



Rapid Review: What is the specific role of daycares and schools in COVID-19 transmission?

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Executive Summary

Background

As jurisdictions continue to lift restrictions implemented to slow the spread of coronavirus disease 2019 (COVID-19), they face major decisions about when and how to re-open and operate schools and daycares. While children are known to be effective vectors for other viruses, such as influenza, their role in the transmission of COVID-19 is much less clear.

This rapid review was produced to support public health decision makers' response to the COVID-19 pandemic. This review seeks to identify, appraise and summarize emerging research evidence to support evidence-informed decision making.

This rapid review is based on the most recent research evidence available at the time of release. A previous version was completed on July 24, 2020. This updated version includes evidence available up to August 7, 2020.

In this rapid evidence review, we answer the question: **What is the specific role of daycares and schools in COVID-19 transmission?**

What Has Changed in This Version?

- Since the publication of our last review, there are now reports of outbreaks involving both staff and children or students in high school and overnight camp settings. In both settings rates of community transmission were high and minimal infection control procedures were reported.
- One prospective study of all confirmed COVID-19 cases with probably school exposure in New South Wales, Australia found minimal secondary transmission amongst children, with transmission higher amongst staff than students. The quality of this study is high, and findings are consistent with smaller studies.

Key Points

- Based on the published reports to date, young children are not a major source of transmission of COVID-19 in school and daycare settings. The quality of evidence is moderate, and findings are consistent.
- Analyses of infection clusters revealed that for children who were infected, transmission was traced back to community and home settings or adults, rather than amongst children within daycares or schools. Within household clusters, adults were much more likely to be the index case than children. The quality of evidence is moderate, and findings are consistent.
- 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; It is not yet possible to evaluate the impact of specific infection prevention and control measures or make best practice recommendations for daycare or school settings due to variability in measures implemented.

Overview of Evidence and Knowledge Gaps

- Most studies evaluating the transmission of COVID-19 in daycare and school settings are limited to case reports of contact tracing and prevalence studies.
- Contact tracing studies have identified very limited transmission by children to children, and children to adults in school settings. Limited evidence suggests the likelihood of infected adults transmitting to students is possible, but less likely than adult to adult transmission.
- The prevalence of COVID-19 infection in children in daycare and school settings was lower than the prevalence of COVID-19 in adults working in daycare and school settings. The quality of evidence is low, and findings are consistent.
- Many studies were conducted prior to implementation of infection prevention measures; however, findings are consistent with those reported from schools that have reopened following lockdown.
- As schools and daycares continue to open around the world and more evidence becomes available, this question should be reviewed again as findings may change. At least two comprehensive studies are underway in the UK and Germany as schools reopen.
- Across studies there appears to be a linear relationship between age and likelihood of contracting and transmitting COVID-19. More research is needed to understand why this may occur, and what the absolute and relative risk differences are across age ranges. The study quality is low, and findings are consistent.

Methods

Research Questions

What is the specific role of daycares and schools in COVID-19 transmission?

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?

Search

On May 7, June 26 and 30, July 20, and again on August 6 and 7, 2020 the following databases were searched for evidence pertaining to the role of children in the transmission of COVID-19:

- Pubmed's curated COVID-19 literature hub: [LitCovid](#)
- [Trip Medical Database](#)
- World Health Organization's [Global literature on coronavirus disease](#)
- Joanna Briggs Institute [COVID-19 Special Collection](#)
- [COVID-19 Evidence Alerts](#) from McMaster PLUS™
- [Public Health +](#)
- [COVID-19 Living Overview of the Evidence \(L·OVE\)](#)
- Cochrane [Coronavirus \(COVID-19\) Special Collections](#)
- Oxford [COVID-19 Evidence Service](#)
- [Guidelines International Network \(GIN\)](#)
- Cochrane Rapid Reviews [Question Bank](#)
- [Prospero Registry of Systematic Reviews](#)
- NCCMT [COVID-19 Rapid Evidence Reviews](#)
- [MedRxiv preprint server](#)
- NCCDH [Equity-informed Responses to COVID-19](#)
- NCCEH [Environmental Health Resources for the COVID-19 Pandemic](#)
- NCCHPP [Public Health Ethics and COVID-19](#)
- NCCID [Public Health Quick Links](#)
- NCCID [Disease Debrief](#)
- NCCIH [Updates on COVID-19](#)
- [Public Health Ontario](#)
- [Institute national d'excellence en santé et en services sociaux \(INESSS\)](#)
- [Uncover \(USHER Network for COVID-19 Evidence Reviews\)](#)

A copy of the search strategy is available on request.

Study Selection Criteria

The search first included recent, high-quality syntheses. If no syntheses were found, single studies were included. English-language, peer-reviewed sources and sources published ahead of print before peer review were included. Grey literature and surveillance sources were excluded.

	Inclusion Criteria	Exclusion Criteria
Population	Children and adolescents aged 1–18	Infants
Intervention	Exposure to or diagnosis of COVID-19	
Comparisons	-	
Outcomes	Transmission of COVID-19	
Setting	Schools, daycares, playgrounds, parks, homes	

Data Extraction and Synthesis

Data on study design, setting, location, population characteristics, interventions or exposure and outcomes were extracted when reported. We synthesized the results narratively due to the variation in methodology and outcomes for the included studies.

The identified syntheses relevant to this report had considerable overlap in the primary literature but varied in the data reported across reviews for the same primary studies. We chose to conduct a new synthesis rather than reporting the overlapping results of the identified syntheses in order to present the data most succinctly and clearly. The primary studies were used to extract study characteristics and key findings, and to appraise study quality.

We evaluated the quality of included evidence using critical appraisal tools as indicated by the study design below. Quality assessment was completed by one reviewer and verified by a second reviewer. Conflicts were resolved through discussion.

Study Design	Critical Appraisal Tool
Synthesis	Assessing the Methodological Quality of Systematic Reviews (AMSTAR) AMSTAR 1 Tool
Cohort	Critical Appraisal Skills Programme (CASP) Cohort Study Checklist
Case Series	Joanna Briggs Institute (JBI) Checklist for Case Series
Case Report	Joanna Briggs Institute (JBI) Checklist for Case Reports
Prevalence	Joanna Briggs Institute (JBI) Checklist for Prevalence Studies
Cross sectional	Joanna Briggs Institute (JBI) Checklist for Analytical Cross Sectional Studies

Completed quality assessments for each included study are available on request.

Findings

Quality of Evidence

In this update, five new single studies, one update to a previously included single study, two new single study protocols and two new syntheses were included for a total of 42 publications addressing two distinct questions. The quality of the evidence included in this review is summarized below. Please note that some publications answered both questions and therefore are included in more than one of the following data tables.

		Total	Quality of Evidence
Single Studies	Completed	22	7 Low 7 Moderate 7 High 1 Not rated
	In progress	2	---
Syntheses	Completed	13	11 Low 2 Moderate
	In Progress	5	---

Warning

Given the need to make emerging COVID-19 evidence quickly available, many emerging studies have not been peer reviewed. As such, we advise caution when using and interpreting the evidence included in this rapid review. We have provided a summary of the quality of the evidence as low, moderate or high to support the process of decision making. Where possible, make decisions using the highest quality evidence available.

Question 1: What is known about the likelihood of transmission of COVID-19 among children and adults in daycare and primary schools and children to their household members?

Table 1: Single Studies

Reference	Date Released	Study Design	Location	Setting	Summary of Findings	Quality Rating:
Contact-Tracing Studies						
New evidence reported August 11, 2020						
Macartney, K., Quinn, H. E., Pillsbury, A. J., Koirala, A., Deng, L., Winkler, N., ... Chant, K. (2020). Transmission of SARS-CoV-2 in Australian educational settings: a prospective cohort study . <i>The Lancet Child & Adolescent Health</i> . Epub ahead of print.	Aug 3, 2020	Cohort	New South Wales, Australia	Daycare, primary and secondary school Physical distancing and hand hygiene measures in place; masks not required.	From Jan 25 to April 10, all lab-confirmed COVID-19 cases in children or staff who attended school or daycare within 24h of symptom onset. 15 adults, 12 children (8 secondary school, 1 primary school, 3 daycare) attended while infectious. Of 1448 close contacts identified, 43.7% had RT-PCR testing. Secondary transmission occurred in 4 of 25 settings. In schools, 5 secondary cases (3 children, 2 adults) were identified in 3 schools. No secondary transmission occurred in 9 of 10 daycares, however one outbreak was identified where 6 adults and 7 children were infected. Secondary attack rate of staff to staff was 4.4%, staff to child 1.5%, child to staff 1.0% and child to child 0.3%.	High

<p>Dub, T., Erra, E., Hagberg, L., Sarvikivi, E., Virta, C., Jarvinen, A., ... Nohynek, H. (2020). Transmission of SARS-CoV-2 following exposure in school settings: experience from two Helsinki area exposure incidents. <i>Preprint</i>.</p>	<p>July 30</p>	<p>Case report</p>	<p>Finland</p>	<p>Primary school, other school not noted.</p> <p>Infection control procedures not reported.</p>	<p>Case A was a 12-year old student who tested positive for COVID-19 in early March, who had attended school and team sports with minor symptoms since late Feb.</p> <p>89 of 121 close school and sport contacts were tested; no secondary cases were identified.</p> <p>Case B was a school staff member who attended work for two days while symptomatic.</p> <p>51 of 63 close contacts were tested for antibodies >28 days after exposure. 6 of 42 students and 1 of 9 teachers were positive for IgG antibodies. Two students had confirmed COVID-19 7- and 6-days post-exposure, one student had confirmed COVID-19 more than 26 days after exposure, thus source of contact was not confirmed.</p> <p>Secondary attack rate amongst household and extended contacts for students was 17%.</p> <p>Secondary attack rate for the single staff was 100% (spouse and two children were the only contacts).</p>	<p>High</p>
<p>Evidence previously reported July 24, 2020</p>						
<p>Yung, C.H., Kam, K., Nadua, K.D., Chong, C.Y., Tan, N.W.H., Li... Ng, K.C. (2020). Novel coronavirus 2019 transmission risk in educational settings. <i>Clinical Infectious Diseases</i>. Epub ahead of print.</p>	<p>Jun 25, 2020</p>	<p>Case report</p>	<p>Singapore</p>	<p>Preschool, secondary school</p> <p>Daily school disinfection. Children were cohorted with staggered recess and lunches.</p>	<p>1 child with COVID-19 attended a preschool for ages 3–6 (number of contacts not reported):</p> <ul style="list-style-type: none"> • 34 contacts developed symptoms and were tested; none tested positive. <p>1 adolescent with COVID-19 attended a secondary school for ages 12–15 (total number of contacts not reported):</p> <ul style="list-style-type: none"> • 8 contacts developed symptoms and were tested; none tested positive. 	<p>High</p>

Heavey, L., Casey, G., Kelly, C., Kelly, D., & McDarby, G. (2020). No evidence of secondary transmission of COVID-19 from children attending school in Ireland, 2020. <i>Eurosurveillance</i> 25(21):pii=2000903.	May 28, 2020	Case report	Ireland	Primary school, secondary school No infection control measures in place. Sports, music and choir practice continued.	3 children aged 10–15 with COVID-19 attended one primary and two secondary schools: <ul style="list-style-type: none"> • The children had contact with 822 students and 83 adults in schools. • Contacts who developed symptoms were tested; the number was not reported. • No contacts tested positive. 	Moderate
National Centre for Immunisation Research and Surveillance. (2020, April 26). COVID-19 in schools – the experience in NSW.	Apr 26, 2020	Case report	Australia	Primary school, secondary school No infection control measures were reported. The premier of New South Wales had encouraged parents to keep students home and schools may have been less populated.	1 child with COVID-19 attended a primary school and had contact with 43 students and 2 adults in school <ul style="list-style-type: none"> • Contacts who developed symptoms were tested (number not reported); none tested positive. 8 adolescents with COVID-19 attended secondary schools who had contact with a total of 509 students and 65 adults in school <ul style="list-style-type: none"> • Symptomatic contacts were tested (approximately 1/3); none tested positive. • 75 close contacts were tested for antibodies four weeks after exposure; 1 secondary student tested positive for antibodies. 	Moderate
Danis, K., Epaulard, O., Bénet, T., Gaymard, A., Campoy, S., Bothelo-Nevers, E.... Saura, C. (2020). Cluster of coronavirus disease 2019 (Covid-19) in the French Alps, 2020. <i>Clinical Infectious Diseases</i> . Epub ahead of print.	Apr 11, 2020	Case report	France	Primary schools No infection control measures at the schools were reported. Schools were closed upon identification of the case.	1 child aged 9 years with COVID-19 attended 3 primary schools: <ul style="list-style-type: none"> • The child had 86 contacts. • 55 contacts developed symptoms and were tested; none tested positive. 	High

Prevalence Studies

New evidence reported August 11, 2020

<p>Robert Koch Institute. (2020, Aug 4). Coronavirus Disease 2019 (COVID-19) Daily Situation Report of the Robert Koch Institute</p>	<p>Aug 4, 2020</p>	<p>Prevalence</p>	<p>Germany</p>	<p>Daycare, schools, after school care, other educational facilities, children's homes, camps</p> <p>Policies include ↓ class sizes, physical distancing, rapid testing; no masks</p>	<p>Of 210 056 cases in Germany to Aug 4, 2020 4,276 (2.03%) were in those cared for or attending childcare settings and 2946 (1.4%) were in staff employed in these settings.</p> <p>No information available on source of exposure or the total number of staff and students who attended during the time period.</p> <p>Prevalence much lower than other settings such as hospitals and care settings (8.6% of total cases), congregate living settings (13.8% of total cases) and the food sector (2.4%) of total cases).</p>	<p>High</p>
<p>Szablewski, C.M., Chang, K.T., Brown, M.M., Chu, V.T., Yousaf, A.R., Anyalechi, N., ... Stewart, R.J. (2020). SARS-CoV-2 transmission and infection among attendees of an overnight camp. <i>Morbidity and Mortality Weekly Report</i>. Epub ahead of print.</p>	<p>Jul 31, 2020</p>	<p>Prevalence</p>	<p>Georgia, USA</p>	<p>Overnight summer camp</p> <p>All attendees tested negative within 12 days of attending.</p> <p>Masks for staff but not campers, doors and windows were not opened for ventilation.</p>	<p>158 staff and counsellors took part in training June 17-20. 363 campers and 3 staff joined on June 21.</p> <p>On June 22 a staff member developed symptoms, on June 23 left the camp and on June 24 tested positive. The camp was closed that day.</p> <p>Test results were available for 344 of 597 attendees.</p> <p>Attack rate was highest amongst staff (56%) compared to youth (49%), and those in larger cabins (53%).</p> <p>The authors note they cannot rule out multiple index cases due to high incidence of COVID-19 in Georgia.</p>	<p>Low</p>

<p>Oster, E. & Alter, G. (2020, August 7). COVID-19 and Children: Our Crowd-sourced Data. COVID-Explained.</p>	<p>Ongoing</p>	<p>Surveillance (crowd-sourced)</p>	<p>United States</p>	<p>Daycares, camps</p> <p>Infection control measures and community transmission vary within and across state.</p>	<p>State-level data is reported as of Aug 6</p> <ul style="list-style-type: none"> • Arizona: 6 childcare facilities with positive cases • California: Of 8 395 childcare centers open, 820 cases have been reported (48% staff, 20% children, 29% parents, 3% other) • Colorado: 7 daycares or camps have reported outbreaks with a total of 46 cases (91% staff) • Kansas: 61 cases in 14 outbreaks, no hospitalizations or deaths • Nevada: 11 child, 13 staff cases in 13 facilities out of 443 total facilities • North Carolina: 1 school and 14 daycare clusters with a total of 111 cases (51.1% staff) • Ohio: 442 reported cases, 75% determined to be acquired through community spread • Oregon: 3 outbreaks with 39 reported cases • Pennsylvania: 54 child or parent and 89 staff cases reported in licensed childcare facilities • Rhode Island: 12 cases amongst 8000 children enrolled (0.15%), 14 cases amongst 1000 adults providing care (0.14%) • Texas: as of July 8, 555 children and 1 140 staff cases across an estimated 12 222 open centers • Tennessee: 47 facilities with positive cases • Utah: 6 outbreaks with 29 total cases in schools, 24 outbreaks with 108 cases in childcare settings • Virginia: 118 cases from 26 outbreaks 	<p>Not rated</p>
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Evidence previously reported July 24, 2020						
Stein-Zamir, C., Abramson, N., Shoob, H., Libal, E., Bitan, M., Cardash, T... Miskin, I. (2020). A large COVID-19 outbreak in a high school 10 days after schools' reopening, Israel, May 2020. <i>Eurosurveillance</i> 25(29): pii=2001352	Jul 23, 2020	Prevalence	Israel	<p>Regional public school with 1,190 students age 12-18 years and 162 staff.</p> <p>No physical distancing or masks. Children took school buses together and participated in extracurricular activities (e.g., sports and dance classes).</p>	<p>Within 10 days of schools reopening an outbreak among high school students was observed linked back to 2 independent index cases. The prevalence of confirmed cases was 13.1% among students and 16.4% among teachers.</p> <p>Cases were highest in grade 7 and grade 9. There was no report of the grade of index cases, or prevalence among close contacts.</p> <p>Prior to school reopening regional prevalence rate among those age 10-19 years was 19.8%. Following opening of schools, the prevalence increased to 40.9%.</p>	Low
National Institute for Public Health and the Environment (RIVM). (2020, July 20). Children and COVID-19.	Jul 20, 2020	Prevalence	Netherlands	<p>Community</p> <p>Primary schools, childcare facilities</p> <p>Infection control measures not reported.</p>	<p>Prior to school closures on March 16th, there were no reports of COVID-19 clusters linked to school or childcare facilities.</p> <p>Partial school re-opening began on May 11 and schools were fully reopened on June 8th.</p> <p>There are a few reports of school employees becoming infected with COVID-19 (0.5%); there are no reports of employees being infected by children.</p>	Low

<p>Torres, J.P., Piñera, C., De La Maza, V., Lagomarcino, A.J., Simian, D., Torres, B... O’Ryan, M. (2020). SARS-CoV-2 antibody prevalence in blood in a large school community subject to a Covid-19 outbreak: a cross-sectional study. <i>Clinical Infectious Diseases</i>. Epub ahead of print.</p>	<p>Jul 10, 2020</p>	<p>Prevalence</p>	<p>Chile</p>	<p>Private school with 14 grade levels experiencing an outbreak following a week of parent-teacher nights. Index case was a staff member.</p> <p>Outbreak occurred prior to school lockdown in May 2020. No infection control measures were reported.</p>	<p>There were 52 confirmed cases in students (15%), staff (35%) and parents (52%).</p> <p>Positive antibody tests were higher amongst teachers (20.6%) compared to support staff (7.1%) and students (9.9%) two months later.</p> <p>1,009 of 2,616 students (aged 4 – 18) participated:</p> <ul style="list-style-type: none"> • 100 students (9.9%; CI: 8.6 – 11.5) tested positive for antibodies • The highest positive rate was among preschool students (12.3%; CI: 7.8-18.6) and lowest was among high school students (5.7%; CI: 3.6-8.9) <p>Students were more likely to have contracted COVID-19 from home caregivers and household relatives than classmates or teachers.</p>	<p>Moderate</p>
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<p>Public Health Agency of Sweden. (2020, July 7). Covid-19 in schoolchildren A comparison between Finland and Sweden.</p>	<p>Jul 7, 2020</p>	<p>Prevalence</p>	<p>Sweden Finland</p>	<p>Preschool, primary school, secondary school</p> <p>In Finland, all schools were closed in March 2020.</p> <p>In Sweden only secondary and post-secondary schools were closed.</p> <p>No ↓ class sizes, physical distancing, temperature checks or masks; handwashing unclear</p>	<p>As of June 14, 2020: In Finland, 584 out of 7,110 (8.2%) reported cases of COVID-19 were among children ages 1-19 years. Age-specific rates were:</p> <ul style="list-style-type: none"> • 1-5 years: 36 per 100 000 • 6-15 years: 42 per 100 000 • 16-19 years: 98 per 100 000 <p>Primary school closures and reopening in Finland did not impact weekly number of reported COVID-19 cases.</p> <p>In Sweden, 1,124 out of 52,424 (2.1%) reported cases of COVID-19 were among children ages 1-19 years. Age-specific rates were:</p> <ul style="list-style-type: none"> • 1-5 years: 16 per 100 000 • 6-15 years: 30 per 100 000 • 16-19 years: 150 per 100 000 <p>No increased risk of infection was found amongst Swedish school or daycare staff.</p> <ul style="list-style-type: none"> • Daycare, Relative Risk (RR) = 0.9 (95% Confidence Interval (CI), 0.7-1.1) • Primary school, RR = 1.1 (95% CI: 0.9-1.3) • Secondary school, RR = 0.7 (95% CI: 0.5-1.0) 	<p>Low</p>
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<p>Stage, H.B., Shingleton, J., Ghosh, S., Scarabel, F., Pellis, L., & Finnie, T. (2020). Shut and re-open: the role of schools in the spread of COVID-19 in Europe. <i>Preprint</i>.</p>	<p>Jun 26, 2020</p>	<p>Cohort</p>	<p>Germany Denmark Norway Sweden</p>	<p>Community Preschool, primary school, secondary school Infection control measures vary by country; Germany: ↓ class sizes, physical distancing, rapid testing; no masks Denmark: ↓ class size, physical distancing, handwashing; no temperature checks or masks Norway: ↓ class sizes, physical distancing, handwashing; no temperature checks or masks Sweden: No reduced class sizes, physical distancing, temperature checks or masks; handwashing unclear</p>	<p>Timing of school closures coincided with a reduction in the growth rate of COVID-19 cases and hospitalizations compared to data models with no intervention. However, implementation of concurrent community interventions (e.g., travel restrictions, social distancing, banned gatherings) mean is it difficult to determine which interventions were most effective. Reopening of schools among younger student groups and those participating in exams did not result in a significant increase in rates of COVID-19. In countries with low community transmission of COVID-19, return of all students did not appear to increase transmission. The return of older students in a country of high community transmission levels appeared to increase transmission among students but not staff.</p>	<p>High</p>
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Fontanet, A., Grant, R., Tondeur, L., Madec, Y., Grzelak, L., Cailleau, I... Hoen, B. (2020a). SARS-CoV-2 infection in primary schools in northern France: A retrospective cohort study in an area of high transmission. <i>Preprint.</i>	Jun 29, 2020	Retrospective cohort	France	Primary school Exposure occurred before school shutdown; no infection control measures were reported. Schools had been shut down for 4 weeks prior to antibody testing.	510 of 1047 students (aged 6–11 years) at a primary school consented to testing for antibodies to the virus that causes COVID-19: <ul style="list-style-type: none"> • 45 of 510 (8.8%) tested positive for antibodies. • 11.9% parents tested positive for antibodies. No information was reported on index cases.	Moderate
Folkhälsomyndigheten. (2020, May 27). Förekomst av covid-19 i olika yrkesgrupper.	Jun 25, 2020	Prevalence	Sweden	Preschool, primary school, secondary school No ↓ class sizes, physical distancing, temperature checks or masks; handwashing unclear	National public health data and census data were used to determine the relative risk of COVID-19 infection for various occupations. For occupations working with children, such as primary and secondary school teachers, preschool teachers and nannies, the relative risk of COVID-19 infection was no different than other occupations. Notably, Sweden has not implemented nationwide lockdown measures.	Moderate
Desmet, S., Skinci, E., Wouters, I., Decru, B., Beuselinck, K., Malhotra-Kumar, S., & Theeten, H. (2020). No SARS-CoV-2 carriage observed in children attending daycare centers during the first weeks of the epidemic in Belgium. <i>Preprint.</i>	May 18, 2020	Prevalence	Belgium	Daycare centers Samples were collected prior to the nationwide lockdown. No infection prevention and control were reported.	84 children aged 0–2.5 years attending 8 different daycare centers were randomly sampled and tested for COVID-19. No children tested positive.	High

<p>Fontanet, A., Tondeur, L., Madec, Y., Grant, R., Besombes, C., Jolly, N... Hoen, B. (2020b). Cluster of COVID-19 in northern France: A retrospective closed cohort study. <i>Preprint</i>.</p>	<p>Apr 23, 2020</p>	<p>Prevalence</p>	<p>France</p>	<p>Secondary school</p> <p>Prior to school closures, no infection control measures reported.</p> <p>Schools had been shut down for 4 weeks prior to antibody testing.</p>	<p>326 of 1262 students (aged 14–17), teachers and staff at a secondary school consented to testing for antibodies to the virus that causes COVID-19:</p> <ul style="list-style-type: none"> • 92 of 240 (38.3%) of students tested positive for antibodies • 11.4% of parents tested positive for antibodies • 10.2% of siblings tested positive for antibodies 	<p>Moderate</p>
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Table 2: In-progress Single Studies

Title	Anticipated Release Date	Setting	Description of Document
New evidence reported August 11, 2020			
Ladhani, S., Ramsay, M., Zambon, M., Flood, J., Beckmann, J., Baawuah, F... Garstang, J. (2020). COVID-19 Surveillance in Children attending preschool, primary and secondary schools.	N/A	Preschool, primary and secondary school	
Charité. (2020). Berlin’s testing strategy – Charité starts screening program for staff from childcare centers and school-based study.	N/A	School	

Table 3: Syntheses

Reference	Date Released	Included Studies Relevant to Transmission by Children in Daycares and Schools	Review Conclusions	Quality Rating
Evidence previously reported July 24, 2020				
Li, X., Xu, W., Dozier, M., He, Y., Kirolos, A., & Theodoratou, E. (2020). The role of children in transmission of SARS-CoV-2: A rapid review . <i>Journal of Global Health, 10</i> (1), 011101.	Jul 3, 2020 (search completed Apr 30, 2020)	Danis, 2020 Fontanet, 2020a NCIRS, 2020 RIVM, 2020	Children are infected less frequently and infect others less frequently than adults. Prolonged fecal shedding may increase the risk of fecal-oral transmission in children.	Low
Usher Institute. (2020, July 2). Summary: What is the evidence for transmission of SARS-COV-2 by children [or in schools]?	Jul 2, 2020 (search completed Jun 21, 2020)	Fontanet, 2020a Heavey, 2020 National Institute for Public Health and the Environment, 2020 NCIRS, 2020 Desmet, 2020	Children, especially young children, are less likely to be infected and to infect others than adults. Children appear to have lower viral loads than adults. Fecal shedding of the virus that causes COVID-19 has been shown and fecal-oral transmission is possible.	Low
Rajmil, L. (2020). Role of children in the transmission of the COVID-19 pandemic: a rapid scoping review . <i>BMJ Paediatrics Open, 4</i> (1), e000722.	Jun 30, 2020 (search completed May 28, 2020)	Heavey, 2020 NCIRS, 2020 RIVM, 2020	Children do not transmit the virus that causes COVID-19 more than adults. Many reported cases of transmission in children were traced to transmission within families.	Low
Institut national de sante publique Québec. (2020, May 21). Revue rapide de la littérature scientifique - COVID-19 chez les enfants: facteurs de risque d'infections sévères et potentiel de transmission .	May 21, 2020 (search completed May 15, 2020)	Danis, 2020 Fontanet, 2020a NCIRS, 2020	Children are susceptible to COVID-19 infection, but upon exposure to the COVID-19, they are less likely to be infected than adults. Transmission of COVID-19 by children is limited.	Low
Health Information and Quality Authority. (2020, June 23). Evidence summary for potential for children to contribute to transmission of SARS-CoV-2 .	Jun 23, 2020 (search completed May 31, 2020)	Desmet, 2020 Fontanet, 2020a Heavey, 2020 NCIRS, 2020	The role that children play in the transmission of the virus that causes COVID-19 is unclear. Larger-scale studies are needed.	Low
Ludvigsson, J.F. (2020). Children are unlikely to be the main drivers of the COVID-19 pandemic – A systematic review . <i>Acta Paediatr.</i> Epub ahead of print.	May 19, 2020 (search completed May 11, 2020)	Danis, 2020 NCIRS, 2020	Children are unlikely to be key drivers of transmission. Opening daycares and schools is unlikely to affect mortality in adults.	Low

<p>Brurberg, K.G. (2020). The role of children in the transmission of SARS-CoV-2-19 – 1st update - a rapid review Oslo: Folkehelseinstituttet/ Norwegian Institute of Public Health.</p>	<p>Apr 30, 2020 (search completed Apr 22, 2020)</p>	<p>Fontanet, 2020a NCIRS, 2020 Viner, 2020a</p>	<p>Children can transmit the virus that causes COVID-19 but are unlikely to be the main drivers of transmission. It is too early to make firm conclusions about the role of children in transmission.</p>	<p>Low</p>
<p>Viner, R.M., Russell, S.J., Croker, H., Packer, J., Ward, J., Stansfield, C... Booy, R. (2020a). School closure and management practices during coronavirus outbreaks including COVID-19: a rapid systematic review. <i>The Lancet Child & Adolescent Health</i>, 4(5), 397–404.</p>	<p>Apr 6, 2020 (search completed Mar 19, 2020)</p>	<p>None included in Table 1. This review included studies from pandemics prior to COVID-19.</p>	<p>It is not possible to specifically evaluate the impact of school closures on infection prevention and control, as they were part of a broad range of quarantine and social distancing measures.</p>	<p>Low</p>

Table 4: In-progress Syntheses

Title	Anticipated Release Date	Setting	Description of Document
Evidence previously reported July 24, 2020			
Harling, M., Pearce-Smith, N., Clark, R., Kijauskaite, G., & Nicholson, W. (2020). <i>What is the risk of transmission of COVID-19 within school and preschool settings, and how effective are interventions to reduce transmission? A rapid review.</i> PROSPERO, CRD42020191867.	Jul 24, 2020	School	This rapid review will summarize evidence for the risk of transmission within schools and onsite daycare centres, as well as evaluate the effectiveness of infection prevention and control measures in school settings.
Minozzi, S., Amato, L., Mitrova, Z., & Davoli, M. (2020). <i>COVID-19 among children and adolescents and impact of school closure on outbreaks control: an overview of systematic reviews.</i> PROSPERO, CRD42020186291.	Jul 31, 2020	Home, school	This review will summarize available evidence for the prevalence of infection and disease as well as the risk of transmission by children and adolescents. The review also seeks to assess the effect of school closures on controlling the spread of COVID-19.

Question 2: What is known about the likelihood of transmission of COVID-19 by toddlers and school-aged children to others?

Table 5: Syntheses

Reference	Date Released	Description of Included Studies	Summary of Findings	Quality Rating: Synthesis	Quality Rating: Included Studies
New evidence reported August 11, 2020					
Madewell, Z. J., Yang, Y., Longini, I. M., Halloran, M. E., & Dean, N. E. (2020). Household transmission of SARS-CoV-2: A systematic review and meta-analysis of secondary attack rate. <i>Preprint.</i>	Aug 1, 2020 (search completed Jul 29, 2020)	40 published studies reporting household secondary transmission, including 10 that compared children to adults.	<p>A meta-analysis found that secondary attack rates were higher from adults to adult contacts (31%, 95% Confidence Interval (CI): 19.4, 42.7%) than from adults to child (<18 years old) contacts (15.7, 95% CI: 9.9, 21.5%).</p> <p>An analysis of attack rates from child index cases was not conducted due to the limited available data.</p>	Low	Not reported
Merckx, J., Labrecque, J.A. & Kaufman, J.S. (2020). Transmission of SARS-CoV-2 by children. <i>Deutsches Ärzteblatt International</i> 2020(117), 553-60.	Jul 25, 2020 (search completed Jun 25, 2020)	<p>Total number of studies not reported, but studies of:</p> <ul style="list-style-type: none"> • Household clusters (n = 4) • School outbreaks (n = 3) • Sero-prevalence (n = 4) • Viral load (n = 2) • Time-series (n = 1) • Modelling (n = 3) 	<p>The authors conclude that whether or not children transmit the virus causing COVID-19 effectively is inconclusive.</p> <p>Viral load estimates are only reported from select samples, which introduces selection bias.</p> <p>Secondary attack rate appears lower for younger children, but the age effect is not well understood.</p> <p>The authors call for studies in representative populations using rigorous epidemiological methods across different settings.</p>	Low	Not reported

Evidence previously reported July 24, 2020					
Li, X., Xu, W., Dozier, M., He, Y., Kirolos, A., & Theodoratou, E. (2020). The role of children in transmission of SARS-CoV-2: A rapid review. <i>Journal of Global Health, 10</i> (1), 011101.	Jul 3, 2020 (search completed Apr 30, 2020)	16 primary studies <ul style="list-style-type: none"> • 1 household contact tracing • 4 school contact tracing • 5 studies providing indirect evidence for potential transmission by children • 6 studies reporting the prevalence of COVID-19 in children 	One case report describes presumed transmission from an infant to its parents. One case report describes environmental contamination by an infant with COVID-19 in a hospital setting. Three studies found that fecal shedding in children lasts longer than in adults. Another study of 3712 COVID-19 patients found similar viral loads between age groups.	Low	Not reported
Usher Institute. (2020, Jul 2). Summary: What is the evidence for transmission of SARS-COV-2 by children [or in schools]?	Jul 2, 2020, (search completed Jun 21, 2020)	83 primary studies: <ul style="list-style-type: none"> • 2 case reports of transmission by children • 14 studies on the potential for infection by children, such as through fecal shedding • 8 studies related to schools or daycares 	Overall, there is limited evidence of transmission of COVID-19 from children to others. Children can become infected through exposure to confirmed cases, most often through household contacts or those with recent travel history. There appears to be a linear relationship between age and likelihood of transmitting COVID-19 in those age 1-19.	Low	Not reported
Health Information and Quality Authority. (2020, Jun 23). Evidence summary for potential for children to contribute to transmission of SARS-CoV-2.	Jun 23, 2020 (search completed May 31, 2020)	10 case series and case reports of household or close-contact transmission involving children.	Overall, included case series show that children very rarely transmit COVID-19 to household members or close contacts. A case report from a single family confirmed transmission from children to caregivers. Analysis of a larger case series reported no confirmed transmission from cases aged 15 years or younger.	Low	Low-moderate
Rajmil, L. (2020). Role of children in the transmission of the COVID-19 pandemic: a rapid scoping review. <i>BMJ Paediatrics Open, 4</i> (1), e000722.	Jun 21, 2020 (search completed May 28, 2020)	14 primary studies <ul style="list-style-type: none"> • 11 contact tracing in households • 2 contact tracing studies in schools • 1 study reported prevalence of COVID-19 in children 	Studies of family clusters demonstrate transmission of COVID-19 to children by family members. Studies did not confirm transmission to family members by children. One study noted that 8% (3 of 40 cases) of children developed symptoms prior to the adults in their households.	Low	Not reported

<p>Viner, R.M., Mytton, O.T., Bonell, C., Melendez-Torres, G.J., Ward, J.L... Eggo, R. (2020b). Susceptibility to SARS-CoV-2 infection amongst children and adolescents compared with adults: a systematic review and meta-analysis. <i>Preprint</i>.</p>	<p>May 24, 2020 (search completed May 16, 2020)</p>	<p>9 contact-tracing studies, including 2 preprint articles and one unpublished report.</p>	<p>Data from 8 contact tracing studies conducted within households or close contacts were meta-analyzed.</p> <p>Secondary infection rates in those <20 years were compared to those >20 years; children were less than half as likely to be infected as adults (Odds Ratio (OR) = 0.41, 95% Confidence Interval (CI) = 0.23, 0.73).</p> <p>It was not possible to compare the likelihood of infection transmission by children vs. adults due to limited available data.</p> <p>One included synthesis found that in 3 of 31 (9.7%) household clusters analyzed; the index case was a child.</p> <p>It is not possible to determine whether children are less likely to be an index case because they are less infectious than adults or because they are less likely to be infected.</p>	<p>Moderate</p>	<p>Low-Moderate</p>
<p>Institut national de sante publicqué Québec. (2020, May 21). Revue rapide de la littérature scientifique - COVID-19 chez les enfants: facteurs de risque d'infections sévères et potentiel de transmission.</p>	<p>May 21, 2020 (search completed May 15, 2020)</p>	<p>9 studies relevant to transmission by children</p> <ul style="list-style-type: none"> • 1 rapid review of • 1 contact tracing study in a household • 2 contact tracing studies in schools <p>5 studies providing indirect evidence for potential transmission by children</p>	<p>Analysis of likelihood of transmission within family clusters was described as challenging since many children remain asymptomatic.</p> <p>Another study of COVID-19 patients found similar viral loads between age groups.</p>	<p>Low</p>	<p>Not reported</p>

<p>Ludvigsson, J. F. (2020). Children are unlikely to be the main drivers of the COVID-19 pandemic – A systematic review. <i>Acta Paediatrica</i>. Epub ahead of print.</p>	<p>May 19, 2020 (search completed May 11, 2020)</p>	<p>47 articles were reviewed; a full list of included studies was not provided.</p>	<p>This review described a systematic search and screen for included studies, however the author did not provide a list of studies reviewed and it is unclear how evidence was synthesized across studies.</p> <p>Cross-sectional studies found that viral loads or viral shedding are similar in different age groups. Most of these studies assessed symptomatic cases.</p> <p>Two case reports and 2 syntheses analyzed transmission of COVID-19 within households. Most reported no evidence of child-to-child or child-to-adult transmission.</p> <p>One included synthesis found that in 3 of 31 (9.7%) household clusters analyzed, the index case was a child (Viner, 2020a).</p>	<p>Low</p>	<p>Not reported</p>
<p>Mehta, N.S., Mytton, O.T., Mullins, E.W.S., Fowler, T.A., Falconer, C.L., Murphy, O.B... Nguyen-Van-Tam, J.S. (2020). SARS-CoV-2 (COVID-19): What do we know about children? A systematic review. <i>Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America</i>. Epub ahead of print.</p>	<p>May 11, 2020 (search completed Mar 9, 2020)</p>	<p>24 primary studies:</p> <ul style="list-style-type: none"> • 20 studies assessing prevalence, symptoms and outcomes in children • 4 case reports of transmission involving children 	<p>Evidence related to transmission by children was limited. Cases in children tended to be identified through contact tracing of adult cases. One case report described probable transmission from an infant to her parents.</p>	<p>Moderate</p>	<p>Not reported</p>

<p>Brurberg, K.G. (2020). The role of children in the transmission of SARS-CoV-2-19 – 1st update - a rapid review. Oslo: Folkehelseinstituttet/ Norwegian Institute of Public Health.</p>	<p>Apr 30, 2020 (search completed Apr 22, 2020)</p>	<p>9 case series or case reports and one narrative review related to the likelihood of children transmitting COVID-19 to others.</p>	<p>Case reports indicate that children are susceptible to COVID-19 infection, although less so than adults. The overall prevalence of COVID-19 among children is unknown due to lack of comprehensive testing.</p> <p>According to tracing of infection routes in case studies, infected children are less likely to transmit the disease than adults, but this data is very limited.</p>	<p>Low</p>	<p>Not reported</p>
<p>Zhen-Dong, Y., Gao-Jun, Z., Run-Ming, J., Zhi-Sheng, L., Zong-Qi, D., Xiong, X., & Guo-Wei, S. (2020). Clinical and transmission dynamics characteristics of 406 children with coronavirus disease 2019 in China: A review. <i>Journal of Infection</i>. Epub ahead of print.</p>	<p>Apr 28, 2020 (search completed Apr 3, 2020)</p>	<p>406 case reports of children up to 16 years of age diagnosed with COVID-19.</p>	<p>Among the included case reports, nearly half of cases were asymptomatic or had only mild symptoms.</p> <p>Evidence from stool samples indicated that children had higher rates of fecal virus RNA (81.8%) than adults (53.4%), suggesting that further investigation of fecal-oral transmission by children may be warranted.</p>	<p>Low</p>	<p>Low</p>

Table 6: In-progress Syntheses

Title	Anticipated Release Date	Setting	Description of Document
Evidence previously reported July 24, 2020			
Chan, M., Bhuiyan, M., Islam, S., Hassan, Z., Satter, S., Haider, N., & Homaira, N. (2020). Epidemiology of COVID-19 in children aged <5 years: a systematic review and metanalysis . PROSPERO, CRD42020181936	Jul 31, 2020	Home	This review will summarize COVID-19 epidemiology in children younger than 5 years of age, including answering the question, "Is there any secondary/household transmission from pediatric COVID-19 cases?"
Du, P., & Luo, X. (2020). Are children more unsusceptible to COVID-19? A rapid review and meta-analysis . PROSPERO, CRD42020190740.	Sep 7, 2020	Home, community	This review will compare the likelihood of infection in children and adults who have been exposed to COVID-19.
Medeiros, G., Azevedo, K., Hugo, V., Segundo, O., Santos, G., Mata, A.N... Piuvezam, G. The control and prevention of COVID-19 transmission in children: a protocol for systematic review and meta-analysis . PROSPERO 2020 CRD42020179263.	Nov 1, 2020	Home	This review will summarize the role of children in COVID-19 Community transmission

Table 7: Single Studies

Reference	Date Released	Study Design	Location	Setting	Summary of Findings	Quality Rating:
New evidence reported August 11, 2020						
Wongsawat, J., Moolasart, V., Srikirin, P., Srijareonvijit, C., Vaivong, N., Uttayamakul, S., & Disthakumpa, A. (2020). Risk of novel coronavirus 2019 transmission from children to caregivers: A case series. <i>Journal of Paediatrics and Child Health</i> , 56(6), 984–985.	Jun 22, 2020	Case series	Thailand	Home	<p>3 cases of confirmed COVID-19 in children are reported. In each case, source of infection was determined to be a close family contact. Following national policies, children were isolated in a health facility.</p> <p>During isolation, caregivers were encouraged to follow strict hand hygiene protocols and not share personal items. Surgical masks were provided but compliance was poor.</p> <p>Caregivers of 2 of 3 children tested negative for COVID-19; the third caregiver did not undergo testing.</p>	Moderate
Evidence previously reported July 24, 2020						
National Institute for Public Health and the Environment (RIVM). (2020, July 20). Children and COVID-19.	Jul 20, 2020	Prevalence	Netherlands	Community Preschool, primary school	<p>Children aged 0-18 years have not been identified as primary sources of COVID-19 transmission. Among children ages 0-18 years with COVID-19, there were no reported contacts who tested positive.</p> <p>In a study of 54 households (239 participants), there were no instances in which a child younger than 12 years of age was identified as the source of COVID-19 transmission.</p> <p>Low rates of COVID-19 cases have been reported among children ages 0-18 years (0.3%-1.4%).</p>	Low

Laxminarayan, R., Wahl, B., Dudala, S.R., Gopal, K., Mohan, C., Neelima, S... Lewnard, J.A. (2020). Epidemiology and transmission dynamics of COVID-19 in two Indian states . <i>Preprint</i> .	Jul 17, 2020	Prevalence	Tamil Nadu and Andhra Pradesh, India	Community	<p>Of 33,584 positive cases from March 5 to June 4, 2020, 4206 had contact tracing data available.</p> <p>Secondary attack rate was highest in household settings (9%) compared to community (2.6%) or healthcare (1%) settings. Secondary attack rates were higher for children than adults, but this was only seen in household settings.</p> <p>The authors note that in many cases, classification of the index case in order to determine secondary attack rate may be imprecise.</p>	Low
Park, Y.J., Choe, Y.J., Park, O., Park, S.Y., Kim, Y.M., Kim, J... Jeong, E.K. (2020). Contact tracing during Coronavirus disease 2020 . <i>Emerging Infectious Diseases</i> . Epub ahead of print.	Jul 16, 2020	Case series	South Korea	<p>Community</p> <p>Pre-school, primary school, secondary school</p>	<p>Of 5,705 COVID-19 positive cases analyzed between January 20 and March 27, 2020:</p> <ul style="list-style-type: none"> • 29 (0.5%) were children ages 0-9 • 124 (2.2%) were children ages 10-19 <p>Young children are less likely to transmit COVID-19 than adults</p> <ul style="list-style-type: none"> • Amongst children ages 0-9, 5.3% (95% CI: 1.3-13.7) of household contacts, 1.1% (95% CI: 0.2-3.6) of non-household contacts tested positive. <p>Among children ages 10-19, 18.6% (95% CI: 14.0-24.0) of household contacts, 0.9% (95% CI: 0.1-2.9) of non-household contacts tested positive.</p>	Low
Somekh, E., Gleyzer, A., Heller, E., Popian, M., Kashani-Ligumski, L., Czeiger, S... Stein, M. (2020). The role of children in the dynamics of intra family coronavirus 2019 spread in densely populated area . <i>The Pediatric Infectious Diseases Journal</i> . Epub ahead of print.	Jun 1, 2020	Case series	Israel	Households	<p>Members of 13 households of COVID-19 cases were tested for COVID-19. Test results were presented by age group:</p> <ul style="list-style-type: none"> • 21 of 36 (58.3%) adults tested positive • 13 of 40 (32.5%) children aged 5–17 tested positive • 2 of 18 (11.1%) children younger than 5 years tested positive <p>In 1 household, the index case was an adolescent aged 14.5 years who was exposed in the community. The index case for the other 12 households were adults.</p>	Low

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