



Living Rapid Review Update 11: What is the specific role of daycares and schools in COVID-19 transmission?



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The authors declare they have no conflicts of interest to report.

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 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 living 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 review is based on the most recent research evidence available at the time of release. A previous version was completed on November 12, 2020. This updated version includes evidence available up to November 30, 2020.

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

What Has Changed in This Version?

- New surveillance data from Canada (Quebec) have been included in this update; cumulative data demonstrate low incidence rates among students and staff in primary and secondary schools, consistent with previous findings.
- New data from the United States also suggests that there is little difference in elementary student case rates whether or not certain infection prevention and control strategies (e.g., student masking, physical distancing, ventilation) are in place; however differences are seen in staff case rates and the differences appear to be larger in high school settings. However, these data are not adjusted for other mitigation factors occurring in the community or school setting, and the sample is not representative of the US population thus should be interpreted with caution.
- Five new single studies investigated transmission risk and/or prevalence across preschool and school settings; overall findings demonstrated low secondary attack rates and prevalence among students. Household transmission was cited as the most probable source of infection.
 - Among this group of studies, one study from Luxembourg reported student-to-student transmission occurring within the same class, however, certain infection prevention and control measures were lifted during the study period (e.g., normal class sizes resumed, masks not mandated while sitting in classrooms).
- Two new syntheses explored child-to-child and child-to-adult transmission in household, community, and school settings; low secondary attack rates among children in household and community settings were reported. There were rare instances of children as index cases, and limited evidence of secondary transmission to school contacts.
- Eight new single studies explored transmission from children to others in household and community settings:
 - Two studies found living with a child at home or in childcare was not associated with an risk of infection or hospitalization

- Three studies reported that a parent/adult commonly served as the index case among household cases
- One study identified that risk of transmission between household members increased with age (i.e., 7.5% among 5-9 year olds vs. 30.2% among aged ≥ 65 years), while another reported no difference in attack rates by age within household settings
- One study found that children who test positive after a known COVID-19 exposure were more likely to have been exposed to an infected sibling; although index cases were not established among these cases.

Key Points

- 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, when infection control measures are in place. The certainty of the evidence is low (GRADE), 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 (GRADE), 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 reviewed, there is wide variability in policies in place limiting the ability 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

- Building upon earlier case reports, contact tracing and prevalence studies, there is a growing body of reports using national or regional surveillance data and comprehensive contact tracing and testing strategies to minimize the likelihood of underestimation of cases. While surveillance reports are identifying cases among staff and students in schools, these commonly include single cases or a small number of cases typically less than 5.
- Surveillance data of outbreaks in school and daycare settings in the United States is inconsistent with data reported from other jurisdictions. Interpretation of this data is limited as key details such as index case and information about secondary transmission and infection control measures in place is not provided. Variation across the United States suggesting levels of community transmission is important is consistent with recent analyses from the United Kingdom and Canada.
- Data from overnight camps show that widespread transmission from children is possible, and again highlights the importance of infection control measures. Most case reports of widespread transmission in these settings is from adolescents.
- Contact tracing studies have identified much lower transmission by children to children, and children to adults than from adults to adults and adults to children in school and household settings. Limited evidence suggests the likelihood of infected adults transmitting to students is possible, but less likely than adult to adult transmission.

- Infection control measures were highly variable across jurisdictions scanned. It is important to note that there may be regional variations in policies in place above what are reported in national guidelines.
- Within daycares most jurisdictions described enhanced hand hygiene (75%, 25% did not describe), cleaning protocols (75%, 25% did not describe), and cohorting (67%, 33% did not describe). Minimizing contact (i.e. physical distancing) between groups of children was described in only two jurisdictions (17%), was not required in 4 jurisdictions (33%) and was not described in 6 (50%). One jurisdiction (8%) required masks for all children, one (8%) in common areas only, and 6 (50%) did not require students to wear masks (33% not described). Masks were required for staff in 66% of settings (not required in 17% and not described in 17%).
- Within primary schools, most jurisdictions described enhanced hand hygiene (81%, 19% not described), cleaning protocols (69%, 31% not described) and pre-attendance screening (56%, 44% not described). Cohorting was reported in 69% of jurisdictions (31% not described). Over half of the jurisdictions require students to physically distance (69%) while 25% do not require distancing between students, and such was not described in one jurisdiction. Requirements on wearing masks among students was described to varying degrees among 69% of the jurisdictions and was not required in 31% of them. Physical distancing and mask wearing were commonly required amongst staff (75%, 63% respectively).
- Within secondary schools, almost all jurisdictions described enhanced hand hygiene (94%), enhanced cleaning procedures (69%, 31% not described), cohorting of students (75%, 25% not described), and physical distancing amongst staff (88%, 12% not described); mandatory face mask wear was reported for staff (75%, not required by 12.5% and not described by 12.5%) and students (81%, not required by 13% and not described by 6%).

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?
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?

Search

The following databases and sources were searched for evidence pertaining to the role of daycares and schools in the transmission of COVID-19 up to November 30, 2020:

- 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 \(USHER Network for COVID-19 Evidence Reviews\)](#)
- Centers for Disease Control and Prevention's [Morbidity and Mortality Weekly Report](#)
- Robert Koch Institute [Situation report of the RKI on COVID-19](#)
- Ontario [COVID-19 cases in schools and child care centres database](#)
- Alberta [COVID-19 school status map](#).
- Quebec [Situation in Schools](#)
- USA [COVID-19 School Response Dashboard](#)

- Newfoundland and Labrador Centre for Applied Health Research ([NLCAHR](#))
- National Institute for Public Health and the Environment ([RIVM](#))
- [COVID-Explained](#)
- Health Information and Quality Authority ([HIQA](#))
- [Government of Ontario](#)
- National Centre for Immunisation Research and Surveillance ([NCIRS](#))
- [Province of Manitoba](#)
- Nova Scotia [Coronavirus \(COVID-19\): Case data](#)
- New Brunswick [COVID-19 Dashboard](#)
- British Columbia [COVID-19 Dashboard](#)
- [PEI COVID-19 Case Data](#)
- Saskatchewan [Weekly Monitoring Report – Children and Youth](#)
- Newfoundland & Labrador [Pandemic Update - Current Status](#)
- Northwest Territories [COVID-19](#)
- Nunavut [COVID-19 \(Novel Coronavirus\)](#)
- Yukon [Case counts: COVID-19](#)

A copy of the search strategy is available at this [link](#).

Information on policies for childcare and educational settings were retrieved from the scientific publications and governmental public health webpages for the jurisdictions included in research articles in this review.

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 were excluded.

Question 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?

	Inclusion Criteria	Exclusion Criteria
Population	Children and adolescents aged 1–18	Infants
Intervention	Exposure to or diagnosis of COVID-19	
Comparisons	-	
Outcomes	Confirmed or suspected case of COVID-19	
Setting	Schools, daycares, camps	

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

	Inclusion Criteria	Exclusion Criteria
Population	Children and adolescents aged 1–18 or household members	Infants
Intervention	Exposure to or diagnosis of COVID-19	
Comparisons	-	
Outcomes	Confirmed or suspected case of COVID-19	
Setting	Community and household settings	

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.

Appraisal of Evidence 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	Joanna Briggs Institute (JBI) Checklist for Cohort Studies
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.

The Grading of Recommendations, Assessment, Development and Evaluations ([GRADE](#)) approach was used to assess the certainty in the findings based on eight key domains.

In the GRADE approach to quality of evidence, **observational studies**, as included in this review, provide **low quality** evidence, and this assessment can be further reduced based on other domains:

- High risk of bias
- Inconsistency in effects
- Indirectness of interventions/outcomes
- Imprecision in effect estimate
- Publication bias

and can be upgraded based on:

- Large effect
- Dose-response relationship
- Accounting for confounding.

The overall certainty of the evidence for each outcome was determined taking in to account the characteristics of the available evidence (observational studies, some not peer-reviewed, unaccounted-for potential confounding factors, different tests and testing protocols, lack of valid comparison groups). A judgement of 'overall certainty is very low', means that the findings are very likely to change as more evidence accumulates.

Findings

Summary of Evidence Quality

In this update, 17 new single studies, two new syntheses, and two in-progress single studies were identified, for a total of 99 publications addressing two distinct questions.

In this version a search was undertaken for infection control policies in place in jurisdictions with published data included in this review.

Question	Evidence included		Overall certainty in evidence
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?	Syntheses In progress syntheses Single studies In progress single studies	13 3 43 4	Low
What is known about the likelihood of transmission of COVID-19 by toddlers and school-aged children to others in other settings?	Syntheses In progress syntheses Single studies In progress single studies	17 4 24 3	Very low
What infection prevention and control policies or procedures have been implemented in daycares and schools?	Policy documents	26	Not applicable

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 overall certainty of the evidence 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:
Data collected following school re-opening						
New evidence reported December 18, 2020						
Government of Québec. (2020, Dec 8). Daily Numbers for the Province – Public and Private School Systems Highlights.	Dec 8, 2020	Prevalence	Quebec	Public and private school system	<p>Data collected from 2740 public schools and 254 private schools including over 1 300 000 students and 226 000 staff since the start of the 2020 year.</p> <p>Confirmed cumulative positive cases in the school system:</p> <ul style="list-style-type: none"> • 13,687 students (~1% of all students) • 3,199 staff (~1.4% of all staff) <p>Number of classes that have been closed:</p> <ul style="list-style-type: none"> • 1,070 in public school system • 169 in private school system <p>2,237 schools have reported one or more positive cases; 1,097 of these no longer have any active cases.</p> <p>8 schools have been closed or partially closed.</p>	Low; NOT PEER REVIEWED
Government of Alberta. (2020, Dec 8). COVID-19 school status map.	Dec 8, 2020	Prevalence	Alberta	Primary and secondary schools	<p>As of Dec 8, 2020:</p> <ul style="list-style-type: none"> • 106 schools (total n unknown) on watch status (a school outbreak declared, ≥ 5 cases COVID-19 may have been acquired/transmitted at school). • 131 schools (total n unknown) reported an outbreak of 2-4 cases in a 14-day period, COVID-19 may have been acquired/transmitted at school. <p>Start date is unknown.</p>	Moderate; NOT PEER REVIEWED

Government of Ontario. (2020, Dec 7). COVID-19 cases in schools and child care centres.	Dec 7, 2020	Prevalence	Ontario	Primary, secondary schools, and childcare	<p>From Sep 5, to Dec 7, a total of 5,402 school-related cases have been reported in publicly funded schools in Ontario:</p> <ul style="list-style-type: none"> • 3,531 student cases • 783 staff cases • 1,088 'other' cases (not identified) <p>Currently, as of Dec 7, 803 (16.63%) schools have reported a case and 10 (0.21%) schools are closed.</p> <p>From Jun 12 to Dec 7, a total of 893 cases occurred in those connected to childcare settings in Ontario:</p> <ul style="list-style-type: none"> • 487 child cases • 406 staff/provider cases <p>Currently, as of Dec 7, 158 (3.01%) centres have reported a case and 22 (0.42%) centres are closed.</p>	Moderate; NOT PEER REVIEWED
National Institute for Public Health and the Environment (RIVM). (2020, Dec 2). Children and COVID-19.	Dec 2, 2020	Prevalence	Netherlands	Primary schools, childcare facilities	<p>Between Jun 1 to Nov 30, 6% of over 320,000 people working in education or childcare tested positive. This is lower than the 9% positive of over 4 million adults tested in the general population at the same time.</p>	Low; NOT PEER REVIEWED
Robert Koch Institute. (2020, Nov 30). Coronavirus Disease 2019 (COVID-19) Daily Situation Report of the Robert Koch Institute.	Nov 30, 2020	Prevalence	Germany	Childcare, schools, after school care, other educational facilities, children's homes, camps	<p>Of 1,053,869 total cases in Germany from Jan until Nov 30, 30,460 (2.9%) were in those cared for or attending childcare/school/camp settings and 14,120 (1.3%) 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 was lower than other settings such as hospitals and clinical settings (3.6% of total), congregate living settings (5.4% of total). No data is given on the number of people employed in these settings.</p>	Moderate; NOT PEER REVIEWED

<p>Armann, J.P., Unrath, M., Kirsten, C., Lück, C., Dalpke, A.H., & Berner, R. (2020). SARS-CoV-2 IgG antibodies in adolescent students and their teachers in Saxony, Germany (SchoolCoviDD19) : persistent low seroprevalence and transmission rates between May and October 2020. Preprint.</p>	<p>Nov 29, 2020</p>	<p>Cross-sectional</p>	<p>Germany</p>	<p>School</p>	<p>After school reopenings in May/Jun, out of 2045 individuals (1538 students grades 8-11; 503 teachers), seroprevalence was 0.6% (12/2045) including 11 seropositive students and 1 teacher.</p> <p>In Sep/Oct, out of 1779 individuals (1334 students; 445 teachers), seroprevalence was 0.7% (12/1779) including 11 seropositive students and 1 teacher.</p> <p>Seropositive individuals were detected in 7/13 schools, with 4 in one school as the max. Seroprevalence ranged from 0 to 2.2 per individual school.</p> <p>During the study period, SARS-CoV-2 infections per 100,000 in the community increased from 139 to 245.</p> <p>Infection prevention control measures in schools are unknown.</p>	<p>Moderate; <i>PREPRINT</i></p>
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<p>Oster, E. (2020, Nov 22). National COVID-19 School Response Dashboard.</p>	<p>Nov 22, 2020</p>	<p>Prevalence</p>	<p>United States</p>	<p>Schools</p>	<p>From Aug 31 - Nov 22, 13,042,050 students learning in-person and 4,009,992 in-person staff included in the dashboard.</p> <ul style="list-style-type: none"> • Daily case rate was 15 per 100,000 students, with an infection rate of 0.22% (average by 2-week period). • Daily case rate was 30 per 100,000 staff, with an infection rate of 0.42% (average by 2-week period). • The community case rate in school-matched population was 22 per 100,000. <p>As of Nov 9, 5.3% of schools reported outbreaks of 5 or more cases (staff/students combined), 1.4% of schools reported outbreaks of 10 or more cases.</p> <p>Case rates (per 100,000) by mitigation strategies include:</p> <p><u>Student Masking</u> Case rates for no mask vs mask: Community case rate <10:</p> <ul style="list-style-type: none"> • Students: (7 vs 4) • Staff: (33 vs 8) <p>Community case rate >20:</p> <ul style="list-style-type: none"> • Students: (20 vs 23) • Staff: (120 vs 46) <p><u>Student distancing</u> Case rates for no 3 foot distance vs 3 foot distance: Community case rate <10:</p> <ul style="list-style-type: none"> • Students: (5 vs 4) • Staff: (13 vs 8) <p>Community case rate >20:</p> <ul style="list-style-type: none"> • Students: (27 vs 34) • Staff: (83 vs 83) <p><u>Increased ventilation</u> Case rates for no increased ventilation vs increased ventilation Community case rate <10:</p> <ul style="list-style-type: none"> • Students: (9 vs 3) • Staff: (22 vs 8) 	<p>Low; NOT PEER REVIEWED</p>
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					<p>Community case rate >20:</p> <ul style="list-style-type: none"> • Students: (33 vs 33) • Staff: (95 vs 80) <p><u>In-person density</u></p> <p>Community case rate <10:</p> <ul style="list-style-type: none"> • Students: <ul style="list-style-type: none"> ○ Density <60%: 9 ○ Density 60-90%: 7 ○ Density >90%: 5 • Staff: <ul style="list-style-type: none"> ○ Remote: 9 ○ Density <60%: 12 ○ Density 60-90%: 16 ○ Density >90%: 18 <p>Community case rate >20:</p> <ul style="list-style-type: none"> • Students: <ul style="list-style-type: none"> ○ Density <60%: 20 ○ Density 60-90%: 25 ○ Density >90%: 21 • Staff: <ul style="list-style-type: none"> ○ Remote: 30 ○ Density <60%: 37 ○ Density 60-90%: 68 ○ Density >90%: 73 	
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<p>Larosa, E., Djuric, O., Cassinadri, M., Cilloni, S., Bisaccia, E., Vicentini, M., ... Reggio Emilia Covid-19 Working Group. (2020). Secondary transmission of COVID-19 in preschool and school settings after their reopening in northern Italy: a population-based study. <i>Preprint</i>.</p>	<p>Nov 18, 2020</p>	<p>Cohort</p>	<p>Italy</p>	<p>Preschools, primary schools, middle schools, high schools</p>	<p>From Sep 1 to Oct 15, after the reopening of schools, across 41 classes in 36 different schools [8 preschools (aged 0-5 years), 10 primary (aged 6-10 years), 5 middle (aged 11-13 years), 13 high schools (aged 14-19 years)], 994 students and 204 teachers were tested following the identification of 43 primary cases (38 students, 5 teachers).</p> <p>Secondary cases occurred in 13 out of 41 classes. The attack rate for secondary cases among students was 3.9%. The attack rate was higher in secondary schools (6.64%) vs. primary schools (0.44%). There were no secondary cases in preschools or among teachers.</p> <p>Most routes of transmission appear to have been from a an infected family member or close contact. Only one middle school appears to have had transmission within the school, with the index cases possibly being teachers.</p>	<p>Moderate; <i>PREPRINT</i></p>
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<p>COVID-Explained. (2020, Nov 9). Data Overview: Child Care Centers, Camps, and Outbreaks.</p>	<p>Nov 9, 2020</p>	<p>Surveillance (crowd-sourced)</p>	<p>United States</p>	<p>Daycares, camps Infection control measures and community transmission vary within and across state.</p>	<p>State-level data as of Nov 9 (unless noted):</p> <ul style="list-style-type: none"> • Arizona: As of Nov 8, 97 childcare facilities with cases • California: As of Nov 5, of 9968 open childcare facilities, 2164 cases reported (47% staff, 25% children, 25% parents, 2% other) • Colorado: As of Nov 4, 48 childcare facilities have reported outbreaks (active and resolved) with 178 lab-confirmed cases (71% staff, 29% children) • Kansas: As of Nov 8, 17 outbreaks in daycares with 78 cases (3 hospitalizations) and 52 outbreaks in schools with 508 cases (8 hospitalizations, 1 death) • Minnesota: As of Nov 5, of 755 childcare programs with confirmed cases, 503 have had 1 case, 208 have had 2-4 cases, and 44 have had 5 or more cases. There have been 813 cases amongst child care staff and 412 amongst children • Nevada: As of Nov 8, there have been 64 confirmed cases (31% child, 69% staff) in 38 out of 443 total childcare facilities • North Carolina: As of Nov 6, 37 schools (total 328 cases, 42% staff, 58% children) and 18 daycares (total 112 cases, 61% staff, 39% children) had clusters • Ohio: As of Jul 28, 442 reported cases linked to childcare (69% staff, 31% children), 75% determined to be acquired through community spread • Oregon: As of Nov 4, 16 active outbreaks with 71 reported cases in childcare facilities (9 outbreaks, with 67 cases resolved) • Pennsylvania: As of Nov 6, 269 child or parent and 369 staff cases reported in licensed childcare facilities • Rhode Island: Between Jun 1 – Jul 31, of 666 total childcare centres, 29 had confirmed cases (17 children and 16 staff) • Texas: As of Nov 5, 1891 child and 3436 employee reported cases among 2802 total facilities • Tennessee: As of Jul 14, 47 facilities with positive cases • Utah: As of Nov 8, 54 current outbreaks with 255 cases (5 hospitalizations) in childcare settings (median age 23); 7940 cumulative school-associated cases (13% teachers, 75% students, and 12% other/unknown). 	<p>Not rated; NOT PEER REVIEWED</p>
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					<ul style="list-style-type: none"> Virginia: As of Nov 8, 67 outbreaks with 334 cases in childcare settings, 45 outbreaks with 246 cases in schools 	
<p>Cai, J., Wang, X., Zhao, J., Ge, Y., Xu, J., Tian, H., ... Zeng, M. (2020). Comparison of Clinical and Epidemiological Characteristics of Asymptomatic and Symptomatic SARS-CoV-2 Infection in Children. <i>Virologica Sinica</i>. Epub ahead of print.</p>	Nov 4, 2020	Cohort	China	Household, community	<p>From Jan 19 to Apr 30, 49 children were infected (mean age 11.5 ± 5.12 years).</p> <p>21 children (43%), had a known exposure within:</p> <ul style="list-style-type: none"> Household (15; 71.4%) School dormitory (5; 23.8%) Travel bus (1; 4.8%) 	Low
<p>Hoehl, S., Kreutzer, E., Schenk, B., Westhaus, S., Foppa, I., Herrmann, I., ... Ciesek, S. (2020). Longitudinal testing for respiratory and gastrointestinal shedding of SARS-CoV-2 in day care centres in Hesse. Germany Results of the SAFE KiDS Study. <i>Preprint</i>.</p>	Nov 4, 2020	Cohort	Germany	Day care centres	<p>From Jun 18 to Sep 10, 825 children (aged 3 months to 8 years) and 372 staff members from 50 randomly selected daycare centres participated in weekly screening for COVID-19 using buccal mucosa swab, and anal swab and RT-PCR.</p> <p>No children tested positive for COVID-19; 2 staff (one symptomatic, one asymptomatic) tested positive from 2 different day care centres.</p>	Moderate; PREPRINT

<p>Mossong, J., Mombaerts, L., Veiber, L., Pastore, J., LeCoroller, G., Schnell, M., ... Wilmes, P. (2020). SARS-CoV-2 Transmission in Educational Settings During an Early Summer Epidemic Wave in Luxembourg. <i>Preprint.</i></p>	<p>Oct 26, 2020</p>	<p>Cohort</p>	<p>Luxembourg</p>	<p>Preschool, primary school, secondary school</p>	<p>From May 4 – Jul 25, there were 424 confirmed cases among students and teachers:</p> <ul style="list-style-type: none"> • 176 pre- and primary school students (41.5%) • 214 secondary school students (50.5%) • 16 primary school teachers (3.8%) • 18 secondary school teachers (4.3%) <p>Probable sources of transmission included:</p> <ul style="list-style-type: none"> • Infected family member (42.5%) • School (11.6%) • Friend (3.8%) • From another or multiple sources (4.2%) • Unknown (37.5%) <p>Of 228 cases that attended school while infectious, 29 cases led to 49 secondary cases (school transmission).</p> <p>Of the 49 secondary cases:</p> <ul style="list-style-type: none"> • 38 (78%) were student-to-student, same class • 7 (14%) were teacher-to-student • 3 (6%) were student-to-teacher • 1 was teacher-to-teacher transmission. <p>The effective reproductive rate in schools was 0.27.</p> <p>Comparing Luxembourg’s two waves (Mar-Apr and Jul), incidence was lower in school-age children (28 per 100,000) compared to adults (208 per 100,000; IRR=0.13, 95% CI=0.09, 0.19) in the first wave; there were no differences between groups in the second wave. Incidence was lower in students compared to teachers during the first wave (IRR=0.20, 95% CI=0.12, 0.34), but both teachers and students were affected during the second.</p> <p>Positivity rates were lower in children (5.1%) than in adults (10.9%) during the first wave, but were more similar (1.2% and 0.82%, respectively) in the second.</p>	<p>Moderate; <i>PREPRINT</i></p>
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Data collected prior to school lockdown measures

Previously Reported Evidence						
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>Journal of Medical Virology</i> . Epub ahead of print.	Nov 24, 2020	Prevalence	Belgium	Daycare centers 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 in Feb (at the start of the epidemic) and in Mar (before lockdown). No children tested positive.	High
Pray, I.W., Gibbons-Burgener, S.N., Rosenberg, A.Z., Cole, D., Borenstein, S., Bateman, A., ... Westergaard, R.P. (2020). COVID-19 Outbreak at an Overnight Summer School Retreat — Wisconsin, July–August 2020 . <i>Morbidity and Mortality Weekly Report</i> 69(43): 1600-1604.	Oct 30, 2020	Case Report	Wisconsin, United States	Community/ Summer Camp	<p>127 students, 21 counsellors (aged 17-24 years) and 4 staff members from 21 states and 2 foreign countries attended camp from Jul 2 to Aug 11.</p> <p>All attendees provided a negative COVID-19 test (last 7 days or serology in last 3 months) and were asked to self-quarantine for 7 days, and prior to wear masks while travelling.</p> <p>The index case (grade 9 student) developed COVID-19 symptoms on Jul 3 and tested positive on Jul 5.</p> <p>Despite efforts to isolate close contacts, 116/152 (76%) of attendees had confirmed (n=78) or probable (n=38) COVID-19. This included:</p> <ul style="list-style-type: none"> • 100/127 students (79%) • 15/21 counsellors (71%) • 1 staff member (25%) <p>Excluding the 24 attendees who provided positive serologic results prior to camp, the attack rate = 91% (116/128).</p>	High

<p>Cooch, P., Watson, A., Olarte, A., Crawford, E., CLIAhub Consortium, DeRisi, J., ... Bardach, N. (2020). Supervised self-collected SARS-CoV-2 testing in indoor summer camps to inform school reopening. <i>Preprint.</i></p>	<p>Oct. 23, 2020</p>	<p>Cross-sectional</p>	<p>California, United States</p>	<p>Community/ Household</p>	<p>163 participants (including 67 campers, 76 household contacts and 20 staff) self-collected nasal and saliva swabs at the beginning and end of 2 summer camps (between 3-5 weeks apart). No positive RT-PCR tests for SARS-CoV-19 were found at either timepoint.</p> <p>Seven participants (4%, 95% CI=1-7%) tested positive for SARS-CoV-19 antibodies at one or more timepoints.</p> <p>It was not possible to determine whether any transmission occurred between participants in this study as no documented cases occurred during camps.</p>	<p>High; <i>PREPRINT</i></p>
<p>Buonsenso, D., De Rose, C., Moroni, R., & Valentini, P. (2020). SARS-CoV-2 infections in Italian schools: preliminary findings after one month of school opening during the second wave of the pandemic. <i>Preprint.</i></p>	<p>Oct 11, 2020</p>	<p>Prevalence</p>	<p>Italy</p>	<p>Preschool/ kindergarten schools</p>	<p>From Sept 3-Oct 5 2020, 1350 cases linked to 1212 (1.8%) Italian schools were reported on an open access database that covers media reports of school cases. This included: 1059 students, 145 teachers and 146 others.</p> <p>Of schools reporting cases, 92.7% had 1 case; 1 cluster of 10 or more students (secondary school) was identified.</p> <p>Students made up a greater proportion of total cases in middle and secondary schools, compared to nursery/kindergartens, primary schools, and peer schools.</p>	<p>Low; <i>PREPRINT</i></p>

<p>Okarska-Napierala, M., Mańdziuk, J., & Kuchar, E. (2020). SARS-CoV-2 Cluster in Nursery, Poland. <i>Emerging Infectious Disease</i>, 27(1).</p>	<p>Oct 9, 2020</p>	<p>Case Report</p>	<p>Poland</p>	<p>Childcare</p>	<p>Following lockdown, a childcare facility reopened on May 18. The facility was closed on May 31 following a staff worker's contact with a symptomatic COVID-19 case (family member). The staff member tested positive on Jun 4. Subsequent testing of 2 initial case patients and 104 contacts found positive cases for:</p> <ul style="list-style-type: none"> • 4 nursery workers (1 who was also a parent of a child at the facility) • 3 children of staff • 8 children attending the facility • 3 siblings of those children • 8 parents • 1 grandparent <p>Overall positivity rate was 27%.</p>	<p>Low</p>
<p>Gilliam, W.S., Malik, A.A., Shafiq M., Klotz, M., Reyes, C., Humphries, J.E., ... Omer, S.B. (2020). COVID-19 Transmission in US Child Care Programs. <i>Pediatrics</i>. Epub ahead of print.</p>	<p>Oct 1, 2020</p>	<p>Cross-sectional</p>	<p>United States</p>	<p>Childcare</p>	<p>Among 57,335 childcare providers who participated in the study:</p> <ul style="list-style-type: none"> • 51.4% reported their childcare facility closed near the start of the pandemic and remained closed. • 48.6% reported their childcare facility did not close, closed but had reopened, or closed at a later date due to a confirmed or suspected case of COVID-19. <p>No association was found between exposure to child care and COVID-19 in both unmatched (OR=1.06; 95% CI 0.82 to 1.38, p=0.66) and matched (OR=0.94; 95% CI 0.73 to 1.21, p=0.64) analyses.</p> <p>Childcare centres that were open reported high rates of infection mitigation strategies such as increased cleaning, cohorting and smaller group sizes. Findings must also be interpreted in the context of community transmission rates.</p>	<p>Moderate</p>

<p>Otte im Kampe, E., Lehfeld, A. S., Buda, S., Buchholz, U., & Haas, W. (2020). Surveillance of COVID-19 school outbreaks, Germany, March to August 2020. <i>Eurosurveillance</i> 25(38).</p>	<p>Sep 24, 2020</p>	<p>Prevalence</p>	<p>Germany</p>	<p>Schools</p>	<p>From Jan 28 and Aug 31 2020, 48 outbreaks (0.5% of all in Germany) occurred in schools.</p> <p>Of the 216 cases:</p> <ul style="list-style-type: none"> • 102 (47.2%) were in adults age >21 • 39 (18.1%) in students aged 15-20 • 45 (21.8%) in students aged 11-14 • 30 (13.9%) in students aged 6-10 <p>5 school outbreaks were linked to outbreaks in other settings.</p> <p>In 10 outbreaks (21%), only adult cases occurred. In 29 outbreaks (60%), only one grade was affected.</p> <p>Most outbreaks had a small number of cases; only 2 outbreaks (both prior to school lockdown) had >10 cases. Thus, while there is some indication of transmission in schools, relative to the number of staff and students, data suggests this transmission is limited.</p>	<p>High</p>
<p>Ulyte, A., Radtke, T., Abela, I.R., Haile, S.R., Blankenberger, J., Jung, R., ... Kriemler, S. (2020). Variation in SARS-CoV-2 seroprevalence in school-children across districts, schools and classes. <i>Preprint</i>.</p>	<p>Sep 18, 2020</p>	<p>Prevalence</p>	<p>Zurich, Switzerland</p>	<p>Schools</p>	<p>From Jun 16 – Jul 9, 2020, testing of 2585 children in 55 randomly selected schools found a seroprevalence rate of 2.8% (95% CI 1.6-4.1%). Participation rate was 45% (5% to 94% across classes).</p> <p>Seroprevalence rates were higher in younger children:</p> <ul style="list-style-type: none"> • Grades 1-2 = 3.8% (95% CI 1.9-6.1%) • Grades 4-5 = 2.5% (95% CI 1.1-4.2%) • Grades 7-8 = 1.5% (95% CI 0.5-3.0%) <p>Seroprevalence rates were similar in adults, however PCR confirmed cases were much higher for adults (0.24% vs 0.03%).</p> <p>The number of classes with seropositive children was very small suggesting little evidence of major school transmission.</p> <p>Schools were closed between Mar 16 and May 10, 2020.</p>	<p>Moderate; <i>PREPRINT</i></p>

<p>Fong, M.W., Cowling, B.J., Leung, G.M., & Wu, P. (2020). Letter to the editor: COVID-19 cases among school-aged children and school-based measures in Hong Kong, July 2020. <i>Eurosurveillance</i> 25(37).</p>	<p>Sep 17, 2020</p>	<p>Case Report</p>	<p>Hong Kong</p>	<p>Schools</p>	<p>Secondary schools returned late May and primary schools in early Jun. Schools closed again Jul 12 (summer break). By Jul 18 there were 20 cases in children aged 5-17 years.</p> <p>15 cases were linked to household or community clusters, or unknown source. 5 cases linked to a secondary school cluster and tutorial center cluster.</p> <p>School wide testing occurred for 7/15 cases, and the two school/tutorial center clusters. No other cases in this age range have been linked to the 20 cases.</p>	<p>Moderate</p>
<p>Lopez, A.S., Hill, M., Antezano, J., Vilven, D., Rutner, T., Bogdanow, L., ... Tran, C.H. (2020). Transmission dynamic of COVID-19 outbreaks associated with child care facilities – Salt Lake City, Utah, April-July 2020. <i>Morbidity and Mortality Weekly Report</i> 69(37): 1319–1323.</p>	<p>Sep 11, 2020</p>	<p>Case Series</p>	<p>Utah, United States</p>	<p>Childcare facilities and day camps for school-aged children</p>	<p>From Apr 1 – Jul 10 Salt Lake County, Utah identified 17 childcare facilities with at least two confirmed COVID-19 cases; this report describes 3.</p> <p>Amongst 101 staff and children, 22 confirmed cases identified (10 staff, 12 children). Amongst 83 close contacts, 9 confirmed (2 adult, 7 pediatric) and 7 probable (2 adult, 5 pediatric) cases were identified.</p> <p>Facility attack rates ranged from 17%-100%. Overall attack rates ranged from 7%-36%.</p> <p><u>Facility A:</u> (temperature checks, frequent cleaning, staff masks); 12 staff and children, 15 close contacts, 2 confirmed adult cases, no transmission to/from children; index case staff</p> <p><u>Facility B:</u> (temperature checks, frequent cleaning, staff masks); 5 staff and children in setting all tested positive, of 28 close contacts 2 confirmed and 3 probable cases; likely transmission from children to household; index case staff</p> <p><u>Facility C:</u> (home temperature and symptom screening requested, no masks); 84 staff and children, 15 confirmed cases ; 40 close contacts had 5 confirmed and 2 probable cases; likely transmission from children; index case unknown</p>	<p>High</p>

<p>Ehrhardt, J., Ekinci, A., Krehl, H., Meincke, M., Finci, I., Klein, J., ... Brockmann, S.O. (2020). Transmission of SARS-CoV-2 in children aged 0 to 19 years in childcare facilities and schools after their reopening in May 2020, Baden-Württemberg, Germany. <i>Eurosurveillance</i> 25(36): pii=2001587.</p>	<p>Sep 10, 2020</p>	<p>Prevalence</p>	<p>Germany</p>	<p>Children's homes, childcare, schools</p>	<p>557 confirmed cases in children 0-19 in Baden-Württemberg, Germany May 25 - Aug 5, 1 week after opening to 1 week after summer closure. School data available for 453 cases; 137 attended school or childcare for at least 1 day during infectious period.</p> <p>Source of transmission was primarily household (41.9%), followed by event (8.4%), school or childcare (3.3%), church (3.1%), travel (1.1%). 41.3% had unknown source, but unlikely to be school or childcare due to close examination of close contacts.</p> <p>In a school or childcare setting, 11 cases were infected by another pupil and 4 cases infected by a teacher.</p> <p>Across settings, group sizes reduced by 50%, enhanced cleaning, ventilation, exclusion of sick children and hand hygiene. Masks not required for students in the class but were required outside for some primary and secondary schools. Physical distancing only required for secondary school.</p>	<p>Moderate</p>
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<p>Link-Gelles, R., DellaGrotta, A.L., Molina, C., Clyne, A., Campagna, K., Lanzieri, T.M., ... Bandy, U. (2020). Limited Secondary Transmission of SARS-CoV-2 in Child Care Programs -Rhode Island, June 1- July 31, 2020. <i>Morbidity and Mortality Weekly Report</i> 69(34): 1170-1172.</p>	<p>Aug 28, 2020</p>	<p>Case Series</p>	<p>Rhode Island, United States</p>	<p>Childcare</p>	<p>Childcare programs re-opened on Jun 1, 2020; data presented on all possible childcare-associated COVID-19 cases to Jul 31, 2020.</p> <p>52 positive/probable cases of 101 possible cases reported:</p> <ul style="list-style-type: none"> • 30 (58%) children (median age = 5 years) • 22 (42%) adults (20 teachers, 2 parents) <p>Cases occurred in 29 (4.4%) of 666 re-opened childcare programs:</p> <ul style="list-style-type: none"> • 20 programs (69%) had a single case with no secondary transmission • 5 programs (15%) had 2-5 cases with no secondary transmission • 4 programs (0.6%) had possible secondary transmission <p>Among 4 programs with possible secondary transmission:</p> <ul style="list-style-type: none"> • Program #1: 5 children, 4 staff, 1 parent; 60 children and 21 staff quarantined • Program #2: 3 confirmed cases; 26 students and 17 staff quarantined • Program #3: 2 cases; appear un-linked but cannot confirm • Program #4: 1 staff, 1 child; 37 students and 16 staff quarantined <p>In programs where secondary transmission likely took place, epidemiologic investigations identified lack of adherence to Department of Health guidelines (e.g., movement between groups/classrooms).</p>	<p>Moderate</p>
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<p>Blaisdell, L.L., Cohn, W., Pavell, J.R., Rubin, D.S. & Vergales, J.E. (2020). Preventing and Mitigating SARS-CoV-2 Transmission – Four Overnight Camps, Maine, June-August 2020. <i>Morbidity and Mortality Weekly Report</i> 69(35): 1216-1220.</p>	<p>Aug 26, 2020</p>	<p>Case Report</p>	<p>Maine, United States</p>	<p>Overnight camps</p>	<p>642 children and 380 staff members (aged 7-70 years) attended 4 overnight camps from Jun to Aug 2020.</p> <p>12 attendees (11 children and 1 staff) were identified as having COVID-19 related signs or symptoms during daily screening checks. All tested negative.</p> <p>Three asymptomatic attendees tested positive for SARS-CoV-2 after camp arrival (1 child, 2 staff). They were immediately isolated, and respective cohorts quarantined. No secondary transmission was identified.</p> <p>Preventative measures included prearrival quarantine, pre- and post-arrival testing and symptom screening, cohorting, face coverings, physical distancing, enhanced hygiene, cleaning and disinfecting and maximal outdoor programming.</p>	<p>Moderate</p>
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<p>Ismail, S.A., Saliba, V., Lopez Bernal, J., Ramsay, M.E., & Ladhani, S.N. (2020). SARS-CoV-2 infection and transmission in educational settings: cross-sectional analysis of clusters and outbreaks in England. <i>Preprint</i>.</p>	<p>Aug 24, 2020</p>	<p>Cross-sectional</p>	<p>England</p>	<p>Preschools, primary, secondary, schools</p>	<p>From Jun 1-30, 2020, Public Health England conducted enhanced surveillance including daily monitoring of school. Staggered reentry ranged from 475 000 to 1 646 000 children attended 20 500 to 23 400 settings.</p> <p>101 reports of confirmed 70 cases in children and 128 cases in staff:</p> <ul style="list-style-type: none"> • 67 reports involved a single case with no secondary transmission • 4 reports described co-primary cases (cases coming from the same household, all asymptomatic but identified through contact with a known household case) • 30 reports confirmed outbreaks of ≥ 2 cases • Outbreaks: • 53% of confirmed outbreaks involved only one secondary case linked to the index case • Probably transmission was staff-to-staff (n = 15), staff-to-student (n = 7), student-to-staff (n = 6) and student-to-student (n = 2) <p>Number of outbreaks was correlated with community infection rates.</p> <p>Rates of infection were highest in youngest children:</p> <ul style="list-style-type: none"> • Early years: 9.9 per 100,000 students/day (CI=6.2-15.0) • Primary: 8.3 per 100,000 students/day (CI=6.0-11.0) • Secondary: 2.0 per 100,000 students/day (CI=0.24-7.1) • Staff: 20.6 per 100,000 staff/day (CI=16.9-24.9) <p>Rates of outbreaks highest in primary schools:</p> <ul style="list-style-type: none"> • Early years: 0.51 outbreaks per 1,000 settings/month (CI=0.05-0.80) • Primary: 4.8 outbreaks per 1,000 settings/month (CI=0.20-1.04) • Secondary: 1.6 outbreaks per 1,000 settings/month (CI=0.58-3.4) 	<p>Moderate; <i>PREPRINT</i></p>
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<p>European Centre for Disease Prevention and Control (2020, Aug 6). COVID-19 in children and the role of school settings in COVID-19 transmission.</p>	<p>Aug 6, 2020</p>	<p>Cross-sectional</p>	<p>Europe and UK</p>	<p>Preschools, schools</p>	<p>15 of 31 European and UK countries responded to a telephone survey about cases or outbreaks in schools:</p> <ul style="list-style-type: none"> • 4 countries reported no cases in schools • 5 reported individual cases in students or staff with no secondary transmission • 5 countries reported limited clusters of <10 cases in school settings involving few secondary cases • 1 country reported a cluster of ≥10 cases in a school setting (4 students, 9 staff) <p>Countries which had reopened schools did not see an increase in cases.</p>	<p>Low</p>
<p>Yoon, Y., Kim, K.R., Park, H., Kim, S.Y., & Kim, Y.J. (2020). Stepwise School Opening Online and Offline and an Impact on the Epidemiology of COVID-19 in the Pediatric Population. <i>Preprint.</i></p>	<p>Aug 4, 2020</p>	<p>Prevalence</p>	<p>Korea</p>	<p>Schools</p>	<p>Report of phased school opening for all grades from May 20 to Jun 8, data collected to Jul 11. Proportion of pediatric cases nationally remained constant (~7.0%).</p> <p>A total of 45 children had confirmed COVID-19 cases in 40 schools. Additional testing of more than 11,000 students found only one additional case.</p> <p>71.1% of cases had known source of infection; 78% of known sources were family. Older children were more likely to have unknown source. Younger children were more likely to be infected by a family member.</p>	<p>Moderate; <i>PREPRINT</i></p>

<p>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>, 4(11), 807-816.</p>	<p>Aug 3, 2020</p>	<p>Cohort</p>	<p>New South Wales, Australia</p>	<p>Daycare, primary and secondary school</p>	<p>From Jan 25 to Apr 10, all lab-confirmed COVID-19 cases in children or staff who attended school or daycare within 24h of symptom onset.</p> <p>15 adults, 12 children (8 secondary school, 1 primary school, 3 daycare) attended while infectious.</p> <p>Of 1448 close contacts identified, 43.7% had RT-PCR testing. Secondary transmission occurred in 4 of 25 settings.</p> <p>In schools, 5 secondary cases (3 children, 2 adults) were identified in 3 schools.</p> <p>No secondary transmission occurred in 9 of 10 daycares, however one outbreak was identified where 6 adults and 7 children were infected.</p> <p>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%.</p>	<p>Moderate</p>
<p>National Centre for Immunisation Research and Surveillance. (2020, Jul 31). COVID-19 in schools and early childhood education and care services – the Term 2 experience in NSW.</p>	<p>Jul 31, 2020</p>	<p>Cohort</p>	<p>Australia</p>	<p>Daycare, primary school, secondary school</p>	<p>Surveillance data from Apr 10 to Jul 3 while all daycares were open, and schools were undergoing gradual reopening. Schools were fully reopened with face to face learning by May 25.</p> <p>Daycare:</p> <ul style="list-style-type: none"> • 1 child with confirmed COVID-19 had contact with 84 students and 18 staff in school • 82% of contacts were tested; none tested positive <p>Primary school:</p> <ul style="list-style-type: none"> • 1 child with confirmed COVID-19 had contact with 15 students and 4 adults in school • 57% of contacts were tested; none tested positive <p>Secondary school:</p> <ul style="list-style-type: none"> • 2 adolescents with confirmed COVID-19 had contact with a total of 165 students and 23 adults in school • 55% of contacts were tested; none tested positive 	<p>Moderate</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> 69(31): 1023-1025.</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 Jun 17-20. 363 campers and 3 staff joined on Jun 21.</p> <p>On Jun 22 a staff member developed symptoms, on Jun 23 left the camp and on Jun 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>
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<p>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.</p>	<p>Jul 23, 2020</p>	<p>Prevalence</p>	<p>Israel</p>	<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 extra-curricular activities (e.g., sports and dance classes).</p>	<p>Within 10 days of schools reopening an outbreak among secondary 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>	<p>Low</p>
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<p>Public Health Agency of Sweden. (2020, Jul 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 Mar 2020.</p> <p>In Sweden only secondary and post-secondary schools were closed.</p>	<p>As of Jun 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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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> .	Jun 26, 2020	Cohort	Germany Denmark Norway Sweden	Community Preschool, primary school, secondary school infection control measures vary by country.	<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.</p> <p>Reopening of schools among younger student groups and those participating in exams did not result in a significant increase in rates of COVID-19.</p> <p>In countries with low community transmission of COVID-19, return of all students did not appear to increase transmission.</p> <p>The return of older students in a country of high community transmission levels appeared to increase transmission among students but not staff.</p>	Moderate; <i>PREPRINT</i>
Yung, C.H., Kam, K., Nadua, K.D., Chong, C.Y., Tan, N.W.H., Li, J., ... Ng, K.C. (2020). Novel coronavirus 2019 transmission risk in educational settings . <i>Clinical Infectious Diseases</i> . Epub ahead of print.	Jun 25, 2020	Case report	Singapore	Preschool, secondary school	<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 	High
Folkhälsomyndigh etc. (2020, May 27). Förekomst av covid-19 i olika yrkesgrupper .	May 27, 2020	Prevalence	Sweden	Preschool, primary school, secondary school	<p>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.</p> <p>Notably, Sweden has not implemented nationwide lockdown measures.</p>	Moderate

Data collected prior to school lockdown measures						
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>	Jul 30, 2020	Case report	Finland	Primary school, other school not noted. Infection control procedures not reported.	Case A (age 12) tested positive for COVID-19 in early Mar after attending school and team sports with minor symptoms since late Feb. 89 of 121 close school and sport contacts tested; no secondary cases identified. Case B (school staff) attended work for 2 days while symptomatic. 51 of 63 close contacts tested for antibodies >28 days post-exposure. 6 of 42 students, 1 of 9 teachers were positive for IgG antibodies. 2 students had confirmed case 7- and 6-days post-exposure, 1 student had confirmed COVID-19 >26 days post-exposure, thus source was unconfirmed. Secondary attack rate for household and extended contacts for students was 17%. Secondary attack rate for staff was 100% (spouse and two children contacts).	High; <i>PREPRINT</i>
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.	Jul 10, 2020	Prevalence	Chile	Private school with 14 grade levels experiencing an outbreak following a week of parent-teacher nights. Index case was a staff member. No infection control measures were reported.	There were 52 confirmed cases in students (15%), staff (35%) and parents (52%). Positive antibody tests were higher amongst teachers (20.6%) compared to support staff (7.1%) and students (9.9%) two months later. 1,009 of 2,616 students (aged 4 – 18) participated: <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 secondary school students (5.7%; CI: 3.6-8.9) Students were more likely to have contracted COVID-19 from home caregivers and household relatives than classmates or teachers.	Moderate

<p>Brown, N.E., Bryant-Genevier, J., Bandy, U., Browning, C.A., Berns, A.L., ... Watson, J. (2020). Antibody Responses after Classroom Exposure to Teacher with Coronavirus Disease, March 2020. <i>Emerging Infectious Diseases</i> 26(9).</p>	<p>Jun 29, 2020</p>	<p>Cross-sectional</p>	<p>United States</p>	<p>Secondary school</p>	<p>A symptomatic teacher, who had taught 16 different classes during Feb 24-27, tested positive for COVID-19 on Mar 1.</p> <p>Among 21 students who had contact with the teacher, and who volunteered to participate in a serologic survey, results for only two students suggested previous SARS-CoV-2 infection (both positive and indeterminate results).</p>	<p>Low</p>
<p>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>.</p>	<p>Jun 29, 2020</p>	<p>Retrospective cohort</p>	<p>France</p>	<p>Primary school</p> <p>No infection control measures were reported.</p> <p>Schools had been shut down for 4 weeks prior to antibody testing.</p>	<p>510 of 1047 students (aged 6–11 years) at a primary school consented to testing for antibodies to the virus that causes COVID-19:</p> <ul style="list-style-type: none"> • 45 of 510 (8.8%) tested positive for antibodies • 11.9% parents tested positive for antibodies <p>No information was reported on index cases.</p>	<p>Moderate; <i>PREPRINT</i></p>

<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.</p>	<p>May 28, 2020</p>	<p>Case report</p>	<p>Ireland</p>	<p>Primary school, secondary school</p> <p>No infection control measures in place. Sports, music and choir practice continued.</p>	<p>3 children aged 10–15 with COVID-19 attended one primary and two secondary schools:</p> <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 <p>No contacts tested positive.</p>	<p>Moderate</p>
<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>No infection control measures reported. 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; <i>PREPRINT</i></p>

<p>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, February 2020. <i>Clinical Infectious Diseases</i> 71(15): 825-832.</p>	<p>Apr 11, 2020</p>	<p>Case report</p>	<p>France</p>	<p>Primary schools</p> <p>No infection control measures at the schools were reported. Schools were closed upon identification of the case.</p>	<p>1 child aged 9 years with COVID-19 attended 3 primary schools:</p> <ul style="list-style-type: none"> • The child had 86 contacts • 55 contacts developed symptoms and were tested; none tested positive 	<p>High</p>
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Table 2: In-progress Single Studies

Title	Anticipated Release Date	Setting	Description of Document
New evidence reported December 18, 2020			
Duysburgh, E. & Vermeulen, M. (2020). Prevalence and Incidence of Antibodies Against SARS-CoV-2 in Children Measured for One Year in Belgium: a Sero-epidemiological Prospective Cohort Study.	Aug 31, 2021	Schools	This study will determine the seroprevalence and seroconversion of antibodies against SARS-CoV-2 in primary and secondary school-aged children at different time points.
Previously reported evidence			
Assistance Publique - Hôpitaux de Paris. (2020). COVID-19 Infection and Transmission in Exposed, Confined and Community-based Infants (COVIDOCRECHE).	Estimated study completion date: Jun 2, 2021	Hospitals, Childcare centres for healthcare workers' children	This study will measure rates of COVID-19 cases and presence of anti-SARS-CoV2 antibodies in children of healthcare workers attending childcare, childcare staff, and hospital laboratory and administrative workers.
German Clinical Trials Register. (2020). Prospective Study initiated by University Hospital Rostock concerning COVID-19 in mothers, nursery and school teachers of children in Rostock.	N/A	Childcare, schools	This study will measure prevalence of COVID-19 and associated antibodies in mothers, childcare nurses and teachers, and school teachers over the period of 12 months.
Charité. (2020). Berlin's testing strategy – Charité starts screening program for staff from childcare centers and school-based study.	N/A	School	Through this study, primary and secondary school children and staff will undergo testing at regular intervals over 12 months.

Table 3: Syntheses

Reference	Date Released	Included Studies Relevant to Transmission by Children in Daycares and Schools	Review Conclusions	Quality Rating
New evidence reported December 18, 2020				
Suk, J.E., Vardavas, C., Nikitara, K., Phalkey, R., Leonardi-Bee, J., Pharris, A., ... Semenza, J.C. (2020). The role of children in the transmission chain of SARS-CoV-2: a systematic review and update of current evidence. <i>Preprint.</i>	Nov 9, 2020 (Search completed Aug 31, 2020)	Heavey, 2020 Danis, 2020 Yung, 2020 Macartney, 2020 Stein-Zamir, 2020 Link-Gelles, 2020 Koo, 2020 Zhang, 2020 Bayham, 2020 Kim, 2020 Chin, 2020 Abdollahi, 2020 Prem, 2020 Auger, 2020	There was limited to no evidence of secondary transmission among school contacts. One outbreak following school re-opening was attributed to crowded classes, no masks, and the use of air conditioning. Conversely, another study showing limited transmission after re-opening attributed success to class distancing, use of masks for adults, daily screening, and disinfection.	Moderate; PREPRINT
Previously reported evidence				
Goldstein, E., Lipsitch, M., & Cevik, M. (2020). On the effect of age on the transmission of SARS-CoV-2 in households, schools and the community. <i>The Journal of Infectious Diseases.</i> Epub ahead of print.	Oct 29, 2020 (Search completed Oct 5, 2020)	Ehrhardt, 2020 Fontantet, 2020a Fontantet, 2020b Macartney, 2020 Stein-Zamir, 2020 Torres, 2020 Otte im Kampe 2020 Salt Lake County, 2020.	Some evidence that no/limited mitigation strategies (eg crowded classrooms) are associated with spread of SARS-CoV-2 in secondary schools. However, introduction of mitigation strategies may prevent outbreaks.	Low
Xu, W., Li, X., Dozier, M., He, Y., Kirolos, A., Lang, Z., ... Theodoratou, E. (2020). What is the evidence for transmission of COVID-19 by children in schools? A living systematic review. <i>Preprint.</i>	Oct 14, 2020 (Search completed Sep 14, 2020)	Danis, 2020 Heavey, 2020 Yung, 2020 NCIRS, 2020 Macartney, 2020 Torres, 2020 Armann, 2020 Desmet, 2020 Fontanet, 2020a Fontanet, 2020b Stein-Zamir, 2020	Five cohort studies found 18 secondary cases in 3345 contacts. Six cross-sectional studies reported 639 COVID-19 cases from 6682 participants tested. The authors calculated the pooled attack rate to be 0.08% (95% CI: 0.00-0.86). Quality of evidence (based on 5 cohort studies and 6 cross sectional studies) was low, but suggests that students have lower infection attack rates and positivity rates, compared to staff.	Moderate; PREPRINT

Health Information and Quality Authority. (2020, Aug 21). Evidence summary for potential for children to contribute to transmission of SARS-CoV-2.	Aug 21, 2020 (Search completed Aug 10, 2020)	Desmet, 2020 Dub, 2020 Fontanet, 2020a Heavey, 2020 Macartney, 2020 Stein-Zamir, 2020	Based on low certainty evidence, transmission from child-to-adult or child-to child does occur in household and education settings, but transmission rates for children are low. Three studies with nine cases and 1036 close contacts confirmed secondary transmission. Three studies with 74 confirmed cases across 66 facilities to over 13 000 close contacts identified 198 confirmed cases.	Low
Alberta Health Services. (2020, Aug 7). COVID-19 Scientific Advisory Group Rapid Evidence Report.	Aug 7, 2020 (Search completed Jun 10, 2020)	Number of studies not reported, included scientific evidence and news media reports	Exposed children in schools and daycares appear to be less infected than exposed adults in other settings. There is no evidence to suggest that transmission to teachers and staff is higher than community-based transmission. Transmission appears to be lower for younger children and may be higher for older children and teens in school settings; transmission can be limited if public health precautions are in place.	Moderate
Public Health England. (2020, Jul 28). Transmission of COVID-19 in school settings and interventions to reduce the transmission: a rapid review.	Jul 28, 2020 (Search completed Jun 18, 2020)	Danis, 2020 Fontanet, 2020a NCIRS, 2020	Transmission of COVID-19 within school settings is low, however additional research is needed to understand the role of schools in transmission of COVID-19.	Moderate
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, 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)	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</i> , 4(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
Ludvigsson, J.F. (2020). Children are unlikely to be the main drivers of the COVID-19 pandemic – A systematic review . <i>Acta Paediatrica</i> 109(8), 1525-1530.	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
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.	Apr 30, 2020 (Search completed Apr 22, 2020)	Fontanet, 2020a NCIRS, 2020 Viner, 2020a	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.	Low
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.	Apr 6, 2020 (Search completed Mar 19, 2020)	None included in Table 1. This review included studies from pandemics prior to COVID-19.	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.	Low

Table 4: In-progress Syntheses

Title	Anticipated Release Date	Setting	Description of Document
Previously reported evidence			
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.	Unknown; completed but not published	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.
Chatterji, M., Kitamura, K., Muenig, P., Willson, G.E., De Leon Jr., R., & Allegrante, J.P. (2020). <i>The relative effectiveness of multilevel interventions in reducing risks of transmission of lethal viruses in Grade K-12 school communities and school linked populations: a systematic review and best-evidence synthesis</i> . PROSPERO, CRD42020201930.	Aug 29, 2020	School and school-linked populations	This review will report on the relative efficacy of multilevel intervention in reducing risks of COVID-19 and other lethal viruses among kindergarten to grade 12 school communities and in school linked populations.
Bhamani, S., Tabani, A., Ahmed, D., & Saleem, A. (2020). <i>A rapid systematic review on COVID transmission trends in children on schools reopening in lower middle income countries</i> . PROSPERO, CRD42020204925.	Feb 28, 2021	Schools	This review will summarize virus transmission among children and outbreaks occurring after schools re-open in lower middle-income countries.

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 December 18, 2020					
Suk, J.E., Vardavas, C., Nikitara, K., Phalkey, R., Leonardi-Bee, J., Pharris, A., ... Semenza, J.C. (2020). The role of children in the transmission chain of SARS-CoV-2: a systematic review and update of current evidence. <i>Preprint.</i>	Nov 9, 2020 (Search completed Aug 31, 2020)	8 observational studies reporting child-to-adult transmission in: <ul style="list-style-type: none"> community (1 case study, 1 ecological study) household (6 studies) 	Transmission by children appears lower than adults, and is higher within household settings than community settings, especially when physical distancing measures are in place in community settings.	Moderate; PREPRINT	Not reported
Zhu, Y., Bloxham, C., Hulme, K., Sinclair, J., Tong, Z.W.M., Steele, L.E., ... Short, K. (2020). Children Are Unlikely to Have Been the Primary Source of Household SARS-CoV-2 Infections. <i>Preprint.</i>	Apr 9, 2020 (Search completed Mar 18, 2020)	40 studies, in addition to case information obtained from local news sources, that described SARS-CoV-2 infection in children (settings not described)	Of 31 total household transmission clusters (across China, Singapore, USA, Vietnam, South Korea), 3 (9.7%) were identified as having a pediatric index case. The low number of pediatric index cases could be influenced, in part, by asymptomatic children (19% of all pediatric cases in this review) going undetected as index cases.	Low; PREPRINT	Not reported

Previously reported evidence					
Goldstein, E., Lipsitch, M., & Cevik, M. (2020). On the effect of age on the transmission of SARS-CoV-2 in households, schools and the community . <i>The Journal of Infectious Diseases</i> . Epub ahead of print.	Oct 29, 2020 (Search completed Oct 5, 2020)	14 studies across multiple settings <ul style="list-style-type: none"> • 1 hospital based study • 8 household based study • 5 settings unspecified <p>3 studies looked at age variation in infectivity</p>	<p>Studies generally found lower secondary attack rates in children who were contacts, although a few studies found secondary attack rates were similar across child and adult contacts. Challenges in identifying the true index case, and higher potential exposure scenarios in adults compared to children are listed as two factors that may bias results across studies.</p> <p>Several studies indicate that infectivity may increase with age, although findings are overall inconclusive.</p>	Low	Not reported
Koh, W.C., Naing, L., Chaw, L., Rosledzana, M.A., Alikhan, M.F., Jamaludin, S.A., ... Wong, J. (2020). What do we know about SARS-CoV-2 transmission? A systematic review and meta-analysis of the secondary attack rate and associated risk factors . <i>PLoS ONE</i> , 15(10), e0240205.	Oct 8, 2020 (Search completed Jul 25, 2020)	57 studies across multiple settings: <ul style="list-style-type: none"> • 43 studies in households • 18 studies in healthcare settings • 17 studies in other settings 	<p>In households, adult close contacts were more likely to be infected than children (RR =1.71; 95% CI: 1.35 - 2.17).</p> <p>The secondary attack rate (SAR) was significantly higher in adults (33.3%; 95% CI: 24.4% - 42.1%) than in children (16.9%; 95% CI: 10.9% - 22.9%).</p>	Moderate	High
Viner, R.M., Mytton, O.T., Bonell, C., Melendez-Torres, G.J., Ward, J.L., Hudson, L., ... Eggo, R. (2020b). Susceptibility to SARS-CoV-2 Infection Among Children and Adolescents Compared With Adults A Systematic Review and Meta-analysis . <i>JAMA Pediatrics</i> . Epub ahead of print.	Sep 25, 2020 (Search completed Jul 28, 2020)	32 studies <ul style="list-style-type: none"> • 18 contact tracing • 14 population-screening 	<p>Lower secondary attack rates in children and adolescents compared to adults in 11 studies, however some confidence intervals were wide. No differences were found in 3 studies. One study found a higher secondary attack rate in those < 19 than adults.</p> <p>Lower seroprevalence was found in children compared to adults but was similar between adolescents and adults.</p>	Low	Moderate

Health Information and Quality Authority. (2020, Aug 21). Evidence summary for potential for children to contribute to transmission of SARS-CoV-2.	Aug 21, 2020 (Search completed Aug 10, 2020)	19 studies of household and close contact transmission involving children.	10 of 19 studies reported child to adult or child to child transmission, although at very low rates. Accuracy of reporting is of concern and it is possible recording of cases may be incomplete and errors in ascertaining direction of transmission.	Low	Low-moderate
Alberta Health Services. (2020, Aug 7). COVID-19 Scientific Advisory Group Rapid Evidence Report	Aug 7, 2020 (Search completed Jun 10, 2020)	Number of included studies not reported; data presented comes from case reports, case series, cross-sectional, cohort studies and media reports.	Transmission is most from symptomatic adults to other adults or children. Child to adult transmission appears to be lower based on epidemiologic studies from multiple countries, particularly for children <10 years old. An estimated 1.33 cases per exposure to a pediatric case and 5.79 cases per exposure to an adult case.	Moderate	Not reported
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.	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%). An analysis of attack rates from child index cases was not conducted due to the limited available data.	Low; PREPRINT	Not reported

<p>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.</p>	<p>Jul 5, 2020 (Search completed Jun 25, 2020)</p>	<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>	<p>Low</p>	<p>Not reported</p>
<p>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</i>, 10(1), 011101.</p>	<p>Jul 3, 2020 (Search completed Apr 30, 2020)</p>	<p>16 primary studies:</p> <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 	<p>One case report describes presumed transmission from an infant to its parents.</p> <p>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.</p>	<p>Low</p>	<p>Not reported</p>
<p>Usher Institute. (2020, Jul 2). Summary: What is the evidence for transmission of SARS-COV-2 by children [or in schools]?</p>	<p>Jul 2, 2020, (Search completed Jun 21, 2020)</p>	<p>83 primary studies:</p> <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 	<p>Overall, there is limited evidence of transmission of COVID-19 from children to others.</p> <p>Children can become infected through exposure to confirmed cases, most often through household contacts or those with recent travel history.</p> <p>There appears to be a linear relationship between age and likelihood of transmitting COVID-19 in those age 1-19.</p>	<p>Low</p>	<p>Not reported</p>

<p>Rajmil, L. (2020). Role of children in the transmission of the COVID-19 pandemic: a rapid scoping review. <i>BMJ Paediatrics Open</i>, 4(1), e000722.</p>	<p>Jun 21, 2020 (Search completed May 28, 2020)</p>	<p>14 primary studies:</p> <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 	<p>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.</p>	<p>Low</p>	<p>Not reported</p>
<p>Institut national de sante publié 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> 109(8), 1525-1530.</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>

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</i> . Epub ahead of print.	May 11, 2020 (Search completed Mar 9, 2020)	24 primary studies: <ul style="list-style-type: none"> • 20 studies assessing prevalence, symptoms and outcomes in children • 4 case reports of transmission involving children 	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.	Moderate	Not reported
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.	Apr 30, 2020 (Search completed Apr 22, 2020)	9 case series or case reports and one narrative review related to the likelihood of children transmitting COVID-19 to others.	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. 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.	Low	Not reported
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> 81(2), e11–e15.	Apr 28, 2020 (Search completed Apr 3, 2020)	406 case reports of children up to 16 years of age diagnosed with COVID-19.	Among the included case reports, nearly half of cases were asymptomatic or had only mild symptoms. 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.	Low	Low

Table 6: In-progress Syntheses

Title	Anticipated Release Date	Setting	Description of Document
Previously reported evidence			
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. (2020). The control and prevention of COVID-19 transmission in children: a protocol for systematic review and meta-analysis. PROSPERO, CRD42020179263.	Nov 1, 2020	Home	This review will summarize the role of children in COVID-19 Community transmission.
Bockey, A., Torres, J., Hausner, E., Waffenschmidt, S., Beckmann, L., Chuermann, C., & Lange, B. (2020). The direct and indirect effects of COVID-19 and COVID-19 control measures on children: a systematic review. PROSPERO, CRD42020209327.	Dec 31, 2020	Home, community	This review will explore the direct and indirect effects of COVID-19 on children, specifically: the effect of non-pharmaceutical interventions on COVID-19 incidence (including source of transmission) and indirect impact on health and wellbeing, and effect of measures to decrease the indirect burden of disease associated with COVID-19.

Table 7: Single Studies

Reference	Date Released	Study Design	Location	Setting	Summary of Findings	Quality Rating:
New evidence reported December 18, 2020						
National Institute for Public Health and the Environment (RIVM). (2020, Dec 2). Children and COVID-19 .	Dec 2, 2020	Prevalence	Netherlands	Community	<p>From Jun 29 and Sep 6, over 62 000 contacts were traced for COVID-19 patients. Of the COVID-19 cases,</p> <ul style="list-style-type: none"> • 14 (0.3%) had an index case under age 4 • 36 (0.7%) had an index case aged 4-11 • 4.6% had an index case aged 12-17 <p>(Extensive contact tracing was not conducted from Aug to Nov given high number of reported infections.)</p> <p>Data on 7,641 (up to Sep 14) paired patients (source patient and patient they infected) showed that transmission mainly occurs between people in the same age group, with minimal transmission between parents and children.</p>	Low; NOT PEER REVIEWED
Pitman-Hunt, C., Leja, J., Jiwani, Z.M., Rondot, D., Ang, J., & Kannikeswaran, N. (2020). SARS-CoV-2 Transmission in an Urban Community: The Role of Children and Household Contacts . <i>Journal of the Pediatric Infectious Diseases Society</i> . Epub ahead of print.	Nov 27, 2020	Cohort	United States	Household	<p>From Mar 12 – Jun 15, 1264 children were tested for COVID-19; 71 (5.1%) tested positive. A household sick contact was identified in 42% of these cases; a parent was the most common index case (76%). No child-to-adult transmission was identified; child-to-child transmission was found in only 1 case.</p>	Moderate
Bi, Q., Lessler, J., Eckerle, I., Lauer, S.A., Kaiser, L., Vuilleumier, N., ... Azman, A.S. (2020). Household Transmission of SARS-COV-2: Insights from a Population-based Serological Survey . <i>Preprint</i> .	Nov 4, 2020	Cross-sectional	Switzerland	Household, community	<p>From Apr 3 to Jun 30, 4,534 members from 2,267 households were included; 6.6% individuals tested positive for antibodies and 9.8% of households had at least one seropositive member.</p> <p>Risk of transmission between members increased with age: from 7.5% among aged 5-9 years (95% CI: 1.3, 20.3) to 30.2% among aged \geq 65 years (95% CI: 14.3, 48.2), with little difference among 10-64 year olds.</p>	Moderate; PREPRINT

<p>Kuwelker, K., Zhou, F., Blomberg, B., Lartey, S., Brokstad, K.A., Trieu, M.C., ... Onyango, T.B. (2020). High attack rates of SARS-CoV-2 infection through household-transmission: a prospective study. <i>Preprint.</i></p>	<p>Nov 4, 2020</p>	<p>Cohort</p>	<p>Norway</p>	<p>Household</p>	<p>From Feb 28 to Apr 4, 112 index cases (via RT-PCR) and 179 household members were included in this study.</p> <p>Within household settings, adults <60 years old and children had similar attack rates (43% and 46%, respectively).</p>	<p>Moderate; <i>PREPRINT</i></p>
<p>Contejean, A., Leporrier, J., Canouï, E., Fourgeaud, J., Mariaggi, A.A., Alby-Laurent, F., ... Kernéis, S. (2020). Transmission routes of SARS-CoV-2 among healthcare workers of a French university hospital in Paris. France: a case-control study. <i>Preprint.</i></p>	<p>Nov 3, 2020</p>	<p>Case-control</p>	<p>France</p>	<p>Hospital</p>	<p>From Feb 24 to Apr 10, 336 healthcare workers with positive RT-PCR results and 228 negative controls were included.</p> <p>Having a child at home or in childcare facilities was not associated with a risk of COVID-19 infection.</p>	<p>High; <i>PREPRINT</i></p>
<p>Hurst, J.H., Heston, S.M., Chambers, H.N., Cunningham, H.M., Price, M.J., Suarez, L.S., ... Kelly, M.S. (2020). SARS-CoV-2 Infections Among Children in the Biospecimens from Respiratory Virus-Exposed Kids (BRAVE Kids) Study. <i>Clinical Infectious Diseases.</i> Epub ahead of print.</p>	<p>Nov 3, 2020</p>	<p>Cohort</p>	<p>United States</p>	<p>Community</p>	<p>From Apr 7 to Jul 16, 382 children aged < 21 years (median age 9.7 years) who had a close contact with an individual with confirmed COVID-19 were included in the study; 293 (77%) were infected, 89 (23%) were not.</p> <p>Children who tested positive were more likely to have been exposed to a sibling vs. those who tested negative(49% vs. 29%, p=0.001).</p>	<p>Moderate</p>

<p>Forbes, H., Morton, C.E., Bacon, S., McDonald, H.I., Minassian, C., Brown, J.P., ... Tomlinson, L.A. (2020). Association between living with children and outcomes from COVID-19: an OpenSAFELY cohort study of 12 million adults in England. <i>Preprint.</i></p>	<p>Nov 2, 2020</p>	<p>Cohort</p>	<p>England</p>	<p>Household, community</p>	<p>From Feb 1 to Aug 3, adults living with and without children in the household were compared for risk of COVID-19 infection and severe outcomes.</p> <p>Among 9,157,814 adults aged ≤ 65 years:</p> <ul style="list-style-type: none"> • Living with children aged 0-11 years was not associated with risk of COVID-19 infection, hospital or ICU admission; it was associated with reduced risk of death (HR = 0.74, 95% CI: 0.60, 0.90). • Living with children aged 12-18 years was not associated with COVID-19-related hospital or ICU admission or death from COVID-19; it was associated with an increased risk of infection (HR = 1.08, 95% CI: 1.03, 1.13). <p>Among 2,567,671 adults aged > 65 years, living with children of any age was not associated with any SARS-CoV-2 related outcomes.</p> <p>There was no change in these risk levels comparing periods before and after school closures.</p>	<p>High; <i>PREPRINT</i></p>
<p>Heudorf, U., Steul, K., & Gottschalk, R. (2020). Sars-Cov-2 in children – insights and conclusions from the mandatory reporting data in Frankfurt am Main, Germany, March–July 2020. <i>GMS Hygiene and Infection Control</i> 15(24).</p>	<p>Oct 9, 2020</p>	<p>Prevalence</p>	<p>Germany</p>	<p>Household, community</p>	<p>From Mar 1 to Jul 31, 1977 infected people were reported, including 138 children aged 0-14 years.</p> <p>The age-related incidence in children was lower than the general population (256/100 000):</p> <ul style="list-style-type: none"> • 0-4 years, 142/100,000 • 5-9 years, 132/100,000 • 10-14 years, 178/100,000 <p>Clusters of children from refugee accommodations and parish outbreaks were excluded; 90 cases were included.</p> <ul style="list-style-type: none"> • 77.7% were infected by an adult within the family • 5.5% transmission at daycare centre/school was possible/likely • 4.4% could not determine transmission route, could have been from child to adult • 4.4% were acquired abroad • 2.2% were between households (e.g. as a result of child sleepovers) 	<p>High</p>

<p>Teherani, M.F., Kao, C.M., Camacho-Gonzalez, A., Banskota, S., Shane, A.L, Linam, W.M., & Jaggi, P. (2020). Burden of Illness in Households With Severe Acute Respiratory Syndrome Coronavirus 2–Infected Children. <i>Journal of the Pediatric Infectious Diseases Society</i> 9(5): 613-616.</p>	<p>Aug 11, 2020</p>	<p>Cohort</p>	<p>United States</p>	<p>Household</p>	<p>From Mar 16 to Jun 14, among 32 households in which there was a SARS-CoV-2-infected child (<18 years), 144 household contacts were identified:</p> <ul style="list-style-type: none"> • 58 (40%) children • 86 (60%) adults <p>46.5% of household contacts developed symptoms.</p> <p>Majority of cases originated from an adult household member, with child-to-adult transmission suspected in 7 of the 32 households (22%). The potential exposures for these child index cases were identified as daycare (1), school (2), close contact (1), and unknown (3).</p>	<p>Moderate</p>
<p>Previously reported evidence</p>						
<p>Hu, S., Wang, W., Wang, Y., Litvinova, M., Luo, K., Ren, L., ... Yu, H. (2020). Infectivity, susceptibility, and risk factors associated with SARS-CoV-2 transmission under intensive contact tracing in Hunan, China. <i>Preprint</i>.</p>	<p>Nov 3, 2020</p>	<p>Case Series</p>	<p>China</p>	<p>Community</p>	<p>From Jan 23 to Apr 2, comprehensive contact tracing was carried out amongst 1,178 confirmed cases and 15,648 contacts. 471 contacts (3.0%) tested positive.</p> <p>Based on the age of the index case, transmission was not significantly different in those aged 0-14 years compared to 15-59 years (OR = 0.28, 95% CI: 0.04, 2.04).</p> <p>No significant relationship between age and risk of transmission (OR = 1.57, 95% CI: 0.87, 2.81).</p>	<p>Moderate; <i>PREPRINT</i></p>

<p>Grijalva, C.G., Rolfes, M.A., Zhu, Y., McLean, H.Q., Hanson, K.E., Belongia, E.A., ... Talbot, H.K. (2020). Transmission of SARS-COV-2 Infections in Households – Tennessee and Wisconsin, April–September 2020. <i>Morbidity and Mortality Weekly Report</i> 69(40): 1631-1634.</p>	<p>Oct 30, 2020</p>	<p>Cohort</p>	<p>Tennessee, Wisconsin, United States</p>	<p>Household</p>	<p>101 index patients and 191 asymptomatic household contacts from 101 households were enrolled. In 14 households, the index case was under 18 (5 patients <12 years; 9 patients 12-17 years). Of these, the secondary infection rate was:</p> <ul style="list-style-type: none"> • 53% (95% CI: 31-74%) when index patient was < 12 years. 9 confirmed cases from 17 contacts at risk. • 38% (95% CI:23-56%) when index patient was 12-17 years. 11 confirmed cases from 29 contacts at risk <p>The secondary infection rate when the index patient was aged 18-49 was 55% (95%CI: 46-64%) and when aged > 50 was 62% (95%CI: 44-77%).</p>	<p>Moderate</p>
<p>Dong, Q.Q., Qiu, L.R., Cheng, L.M., Shu, S.N., Chen, Y., Zhao, Y., ... Luo, X.P. (2020) Kindergartens Reopening in the Period of Regular Epidemic Prevention and Control, Beneficial or Harmful? <i>Current Medical Science</i> 40(5), 817-821.</p>	<p>Oct 29, 2020</p>	<p>Case Report</p>	<p>China</p>	<p>Household</p>	<p>2 female toddlers diagnosed with moderate COVID-19.</p> <p>Patient 1 lived with her parents, grandparents and 7 year old sister who had close contact with her (with some sporadic use of masks). None of these contacts tested positive for COVID-19 in the 2 month period following the child’s diagnosis.</p> <p>Both of patient 2’s parents were diagnosed with COVID-19 (one an asymptomatic carrier). While they were quarantined in hospital, patient 2 was cared for by her grandmother who did not test positive for COVID-19.</p>	<p>High</p>

<p>Chu, V.T., Yousaf, A.R., Chang, K., Schwartz N.G., McDaniel, C.J., Szablewski, C.M., ... Stewart, R.J. (2020). Transmission of SARS-CoV-2 from Children and Adolescents. <i>Preprint</i>.</p>	<p>Oct 12, 2020</p>	<p>Cohort</p>	<p>United States</p>	<p>Household</p>	<p>Across 194 households, 526 household contacts were identified from 224 primary cases of children and adolescents who attended a camp in Jun 2020 and self-reported COVID-19 (based on molecular or antigen testing). The mean age of primary cases was 14 years.</p> <p>48 household contacts were classified as secondary cases (either confirmed or probable COVID-19). 7 cases were in contacts aged under 18 (none hospitalized), 41 secondary cases were over the age of 18 (4 were hospitalized). The secondary attack rate (SAR) was 9% (95% CI: 7-12%), but among contacts who reported COVID-19 testing, SAR was 12% (46/377; 95% CI: 9-16%).</p> <p>This study provides evidence of transmission from children/adolescents to both adults and other children who are household contacts.</p>	<p>Low; <i>PREPRINT</i></p>
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<p>Schwartz, N.G., Moorman, A.C., Makaretz, A., Chang, K.T., Chu, V.T., Szablewski, C.M., ... Stewart, R.J. (2020). Adolescent with COVID-19 as the Source of an Outbreak at a 3-Week Family Gathering – Four States, June-July 2020. <i>Morbidity and Mortality Weekly Report</i> 69(40): 1457-1459.</p>	<p>Oct 9, 2020</p>	<p>Case Report</p>	<p>United States</p>	<p>Household</p>	<p>An adolescent (index case) exposed to a large COVID-19 outbreak in Jun 2020 subsequently attended a 3 week family gathering. Members of 5 households attended the family gathering at various times during the 3 weeks. 13 family members shared a house with the index case for between 8-25 days. An additional 6 family members visited on 2 separate days, but remained outdoors.</p> <p>Of the 14 family members (including the index case) who stayed in the same house, 12 experienced symptoms. Of these:</p> <ul style="list-style-type: none"> • 6 returned a positive COVID-19 PCR test (2 grandparents, 2 parents, 1 aunt, 1 uncle) • 4 were classified as probable COVID-19 cases based on positive antigen testing or clinical criteria and epidemiologic criteria (1 sibling, 1 cousin, 1 aunt, 1 uncle) • 2 were classified as suspected COVID-19 cases based on positive antibody testing (the index case and a sibling). <p>None of the 6 family members who visited but remained outside developed symptoms and 4 that were tested all returned negative tests.</p>	<p>Moderate</p>
<p>Maltezou, H.C., Magaziotou, I., Dedoukou, X., Eleftheriou, E., Raftopoulos, V., Michos, A., ... Tsolia, M. (2020). Children and Adolescents With SARS-CoV-2 Infection: Epidemiology, Clinical Course and Viral Loads. (2020). <i>The Pediatric Infectious Disease Journal</i>. Epub ahead of print.</p>	<p>Oct 6, 2020</p>	<p>Prevalence</p>	<p>Greece</p>	<p>Community</p>	<p>National registry information on national COVID-19 infections in Greece from Feb 26 (first case diagnosed) to Jun 30, 2020 revealed 203 cases in children aged 0-19 years old. Sources of infection included:</p> <ul style="list-style-type: none"> • Family (n = 132; 65%) • Community (n=29; 14.3%) • Travel (n=9; 4.4%) • School (n=4; 2%) • Other (n=4; 2%) • Unknown (n=25; 12.3%) <p>Transmission occurred from an adult to a child in 133 families. There was only 1 documented case of transmission from an adolescent to a parent, and no reported child-to-child transmission.</p>	<p>High</p>

<p>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>Science</i>, 370(6517), 691-697.</p>	<p>Sep 30, 2020</p>	<p>Prevalence</p>	<p>Tamil Nadu and Andhra Pradesh, India</p>	<p>Community</p>	<p>From 435,539 positive cases from Mar 5 to Jun 4, 2020, contact tracing reached 3,084,885 known contacts. Epidemiological and testing data was available for 575,071 contacts of 84,965 cases.</p> <p>Secondary attack rate was highest in household settings (9%) compared to community (2.6%) or healthcare (1.2%) settings. The highest probability of transmission was in case-contact pairs of similar age. This was strongest for children aged 0-14, and for adults aged 65+.</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>	<p>Low</p>
<p>Wood, R., Thomson, E.C., Galbraith, R., Gribben, C., Caldwell, D., Bishop, J., ... McAllister, D.A. (2020). Sharing a household with children and risk of COVID-19: a study of over 300,000 adults living in healthcare worker households in Scotland. <i>Preprint</i>.</p>	<p>Sep 22, 2020</p>	<p>Prevalence</p>	<p>Scotland</p>	<p>Household</p>	<p>Through record-linkage of 158,445 Scottish NHS workers and their households, COVID-19 cases, cases requiring hospitalization, and severe cases (ICU admission or death) from Mar 1 to Jul 7 2020.</p> <p>There was an inverse association between number of children age 0-11 in the household and risk of an adult COVID-19 case (HR = 0.89, 95% CI 0.84-0.95).</p> <p>Stronger associations found in pre-school (0.82; 95% CI 0.74-0.91) vs. primary school (0.94; 95% CI 0.88-1.00).</p> <p>Similar patterns for cases requiring hospitalization, although was not statistically significant (HR = 0.89, 95% CI 0.74-1.06).</p> <p>There was no association between number of young children in the household and risk of severe cases (HR = 0.99, 95% CI 0.69-1.40), however frequency of this outcome was low (n = 97).</p>	<p>High; <i>PREPRINT</i></p>

<p>Lyngse, F.P., Kirkeby, C.T., Halasa, T., Andreasen, V., Skov, R.L., Møller, F.T., ... Mølbak, K. (2020). COVID-19 transmission within Danish households: A nationwide study from lockdown to reopening. <i>Preprint</i>.</p>	<p>Sep 9, 2020</p>	<p>Prevalence</p>	<p>Denmark</p>	<p>Household</p>	<p>Administrative registry data from all COVID-19 tests in Denmark from Feb 27 (first positive) to Jul 24 including 6782 primary cases and 14232 contacts.</p> <p>There is a linear relationship between age and attack rate and transmission risk. Although youngest children had higher transmission risk due to close contact with parents.</p> <p>Susceptibility to infection increases with the age of the susceptible person.</p> <p>Where primary case is an adult, transmission risk increases linearly with age of contacts/potential secondary cases.</p>	<p>Moderate; <i>PREPRINT</i></p>
<p>Kim, J., Choe, Y.J., Lee, J., Park, Y.J., Park, O., Han, M.S., ... Choi, E.H. (2020). Role of children in household transmission of COVID-19. <i>Archives of Disease in Childhood</i>. Epub ahead of print.</p>	<p>Aug 7, 2020</p>	<p>Case Series</p>	<p>South Korea</p>	<p>Household</p>	<p>All confirmed pediatric cases of COVID-19 from Jan 20 to Apr 6, 2020 were included.</p> <ul style="list-style-type: none"> • 107 index cases and 248 household members identified; median age 15 years, interquartile range 10-17 years • 41 of 248 contacts (16.5%) developed COVID-19 <ul style="list-style-type: none"> ○ one episode of secondary transmission identified as a younger sibling ○ exposure time was 2 days during the pre-symptomatic period and 1 day during the symptomatic period of the index case • Overall, household secondary attack rate was 0.5% (95% CI 0.0% to 2.6%) <p>The authors note potential underestimation of results due to testing inaccuracies and exclusion of household cases with the same initial exposure.</p>	<p>Moderate</p>

Maltezou, H.C., Vorou, R., Papadima, K., Kosyvakis, A., Spanakis, N., Gioula, G., ... Papa, A. (2020). Transmission dynamics of SARS-CoV-2 within families with children in Greece: A study of 23 clusters . <i>Journal of Medical Virology</i> . Epub ahead of print.	Aug 7, 2020	Case series	Greece	Household	<p>From Feb 26 to May 3, 2020 (period of lockdown) all family clusters with at least one child were identified from a national registry:</p> <ul style="list-style-type: none"> • 23 clusters with 109 household members (66 adults, 43 children) were identified • Median attack rate was 60% (range 33.4 to 100%) • Despite close contact between infected children and non-infected adults in 14 clusters, no child to adult or child to child transmission was confirmed • An adult was the first identified case in 21 clusters, and a child in 2 	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 outbreak, South Korea, 2020 . <i>Emerging Infectious Diseases</i> 26(10), 2465-2468.	Jul 16, 2020	Case series	South Korea	Community	<p>Of 5,705 COVID-19 positive cases analyzed between Jan 20 and Mar 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
Wongsawat, J., Moolasart, V., Srikin, 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

van der Hoek, W., Backer, J.A., Bodewes, R., Friesema, I., Meijer, A., Pijnacker, R., ... van den Hof, S. (2020). The role of children in the transmission of SARS-CoV-2. <i>Nederlands Tijdschrift Voor Geneeskunde</i> , 164: D5140.	Jun 3, 2020	Cohort	Netherlands	Household	All laboratory confirmed cases of COVID-19 from Mar 23 to Apr 16, 2020 in families were identified: <ul style="list-style-type: none"> • Within 54 clusters (227 participants, 185 were immediate family) no children under 12 were the source of transmission • Children 1-11 were less often positive compared to older children or adults • 368 children (0-18 years) have been positive for COVID-19 accounting for 0.9% of the total number of cases 	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> 39(8), e202-e204.	Jun 1, 2020	Case series	Israel	Households	Members of 13 households of COVID-19 cases were tested for COVID-19. Test results were presented by age group: <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

Table 8: In-Progress Single Studies

Title	Anticipated Release Date	Setting	Description of Document
New evidence reported December 18, 2020			
Muntau, A.C., Gersting, S.W., & Mir, T. (2020). Prevalence of Infection and Seroconversion and the Clinical Course of the Novel Coronavirus SARS-CoV-2 Infection in Children Between 0 to 18 Years of Age in Hamburg and Surroundings.	Mar 31, 2021	Community	This study will determine the seroprevalence of children and household contacts in a low incidence setting.
Duysburgh, E. & Vermeulen, M. (2020). Prevalence and Incidence of Antibodies Against SARS-CoV-2 in Children Measured for One Year in Belgium: a Sero-epidemiological Prospective Cohort Study.	Aug 31, 2021	Schools	This study will determine the seroprevalence and seroconversion of antibodies against SARS-CoV-2 in primary and secondary school-aged children at different time points.
Previously reported evidence			
Xu, S.F., Lu, Y.H., Zhang, T., Xiong, H.Y., & Wang, W.B. (2020). Cross-Sectional Seroepidemiologic Study of Coronavirus Disease 2019 (COVID-19) among Close Contacts, Children, and Migrant Workers in Shanghai. <i>Int. J. Environ. Res. Public Health</i> , 17(19), 7223.	N/A	Community School	This study will measure serum antibody levels against SARS-CoV-2 among migrant workers, children, and close contacts, and explore potential asymptomatic infection and risk factors of COVID-19.

Question 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?

Table 9: Regional COVID-19 prevention and control policies, daycares

Location	Date	Screen	Temp. Check	Reduced Class Size	Cohort	Distance: Children	Distance: Staff	Masks: Children	Masks: Staff	Hand Hygiene	Enhanced Cleaning	Ventilation	Other
Australia (New South Wales)	Mar 16, 2020	Yes	NR	NR	Yes	NR	NR	No	No	Yes	Yes	NR	
Canada (Ontario)	Oct 5, 2020	Yes	NR	No	Yes	NR	NR	NR	Yes + eye protection	NR	Yes	NR	Log daily attendance Must have a COVID-19 response plan No non-essential visitors Drop-off/pick-up protocols in place
Canada (Québec)	Nov 20, 2020	NR	NR	NR	Yes	Yes between cohorts	No	No	Yes	Yes	Yes	NR	
Finland	Aug 6, 2020	Yes	NR	"Limited"	Where possible	Avoid or reduce contact	Avoid or reduce contact	NR	NR	Yes	Yes	NR	No one other than children and staff
Germany (Baden-Württemberg)	Sep 10, 2020	NR	NR	Yes	NR	No	No	No	Yes	Yes	Yes	Yes	
Italy	Aug 3, 2020	Yes	No	NR	Yes	NR	NR	No	Yes	Yes	Yes	Yes	
Luxembourg	Dec 2, 2020	NR	NR	NR	NR	No	Yes	No (<6 years)	Yes	Yes	Yes	Yes	
Netherlands	n.d.	Yes	NR	NR	NR	No	1.5m	NR	NR	Yes	NR	NR	
Poland	Oct 9, 2020	NR	NR	NR	Yes	NR	NR	NR	When in contact with children	NR	NR	NR	
Singapore	May 28, 2020	Yes	Yes	NR	Yes	NR	NR	Yes (age 2+)	Yes	Yes	Yes	NR	

Sweden	Nov 24, 2020	NR	NR	NR	NR	NR	NR	No	No	NR	NR	NR	If child becomes unwell, must stay home for 48 hours after recovery (unless only mild symptoms; avoid travelling on public transport (buses, trams, the Metro))
United States (Rhode Island)	Aug 21, 2020	Yes	NR	Yes	Yes	No	NR	Common areas only	Yes	Yes	Yes	NR	

NR: Not Reported

Table 10: Regional COVID-19 prevention and control policies, primary schools

Location	Date	Screen	Temp. Check	Reduced Class Size	Cohort	Distance: Students	Distance: Staff	Masks: Students	Masks: Staff	Hand Hygiene	Enhanced Cleaning	Ventilation	Other
Australia (New South Wales)	Dec 8, 2020	Negative test required to return after symptoms	No	NR	Yes	No	Yes (1.5 m from other staff)	No	No	Yes	Yes	NR	No parents in schools unless for a parent-carer meeting or volunteering for educational purposes; stay home if unwell
Canada (Alberta)	n.d.	Yes	NR	NR	Yes	Yes	Yes	Grades 4 and higher when physical distancing not possible	Yes when physical distancing not possible	Yes	Yes	NR	
Canada (Ontario)	Nov 27, 2020	Yes	NR	NR	Yes	Yes	Yes	Yes (Grades 4+)	Yes	Yes	Yes	NR	Staggered bell times
Canada (Québec)	Nov 20, 2020	NR	NR	NR	Yes	Yes between cohorts	Yes	Yes (elementary grades 5 and 6)	Yes	NR	Yes	NR	
Denmark	May 15, 2020	Yes	Yes	Yes	Yes	2m	2m	No	NR	Yes	NR	NR	Staggered reopening; no family members allowed
England	Dec 3, 2020	Yes	No	No	Yes	Encouraged for "older children" where possible	Yes (2m)	Recommended but at discretion of school; mandatory on transportation (age 11+)	Yes	Yes	Yes	Yes	
Finland	Aug 6, 2020	Yes	NR	NR	Yes	No	No	No	No	Yes	Yes	NR	Only children and staff allowed in
Germany	Sept 24, 2020	NR	NR	Yes	Yes	Yes	Yes	All over the age of 6	Yes	Yes	NR	Yes	Staggered timetables, opening school for select grades
Hong Kong	Oct 23, 2020	Yes	Yes	NR	Yes	1.5m	NR	Yes	Yes	Yes	Yes	Yes	Shortened school days

Italy	Aug 6, 2020	NR	NR	NR	NR	1m	NR	Yes (age 6+)	Yes	NR	NR	NR	
Korea	Aug 4, 2020	Yes	Yes	Yes	NR	Yes (not specified)	Yes (not specified)	Yes, indoors	Yes	Yes	Yes	NR	Plastic barriers at lunch
Luxembourg	Dec 2, 2020	NR	NR	NR	Fewer contacts outside classroom	Limited movement, fixed place	Yes	Yes (6+) outside of the classroom	Yes	Yes	Yes	Yes	
Netherlands	Dec 10, 2020	NR	NR	NR	NR	No	Yes (1.5m)	No	No	Yes	Yes	Yes	
Norway	Sep 28, 2020	Yes	NR	NR	Yes	No	1m	If symptoms develop and cannot physically distance	No	Yes	Yes	NR	
Sweden	Nov 24, 2020	NR	NR	NR	NR	NR	NR	No	No	NR	NR	NR	
Switzerland	Nov 6, 2020	NR	NR	NR	NR	1.5m	1.5m	Yes (age 12+)	Yes	Yes	NR	NR	

NR: Not Reported

Table 11: Regional COVID-19 prevention and control policies, secondary schools

Location	Date	Screen	Temp. Check	Class Size	Cohort	Distance: Students	Distance: Staff	Masks: Students	Masks: Staff	Hand Hygiene	Enhanced Cleaning	Ventilation	Other
Australia (New South Wales)	Dec 8, 2020	Negative test required to return after symptoms	No	NR	Yes	No	Yes (1.5m from other staff)	No	No	Yes	Yes	NR	No parents in schools unless for a parent-carer meeting or volunteering for educational purposes; stay home if unwell
Canada (Alberta)	n.d.	Yes	NR	NR	Yes	Yes	Yes	Yes, when physical distancing cannot be maintained	Yes, when physical distancing cannot be maintained	Yes	Yes	NR	
Canada (Ontario)	Nov 27, 2020	Yes	NR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NR	Hybrid in-person and remote learning in higher-risk areas
Denmark	May 15, 2020	Yes	Yes	Yes	Yes	2m	2m	No	NR	Yes	NR	NR	Staggered reopening; no family members allowed
England	Dec 3, 2020	Yes	No	No	Yes	Encouraged for "older children" where possible	Yes (2m)	Recommended, but at discretion of school; mandatory on transportation (age 11+)	Yes	Yes	Yes	Yes	
Finland	Aug 6, 2020	Yes	NR	NR	Yes	1-2m	1-2m	NR	NR	Yes	Yes	NR	
Germany	Sept 24, 2020	NR	NR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NR	Yes	
Hong Kong	Oct 23, 2020	Yes	Yes	NR	Yes	1.5m	NR	Yes	Yes	Yes	Yes	Yes	Shortened school days
Israel	n.d.	Yes (home)	Yes (home)	NR	Yes	Yes (not specified)	Yes (not specified)	Yes	Yes	Yes	NR	NR	
Italy	Aug 6, 2020	NR	NR	NR	NR	1m	NR	Yes (age 6+)	Yes	NR	NR	NR	

Korea	Aug 4, 2020	Yes	Yes	Yes	NR	Yes (not specified)	Yes (not specified)	Yes, indoors	Yes	Yes	Yes	NR	Plastic barriers at lunch
Luxembourg	Dec 2, 2020	NR	NR	NR	Fewer contacts outside classroom	Limited movement, fixed place	Yes	Yes (6+) outside of the classroom	Yes	Yes	Yes	Yes	
Netherlands	Dec 10, 2020	NR	NR	NR	NR	No	Yes (1.5m)	Yes	Yes	Yes	Yes	Yes	
Norway	Sep 28, 2020	Yes	NR	NR	Yes	Yes (not specified)	1m	In transit or with symptoms	No	Yes	Yes	NR	
Singapore	Dec 2, 2020	Yes	Yes	No	Yes	Yes (safe distancing with fixed seating and staggered travel)	Yes	Yes	Yes	Yes	Yes	NR	
Switzerland	Nov 6, 2020	NR	NR	NR	NR	1.5m	1.5m	Yes (age 12+)	Yes	Yes	NR	NR	

NR: Not Reported

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