



CANCOVID
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Rapid Review

School transmission and environments in Canada

EXECUTIVE SUMMARY

COVID-19 school transmission and environment with evidence from Canada and other countries

Question: After three months of school opening, what data do we have in Canada on rates of infection among students and staff, on evidence for school transmission, and what do we know about the environment in schools that experienced outbreaks?

Summary of Included Resources

Our rapid search uncovered six rapid reviews, of which two are 'living' (regularly updated) reviews, three Canadian federal and provincial guidance documents, and one modeling study from Quebec. Also included are international guidance documents, reviews, epidemiological reports, and a cohort study. The quality of the evidence as presented by these reviews is relatively low. The comprehensiveness of this summary may be limited given the rapid timeline for our search and summary of documents retrieved.

What do we know?

Transmission among students and staff

While science gaps remain, current data suggests that the risk of transmission among children and from children to adults in schools and daycare settings is likely to be relatively low and the rate of transmission is variable if standard infection control measures are followed. Emerging evidence suggests a lower overall rate of students infected with COVID-19 at school compared to school staff. Children over the age of 10 may be as likely as adults to transmit the virus but those under the age of 10 may be less likely. Some reports suggest that the source/setting of infection in children is more likely to be at home through household contacts and due to exposure during travel.

Environment in schools

School transmission rates seem to be influenced by the level of community transmission. Common environmental structural measures to controlling transmission include dividing up school playgroups and improving air circulation. Testing may be effective in controlling infections in schools in Ontario if done frequently, if results are reported quickly, and if followed by prompt self-isolation at home.

What are the notable gaps?

There is currently no high-level evidence (systematic reviews, rapid reviews, meta-analyses) that focuses specifically on Canadian schools and environments only. Rather, most of the studies reported here draw upon data from Canada and other countries, rendering it difficult to draw insight related to transmissions and environments specific to Canadian school settings. There is also limited high quality evidence comparing and quantifying COVID-19 transmission in schools verses in the community. As such new research may focus on:

- investigating how various public health measures affect school transmission rates; and
- cohort studies that compare COVID-19 transmission and test-positivity rate in students and staff in different school contexts and locations.

What is on the horizon? What are the studies that are underway to address these gaps?

Canadian studies in progress

- Two CIHR-funded cohort studies by Dr. Byron Berenger (University of Calgary) and Dr. Catherine Birke (Unity Health Toronto) to understand COVID-19 transmission among children; and

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- One living systematic review by Dr. Sarah Neil-Sztramko (McMaster University) on the likelihood of COVID-19 transmission among children and adults in schools/daycares, and infection control policies implemented in schools following the re-opening.

Studies in progress in other countries

There are six reviews being conducted by non-Canadian researchers from the United States of America, England, Italy, Germany, and Pakistan exploring aspects of the environment in schools, effects of school closures on infection rates, and school transmission rates.

Concluding statement: School transmission may be low if standard infection control measures are in place and may be influenced by local community transmission. More research is underway in Canada to shed light on COVID-19 transmission among children and adults in school settings.

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After three months of school opening, what data do we have in Canada on rates of infection among students and staff, on evidence for school transmission, and what do we know about the environment in schools that experienced outbreaks?

Summary:

The following is a brief summary of the available evidence and guidance relevant to COVID-19 transmission in schools in Canada. This is an update to the December 2020 version, which adds two rapid reviews, one living systematic review, one scoping review, and provincial surveillance resources. For additional information about each of the sources, see the Tables below. The comprehensiveness of this summary may be limited given the rapid timeline for our search and documents retrieved, and it is possible that we may have missed potentially relevant evidence.

Transmission in Schools

A [Living Rapid Review from the National Collaborating Centre for Methods and Tools](#) (January, 2021) indicates that the risk of transmission from children-to-children and children-to-adults in primary schools and daycare settings is low provided that Infection Prevention and Control (IPAC) measures are in place (GRADE level of evidence: Moderate) [1]. In addition, a living systematic review on [evidence for transmission of COVID-19 by children in schools](#) (December, 2020) highlights the lack of high-quality evidence to measure the extent of school transmissions, especially in comparison to community transmissions [2]. However, this review reports poor-quality evidence suggesting an overall low infection attack and positivity rates in schools, with lower rates in students compared to staff. Finally, the [COVID-19 Scientific Advisory Group Rapid Evidence Report](#) (August, 2020) concluded that transmission rates in schools and daycares are variable, and school outbreaks are described most commonly in areas with higher community transmission [3].

According to the [Saskatchewan Government](#) (September, 2020), in confirmed COVID cases, there was minimal spread in school settings beyond the index case, although outbreaks have been reported [4]. The report [COVID-19's unfortunate events in schools: mitigating classroom clusters in the context of variable transmission](#) (October, 2020) suggests that children under the age of 10 may be less likely to transmit the disease compared to adults, and children over the age of 10 may be as likely as adults [4,5].

Environment in Schools

A [Cochrane scoping review](#) (November, 2020) highlights that measures implemented in schools to prevent transmissions vary and that further investigation on how these measures affect transmission rates is needed [6]. Common environmental and structural measures to reduce transmission include: (1) forming school cohorts, i.e., bubbles or pods to which specific students are assigned; and (2) improving air circulation [6].

A [sample simulation in Ontario](#) (January 2021) suggests that in-school testing can be an effective method in controlling infections in schools, provided that they are taken frequently, with expedited test results, and infected students self-isolate at home [7].

A modeling study, [COVID-19's unfortunate events in schools: mitigating classroom clusters in the context of variable transmission](#) (October, 2020), suggests that small differences in individual viral load over their course of their infection and the school environment/activity influences transmission rate. As such, even these small differences may contribute to transmission variability in classroom clusters ranging from 1-20 individuals of a class of 25 [5]. The results of this modeling study were relatively consistent with evidence from schools. Additionally, unless the transmission rate is low, none of the mitigation protocols (which are initiated once an individual tests positive) can prevent a large transmission of classroom clusters according to the model [5].

A rapid review from the [Saskatchewan Health Authority & University of Saskatchewan](#) (August, 2020) indicated that the European Centres for Disease Control recommends that all symptomatic people and asymptomatic high-risk close contacts should be referred for testing in addition to fast and effective

contact tracing as it is important to help prevent outbreaks in school settings [8]. In addition, the Centres for Disease Control and Prevention does not recommend universal symptom screening to be conducted prior to going to school [8].

The [Government of Canada's Evaluating COVID-19 disease transmission and public health measures in schools: Outbreak investigation guidance](#) (November, 2020), reported that meticulous documentation of details obtained during interviews of close contacts to an index case are also very important in outbreak investigations [9]. An outbreak investigation in Canada should generally follow a cycle of: 1) preparedness; 2) investigation/response; and 3) sharing results from the investigation and lessons learned [9]. The modeling study, [COVID-19's unfortunate events in schools: mitigating classroom clusters in the context of variable transmission](#) showed that only rapid universal monitoring prevented case clusters in schools [5]. Furthermore, describing epidemiological data visually with Gantt charts or transmission chain diagrams may be helpful in identifying who becomes, and who is most at risk of becoming, a case [9].

Epidemiology of School Transmission across Canada

In this update, we included new online resources (websites, interactive maps, and reports) on surveillance of school-based cases, exposures and outbreaks lists in Alberta, British Columbia, Manitoba, and Saskatchewan. The latest epidemiological data from Ontario's [COVID-19 cases in schools and child care centres](#) and Quebec's [Daily Numbers for the Province – Public and Private School Systems Highlights](#) have also been included in this updated summary.

British Columbia

Different health regions have officially launched their COVID19 cases and outbreaks lists online. Examples are: [Fraser Health School Exposures](#) [10], [Northern Health School Exposures](#) [11], and [Vancouver Coastal Health School Exposures](#) [12].

Alberta

The [Alberta COVID19 School Status Interactive Map](#) provides updated information on school cases and outbreaks in Alberta [13].

Manitoba

The [Winnipeg Regional Health Authority](#) provides a list of school exposure and restrictions [14].

Saskatchewan

As of January, 31st, 2021, [COVID-19 Cases in Saskatchewan Schools](#) provides an online resource tracking school cases and outbreaks [15].

New Brunswick

As of January 29th, 2021, [26 new cases / confirmed cases in school](#) news report from New Brunswick's health authorities identifies 26 new cases included confirmed cases in a school located in a Red Level Zone [16].

Ontario

As of February 2nd, [COVID-19 cases in schools and child care centres](#) (February, 2021) reports 7381 school-related cases with 5,161 student cases: and 4828(0.66%) schools in the province with reported cases [17]. In the [Environmental Scan of School Reopening During COVID-19](#), (August, 2020) Public Health Ontario describes: 1) school reopening strategies; 2) any reported outbreaks; 3) cases or transmission in schools post-reopening; and 4) public health measures applied in school across different jurisdictions [18].

Quebec

As of January 29th, 2021 the [Daily Numbers for the Province – Public and Private School Systems Highlights](#) reports that there have been a total of 4492 students infected with a daily change of 365

additional cases [19]. In addition, 17372 students had been infected between December 22nd, 2020 and the start of the school year [19].

Nova Scotia

As of January 21st, 2021 the CBC reported [Two new cases of COVID-19 reported in Nova Scotia](#) including one-school based case [20].

Evidence from countries outside of Canada

A [European epidemiological surveillance report](#) (December, 2020) suggests that while school transmissions have been reported in pre-primary, primary, and secondary schools, the incidence of COVID-19 in school settings appears to be impacted by levels of community transmission [21].

In England, the [COVID-19 Surveillance in School KIDs \(sKIDs\)](#) (September, 2020) report indicates that infection and transmission rates were low in preschool and primary schools under surveillance [22]. In addition, seropositivity rates in students and staff were similar and not associated with school attendance during the lockdown.

In the United States, a study investigating [factors associated with transmission in children and adolescents seen in outpatient facilities and emergency departments](#) (December, 2020) reported that attending school or childcare was not associated with positive SARS-CoV-2 test results [23]. However, close contact with persons with COVID-19, gatherings with persons outside the household, and lack of consistent mask use in school were associated with infection.

National guidance by the [Llywodraeth Cymru Welsh Government](#) (November, 2020), suggests that evidence from surveillance studies indicates that there are higher levels of infection and transmission, especially in the 11-17-year-old age group [24]. Additionally, new evidence suggests that school re-openings are associated with higher risk of COVID-19 infection, however, there is lack of evidence to identify the sources and settings that are significant contributors [24]. Similarly, the Children's Task and Finish Group's paper, [Children, schools, and COVID-19 transmission](#) (November, 2020) suggest that children ages 12-16 played a significantly higher role in bringing the infection into households [25]. Within two months, there were increases in the prevalence of infection between the ages 2-24 – higher prevalence rates were seen in ages 16-24, and school year 7-11 [25].

For a list of additional guidance documents, rapid reviews, and a list of upcoming research please see tables 3, 4, and 5 in the appendix.

Last Updated: 19th February 2021

Table 1: Summary of Evidence

Type of Evidence	Author	Resource	Last Updated	Summary
Reviews: Evidence of Transmission and Environment in Schools				
<p>[1] Living Rapid Review</p>	<p>National Collaborating Centre for Methods and Tools.</p>	<p>Living Rapid Review Update 12: What is the specific role of daycares and schools in COVID-19 transmission?</p>	<p>January 21, 2021</p>	<ul style="list-style-type: none"> • Methods: search strategy included published high-quality synthesis and single studies. • Methods: quality of the evidence was assessed using GRADE approach. • Based on the published reports to date from both prior to COVID-19 lockdown and following re-opening, the risk of transmission from children to children and children to adults in primary school and daycare settings appears low, particularly when infection prevention and control (IPAC) measures are in place. The certainty of the evidence is low, and findings may change as new data become available. • Within clusters and outbreaks, adult to adult transmission seems to be more common than child to adult or adult to child. Certainty of the evidence is very low, and findings are very likely to change as new data become available. • Implementation of infection control measures appear to be important to limiting spread as evidenced by several outbreaks where limited or no measures were in place. • Across jurisdictions, there is wide variability in policies in place limiting the ability to evaluate the impact of specific IPAC measures or make best practice recommendations for daycare or school settings due to variability in measures implemented.

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<p>[2] Living systematic review (pre-print commonly cited in other sources)</p>	<p>Xu et al.</p>	<p>What is the evidence for transmission of COVID-19 by children in schools? A living systematic review</p>	<p>Dec 2020</p>	<ul style="list-style-type: none"> • Methods: search strategy included cohort studies, viral genotyping studies and cross-sectional studies from peer-reviewed journals and pre-prints. • Methods: the evidence was synthesized using a meta-analysis format. • Methods: the Newcastle Ottawa Scale (NOS) was used to assess the quality of the individual studies. • There are limited high-quality evidence available to quantify the extent of SARS-CoV-2 transmission in schools or to compare it to community transmission. • Emerging evidence suggests lower overall attack rate and SARS-CoV-2 positivity rate in students compared to school staff. • Future prospective and adequately controlled cohort studies are necessary to confirm this finding.
<p>[6] Scoping Review</p>	<p>Krishnaratne et al.</p>	<p>Measures implemented in the school setting to contain the COVID-19 pandemic: a scoping review</p>	<p>November 2020</p>	<ul style="list-style-type: none"> • Methods: scoping Review, searches on Cochrane COVID-19 Study Register, MEDLINE, Embase, the CDC COVID-19 Research Articles Downloadable Database for preprints, and the WHO COVID-19 Global literature. • Authors identified three broad types of measures across Europe, the Americas, the WHO Eastern Mediterranean and West Pacific regions. • Organisational measures – masks, physical distancing. • Environmental or Structural measures – dividing up school playgroups and improving circulation. • Surveillance and response measures to detect infections – testing, tracing, symptom screening, and isolation of confirmed or suspected cases.

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				<ul style="list-style-type: none"> The review provides a good stepping-stone for future rapid reviews on measures implemented to curb school transmission.
[3] Rapid Review	Alberta Health Services	COVID-19 Scientific Advisory Group Rapid Evidence Report	Aug 7, 2020	<ul style="list-style-type: none"> In current epidemiologic reports children are more likely to be exposed to, and infected by, SARS-CoV-2 at home followed by travel. Transmission rates in schools and daycares are variable and overall, school outbreaks are described most in areas with higher community transmission. Similar childhood infection rates have been found in otherwise similar countries with and without school closure. Older students (teens) may exhibit a higher likelihood of transmission than younger students.
[8] Rapid Review	Saskatchewan Health Authority & University of Saskatchewan	COVID-19 Surveillance Strategies Schools	August 27, 2020	<ul style="list-style-type: none"> Methods: search strategy included reviewing indexed literature, grey literature, news sources, or other sources as agreed upon, and some reference lists for especially pertinent articles. The quality of the body of evidence evaluated using the GRADE hierarchy. A limitation is that large scale universal testing in schools to date has been done only in response to an outbreak not as routine surveillance. It is recommended that all symptomatic people and asymptomatic high-risk close contacts should be referred for testing and fast and effective contact tracing following testing is key. It is recommended that schools or districts work with public health officials to determine the necessity and details of implementing any testing strategies.

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				<ul style="list-style-type: none"> The quality of evidence was rated as Very Low (“D”).
Overview of Guidelines and Recommendations	Lo Moro et al	Reopening Schools during the COVID-19 Pandemic: Overview and Rapid Systematic Review of Guidelines and Recommendations on Preventive Measures and the Management of Cases	October, 2020	<ul style="list-style-type: none"> Methods: overview and Rapid Systematic Review. Methods: authors search traditional databases and government institutional sources. Authors conclude that most countries agree on prevention and management of suspected and confirmed cases. They found no consensus on criteria for return to school for children who have tested positive. They highlight the importance of finding an effective and evidence-informed criterion to reduce school transmissions.
Guidance				
[9] National Guidance	The Government of Canada	Evaluating COVID-19 disease transmission and public health measures in schools: Outbreak investigation guidance	November 16, 2020	<ul style="list-style-type: none"> An outbreak investigation in Canada should loosely follow a cycle of preparedness, investigation/response, and learning. Meticulous documentation of details obtained during interviews of close contacts to an index case are very important in outbreak investigation, even if contacts do not become cases. Data visualization techniques may be very helpful in identifying who becomes a case and who most at risk of becoming a case.
[4] Provincial Guidance	Saskatchewan Government	Saskatchewan’s school re-opening plan in comparison to other provincial plans and	September 3, 2020	<ul style="list-style-type: none"> Children over 10-years may be as likely as adults to transmit the virus. Children under 10-years old can still transmit the virus but may be less likely to do so than adults.

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		federal and U.S. recommendations		<ul style="list-style-type: none"> In documented cases, there was minimal spread in school settings beyond the index case, though outbreaks have still been reported.
[18] Provincial Guidance	Public Health Ontario	Environmental Scan of School Reopening During COVID-19	August 14, 2020	<ul style="list-style-type: none"> Methods: authors conducted a jurisdictional scan and included epidemiological data from the World Health Organization and reports from individual provinces and states. This report describes school reopening strategies, COVID-19 context at reopening, reported outbreaks, cases or transmission in schools post-reopening, and public health measures applied in schools across different jurisdictions. Within Canada, the report describes these details for British Columbia and Quebec, noting COVID-19 among schools in Quebec within the first few weeks of school reopening.
Single Studies				
[5] Single Study	Tupper & Colijn	COVID-19's unfortunate events in schools: mitigating classroom clusters in the context of variable transmission	October 22, 2020	<ul style="list-style-type: none"> Methods: modeling study using crowdsourced data from COVID-19 Écoles Québec. Authors modeled two contributing factors affecting transmission: the individual and the classroom/activity combination. School transmission can both be limited or can result in more widespread transmission. Children have the same respiratory viral loads and adults, indicating that transmission can still occur. The study modeled that only rapid universal monitoring (i.e., regular, onsite, and pooled testing) accomplished preventing clustered cases in schools.

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Organizational Scans				
[10] Organizational Scan	Masks4Canada	Canada COVID-19 School Case Tracker	n.d.	
[11] Organizational Scan	Toronto District School Board	COVID-19 Advisories	December 1, 2020	

Table 2: Evidence from Outside of Canada

Type of Evidence	Author	Resource	Date	Summary
Guidance from OECD countries				
[24] National Guidance	Lywodraeth Cymru Welsh Government	Evidence review on Children and Young People Under 18 in Preschool, School or College following the Firebreak	November 9, 2020	<ul style="list-style-type: none"> • In Wales, evidence indicates that open schools is associated with higher rates of infection, although the mechanism remains unclear. • Data shows growth in the COVID-19 infection rate in all age groups under 18 since the end of August, with rates highest in older teenagers and young adults. • There is a lack of evidence to identify the setting (household, community or educational) that is the most significant contributor to transmission. • It is recommended that all infection prevention and control principles are adhered to and more research should address transmission dynamics of all age groups.
[25] National Guidance	The Government of the United Kingdom	Children, schools and COVID-19 transmission	November 18, 2020	<ul style="list-style-type: none"> • Internationally, there is no consistent pattern between school openings and increases in case numbers. • Among children in the United Kingdom, cases increased first in children aged 16-24 and then followed by increases in younger age groups.

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National Guidance	United Kingdom Office for National Statistics	Drop-in rate over half term shows role of schools in transmission	November 11, 2020	<ul style="list-style-type: none"> In the United Kingdom, the number of cases amongst secondary-age children had largely decreased confirming the role of COVID-19 transmission in schools during the week of their half-term closure.
Single Studies: Evidence of Transmission, and Epidemiological reports				
[21] Epidemiological Report	European Center for Disease Prevention and Control	COVID-19 in children and the role of school settings in transmission - first update	Dec 23, 2020	<ul style="list-style-type: none"> The return to school of children around mid-August 2020 coincided with a general relaxation of other NPI measures in many countries and does not appear to have been a driving force in the upsurge in cases observed in many EU Member States from October 2020. Trends in case notification rates observed since August 2020 for children aged 16-18 years most closely resemble those of adults aged 19-39 years. Transmission of SARS-CoV-2 can occur within school settings and clusters have been reported in preschools, primary and secondary schools. Incidence of COVID-19 in school settings appear to be impacted by levels of community transmission –where epidemiological investigation has occurred, transmission in schools has accounted for a minority of all COVID-19 cases in each country. Educational staff and adults within the school setting are generally not seen to be at a higher risk of infection than other occupations, although educational roles that put one in contact with older children and/or many adults may be associated with a higher risk. Non-pharmaceutical interventions in school settings in the form of physical distancing that prevent crowding as well as hygiene and safety measures are essential to preventing transmission.

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				<ul style="list-style-type: none"> Measures must be adapted to the setting and age group and consider the need to prevent transmission as well as to provide children with an optimal learning and social environment.
[22] Prospective Active National Surveillance Report	Public Health England	Prospective active national surveillance of preschools and primary schools for SARS-CoV-2 infection and transmission in England, June 2020 (sKIDs COVID-19 surveillance in school KIDs)	Sept 1, 2020	<ul style="list-style-type: none"> The COVID-19 Surveillance in School KIDs (sKIDs) study included two arms: weekly nasal swabs for at least 4 weeks and blood sampling with nasal and throat swabs at the beginning (early June) and end of half-term (mid-July). SARS-CoV-2 infection and transmission rates were low in preschool and primary schools under surveillance. Seropositivity rates in students and staff were similar and not associated with school attendance during the lockdown. Similar studies are needed in secondary schools and higher educational settings.
[23] Single Study	Hobbs et al.	Factors Associated with Positive SARS-CoV-2 Test Results in Outpatient Health Facilities and Emergency Departments Among Children and Adolescents Aged <18 Years — Mississippi, September–November 2020	Dec 15, 2020	<ul style="list-style-type: none"> Methods: case control study in the United States of America comparing exposures reported by parents/guardians of children and adolescents <18 with SARS-CoV-2 infection confirmed by RT PCR with exposures reported among those with a negative RT PCR result. The authors conclude that among children and adolescents aged <18 years in Mississippi, close contact with persons with COVID-19 and gatherings with persons outside the household and lack of consistent mask use in school were associated with SARS-CoV-2 infection. The study also reports that attending school or childcare was not associated with receiving positive SARS-CoV-2 test results in the study population.

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▼ Organizational Scan

Masks4Canada tracks confirmed positive COVID-19 cases in Canadian public and private K-12 schools. They do not track cases in childcare facilities, unless attached to school buildings. Find the interactive website [here](#) [10].

The [Toronto District School](#) Board provides a very clear tracker to identify what schools have experienced COVID-19 outbreaks. This tracker provides how many confirmed cases there are among students and staff, how many are resolved and whether that outbreak remains open or closed [11].

▼ What's Trending on Media and Social Media?

On November 25, 2020, the Global News released an article on a new interactive map of confirmed school-related cases of COVID-19. This map can provide information about the proportion of affected students who are of low-socioeconomic status or experience health inequities. Find the article [here](#).

A [news article](#) was released on November 17, 2020, about the risk of COVID-19 transmission in schools suggests that community rates have gone up, but it may not be at fault with schools. Ranking the risk of schools wrong in higher prevalence areas has led to limiting efforts to control community spread, and ranking them wrong in low prevalence areas led them to not open while other essential places are opened.

APPENDIX

Table 3: Environmental scan of epidemiological evidence from Canadian Provinces and Territories

Province/Territory	Resource	Epidemiology data, spread, prevalence, incidence (including date), evidence on environment
[13] Alberta	Alberta COVID19 School Status Interactive Map	<ul style="list-style-type: none"> Online resource providing information on outbreaks, alerts and open schools in Alberta based on the number of reported cases.
Alberta	Alberta Health Services, CEO Update – December 24, 2020	<ul style="list-style-type: none"> Dec 17th, 2020: AHS has confirmed 3,447 individuals with COVID-19 were present at schools while infectious or acquired the disease in the school setting. Two of every five schools (962 out of 2,415) in the province have reported an individual has attended their school while infectious or had in-school transmission.
Alberta	Edmonton Public School staff conducting COVID-19 contact tracing amid backlog of cases	<ul style="list-style-type: none"> December 4th, 2020: since September, there have been 765 cases in public schools in Edmonton.
Alberta	Alberta schools advising thousands of students to isolate based on informal COVID notices	<ul style="list-style-type: none"> December 2nd, 2020: 17% of Alberta schools had COVID outbreaks with more than two associated cases. In school transmission likely occurred in 253 schools.
[10] British Columbia	Fraser Health School Exposures Northern Health School Exposures Vancouver Coastal Health School Exposures	<ul style="list-style-type: none"> As of January 2021: online resource providing information on outbreaks.
[11] British Columbia	Coronavirus: List of B.C. school exposures	<ul style="list-style-type: none"> Lists all BC school exposures with dates.
[12] British Columbia	BC schools report Covid-19 infections	<ul style="list-style-type: none"> October 2nd, 2020: a total of 70 schools and 1 board office has reported Covid-19 cases.

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Manitoba	Winnipeg Regional Health Authority	<ul style="list-style-type: none"> Lists all school exposures in Winnipeg.
Manitoba	Manitoba confident schools aren't a COVID-19 transmission hotspot	<ul style="list-style-type: none"> December 1st, 2020: 906 school related cases have been identified in 331 schools.
[16] New Brunswick	26 new cases / confirmed cases in school	<ul style="list-style-type: none"> January 29th, 2021: 2 new cases in a school located in a Red Level Zone.
New Brunswick	3 more New Brunswick schools confirmed cases of COVID-19	<ul style="list-style-type: none"> November 23rd, 2020: 5 new schools with Covid cases since the week before and 10 schools with Covid cases since the beginning of the school year.
Newfoundland & Labrador	1st student COVID-19 case in N.L. prompts Deer Lake school shutdown	<ul style="list-style-type: none"> November 23rd, 2020: the first case in a school is reported.
[20] Nova Scotia	Two new cases of COVID-19 reported Thursday in Nova Scotia	<ul style="list-style-type: none"> January 21st, 2021: there were two new COVID-19 cases, on of which was from a school.
Nova Scotia	Nova Scotia reports one new school-based case of COVID-19	<ul style="list-style-type: none"> December 6th, 2020: this is the 9th individual school-based case of COVID-19.
[17] Ontario	COVID-19 cases in schools and childcare centres	<ul style="list-style-type: none"> February 2, 2021: 7,381 school-related cases, with 5,161 student cases. February 2, 2021: 4828(0.66%) schools with reported cases. December 7th, 2020: 5,402 school-related cases, with 3,531 school related student cases.

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		<ul style="list-style-type: none"> December 7th, 2020: 803 (16.63%) schools currently have a reported case. December 7th, 2020: 10 (0.21%) schools are closed due to cases.
Prince Edward Island	P.E.I. announces 4 new COVID-19 cases; restrictions on schools, restaurants, shopping	<ul style="list-style-type: none"> December 6, 2020, 4 high schools have reported cases and are now closed.
[19] Quebec	Daily Numbers for the Province – Public and Private School Systems Highlights	<ul style="list-style-type: none"> January 29th, 2021: 1 530 schools that have reported one or more positive cases since January 5th. January 29th, 2021: 4 492 students infected with a daily change of 365 additional cases. December 22nd, 2020: 17372 students have been infected since the start of the school year. December 3rd, 2020: 15,322 students have been infected since the start of September. December 3rd, 2020: 2,641 students are currently infected, 3,003 are from the public school system and 638 are from the private school system. December 3rd, 2020: 992 classes have been closed since the beginning of September.
Quebec	School COVID-19 cases consistent with community transmission, but Quebec could be in trouble, data show	<ul style="list-style-type: none"> November 5th, 2020: schools accounted for 20% of the province's COVID-19 cases.
[15] Saskatchewan	COVID-19 Cases in Saskatchewan Schools	<ul style="list-style-type: none"> Online resource tracking school cases and outbreaks. From January 27 to February 10, 2021, COVID-19 positive staff or student cases were anywhere between a minimum of 1 to a maximum of 6 in Saskatchewan Schools.

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Table 4: Additional evidence summary for school transmission

Author; Study location; Methods	Key Findings
[7] Asgary et al, 2021; Ontario; agent-based model and policy implications	Sample simulation results for parameter values based on schools and disease related information, in the Province of Ontario, Canada. The findings show that testing can be an effective method in controlling the SARS-CoV-2 infection in schools if taken frequently, with expedited test results and self-isolation of infected students at home.
Naimark et al, 2020; Ontario; agent-based model	School opening was associated with about 5% of community cases; model assumed caps on class sizes, children remaining in a single class for the duration of the day, and high school students receiving hybrid instruction (online/in-person)
Larisa et al, 2020; Northern Italy; population-based study of cases in schools/daycares	Prospective study of investigations of cases arising in 41 classes in 36 educational institutions (8 daycares, 10 primary schools, 18 secondary schools) Sept 1-Oct 15 2020. Context: all close contacts isolated and tested after primary contact and again at 10-14 days (if initial test less than 6 days from contact). Masks mandatory in secondary schools. After a case is identified all class is isolated (if social distancing was not possible), or only close contacts isolated (if social distancing observed). Findings: 43 primary cases (38 pupils, 5 teachers) led to 39 secondary cases, clusters varying from 1 to 22 individuals. No secondary cases in teachers; more cases in secondary schools.
Lazebik et al, 2020; Israel; Markov/mathematical model	Longer school day was associated with reduced infection because school transmission was modelled as less frequent than in family or between adults in workplace. The assumptions made to make the model tractable (e.g. no modelling of travel to school/work) make findings less reliable than the more complex agent-based models
Saad et al, 2020; US; Coronavirus Matlab Simulation Model	Compares three models in schools: no mitigation; mitigation (masks and social distancing; active surveillance i.e. random daily testing of a proportion of students; plus, combinations. Best policy is of mitigation with 6-10% of children tested daily; without mitigation, 8-10% testing daily is optimal. Relatively simple model.
Miron et al, 2020; Florida; empirical data following school reopening Aug/Sept	Counties where schools physically reopened saw increases of cases of 1.2 times in elementary school age children and 1.3 times in high-school age children; no increase seen in children where schools opened remotely. However, counties with remote schooling have different characteristics than those without (different background rates, mask mandates, and socio-economic status)

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<p>Germann et al, 2020; whole US (by county); agent-based model EpiCast (adapted from a flu model)</p>	<p>Very sophisticated model from Los Alamos Labs, based on a flu model; has scenarios with fewer open workplaces and more open workplaces, and for each of those circumstances, nine different school scenarios ranging from 100% on-site to 100% remote. Surprisingly, does not distinguish elementary from high school. Model shows that with 20% of children staying home (expected behavior), leads to 5% drop in clinical attack rate (CAR); but 40% split cohorts (alternating cohorts of children attend school 2 days a week; don't mix with the other cohort) reduces CAR 75%, when fewer workplaces are open. Rates are much higher when more workplaces are open, and higher if schools reopen when community rates are higher. (Well worth reading whole paper)</p>
<p>Johnson et al, 2020; United States of America; epidemiological SEIR model</p>	<p>Basic epidemiological SEIR model, undifferentiated by age of children; predicts that many schools will be forced to close in US within 20-60 days of opening, due to large clusters and spread to community. Discuss (without modelling) implications of environmental factors.</p>
<p>Newell, 2020; single equation model</p>	<p>Single equation model focusing on external temperature effects. Does not take other parameters into account.</p>

Table 5: Upcoming CIHR funded research and PROSPERO vetted reviews related to school transmission and environments

First author (Institution/Country)	Title	Abstract/ Description	Relevance	Source; link
CIHR Funded Research				
<p>Byron Michael Berenger (University of Calgary)</p>	<p>Household Transmission Dynamics and Vial Load among Asymptomatic SARS-CoV-2 Infected Children</p>	<p>Children have milder disease than adults and many have no symptoms even when infected by SARS-CoV-2. At present, we do not know how likely asymptomatic-infected children are to transmit the infection. Gaining an understanding of this issue is crucial to determining the role children play in transmission and what the risks will be to other children and adults when children return to school. To answer these questions we will enroll children who are brought for care due to non-infectious reasons (e.g. fall, cut, injury, pain) to 20 emergency departments across Canada and the United States. These sites are participating in the CIHR-funded, 57-site, Pediatric Emergency Research Network (PERN)-COVID-19 study, and currently perform screening of select asymptomatic children for SARS-CoV-2. Participating sites will enroll 400 asymptomatic SARS-CoV-2 positive children</p>	<p>Transmission among children</p>	<p>Canadian Research Information System (no link)</p>

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		<p>and 1,200 uninfected children (3:1 ratio of uninfected to infected child). Study aims: 1) Household Transmission Dynamics: Data will be collected regarding exposures and symptoms at baseline and again at 14 days for enrolled children (infected and uninfected) and their household members. Household members who develop symptoms of COVID-19 will be encouraged to have SARS-CoV-2 testing done (if not already) and the results will be obtained. Analyzing and modeling this information, comparing households with transmission versus those without, will help us understand the transmission risk posed by asymptomatic SARS-CoV-2 infected children. In particular this information will inform social distancing policies (e.g. school re-opening) 2) Viral Load Quantification: All SARS-CoV-2 positive specimens will have viral load quantification performed. These results will be analyzed alongside those from aim #1 to determine the relationship with household transmission. Viral load quantification data will also be analyzed alongside symptom evolution data to inform our understanding of the presymptomatic state.</p>		
<p>Catherine Sari Birke (Unity Health Toronto)</p>	<p>TARGet Kids! COVID-19 Study of Children and Families: Safe Return to School, Work, and Play</p>	<p>Across Canada and around the world, governments have implemented policies to limit the spread of COVID-19 including physical isolation, school and childcare closures. Many governments are now reducing these measures and returning children and families back to school and work due to a number of economic, social, and political factors. The World Health Organization recommends that governments seeking to relax physical isolation measures do so through two complementary approaches: 1) breaking chains of transmission through testing, isolating, and treating and 2) monitoring disease circulation through surveillance and serological surveys. We propose to pivot Canada's largest ongoing children's study, TARGet Kids, to provide high-quality, real-time data to monitor, quantify and characterize COVID-19 infection among children and parents. We aim to measure the incidence of new infections as well as previous COVID-19 exposure so that we can understand how COVID-19 is transmitted between children and their parents, risk factors for infection, disease severity, and health system use.</p>	<p>Transmission among children and parents</p>	<p>Canadian Research Information System (no link)</p>

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		We will also answer important questions about COVID-19 serological status of children and parents and the impact of physical isolation on child emotional and behavioral health as well as parent mental health and stress. We will provide evidence to support policy interventions to break underrecognized chains of transmission and reduce illness severity which will help policy makers guide children and their parents in safely returning to school, work and play. Key strengths of this proposal include a scientifically rigorous plan with a well-tested rapid implementation strategy that leverages Canada's largest children's cohort study to provide real-time high-quality data on COVID-19 community transmission.		
Reviews				
Sarah Neil-Sztramko (McMaster University)	Living Rapid ReviewS: What is the specific role of daycare and schools in COVID-19 transmission?	<ol style="list-style-type: none"> 1. What is known about the likelihood of transmission of COVID-19 among children and adults in daycare and schools, and among children to their household members? 2. What is known about the likelihood of transmission of COVID-19 by toddlers and school aged children to others in other settings? 3. What infection prevention and control policies have been put in place in daycares and schools that have published data on COVID-19 cases amongst students and teachers following re-opening? 	Evidence on school transmission	PROSPERO
Jonathan Silverberg (United States of America)	How effective are school-based interventions to reduce the transmission of respiratory	How effective are school-based interventions in reducing the transmission of respiratory infections, including COVID-19, in a school setting?	Explores aspects of the environment in schools as measures to prevent transmission	PROSPERO

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	infections, including COVID-19, in a school setting?			
Annabelle Bockey, (Germany)	The direct and indirect effects of COVID-19 and COVID-19 control measures on children: a systematic review	What are the direct and indirect effects of COVID-19 on children? Particularly, what are the effects of non-pharmaceutical interventions (NPIs) on children in relation to both incidence of COVID-19 and indirect consequences on the health and wellbeing of children; and, what is the effect of measures introduced to reduce the indirect burden of disease of COVID-19 in children?	Explores the effects of school closures on COVID19 infection rates	PROSPERO
Katy Gaythorpe (England)	Systematic review of susceptibility, transmissibility and severity of SARS-CoV-2 in children and adolescents	A systematic review to assess the evidence on the role of children in COVID-19 transmission will be conducted focusing on three key questions: 1) Are children susceptible to infection? 2) Are children capable of transmitting infection? 3) What is the disease severity in children?	Explores the effects of school closures on COVID19 infection rates as a measure of children’s role in transmission	PROSPERO
Shelina Bhamani (Pakistan)	A rapid systematic review on COVID transmission trends in children on	What are the COVID transmission trends of children post schools reopening?	Evidence on school transmission	PROSPERO

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	schools reopening in lower middle income countries			
Silvia Minozzi (Italy)	COVID-19 among children and adolescents and impact of school closure on outbreaks control: an overview of systematic reviews	<p>Objective: to provide an overview of the available knowledge of the characteristics of COVID-19 amongst children and adolescents, the role of children in the spread of the disease and the impact of school closure on outbreaks control.</p> <p>In details, five questions will be addressed:</p> <ol style="list-style-type: none"> 1. Which is the prevalence of the infection and of the disease among children and adolescents. 2. What are the clinical characteristics of the disease among children and adolescents. 3. Which is the risk of children and adolescents to be infected. 4. Which is the risk of disease transmission by children and adolescents. 5. What is known about the impact of school closure on COVID-19 outbreaks control. 	<p>Explores the effects of school closures on COVID19 infection rates;</p> <p>Explores aspects of the environment in schools as measures to prevent transmission.</p>	PROSPERO