A and table S4). Rates of reported COVID-19 outcomes were positively correlated with county-level confirmed SARS-CoV-2 incidence (figs. S4 and S5). When stratifying by grade level (restricted to households reporting children in a single grade strata), we find that the strength of the associations with full-time schooling increases with grade (Fig. 2A and table S4).

The association between COVID-19 outcomes and reporting a child in the household engaged in part-time in-person schooling is attenuated but still statistically significant for CLI (aOR 1.21, 95% CI 1.13-1.29), loss of taste or smell (aOR 1.18, 95% CI 1.13-1.24) and reporting a positive test (aOR 1.09, 95% CI, 1.03-1.14). Among those reporting part-time schooling, the association between grade and COVID-19-related outcomes is less clear (Fig. 2A and table S4).

Respondents were asked to select all mitigation measures in place for any household child engaged in in-person schooling from a list of 14 measures (see materials and methods for wording). For students engaged in any form of in-person learning, the most common mitigation measure reported was student mask mandates (88%, unweighted), followed by teacher mask mandates (80%), restricted entry (e.g., no parents or caregivers allowed into school) (66%) and extra space between desks (63%) (see table S5 for survey weighted rates). The distribution of mitigation measures reported was similar between those reporting full- and part-time in-person schooling, though most measures were slightly more likely to be reported in the part-time setting (Fig. 2B). Besides staying with the same teacher and staying with the same students throughout the day, we found minimal evidence of clustering of mitigation measures in principal components (table S6) or hierarchical clustering analyses (fig. S6). Student mask mandates were the only intervention reported alone.

Overall, respondents reporting a household child engaged in in-person school reported a mean of 6.7 (IQR 4-9) mitigation measures in place at any school attended. Those reporting only children in part-time schooling reported more mitigation measures (mean 7.0, IQR 5-10) than those reporting only children in full-time schooling (mean 6.4, IQR 4-9). There is substantial geographic heterogeneity in the number of mitigation measures reported (Fig. 1D, fig. S7, and tables S5 and S7), with households in South Dakota reporting the least (mean 4.6, IQR 2-7), and households in Vermont reporting the most (mean 8.9, IQR 8-11).

We find a dose-response relationship with the number of mitigation measures implemented and the risk of COVID-19 outcomes among adult household members responding to the survey after adjustment for individual- and county-level factors. On average, each measure implemented is associated with a 9% decrease in the odds of CLI (aOR 0.91, 95% CI 0.89-0.92), an 8% decrease in the odds of loss of taste or smell (aOR 0.92, 95% CI 0.91-0.93) and a 7% decrease in the odds of a recent positive SARS-CoV-2 test (aOR 0.93, 95% CI 0.92-0.94) (table S8). Regression treating each individual mitigation measure as having an independent effect shows that daily symptom screening is clearly associated with greater risk reductions than the average measure (Fig. 3 and table S9), with some evidence that teacher mask mandates and cancelling extra-curricular activities are also associated with larger reductions than average. In contrast, closing cafeterias, playgrounds and use of desk shields are associated with lower risk reductions (or even risk increases); however this may reflect

saturation effects as these are typically reported along with a high number of other measures. Notably, part-time in-person schooling is not associated with a decrease in the risk of COVID-19-related outcomes compared to full-time in-person schooling after accounting for other mitigation measures. Despite this heterogeneity in impact, we find that models including only the number of mitigation measures well approximate those where measures are modeled individually (fig. S8).

To explore what, if any, levels of mitigation are associated with elimination of the risk posed by in-person schooling, we conducted analyses where the in-person exposure groups were specific to whether 0, 1-3, 4-6, 7-9 or 10 or more mitigation measures were reported (Fig. 4, fig. S9, and tables S10 and S11). We found that when 7 or more mitigation measures were in place the positive association between in-person schooling and COVID-19 outcomes disappeared. This result was robust to adjustment for the expected number of interventions (i.e., generalized propensity scores) based on geographic or individual level covariates, but was less clear when propensity scores were based on both (fig. S10). Among those reporting 7 or more mitigation measures, over 80% reported student and teacher mask mandates, restricted entry, extra space between desks and no supply sharing, and over 50% reported student cohorting, reduced class size and daily symptom screening.

The results presented here show a clear association between in-person schooling and the risk of COVID-19-related outcomes in adult household members, and that this association disappears when more than seven school-based mitigation measures are reported. However, this association may not be causal, particularly given that in-person schooling and mitigation measures are not distributed randomly in the population (Fig. 1 and tables S1 to S3, S5, S7, S10, and S11). For instance, households with a student attending in-person school tend to be in counties that are a higher percentage white (fig. S2), and contain respondents who are more likely to have recently eaten out or gone to a bar (table S2). Despite our best efforts to adjust for local incidence, individual behavior and other potential confounders, it is possible that unmeasured factors drive the observed associations; and some sub-analyses raise the possibility that complex interactions between geography and individual factors (but neither alone) may explain some of the observed results (fig. S10), though over-adjustment is a concern in these models.

To address the possibility that the association with in-person schooling could be the result of differences between urban, suburban and rural counties, local patterns of incidence, or other differences between those more and less likely to send children to school in-person we performed several stratified analyses (Fig. 5). When stratifying by propensity for inperson schooling and counties classified by size and metro status, or incidence, we found few systematic or statistically significant deviations from overall estimates, even if overall rates of outcomes differed (i.e., little evidence of effect modification by strata). We find similar results when stratifying counties by reported schooling behaviors, state, percent white, poverty and access to broadband internet (figs. S11 to S14 and table S12). The notable exception is an apparent increase in the risk associated with in-person schooling in households with a higher propensity to have children attending in-person classes (Fig. 5C).

While we were not able to specifically examine the relationship between in-person schooling, mitigation measures and risk to teachers, we were able to assess the risk associated with reporting paid work outside the home among pre-K through high school teachers. Teachers working outside the home were more likely to report COVID-19-related outcomes than those working at home (e.g., Test positive aOR 1.8, 95% CI 1.5-2.2; fig. S15 and table S13). The confidence interval summarizing the elevation of risk overlapped with corresponding intervals associated with working in healthcare (aOR 1.7, 95% CI 1.5-1.9) and office work (aOR 1.6, 95% CI 1.5-1.7).

The results presented here provide evidence that in-person schooling poses a risk to those living in the households of students, but that this risk can be managed through commonly implemented school-based mitigation measures. This is consistent with findings from Sweden, where authors found risk to parents and teachers using a quasi-experimental approach (15). However, much remains unknown. We were unable to measure the risk posed by in-person schooling to the students themselves, nor were we able to specifically assess how different policies impact teachers and other school staff. While the interplay between school policies and local incidence is complex and, possibly, multi-directional, we find substantial variation in SARS-CoV-2 incidence regardless of the mean number of mitigation measures implemented within counties (figs. S8 and S15) and observed associations persist across study periods (figs. S17 to S19). This study also provides limited insight into the mechanisms by which in-person schooling increases risk, and it remains possible that classroom transmission plays a minor role, and other school-related activities drive risk.

This study has limitations. Measures of association between COVID-19 outcomes and key exposures may be biased if confounding factors were not fully accounted for. Though we adjust for several county-level measures of socioeconomic status, these data were not available at the individual level and are known to be associated with COVID-19 risk and attitudes about in-person schooling. Analyses stratified on urbanization, background COVID-19 risk, and propensity for inperson schooling (table S5) did not reveal substantial sensitivity to the levels of factors investigated, nor did examining alternative measures of individual and household COVID-19 occurrence (figs. S20 to S22), alleviating some of these concerns. Still, more formal studies that span schools with multiple policies and approaches would enhance insights into these questions.

Additionally, cross-sectional internet-based surveys have limitations and are subject to response biases. Although results are qualitatively consistent across COVID-19 outcomes [symptoms-based, test-based, and among those tested (figs. S20 to S22)], self-report has numerous limitations, for instance, we cannot robustly assess asymptomatic spread. We were also unable to evaluate compliance with or investment in reported mitigation measures, and there is potential for mitigation measures to be reported inaccurately on the survey. Survey respondents may not be representative of the full U.S. population, and while survey weights help account for non-response and coverage biases, weights calculated based on the Facebook user base were adjusted for representativeness of the wider population based only on age and gender, hence may not ensure representativeness across all covariates. However, the sample size of the survey and consistency of our findings across sub-analyses allay some of these concerns, as does assessment of non-COVID outcomes (figs. S23 and S24). Further, any response biases would have to be differential based on schooling status to bias our results away from the null.

The debate around in-person schooling in the United States has been intense, and has exacerbated differences in approach between independent school systems and individual families nationally. This lack of coordination has provided an opportunity to learn about the risks of in-person schooling, and the degree to which mitigation measures may reduce risk. The results presented here provide one dimension of evidence for decision makers to consider in the context of a complex policy landscape with many competing risks and priorities. While online surveys have their unique limitations, the wide reach of the COVID-19 Symptom Survey has allowed us to gather data from households engaged in heterogeneous schooling activities throughout the country in a way few other studies could. In analyzing these data, we find support for the idea that in-person schooling carries with it increased COVID-19 risk to household members; but also evidence that common, low cost, mitigation measures can reduce this risk.

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https://github.com/HopkinsIDD/inperson-schooling-covid-survey (note this code will not reproduce paper tables and figures without obtaining underlying data from CMU). Analytic code is available at (20). This work is licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) license, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. To view a copy of this license, visit https://creativecommons.org/licenses/by/4.0/. This license does not apply to figures/photos/artwork or other content included in the article that is credited to a third party; obtain authorization from the rights holder before using such material.

SUPPLEMENTARY MATERIALS

science.sciencemag.org/cgi/content/full/science.abh2939/DC1 Materials and Methods Figs. S1 to S26 Tables S1 to S13 References (21–24) MDAR Reproducibility Checklist Data S1 to S3 27 February 2021; accepted 26 April 2021 Published online 29 April 2021 10.1126/science.abh2939



Fig. 1. Spatial distribution of survey responses. (A) Number of survey respondents reporting a school age student in the household by county. (B) Percentage of households with school age children reporting any in-person schooling by county, excluding counties with fewer than 10 responses (excluded counties in dark grey). (C) Percentage of households reporting a child in in-person schooling who report full-time in-person schooling, excluding counties with fewer than 10 reporting in-person schooling. (D) Average number of school-based mitigation measures reported for children with in-person schooling, excluding counties with fewer than 10 reporting in-person schooling.



Fig. 2. Risk from in-person schooling and distribution of mitigation measures by grade. (A) Odds ratio of COVID-19-related outcomes associated with full- and part-time in-person schooling by outcome and grade level, compared to individuals with children in their household not attending in-person schooling and adjusted for individual- and county-level covariates (but not number of mitigation measures) indicating that the strength of the association increases with grade level. (B) Distribution of mitigation measures by grade level and full- versus part-time in-person status across all grades.



Fig. 3. Impact of individual mitigation measures. (**A**) Relationship between number of mitigation measures and percent reporting COVID-19-related outcomes using a log-linear (solid) and spline (dashed) model. (**B**) Odds ratio of COVID-19-related outcomes by mitigation measure in multivariable model including all measures, versus the reduction due to a generic mitigation measure (dotted line).







Fig. 5. Sub-group analysis of association between in-person schooling and COVID-19-related outcomes. Estimated odds ratio (versus those in strata not reporting in-person schooling) of COVID-19-related outcomes from full-time (circles, dashed lines) and part-time (triangles, dotted line) in-person schooling when data are stratified by (**A**) county population size and relation to metropolitan areas (metropolitan area, non-metropolitan area, adjacent to metropolitan area), (**B**) quintile of incidence (Q1 is lowest, Q5 is highest) and (**C**) propensity to report in-person schooling (Q5 most likely to have in-person schooling, Q1 least likely). Horizontal dashed and dotted lines show overall point estimates for full-time and part-time in-person instruction, respectively.



Household COVID-19 risk and in-person schooling

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TAB 19

SARS-CoV-2 Acquisition and Immune Pathogenesis Among School-Aged Learners in Four Diverse Schools

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Key Points:

- Successful COVID-19 mitigation was implemented across a diverse range of schools.
- School-associated SARS-CoV-2 infections reflect regional rates rather than remote or onsite learning.
- Seropositive school-aged children with asymptomatic to mild SARS-CoV-2 infections generate robust humoral and cellular immunity.

ABSTRACT

Background: Understanding SARS-CoV-2 infection in children is necessary to reopen schools safely.

Methods: We measured SARS-CoV-2 infection in 320 learners $[10.5 \pm 2.1(sd); 7-17 \text{ y.o.}]$ at four diverse schools with either remote or on-site learning. Schools A and B served low-income Hispanic learners; school C served many special-needs learners; and all provided predominantly remote instruction. School D served middle- and upper-income learners, with predominantly on-site instruction. Testing occurred in the fall (2020), and 6-8 weeks later during the fall-winter surge (notable for a tenfold increase in COVID-19 cases). Immune responses and mitigation fidelity were also measured.

Results: We found SARS-CoV-2 infections in 17 learners only during the surge. School A (97% remote learners) had the highest infection (10/70, 14.3%, p<0.01) and IgG positivity rates (13/66, 19.7%). School D (93% on-site learners) had the lowest infection and IgG positivity rates (1/63, 1.6%). Mitigation compliance [physical distancing (mean 87.4%) and face covering (91.3%)] was remarkably high at all schools. Documented SARS-CoV-2-infected learners had neutralizing antibodies (94.7%), robust IFN- γ + T cell responses, and reduced monocytes. **Conclusion:** Schools can implement successful mitigation strategies across a wide range of student diversity. Despite asymptomatic to mild SARS-CoV-2 infection, children generate robust humoral and cellular immune responses.

Abbreviations: CHOC, Children's Hospital of Orange County; OCHCA, Orange County Health Care Agency; SOCOM, Systematic Observation of COVID-19 Mitigation; HDL, high-density lipoprotein; LDL, low-density lipoprotein; PBMCs, peripheral blood mononuclear cells; NP, nucleocapsid protein; RBD, receptor binding domain; NK, natural killer cells; mDCs, myeloid dendritic cells; PD-1, programmed death cell protein 1; MFI, mean fluorescence intensity

INTRODUCTION

An urgent need for data on SARS-CoV-2 incidence, immune mechanisms, and mitigation fidelity in the unique setting of K-12 schools was recognized at the earliest stages of the COVID-19 pandemic¹ when K-12 schools closed in the U.S. and across the world. In this report, we summarize the results of the Healthy School Restart Study, a prospective study of four diverse schools in Orange County, California, at two distinct phases of the COVID-19 pandemic: 1) early in the fall (2020) school semester, at a relatively low level of community COVID-19 case rates of approximately 3-4 cases per 100,000 across the county (in September 2020, surveillance rates for the county were estimated at 12% but 17% in communities of color²). and 2) approximately 6-8 weeks later in the midst of the fall-winter surge in which COVID-19 had increased to about 40 cases per 100,000. We tested the assumption used to support school closures that learners would be less susceptible to viral infection if they avoided on-site learning³⁻⁵. Key objectives were 1) to begin to understand SARS-CoV-2 infection in schools that reflected the diversity of our region, 2) to gain insight into the serological and cellular mechanisms in the pediatric population in response to SARS-CoV-2 infection, and 3) to measure the fidelity of SARS-CoV-2 mitigation procedures.

METHODS

Design

A total of 320 learners [mean age 10.5 ± 2.1 (sd); range 7-17 y.o.] and 99 school staff enrolled in our study across four schools for two testing cycles. Participants were allowed to enroll in the study at the second cycle even if they did not participate in the first visit. During the first cycle, 181 students aged 10-13 y.o. were enrolled. During the second cycle, 161 learners returned, and 139 new learners aged 7-17 y.o. were enrolled to accommodate additional requests

for testing by the schools. During the first cycle, 99 adults were enrolled, and during the second cycle, 90 returned. At each of the testing cycles, each participant underwent:

- 1. Brief medical history and a COVID-19 symptom screening
- 2. Anterior nasal swab for SARS-CoV-2 and co-circulating respiratory pathogens
- Optional non-fasting phlebotomy for serological and other immunological markers of SARS-CoV-2 infection

Pediatric participants were also offered a non-fasting lipid screening as an added benefit to the optional phlebotomy at cycle 2, as this screening test is recommended by the American Academy of Pediatrics.

School Selection and Study Participants

We partnered with four schools that reflected the diverse population of Orange County ensuring adequate representation of low-income, minority, and special-needs learner-participants (Table). Inclusion criteria for the student participants were age (7-17 y.o.), current enrollment at one of the schools participating in the study, and fluency and literacy in English or Spanish. The criteria for adult school staff participants were age (equal or greater than 18 years), current employment at one of the participating schools, and fluency and literacy in English or Spanish. *IRB Approval and Consent*

The study was approved by the institutional review boards at the Children's Hospital of Orange County (CHOC) and the University of California Irvine (UCI). Informed assent from the children and informed consent from parents or legally authorized guardians, or from the adult participants, were obtained remotely or in person.

Approach to Participation

We organized virtual meetings with school staff and teachers to explain the study and to answer questions at each school. We also held town-hall-type meetings with potential students and their parents or authorized legal guardians. Meetings were held in both English and Spanish. We positioned our testing setup out of the way of normal school operations.

Identification of SARS-CoV-2 and Co-Circulating Respiratory Pathogens

Anterior nasal swabs were obtained from each participant. The BIOFIRE Respiratory 2.1 Panel was used to identify SARS-CoV-2 in addition to 21 other respiratory pathogens by RTqPCR done in the CHOC Clinical Laboratory. Per state mandates, positive SARS-CoV-2 findings were reported by the laboratory to the Orange County Health Care Agency (OCHCA) for subsequent confidential action and tracing by county health authorities.

Blood Samples for Immune Response and Lipid Profile

Whole blood samples were collected in CPT tubes from 274 of the 320 learners. Plasma and peripheral blood mononuclear cells (PBMCs) were isolated by centrifugation. Presence of nucleocapsid protein (NP)-specific IgG was determined with the Abbott Architect immunoassay. IgM and IgG antibody titers against the NP and the receptor binding domain (RBD) of the spike protein were measured using standard ELISA⁶. Specific SARS-CoV-2 neutralizing antibodies were measured using focus reduction neutralizing assays⁶. IFN- γ producing T cells following stimulation with overlapping peptide pools were determined using mAB ELISpot plates and PBMCs from 34 SARS-CoV-2 seropositive samples and 34 age- and sex-matched uninfected controls from enrolled participants⁷. Circulating immune and inflammatory mediators (e.g., TNF- α , IL-6) were also measured using the Human 45-Plex kit from R&D⁷. Immunophenotyping to identify innate and adaptive cells was done using flow cytometry in 15 SARS-CoV-2 seropositive samples and 15 age- and sex-matched controls⁷. As an added benefit to the risk of phlebotomy, learners were offered a non-fasting lipid screening, measured by enzymatic reflectance spectrophotometry. This screening test is highly recommended for children and adolescents by the American Academy of Pediatrics but underutilized⁸.

Regional Incidence of COVID-19

OCHCA collaborators routinely collect COVID-19 case rates across the county. To better understand the specific regional impact of COVID-19 at each of the four schools, we collated the countywide COVID-19 case data according to the zip codes of the learners at each of the schools during the two testing cycles (Figure 1).

Systematic Observation of COVID-19 Mitigation (SOCOM)

We adapted existing observation instruments, such as the System for Observing Play and Leisure Activity in Youth (SOPLAY) and the System for Observing Play and Recreation in Communities (SOPARC)^{9,10}, to quantify the fidelity of face covering and physical distancing (\geq 6 ft.) mitigation in schools¹¹. This new observation technique, Systematic Observation of COVID-19 Mitigation (SOCOM), used momentary time sampling techniques in which systematic and periodic scans of individuals were made in different (pre-determined) school environments (e.g., classroom, communal dining) and during physical activity (e.g., recess, physical education classes). Trained observers visited each of the 4 schools 3-5 times over a one-week interval and quantified mitigation in classrooms, recess, communal dining, and physical education (PE) classes.

Statistical Analysis

All serology measurements and symptom ratings were treated as binary (yes/no) across the two visits. Lipid measures were each classified as normal or abnormal based on age-

appropriate criteria. In the case of high-density lipoprotein (HDL) and low-density lipoprotein (LDL), the abnormal cases were further distinguished as low or high. Site comparisons of proportions, as well as cross-tabulations of two factors, were performed with Chi-Square analysis utilizing the Mantel-Haenszel correction. A α -level of 0.05 was used as the criterion for statistical significance. For learners found to be infected, age- and sex-matched uninfected peers were selected as controls for analysis. Immunological datasets were first tested for normality. To compare differences in various immune cell subsets between infected and age- and sex-matched uninfected participants, we used one-way ANOVA and Holm Sidak's multiple comparisons tests. Group comparisons were tested using an unpaired t-test (Mann-Whitney U-test). For focus reduction neutralization assays, the half maximum inhibitory concentration (IC50) was calculated by non-linear regression analysis using normalized counted foci; 100% of infectivity was obtained by normalizing the number of foci counted in the wells derived from the cells infected with SARS-CoV-2 virus in the absence of plasma. Pearson correlation analyses were done by log transforming antibody end-point titers or neutralization titers.

RESULTS

Incidence of SARS-CoV-2 and Other Respiratory Viral Infections

No positive nasal RT-qPCR tests were identified in the first cycle of testing. During the second cycle, a total of 17 SARS-CoV-2 RT-qPCR positive results were observed among the 300 learners that were tested [5.7%, mean age 10.4 ± 2.1 (sd); range 7-17 y.o.]. Examination of SARS-CoV-2 community case rates by school site participants' zip codes revealed low rates during the first cycle of testing, and a substantial rise in rates during the second cycle of testing (Figure 1A). As shown in Figure 1B, school A had the highest number of SARS-CoV-2 infected learners (p<0.01). In the aggregate (Figure 1C), there was no statistically significant difference in

SARS-CoV-2 positive rates among remote or on-site learners (p=.1468). None of the hybrid learners (n=3) were positive for SARS-CoV-2. There was one additional case of SARS-CoV-2 among learners (n=8), who declined to disclose their education modality (i.e., remote, on-site or hybrid). In school B (the same geographic location as school A), we found 2 of 45 on-site learners (4.4%) and 4 of 89 remote learners (4.5%) had positive SARS-CoV-2 RT-qPCR. School D had 1 (1.3%) of on-site learners vs. none of remote learners had positive SARS-CoV-2 RTqPCR. The low number of on-site participants in school A (n=2) prevented us from directly comparing SARS-CoV-2 positivity between remote and on-site instruction at each school site. Among the 90 staff and teachers tested in the second cycle visit, 6 (6.7%) were SARS-CoV-2 positive (Figure 1B). As with the learners, there were no positive results among the staff in the first cycle of testing. When normalized to data obtained from OCHCA zip-code-based case rates, school A showed the highest ratio of learner-to-local SARS-CoV-2 RT-qPCR positivity. We found that a significant number of learners in schools A and B had either low HDL or high LDL. In addition, 26% of learners with low HDL (p<0.0001) were also found to be SARS-CoV-2 RTqPCR positive. There was no evidence of either influenza or RSV infection. Rhinovirus/enterovirus was observed in learners at all 4 schools (A: 9 of 72, 12.5%; B:15 of 142, 10.6%; C: 1 of 17, 5.9%; and D: 8 of 89, 9.0%). There was no correlation between SARS-

CoV-2 and rhinovirus/enterovirus infections (p=.8397).

Assessing Humoral and Cellular Immunity to SARS-CoV-2 in Children

Substantial numbers of learners (n=28) were found to have anti-NP IgG antibodies, indicating previous infection with SARS-CoV-2 (Figure 2A). As with the SARS-CoV-2 RTqPCR results, there were large differences among the schools, most likely reflecting the differences in neighborhood infection rates (Figure 1A). There was also a significant association (p<0.0269) between SARS-CoV-2 RT-qPCR and anti-NP IgG results. Infected learners had detectable IgM and IgG titers against both the NP and the RBD of the spike protein (Supplemental Figure 1A), as well as neutralizing antibodies specifically to SARS-CoV-2 (Figure 2B, C). Neutralizing and binding antibody titers showed significant correlations (Supplemental Figure 1B). Moreover, learners with a history of SARS-CoV-2 infection generated broad and robust T cell responses as measured by IFN-y ELISPOT following stimulation with overlapping peptides covering the entire viral proteome (Figure 3A). While the frequency of total CD4+ T cells was significantly lower in infected children (Figure 3B), the subset of proliferating (Ki-67+) CD4+ T cells was increased. This was driven by an increased proliferation within the effector memory CD4+ T cell (CD4+CD45RA-CCR7-Ki-67+) subset (Figure 3C). Levels of programmed death cell protein 1 (PD-1) were increased on CD4+ and CD8+ T cells from infected children indicative of recent activation (Figure 3D). Frequencies of circulating monocytes and natural killer (NK) cell subsets were lower in infected children (Figure 4A). There was no difference in inflammatory mediator responses (such as IL-1, IL-6, TNF- α) between healthy and SARS-CoV-2 seropositive children. Levels of innate immune cell activation markers such as HLA-DR were increased on myeloid dendritic cells (mDCs), while levels of FcyIII (CD16) and co-stimulatory molecule, CD86, were reduced on total NK cells and various monocytes subsets (Figure 4B, C).

COVID-19 Symptoms

School A had the highest number of learners who reported symptoms associated with COVID-19 at 30% (p=0.0452). Rates for schools B, C, and D were 14.9%, 7.7%, and 18.6%, respectively. Learners who reported symptoms were significantly more likely to have SARS-CoV-2 positivity (13.6% vs. 3.5%, p<0.0018). Conversely, learners who were SARS-CoV-2

positive were more likely to have symptoms (47.1% vs. 16.8%, p=0.0018); in this group cough and fatigue were the most common.

Systematic Observation of COVID-19 Mitigation (SOCOM)

SOCOM observations revealed high levels of face coverings and physical distancing compliance in classrooms at all four schools (Figure 5) and quantified the intuitively expected reduction in face coverings during communal dining (p<0.0001). At school D, which had the vast majority of on-site learners, face covering was consistently high (classroom, 96.7%; active recess, 97.3%; and PE, 97.0%). Physical distancing at school D varied (classroom, 81.6%; active recess, 35.1%; PE, 50.7%).

DISCUSSION

This is one of the first school-based studies completed during the pandemic that directly and prospectively observed SARS-CoV-2 infection rates from school learners and staff. The four participating schools reflected the enormous diversity of income, community COVID-19 case rates, school type (private, charter, public), and learning status (remote vs. on-site) that face learners, school staff, and policy makers across the U.S. The huge increase in COVID-19 case rates between the two testing cycles permitted insight into the effect of the fall surge in SARS-CoV-2 infection. A unique feature of this research was that in contrast to the bulk of the data recently published on school-related SARS-CoV-2 infection, data was collected at the school site directly and not from data measured by report through public health agencies. Weaknesses of the study include 1) the possibility of selection bias as each participant and authorized legal guardian consented through a lengthy process in a time of great stress and anxiety, and 2) only one of our schools (school D) had predominately on-site learning.

Our results are consistent with several surveillance-based studies focused on schools during the pandemic. Zimmerman et al.¹² implemented a comprehensive education and collaboration program and collected public health data in North Carolina; Falk et al.¹³ studied a rural Wisconsin community; and Macartney et al.¹⁴ studied preschools and K-12 schools in Australia. All studies concluded that secondary transmission of SARS-CoV-2 within schools was limited. We also found that infection rates reflected those of the community and neither remote learning nor highly mitigated on-site school attendance could eliminate SARS-CoV-2 infection. Comparisons and conclusions among our study and others done to date must be made with caution. For example, Zimmerman and Falk relied on public health agency contact tracing data. SARS-CoV-2 testing in learners or teachers would most likely result from a family reporting either symptoms or a known exposure to a primary care provider or testing center. Positive results would subsequently be linked to a particular school. Some infected individuals who were asymptomatic or symptom-deniers may not have been identified.

We show that under certain conditions, schools could host on-site learning with relatively low SARS-CoV-2 infection rates. The private school in our study (school D) remained open with a majority of on-site learners from July through December 2020, with few SARS-CoV-2 cases and low IgG positivity despite a tenfold increase in regional case rates. School D prepared for on-site learning by creating an advisory committee consisting of parents, local physicians, and content experts, and made an initial investment of about \$1,400 per student to meet mitigation guidelines. While cost comparisons among schools serving very heterogeneous populations are always challenging, Rice et al.¹⁵ estimated that a comprehensive program of mitigation at schools would cost up to \$442 per student.

Although SARS-CoV-2 infected children tend to report fewer symptoms than adults¹⁶, we found that school A had both the highest percentage of learners with symptoms and highest percentage of SARS-CoV-2 positivity. In addition, there was a significant relationship between SARS-CoV-2 positivity and presence of symptoms. These data support the use of limited symptom screening as a mechanism to enhance healthy school reopening.

We found that 26% of infected learners had significantly low circulating levels of HDL. Factors relating to obesity and physical activity are known to affect COVID-19 disease severity in adults and children^{17–19}. Overweight and obesity are associated with these lipid abnormalities, all of which tend to occur with greater incidence in low-income school-aged children^{20,21}. Levels of HDL seem to be particularly sensitive to physical activity^{22,23}. The mechanisms responsible for the significant association that we found between low HDL levels and SARS-CoV-2 are at present unknown, but may be related to the association of overweight/obesity and chronic inflammation in children²⁴. Increases in physical inactivity and weight in children have accompanied school closures over the past year^{25,26}.

Widespread implementation of pediatric COVID-19 vaccination²⁷ is many months away, and it is likely that adherence to COVID-19 mitigation procedures, including physical distancing and face covering, will need to continue for the near future. Previous studies cited above all highlighted the need to achieve high fidelity of COVID-19 mitigation procedures if viral transmission were to be limited. The in-classroom SOCOM data that we collected also revealed high fidelity at all four schools, including school C, which served many children with special needs, presenting additional challenges to COVID-19 mitigation. The successful implementation of mitigation procedures both in on-site settings and in the instruction to remote learners might have played a role in the complete absence of influenza virus that we observed^{28,29}. In contrast,

rhinovirus (which has the highest detection rate on school room desks among any respiratory viruses³⁰) was observed in all schools. Implementation of quantifiable non-intrusive instruments like SOCOM along with testing of several respiratory viruses could help schools implement actionable strategies to limit SARS-CoV-2 transmission. The SOCOM method can help schools not only implement but also determine compliance with mitigation strategies.

Our immunological analyses revealed patterns that can explain the mild symptomatology that accompanies SARS-CoV-2 infection in most children. Frequencies of circulating total and classical monocytes, and expression levels of monocyte activation markers were lower in the infected compared with uninfected children. Moreover, key inflammatory mediators (e.g., IL-1, IL-6, and TNF- α) did not differ between the infected and uninfected comparison groups. This is in contrast to the monocytosis and heightened systemic inflammation observed in adult patients^{31,32}. The absence of a heightened inflammatory profile, however, did not indicate a weaker immune response to SARS-CoV-2. Infected children generated robust and broad humoral and cellular immune responses and had detectable levels of SARS-CoV-2-specific IFN-y secreting CD4+T cells following exposure to SARS-CoV-2 antigens. The infected children also had increased expression of PD1 on both total CD4+ and CD8+ T cells and a higher frequency of proliferating effector memory CD4+ T cells indicative of a recent history of activation. The frequency of circulating cytolytic NK cells, those that mediate antibody-dependent cell cytotoxicity, was lower in the infected children. This observation corroborates previous studies in both children and adults, and supports the speculation that NK cells may be recruited into the $lung^{31,33-35}$. Similarly, the frequency of circulating CD4+ T cells was reduced, suggestive of potential recruitment into the site of infection. These results support a maturation-dependent immune response to SARS-CoV-2 infection in children, one that specifically leads to milder

disease and, possibly, to reduced transmission. The immune dysregulation that occurs in the rare but serious pediatric multisystem inflammatory syndrome in children (MIS-C) remains poorly understood³⁶. However, based on the literature, MIS-C patients have much higher levels of circulating inflammatory mediators³⁷ than what we observed in our study in acutely infected children who were asymptomatic to mildly symptomatic.

CONCLUSION

This study indicated that neither remote nor on-site learning strategies could eliminate SARS-CoV-2 infection in school-aged children. Varied levels of successful infection prevention were observed in the four diverse schools studied that had differences in income level and regional levels of COVID-19 infection. The key challenge, of course, is balancing the damaging effects of school closures, which in the U.S. and throughout the world have adversely impacted low-income school-aged children and those with disabilities^{38,39}, with the consequences of SARS-CoV-2 transmission to other learners and school staff. In retrospect, a larger, arguably national, more comprehensive approach to prospectively collecting SARS-CoV-2 infection patterns in school-aged children, their school staff and faculty, and family contacts would likely have provided the necessary information to achieve the shared goal of the healthiest environment for the continued education and physical and mental health of children and adolescents throughout the country. Our data do support the notion embodied in the Centers for Disease Control and Prevention (CDC) School Health Index that schools can effectively promote good health in children ⁴⁰. We speculate that even at times of high community SARS-CoV-2 prevalence, schools can be among the healthiest places for children to be so long as the right mitigation strategies are in place. Finally, we would be remiss in not highlighting the remarkable dedication of the faculty and staff at all four schools who worked tirelessly to continue to provide

meaningful learning to their students, and willingly and enthusiastically permitted us to intrude

into their sites during an anxiety-provoking and uncertain time.

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FIGURE LEGENDS

FIGURE 1. Regional and school-based SARS-CoV-2 positivity. (A) The marked growths in regional case rates (by participating students' zip codes) are shown for each school site at testing cycle 1 and 2. (B) SARS-CoV-2 positivity by RT-qPCR in learners and staff at each of the school sites during cycle 2. (C) SARS-CoV-2 positivity by RT-qPCR in remote vs. on-site learners (aggregate of all 4 schools).

FIGURE 2. SARS-CoV-2-specific antibodies identified in school children. (A) Seroprevalence among learners at various schools. Neutralizing antibody titers against SARS-CoV-2 in learners from (B) testing cycle 1 and (C) cycle 2. Each learner is represented by a separate symbol and a best fit curve characterizing the neutralizing antibody capacity. The red line represents the positive control while the blue line represents the negative control. Infected, minimally symptomatic learners showed robust neutralizing antibody function to SARS-CoV-2.

FIGURE 3. Effect of SARS-CoV-2 infection on adaptive immunity. (A) SARS-CoV-2-specific T cells were detected in seropositive learners by IFN- γ ELISpot assay following stimulation with overlapping peptides covering the entire viral proteome. (B) The frequency of adaptive immune cell subsets was identified by flow cytometry and revealed that the frequency of total CD4+ T cells was significantly lower in infected children. (C) There was nonetheless an increase in the proliferation of total CD4+ T cells (CD4+Ki-67+) and their effector memory subset (CD4+CD45RA-CCR7-Ki-67+). (D) Expression of programmed cell death protein 1 (PD-1), a marker of recent activation, on T cells of infected learners was also increased. Infected, minimally symptomatic learners showed robust adaptive immune responses to SARS-CoV-2. *p<0.05, **p<0.01, ***p<0.001.

FIGURE 4. Effect of SARS-CoV-2 infection on innate immune cells. (A) The frequency of innate immune cell subsets was identified by flow cytometry and demonstrated decreased frequencies of circulating monocytes and natural killer (NK) cells in infected children. (B) The mean fluorescence intensity (MFI) of innate immune cell activation markers such as HLA-DR on myeloid dendritic cells (mDCs) was increased, whereas the expression of Fc γ III receptor (CD16) on total NK cells and non-classical monocytes was reduced. (C) The expression of co-stimulatory molecule, CD86, on total monocytes, classical monocytes and non-classical monocytes was also reduced. *p<0.05, **p<0.01, ***p<0.001, ****p<0.0001.

FIGURE 5. SOCOM data. (A) Physical-distancing and face-covering compliance was high in all schools and there was no correlation between in-classroom data and SARS-CoV-2 positivity. (B) Mean SOCOM values for classroom, communal dining, recess, and physical activity. Classroom physical-distancing was significantly highest, while face covering was lowest in communal dining. ****p<0.0001.

SUPPLEMENTAL MATERIAL FIGURE LEGENDS SUPPLEMENTAL FIGURE 1. SARS-CoV-2 antibodies. (A) Detection of IgM and IgG endpoint titers against SARS-CoV-2 nucleoprotein (NP) and receptor-binding domain (RBD) in learners. (B) Correlation between the half maximum inhibitory concentration (IC50) of the focus reduction neutralization titer (FRNT50) and IgM/IgG end-point titers in seropositive learners. **p<0.01, ****p<0.0001.









Total CD8+PD-1+ T cells



-0.2

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A



5 Log CD16 MFI 100000-4 3 50000 2-1 **Total Monocytes Classical Monocytes** **** 6000-4000



Total NK cells

6

Myeloid Dendritic cells

150000

HLA-DR MFI

8000-

6000-

130 MFI

2000-

0

в

8

7

6

5

4

3

2

1

С







Non-Classical Monocytes





Β.





Supplementary Figure 1

TAB 20

SARS-CoV-2 infection and transmission in school settings during the second wave in Berlin, Germany: a cross-sectional study

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Abstract

Background: School attendance during the SARS-CoV-2 pandemic is intensely debated. Modelling studies suggest that school closures contribute to community transmission reduction. However, data among school-attending students and staff are scarce. In November 2020, we examined SARS-CoV-2 infections and seroreactivity in 24 randomly selected school classes and connected households in Berlin, Germany.

Methods: Students and school staff were examined, oro-nasopharyngeal swabs and blood samples collected, and SARS-CoV-2 infection and IgG antibodies detected by RT-PCR and ELISA. Household members performed self-swabs. Individual and institutional infection prevention and control measures were assessed. Classes with SARS-CoV-2 infection and connected household members were re-tested after one week.

Findings: 1119 participants were examined, including 177 primary and 175 secondary school students, 142 staff, and 625 household members. Participants reported mainly cold symptoms (19.4%). SARS-CoV-2 infection occurred in eight of 24 classes affecting each 1-2 individuals. Infection prevalence was 2.7% (95%CI; 1.2-5.0%; 9/338), 1.4% (0.2-5.1%; 2/140), and 2.3% (1.3-3.8%; 14/611) among students, staff and household members, respectively, including quarantined persons. Six of nine infected students were asymptomatic. Prevalence increased with inconsistent facemask use in school, way to school on foot, and case-contacts outside school. IgG antibodies were detected in 2.0% (0.8-4.1%; 7/347), 1.4% (0.2-5.0%; 2/141) and 1.4% (0.6-2.7%; 8/576), respectively. For three of nine households with infection(s) detected at cross-sectional assessment, origin in school seemed possible. After one week, no school-related, secondary infections appeared in affected classes; the attack rate in connected households was 1.1%.

Interpretation: These data suggest that school attendance under preventive measures is feasible, provided their rigorous implementation. In balancing threats and benefits of open *versus* closed schools during the pandemic, parents and society need to consider possible spill-overs into their households. Deeper insight is needed into the infection risks due to being a schoolchild as compared to attending school.

Funding: Senate of Berlin.

Introduction

In the SARS-CoV-2 pandemic, schooling takes a central role in the public debate. The focus is on whether schools are safe to attend, whether children, adolescents, and/or schools are relevant sources of community infections, and whether school operation should be maintained, modified, or suspended.¹ Compared to adults, SARS-CoV-2 infections in children tend to take a mild course or to stay asymptomatic, while contagiousness still is ambiguous.² Remarkably, however, children and adolescents temporarily took top incidence positions in various studies in autumn 2020,^{3,4} and modelling studies suggest that closure of educational facilities significantly limits overall transmission.⁵ Nevertheless, there still is insufficient evidence as to whether schools actually drive the pandemic, or rather mirror it.^{6,7} Observational studies on the association of school closures with community transmission have yielded inconsistent results, ranging from none to substantial reduction.⁸ When considering infection risks, a distinction needs to be made between schools, students and agetypical, contextual whereabouts, e.g., public transport or after-school meetings. Limited data suggest that schools are not high-risk settings for SARS-CoV-2 transmission between students and/or staff.^{2,9} On the contrary, there is evidence that school attendance itself is not a risk factor but inconsistent mask use in school, contacts to COVID-19 cases, and gatherings outside the household.¹⁰ Therefore, risks need to be balanced against the detrimental impact school closures have on children and societies as to health, social equality, workforce, and economy.^{11,12}

Germany experienced a strong second pandemic wave starting September 2020 and implemented a countrywide lockdown including school closures on December 16, 2020. During the preliminary peak of the second wave, we aimed at assessing SARS-CoV-2 infection and transmission in Berlin schools among schoolchildren, staff and connected household members as well as at estimating secondary infections arising from the school context.

Methods

Study design, setting and participants

This is a cross-sectional analysis of a longitudinal study among students and school staff from each one class in 24 schools in Berlin, and related household members. The present second round of

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examinations was conducted between November 2 and 16, 2020. During that time, SARS-CoV-2 transmission in Berlin (population, 3·8 million) was comparatively high: 14,514 cases were recorded, and the 7-day incidence was 185-210/100,000 inhabitants.¹³ A first round had taken place in June 2020, at low incidence.¹⁴ For the selection of schools, the city districts were divided into three socio-economic strata. In each stratum, two districts were randomly selected, and in these, two primary and two secondary schools. Three schools unable to participate were replaced by randomly resampled substitutes. Classes were selected amongst grades 3-5 and 9-11. We aimed at examining 20 students *per* class and ≤10 staff. In the first round, the proportion of students participating *per* class was 65% (range, 13%-96%). Hereafter, students and staff are considered index participate. The study was reviewed by the Ethics Committee of Charité–Universitätsmedizin Berlin (EA2/091/20). Informed written consent and assent was obtained from all participants and legal

representatives.

Cross-sectional data collection

Study teams visited the schools on a scheduled day. A brief medical history was obtained. Forehead temperature was scanned, and fever defined as ≥37.5°C. Oro-nasopharyngeal swabs (nerbe plus, Germany) were collected, and finger-prick blood samples taken onto filter-paper (BioSample Card, Ahlstrom Munksjö, Germany). Household members attended mobile clinics at school for symptom assessment and finger-pricking. They delivered self-collected swabs (oropharynx and nostriles), after beforehand having received instructions and swabs (CoronaOne, Germany). Participants absent due to illness or quarantine were visited at home, usually same-day. SARS-CoV-2 infection was determined by RT-PCR (GFE-Blut, Frankfurt, Germany). For anti-SARS-CoV-2-IgG, 4.75 mm dried blood spot discs were extracted in 250 µl buffer, and ELISA was performed on a EUROLabWorkstation (Euroimmun AG, Germany). In case of SARS-CoV-2 infection, health authorities were notified, participants received quarantine instructions, and during following days, they were repeatedly interviewed on health and potential infection sources.

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Participants completed a digital questionnaire (child, adolescent, and adult versions) two days before the study visit. Parameters assessed, spanning the preceding two weeks if appropriate, included household composition, signs and symptoms, contacts to SARS-CoV-2 positive persons, hand hygiene, physical distancing and facemask wearing.

Lastly, the school-related implementation of governmentally recommended infection prevention and control (IPC) measures was documented, including hygiene measures, distancing, absence rules at illness, ventilation, cohorting, staggering of teaching hours, and home-schooling.

Follow-up data collection

For classes with detected SARS-CoV-2 infection, all associated students, staff and household members were re-tested after one week *via* self-sampling (CoronaOne, Germany). No re-testing was done if the positive index participant was quarantined, i.e., did not expose classmates or staff.

Data processing and statistical analysis

Data collection was pseudonymised. On site, data was collected on paper and subsequently entered into REDCap electronic data capture tools.¹⁵ Descriptive analyses were segregated for primary and secondary school students, staff and household members.

We compared variables between SARS-CoV-2 infected and uninfected participants by computing proportions, odds ratios (ORs) and 95% confidence intervals (CIs). Variables of interest were socioeconomic stratum, case-contacts and mask wearing in and outside school, hand washing, and transport to school/work. We used R version 3.6.3.

Role of the funding source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. All authors had full access to all the data in the study and accept responsibility for the decision to submit for publication.

Results

Participants' characteristics

We examined 1119 participants in 24 schools including 177 primary and 175 secondary school students, 142 staff and 625 household members. Fifty participants were visited at home because of illness or quarantine, or household members provided their swabs. Seventeen students and two staff had dropped out or withdrawn consent since June 2020. The median age of primary and secondary school students was 11 and 15 years, respectively; half were female (Table 1). Staff comprised largely mid-aged, female teachers and educators (91.2%, 114/125) in addition to facility personnel. Most household members were adults (73.8%, 461/625).

Fever was present in 1.7%, 8.0%, and 2.9% of primary and secondary school students and staff, respectively, and any current symptom reported in 15.8%, 20.1%, and 21.3%. Leading complaints were rhinorrhoea, headache, sore throat, and cough (Table 1). Symptoms within the preceding two weeks were reported by 60.2% (195/324) of all index participants, with headache (37.3%, 121/324), sore throat (15.7%, 51/324), and rhinorrhoea (14.8%, 48/324) prevailing. Chronic conditions were stated by 10.5% of students and by 28.0% of staff, hypertension (2.6%, 13/494), lung disease (1.8%, 9/494), and obesity (1.0%, 5/494) leading.

Among household members, 3.1% were febrile at examination. Most commonly reported present symptoms (19.7%) were rhinorrhoea, cough, and sore throat (Table 1), whereas leading symptoms in the preceding two weeks (55.5%) were headache (30.5%, 131/429), tiredness (18.6%, 80/429), and rhinorrhoea (16.8%, 72/429). Most frequently stated chronic conditions (22.9%) included hypertension (4.6%, 29/624), obesity (3.7%, 23/624), and lung disease (2.1%, 13/624).

Swabs were available from 347 (98.6%) students, 142 (100%) staff, and 622 (99.5%) household members; 22 specimens were lost or did not yield a result. The electronic questionnaires had a response frequency ranging from 54.9% (614/1119) to 67.7% (758/1119) for individual items.

School infection prevention and control measures

All schools reported the implementation of basic IPC measures such as signs on hand hygiene, soap and water in restrooms, and air ventilation at least three times a day. About half of the schools (10/22)

had a hygiene commissioner. Most students (20/21 classes) and staff (22/23) reportedly adhered to hand hygiene and sneezing etiquette in more than half of the time. Three in four classes (18/24) had fixed teaching groups, but mixing with others outside was possible in almost all schools (22/24). Students were not supposed to attend school with cold-like symptoms in 19 of 22 classes. More than half of the classes (13/22) did not provide online teaching. Two-thirds (15/24) of the schools did not have a facemask obligation *in* the classroom for students or staff, but *outside* the classroom it was obligatory for almost all (22/24).

SARS-CoV-2 infections among students and staff

One-third (8/24) of the classes had one or two cases of SARS-CoV-2 infection detected summing up to ten cases (Table 2). These included six primary school students (two in one class, no close contact reported), three secondary students (two in one class, no close contact reported), and one secondary school staff. The resulting prevalence in school was 2.7% ([95% CI; 1.2-5.0%]; 9/338) among students and 0.7% among staff ([95% CI; 0.0-3.9%]; 1/140; excluding one isolated staff member who tested positive but had already tested positive a week earlier). Seven of the ten SARS-CoV-2 infected individuals were asymptomatic at testing. Of those, three developed compatible symptoms within 3-7 days, and five reported cold-like symptoms in the preceding 3-7 days. One positive staff and one positive student did not report previous, current, or later symptoms. None of the positive index participants required hospitalization.

Simultaneous SARS-CoV-2 infections among household members

Fourteen members of nine households tested positive in parallel to the school-based testing (prevalence, 2.3% [1.3-3.8%]; 14/611). Nine were adults, two pre-school children, and three students at non-study schools. Three family members entered the study four days delayed, were tested positive, and considered contemporaneously infected for the cross-sectional evaluation. Three of nine households were (partially) in quarantine (for three, ten, and twenty-one days), of which two households comprised a staff member (one negatively, one positively tested), and in the third one, two household members were infected. Of the nine positive households, six had no infected student or staff

in school, whereas three did. For the three positive households with a positive student in school, extensive review could not solve the origin of infection.

Half (7/14) of the SARS-CoV-2 infected household members reported cold-like symptoms on the test day. Among the asymptomatic individuals, most reported symptoms previously and/or subsequently; one mid-aged adult was briefly hospitalized for oxygen substitution (Table 3).

SARS-CoV-2 IgG antibodies

Anti-Sars-CoV-2 IgG antibodies were present in 2.0% ([0.8-4.1%]; 7/347) of students, 1.4% ([0.2-5.0%]; 2/141) of staff, and 1.4% ([0.6-2.7%]; 8/576) of household members. Among infected participants, 9.5% (2/21) showed anti-SARS-CoV-2-IgG, and 14.3% (3/21) had borderline reactivity. Five presently uninfected index participants who had no antibodies in June 2020, did so in the present study. None was aware of previous infection. Thus, 1.1% ([0.4-2.6%]; 5/449) of students and staff passed through SARS-CoV-2 infection without noticing.

New SARS-CoV-2 infections at follow-up after one week

For eight classes with attending SARS-CoV-2-positive index participants, students, staff, and connected household members were re-tested after one week. Students and staff of five of the eight affected classes were quarantined within a median of three days (range, 1-5) after swabbing. In three schools, only close contacts were quarantined. Of note, no school-related infection of students or staff was observed at re-testing. Yet, seven (1-8%) new infections were detected among 381 individuals associated with the affected classes and tested negative or not tested at baseline. These occurred as single events with respect to five classes, and with respect to one class, two new infections were detected. Two index participants tested positive at follow-up (Table 4). However, we specified their infections as not school-related: In the first case, a secondary school student was re-tested because of a positively tested household member had developed symptoms a few days before the student. In the second case, a staff member had been at home at the cross-sectional assessment to take care of a positively tested household member, and was tested positive at follow-up. Furthermore, five

household members (four adults, one child) tested positive at follow-up. Except for the before mentioned household member of the positive index student, the remaining four had a positive child in school a week before. For two of them, we assumed SARS-CoV-2 transmission *via* a positive index participant, and for two household members, this remained unclear. In consequence, we conservatively estimated the attack rate following ten infections in eight school classes as 1.1% ([0.3-2.9]; 4/352 persons with exposed index participant at cross-sectional assessment).

As to manifestation, two positive individuals were asymptomatic at retesting, whereas the others reported mainly cold-like symptoms (Table 4).

Comparison of SARS-CoV-2 infected and non-infected participants

At cross-sectional assessment, SARS-CoV-2 infection was present in 4-7%, 1-9%, and 1-0% of classes located in the low, medium, and high socio-economic strata, respectively (high *vs.* low; OR, 4-71 [0-82-48-18]; Table 5). Nine in ten index participants stated to wear a facemask often or always at school, and their infection prevalence was 1-4%. Of those who wore masks never to sometimes, 14-3% tested positive (OR, 11-38 [2-28-59-64]). Similarly, 50% (8/16) of the non-affected classes and 12-5% (1/8) of the affected classes reported a facemask obligation in classroom. While contact to a suspected or confirmed COVID-19 case *in* school did not confer increased odds of infection, such contacts *outside* school tended to do so (infection prevalence, 8-3%; OR, 3-52 [0-56-16-27]). Lastly, infection tended to be more common in those who reported to walk to school (without other transport means; prevalence, 8-2%; OR, 3-84 [0-76-16-82]).

Among household members, infection was more prevalent in the low compared to the high socioeconomic stratum (OR, 12.37 [2.68-114.84]), and in those who had contact to a suspected or confirmed case outside of work or school (OR, 5.76 [1.37-21.96]; data not shown).

Discussion

Our essential results from schools during peaking SARS-CoV-2 transmission in Berlin are: In one third of the classes, one or two infections were detected, mostly asymptomatic. Connected household members in 2.3% were also infected; a school-related origin of infection was unlikely in two thirds. No secondary infections occurred in the affected classes within one week. The attack rate in households connected to positive classes was 1.1%. Infection prevalence in school was increased in case of rare facemask wearing in school, walking to school, low socioeconomic stratum, and case-contacts beyond school.

The SARS-CoV-2 prevalence of 2.7% among our student participants exceeds results of similar studies in Germany and other highly affected European countries in that period. Among >2500 students and staff in Saxony, Germany, in November 2020, 1.0% were SARS-CoV-2 infected; seroprevalence was 1.4%.¹⁶ A simultaneous study in Austrian students reported 0.4% SARS-CoV-2 prevalence,¹⁷ while in more than one-hundred English schools, 1.2% of students and 1.3% of staff were infected.⁴ During data collection, the 7-day incidence in Berlin among those aged 15-19 years exceeded that of younger ages (Figure 1). This accords with higher infection figures in secondary than in primary school students,³ but contrasts our findings. We cannot exclude an incidental finding; differences in hygiene and distancing might also be involved,¹⁸ e.g., mask wearing was not mandatory at primary schools. Only one of 140 attending school staff was infected at cross-sectional testing. This is in line with data from England, where SARS-CoV-2 infection was present in 0.4% of teachers, similar to other professions, arguing against increased infection risks among school staff.⁴ More than half of all participants reported mainly cold-like symptoms in the preceding two weeks, and about one in five on the test day. During study conduct, acute respiratory infections in Germany occurred at less than half the rate of previous years, likely due to enhanced hygiene measures.¹⁹ Then again, surveyed symptoms are subjective, and health consciousness might increase during a pandemic, possibly causing overestimations. Yet, seven of ten positively tested index participants were asymptomatic and would thus not have been identified by symptom-based testing. Similarly, five index participants unknowingly had developed antibodies. This stresses the potential benefit of routine testing in schools, as gradually being considered in several European countries.

When comparing SARS-CoV-2 uninfected and infected index participants, the latter tended to attend school in the low socio-economic stratum. School stratum was a rough proxy disregarding intradistrict variability of education, occupation and income, but also elsewhere, social disadvantage and SARS-CoV-2 infection in students were associated.¹⁷ Moreover, household infection clusters in our study occurred largely at low socio-economic stratum. This may reflect household crowding with insufficient distancing and isolation possibilities promoting transmission. Increased infection prevalence was observed among those who incompletely used facemasks in school. Wearing a facemask in school was not obligatory at that time, but many schools and classes nevertheless adhered to it. Prevalence was similar among participants reporting case-contacts in school, but for casecontacts *outside* of school, infection tended to be more prevalent. This corroborates findings from Mississippi, USA, where attending lessons was not a risk factor for SARS-CoV-2 infection among students, but inconsistent mask wearing in school, close case-contacts outside the household, and social gatherings.¹⁰ Lastly, prevalence was increased among those who walked to school. Lacking conclusive arguments, we suspect grouping up with friends on the way as a reason. In the connected households, 2.3% SARS-CoV-2 prevalence was observed at cross-sectional assessment. Only for three of nine affected households, a school-link was assumed. At re-testing, no school-related secondary infection was seen among students and staff of eight affected classes, despite ongoing exposure before quarantine. For the connected households, the attack rate was 1.1%. This suggests that, even at high epidemic activity, attending lessons is not a major place of transmission if adequate IPC measures are implemented. So far, only few larger school outbreaks occurred in Germany.^{20,21} In the federal state of Rhineland-Palatinate between August and December 2020, school surveillance yielded a secondary attack rate among primary contacts of around 1%.²² A simultaneous investigation in neighbouring Hesse found an average secondary attack rate of 1.3% among contact persons in school.²³ Likewise in Italy, low school prevalence and intra-school transmission prevailed up to October 2020.²⁴

These findings of a rather low level of transmission in the school context are difficult to reconcile with results indicating very substantial effects of school closures. In observational US data from early 2020, school closure was associated with significant declines in COVID-19 incidence and mortality,²⁵

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whereas in systematic review of observational studies, effects of school closure are inconsistent.⁸ Several modelling studies - usually from the first wave of the pandemic - suggest modest to substantial associations between school closures and incidence.^{5,26} These include estimates of 40-60% reduced peak incidence,²⁶ and of reducing the reproduction number by more than a third.⁵ Moreover, school closures have been associated with an overall mobility reduction of 21.6% in Switzerland.²⁷ It remains difficult to disentangle the direct or indirect consequences of school closure from that of other nonpharmaceutical interventions, which were frequently implemented in parallel.²⁵ For example, school closures imply less mobility, but also substantial disruptions in daily routines, particularly for parents, and altered working conditions, childcare, and social contacts. Recent evidence shows that incidence in school and population are linked.⁴ Similarly, our data suggest that most detected infections were not acquired in school. In class, students experience clear guidelines regarding preventive behaviour and respective enforcement. Such rules, e.g., facemask wearing and airing, may partially explain the rather low infection figures despite grouping in class. In contrast, during school closures, students possibly assemble in uncontrolled settings.²⁸ Conceivably, shutting down educational facilities brings about transmission reductions, which are not directly attributable to attending classes and intra-school transmission, but to indirect consequences including parental behaviour. If that were true, pandemic mitigation measures would need to focus more strongly on indirect patterns, e.g., mandatory filtering masks in public, equalising public transport, and obligatory work from home wherever possible. However, there is a lack of information to delineate the respective impacts on the SARS-CoV-2 pandemic during school closures. This is all the more regrettable when considering the many harmful consequences of this measure for children and beyond.^{11,12}

The strengths of our study are random selection of schools across Berlin, school-based generation of empirical data, inclusion of connected households, solid laboratory methods, and screening rather than symptom-based testing allowing for the detection of asymptomatic infections. The study is limited as to a low number of outcome events and a potential selection bias (voluntary participation). Comparative data on the prevalence of SARS-CoV-2 in the Berlin population is not available. Incomplete swabbing due to self-administration cannot completely be excluded despite illustrated instructions and PCR quality control including human *RNase P* gene co-amplification.

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In conclusion, SARS-CoV-2 infection activity in Berlin schools during peak transmission appeared to be low. Secondary transmission in class was absent, and in connected households, the attack rate was around 1%. Based on our findings, we are cautiously optimistic that schooling itself does not necessarily lead to child-to-child transmission or constitute a central pandemic driver, provided that IPC measures are rigorously implemented. Continuation of our study will show whether this is true as pandemic determinants change, including vaccination coverage, herd immunity, relaxed or tightened lockdown, and viral mutations. Our findings do not exclude the possibility of school-based outbreaks, particularly at even higher transmission or enhanced viral transmissibility. Repeat screening in schools to detect also asymptomatic infections is justified by our data and should help reducing the infection burden.²⁹ As a prerequisite for further, tailored measures, deeper insight is needed into the attributable fraction of infections due to being a schoolchild as compared to attending class in itself.

Contributors

ST, MT, FH, TK, JS, and FPM designed the study. ST, MT, WvL, CH, AvdH, JK, MAM, AR, and FPM conducted on-site examinations, interviews, and sample collection. MS and FB did laboratory examinations. ST, WvL, FH, AvdH, JK, FPM, and TK were responsible for verifying underlying data, data management and analysis. CvK, VK, and JS organized staff allocation and logistics. BECOSS study group members did data collection. ST, WvL, FH, and FPM wrote the manuscript. All authors participated in drafting the article or revising it critically for intellectual content, and approved the final version.

Declaration of interests

TK states to have received outside of the submitted work personal fees from Eli Lily, Newsenselab, Total and BMJ. All other authors declare they have no conflict of interests.

Data Sharing

De-identified participant data and data dictionary will be available for academic institutions upon request and following approval of an analysis proposal through the Institute of Tropical Medicine and International Health, Charité - Universitätsmedizin Berlin, for 12 months after publication of results.

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Table 1. Characteristics of study participants

	Primary school students	Secondary school students	Staff	Household members
No.	177	175	142	625
Age (years; median, range), n=1098	11.0 (9.0, 13.0)	15.0 (14.0, 18.0)	47.0 (28.0, 65.0)	42.0 (2.0, 86.0)
Male sex (%, n/n)	52.3% (92/176)	45.7% (80/175)	28.2% (40/142)	48.8% (301/617)
Reported symptoms on examination day (%, n/n)				
Any	15.8% (28/177)	20.1% (35/174)	21.3% (30/141)	19.7% (118/600)
Headache	3.4% (6/177)	8.6% (15/174)	7.8% (11/141)	5.0% (30/600)
Rhinorrhoea	10.7% (19/177)	8.0% (14/174)	6.4% (9/141)	10.3% (62/600)
Cough	3.4% (6/177)	2.9% (5/174)	5.0% (7/141)	6.0% (36/600)
Sore throat	1.7% (3/177)	5.2% (9/174)	8.5% (12/141)	5.0% (30/600)
Diarrhoea	0.6% (1/177)	1.1% (2/174)	1.4% (2/141)	2.0% (12/600)
Limb pain	1.1% (2/177)	0% (0/174)	0% (0/141)	1.3% (8/600)
Loss of smell or taste	0% (0/177)	0% (0/174)	0% (0/141)	1.5% (9/600)
Feeling feverish	1.7% (3/177)	0.6% (1/174)	0.7% (1/141)	1.2% (7/600)
Fever, ≥37.5°C, measured on-site	1.7% (3/175)	8.0% (14/174)	2.9% (4/140)	3.1% (18/579)
Any symptoms in the preceding 14 days (%, n/n)	48.4% (45/93)	61.0% (64/105)	68.3% (86/126)	55.5% (238/429)
Any self-reported chronic condition (%, n/n)	6.3% (6/95)	14.3% (15/105)	28.0% (35/125)	22.9% (99/433)
Regular medication (%, n/n)	4.2% (4/95)	10.7% (11/103)	28.8% (36/125)	25.2% (109/432)
SARS-CoV-2 infection (%, n/n)	3.5% (6/171)	1.8% (3/167)	1.4% (2/140)*	2.3% (14/611)
Anti-SARS-CoV-2 IgG positivity (%, n/n)	1.1% (2/174)	2.9% (5/173)	1.4% (2/141)	1.4% (8/576)

*, one staff member in quarantine, not attending school

Index participant´s school type	Social stratum	Ct- value	Temper- ature (°C)	Reported present symptoms	Symptoms before test day	New symptoms after test day	Self-reported contact to a confirmed or suspected case in preceding two weeks	Positive HHM (n/n tested) at cross- sectional assessment
Primary school	High	14.1	37.6	None (but febrile at examination)	1 day before test: headache	1 day after test: loss of smell and taste	Yes, outside school	Yes (1/1)
Primary school	Low	18.9	36.1	None	6 days before test: elevated temperature, headache, fatigue for 2 days	None	None stated (other positive case in class)	No test result
Primary school	Low	17.0	36.1	Headache, cough	5 days before test: headache and fever for 2 days	None	None stated (other positive case in class)	No (0/3)
Primary school	Low	19.5	36.5	None	3 days before test: headache, eye pain	4 days after test: anosmia	Yes, at school	Yes (1/3)
Primary school	Medium	29.5	36.2	Headache, sore throat	None	None	Yes, outside school	No (0/1)
Primary school	Low	14.7	35.2	None	None	None	None stated	Yes (3/5)*
Secondary school	High	21.8	37.1	None	None	7 days after test: sense of taste changed	No data	Not tested **
Secondary school	Medium	27.1	37.4	None	10 days before test: cold for 7 days	None	Yes, at school (and other positive case in class)	Not tested
Secondary school	Medium	23.3	36.6	None	7 days before test: sore throat	None	None stated (other positive case in class)	Not tested
Secondary School	Low	24.4	36.1	None	None	None	None stated	Not tested

Table 2. Characteristics of SARS-CoV-2 infections detected in school

HHM, household member. Age and sex not reported to avoid identifiability of participants. *, Family members tested four days after student; **, One family member was not tested during crosssectional study, but had tested positive elsewhere 8 days earlier

Index participant's school type; household No.	Positive index household member in school	Social stratum	Ct- value	Tempera- ture (°C; self- measured)	Reported present symptoms	Symptoms before test day	New symptoms after test day	Self-reported contact to a confirmed or suspected case in preceding two weeks	Total no. of positive household members at cross-sectional testing (n/n tested)
Primary school 1)	Yes	High	19.3	37.9	None (but febrile at examination)	None	1 day after test: fever, cough, felt very ill for 14 days	Yes	(2/2)
Primary school 2)	No	High	20.4	36.0	None	5 days before test: feverish	5 days after test: limb pain, weakness, felt very ill for 14 days	No	(1/3)
Primary school 3)	No	Low	25.9	37.2	Cough	None	None	None stated	(2/4)
Primary school 3)	No	Low	25.2	36.7	Sore throat	None	None	None stated	(2/4)
Primary school 4)	Yes	Low	26.1	36.4	None	3 days before test: cold symptoms	Anosmia	None stated	(2/4)
Primary school 5) *	No	Low	23.5	36.3	Rhinorrhoea, cough	3 days before test: cold symptoms for 10 days	None	Yes	(1/4)
Primary school 6)	Yes	Low	11.9		None	5 days before test: limb pain, anosmia	2 days after test: fever, feeling very ill, after 7 days hospitalized for 5 days receiving oxygen	None stated	(4/6)
Primary school 6)	Yes	Low	21.9		None	14 days before test: cough	None	None stated	(4/6)
Primary school 6)	Yes	Low	22.5		None	14 days before test: mild cold	None	Yes	(4/6)
Secondary school 7) *	No*	Low	21.6	36.3	Cough	14 days before test: fever and cough for 3 days	None	Yes	(3/3)
Secondary school 7) *	No*	Low	19.4	36.3	Rhinorrhoea	10 days before test: start of cold	None	Yes	(3/3)
Primary school 8) *	No	Low	21.4		Rhinorhoea, an- osmia	None	None	Yes	(2/5)
Primary school 8) *	No	Low	16.9		Rhinorrhoea, cough, anosmia	Cold symptoms	None	Yes	(2/5)
Secondary school 9)	No	Low	24.8	35.7	None	14 days before: mild cold	None	No data	(1/5)

Table 3: Characteristics of SARS-CoV 2 infections among household members, detected simultaneously to school survey

Age not reported to avoid identifiability of participants. *, in quarantine

Index partici- pant's school type	Index par- ticipant or household member	In index partici- pants: case in class dur- ing cross- sectional testing?	Linked index participant positive at cross-sectional testing?	Other HHM positive at cross- sectional testing?	Infection assumed to be school- related? ^{**}	Social stratum	Ct- value	Tem- pera- ture (°C)	Present symptoms	Symptoms after testing	Cumulative no. of household members tested positive (n/n tested) ⁺
Primary school	ННМ		Yes	Yes	Unclear	High	15.8		Headache, limb pain, anosmia, cough	Cough for approx. 14 days	3/4
Primary school	HHM		Yes	n.a.	Unclear	Low	21.0	36.4	None	None	2/2
Primary school	Index participant	No		Yes	No	Low	22.5	36.9	Headache, feeling feverish	Headache, 1 day after test: anosmia, 3 days after: weakness	2/4
Primary school	ННМ		Yes	Yes	Yes	Low	13.6	36.4	Limb pain, dizziness	2 days after test: anosmia, dizziness, weakness, cough for 1 month	3/4
Secondary School	HHM		Yes	n.a.	Yes	Medium	24.4	36.7	None	None	2/4
Secondary School	Index participant	No*		No	No	Low	21.8	36.5	Headache, diarrhoea	1 day after: cold, limb pain, diarrhea, dizziness	2/3
Secondary School	ННМ		No	No	No	Low	10.7	36.2	Cold symptoms	Strong cold symptoms for a total of 5 days (started 2d before test)	2/3

Table 4. Characteristics of new SARS-CoV 2-positive cases at follow-up testing after 7 days

HHM, household member. Age not reported to avoid identifiability of participants.*, No fixed class in this school subcohort; positive staff identified in school at cross-sectional testing; but no contact between those two cases, therefore not regarded as a secondary case. **, Based on review. +, including those from cross-sectional testing

	Negative, N=467	Positive, N=11	OR	95% CI
	n (%)	n (%)		
Female	269 (97.8%)	6 (2.2%)	1	-ref-
Male	197 (97.5%)	5 (2.5%)	$1 \cdot 14$	(0.27-4.54)
Socio-economic stratum				
- High	193 (99.0%)	2 (1.0%)	1	-ref-
- Medium	151 (98.1%)	3 (1.9%)	1.92	(0.22-23.18)
- Low	123 (95.3%)	6 (4.7%)	4.71	(0.82-48.18)
Contact to suspected or confirmed				
case at school				
- No	213 (96.4%)	8 (3.6%)	1	-ref-
- Yes	92 (97.9%)	2 (2.1%)	0.58	(0.06-2.98)
Contact to suspected or confirmed				
case outside of school				
- No	271 (97.5%)	7 (2.5%)	1	-ref-
- Yes	33 (91.7%)	3 (8.3%)	3.52	(0.56-16.27)
Mask wearing frequency at school				
- Often to always	273 (98.6%)	4 (1.4%)	1	-ref-
- Never to sometimes	30 (85.7%)	5 (14.3%)	11.38	(2.28-59.64)
Mask wearing frequency in public				
- Often to always	299 (97.4%)	8 (2.6%)	1	-ref-
- Never to sometimes	5 (100.0%)	0 (0.0%)		
Hand washing frequency				
- 0-1 times	6 (85.7%)	1 (14·3%)	1	-ref-
- 2-4 times	92 (98.9%)	1 (1.1%)	0.07	(0.00-5.97)
$- \ge 5$ times	206 (96.7%)	7 (3.3%)	0.20	(0.02-10.70)
Transport to/from school/work:				
Exclusively by foot				
- No	259 (97.7%)	6 (2·3%)	1	-ref-
- Yes	45 (91.8%)	4 (8.2%)	3.84	(0.76-16.83)
Exclusively by bicycle				
- No	227 (96.6%)	8 (3.4%)	1	-ref-
- Yes	77 (97.5%)	2 (2.5%)	0.74	(0.07-3.81)
Exclusively by car				
- No	249 (96.1%)	10 (3.9%)	1	-ref-
- Yes	55 (100.0%)	0 (0.0%)	••	
By public transport (exclusively, or				
in combination with other means of				
transport)				
- No	206 (97.2%)	6 (2.8%)	1	-ref-
- Yes	98 (96.1%)	4 (3.9%)	1.40	(0.28-6.06)

Table 5. Variable comparison between SARS-CoV-2 negative and positive index participants at cross-sectional survey



Figure 1. 7-day incidence of recorded SARS-CoV-2 infection according to age groups in Berlin,

Germany, 2020

Note. Study period indicated by grey shading. Data on PCR-confirmed SARS-CoV-2 infections, notified to local health authorities, and derived from https://daten.berlin.de/tags/covid-19-erkrankungen (German).

TAB 21
Effectiveness of Non-Pharmaceutical Interventions on Child and Staff COVID-19 Cases in US Summer Camps

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Abbreviations: COVID-19 (coronavirus disease 2019); NPI (non-pharmaceutical interventions)

What's Known on This Subject: Approximately 82% of US overnight camps did not open during Summer 2020 due to concerns regarding whildren's ability to transmit SARS-CoV-2. Camps that did operate during this time instituted varied non-pharmaceutical interventions (NPIs) to deduce SARS-CoV-2 transmission, with little information available on the effectiveness of these NPIs within child congregate settings. Large population-based studies are needed to improve our understanding of the extent of SARS-CoV-2 infection amongst children and their caregivers and to determine whether and to what degree child congregate programs can safely open during the pandemic.

What This Study Adds: Our study, the largest survey of COVID-19 cases in child congregate settings at the national level, provides new information on the relative effectiveness of NPIs on mitigating COVID cases among children and staff within camp settings. We showed COVID-19 ase rates in campers and staff to be low relative to corresponding case rates in the US and found constant camper facial coverings to be the most iffective risk reduction method for SARS-CoV-2 transmission within camps. While less effective, constant use of staff facial coverings and targeted physical distancing measures, but not pre-camp quarantines, were also shown to reduce COVID-19 risks. Our findings has important implications for child congregate settings, helping to guide their successful opening and operation.

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Contributors Statement Page: Dr. Suh conceptualized and designed the study, drafted, reviewed and revised the manuscript; Ms. Meehan conducted data analyses and reviewed the manuscript; Dr. Blaisdell critically reviewed the manuscript; Dr. Browne designed the data collection instruments, collected data, and reviewed the manuscript; All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

Abstract

Background. Most camps remained closed during Summer 2020, due to concerns regarding child transmission of SARS-CoV-2 and limited information about the effectiveness of non-pharmaceutical interventions (NPIs) within child congregate settings.

Methods. We surveyed US camps about on-site operations, camper and staff demographics, COVID-19 cases amongst campers and staff, and NPI usage as related to pre-camp quarantines, facial coverings, physical distancing, cleaning, and facility modifications. For all NPIs, save quarantines, responses were provided on a 5-point Likert scale format.

Results. Within 486 on-site camps, a range of NPIs were instituted, most often related to reduced camper interactions, staff face coverings, cleaning, and hand hygiene. Camper facial coverings were less common, with campers always wearing masks at ~34% of the camps. Approximately 15% of camps reported 1+ confirmed COVID-19 case in either campers or staff, with three camps reporting a COVID outbreak. In both single and multi-NPI analyses, the risk of COVID-19 cases was lowest when campers always wore facial coverings. While less effective, constant use of staff facial coverings and targeted physical distancing measures, but not pre-camp quarantine, also reduced COVID-19 risks.

Conclusions. We found constant facial coverings, especially for campers, and targeted physical distancing measures to reduce risks of SARS-CoV-2 transmission within summer camps. Our findings provide valuable guidance for future operations of camp and other child congregate settings with regard to efficient and effective NPI usage to mitigate SARS-CoV-2 infection.

4

Introduction

Each year, summer camps in the United States (US) host more than 26 million children and employ 1.5 million staff of all ages, race/ethnicities, genders, and socio-economic position [1]. Alongside the closing of schools, camps were massively disrupted across the US as a result of the coronavirus disease 2019 (COVID-19) pandemic. Many camp programs, including approximately 82% of US overnight camps [1], did not open during Summer 2020, due to a lack of understanding of (1) the degree to which SARS-CoV-2 is transmitted in within child congregate settings and (2) the non-pharmaceutical interventions (NPIs) needed to minimize this transmission.

To date, few studies have been conducted that examine SARS-CoV-2 transmission and NPI effectiveness in camp settings, with evidence to date anecdotal in nature or based on small sample sizes. This evidence shows that camps that operated during Summer 2020 experienced varying degrees of success in mitigating SARS-CoV-2 transmission, possibly due to differences in the use of non-pharmaceutical interventions (NPI). SARS-CoV-2 transmission, for example, was low within four Maine overnight camps that implemented prearrival quarantine, pre- and post-arrival testing and symptom screening, cohorting, face covering use, physical distancing, enhanced hygiene measures, cleaning and disinfecting, and maximal outdoor programming [2]. In contrast, an overnight camp in Georgia experienced significant SARS-CoV-2 transmission among campers and staff [3], with an overall attack rate of 44%. Attack rates increased with length of time spent at the camp. Transmission was attributed to large number of campers sleeping in the same cabin and frequent singing and cheering without the regular use of facial coverings. Similarly, an outbreak of COVID-19 occurred at a boys' overnight summer school retreat in Wisconsin [4]. Among 152 attendees, 116 (76%) were classified as having confirmed or probable COVID-19. At this retreat, organizers required documentation of a negative prearrival RT-PCR result, 7-day prearrival quarantine, and outdoor programming, but did not implement other recommended NPIs.

In this paper, we use data from a nationwide survey of camps operating during Summer 2020 to estimate the prevalence of COVID-19 cases amongst campers and staff and its relation to individual and multiple NPIs instituted at these camps.

Methods

The study was approved by the institutional review board at Tufts University.

As part of the American Camp Association (ACA)'s annual survey of US camps, we asked camps that operated in-person programs in summer 2020 about camper and staff demographics, COVID-19 cases, and non-pharmaceutical interventions (NPI). ACA's online survey was distributed in September 2020 via weekly e-newsletter, direct email, and camp networks. Respondents answered anonymously on behalf of a single camp or multiple camps (if the respondent operated multiple sites). Camps were asked to provide information about (1) their state of operation, (2) the state and countries in which their campers resided, and (3) the number and demographic characteristics (as percent) of campers and staff, with single site camps providing answers by week and multi-site camps as aggregate information over the summer.

COVID-19-related questions included those related to the number of confirmed and suspected COVID-19 cases for campers and staff, again reported by week by single site camps and as aggregate information by multi-site camps for each of their camps. NPI-related questions included those about camp policies and NPI usage with regard to camper and staff quarantines at home or at camp, staff and camper facial coverings, reduced capacity, activity cohorts, physical distancing, hand sanitizing, increased cleaning, decreased visitors, modified programs, and modified sleeping, dining, and bathroom arrangements. For all questions about NPIs, save those about quarantines, responses were provided on a 5-point Likert scale format, as always, often, sometimes, rarely and never.

Camp respondents leaving >50% of overall responses blank were omitted from data analysis. Data were analyzed using descriptive statistics, including summary statistics and graphical analysis of the time trends in COVID-19 cases and their relation to regional case rates. NPI effectiveness alone and in pairs was examined using risk ratios, with analyses of multiple NPIs performed based on total cases for specific NPI combinations. These combinations were selected based on their observed effectiveness when examined alone and on their combined use among many camps. All analyses were performed using R statistical software (R version 4.0.3).

Results

A total of 1,193 single and multi-site camps completed the survey, representing 1,489 camps, as shown in Table 1. Camps were located in 49 states and the District of Columbia, with 26% located in the Midwest, 23% in the Northeast, 22% in the South, and 16% in the West. The racial and socioeconomic distribution of campers mirrored that of the entire camp population [1]. Approximately 73% of campers identified as White, 8.3% Black, 6.0% Hispanic, 4.2% Asian, and 6.0% bi- or multi-racial, while about 48% of campers were from middle income, 34% from high, and 18.5% from low income households.

486 of the responding camps, serving about 90,000 campers, operated on-site during summer 2020, including 59 overnight, 206 day, and 220 combination day, overnight, and rental camps (with 1 missing response). Day and overnight single site camps operated in all regions of the US, with lower rates of operation in the West and highest rates of operation in the Northeast (Figure 1). Rates of operation for the single-site camps were highest during the middle of the summer in all regions of the US, as shown by the mid-summer peak in the number of camps, children, and staff at these single-site camps.

NPI usage and COVID-19 cases across on-site camps are shown in Table 2. Most camps reported constant use of NPIs related to staff facial coverings (69%), reduced capacity (89%), smaller cohort sizes (86%), increased cleaning (95%), and more frequent handwashing (96%). Constant physical distancing (66%) and face coverings among campers (33%) was reported by a smaller number of camps. Correspondingly, approximately one-third of camps required campers and staff to quarantine at home prior to attending camp, with fewer camps requiring staff to quarantine at camp and only 18 requiring campers to quarantine at camp. Modifications to sleeping arrangements were fairly typical amongst overnight and combination overnight/day/rental camps, while altered dining and bathroom arrangements were more common at day and combination camps.

For the 486 on-site camps serving 90,000 campers, the total number of confirmed cases equaled 30 and 72 cases, respectively, with 111 suspected and confirmed cases for campers and 191 suspected and confirmed cases reported for staff. A total of 74 camps reported having at least one confirmed COVID-19 case and 127 camps reported having at least one confirmed or suspected COVID-19 case. Of the camps with a confirmed case, 10 camps were overnight, 52 were day and 12 were combination overnight/day/rental camps. Five camps experienced more than five total cases among campers and staff, of which three experienced a COVID outbreak (>3 cases in a week). In the largest of these outbreaks, Camp A experienced 26 confirmed cases (9 camper, 17 staff) out of 66 overnight campers and 20 staff in one week. The NPIs instituted at Camp A were limited to regular hand sanitizing, increased cleaning, and pre-camp quarantining at home for campers and at home and camp for staff. The other two outbreaks occurred in day camps that used a wider range of NPIs. In Camp B, among a group of approximately 100 day campers and 30 staff, four confirmed cases in campers and three in staff during a one-week period were reported. This camp reported always requiring quarantining before camp, staff facial coverings, increasing cleaning, regular hand hygiene, and instituting measures to decrease its capacity and visitor access. Further, Camp B reported always or often instituting measures to increase physical distancing, through for example use of cohorts or pods or modified program, dining, and bathroom arrangements. However, camper facial coverings were not typical at Camp B. In the second day camp, Camp C, which had 199 day campers and 82 staff, four confirmed and nine suspected cases amongst staff were experienced during one week. At this camp, camper and staff facial coverings, physical distancing, cleaning, decreased visitors and decreased capacity, but not quarantine measures, were always or often in place.

For single site camps, the number of confirmed COVID-19 cases each week was low, absent the 3 observed outbreaks (Figure 1). Camper and staff COVID-19 cases occurred primarily in mid-summer, corresponding to weekly trends in the number of campers and staff and the overall US case rates. The higher number of confirmed cases in mid-summer in the South and West reflected community rates at that time, while those in the Northeast and Midwest largely reflected the three COVID-19 outbreaks.

Case rates were higher amongst campers in day as compared to overnight camps and camps with multiple program types, but the opposite pattern was observed for staff, with case rates for staff higher in overnight as compared to other camps. The incidence rate for COVID-19 cases amongst

campers and staff was 3.3 and 8.03 per 10,000 campers, respectively. Incidence rates for cases amongst campers in overnight and day camps equaled 6.78 and 6.20, respectively, with a statistically insignificant relative risk (RR) of 1.09 (CI 95%: 0.51, 2.35), consistent with no difference in COVID-19 risks. For staff, RRs comparing overnight to day camps were also statistically insignificant at the 0.05 level, although the RR was larger than 1 (1.65, CI 95%: 0.99, 2.75) reflecting the outbreak in staff at one overnight camp. Across all on-site camps, risks of COVID-19 cases for campers and staff together were similar irrespective of whether the campers traveled from out-of-state to attend camp, with a statistically insignificant RR of 0.92 (95% CI: 0.61, 1.41).

The risk of COVID-19 cases was significantly reduced when campers or staff always wore facial coverings (Table 2). COVID-19 risks for campers were 0.36 (95% CI: 0.14, 0.95) and 0.39 (95% CI: 0.08, 0.40) times as high in camps with strict face covering policies for campers and staff, respectively, as compared to camps without, indicating that campers attending camps where face coverings were always worn had an approximately two-thirds reduction in risk of COVID-19 as compared to other campers. Correspondingly, COVID-19 risks were also reduced for staff working in camps where campers or staff always wore face coverings as compared to where they did not, with an 83% (RR: 0.17, 95% CI: 0.08, 0.40) and 62% (RR: 0.38, 95% CI: 0.24, 0.60) reduction in risks, respectively.

Pre-camp home quarantine measures for campers or staff were not found to significantly reduce risk of COVID-19 cases for either group. While no confirmed COVID-19 cases were experienced in camps requiring campers to quarantine at camp, the number of camps with such requirements was low, making their generalizability to other settings unclear.

Targeted physical distancing measures, including use of cohorts, pods, or bubbles, physical distancing, and modified programs to allow for physical distancing, were associated with less risk of COVID-19 cases in campers and to a lesser extent in staff. When evaluated individually, each of these physical distancing measures when always used produced similar reductions in risk, with rate reductions in campers of 61% (RR: 0.39, 95% CI: 0.19, 0.82) for cohorts, pods or bubbles, 69% (RR: 31, 95% CI 0.15, 0.65) for physical distancing measures, and 70% (RR: 0.30; 95% CI: 0.15, 0.61) for programs modified to increase physical distance. While statistically significant, risk reduction for staff was less pronounced when programs were

modified for physical distancing, with ~50% (RR: 0.52, 95% CI: 0.32, 0.82) reduction in COVID-19 risk as compared to staff working at other camps. While RRs were below 1, risks did not differ significantly for staff working at camps where cohorts or physical distancing NPIs were always as compared to not always in place. Risks for campers and staff were not reduced in camps that always decreased its capacity (campers: 1.44, 95% CI: 0.59, 3.52); staff: 3.77, 9 5% CI: 1.63, 8.72), suggesting that physical distancing behavior is needed for risk reduction rather than simply reduced numbers.

Since NPIs are often implemented together, we also examined RRs for specific pairwise NPI combinations (Table 3). As with individual NPIs, we found that constant camper facial coverings consistently lowered risks for campers and staff, regardless of what other NPI was also used. RRs were lowest in camps that always had both campers and staff wear facial coverings, with a 73% (RR: 0.27; 95% CI: 0.10, 0.73) and 87% (RR: 0.13; 95% CI: 0.06, 0.31) reduction in risks, respectively, as compared to camps where neither campers nor staff always wore facial coverings. This reduction in risks were greater than that when only staff, but not campers, wore facial coverings, suggesting the greater importance of camper facial coverings as an NPI.

We found an approximate 80% reduction in risks for both campers (RR: 0.22; 95% CI: 0.07, 0.65) and staff (RR: 0.18; 95% CI: 0.08, 0.44), when camps always implemented both camper facial coverings and a physical distancing NPI, as compared to when neither was always implemented. This reduction in risks was larger than that when only physical distancing NPIs were always implemented. When two targeted physical distancing NPIs – physical distancing and modified programs to increase physical distancing – were always implemented together, RRs were significantly lower as compared to camps where neither were always implemented. However, risks for camps implementing both physical distancing NPIs were similar to camps implementing just one physical distancing NPI. The additional use of pre-camp home quarantines did not reduce risks beyond that afforded by physical distancing or facial coverings alone.

Discussion

In our sample of 486 camps operating on-site during summer 2020, the number of COVID-19 cases was low, with an incidence rate for campers and staff of 3.35 and 8.03 per 10,000 campers, resulting in a total of 30 and 72 confirmed cases, respectively. COVID-19 case incidence rates were not statistically different for overnight and day camps. COVID-19 case rates in camps are low relative to overall rates in the US during the same period, which in June 1 were estimated to equal approximately 55 cases per 10,000 people, increasing to 184 cases per 10,000 people by August 31 [5]. A range of NPIs were instituted at the camps, with risk ratios for individual and multiple NPIs consistently demonstrating the importance of constant facial coverings, especially by campers, and of targeted physical distancing measures.

Our findings are consistent with evidence showing lower incidence rates in children overall [6] and within congregate settings [7], reduced risks of SARS-CoV-2 infection with the use of facial coverings and physical distancing [2,8,9,10] and with anecdotal evidence of SARS-CoV-2 outbreaks in camps where camper and often staff face coverings was not universal [3,4,11]. For example, in a study of COVID-19 cases and transmission in 17 Wisconsin schools, authors reported low transmission rates in schools that required student masking and cohorting [10]. Correspondingly, In a study of almost 2 million confirmed COVID-19 cases from 190 countries [12], for example, the individual and combined effectiveness of mandatory public face coverings, quarantine, social distancing, and traffic restrictions on the COVID-19 effective reproduction number (R_t) was examined. The study showed the greatest reductions in R_t for physical distancing measures and the simultaneous implementation of 2+ NPIs, with individual implementation of any of the examined NPIs, including mandatory facial coverings, also reducing R_t of COVID-19. As in this study, we also found physical distancing measures to effectively reduce risks. However, we found camper facial coverings to offer greater risk reduction, likely reflective of (1) our study being within a child congregate setting, where children and staff spend considerable time together and physical distancing measures are harder to enforce and (2) the ability of camper masks when always worn to reduce risks of SARS-CoV-2 transmission during the period before a COVID-19 case can be identified.

NPIs related to decreased capacity and pre-camp quarantining were not found by themselves to be significant COVID-19 risk reduction measures, which particularly in the case of pre-camp quarantining was surprising given evidence of its effectiveness in other settings. For example, successful operation of four Maine overnight camps during Summer 2020 was attributed in part to implementation of strict prearrival quarantines and pre- and

post-arrival testing, which identified asymptomatic COVID-19 cases prior to the start of camp, and with subsequent isolation and contact quarantining, prevented further SARS-CoV-2 transmission [2]. These camps also instituted face coverings, targeted physical distancing measures, and other NPIs. Our results suggest that face coverings and targeted physical distancing measures in particular were important contributors to the lack of COVID-19 cases at the Maine camps.

Our study has several limitations. First, our findings are based on aggregate data reported by camps, and as such, measures of NPI usage and COVID-19 cases were not independently verified. As a result, COVID-19 cases were likely underestimated due to under-reporting and lack of detection of asymptomatic cases. It is also possible that NPI usage was underestimated or overestimated. Second, our findings may be affected by selection bias, resulting from the self-selection of camps voluntarily participating in our survey. Demographics of camps participating in the survey mirrored that of the overall camp population, suggesting that selection bias was minimal. Third, completion rates of several survey questions were below 75%, suggesting the potential for reporting bias in regards to what information they chose to report.

These limitations are balanced by our substantial study strengths, including our nationwide cohort of day and overnight camps and the associated data documenting COVID-19 cases and the usage and adherence to numerous NPIs. These data allowed us to characterize COVID-19 risks to both campers and staff and to assess the effectiveness of NPIs, including facial coverings, physical distancing, quarantine, and cleaning measures. Our findings show rates of COVID-19 cases for campers and staff were relatively low – even in areas with high community COVID-19 rates – and further demonstrate the importance of strict face covering and targeted physical distancing measures to reduce SARS-CoV-2 infection in campers and staff.

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Comp Descriptor	Num	berª	Confirmed Cases ^b				
	Camps	Children	Camps	Camper	Staff	Total	
Operations for Summer 2020							
All surveyed camps	1489	89,805	74	30	72	102	
Onsite	486	89,635	74	30	72	102	
Camp Type (Onsite Only)							
Overnight	59	16,228	10	11	30	41	
Day	206	25,826	52	16	29	45	
Combination	220	47,581	12	3	13	16	
Missing	1	0	0	0	0	0	
Camp Type (Onsite Only)							
Single camp	295	70,982	36	27	65	92	
Multi-site camp	191	18,653	38	3	7	10	
Region (Onsite Only)							
Midwest	124	17,259	34	10	30	40	
Northeast	113	24,665	8	5	12	17	
South	108	20,605	15	9	18	27	
West	78	11,696	10	1	7	8	
Missing	63	15,410	5	5	5	10	

Table 1. Summary of the Number of Camps, Campers and Confirmed COVID-19 Cases: Summer 2020

^a Number camps that responded to the survey; number of children onsite for summer 2020 estimated as unique campers ^b Number of camps that reported cases; number of confirmed camper and staff cases

NPI		Total Number ^a		No. with	n/of Confirm e	ed Cases	Risk Ratio (95% Cl) ^c		
		Camps	Campers ^b	Camps	Campers	Staff	Campers	Staff	
Pre-Camp Quarantine at home									
Campers	Yes	97	26,311	17	16	40	2.82 **	2.86***	
	No	285	60,254	54	13	32	(1.36, 5.86)	(1.80, 4.55)	
Staff	Yes	103	25,701	16	16	39	3.07 **	2.81 ***	
	No	278	59,196	53	12	32	(1.45, 6.49)	(1.76, 4.48)	
Pre-Camp	Quarantine at ca	amp							
Campers	Yes	18	7,580	7	0	7	0.00	1.07	
	No	337	72,038	59	27	62	(0.00, NA)	(0.49, 2.34)	
Staff	Yes	73	25,151	10	9	26	1.18	1.39	
	No	293	59,225	57	18	44	(0.53,2.62)	(0.86, 2.26)	
Facial Cove	rings								
Campers	Always	126	30,883	13	5	6	0.36 **	0.17 ***	
	Not always	255	56,176	59	25	63	(0.14, 0.95)	(0.08, 0.40)	
Staff	Always	268	60,682	56	14	33	0.39 **	0.38 ***	
	Not always	122	27,117	18	16	38	(0.19, 0.80)	(0.24, 0.60)	
Decreased Capacity									
	Always	326	56,838	63	24	63	1.44	3.77 **	
	Not always	39	20,429	9	6	6	(0.59, 3.52)	(1.63, 8.72)	
Physical Di	stancing								
	Always	257	57,183	56	11	40	0.31 **	0.67	
	Not always	133	30,616	18	19	32	(0.15, 0.65)	(0.42, 1.07)	
Use of cohorts, pods, bubbles						**			
	Always	301	63,501	65	18	48	0.39	0.63	
	Not always	49	16,653	6	12	20	(0.19, 0.82)	(0.37, 1.06)	
Modified programs to allow for physical distancing						**	**		
	Always	292	61,289	59	13	59	0.30	0.52	
Deeree	Not always	91	23,895	15	1/	31	(0.15, 0.61)	(0.32, 0.82)	
Decreased	Always	ng parents	70 906	70	77	69	1 20	2.62	
	Sometimes	306 17	10,090	70	27	/	1.39 (0.42, 4.57)	2.62 (0.96.7.18)	
	Somerimes	47	10,922	4	3	4	(0.72, 4.37)	(0.50, 7.10)	

Table 2. NPI Usage and Camper and Staff Number and COVID-19 Cases

Increased cleaning f							
Always	371	80,997	69	27	69	0.71	2.71
Not alw	ays 18	6,352	4	3	2	(0.21, 2.33)	(0.66, 11.03)
Regular hand hygiene							
Always	374	81,247	71	27	71	0.72	5.68
Not alw	ays 15	6,499	3	3	1	(0.22, 2.37)	(0.79, 40.87)
Altered dining to de	crease numbers	or increase pl	hysical dist	ancing			
Always	257	65,365	60	23	60	0.24 **	1.57
Not alw	ays 24	3,411	4	5	2	(0.09, 0.63)	(0.38, 6.40)
Changed or increased bathroom facilities							
Always	160	39,463	31	7	31	0.34 **	0.90
Not alw	ays 139	40,301	19	21	35	(0.15, 0.80)	(0.56, 1.47)

^a Does not include camps not reporting data for examined NPI. ^b No. campers estimated from unique no. onsite campers. ^c RR for always vs. not always. RRs for staffers determined using no. campers as denominator. ^{**}p-value<0.05 ^{**} p-value<0.00

	Response	Number		Number of Cases			RR (95% CI)	
NPI		Camps	Campers	Camps	Camper	Staff	Camper	Staff
	Neither	118	26,589	18	16	39		
Camper and Staff	Camper Facial Covering Only	0	0	0	0	0	-	-
Facial Covering	Staff Facial Covering Only	137	29,587	41	9	24	0.51 (0.22, 1.14)	0.55 (0.33, 0.92)
	Both	126	30,883	13	5	6	0.27 (0.10, 0.73)	0.13 (0.06, 0.31)
	Neither	195	42,087	47	11	29		
Camper Facial	Camper Facial Covering Only	87	17,547	6	2	2	0.44 (0.10, 1.97)	0.17 (0.04, 0.69)
Covering and Home	Home Camper Quarantine Only	56	14,029	12	14	34	3.82 (1.73, 8.41)	3.52 (2.14, 5.77)
cumper quarantine	Both	34	10,786	4	2	4	0.71 (0.16, 3.20)	0.54 (0.19, 1.53)
	Neither	110	25,477	17	18	32		
Camper Facial	Camper Facial Covering Only	21	5,019	1	1	0	0.28 (0.04, 2.11)	0.00 (0.00, NA)
Covering and Physical Distancing	Physical Distancing Only	145	30,699	42	7	31	0.32 (0.13, 0.77)	0.80 (0.49, 1.32)
	Both	105	25,864	12	4	6	0.22 (0.07, 0.65)	0.18 (0.08, 0.44)
	Neither	85	23,113	15	17	31		
Camper Facial	Camper Facial Coverings Only	4	662	0	0	0	0.00 (0.00, NA)	0.00 (0.00, NA)
Coverings and Modified Programs	Modified Programs Only	167	31,384	44	8	32	0.35 (0.15, 0.80)	0.76 (0.46, 1.25)
	Both	120	29,285	13	5	6	0.23 (0.09, 0.63)	0.15 (0.06, 0.37)
	Neither	79	19,504	14	17	30		
Physical Distancing and Modified Programs	Physical Distancing Only	12	4,391	1	0	1	0.00 (0.00, NA)	0.15 (0.02, 1.09)
	Modified Programs Only	54	11,112	4	2	2	0.21 (0.05, 0.89)	0.12 (0.03, 0.49)
	Both	238	50,177	55	11	39	0.25 (0.12, 0.54)	0.51 (0.31, 0.81)
Physical Distancing and Home Camper Quarantine	Neither	99	21,689	10	4	8		
	Physical Distancing Only	186	38,565	44	9	24	1.27 (0.39, 4.11)	1.69 (0.76, 3.75)
	Home Camper Quarantine Only	32	8,807	8	15	24	9.24 (3.07, 27.82)	7.39 (3.32,16.44)
	Both	61	16,008	9	1	16	0.34 (0.04, 3.03)	2.71 (1.16, 6.33)
Modified Programs and Home Camper Quarantine	Neither	70	16,915	10	3	9		
	Modified Programs Only	212	40,724	44	10	23	1.38 (0.38, 5.03)	1.06 (0.49, 2.29)
	Home Camper Quarantine Only	19	6,860	5	14	22	11.51 (3.31,40.03)	6.03 (2.78,13.08)
	Both	72	17,955	12	2	18	0.63 (0.10, 3.76)	1.88 (0.85, 4.19)

Table 3. Effect of Multiple NPI Combinations on Total (Camper and Staff) COVID-19 Cases^a

^a Comparisons made using subset of data for which there is complete data for each examined NPI. RRs calculated comparing 1 or 2 NPIs to neither NPI.

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TAB 22



Chief Justice says Canada attempted 'cultural genocide' on aboriginals

SEAN FINE > JUSTICE WRITER PUBLISHED MAY 28, 2015

This article was published more than 7 years ago. Some information may no longer be current.



Chief Justice Beverley McLachlin in Vancouver June 6, 2013. In a speech on May 28, 2015, she referred to Canada's treatment of its aboriginal people as a "cultural genocide" that began in the colonial period. JOHN LEHMANN/THE GLOBE AND MAIL

Supreme Court Chief Justice Beverley McLachlin says Canada attempted to commit "cultural genocide" against aboriginal peoples, in what she calls the worst stain on Canada's human-rights record.

Genocide – an attempt to destroy a people, in whole or part – is a crime under international law. The United Nations' Convention on the Prevention and Punishment of the Crime of Genocide, adopted in 1948, does not use the phrase "cultural genocide," but says genocide may include causing serious mental harm to a group.

Chief Justice McLachlin appears to be the highest-ranking Canadian official to use the phrase. Former Liberal prime minister Paul Martin used it two years ago in describing residential schools for aboriginal children when he testified before the Truth and Reconciliation Commission set up by the Conservative government. That commission is to make its report public next week.

"The most glaring blemish on the Canadian historic record relates to our treatment of the First Nations that lived here at the time of colonization," Chief Justice McLachlin said. She was delivering the fourth annual Pluralism Lecture of the Global Centre for Pluralism, founded in 2006 by the Aga Khan, spiritual leader of Ismaili Muslims, and the federal government.

After an initial period of inter-reliance and equality, she said Canada developed an "ethos of exclusion and cultural annihilation."

Peter Russell, a political science professor emeritus at the University of Toronto, said that Chief Justice McLachlin shares with virtually all Supreme Court judges since a landmark rights case in 1990 "a tremendous sense of sorrow about the denial of very fundamental rights to Canada's native people."

Chief Justice McLachlin, who has been on the court since 1989 and chief since 2000, is its longest-serving chief justice. She cited early laws barring treaty Indians from leaving reservations, rampant starvation and disease and the denial of the right to vote.

She also pointed to the outlawing of aboriginal religious and social traditions, such as the potlatch and the sun dance, and to residential schools, in which children who had been taken from their parents "were forbidden to speak their native languages, forced to wear white man's clothing, forced to observe Christian religious practices and sometimes subjected to sexual abuse.

The objective was to 'take the Indian out of the child,' and thus to solve what John A. Macdonald referred to as the 'Indian problem.'"

Chief Justice McLachlin authored the court's unanimous ruling last June that legal observers called the most important aboriginal-rights decision in Canadian history. The court determined that native Canadians still own their ancestral lands, unless they signed away their ownership in treaties with government. While they do not retain absolute control, the ruling gives them enormous leverage in negotiations with outside parties that wish to develop their lands. The court granted title to the Tsilhqot'in Nation to an area more than half the size of greater Vancouver, though only 400 people lived there when when the British Crown asserted its sovereignty in 1846.

In her speech, she said Canada had learned from its mistakes, and she cited Prime Minister Stephen Harper's 2008 apology to aboriginal peoples for the abuses of the residential schools.

The event was held in partnership with The Globe and Mail.

TAB 23

CMA CODE OF ETHICS AND PROFESSIONALISM

The CMA Code of Ethics and Professionalism articulates the ethical and professional commitments and responsibilities of the medical profession. The Code provides standards of ethical practice to guide physicians in fulfilling their obligation to provide the highest standard of care and to foster patient and public trust in physicians and the profession. The Code is founded on and affirms the core values and commitments of the profession and outlines responsibilities related to contemporary medical practice.

In this Code, ethical practice is understood as a process of active inquiry, reflection, and decision-making concerning what a physician's actions should be and the reasons for these actions. The Code informs ethical decision-making, especially in situations where existing guidelines are insufficient or where values and principles are in tension. The Code is not exhaustive; it is intended to provide standards of ethical practice that can be interpreted and applied in particular situations. The Code and other CMA policies constitute guidelines that provide a common ethical framework for physicians in Canada.

In this Code, medical ethics concerns the virtues, values, and principles that should guide the medical profession, while professionalism is the embodiment or enactment of responsibilities arising from those norms through standards, competencies, and behaviours. Together, the virtues and commitments outlined in the Code are fundamental to the ethical practice of medicine.

Physicians should aspire to uphold the virtues and commitments in the Code, and they are expected to enact the professional responsibilities outlined in it.

Physicians should be aware of the legal and regulatory requirements that govern medical practice in their jurisdictions.

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A. VIRTUES EXEMPLIFIED BY THE ETHICAL PHYSICIAN

Trust is the cornerstone of the patient–physician relationship and of medical professionalism. Trust is therefore central to providing the highest standard of care and to the ethical practice of medicine. Physicians enhance trustworthiness in the profession by striving to uphold the following interdependent virtues:

COMPASSION. A compassionate physician recognizes suffering and vulnerability, seeks to understand the unique circumstances of each patient and to alleviate the patient's suffering, and accompanies the suffering and vulnerable patient.

HONESTY. An honest physician is forthright, respects the truth, and does their best to seek, preserve, and communicate that truth sensitively and respectfully.

HUMILITY. A humble physician acknowledges and is cautious not to overstep the limits of their knowledge and skills or the limits of medicine, seeks advice and support from colleagues in challenging circumstances, and recognizes the patient's knowledge of their own circumstances.

INTEGRITY. A physician who acts with integrity demonstrates consistency in their intentions and actions and acts in a truthful manner in accordance with professional expectations, even in the face of adversity.

PRUDENCE. A prudent physician uses clinical and moral reasoning and judgement, considers all relevant knowledge and circumstances, and makes decisions carefully, in good conscience, and with due regard for principles of exemplary medical care.

B. FUNDAMENTAL COMMITMENTS OF THE MEDICAL PROFESSION

Commitment to the well-being of the patient

Consider first the well-being of the patient; always act to benefit the patient and promote the good of the patient.

Provide appropriate care and management across the care continuum.

Take all reasonable steps to prevent or minimize harm to the patient; disclose to the patient if there is a risk of harm or if harm has occurred.

Recognize the balance of potential benefits and harms associated with any medical act; act to bring about a positive balance of benefits over harms.

Commitment to respect for persons

Always treat the patient with dignity and respect the equal and intrinsic worth of all persons. Always respect the autonomy of the patient.

Never exploit the patient for personal advantage.

Never participate in or support practices that violate basic human rights.

Commitment to justice

Promote the well-being of communities and populations by striving to improve health outcomes and access to care, reduce health inequities and disparities in care, and promote social accountability.

Commitment to professional integrity and competence

Practise medicine competently, safely, and with integrity; avoid any influence that could undermine your professional integrity.

Develop and advance your professional knowledge, skills, and competencies through lifelong learning.

Commitment to professional excellence

Contribute to the development and innovation in medicine through clinical practice, research, teaching, mentorship, leadership, quality improvement, administration, or advocacy on behalf of the profession or the public.

Participate in establishing and maintaining professional standards and engage in processes that support the institutions involved in the regulation of the profession.

Cultivate collaborative and respectful relationships with physicians and learners in all areas of medicine and with other colleagues and partners in health care.

Commitment to self-care and peer support

Value personal health and wellness and strive to model self-care; take steps to optimize meaningful co-existence of professional and personal life.

Value and promote a training and practice culture that supports and responds effectively to colleagues in need and empowers them to seek help to improve their physical, mental, and social well-being.

Recognize and act on the understanding that physician health and wellness needs to be addressed at individual and systemic levels, in a model of shared responsibility.

Commitment to inquiry and reflection

Value and foster individual and collective inquiry and reflection to further medical science and to facilitate ethical decision-making.

Foster curiosity and exploration to further your personal and professional development and insight; be open to new knowledge, technologies, ways of practising, and learning from others.

C. PROFESSIONAL RESPONSIBILITIES

PHYSICIANS AND PATIENTS

Patient-physician relationship

The patient–physician relationship is at the heart of the practice of medicine. It is a relationship of trust that recognizes the inherent vulnerability of the patient even as the patient is an active participant in their own care. The physician owes a duty of loyalty to protect and further the patient's best interests and goals of care by using the physician's expertise, knowledge, and prudent clinical judgment.

In the context of the patient–physician relationship:

- Accept the patient without discrimination (such as on the basis of age, disability, gender identity or expression, genetic characteristics, language, marital and family status, medical condition, national or ethnic origin, political affiliation, race, religion, sex, sexual orientation, or socioeconomic status). This does not abrogate the right of the physician to refuse to accept a patient for legitimate reasons.
- 2. Having accepted professional responsibility for the patient, continue to provide services until these services are no longer required or wanted, or until another suitable physician has assumed responsibility for the patient, or until after the patient has been given reasonable notice that you intend to terminate the relationship.
- 3. Act according to your conscience and respect differences of conscience among your colleagues; however, meet your duty of non-abandonment to the patient by always acknowledging and responding to the patient's medical concerns and requests whatever your moral commitments may be.
- 4. Inform the patient when your moral commitments may influence your recommendation concerning provision of, or practice of any medical procedure or intervention as it pertains to the patient's needs or requests.
- 5. Communicate information accurately and honestly with the patient in a manner that the patient understands and can apply, and confirm the patient's understanding.
- 6. Recommend evidence-informed treatment options; recognize that inappropriate use or overuse of treatments or resources can lead to ineffective, and at times harmful, patient care and seek to avoid or mitigate this.
- 7. Limit treatment of yourself, your immediate family, or anyone with whom you have a similarly close relationship to minor or emergency interventions and only when another physician is not readily available; there should be no fee for such treatment.
- 8. Provide whatever appropriate assistance you can to any person who needs emergency medical care.
- 9. Ensure that any research to which you contribute is evaluated both scientifically and ethically and is approved by a research ethics board that adheres to current standards of practice. When involved in research, obtain the informed consent of the research participant and advise prospective participants that they have the right to decline to participate or withdraw from the study at any time, without negatively affecting their ongoing care.
- 10. Never participate in or condone the practice of torture or any form of cruel, inhuman, or degrading procedure.

Decision-making

Medical decision-making is ideally a deliberative process that engages the patient in shared decision-making and is informed by the patient's experience and values and the physician's clinical judgment. This deliberation involves discussion with the patient and, with consent, others central to the patient's care (families, caregivers, other health professionals) to support patient-centred care.

In the process of shared decision-making:

- 11. Empower the patient to make informed decisions regarding their health by communicating with and helping the patient (or, where appropriate, their substitute decision-maker) navigate reasonable therapeutic options to determine the best course of action consistent with their goals of care; communicate with and help the patient assess material risks and benefits before consenting to any treatment or intervention.
- 12. Respect the decisions of the competent patient to accept or reject any recommended assessment, treatment, or plan of care.
- 13. Recognize the need to balance the developing competency of minors and the role of families and caregivers in medical decision-making for minors, while respecting a mature minor's right to consent to treatment and manage their personal health information.
- 14. Accommodate a patient with cognitive impairments to participate, as much as possible, in decisions that affect them; in such cases, acknowledge and support the positive roles of families and caregivers in medical decision-making and collaborate with them, where authorized by the patient's substitute decision-maker, in discerning and making decisions about the patient's goals of care and best interests.
- 15. Respect the values and intentions of a patient deemed incompetent as they were expressed previously through advance care planning discussions when competent, or via a substitute decision-maker.
- 16. When the specific intentions of an incompetent patient are unknown and in the absence of a formal mechanism for making treatment decisions, act consistently with the patient's discernable values and goals of care or, if these are unknown, act in the patient's best interests.
- 17. Respect the patient's reasonable request for a second opinion from a recognized medical expert.

PHYSICIANS AND THE PRACTICE OF MEDICINE

Patient privacy and the duty of confidentiality

- 18. Fulfill your duty of confidentiality to the patient by keeping identifiable patient information confidential; collecting, using, and disclosing only as much health information as necessary to benefit the patient; and sharing information only to benefit the patient and within the patient's circle of care. Exceptions include situations where the informed consent of the patient has been obtained for disclosure or as provided for by law.
- 19. Provide the patient or a third party with a copy of their medical record upon the patient's request, unless there is a compelling reason to believe that information contained in the record will result in substantial harm to the patient or others.
- 20. Recognize and manage privacy requirements within training and practice environments and quality improvement initiatives, in the context of secondary uses of data for health system management, and when using new technologies in clinical settings.

21. Avoid health care discussions, including in personal, public, or virtual conversations, that could reasonably be seen as revealing confidential or identifying information or as being disrespectful to patients, their families, or caregivers.

Managing and minimizing conflicts of interest

- 22. Recognize that conflicts of interest may arise as a result of competing roles (such as financial, clinical, research, organizational, administrative, or leadership).
- 23. Enter into associations, contracts, and agreements that maintain your professional integrity, consistent with evidence-informed decision-making, and safeguard the interests of the patient or public.
- 24. Avoid, minimize, or manage and always disclose conflicts of interest that arise, or are perceived to arise, as a result of any professional relationships or transactions in practice, education, and research; avoid using your role as a physician to promote services (except your own) or products to the patient or public for commercial gain outside of your treatment role.
- 25. Take reasonable steps to ensure that the patient understands the nature and extent of your responsibility to a third party when acting on behalf of a third party.
- 26. Discuss professional fees for non-insured services with the patient and consider their ability to pay in determining fees.
- 27. When conducting research, inform potential research participants about anything that may give rise to a conflict of interest, especially the source of funding and any compensation or benefits.

PHYSICIANS AND SELF

- 28. Be aware of and promote health and wellness services, and other resources, available to you and colleagues in need.
- 29. Seek help from colleagues and appropriate medical care from qualified professionals for personal and professional problems that might adversely affect your health and your services to patients.
- 30. Cultivate training and practice environments that provide physical and psychological safety and encourage help-seeking behaviours.

PHYSICIANS AND COLLEAGUES

- 31. Treat your colleagues with dignity and as persons worthy of respect. Colleagues include all learners, health care partners, and members of the health care team.
- 32. Engage in respectful communications in all media.
- 33. Take responsibility for promoting civility, and confronting incivility, within and beyond the profession. Avoid impugning the reputation of colleagues for personal motives; however, report to the appropriate authority any unprofessional conduct by colleagues.
- 34. Assume responsibility for your personal actions and behaviours and espouse behaviours that contribute to a positive training and practice culture.

- 35. Promote and enable formal and informal mentorship and leadership opportunities across all levels of training, practice, and health system delivery.
- 36. Support interdisciplinary team-based practices; foster team collaboration and a shared accountability for patient care.

PHYSICIANS AND SOCIETY

- 37. Commit to ensuring the quality of medical services offered to patients and society through the establishment and maintenance of professional standards.
- 38. Recognize that social determinants of health, the environment, and other fundamental considerations that extend beyond medical practice and health systems are important factors that affect the health of the patient and of populations.
- 39. Support the profession's responsibility to act in matters relating to public and population health, health education, environmental determinants of health, legislation affecting public and population health, and judicial testimony.
- 40. Support the profession's responsibility to promote equitable access to health care resources and to promote resource stewardship.
- 41. Provide opinions consistent with the current and widely accepted views of the profession when interpreting scientific knowledge to the public; clearly indicate when you present an opinion that is contrary to the accepted views of the profession.
- 42. Contribute, where appropriate, to the development of a more cohesive and integrated health system through inter-professional collaboration and, when possible, collaborative models of care.
- 43. Commit to collaborative and respectful relationships with Indigenous patients and communities through efforts to understand and implement the recommendations relevant to health care made in the report of the Truth and Reconciliation Commission of Canada.
- 44. Contribute, individually and in collaboration with others, to improving health care services and delivery to address systemic issues that affect the health of the patient and of populations, with particular attention to disadvantaged, vulnerable, or underserved communities.

Approved by the CMA Board of Directors Dec 2018

TAB 24



STANDARDS OF PRACTICE

Informed Consent

Under Review: No Issued By: Council: January 1, 2010 Reissued by Council: June 1, 2016



The <u>Standards of Practice</u> of the College of Physicians & Surgeons of **Alberta ("CPSA") are the** <u>minimum</u> standards of professional behavior and ethical conduct expected of all regulated members registered in Alberta. Standards of Practice are enforceable under the *Health Professions Act* and will be referenced in the management of complaints and in discipline hearings. CPSA also provides <u>Advice to the Profession</u> to support the implementation of the Standards of Practice.

- 1. A regulated member must **obtain a patient's informed consent**ⁱ prior to an examination, assessment, treatment or procedure; such consent may be implied, expressed orally or in writing as appropriate.
- 2. If a patient is under the age of 18 years, a regulated member must:
 - a. determine whether the patient is a mature minor with the capacity to give informed consent¹; and
 - b. if the patient is not a mature minor, seek informed consent from the patient's legal guardian, in accordance with legislation¹.
- 3. If an adult patient lacks capacity to give informed consent, a regulated member must **seek informed consent from the patient's legal guardian or** substitute decision maker, in accordance with legislation¹.
- 4. A regulated member who has reasonable grounds to believe an informed consent decision by a legal guardian or substitute decision maker is not in the best interests of the patient must seek legal advice, such as from the <u>Canadian Medical Protective Association</u>, or advice from CPSA.
- 5. A regulated member obtaining informed consent from a patient, or the **patient's legal guardian or substitute decision maker**, must ensure the decision maker:
 - a. is aware of his/her right to withdraw consent at any time;

Terms used in the Standards of Practice:

 $^{{\}boldsymbol{\cdot}}$ "Regulated member" means any person who is registered or who is required to be registered

as a member of this College. The College regulates physicians, surgeons and osteopaths.

^{• &}quot;Must" refers to a mandatory requirement.

^{• &}quot;May" means that the physician may exercise reasonable discretion.

^{• &}quot;Patient" includes, where applicable, the patient's legal guardian or substitute decision maker.



- b. is free of undue influence, duress or coercion in making the consent decision;
- c. receives a proper explanation that includes, but is not limited to:
 - i. diagnosis reached;
 - ii. advised interventions and treatments;
 - iii. exact nature and anticipated benefits of the proposed examination, assessment, treatment or procedure;
 - iv. common risks and significant risks;
 - v. reasonable alternative treatments available, and the associated common risks and significant risks;
 - vi. natural history of the condition and the consequences of forgoing treatment; and
- d. demonstrates a reasonable understanding of the information provided and the reasonably foreseeable consequences of both a decision and a failure to make a decision.
- 6. A regulated member who assesses the capacity of a patient to give informed consent must:
 - a. use accepted capacity assessment processes;
 - b. to the extent possible, conduct the capacity assessment at a time and under circumstances in which the patient is likely to be able to demonstrate full capacity; and
 - c. inform the patient of the nature and consequences of the capacity assessment.
- 7. A regulated member obtaining informed consent for a patient to participate in health research must comply with CPSA's <u>Human Health</u> <u>Research</u> standard of practice.

Terms used in the Standards of Practice:

 $^{{\}boldsymbol{\cdot}}$ "Regulated member" means any person who is registered or who is required to be registered

as a member of this College. The College regulates physicians, surgeons and osteopaths.

^{• &}quot;Must" refers to a mandatory requirement.

^{• &}quot;May" means that the physician may exercise reasonable discretion.

^{• &}quot;Patient" includes, where applicable, the patient's legal guardian or substitute decision maker.



(8) A regulated member may <u>delegate responsibility</u> for obtaining informed consent to another healthcare professional only when <u>confident the</u> <u>delegate</u> has the appropriate knowledge, skill and judgment to meet the expectations of this standard.

RELATED STANDARDS OF PRACTICE

- <u>Code of Ethics & Professionalism</u>
- <u>Human Health Research</u>
- Medical Assistance in Dying
- <u>Responsibility for a Medical Practice</u>
- <u>Supervision of Restricted Activities</u>

COMPANION RESOURCES

- Advice to the Profession: Informed Consent for Adults
- Advice to the Profession: Informed Consent for Minors
- Advice to the Profession: Legislated Reporting & Release of Medical
 Information
- Office of the Public Guardian's Guide to Capacity Assessment under the
 Personal Directives Act
- Office of the Public Guardian's Resources for Capacity Assessors
- CMPA's Consent: A guide for Canadian Physicians
- CMPA's Informed consent: Overview and objectives
- CMPA's Informed consent: Why and when do we need consent?

¹ See CPSA's Advice to the Profession: Informed Consent for Adults and Informed Consent for Minors.

Terms used in the Standards of Practice:

^{• &}quot;Regulated member" means any person who is registered or who is required to be registered

as a member of this College. The College regulates physicians, surgeons and osteopaths.

^{• &}quot;Must" refers to a mandatory requirement.

^{• &}quot;May" means that the physician may exercise reasonable discretion.

^{• &}quot;Patient" includes, where applicable, the patient's legal guardian or substitute decision maker.

TAB 25

Summary Sheet

AHS Consent to Treatment / Procedure(s) Policy

Alberta Health Services (AHS) is committed to best practice which contributes to Patient safety, and enhances the Patient experience. The AHS Consent to Treatment/Procedure(s) policy and procedures will facilitate a fair, respectful and informed Consent Process that is achieved consistently across the organization.

The Consent Process

Obtaining consent is a process involving a discussion or series of discussions and interactions between the Most Responsible Health Practitioner and the Patient, his/her Co-Decision Maker or Alternate Decision-Maker (as applicable). There are five steps to the process:

Step 1. The determination of Capacity

Assess the Patient's Capacity to make the decision at hand

Step 2. The provision of relevant information

Provide the Patient with the information required to understand the proposed Treatment/Procedures and to make an informed decision

Step 3. The verification of understanding

Provide the Patient with the opportunity to ask questions and provide understandable answers

Step 4. The decision-making

Patient makes the health care decision

Step 5. Documentation of the Consent Process and outcome

Ensure appropriate documentation of the Consent Process and outcomes on the Patient's Health Record

Emergency Health Care

Adult Patient:

Emergency health care may be provided to an Adult without consent if health care is necessary to:

- Preserve the Adult's life;

- Prevent serious physical or mental harm to the adult; or

- Alleviate severe pain

AND

1. The Adult lacks Capacity to consent as a result of drug or alcohol impairment, lack of consciousness or another cause.

2. There is no knowledge/evidence that the Adult had previously expressed wishes to the contrary.

3. No Guardian or Agent for the Adult in existence or immediately available and accessible.

Minor Patient:

Emergency health care for a Minor may be provided where a Mature Minor or Legal Representative is unable to provide consent if the Minor has an illness or injury and their life or health is immediately threatened.

AND

There is no knowledge that the Mature Minor or Legal Representative would have objected to the Treatment/Procedure.

Disclaimer

This summary sheet is intended to be a guide and is not to replace the content of the AHS policy Consent to Treatment/Procedure(s) and its related procedures or legal advice. Examples herein are for illustrative purposes only; the application of the AHS policy/procedures and legislation may vary depending on circumstances unique to each situation. Readers are encouraged to view the policy/procedure documents and legislation directly and should consult Policy Services{policy@albertahealthservices.ca} if in need of clarification.

Refusal / Withdrawal

Adult Patient:

An Adult Patient determined to have Capacity has the right to refuse or revoke a prior consent to a proposed Treatment/Procedure on any grounds, even when it is clear that the health care is necessary to preserve their life or health.

Minor Patient:

In the event that a Mature Minor, or the Legal Representative for a Minor, refuses to provide consent or withdraws consent for essential medical, surgical or other remedial Treatment necessary for the health or well-being of the Mature Minor or Minor, this shall be immediately reported to the Director of Child and Family Services Authority.

Duration of Consent

A consent is valid until:

- The Treatment/Procedure consented to is performed
- The Patient's condition changes
- The Patient withdraws the consent
- Further risks become known
- Alternative Treatments become available


TAB 26



TITLE

CONSENT TO TREATMENT/PROCEDURE(S)		
<u>Scope</u> Provincial	DOCUMENT# PRR-01	
Approval Authority Executive Leadership Team	INITIAL EFFECTIVE DATE October 31, 2010	
SPONSOR Vice President, Health Professions & Practice; Associate Chief Medical Officer, Quality & Medical Affairs	Revision Effective Date January 16, 2020	
Parent Document Title, Type and Number Not applicable	Scheduled Review Date January 16, 2023	

NOTE: The first appearance of terms in bold in the body of this document (except titles) are defined terms – please refer to the Definitions section.

If you have any questions or comments regarding the information in this document, please contact the Policy & Forms Department at <u>policy@ahs.ca</u>. The Policy & Forms website is the official source of current approved policies, procedures, directives, standards, protocols and guidelines.

OBJECTIVES

- To facilitate an **informed consent process** within Alberta Health Services (AHS) that reflects good practice, contributes to **patient** safety, and enhances the patient experience.
- To facilitate a fair, respectful process for **informed consent** that is achieved consistently across all care areas within AHS.
- To facilitate compliance with applicable law.

PRINCIPLES

The principle of respect for persons is foundational within this policy and demonstrated by patients being supported in determining what happens to their own bodies, in keeping with their own values and beliefs. Where patients cannot make their own decisions, respect for persons is upheld by recognizing the decision-making role of an appropriate **alternate decision-maker**.

Informed consent:

- requires capacity;
- shall be informed;
- shall be specific;
- shall be voluntary;
- requires understanding; and

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• shall be documented.

On an exceptional basis, patient-informed consent decisions can be overridden in accordance with legislation such as the *Mental Health Act* and the *Public Health Act*.

The **most responsible health practitioner (MRHP)** providing the **treatment/procedure(s)** to a patient has a duty to obtain informed consent.

AHS is committed to providing continuing education for all personnel to implement this policy and the subsequent procedures.

APPLICABILITY

Compliance with this document is required by all Alberta Health Services employees, members of the medical and midwifery staffs, Students, Volunteers, and other persons acting on behalf of Alberta Health Services (including contracted service providers as necessary).

ELEMENTS

1. Informed Consent is Required

- 1.1 Before providing a specific treatment/procedure(s) or plan of treatment/procedure(s), the MRHP shall obtain **express informed consent** or **implied informed consent** from the patient, unless a valid exception to informed consent applies (see Section 5 below).
- 1.2 The MRHP is responsible for determining the most appropriate method of obtaining informed consent (express or implied).
- 1.3 All consent, whether express or implied, shall be informed.
- 1.4 Implied informed consent may be presumed in (but is not limited to) circumstances where the patient presents voluntarily for an examination, investigation, or minor or less invasive treatment/procedure(s) which the MRHP determines does not require express informed consent.
 - a) The MRHP shall be satisfied that the circumstances or the actions of the patient imply permission for the examinations, investigations, and treatment/procedure(s) proposed.
 - b) If there is any doubt that there is implied informed consent, the MRHP shall obtain express informed consent from the patient.
 - c) Implied informed consent is encouraged to be documented by the MRHP in the patient's **health record**.
- 1.5 When the MRHP determines that express informed consent is required to evidence the patient's informed consent to the treatment/procedure(s):

- a) verbal consent shall be documented by the MRHP in the patient's health record; or
- b) written (signed) consent shall be documented by the MRHP through obtaining the signature of the patient on the applicable **consent form** (see Section 1.7 below), which shall then be attached to the patient's health record. Where a consent form is used, documentation in the patient's health record regarding the informed consent discussion is also recommended.
- 1.6 Notwithstanding Section 1.2 above, written (signed) consent shall be obtained for:
 - a) the transfusion of blood and blood products;
 - b) surgery;
 - c) invasive investigative procedures;
 - d) human tissue and organ donation; and
 - e) medical assistance in dying, consistent with the AHS *Medical Assistance in Dying* Policy.
- 1.7 The following consent forms shall be used in the following situations or any other treatment/procedure(s) for which the MRHP deems written (signed) consent to be appropriate:
 - a) The AHS *Consent to Surgery or Invasive Procedure* Form should be used for all surgical or invasive procedures including endoscopy or cardiac catheterization. This form includes sections about possible transfusion and testing for blood-borne viruses in the event of needle-stick injuries or body fluid splashes as well as for the retention of tissue and the involvement of trainees.
 - b) The AHS *Consent to Treatment Plan/Intervention or Procedure* Form should be used for lesser or non-invasive procedures or treatment plans and interventions that are deemed to reach the threshold of requiring written (signed) consent such as a bedside procedure or blood product transfusion.
 - c) The AHS *Emergency Health Care: Documentation of Exception to Consent* Form should be used in situations where it is deemed that a procedure, which would otherwise require written (signed) consent, is occurring in an emergency situation where it is not possible to do so.
- 1.8 Informed consent may be obtained in the MRHP's community office rather than at the applicable **Alberta Health Services (AHS) setting** where the patient will be receiving the treatment/procedure(s). Any completed consent forms shall then

be forwarded to the applicable AHS setting where the patient will be receiving the treatment/procedure(s).

2. Accountability

- 2.1 The accountability to obtain informed consent shall rest with the MRHP who is providing the specific treatment/procedure(s).
- 2.2 The MRHP remains accountable for the informed consent process when one (1) or more than one (1) **health care provider** is involved in providing the treatment/procedure(s).
- 2.3 The MRHP is responsible for confirming the validity of informed consent prior to the delivery of the treatment/procedure(s).
- 2.4 For programs that offer multiple treatment/procedure(s), each MRHP is accountable for the informed consent process related to the treatment/procedure(s) they are providing.

3. Required Components of Informed Consent

- 3.1 Capacity:
 - a) The MRHP is responsible to conduct initial assessment of the patient for determination of capacity to make treatment and care decisions.
 - (i) Where the MRHP cannot complete an assessment of the patient for the determination of capacity to make treatment decisions, the MRHP shall ensure assessment of the patient's capacity by an appropriate clinical expert (refer to list of approved capacity assessors).
 - b) An **adult** patient is presumed to have capacity to make treatment/procedure(s) decisions unless the patient is determined to lack capacity.
 - (i) When an adult patient lacks capacity to consent to a treatment/procedure(s), the authority of a co-decision-maker or an alternate decision-maker shall be recognized in accordance with the AHS Consent to Treatment/Procedure(s): Adults with Impaired Capacity and Adults who Lack Capacity Procedure.
 - (ii) Capacity for a **minor** patient shall be determined in accordance with the AHS *Consent to Treatment/Procedure(s): Minors / Mature Minors* Procedure.
 - c) The MRHP shall be satisfied that the patient has the capacity to make each treatment/procedure(s) decision.

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- (i) If a patient is considered to have capacity and consents to the proposed treatment/procedure(s), they may be treated.
- (ii) A patient's capacity can change depending on changes to their mental and physical health.
- (iii) The determination of capacity shall relate to each specific treatment/procedure(s) or plan of treatment/procedure(s).
- (iv) Informed consent shall be obtained prior to the administration of any medication that may significantly affect the patient's capacity to make an informed decision (i.e., analgesic, narcotic, or anaesthetic).
- (v) A patient may have capacity even if they are unable to communicate verbally. Communication with the patient shall be facilitated by any means that enables understanding (see Section 3.5 below).
- (vi) The patient's choice to make decisions based on their values and beliefs shall be supported, subject to exceptions (see Section 5 below).
- 3.2 Informed:
 - a) The MRHP shall ensure all necessary information has been provided to the patient so that the patient can make an informed decision about the treatment/procedure(s). Necessary information shall include but is not limited to:
 - (i) the condition for which the treatment/procedure(s) is proposed;
 - the treatment/procedure(s) plans/interventions and/or list of agreed upon treatment/procedure(s), that are clinically indicated and approved for the condition;
 - (iii) the potential risks and benefits of the proposed treatment/procedure(s);
 - (iv) information applicable to the patient's particular circumstances or as specifically requested by the patient;
 - If the patient alerts the MRHP of particular circumstances that might affect the information the patient would want for their treatment/procedure(s), the MRHP shall be responsible for addressing those particular circumstances with further information as requested by the patient.
 - (v) alternatives to the proposed treatment/procedure(s);

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- (vi) the potential consequences of both providing consent or refusing to provide consent for the proposed treatment/procedure(s); and
- (vii) who will perform the treatment/procedure(s) and who may provide assistance, including whether the treatment/procedure(s) will include health care providers in training (i.e., residents, students).

3.3 Specific:

- a) The provision of informed consent shall relate to each specific treatment/procedure(s) or a plan of treatment/procedure(s).
- b) Treatment/procedure(s) that:
 - (i) are in addition to the treatment/procedure(s) already consented to;
 - (ii) are different from the treatment/procedure(s) consented to;
 - (iii) were unanticipated at the time informed consent was obtained;
 - (iv) may be convenient to do; or
 - (v) may be beneficial to the patient,

shall <u>not</u> be performed without obtaining further informed consent, unless a valid exception to informed consent applies (see Section 5 below).

- c) New informed consent shall be obtained when one (1) or more of the following occurs:
 - (i) the patient's condition has materially changed;
 - (ii) the medical knowledge about the patient's condition or the treatment/procedure(s) available has materially changed;
 - (iii) when the treatment/procedure(s) for the patient changes;
 - (iv) the previously given consent and/or any portion of the previously given consent has been withdrawn (see Section 4 below); and
 - (v) the patient has refused the involvement of particular individuals in their treatment/procedures(s) (i.e., medical students).
- d) If the previous informed consent was evidenced using a consent form, then the new or subsequent informed consent should also be evidenced using a consent form.

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3.4 Voluntary:

- a) The patient shall have the opportunity, without undue influence, to accept or refuse a treatment/procedure(s).
- b) As time permits in the clinical circumstance, informed consent discussions shall occur when the patient has a reasonable opportunity to reflect on the decision and ask questions.
- c) When appropriate to do so, informed consent discussions should not take place in the operating room or the operating room environment.
- d) The patient shall be given an opportunity to take the time required to reflect on the information and to consult with whom they choose prior to making a decision.
- e) A patient's decision to accept or refuse a treatment/procedure(s) shall not prejudice their access to ongoing or future health care.
- 3.5 Understanding:
 - a) The MRHP accountable for the informed consent process shall:
 - (i) provide the patient with the opportunity to ask questions;
 - (ii) provide responses to the questions asked by the patient; and
 - (iii) ensure the patient has understood the information sufficiently to proceed with the informed consent discussion.
 - b) The informed consent discussion is a shared process between the patient and the MRHP, resulting in the patient's decision to accept or refuse the proposed treatment/procedure(s).
 - c) The MRHP shall communicate with the patient in a manner that supports the patient's ability to understand and shall address all communication barriers including, but not limited to:
 - (i) hearing;
 - (ii) sight;
 - (iii) language;
 - (iv) culture;
 - (v) literacy;
 - (vi) level of education;

- (vii) level of anxiety and stress; and
- (viii) environmental factors, including location of discussion.
- d) If the patient is having difficulty understanding the discussion or reading and completing the consent form (if applicable), the discussion and contents of the consent form shall be read and explained to the patient in the presence of a witness and with the assistance of an interpreter, as necessary. Documentation of this process is recommended. The MRHP may allow, at the patient's request, their **family** to accompany the patient and offer their assistance to help the patient to understand or demonstrate an understanding of the information provided.

4. Refusal of Treatment/Procedure(s) and Withdrawal of Informed Consent

- 4.1 Subject to situations in which a treatment/procedure(s) is ordered in accordance with applicable legislation, an adult patient with capacity to consent to a treatment/procedure(s) may at any time:
 - a) refuse to consent to all or a portion of a proposed treatment/procedure(s); or
 - b) withdraw previously given informed consent to any or all of the treatment/procedure(s) at any time prior to or during the treatment/procedure(s).
- 4.2 Subject to situations in which a treatment/procedure(s) is ordered in accordance with applicable legislation, an adult patient with capacity may refuse to consent to a treatment/procedure(s) or withdraw informed consent on any grounds prior to the start of the treatment/procedure(s), even when it is clear that the treatment/procedure(s) is necessary to preserve their life or health. In such an instance, the treatment/procedure(s) shall <u>not</u> be carried out, even if failure to provide such a treatment/procedure(s) may result in the patient's death.
 - a) The alternate decision-maker for an adult patient lacking capacity may refuse a treatment/procedure(s) or withdraw previously given informed consent in accordance with the AHS *Consent to Treatment/Procedure(s):* Adults with Impaired Capacity and Adults who Lack Capacity Procedure.
 - b) A **mature minor** or a minor's **legal representative** may refuse a treatment/procedure(s) or withdraw previously given informed consent in accordance with the AHS *Consent to Treatment/Procedure(s): Minors / Mature Minors* Procedure.
- 4.3 After a treatment/procedure(s) has been commenced, the MRHP shall stop providing the treatment/procedure(s) immediately upon the withdrawal of the informed consent and shall revisit the informed consent process with new or additional information that should be shared with the patient.

- a) If the termination of the treatment/procedure(s) will result in immediate and serious risk to the patient, the MRHP may be required to continue with the originally consented to treatment/procedure(s) to the extent required to limit the immediate and serious risk to the patient.
- 4.4 Where a patient refuses to consent to a treatment/procedure(s) or withdraws previously given informed consent, the MRHP shall explain the potential risks and consequences of the refusal or withdrawal of informed consent, without undue influence.
 - a) This explanation can be witnessed by a second **health care professional** to confirm patient identity and confirm the discussion occurred.
 - b) The MRHP shall document on the patient's health record:
 - (i) the refusal or withdrawal of informed consent;
 - the circumstances of the refusal, including the patient's reasons for withdrawing informed consent or refusing the treatment/procedure(s);
 - (iii) a summary of the discussion with the patient about the patient's clinical condition, the planned treatment/procedure(s) or interventions, the expected outcomes, material risks, and potential consequences of withdrawing informed consent or refusing the treatment/procedure(s);
 - (iv) the outcome of the discussion;
 - (v) the presence of witnesses, if any; and
 - (vi) where written (signed) informed consent was previously given, withdrawal of consent shall be documented in the 'withdrawal' section of the consent form.
- 4.5 The patient may provide informed consent again at any time following a subsequent informed consent discussion.
- 4.6 Adult patients who carry written and signed statements refusing the infusion of blood products shall have their wishes respected. This includes situations where the patient presents to an AHS setting for emergency health care.

5. Exceptions to Informed Consent

- 5.1 Emergency Health Care Exception:
 - a) For adult patients:

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- (i) If an adult patient requires emergency treatment/procedure(s) but the adult lacks the capacity to provide informed consent or refuses informed consent due to altered consciousness from trauma, drugs, alcohol, or any other cause, or where informed consent cannot be immediately obtained from the adult's alternate decision-maker, emergency health care may be provided by a MRHP:
 - only where it is immediately necessary to preserve the patient's life, prevent serious physical or mental harm to the patient, or to alleviate serious pain; and
 - where there is no knowledge that the patient would have objected to the treatment/procedure(s).
 - If a Physician is not available, a Nurse Practitioner or Registered Nurse may initiate emergency health care as per their scope of practice.
- (ii) The MRHP shall document that an emergency situation exists by completing the relevant section of the AHS *Emergency Health Care: Documentation of Exception to Consent* Form. In all possible situations, a second Physician or MRHP shall confirm the existence of the emergency situation, although it is recognized that in rural settings there may not always be a second Physician available.
 - If a second Physician is not available, a Nurse Practitioner or Registered Nurse may confirm the existence of the emergency situation and document the same on the AHS *Emergency Health Care: Documentation of Exception to Consent* Form.
 - Resident Physicians are not permitted to provide a written opinion to confirm the criteria for emergency health care.
- (iii) The details of the emergency situation and all treatment/procedure(s) decisions shall be documented in the patient's health record. All reasonable efforts shall be made to contact the patient's alternate decision-maker or next of kin, as appropriate, to advise that emergency treatment/procedure(s) was provided.
- (iv) The Emergency Health Care Exception is only valid during the emergency situation. All future treatment/procedure(s) provided outside of the emergency situation shall require informed consent.

- b) For minor patients:
 - (i) The applicability of the Emergency Health Care Exception for a minor patient shall be determined in accordance with the AHS *Consent to Treatment/Procedure(s): Minors / Mature Minors* Procedure.
- 5.2 Exceptional Circumstances:
 - a) The requirement for informed consent may be overridden by a warrant, subpoena, court order, or applicable legislation (e.g., a review panel's treatment order under the *Mental Health Act*, orders under the *Public Health Act*, orders under the *Mandatory Testing and Disclosure Act*, etc.).

6. Documentation

- 6.1 The MRHP is responsible for ensuring appropriate documentation of the informed consent process and outcomes in the patient's health record. Specifically, the following outcomes shall be documented:
 - a) agreement with informed consent to the treatment/procedure(s);
 - b) refusal of the treatment/procedure(s) (refer to Section 4 above); and
 - c) withdrawal of consent previously given (refer to Section 4 above).
- 6.2 All relevant legal documents including, but not limited to, court orders, warrants, subpoenas, **personal directives**, capacity assessments, and evidence of the formal status of alternate decision-makers, shall be documented on the patient's health record.
- 6.3 While the requirements for documentation outlined in Section 6.1 above are met by appropriately filling in the applicable consent form where written (signed) consent has been deemed necessary, documentation in the patient's health record regarding the consent discussion is recommended.
- 6.4 Completed consent forms required for treatment/procedure(s) may be faxed or scanned (refer to the AHS *Transmission of Information by Facsimile or Electronic Mail* Policy). When possible, and at the earliest opportunity, the original consent form shall be obtained and placed on the patient's health record.
- 6.5 When an interpreter is used to assist in obtaining consent, the interpreter shall complete the relevant documentation on the consent form.
 - a) The MRHP shall follow up to ensure the consent form has been completed as required.
- 6.6 A blind or disabled person's 'mark' is recognized as a valid signature on the consent form.

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6.7 Witness documentation of informed consent:

- a) A written (signed) consent form should be witnessed.
- b) Any person, other than a relative of the patient, the MRHP, or the interpreter for the patient, may witness the signing of a consent form.
 - Before acting as a witness or signing the consent form as a witness, confirmation of the patient's identity by the witness shall be required.
 - (ii) If the signee is not the patient, the witness shall request to see a form of the signee's identification and confirm that the person making a mark on behalf of the patient has been asked to do so by the patient.
- c) Witnessing a consent form indicates <u>only</u> that the witness observed the consent form being signed and is <u>not</u> evidence of the consent process.
- d) In the event that the patient expresses doubt about the consent process and/or requests further explanation, the witness shall not sign the consent form and the MRHP shall be notified.

DEFINITIONS

Adult means a person aged 18 years and older.

Agent means the person(s) named in a personal directive who can make decisions on personal matters according to the wishes expressed by the patient.

Alberta Health Services (AHS) setting means any environment where treatment/procedures and other health services are delivered by, on behalf of or in conjunction with, Alberta Health Services.

Alternate decision-maker means a person who is authorized to make decisions with or on behalf of the patient. These may include, specific decision-maker, a minor's legal representative, a guardian, a 'nearest relative' in accordance with the *Mental Health Act* (Alberta) or an agent in accordance with a personal directive or a person designated in accordance with the *Human Tissue and Organ Donation Act* (Alberta). This also includes what was previously known as the substitute decision-maker.

Capacity means the ability for the patient to 1) understand the nature, risks, and benefits of the procedure and the consequences of consenting or refusing; and 2) understand that this explanation applies to them.

Consent form means an Alberta Health Services approved form of documentation that can be used to provide evidence of the outcome of the consent process, that is, agreement to or refusal of a treatment/procedure.

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Express informed consent means direct, explicit agreement to undergo treatment/procedure(s), given either verbally or in writing (signed).

Family means one or more individuals identified by the patient as an important support, and who the patient wishes to be included in any encounters with the health care system, including, but not limited to, family members, legal guardians, friends, and informal caregivers.

Guardian means, where applicable:

For a minor:

a) A guardian as defined by the *Family Law Act* (Alberta), a divorced parent with custody of the minor, or a person appointed pursuant to a will, personal directive, court order, agreement or by authorization of legislation (e.g., *Child, Youth and Family Enhancement Act* [Alberta]).

For an adult:

a) An individual appointed by the Court in accordance with the *Adult Guardianship and Trusteeship Act* (Alberta) to make decisions on behalf of the adult patient when the adult patient lacks capacity.

Health care professional means an individual who is a member of a regulated health discipline, as defined by the *Health Disciplines Act* (Alberta) or the *Health Professions Act* (Alberta), and who practises within scope and role.

Health care provider means any person who provides goods or services to a patient, inclusive of health care professionals, staff, students, volunteers and other persons acting on behalf of or in conjunction with Alberta Health Services.

Health record means the collection of all records documenting individually identifying health information in relation to a single person.

Implied informed consent means consent inferred from the patient's or alternate decisionmaker's (if applicable) actions and surrounding circumstances.

Informed consent means the patient's agreement (or alternate decision-maker) to undergo a treatment/procedure after being provided, in a manner the patient can understand, with the relevant information about the nature of the treatment/procedure(s), its benefits, potential risks and alternatives, and the potential consequences of refusal.

Informed consent process means a discussion or series of discussions and interactions that may occur over a period of time between the most responsible health practitioner and patient or their alternate decision-maker (if applicable) including: i) the determination of capacity, as necessary, ii) the provision of relevant information, iii) the verification of understanding, iv) the decision-making and v) documentation of the consent process and outcome.

Legal representative means the following in relation to a minor, as applicable:

a) guardian; or

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b) nearest relative as defined in the *Mental Health Act* (Alberta), who has the authority to consent to treatment for a minor formal patient or minor who is subject to a Community Treatment Order.

Mature minor means a person aged less than 18 years, who has been assessed and determined as having the intelligence and maturity to appreciate the nature, risks, benefits, consequences, and alternatives of the proposed treatment/procedure(s), including the ethical, emotional, and physical aspects.

Minor means a person aged less than 18 years.

Most responsible health practitioner (MRHP) means the health practitioner who has responsibility and accountability for the specific treatment/procedure(s) provided to a patient and who is authorized by Alberta Health Services to perform the duties required to fulfill the delivery of such a treatment/procedure(s) within the scope of their practice.

Patient means all persons, inclusive of residents and clients, who receive or have requested health care or services from Alberta Health Services and its health care providers. Patient also means, where applicable:

- a) a co-decision-maker with the person; or
- b) an alternate decision-maker on behalf of the person.

Personal directive means a written document in accordance with the requirements of the *Personal Directives Act* (Alberta), in which an adult names an agent(s) or provides instruction regarding their personal decisions, including the provision, refusal, and/or withdrawal of consent to treatments/procedures. A personal directive (or part of) has effect with respect to a personal matter only when the maker lacks capacity with respect to that matter.

Physician means a person licensed in independent practice and in good standing with the College of Physicians and Surgeons of Alberta pursuant to the *Health Professions Act* (Alberta).

Specific Decision-Maker means a nearest relative who may be selected from a hierarchy of relatives to make a specific decision on behalf of the patient according to the *Adult Guardianship and Trusteeship Act.*

Treatment/procedure(s) means a specific assessment, treatment, investigative procedure(s), or series of treatments/procedures planned to manage a clinical condition; these can be presented as a treatment plan/intervention.

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REFERENCES

- Alberta Health Services Governance Documents:
 - Consent to Mental Health Treatment/Procedure(s): Formal Patients and Persons Subject to Community Treatment Orders Under the Mental Health Act Policy (#PRR-01-04)
 - Consent to Treatment/Procedure(s): Adults with Impaired Capacity and Adults who Lack Capacity Procedure (#PRR-01-02)
 - Consent to Treatment/Procedure(s): Deceased Donation of Human Organs and Tissues Policy (#PRR-01-05)
 - Consent to Treatment/Procedure(s): Minors / Mature Minors Procedure (#PRR-01-03)
 - *Medical Assistance in Dying* Policy (#HCS-165-01)
 - o Transmission of Information by Facsimile or Electronic Mail Policy (#1113)
- Alberta Health Services Forms:
 - Consent and Declaration for Treatment/Procedure (on Behalf of a Formal Patient or Person Subject to a Community Treatment Order who lacks capacity) Form (#09565)
 - Tissue and/or Organ Donation Consent (Human Tissue and Organ Donation Act of Alberta) Form (#09816)
 - Consent to Surgery or Invasive Procedure Form (#18628)
 - Consent to Treatment Plan/Intervention or Procedure Form (#09741)
 - Emergency Health Care: Documentation of Exception to Consent Form (#18629)
- Non-Alberta Health Services Documents:
 - Adult Guardianship and Trusteeship Act (Alberta)
 - o Child, Youth and Family Enhancement Act (Alberta)
 - o College of Physicians and Surgeons of Alberta: Standards of Practice (Alberta)
 - Family Law Act (Alberta)
 - o Health Information Act (Alberta)
 - o Health Professions Act (Alberta)
 - Human Tissue and Organ Donation Act (Alberta)
 - Mandatory Testing and Disclosure Act (Alberta)
 - o Mental Health Act (Alberta)
 - Personal Directives Act (Alberta)
 - Protection for Persons in Care Act (Alberta)
 - Protection of Children Abusing Drugs Act (Alberta)
 - Public Health Act (Alberta)

VERSION HISTORY

Date	Action Taken
August 01, 2011	Revised
February 27, 2012	Non-substantive change
January 16, 2020	Revised