

COVID-19 Evidence Support Team EVIDENCE SEARCH REPORT

Review Question:	What are the effects of the new COVID variants on transmission and school reopenings in pediatric populations?		
Context:	Update to question EOC070201v2-01 ESR, adding variants of concern to the search		
	Transmission to and from children, especially in light of the variants and vaccines		
Review Code:	PH030801v2 ESR	Complete Date:	August 18, 2021
Cite As:	Howell-Spooner, B., Mueller, M. What are the effects of the new COVID variants on transmission and school reopenings in pediatric populations? 2021 Aug 18, Document no.: PH030801v2 ESR. In: COVID-19 Rapid Evidence Reviews [Internet]. SK: SK COVID Evidence Support Team, c2021. 49 p. (CEST evidence search report).		

Librarian Notes & Comments

Hello,

We updated the previous database search to include terms that include the variants and the available vaccines, and the same for grey literature.

Published literature is current to the defined dates but some do use data on COVID that is from before the variants arose and vaccines were available.

Sincerely,

Brianna and Mark

Disclaimer

This information is provided as a service by the Saskatchewan Health Authority and University of Saskatchewan Libraries. Professional librarians conduct searches of the literature. Results are subject to the limitations of the databases and the specificity, broadness and appropriateness of the search parameters presented by the requester. The Libraries do not represent in any matter that retrieved citations are complete, accurate or otherwise to be relied upon. The search results are only valid as of the date and time at which the search is conducted. The Libraries do not accept responsibility for any loss or damage arising from the use of, or reliance on, search results.

Search Results: Guidelines, Summaries & Other Grey Literature

Centers for Disease Control and Prevention

- Guidance for COVID-19 Prevention in K-12 Schools. [5 August 2021]. <https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/k-12-guidance.html>
- COVID-19 Guidance for Operating Early Care and Education/Child Care Programs. [9 July 2021]. <https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/child-care-guidance.html>
 - **LIBRARIAN'S NOTE FOR ABOVE RESOURCES:** "Given new evidence on the B.1.617.2 (Delta) variant, CDC has updated the guidance for fully vaccinated people. CDC recommends universal indoor masking for all teachers, staff, students, and visitors to K-12 schools, regardless of vaccination status. Children should return to full-time in-person learning in the fall with layered prevention strategies in place."
- Science Brief: Transmission of SARS-CoV-2 in K-12 Schools and Early Care and Education Programs – Updated. [9 July 2021]. https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/transmission_k_12_schools.html
 - **LIBRARIAN'S NOTE:** "The studies are also not limited to experiences in the United States and do not account for new variants of the virus. This context is important to consider when reviewing this summarized science."

COVID-END

- What is known about how schools (K-12) and post-secondary institutions (colleges and universities) adjust COVID-19 transmission mitigation measures as infection rates change and vaccination rates increase? [18 June 2021]. https://www.mcmasterforum.org/docs/default-source/product-documents/living-evidence-profiles/covid-19-living-evidence-profile-3.2_what-is-known-about-how-schools-and-post-secondary-institutions-adjust-covid-19-transmission-mitigation-measures-as-infection-rates-change-and-vaccination-rates-increase.pdf?sfvrsn=d9b11380_18
 - **LIBRARIAN'S NOTE:** "Yukon: As of 25 May 2021, the next phase in Yukon will consider relaxing physical distancing, masking and other requirements for approved plans for some or all education and childcare facilities when supported by high vaccination rates and improved understanding of variants." (pg. 21)

European Centre for Disease Control

- COVID-19 in Children and the Role of School Settings in Transmission - Second Update. [8 July 2021]. <https://www.ecdc.europa.eu/sites/default/files/documents/COVID-19-in-children-and-the-role-of-school-settings-in-transmission-second-update.pdf>
 - **LIBRARIAN'S NOTE:** "Key Messages: (1) Increased transmissibility across all age groups has been reported for SARS-CoV-2 variants of concern (VOCs), most notably for the Delta variant. In regions where an increasing percentage of adults are fully vaccinated against COVID-19 but where children are not vaccinated, it may be anticipated that in the coming months increasingly greater proportions of reported SARS-CoV-2 cases will be among children; (2) The majority of the studies referred to in this report were conducted prior to the emergence and widespread circulation of the Delta variant. This should be taken into account when interpreting reported study results." (pg. 1)

National Collaborating Centre for Methods and Tools

- Evidence Brief on SARS-CoV-2 Variants of Concern and Transmission in Children. [26 March 2021]. <https://www.nccmt.ca/covid-19/covid-19-evidence-reviews/417>
 - **LIBRARIAN'S NOTE:** See attachment "COVID19_EvidenceBrief_VOCTransmissionChildren.pdf"

- Living Rapid Review Update 17: What is the specific role of daycares and schools in COVID-19 transmission? [12 August 2021]. <https://www.nccmt.ca/covid-19/covid-19-rapid-evidence-service/19>
 - **LIBRARIAN'S NOTE:** *"In this version, new eligibility criteria have been added to focus on the most relevant studies to the current context. In this version, only studies which include data collected on or after January 1st, 2021, are included. While major regional variations exist, this represents the time where vaccinations were beginning to be available, and variants of concern (VoC) were becoming more common in many regions around the world."* (pg. 2)

Public Health Agency of Canada

- Planning for the 2021-2022 School Year in the Context of COVID-19 Vaccination. [17 August 2021]. <https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/guidance-documents/planning-2021-2022-school-year-vaccination.html>
 - **LIBRARIAN'S NOTE:** *"For K-12 schools specifically, it is important to consider the transmission dynamics of SARS-CoV-2 in children/youth and school settings, while recognizing that those less than 12 years of age will not be eligible for COVID-19 vaccine, and that evidence may change, particularly concerning variants of concern (VOCs)"*

Public Health England

- SARS-CoV-2 Variants of Concern and Variants under Investigation in England Technical Briefing 16. [18 June 2021]. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1001359/Variants_of_Concern_VOC_Technical_Briefing_16.pdf
 - **LIBRARIAN'S NOTE:** *Refer to pg. 38-9 for data on SARS-CoV-2 outbreaks or clusters in primary and secondary schools (including special educational needs settings) by variant type identified and epidemiological week, from 26 April to 13 June 2021*
 - **LIBRARIAN'S NOTE:** *"These data will not be included in subsequent Variants of Concern Technical Briefings, however information on emerging variants linked to educational settings will be included where relevant."* (pg. 38). **No indication on where that information will be posted.**
- SARS-CoV-2 Variants of Concern and Variants under Investigation in England Technical Briefing 15. [11 June 2021]. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/993879/Variants_of_Concern_VOC_Technical_Briefing_15.pdf
 - **LIBRARIAN'S NOTE:** *Refer to pg. 45-6 for data on SARS-CoV-2 outbreaks or clusters in primary and secondary schools (including special educational needs settings) by variant type identified and epidemiological week, from 26 April to 6 June 2021*
- SARS-CoV-2 Variants of Concern and Variants under Investigation in England Technical Briefing 14. [3 June 2021]. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/991343/Variants_of_Concern_VOC_Technical_Briefing_14.pdf
 - **LIBRARIAN'S NOTE:** *Refer to pg. 42-3 for data on SARS-CoV-2 outbreaks or clusters in primary and secondary schools (including special educational needs settings) by variant type identified and epidemiological week, from 26 April to 30 May 2021*

Public Health Ontario

- COVID-19 Infection in Children: January 15, 2020 to June 30, 2021. [2021]. <https://www.publichealthontario.ca/-/media/documents/ncov/epi/2020/05/covid-19-epi-infection-children.pdf?la=en>

- **LIBRARIAN'S NOTE:** "This report includes the most current information available from CCM as of July 14, 2021"
- **LIBRARIAN'S NOTE:** "This report includes information on demographic characteristics, laboratory testing, severity of illness, acquisition exposures and variants of concern (VOCs)"
- Enhanced Epidemiologic Study: COVID-19 in Ontario: Elementary and Secondary School Outbreaks and Related Cases, August 30, 2020 to April 24, 2021. [2021]. <https://www.publichealthontario.ca/-/media/documents/ncov/epi/2020/12/covid-19-school-outbreaks-cases-epi-summary.pdf?la=en>
 - **LIBRARIAN'S NOTE:** "There have been 547 school-associated outbreaks with at least one case with a variant of concern (VOC)-associated mutation or VOC lineage confirmed from January 31 to April 24, 2021. The laboratory detection of a variant of concern (VOC) is a multi-step process. Samples that test positive for SARS-CoV-2 and have a cycle threshold (Ct) value ≤ 35 can be tested for mutations common to variants of concern. If positive for the mutation of interest with a Ct value of ≤ 30 , these samples may then undergo genomic analyses to identify the VOC lineage. Overall, there was a significant difference in the median number of cases per outbreak with a VOC-associated mutation or confirmed VOC detected (median=3) compared to outbreaks without a VOC-associated mutation or confirmed VOC detected (median=2)." (pg. 2)

Prevent Pandemics

- InDepth COVID-19 Science Review July 16, 2021. [16 July 2021]. <https://preventepidemics.org/wp-content/uploads/2021/07/Science-Review-July-16-2021--Prevent-Epidemics.pdf>
 - **LIBRARIAN'S NOTE:** "Contents: Opening K-12 schools for in-person learning amidst vaccines and variants: what have we learned and how can this guide us?"

Search Results: Journal Articles (includes preprints)

Sorted by newest-oldest.

1. Aiano F, McOwat K, Obi C, et al. COVID-19 Outbreaks in Nurseries During Rapid Spread of the B. 1.1. 7 Variant of SARS-CoV-2 in England: Cross-Sectional National Surveillance, November 2020–January 2021. 2021.

ABSTRACT: Background: The reopening of schools during the COVID-19 pandemic has raised concerns about widespread infection and transmission of SARS-CoV-2 in educational settings. In June 2020, Public Health England (PHE) initiated prospective national surveillance of SARS-CoV-2 in primary schools across England (SKIDs). We used this opportunity to assess the feasibility and agreeability of large-scale surveillance and testing for SARS-CoV-2 infections in school among staff, parents and students. Methods: Staff and students in 131 primary schools were asked to complete a questionnaire at recruitment and provide weekly nasal swabs for SARS-CoV-2 RT-PCR testing (n=86) or swabs with blood samples for antibody testing (n=45) at the beginning and end the summer half-term. In six blood sampling schools, students were asked to complete a pictorial questionnaire before and after their investigations. Results: In total, 134 children aged 4-7 years (n=40) or 8-11 years (n=95) completed the pictorial questionnaire fully or partially. Prior to sampling, oral fluid sampling was the most acceptable test (107/132, 81%) followed by throat swabs (80/134, 59%), nose swabs (77/132, 58%), and blood tests (48/130, 37%). Younger students were more nervous about all tests than older students but, after completing their tests, most children reported a "better than expected" experience with all the investigations. Students were more likely to agree to additional testing for nose swabs (93/113, 82%) and oral fluid (93/114, 82%), followed by throat swabs (85/113, 75%) and blood tests (72/108, 67%). Parents (n=3,994) and staff (n=2,580) selected a preference for weekly testing with nose swabs, throat swabs or oral fluid sampling, although staff were more flexible about testing frequency. Conclusions: Primary school staff and parents were supportive of regular tests for SARS-CoV-2 and selected a preference for weekly testing. Children preferred nose swabs and oral fluids over throat swabs or blood sampling.

URL: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3826200

2. Alfano V, Ercolano S, Cicatiello L. School openings and the COVID-19 outbreak in Italy. A provincial-level analysis using the synthetic control method. Health Policy. 2021;02:02.

ABSTRACT: Schools have been central in the debate about COVID-19. On the one hand, many have argued that they should be kept open, given their importance to youngsters and the future of the country, and the effort many countries have made in establishing protocols to keep them safe. On the other hand, it has been argued that open schools further the spread of the virus, given that these are places with large-scale interaction between teenagers and adults accompanying their children, as well as a major source of congestion on public transportation. We aim to identify the effect of school openings on the spread of COVID-19 contagion. Italy offers an interesting quasi-experimental setting in this regard due to the scattered openings that schools have experienced. By means of a quantitative analysis, employing a synthetic control method approach, we find that Bolzano, the first province in Italy to open schools after the summer break, had far more cases than its synthetic counterfactual, built from a donor pool formed from the other Italian provinces. Results confirm the hypothesis that despite the precautions, opening schools causes an increase in the infection rate, and this must be taken into account by policymakers. Copyright © 2021 Elsevier Ltd. All rights reserved.

URL: <https://www.sciencedirect.com/science/article/pii/S0168851021001676>

3. Armann JP, Kirsten C, Galow L, et al. SARS-CoV-2 transmissions in students and teachers: seroprevalence follow-up study in a German secondary school in November and December 2020. *BMJ Paediatrics Open*. 2021;5(1):e001036.

ABSTRACT: Objective: To quantify the number of undetected SARS-CoV-2 infections in educational settings.

Design: Serial SARS-CoV-2 seroprevalence study before and during the second wave of the COVID-19 pandemic.

Setting: Secondary school in Dresden, Germany.

Participants: Grade 8-12 students and their teachers were invited to participate in serial blood sampling and SARS-CoV-2 IgG antibody assessment.

Main outcome measure: Seroprevalence of SARS-CoV-2 antibodies in study population.

Results: 247 students and 55 teachers participated in the initial study visit and 197 students and 40 teachers completed follow-up. Seroprevalence increased from 1.7% (0.3-3.3) to 6.8% (3.8-10.1) during the study period mirroring the increase of officially reported SARS-CoV-2 infections during this time. The ratio of undetected to detected SARS-CoV-2 infections ranged from 0.25 to 0.33.

Conclusions: We could not find evidence of relevant silent, asymptomatic spread of SARS-CoV-2 in schools neither in a low prevalence setting nor during the second wave of the pandemic, making it unlikely that educational settings play a crucial role in driving the SARS-CoV-2 pandemic.

Trial registration number: DRKS00022455. Copyright © Author(s) (or their employer(s)) 2021. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

URL: <https://bmjpaedsopen.bmj.com/content/5/1/e001036>

4. Bignami-van Assche S, Boujija Y, Fisman D, et al. In-person schooling and COVID-19 transmission in Canada's three largest cities. *medRxiv*. 2021:2021.03.21.21254064. DOI: 10.1101/2021.03.21.21254064

ABSTRACT: In North America and Europe, the Fall 2020 school term has coincided with the beginning of the second wave of the novel coronavirus (COVID-19) pandemic, sparking a heated debate about the role of in-person schooling for community transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). This issue has immediate policy relevance for deciding how to operate schools safely as the pandemic unfolds, new variants of SARS-CoV-2 are circulating, and immunization coverage remains low. We contribute to this debate by presenting data on trends in COVID-19 weekly incidence among school-aged children 0-19 years old vis-à-vis other age groups during Fall 2020 in Canada's three largest cities: Montréal, Toronto and Calgary. We interpret these trends in light of the different back-to-school policies and other public health measures implemented in the three cities over the observation period. **KEY POINTS** School closures are an effective measure to reduce the overall incidence of the novel coronavirus (COVID-19). Nonetheless, there is a general consensus that the decision to close schools to control the spread of COVID-19 should be used as last resort because of the negative impact on children's development and mental health, and since they are less likely to have severe COVID-19 outcomes than adults. Existing evidence highlights the importance of adopting appropriate mitigation strategies for limiting COVID-19 community spread when returning to in-person schooling. To understand the association between in-person schooling and COVID-19 transmission given different mitigation strategies, especially universal masking and distance learning, we compare how the second wave of COVID-19 has affected school-aged children age 0-19 years old vis-à-vis other age groups in Montréal, Toronto and Calgary during Fall 2020. The case of Montréal attests to the negative consequences of not implementing recommended migration strategies when reopening schools, even when public health measures such

as gatherings restrictions are in place to maintain low levels of community transmission. On the contrary, school measures adopted in Toronto (optional distance learning and masking mandates), have limited the role of COVID-19 transmission among school-aged children for overall community transmission. In Calgary, this effect has been smaller, likely because public health measures to limit COVID-19 community spread were not introduced until early December 2020. Our findings have immediate policy relevance for deciding how to operate schools safely as the pandemic unfolds, new variants of SARS-CoV-2 are circulating, and immunization coverage remains low.

Competing Interest Statement The authors have declared no competing interest.

Funding Statement No funding to declare.

Author Declarations I confirm all relevant ethical guidelines have been followed, and any necessary IRB and/or ethics committee approvals have been obtained. Yes The details of the IRB/oversight body that provided approval or exemption for the research described are given below: No IRB was necessary because the analysis exploited publicly-available data. All necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived. Yes I understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance). Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable. Yes Official counts of COVID-19 cases (defined as positive real-time reverse transcription-polymerase chain) by age were obtained from provincial reporting jurisdictions. For Montreal, they were extracted from aggregate counts of COVID-19 cases released in weekly reports by the Direction regionale de sante publique. For Toronto and Calgary, individual-level case report data were available from, respectively, Ontario Health and Alberta Health.

<https://santemontreal.qc.ca/fileadmin/fichiers/Campagnes/coronavirus/situation-montreal/rapports-etat-evaluation-montreal/COVID19-Situation-Montreal-Arrondissements-VillesLieses.pdf> <https://www.alberta.ca/covid-19-alberta-data.aspx>

URL: <http://medrxiv.org/content/early/2021/03/23/2021.03.21.21254064.abstract>

DOI: 10.1101/2021.03.21.21254064

5. Bilinski A, Ciaranello A, Fitzpatrick MC, et al. SARS-CoV-2 testing strategies to contain school-associated transmission: model-based analysis of impact and cost of diagnostic testing, screening, and surveillance. medRxiv. 2021:2021.05.12.21257131. DOI: 10.1101/2021.05.12.21257131

ABSTRACT: Background In March 2021, the Biden administration allocated \$10 billion for COVID-19 testing in schools. We evaluate the costs and benefits of testing strategies to reduce the infection risks of full-time in-person K-8 education at different levels of community incidence. Methods We used an agent-based network model to simulate transmission in elementary and middle school communities, parameterized to a US school structure and assuming dominance of the delta COVID-19 variant. We assess the value of different strategies for testing students and faculty/staff, including expanded diagnostic testing ("test to stay" policies that take the place of isolation for symptomatic students or quarantine for exposed classrooms); screening (routinely testing asymptomatic individuals to identify infections and contain transmission); and surveillance (testing a random sample of students to signaling undetected transmission and trigger additional investigation or interventions). Main outcome measures We project 30-day cumulative incidence of SARS-CoV-2 infection; proportion of cases detected; proportion of planned and unplanned days out of school; and the cost of testing programs and of childcare costs associated with different strategies. For screening policies, we further estimate cost per SARS-CoV-2 infection averted in students and staff, and for surveillance, probability of correctly or falsely triggering an outbreak response at different incidence and attack rates. Results Accounting for programmatic and childcare costs, "test to stay" policies achieve similar model-projected transmission to quarantine policies, with reduced overall costs. Weekly universal screening prevents approximately 50% of in-school transmission, with a lower projected societal cost than hybrid or remote schooling. The cost per infection averted in students and staff by weekly screening is lower for older students and schools with higher mitigation and declines as community transmission rises. In settings where local student incidence is unknown or rapidly changing, surveillance may trigger detection of moderate-to-large in-school outbreaks with fewer resources compared to screening. Conclusions "Test to stay" policies and/or screening tests can facilitate consistent in-person school attendance with low transmission risk across a range of community incidence. Surveillance may be a useful reduced-cost option for detecting outbreaks and identifying school environments that may benefit from increased mitigation. Competing Interest Statement The authors have declared no competing interest. Funding Statement The authors were supported by the Centers for Disease Control and Prevention through the Council of State and Territorial

Epidemiologists (NU38OT000297-02; AB, JAS), the National Institute of Allergy and Infectious Diseases (R37AI058736-16S1; AC, K01AI141576; MCF, and K08127908; EAK), the National Institute on Drug Abuse (3R37DA01561217S1; JAS), and Facebook (unrestricted gift; JG, AB, JAS). The papers' contents are solely the responsibility of the authors and do not represent the official views of the funders. Author Declarations I confirm all relevant ethical guidelines have been followed, and any necessary IRB and/or ethics committee approvals have been obtained. Yes The details of the IRB/oversight body that provided approval or exemption for the research described are given below: N/A -- simulation model All necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived. Yes I understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance). Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable. Yes Model code and replication files are publicly available as an R package on GitHub.

<https://github.com/abilinski/BackToSchool2>

URL: <http://medrxiv.org/content/early/2021/08/10/2021.05.12.21257131.1.abstract>

DOI: 10.1101/2021.05.12.21257131

6. Bilinski A, Salomon JA, Giardina J, et al. Passing the Test: A Model-Based Analysis of Safe School-Reopening Strategies. *Ann Intern Med.* 2021;08:08.

ABSTRACT: BACKGROUND: The COVID-19 pandemic has induced historic educational disruptions. In April 2021, about 40% of U.S. public school students were not offered full-time in-person education.

OBJECTIVE: To assess the risk for SARS-CoV-2 transmission in schools.

DESIGN: An agent-based network model was developed to simulate transmission in elementary and high school communities, including home, school, and interhousehold interactions.

SETTING: School structure was parametrized to reflect average U.S. classrooms, with elementary schools of 638 students and high schools of 1451 students. Daily local incidence was varied from 1 to 100 cases per 100 000 persons.

PARTICIPANTS: Students, faculty, staff, and adult household members.

INTERVENTION: Isolation of symptomatic individuals, quarantine of an infected individual's contacts, reduced class sizes, alternative schedules, staff vaccination, and weekly asymptomatic screening.

MEASUREMENTS: Transmission was projected among students, staff, and families after a single infection in school and over an 8-week quarter, contingent on local incidence.

RESULTS: School transmission varies according to student age and local incidence and is substantially reduced with mitigation measures. Nevertheless, when transmission occurs, it may be difficult to detect without regular testing because of the subclinical nature of most children's infections. Teacher vaccination can reduce transmission to staff, and asymptomatic screening improves understanding of local circumstances and reduces transmission.

LIMITATION: Uncertainty exists about the susceptibility and infectiousness of children, and precision is low regarding the effectiveness of specific countermeasures, particularly with new variants.

CONCLUSION: With controlled community transmission and moderate mitigation, elementary schools can open safely, but high schools require more intensive mitigation. Asymptomatic screening can facilitate reopening at higher local incidence while minimizing transmission risk.

PRIMARY FUNDING SOURCE: Centers for Disease Control and Prevention through the Council of State and Territorial Epidemiologists, National Institute of Allergy and Infectious Diseases, National Institute on Drug Abuse, and Facebook.

URL: <https://pubmed.ncbi.nlm.nih.gov/33532804/>

7. Bosslet GT, Pollak M, Jang JH, et al. The effect of in-person primary and secondary school instruction on county-level SARS-CoV-2 spread in Indiana. *Clin Infect Dis.* 2021;13:13.

ABSTRACT: OBJECTIVE: To determine the county-level effect of in-person primary and secondary school reopening on daily cases of SARS-CoV-2 in Indiana.

METHODS: This is a county-level population-based study using a panel data regression analysis of the proportion of in-person learning to evaluate an association with community-wide daily new SARS-CoV-2 cases. The study period was July 12-October 6, 2020. We included 73 out of 92 (79.3%) Indiana counties in the analysis, accounting for 85.7% of school corporations and 90.6% of student enrollment statewide. The primary exposure was the proportion of

students returning to in-person instruction. The primary outcome was the daily new SARS-CoV-2 cases per 100,000 residents at the county level.

RESULTS: There is a statistically significant relationship between the proportion of students attending K-12 schools in-person and the county level daily cases of SARS-CoV-2 28 days later. For all ages, the coefficient of interest (beta) is estimated at 3.36 (95% CI: 1.91-4.81; $p < 0.001$). This coefficient represents the effect of a change the proportion of students attending in-person on new daily cases 28 days later. For example, a 10 percentage point increase in K-12 students attending school in-person is associated with a daily increase in SARS-CoV-2 cases in the county equal to 0.336 cases/100,000 residents of all ages.

CONCLUSION: In-person primary and secondary school is associated with a statistically significant but proportionally small increase in the spread of SARS-CoV-2 cases. Copyright © The Author(s) 2021. Published by Oxford University Press for the Infectious Diseases Society of America. All rights reserved. For permissions, e-mail: journals.permissions@oup.com.

URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8083360/>

8. Brookman S, Cook J, Zucherman M, et al. Effect of the new SARS-CoV-2 variant B.1.1.7 on children and young people. *The Lancet Child & adolescent health.* 2021;5(4):e9-e10. DOI: 10.1016/S2352-4642(21)00030-4 10.1016/S2352-4642(21)00030-4. Epub 2021 Feb 10.

URL: <https://www.ncbi.nlm.nih.gov/pubmed/33581054>

DOI: 10.1016/S2352-4642(21)00030-4

10.1016/S2352-4642(21)00030-4. Epub 2021 Feb 10.

9. Busa F, Bardanzellu F, Pintus MC, et al. COVID-19 and school: To open or not to open, that is the question: To first review on current knowledge. *Pediatr Rep.* 2021;13(2):257-78.

ABSTRACT: The COVID-19 pandemic has led to an unprecedented closure of schools in terms of duration. The option of school closure, SARS-CoV-2 initially being poorly known, was influenced by the epidemiological aspects of the influenza virus. However, school closure is still under debate and seems unsupported by sure evidence of efficacy in the COVID-19 era. The aim of our narrative review is to discuss the available literature on SARS-CoV-2 spread among children and adolescents, in the school setting, trying to explain why children appear less susceptible to severe disease and less involved in viral spreading. We also tried to define the efficacy of school closure, through an overview of the effects of the choices made by the various countries, trying to identify which preventive measures could be effective for a safe reopening. Finally, we focused on the psychological aspects of such a prolonged closure for children and adolescents. SARS-CoV-2, children, COVID-19, influenza, and school were used as key words in our literature research, updated to 29 March 2021. To our knowledge, this is the first review summarizing the whole current knowledge on SARS-CoV-2 spreading among children and adolescents in the school setting, providing a worldwide overview in such a pandemic context. Copyright © 2021 Page Press Publications. All rights reserved.

URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8293384/>

10. Casini L, Roccetti M. Reopening Italy's schools in September 2020: a Bayesian estimation of the change in the growth rate of new SARS-CoV-2 cases. *BMJ Open.* 2021;11(7):e051458.

ABSTRACT: **OBJECTIVES:** COVID-19's second wave started a debate on the potential role of schools as a primary factor in the contagion resurgence. Two opposite positions appeared: those convinced that schools played a major role in spreading SARS-CoV-2 infections and those who were not. We studied the growth rate of the total number of SARS-CoV-2 infections in all the Italian regions, before and after the school reopening (September-October 2020), investigating the hypothesis of an association between schools and the resurgence of the virus.

METHODS: Using a Bayesian piecewise linear regression to scrutinise the number of daily SARS-CoV-2 infections in each region, we looked for an estimate of a changepoint in the growth rate of those confirmed cases. We compared the changepoints with the school opening dates, for each Italian region. The regression allows to discuss the change in steepness of the infection curve, before and after the changepoint.

RESULTS: In 15 out of 21 Italian regions (71%), an estimated change in the rate of growth of the total number of daily SARS-CoV-2 infection cases occurred after an average of 16.66 days (95% CI 14.47 to 18.73) since the school reopening. The number of days required for the SARS-CoV-2 daily cases to double went from an average of 47.50 days (95% CI 37.18 to 57.61) before the changepoint to an average of 7.72 days (95% CI 7.00 to 8.48) after it.

CONCLUSION: Studying the rate of growth of daily SARS-CoV-2 cases in all the regions provides some evidence in favour of a link between school reopening and the resurgence of the virus. The number of factors that could have

played a role is too many to give a definitive answer. Still, the temporal correspondence warrants further systematic experiments to investigate on potential confounders that could clarify how much reopening schools mattered. Copyright © Author(s) (or their employer(s)) 2021. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

URL: <https://bmjopen.bmj.com/content/11/7/e051458>

11. Cho EY, Choe YJ. School closures during the coronavirus disease 2019 outbreak. Clinical and Experimental Pediatrics. 2021;64(7):322-7.

ABSTRACT: School closures during the coronavirus disease 2019 (COVID-19) pandemic have been outlined in studies from different disciplines, including economics, sociology, mathematical modeling, epidemiology, and public health. In this review, we discuss the implications of school closures in the context of the current COVID-19 pandemic. Modeling studies of the effects of school closures, largely derived from the pandemic influenza model, on severe acute respiratory syndrome coronavirus 2 produced conflicting results. Earlier studies assessed the risk of school reopening by modeling transmission across schools and communities; however, it remains unclear whether the risk is due to increased transmission in adults or children. The empirical findings of the impact of school closures on COVID-19 outbreaks suggest no clear effect, likely because of heterogeneity in community infection pressure, differences in school closure strategies, or the use of multiple interventions. The benefits of school closings are unclear and not readily quantifiable; however, they must be weighed against the potential high social costs, which can also negatively affect the health of this generation. Copyright © 2021 by The Korean Pediatric Society.

URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8255509/>

12. Cordery R, Reeves L, Zhou J, et al. Transmission of SARS-CoV-2 by children attending school. Interim report on an observational, longitudinal sampling study of infected children, contacts, and the environment. medRxiv. 2021:2021.03.08.21252839. DOI: 10.1101/2021.03.08.21252839

ABSTRACT: Background Transmission of SARS-CoV-2 by children and young people in school settings has not been directly evaluated, nor the main mechanisms of transmission identified. The study set out to undertake sequential longitudinal sampling of infected children, their contacts, and the environment. Methods Cases of COVID-19 were identified through statutory notification and matched to schools reporting cases. Cases of COVID-19 and their contacts from school and home were longitudinally sampled and tested for SARS-CoV-2. Surfaces and air in the home and school environment were also subject to longitudinal sampling and testing. Results Onward transmission of virus to immediate classroom members who participated in the study was not detected. Evidence of more widespread transmission among children remaining in school was not identified with the exception of one unexpected cluster of three asymptomatic cases in one school. Children infected with SARS-CoV-2 in this study shed viral RNA for up to 10 days from symptom onset, with levels peaking at 5-8 days. Viral RNA was identified in the environment around children who were actively shedding virus in the home, but limited contamination was identified in schools. Variant of Concern B.1.1.7 was identified in later cases studied. Summary After 3 months, this small study has not found evidence to suggest COVID-19 is commonly transmitted by children within schools. A minority of infections may be subject to stochastic events that can lead to transmission. Further prospective and retrospective studies are required to identify factors associated with such events. Competing Interest Statement The authors have declared no competing interest. Clinical Trial ISRCTN 13773960 Funding Statement UKRI/Department of Health & Social Care, National Institute for Health Research (NIHR) Author Declarations I confirm all relevant ethical guidelines have been followed, and any necessary IRB and/or ethics committee approvals have been obtained. Yes The details of the IRB/oversight body that provided approval or exemption for the research described are given below: The protocol was approved by the London (Chelsea) Research Ethics Committee (REC), HRA London Centre, Skipton House, London SE1 6LH (Schools Transmission Study REC reference 18/LO/0025; IRAS Reference 225006). Informed consent was obtained from all participants or parents/guardians, and assent was obtained from any participant aged under 18. All necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived. Yes I understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance). Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable. Yes Any data not included in the manuscript are available from the corresponding author upon reasonable request

URL: <http://medrxiv.org/content/early/2021/03/09/2021.03.08.21252839.abstract>
DOI: 10.1101/2021.03.08.21252839

13. Di Domenico L, Sabbatini CE, Pullano G, et al. Impact of January 2021 curfew measures on SARS-CoV-2 B.1.1.7 circulation in France. Euro Surveill: Bulletin European sur les Maladies Transmissibles = European Communicable Disease Bulletin. 2021;26(15):04.

ABSTRACT: Following the spread of the SARS-CoV-2 B.1.1.7 variant, social distancing was strengthened in France in January 2021. Using a two-strain mathematical model calibrated on genomic surveillance, we estimated that curfew measures allowed hospitalisations to plateau by decreasing transmission of the historical strains while B.1.1.7 continued to grow. School holidays appear to have further slowed down progression in February. Without progressively strengthened social distancing, a rapid surge of hospitalisations is expected, despite the foreseen increase in vaccination rhythm.

URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8167415/>

14. Di Gilio A, Palmisani J, Pulimeno M, et al. CO2 concentration monitoring inside educational buildings as a strategic tool to reduce the risk of Sars-CoV-2 airborne transmission. Environ Res. 2021;202:111560.

ABSTRACT: In order to avoid SARS-CoV-2 transmission inside educational buildings and promote the safe reopening of schools, the Italian Government, in line with the other European countries and in accordance with the WHO recommendations, adopted a contingency plan including actions able to guarantee adequate air ventilation in classrooms. Therefore, in this pilot study, a surveillance activity based on the real-time monitoring of CO2 levels as a proxy of SARS-CoV-2 transmission risk, was conducted inside 9 schools (11 classrooms) located in Apulia Region (South of Italy) during the reopening of schools after the lockdown due to COVID-19 pandemic. More specifically, monitoring activities and data treatment were conducted to evaluate the initial scenario inside the classrooms (first stage of evaluation) and the potential improvements obtained by applying a detailed operating protocol of air ventilation based on specific actions and the simultaneous real time visualization of CO2 levels by non-dispersive infrared (NDIR) sensors (second stage of evaluation). Although, during the first evaluation stage, air ventilation through the opening of windows and doors was guaranteed, 6 (54%) classrooms showed mean values of CO2 higher than 1000 ppm and all classrooms exceeded the recommended CO2 concentration limit value of 700 ppm. The development and implementation of tailored ventilation protocol including the real time visualization of CO2 levels allowed to depict better scenarios. An overall improvement of CO2 levels was indeed registered for all classrooms where teachers were compliant and helpful in the management of the air ventilation strategy. Therefore, this study reports the first evidence-based measures demonstrating that, with the exception of few environments affected by structural limits, the real-time visualization and monitoring of CO2 concentrations allows effective air exchanges to be implemented and contributes to prevent SARS-CoV-2 transmission. Moreover, on the basis of the monitoring outcomes and in order to ensure adequate air ventilation in educational buildings, a 4 level-risk classification including specific corrective actions for each level was provided. Copyright © 2021 Elsevier Inc. All rights reserved.

URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8253691/>

15. Duong D. Should Canada's approach to COVID-19 and kids change with new variants? CMAJ. 2021;193(17):E623-E4.

URL: <https://dx.doi.org/10.1503/cmaj.1095936>

16. Fontanet A, Tondeur L, Grant R, et al. SARS-CoV-2 infection in schools in a northern French city: a retrospective serological cohort study in an area of high transmission, France, January to April 2020. Euro Surveill: Bulletin European sur les Maladies Transmissibles = European Communicable Disease Bulletin. 2021;26(15):04.

ABSTRACT: Background Children's role in SARS-CoV-2 epidemiology remains unclear. We investigated an initially unnoticed SARS-CoV-2 outbreak linked to schools in northern France, beginning as early as mid-January 2020. Aims This retrospective observational study documents the extent of SARS-CoV-2 transmission, linked to an affected high school (n = 664 participants) and primary schools (n = 1,340 study participants), in the context of unsuspected SARS-CoV-2 circulation and limited control measures. Methods Between 30 March and 30 April 2020, all school staff, as well as pupils and their parents and relatives were invited for SARS-CoV-2 antibody testing and to complete a questionnaire covering symptom history since 13 January 2020. Results In the high school, infection attack rates were 38.1% (91/239), 43.4% (23/53), and 59.3% (16/27), in pupils, teachers, and non-teaching staff respectively

vs 10.1% (23/228) and 12.0% (14/117) in the pupils' parents and relatives ($p < 0.001$). Among the six primary schools, three children attending separate schools at the outbreak start, while symptomatic, might have introduced SARS-CoV-2 there, but symptomatic secondary cases related to them could not be definitely identified. In the primary schools overall, antibody prevalence in pupils sharing classes with symptomatic cases was higher than in pupils from other classes: 15/65 (23.1%) vs 30/445 (6.7%) ($p < 0.001$). Among 46 SARS-CoV-2 seropositive pupils < 12 years old, 20 were asymptomatic. Whether past HKU1 and OC43 seasonal coronavirus infection protected against SARS-CoV-2 infection in 6-11 year olds could not be inferred. Conclusions Viral circulation can occur in high and primary schools so keeping them open requires consideration of appropriate control measures and enhanced surveillance.

URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8167414/>

17. Gettings JR, Gold JAW, Kimball A, et al. SARS-CoV-2 transmission in a Georgia school district - United States, December 2020-January 2021. Clin Infect Dis. 2021;17:17.

ABSTRACT: BACKGROUND: To inform prevention strategies, we assessed the extent of SARS-CoV-2 transmission and settings in which transmission occurred in a Georgia public school district.

METHODS: During December 1, 2020-January 22, 2021, SARS-CoV-2-infected index cases and their close contacts in schools were identified by school and public health officials. For in-school contacts, we assessed symptoms and offered SARS-CoV-2 RT-PCR testing; performed epidemiologic investigations and whole-genome sequencing to identify in-school transmission; and calculated secondary attack rate (SAR) by school setting (e.g., sports, elementary school classroom), index case role (i.e., staff, student), and index case symptomatic status.

RESULTS: We identified 86 index cases and 1,119 contacts, 688 (63.1%) of whom received testing. Fifty-nine (8.7%) of 679 contacts tested positive; 15 (17.4%) of 86 index cases resulted in ≥ 2 positive contacts. Among 55 persons testing positive with available symptom data, 31 (56.4%) were asymptomatic. Highest SAR were in indoor, high-contact sports settings (23.8%, 95% confidence interval [CI] 12.7, 33.3), staff meetings/lunches (18.2%, CI 4.5-31.8), and elementary school classrooms (9.5%, CI 6.5-12.5). SAR was higher for staff (13.1%, CI 9.0-17.2) versus student index cases (5.8%, CI 3.6-8.0) and for symptomatic (10.9%, CI 8.1-13.9) versus asymptomatic index cases (3.0%, CI 1.0-5.5).

CONCLUSIONS: Indoor sports may pose a risk to the safe operation of in-person learning. Preventing infection in staff members, through measures that include COVID-19 vaccination, is critical to reducing in-school transmission. Because many positive contacts were asymptomatic, contact tracing should be paired with testing, regardless of symptoms.

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URL: <https://pubmed.ncbi.nlm.nih.gov/33864375/>

18. Giardina J, Bilinski A, Fitzpatrick MC, et al. When do elementary students need masks in school? Model-estimated risk of in-school SARS-CoV-2 transmission and related infections among household members before and after student vaccination. medRxiv. 2021:2021.08.04.21261576. DOI: 10.1101/2021.08.04.21261576

ABSTRACT: Background While CDC guidance for K-12 schools recommends indoor masking regardless of vaccination status, final decisions about masking in schools will be made at the local and state level. The impact of the removal of mask restrictions, however, on COVID-19 outcomes for elementary students, educators/staff, and their households is not well known. Methods We used a previously published agent-based dynamic transmission model of SARS-CoV-2 in K-12 schools to simulate an elementary school with 638 students across 6 scenarios: combinations of three viral infectiousness levels (reflecting wild-type virus, alpha variant, and delta variant) and two student vaccination levels (0% and 50% coverage to reflect potential authorization in this age group). For each scenario, we varied observed community COVID-19 incidence (0 to 50 cases/100,000 people/day) and mitigation effectiveness (0-100% reduction to in-school secondary attack rate), and evaluated two outcomes over a 30 day period: (1) the probability of at least one in-school transmission, and (2) the increase in total cases among students, educators/staff, and their household members between in-person and remote instruction. Results Over 30 days in the simulated elementary school, the probability of at least one in-school SARS-CoV-2 transmission and the number of projected infections in the immediate school community varied widely. In one scenario with the delta variant and no student vaccination, assuming that baseline mitigation measures of simple ventilation and handwashing reduce the secondary attack rate by 40%, if decision-makers seek to keep the monthly probability of an in-school transmission below 50%, additional mitigation (e.g., masking) would need to be added at a community incidence of approximately 4/100,000/day. Once students are vaccinated, thresholds shift substantially higher. Limitations The interpretation of model results should be limited by the uncertainty in many of the parameters, including the effectiveness of individual mitigation interventions

and vaccine efficacy against the delta variant, and the limited scope of the model beyond the school community. Additionally, the assumed case detection rate (33% of cases detected) may be too high in areas with decreased testing capacity. Conclusion Despite the assumption of high adult vaccination, the risks of both in-school SARS-CoV-2 transmission and resulting infections among students, educators/staff, and their household members remain high when the delta variant predominates and students are unvaccinated. Mitigation measures or vaccinations for students when available can substantially reduce these risks. These findings underscore the potential role for responsive plans, where mitigation is deployed based on local COVID-19 incidence and vaccine uptake. Competing Interest Statement The authors have declared no competing interest. Funding Statement The authors were supported by the Centers for Disease Control and Prevention through the Council of State and Territorial Epidemiologists (NU38OT000297-02: AB, JAS), the National Institute of Allergy and Infectious Diseases (R37AI058736-16S1: AC; K01AI141576: MCF; and K08127908: EAK), the National Institute on Drug Abuse (3R37DA01561217S1: JAS), and Facebook (unrestricted gift; JG, AB, JAS). The papers' contents are solely the responsibility of the authors and do not represent the official views of the funders. Author Declarations I confirm all relevant ethical guidelines have been followed, and any necessary IRB and/or ethics committee approvals have been obtained. Yes The details of the IRB/oversight body that provided approval or exemption for the research described are given below: N/A - This study only involved the use of a simulation model. All necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived. Yes I understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance). Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable. Yes Model code and replication files are publicly available on GitHub. <https://github.com/abilinski/BackToSchool2>
URL: <http://medrxiv.org/content/early/2021/08/07/2021.08.04.21261576.abstract>
DOI: 10.1101/2021.08.04.21261576

19. Guilamo-Ramos V, Benzekri A, Thimm-Kaiser M, et al. Reconsidering assumptions of adolescent and young adult severe acute respiratory syndrome coronavirus 2 transmission dynamics. Clin Infect Dis. 2021;73:S146-S63.

ABSTRACT: Evidence regarding the important role of adolescents and young adults (AYA) in accelerating and sustaining coronavirus disease 2019 (COVID-19) outbreaks is growing. Furthermore, data suggest that 2 known factors that contribute to high severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) transmissibility-presymptomatic transmission and asymptomatic case presentations-may be amplified in AYA. However, AYA have not been prioritized as a key population in the public health response to the COVID-19 pandemic. Policy decisions that limit public health attention to AYA and are driven by the assumption of insignificant forward transmission from AYA pose a risk of inadvertent reinvigoration of local transmission dynamics. In this viewpoint, we highlight evidence regarding the increased potential of AYA to transmit SARS-CoV-2 that, to date, has received little attention, discuss adolescent and young adult-specific considerations for future COVID-19 control measures, and provide applied programmatic suggestions. Copyright © The Author(s) 2020.

URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7499536/>

20. Haapanen M, Renko M, Artama M, et al. The impact of the lockdown and the re-opening of schools and day cares on the epidemiology of SARS-CoV-2 and other respiratory infections in children - A nationwide register study in Finland. EClinicalMedicine. 2021;34:100807.

ABSTRACT: Background: Nationwide restrictions started in Finland in March to prevent the spread of COVID-19, leading to school and day care closures. The aim of this study is to describe the effect of closures and re-openings on the respiratory pathogen epidemiology.

Methods: Laboratory-confirmed cases of SARS-CoV-2; respiratory syncytial virus (RSV); influenza (A & B); parainfluenza-, adeno-, and rhinoviruses; Mycoplasma pneumoniae; and Streptococcus pneumoniae in children were collected from the National Infectious Disease Register over the period of 2017-2020. Weekly incidences (weeks 1 to 35) with 95% confidence intervals (CIs) were calculated per 100 000 children in 2020 and compared by incidence rate ratios (IRRs) to corresponding periods in 2017-2019.

Findings: The lockdown had immediate impact on the incidences of respiratory pathogens except SARS-CoV-2. Week after the lockdown began IRR was 0*3 (CI 0*3-0*4) and next week the IRR was 0*1 (0*1-0*2). The incidence of SARS-CoV-2 started to decline eight weeks after the lockdown began. The highest recorded weekly incidence of SARS-CoV-2 was 7*2/100 000 children. The effect of the lockdown lasted until late summer. Rhinovirus and SARS-CoV-2 began to increase before the schools or day cares opened in August. The re-opening of schools seemed to have no impact on the incidence of any pathogen.

Interpretation: Our results suggest that general social distancing, including school and day care closures, played a crucial role in reducing infections, and the effect lasted for several weeks. The re-opening of schools and day care centres seems to have had no immediate impact on the incidences of any respiratory pathogens.

Funding: This study had no funding source. Copyright © 2021 The Author(s).

URL: [https://www.thelancet.com/journals/eclinm/article/PIIS2589-5370\(21\)00087-0/fulltext](https://www.thelancet.com/journals/eclinm/article/PIIS2589-5370(21)00087-0/fulltext)

21. Head JR, Andrejko KL, Cheng Q, et al. School closures reduced social mixing of children during COVID-19 with implications for transmission risk and school reopening policies. Journal of the Royal Society Interface. 2021;18(177):20200970.

ABSTRACT: School closures may reduce the size of social networks among children, potentially limiting infectious disease transmission. To estimate the impact of K-12 closures and reopening policies on children's social interactions and COVID-19 incidence in California's Bay Area, we collected data on children's social contacts and assessed implications for transmission using an individual-based model. Elementary and Hispanic children had more contacts during closures than high school and non-Hispanic children, respectively. We estimated that spring 2020 closures of elementary schools averted 2167 cases in the Bay Area (95% CI: -985, 5572), fewer than middle (5884; 95% CI: 1478, 11.550), high school (8650; 95% CI: 3054, 15 940) and workplace (15 813; 95% CI: 9963, 22 617) closures. Under assumptions of moderate community transmission, we estimated that reopening for a four-month semester without any precautions will increase symptomatic illness among high school teachers (an additional 40.7% expected to experience symptomatic infection, 95% CI: 1.9, 61.1), middle school teachers (37.2%, 95% CI: 4.6, 58.1) and elementary school teachers (4.1%, 95% CI: -1.7, 12.0). However, we found that reopening policies for elementary schools that combine universal masking with classroom cohorts could result in few within-school transmissions, while high schools may require masking plus a staggered hybrid schedule. Stronger community interventions (e.g. remote work, social distancing) decreased the risk of within-school transmission across all measures studied, with the influence of community transmission minimized as the effectiveness of the within-school measures increased.

URL: <https://royalsocietypublishing.org/doi/10.1098/rsif.2020.0970>

22. Hoch M, Vogel S, Kolberg L, et al. Weekly SARS-CoV-2 sentinel surveillance in primary schools, kindergartens, and nurseries, Germany, June-November 2020. Emerg Infect Dis. 2021;27(8):2192-6.

ABSTRACT: We investigated severe acute respiratory syndrome coronavirus 2 infections in primary schools, kindergartens, and nurseries in Germany. Of 3,169 oropharyngeal swab specimens, only 2 were positive by real-time reverse transcription PCR. Asymptomatic children attending these institutions do not appear to be driving the pandemic when appropriate infection control measures are used. Copyright © 2021 Centers for Disease Control and Prevention (CDC). All rights reserved.

URL: <https://pubmed.ncbi.nlm.nih.gov/34087088/>

23. Irfan O, Li J, Tang K, et al. Risk of infection and transmission of SARS-CoV-2 among children and adolescents in households, communities and educational settings: A systematic review and meta-analysis. Journal of Global Health. 2021;11:05013.

ABSTRACT: Background: There is uncertainty with respect to SARS-CoV-2 transmission in children (0-19 years) with controversy on effectiveness of school-closures in controlling the pandemic. It is of equal importance to evaluate the risk of transmission in children who are often asymptomatic or mildly symptomatic carriers that may incidentally transmit SARS-CoV-2 in different settings. We conducted this review to assess transmission and risks for SARS-CoV-2 in children (by age-groups or grades) in community and educational-settings compared to adults.

Methods: Data for the review were retrieved from PubMed, EMBASE, Cochrane Library, WHO COVID-19 Database, China National Knowledge Infrastructure (CNKI) Database, WanFang Database, Latin American and Caribbean Health Sciences Literature (LILACS), Google Scholar, and preprints from medRxiv and bioRxiv covering a timeline from December 1, 2019 to April 1, 2021. Population-screening, contact-tracing and cohort studies reporting prevalence and

transmission of SARS-CoV-2 in children were included. Data were extracted according to PRISMA guidelines. Meta-analyses were performed using Review Manager 5.3.

Results: Ninety studies were included. Compared to adults, children showed comparable national (risk ratio (RR) = 0.87, 95% confidence interval (CI) = 0.71-1.060 and subnational (RR = 0.81, 95% CI = 0.66-1.01) prevalence in population-screening studies, and lower odds of infection in community/household contact-tracing studies (odds ratio (OR) = 0.62, 95% CI = 0.46-0.84). On disaggregation, adolescents observed comparable risk (OR = 1.22, 95% CI = 0.74-2.04) with adults. In educational-settings, children attending daycare/preschools (OR = 0.53, 95% CI = 0.38-0.72) were observed to be at lower-risk when compared to adults, with odds of infection among primary (OR = 0.85, 95% CI = 0.55-1.31) and high-schoolers (OR = 1.30, 95% CI = 0.71-2.38) comparable to adults. Overall, children and adolescents had lower odds of infection in educational-settings compared to community and household clusters. Conclusions: Children (<10 years) showed lower susceptibility to COVID-19 compared to adults, whereas adolescents in communities and high-schoolers had comparable risk. Risks of infection among children in educational-settings was lower than in communities. Evidence from school-based studies demonstrate it is largely safe for children (<10 years) to be at schools, however older children (10-19 years) might facilitate transmission. Despite this evidence, studies focusing on the effectiveness of mitigation measures in educational settings are urgently needed to support both public health and educational policy-making for school reopening. Copyright © 2021 by the Journal of Global Health. All rights reserved.

URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8285769/>

24. Johnson KE, Lachmann M, Stoddard M, et al. Detecting in-school transmission of SARS-CoV-2 from case ratios and documented clusters. MedRxiv : the Preprint Server for Health Sciences. 2021;28:28.

ABSTRACT: Claims that in-person schooling has not amplified SARS-CoV-2 transmission are based on similar infection rates in schools and their surrounding communities and limited numbers of documented in-school transmission events. Simulations assuming high in-school transmission suggest that these metrics cannot exclude the possibility that transmission in schools exacerbated overall pandemic risks.

URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8095228/>

25. Johnson KE, Stoddard M, Nolan RP, et al. In the long shadow of our best intentions: Model-based assessment of the consequences of school reopening during the COVID-19 pandemic. PLoS ONE [Electronic Resource]. 2021;16(3):e0248509.

ABSTRACT: As the world grapples with the ongoing COVID-19 pandemic, a particularly thorny set of questions surrounds the reopening of primary and secondary (K-12) schools. The benefits of in-person learning are numerous, in terms of education quality, mental health, emotional well-being, equity and access to food and shelter. Early reports suggested that children might have reduced susceptibility to COVID-19, and children have been shown to experience fewer complications than older adults. Over the past few months, our understanding of COVID-19 has been further shaped by emerging data, and it is now understood that children are as susceptible to infection as adults and have a similar viral load during infection, even if asymptomatic. Based on this updated understanding of the disease, we have used epidemiological modeling to explore the feasibility and consequences of school reopening in the face of differing rates of COVID-19 prevalence and transmission. We focused our analysis on the United States, but the results are applicable to other countries as well. We demonstrate the potential for a large discrepancy between detected cases and true infections in schools due to the combination of high asymptomatic rates in children coupled with delays in seeking testing and receiving results from diagnostic tests. Our findings indicate that, regardless of the initial prevalence of the disease, and in the absence of robust surveillance testing and contact-tracing, most schools in the United States can expect to remain open for 20-60 days without the emergence of sizeable disease clusters. At this point, even if schools choose to close after outbreaks occur, COVID-19 cases will be seeded from these school clusters and amplified into the community. Thus, our findings suggest that the debate between the risks to student safety and benefits of in-person learning frames a false dual choice. Reopening schools without surveillance testing and contact tracing measures in place will lead to spread within the schools and within the communities that eventually forces a return to remote learning and leaves a trail of infection in its wake.

URL: <https://pubmed.ncbi.nlm.nih.gov/33765026/>

26. Jordan I, de Sevilla MF, Fumado V, et al. Transmission of SARS-CoV-2 infection among children in summer schools applying stringent control measures in Barcelona, Spain. Clin Infect Dis. 2021;12:12.

ABSTRACT: BACKGROUND: Understanding the role of children in SARS-CoV-2 transmission is critical to guide decision-making for schools in the pandemic. We aimed to describe the transmission of SARS-CoV-2 among children and adult staff in summer schools.

METHODS: During July 2020 we prospectively recruited children and adult staff attending summer schools in Barcelona who had SARS-CoV-2 infection. Primary SARS-CoV-2 infections were identified through: (1) surveillance program in 22 summer schools' of 1905 participants, involving weekly saliva sampling for SARS-CoV-2 RT-PCR during 2-5 weeks; (2) cases identified through the Catalonian Health Surveillance System of children diagnosed with SARS-CoV-2 infection by nasopharyngeal RT-PCR. All centres followed prevention protocols: bubble groups, hand washing, facemasks and conducting activities mostly outdoors. Contacts of a primary case within the same bubble were evaluated by nasopharyngeal RT-PCR. Secondary attack rates and effective reproduction number in summer schools (R^*) were calculated.

RESULTS: Among the over 2000 repeatedly screened participants, 30 children and 9 adults were identified as primary cases. A total of 253 close contacts of these primary cases were studied (median 9 (IQR 5-10) for each primary case), among which twelve new cases (4.7%) were positive for SARS-CoV-2. The R^* was 0.3, whereas the contemporary rate in the general population from the same areas in Barcelona was 1.9.

CONCLUSIONS: The transmission rate of SARS-CoV-2 infection among children attending school-like facilities under strict prevention measures was lower than that reported for the general population. This suggests that under preventive measures schools are unlikely amplifiers of SARS-CoV-2 transmission and supports current recommendations for school opening. Copyright © The Author(s) 2021. Published by Oxford University Press for the Infectious Diseases Society of America. All rights reserved. For permissions, e-mail: journals.permissions@oup.com.

URL: <https://pubmed.ncbi.nlm.nih.gov/33709138/>

27. Kaiser SV, Watson A, Dogan B, et al. Preventing COVID-19 Transmission in Education Settings. Pediatrics. 2021;10:10.

ABSTRACT: OBJECTIVES: In fall 2020, community hubs opened in San Francisco, California, to support vulnerable groups of students in remote learning. Our objectives were to (1) describe adherence to coronavirus disease 2019 (COVID-19) mitigation policies in these urban, low-income educational settings; (2) assess associations between policy adherence and in-hub COVID-19 transmission; and (3) identify barriers to and facilitators of adherence.

METHODS: We conducted a mixed-methods study from November 2020 to February 2021. We obtained COVID-19 case data from the San Francisco Department of Public Health, conducted field observations to observe adherence to COVID-19 mitigation policies, and surveyed hub leaders about barriers to and facilitators of adherence. We summarized quantitative data using descriptive statistics and qualitative data using thematic content analysis.

RESULTS: A total of 1738 children were enrolled in 85 hubs (39% Hispanic, 29% Black). We observed 54 hubs ($n = 1175$ observations of children and 295 observations of adults). There was high community-based COVID-19 incidence (2.9-41.2 cases per 100 000 residents per day), with 36 cases in hubs and only 1 case of hub-based transmission (adult to adult). Sixty-seven percent of children and 99% of adults were masked. Fifty-five percent of children and 48% of adults were distanced ≥ 6 ft. Facilitators of mitigation policies included the following: for masking, reminders, adequate supplies, and "unmasking zones"; for distancing, reminders and distanced seating.

CONCLUSIONS: We directly observed COVID-19 mitigation in educational settings, and we found variable adherence. However, with promotion of multiple policies, there was minimal COVID-19 transmission (despite high community incidence). We detail potential strategies for increasing adherence to COVID-19 mitigation. Copyright © 2021 by the American Academy of Pediatrics.

URL: <https://pediatrics.aappublications.org/content/early/2021/08/02/peds.2021-051438/tab-article-info>

28. Katz SE, McHenry R, Mauer LG, et al. Low In-School COVID-19 Transmission and Asymptomatic Infection Despite High Community Prevalence. Journal of Pediatrics. 2021.

ABSTRACT: There is concern that in-person schooling during the coronavirus disease 2019 (COVID-19) pandemic will facilitate disease transmission. Through asymptomatic surveillance and contact tracing for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), we found low rates of asymptomatic SARS-CoV-2 infection and little in-school transmission of COVID-19 when physical distancing and masking strategies were enforced despite a high community prevalence of COVID-19. Copyright © 2021 The Authors

URL: <https://pubmed.ncbi.nlm.nih.gov/34144028/>

29. Keeling MJ, Tildesley MJ, Atkins BD, et al. The impact of school reopening on the spread of COVID-19 in England. *Philosophical Transactions of the Royal Society of London - Series B: Biological Sciences*. 2021;376(1829):20200261.

ABSTRACT: By mid-May 2020, cases of COVID-19 in the UK had been declining for over a month; a multi-phase emergence from lockdown was planned, including a scheduled partial reopening of schools on 1 June 2020. Although evidence suggests that children generally display mild symptoms, the size of the school-age population means the total impact of reopening schools is unclear. Here, we present work from mid-May 2020 that focused on the imminent opening of schools and consider what these results imply for future policy. We compared eight strategies for reopening primary and secondary schools in England. Modifying a transmission model fitted to UK SARS-CoV-2 data, we assessed how reopening schools affects contact patterns, anticipated secondary infections and the relative change in the reproduction number, R . We determined the associated public health impact and its sensitivity to changes in social distancing within the wider community. We predicted that reopening schools with half-sized classes or focused on younger children was unlikely to push R above one. Older children generally have more social contacts, so reopening secondary schools results in more cases than reopening primary schools, while reopening both could have pushed R above one in some regions. Reductions in community social distancing were found to outweigh and exacerbate any impacts of reopening. In particular, opening schools when the reproduction number R is already above one generates the largest increase in cases. Our work indicates that while any school reopening will result in increased mixing and infection amongst children and the wider population, reopening schools alone in June 2020 was unlikely to push R above one. Ultimately, reopening decisions are a difficult trade-off between epidemiological consequences and the emotional, educational and developmental needs of children. Into the future, there are difficult questions about what controls can be instigated such that schools can remain open if cases increase. This article is part of the theme issue 'Modelling that shaped the early COVID-19 pandemic response in the UK'.

URL: <https://royalsocietypublishing.org/doi/10.1098/rstb.2020.0261>

30. Kishimoto K, Bun S, Shin JH, et al. Early impact of school closure and social distancing for COVID-19 on the number of inpatients with childhood non-COVID-19 acute infections in Japan. *Eur J Pediatr*. 2021;180(9):2871-8.

ABSTRACT: Many countries have implemented school closures as part of social distancing measures intended to control the spread of coronavirus disease 2019 (COVID-19). The aim of this study was to assess the early impact of nationwide school closure (March-May 2020) and social distancing for COVID-19 on the number of inpatients with major childhood infectious diseases in Japan. Using data from the Diagnosis Procedure Combination system in Japan, we identified patients aged 15 years or younger with admissions for a diagnosis of upper respiratory tract infection (URTI), lower respiratory tract infection (LRTI), influenza, gastrointestinal infection (GII), appendicitis, urinary tract infection (UTI), or skin and soft tissue infection (SSTI) between July 2018 and June 2020. Changes in the trend of the weekly number of inpatients between the two periods were assessed using interrupted time-series analysis. A total of 75,053 patients in 210 hospitals were included. The overall weekly number of inpatients was decreased by 52.5%, 77.4%, and by 83.4% in the last week of March, April, and May 2020, respectively, when compared on a year-on-year basis. The estimated impact was a reduction of 581 (standard error 42.9) inpatients per week in the post-school-closure period ($p < 0.001$). The main part of the reduction was for pre-school children. Remarkable decreases in the number of inpatients with URI, LRTI, and GII were observed, while there were relatively mild changes in the other groups. Conclusion: We confirmed a marked reduction in the number of inpatients with childhood non-COVID-19 acute infections in the post-school-closure period. What is Known: * Most countries have implemented social distancing measures to limit the spread of the novel coronavirus disease 2019 (COVID-19). * A large decrease in pediatric emergency visits has been reported from several countries after the social distancing. What is New: * Based on administrative claims data, a marked reduction in the number of inpatients for childhood non-COVID-19 acute infections was found in the post-school-closure period in Japan. * The magnitude of the reduction was different between the disease groups. Copyright © 2021. The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature.

URL: <https://pubmed.ncbi.nlm.nih.gov/33791861/>

31. Kobayashi J, Takeuchi R, Toyama Y, et al. Urgent need to strengthen school health in Asia and the Pacific Islands. *Pediatr Int*. 2021. DOI: 10.1111/ped.14921
10.1111/ped.14921.

ABSTRACT: In Asia and the Pacific Island region, strengthening of school health activities and measures is urgently recommended to deal with the impact of the increasing risk of potential school closures due to continuation of the coronavirus disease 2019 (COVID-19) pandemic in 2021. As the incidence of COVID-19 in 2020 was relatively low in these regions, many of the countries were able to avoid prolonged school closures. However, even if vaccination is expanded in the future and the pandemic tends to come to an end, the risk of SARS-CoV-2 variants spreading among children will also increase, and the possibility of having to close schools again will also increase.

URL: <https://www.ncbi.nlm.nih.gov/pubmed/34258829>

DOI: 10.1111/ped.14921

10.1111/ped.14921.

32. Koirala A, Goldfeld S, Bowen AC, et al. Lessons learnt during the COVID-19 pandemic: Why Australian schools should be prioritised to stay open. J Paediatr Child Health. 2021;08:08.

ABSTRACT: In 2020, school and early childhood educational centre (ECEC) closures affected over 1.5 billion school-aged children globally as part of the COVID-19 pandemic response. Attendance at school and access to ECEC is critical to a child's learning, well-being and health. School closures increase inequities by disproportionately affecting vulnerable children. Here, we summarise the role of children and adolescents in Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) transmission and that of schools and ECECs in community transmission and describe the Australian experience. In Australia, most SARS-CoV-2 cases in schools were solitary (77% in NSW and 67% in Victoria); of those that did progress to an outbreak, >90% involved fewer than 10 cases. Australian and global experience has demonstrated that SARS-CoV-2 is predominantly introduced into schools and ECECs during periods of heightened community transmission. Implementation of public health mitigation strategies, including effective testing, tracing and isolation of contacts, means schools and ECECs can be safe, not drivers of transmission. Schools and ECEC are essential services and so they should be prioritised to stay open for face-to-face learning. This is particularly critical as we continue to manage the next phase of the COVID-19 pandemic. Copyright © 2021 Paediatrics and Child Health Division (The Royal Australasian College of Physicians).

URL: <https://pubmed.ncbi.nlm.nih.gov/34101922/>

33. Kriemler S, Ulyte A, Ammann P, et al. Surveillance of Acute SARS-CoV-2 Infections in School Children and Point-Prevalence During a Time of High Community Transmission in Switzerland. Frontiers in Pediatrics. 2021;9:645577.

ABSTRACT: Background: Switzerland had one of the highest incidence of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections in Europe during the second wave. Schools were open as in most of Europe with specific preventive measures in place. However, the frequency and transmission of acute unrecognized, asymptomatic or oligosymptomatic infections in schools during this time of high community transmission is unknown. Thereof, our aim was to pilot a surveillance system that detects acute SARS-CoV-2 infections in schools and possible transmission within classes. Methods: Fourteen out of the randomly selected sample of the Ciao Corona cohort study participated between December 1 and 11, a time when incidence rate for SARS-CoV-2 infections was high for the canton of Zurich. We determined point-prevalence of acute SARS-CoV-2 infections of school children attending primary and secondary school. A buccal swab for polymerase chain reaction (PCR) and a rapid diagnostic test (RDT) to detect SARS-CoV-2 were taken twice 1 week apart (T1 and T2) in a cohort of children from randomly selected classes. A questionnaire assessed demographics and symptoms compatible with a SARS-CoV-2 infection during the past 5 days. Results: Out of 1,299 invited children, 641 (49%) 6- to 16-year-old children and 66 teachers from 14 schools and 67 classes participated in at least one of two testings. None of the teachers but one child had a positive PCR at T1, corresponding to a point-prevalence in children of 0.2% (95% CI 0.0-1.1%), and no positive PCR was detected at T2. The child with positive PCR at T1 was negative on the RDT at T1 and both tests were negative at T2. There were 7 (0.6%) false positive RDTs in children and 2 (1.7%) false positive RDTs in teachers at T1 or T2 among 5 schools (overall prevalence 0.7%). All 9 initially positive RDTs were negative in a new buccal sample taken 2 h to 2 days later, also confirmed by PCR. Thirty-five percent of children and 8% of teachers reported mild symptoms during the 5 days prior to testing. Conclusion: In a setting of high incidence of SARS-CoV-2 infections, unrecognized virus spread within schools was very low. Schools appear to be safe with the protective measures in place (e.g., clearly symptomatic children have to stay at home, prompt contact tracing with individual and class-level quarantine, and structured infection prevention measures in school). Specificity of the RDT was within the lower boundary of performance and needs further evaluation for its use in schools. Given the low point prevalence even in a setting of very high incidence, a targeted test, track, isolate and quarantine (TTIQ) strategy for symptomatic children and school

personnel adapted to school settings is likely more suitable approach than surveillance on entire classes and schools. Clinical Trial Registration: <https://clinicaltrials.gov/ct2/show/NCT04448717>, ClinicalTrials.gov NCT04448717. Copyright © 2021 Kriemler, Ulyte, Ammann, Peralta, Berger, Puhan and Radtke.

URL: <https://pubmed.ncbi.nlm.nih.gov/33796490/>

34. Lachassinne E, de Pontual L, Caseris M, et al. SARS-CoV-2 transmission among children and staff in daycare centres during a nationwide lockdown in France: a cross-sectional, multicentre, seroprevalence study. The Lancet Child & adolescent health. 2021;5(4):256-64.

ABSTRACT: BACKGROUND: The extent to which very young children contribute to the transmission of SARS-CoV-2 is unclear. We aimed to estimate the seroprevalence of antibodies against SARS-CoV-2 in daycare centres that remained open for key workers; children during a nationwide lockdown in France. METHODS: Children and staff who attended one of 22 daycare centres during a nationwide lockdown in France (between March 15 and May 9, 2020) were included in this cross-sectional, multicentre, seroprevalence study. Hospital staff not occupationally exposed to patients with COVID-19, or to children, were enrolled in a comparator group. The primary outcome was SARS-CoV-2 seroprevalence in children, daycare centre staff, and the comparator group. The presence of antibodies against SARS-CoV-2 in capillary whole blood was measured with a rapid chromatographic immunoassay. We computed raw prevalence as the percentage of individuals with a positive IgG or IgM test, and used Bayesian smoothing to account for imperfect sensitivity and specificity of the assay. This study is registered with ClinicalTrials.gov, NCT04413968. FINDINGS: Between June 4 and July 3, 2020, we enrolled 327 children (mean age 1.9 [SD 0.9] years; range 5 months to 4.4 years), 197 daycare centre staff (mean age 40 [12] years), and 164 adults in the comparator group (42 [12] years). Positive serological tests were observed for 14 children (raw seroprevalence 4.3%; 95% CI 2.6-7.1) and 14 daycare centre staff (7.7%; 4.2-11.6). After accounting for imperfect sensitivity and specificity of the assay, we estimated that 3.7% (95% credible interval [95% CrI] 1.3-6.8) of the children and 6.8% (3.2-11.5) of daycare centre staff had SARS-CoV-2 infection. The comparator group fared similarly to the daycare centre staff; nine participants had a positive serological test (raw seroprevalence 5.5%; 95% CI 2.9-10.1), leading to a seroprevalence of 5.0% (95% CrI 1.6-9.8) after accounting for assay characteristics. An exploratory analysis suggested that seropositive children were more likely than seronegative children to have been exposed to an adult household member with laboratory-confirmed COVID-19 (six [43%] of 14 vs 19 [6%] of 307; relative risk 7.1 [95% CI 2.2-22.4]). INTERPRETATION: According to serological test results, the proportion of young children in our sample with SARS-CoV-2 infection was low. Intrafamily transmission seemed more plausible than transmission within daycare centres. Further epidemiological studies are needed to confirm this exploratory hypothesis. FUNDING: Assistance Publique-Hôpitaux de Paris; Mairie de Paris, Conseil Départemental de Seine Saint Denis. TRANSLATIONS: For the French translation of the abstract see Supplementary Materials section.

URL: [https://dx.doi.org/10.1016/S2352-4642\(21\)00024-9](https://dx.doi.org/10.1016/S2352-4642(21)00024-9)

35. Ladhani SN, Baawuah F, Beckmann J, et al. SARS-CoV-2 infection and transmission in primary schools in England in June-December, 2020 (sKIDs): an active, prospective surveillance study. The Lancet Child & Adolescent Health. 2021;5(6):417-27.

ABSTRACT: BACKGROUND: Little is known about the risk of SARS-CoV-2 infection and transmission in educational settings. Public Health England initiated a study, COVID-19 Surveillance in School KIDs (sKIDs), in primary schools when they partially reopened from June 1, 2020, after the first national lockdown in England to estimate the incidence of symptomatic and asymptomatic SARS-CoV-2 infection, seroprevalence, and seroconversion in staff and students. METHODS: sKIDs, an active, prospective, surveillance study, included two groups: the weekly swabbing group and the blood sampling group. The swabbing group underwent weekly nasal swabs for at least 4 weeks after partial school reopening during the summer half-term (June to mid-July, 2020). The blood sampling group additionally underwent blood sampling for serum SARS-CoV-2 antibodies to measure previous infection at the beginning (June 1-19, 2020) and end (July 3-23, 2020) of the summer half-term, and, after full reopening in September, 2020, and at the end of the autumn term (Nov 23-Dec 18, 2020). We tested for predictors of SARS-CoV-2 antibody positivity using logistic regression. We calculated antibody seroconversion rates for participants who were seronegative in the first round and were tested in at least two rounds.

FINDINGS: During the summer half-term, 11 966 participants (6727 students, 4628 staff, and 611 with unknown staff or student status) in 131 schools had 40 501 swabs taken. Weekly SARS-CoV-2 infection rates were 4.1 (one of 24 463; 95% CI 0.1-21.8) per 100 000 students and 12.5 (two of 16 038; 1.5-45.0) per 100 000 staff. At recruitment, in 45 schools, 91 (11.2%; 95% CI 7.9-15.1) of 816 students and 209 (15.1%; 11.9-18.9) of 1381 staff members were positive

for SARS-CoV-2 antibodies, similar to local community seroprevalence. Seropositivity was not associated with school attendance during lockdown ($p=0.13$ for students and $p=0.20$ for staff) or staff contact with students ($p=0.37$). At the end of the summer half-term, 603 (73.9%) of 816 students and 1015 (73.5%) of 1381 staff members were still participating in the surveillance, and five (four students, one staff member) seroconverted. By December, 2020, 55 (5.1%; 95% CI 3.8-6.5) of 1085 participants who were seronegative at recruitment (in June, 2020) had seroconverted, including 19 (5.6%; 3.4-8.6) of 340 students and 36 (4.8%; 3.4-6.6) of 745 staff members ($p=0.60$).

INTERPRETATION: In England, SARS-CoV-2 infection rates were low in primary schools following their partial and full reopening in June and September, 2020.

FUNDING: UK Department of Health and Social Care. Copyright © 2021 Elsevier Ltd. All rights reserved.

URL: <https://pubmed.ncbi.nlm.nih.gov/33740430/>

36. Ladhani SN, Ireland G, Baawuah F, et al. Emergence of SARS-CoV-2 Alpha (B.1.1.7) variant, infection rates, antibody seroconversion and seroprevalence rates in secondary school students and staff: active prospective surveillance, December 2020 to March 2021, England. J Infect. 2021. DOI: 10.1016/j.jinf.2021.08.019

ABSTRACT: Objectives : We assessed SARS-CoV-2 infection, seroprevalence and seroconversion in students and staff when secondary schools reopened in March 2021. Methods : We initiated SARS-CoV-2 surveillance in 18 secondary schools across six regions in September 2020. Participants provided nasal swabs for RT-PCR and blood samples for SARS-CoV-2 antibodies at the beginning (September 2020) and end (December 2020) of the autumn term and at the start of the spring term (March 2021). Findings : In March 2021, 1895 participants (1100 students:795 staff) were tested; 5.6% (61/1094) students and 4.4% (35/792) staff had laboratory-confirmed SARS-CoV-2 infection from December 2020-March 2021. Nucleoprotein-antibody seroprevalence was 36.3% (370/1018) in students and 31.9% (245/769) in staff, while spike-antibody prevalence was 39.5% (402/1018) and 59.8% (459/769), respectively, similar to regional community seroprevalence. Between December 2020 and March 2021, 14.8% (97/656; 95%CI: 12.2-17.7) students and 10.0% (59/590; 95%CI: 7.7-12.7) staff seroconverted. Weekly seroconversion rates were similar from September to December 2020 (8.0/1000) and from December 2020 to March 2021 (7.9/1000; students: 9.3/1,000; staff: 6.3/1,000). Interpretation : By March 2021, a third of secondary school students and staff had evidence of prior infection based on N-antibody seropositivity, and an additional third of staff had evidence of vaccine-induced immunity based on S-antibody seropositivity.

URL: <https://www.sciencedirect.com/science/article/pii/S0163445321004011>

DOI: 10.1016/j.jinf.2021.08.019

37. Ladhani SN, Ireland G, Baawuah F, et al. SARS-CoV-2 infection, antibody positivity and seroconversion rates in staff and students following full reopening of secondary schools in England: A prospective cohort study, September–December 2020. EclinicalMedicine. 2021.

ABSTRACT: Background: Older children have higher SARS-CoV-2 infection rates than younger children. We investigated SARS-CoV-2 infection, seroprevalence and seroconversion rates in staff and students following the full reopening of all secondary schools in England. Methods: Public Health England (PHE) invited secondary schools in six regions (East and West London, Hertfordshire, Derbyshire, Manchester and Birmingham) to participate in SARS-CoV-2 surveillance during the 2020/21 academic year. Participants had nasal swabs for RT-PCR and blood samples for SARS-CoV-2 antibodies at the beginning (September 2020) and end (December 2020) of the autumn term. Multivariable logistic regression was used to assess independent risk factors for seropositivity and seroconversion. Findings: Eighteen schools in six regions enrolled 2,209 participants, including 1,189 (53.8%) students and 1,020 (46.2%) staff. SARS-CoV-2 infection rates were not significantly different between students and staff in round one (5/948;[0.53%] vs. 2/876 [0.23%]; $p = 0.46$) or round two (10/948 [1.05%] vs. 7/886 [0.79%]; $p = 0.63$), and similar to national prevalence. None of four and 7/15 (47%) sequenced strains in rounds 1 and 2 were the highly transmissible SARS-CoV-2 B.1.1.7 variant. In round 1, antibody seropositivity was higher in students than staff (114/893 [12.8%] vs. 79/861 [9.2%]; $p = 0.016$), but similar in round 2 (117/893 [13.1%] vs.117/872 [13.3%]; $p = 0.85$), comparable to local community seroprevalence. Between the two rounds, 8.7% (57/652) staff and 6.6% (36/549) students seroconverted ($p = 0.16$). Interpretation: In secondary schools, SARS-CoV-2 infection, seropositivity and seroconversion rates were similar in staff and students, and comparable to local community rates. Ongoing surveillance will be important for monitoring the impact of new variants in educational settings.

URL: <https://doi.org/10.1016/j.eclinm.2021.100948>

38. Landeros A, Ji X, Lange K, et al. An examination of school reopening strategies during the SARS-CoV-2 pandemic. PLoS ONE [Electronic Resource]. 2021;16(5):e0251242.

ABSTRACT: The SARS-CoV-2 pandemic led to closure of nearly all K-12 schools in the United States of America in March 2020. Although reopening K-12 schools for in-person schooling is desirable for many reasons, officials understand that risk reduction strategies and detection of cases are imperative in creating a safe return to school. Furthermore, consequences of reclosing recently opened schools are substantial and impact teachers, parents, and ultimately educational experiences in children. To address competing interests in meeting educational needs with public safety, we compare the impact of physical separation through school cohorts on SARS-CoV-2 infections against policies acting at the level of individual contacts within classrooms. Using an age-stratified Susceptible-Exposed-Infected-Removed model, we explore influences of reduced class density, transmission mitigation, and viral detection on cumulative prevalence. We consider several scenarios over a 6-month period including (1) multiple rotating cohorts in which students cycle through in-person instruction on a weekly basis, (2) parallel cohorts with in-person and remote learning tracks, (3) the impact of a hypothetical testing program with ideal and imperfect detection, and (4) varying levels of aggregate transmission reduction. Our mathematical model predicts that reducing the number of contacts through cohorts produces a larger effect than diminishing transmission rates per contact. Specifically, the latter approach requires dramatic reduction in transmission rates in order to achieve a comparable effect in minimizing infections over time. Further, our model indicates that surveillance programs using less sensitive tests may be adequate in monitoring infections within a school community by both keeping infections low and allowing for a longer period of instruction. Lastly, we underscore the importance of factoring infection prevalence in deciding when a local outbreak of infection is serious enough to require reverting to remote learning.

URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7418733/>

39. Llopia A, Borrás-Santos A, Guinovart C, et al. SARS-CoV-2 transmission in students of public schools of Catalonia (Spain) after a month of reopening. PLoS ONE [Electronic Resource]. 2021;16(5):e0251593.

ABSTRACT: INTRODUCTION: SARS-CoV-2 transmission within schools and its contribution to community transmission are still a matter of debate.

METHODS: A retrospective cohort study in all public schools in Catalonia was conducted using publicly available data assessing the association between the number of reported SARS-CoV-2 cases among students and staff in weeks 1-2 (Sept 14-27th, 2020) of the academic year with school SARS-CoV-2 incidence among students in weeks 4-5. A multilevel Poisson regression model adjusted for the community incidence in the corresponding basic health area (BHA) and the type of school (primary or secondary), with random effects at the sanitary region and BHA levels, was performed.

RESULTS: A total of 2184 public schools opened on September 14th with 778,715 students. Multivariate analysis showed a significant association between the total number of SARS-CoV-2 cases in a centre in weeks 1-2 and the SARS-CoV-2 school incidence among students in weeks 4-5 (Risk Ratio (RR) 1.074, 95% CI 1.044-1.105, p-value <0.001). The adjusted BHA incidence in the first two weeks was associated with school incidence in weeks 4-5 (RR 1.002, 95% CI 1.002-1.003, p-value <0.001). Secondary schools showed an increased incidence in weeks 4 and 5 (RR primary vs secondary 1.709 95% CI 1.599-1.897, p-value <0.001).

CONCLUSIONS: Safety measures adopted by schools were not enough to stop related-to-school transmission in students and could be improved. The safest way to keep schools open is to reduce community transmission down to a minimum.

URL: <https://pubmed.ncbi.nlm.nih.gov/33979410/>

40. Loconsole D, Centrone F, Morcavallo C, et al. Rapid Spread of the SARS-CoV-2 Variant of Concern 202012/01 in Southern Italy (December 2020-March 2021). International Journal of Environmental Research & Public Health [Electronic Resource]. 2021;18(9):29.

ABSTRACT: Epidemiological and virological studies have revealed that SARS-CoV-2 variants of concern (VOCs) are emerging globally, including in Europe. The aim of this study was to evaluate the spread of B.1.1.7-lineage SARS-CoV-2 in southern Italy from December 2020-March 2021 through the detection of the S gene target failure (SGTF), which could be considered a robust proxy of VOC B.1.1.7. SGTF was assessed on 3075 samples from week 52/2020 to week 10/2021. A subset of positive samples identified in the Apulia region during the study period was subjected to whole-genome sequencing (WGS). A descriptive and statistical analysis of the demographic and clinical characteristics of cases according to SGTF status was performed. Overall, 20.2% of samples showed SGTF; 155 strains were confirmed as VOC 202012/01 by WGS. The proportion of SGTF-positive samples rapidly increased over time, reaching 69.2% in

week 10/2021. SGTF-positive cases were more likely to be symptomatic and to result in hospitalization ($p < 0.0001$). Despite the implementation of large-scale non-pharmaceutical interventions (NPIs), such as the closure of schools and local lockdowns, a rapid spread of VOC 202012/01 was observed in southern Italy. Strengthened NPIs and rapid vaccine deployment, first among priority groups and then among the general population, are crucial both to contain the spread of VOC 202012/01 and to flatten the curve of the third wave.

URL: <https://pubmed.ncbi.nlm.nih.gov/33947087/>

41. Loenenbach A, Markus I, Lehfeld AS, et al. SARS-CoV-2 variant B.1.1.7 susceptibility and infectiousness of children and adults deduced from investigations of childcare centre outbreaks, Germany, 2021. Euro Surveill. 2021;26(21). DOI: 10.2807/1560-7917.ES.2021.26.21.2100433

10.2807/1560-7917.ES.2021.26.21.2100433.

ABSTRACT: We investigated three SARS-CoV-2 variant B.1.1.7 childcare centre and related household outbreaks. Despite group cohorting, cases occurred in almost all groups, i.e. also among persons without close contact. Children's secondary attack rates (SAR) were similar to adults (childcare centres: 23% vs 30%; $p = 0.15$; households: 32% vs 39%; $p = 0.27$); child- and adult-induced household outbreaks also led to similar SAR. With the advent of B.1.1.7, susceptibility and infectiousness of children and adults seem to converge. Public health measures should be revisited accordingly.

URL: <https://www.ncbi.nlm.nih.gov/pubmed/34047274>

DOI: 10.2807/1560-7917.ES.2021.26.21.2100433

10.2807/1560-7917.ES.2021.26.21.2100433.

42. Loenenbach A, Markus I, Lehfeld A-S, et al. Susceptibility and infectiousness of children and adults with SARS-CoV-2 variant B.1.1.7 deduced from three daycare centre outbreaks and related household situations; Germany, 2021. medRxiv. 2021:2021.05.12.21256608. DOI: 10.1101/2021.05.12.21256608

ABSTRACT: We investigated three SARS-CoV-2 variant B.1.1.7 kindergarten outbreaks and related household situations. Despite group cohorting, cases occurred in almost all groups, i.e. also among persons without close contact. Secondary attack rates (SAR) of children were similar to adults (day care: 23% vs. 30%; $p=0.15$; households: 32% vs. 39%; $p=0.27$), and also child-induced household outbreaks led to similar SAR compared to adults. With the advent of B.1.1.7, susceptibility and infectiousness of children and adults seem to converge. Competing Interest Statement The authors have declared no competing interest. Funding Statement No external funding was received, that should be reported. Author Declarations I confirm all relevant ethical guidelines have been followed, and any necessary IRB and/or ethics committee approvals have been obtained. Yes The details of the IRB/oversight body that provided approval or exemption for the research described are given below: The German Protection against Infection Act and the law on the duties of the Robert Koch Institute (RKI) allowed the implementation of this outbreak investigation without seeking further institutional ethical review (Infektionsschutzgesetz, IfSG, BGBl. I S. 1045 https://www.rki.de/DE/Content/Infekt/IfSG/ifsg_node.html; <https://www.gesetze-im-internet.de/ifsg/index.html>). Informed consent was obtained from participants. As deputy head of the Department for Infectious Disease Epidemiology at the RKI, the national Public Health Institute of Germany, certified that: - She is the competent authority for assessing whether outbreak investigations and/or research require review by an institutional ethics committee or if the German Protection against Infection Act (Infektionsschutzgesetz, IfSG, BGBl. I S. 1045) allows investigation and/or research without additional institutional review. - The outbreak investigation presented by Loenenbach & Markus et al. in 'Susceptibility and infectiousness of children and adults with SARS-CoV-2 variant B.1.1.7 deduced from three daycare centre outbreaks and related household situations; Germany, 2021' was conducted as part of the official tasks of the local public health authorities of the respective district, supported by the RKI upon official request in accordance to paragraph 4 of the German Protection against Infection Act. Therefore, this investigation was exempt from additional institutional review. We are happy to provide a signed letter with this declaration. All necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived. All necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived. Yes I understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance). Yes I have followed all appropriate research reporting guidelines and

uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable. Yes/No external dataset was used.

URL: <http://medrxiv.org/content/early/2021/05/17/2021.05.12.21256608.abstract>

DOI: 10.1101/2021.05.12.21256608

43. Mendez-Brito A, El Bcheraoui C, Pozo-Martin F. Systematic review of empirical studies comparing the effectiveness of non-pharmaceutical interventions against COVID-19. J Infect. 2021;20:20.

ABSTRACT: OBJECTIVES: To evaluate which non-pharmaceutical interventions (NPIs) have been more and less effective in controlling the COVID-19 pandemic.

METHODS: We performed a systematic review of published and unpublished empirical studies, either observational or interventional, analysing the comparative effectiveness of NPIs against the COVID-19 pandemic. We searched Embase/Medline and medRxiv to identify the relevant literature.

RESULTS: We identified 34 studies. During the first wave of the COVID-19 pandemic, school closing was the most effective NPI, followed by workplace closing, business and venue closing and public event bans. Public information campaigns and mask wearing requirements were also effective in controlling the pandemic while being less disruptive for the population than other NPIs. There was no evidence on the effectiveness of public transport closure, testing and contact tracing strategies and quarantining or isolation of individuals. Early implementation was associated with a higher effectiveness in reducing COVID-19 cases and deaths, while general stringency of the NPIs was not.

CONCLUSIONS: In this systematic review, we found that school closing, followed by workplace closing, business and venue closing and public event bans were the most effective NPIs in controlling the spread of COVID-19. An early response and a combination of specific social distancing measures are effective at reducing COVID-19 cases and deaths. Continuous monitoring of NPIs effectiveness is needed in order to adapt decision making. Copyright © 2021 The Authors. Published by Elsevier Ltd.. All rights reserved.

URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8214911/>

44. Mensah AA, Sinnathamby M, Zaidi A, et al. SARS-CoV-2 infections in children following the full re-opening of schools and the impact of national lockdown: Prospective, national observational cohort surveillance, July-December 2020, England. J Infect. 2021;82(4):67-74. DOI: 10.1016/j.jinf.2021.02.022

10.1016/j.jinf.2021.02.022. Epub 2021 Feb 25.

ABSTRACT: INTRODUCTION: The reopening of schools during the COVID-19 pandemic has raised concern for the safety of staff and students, their families and the wider community. We monitored SARS-CoV-2 infection rates in school-aged children and compared them with adult infection rates before and after schools reopened in England.

METHODS: Public Health England receives daily electronic reports of all SARS-CoV-2 tests nationally. SARS-CoV-2 infection rates by school year from July to December 2020 were analysed, including the effect of a national month-long lockdown whilst keeping schools open in November 2020

RESULTS: SARS-CoV-2 infections rates were low during early summer but started increasing in mid-August, initially in young adults followed by secondary and then primary school-aged children prior to schools reopening in September 2020. Cases in school-aged children lagged behind and followed adult trends after schools reopened, with a strong age gradient in weekly infection rates. There was a strong ($P < 0.001$) correlation in regional infection rates between adults and secondary ($R(2) = 0.96-0.98$), primary ($R(2) = 0.93-0.94$) and preschool-aged ($R(2) = 0.62-0.85$) children. The November lockdown was associated with declines in adult infection rates, followed a week later, by declines in student cases. From 23 November 2020, cases in adults and children increased rapidly following the emergence of a more transmissible novel variant of concern (VOC-202,012/01; B.1.1.7). CONCLUSIONS: In school-aged children, SARS-CoV-2 infections followed the same trajectory as adult cases and only declined after national lockdown was implemented whilst keeping schools open. Maintaining low community infection rates is critical for keeping schools open during the pandemic.

URL: <https://www.ncbi.nlm.nih.gov/pubmed/33639175>

DOI: 10.1016/j.jinf.2021.02.022

10.1016/j.jinf.2021.02.022. Epub 2021 Feb 25.

45. Miller GF, Greening B, Jr., Rice KL, et al. Modeling the Transmission of Covid-19: Impact of Mitigation Strategies in Prekindergarten-Grade 12 Public Schools, United States, 2021. J Public Health Manag Pract. 2021;30:30.

ABSTRACT: BACKGROUND: Schools are an integral part of the community; however, congregate settings facilitate transmission of SARS-CoV-2, presenting a challenge to school administrators to provide a safe, in-school environment for students and staff.

METHODS: We adapted the Centers for Disease Control and Prevention's COVIDTracer Advanced tool to model the transmission of SARS-CoV-2 in a school of 596 individuals. We estimate possible reductions in cases and hospitalizations among this population using a scenario-based analysis that accounts for (a) the risk of importation of infection from the community; (b) adherence to key Centers for Disease Control and Prevention-recommended mitigation strategies: mask wearing, cleaning and disinfection, hand hygiene, and social distancing; and (c) the effectiveness of contact tracing interventions at limiting onward transmission.

RESULTS: Low impact and effectiveness of mitigation strategies (net effectiveness: 27%) result in approximately 40% of exposed staff and students becoming COVID-19 cases. When the net effectiveness of mitigation strategies was 69% or greater, in-school transmission was mostly prevented, yet importation of cases from the surrounding community could result in nearly 20% of the school's population becoming infected within 180 days. The combined effects of mitigation strategies and contact tracing were able to prevent most onward transmission. Hospitalizations were low among children and adults (<0.5% of the school population) across all scenarios examined.

CONCLUSIONS: Based on our model, layering mitigation strategies and contact tracing can limit the number of cases that may occur from transmission in schools. Schools in communities with substantial levels of community spread will need to be more vigilant to ensure adherence of mitigation strategies to minimize transmission. Our results show that for school administrators, teachers, and parents to provide the safest environment, it is important to utilize multiple mitigation strategies and contract tracing that reduce SARS CoV-2 transmission by at least 69%. This will require training, reinforcement, and vigilance to ensure that the highest level of adherence is maintained over the entire school term. Copyright © 2021 Wolters Kluwer Health, Inc. All rights reserved.

URL: <https://pubmed.ncbi.nlm.nih.gov/33938487/>

46. Moghadas SM, Fitzpatrick MC, Shoukat A, et al. Simulated Identification of Silent COVID-19 Infections Among Children and Estimated Future Infection Rates With Vaccination. JAMA Network Open. 2021;4(4):e217097.

ABSTRACT: Importance: A significant proportion of COVID-19 transmission occurs silently during the presymptomatic and asymptomatic stages of infection. Children, although important drivers of silent transmission, are not included in the current COVID-19 vaccination campaigns.

Objective: To estimate the benefits of identifying silent infections among children as a proxy for their vaccination.

Design, Setting, and Participants: This study used an age-structured disease transmission model, parameterized with census data and estimates from published literature, to simulate the estimated synergistic effect of interventions in reducing attack rates during the course of 1 year among a synthetic population representative of the US demographic composition. The population included 6 age groups of 0 to 4, 5 to 10, 11 to 18, 19 to 49, 50 to 64, and 65 years or older based on US census data. Data were analyzed from December 12, 2020, to February 26, 2021.

Exposures: In addition to the isolation of symptomatic cases within 24 hours of symptom onset, vaccination of adults was implemented to reach a 40% to 60% coverage during 1 year with an efficacy of 95% against symptomatic and severe COVID-19.

Main Outcomes and Measures: The combinations of proportion and speed for detecting silent infections among children that would suppress future attack rates to less than 5%.

Results: In the base-case scenarios with an effective reproduction number $Re = 1.2$, a targeted approach that identifies 11% of silent infections among children within 2 days and 14% within 3 days after infection would bring attack rates to less than 5% with 40% vaccination coverage of adults. If silent infections among children remained undetected, achieving the same attack rates would require an unrealistically high vaccination coverage ($\geq 81\%$) of this age group, in addition to 40% vaccination coverage of adults. The estimated effect of identifying silent infections was robust in sensitivity analyses with respect to vaccine efficacy against infection and reduced susceptibility of children to infection.

Conclusions and Relevance: In this simulation modeling study of a synthetic US population, in the absence of vaccine availability for children, a targeted approach to rapidly identify silent COVID-19 infections in this age group was estimated to significantly mitigate disease burden. These findings suggest that without measures to interrupt transmission chains from silent infections, vaccination of adults is unlikely to contain the outbreaks in the near term.

URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7805462/>

47. Moon J, Ryu BH. Transmission risks of respiratory infectious diseases in various confined spaces: A meta-analysis for future pandemics. Environ Res. 2021;202:111679.

ABSTRACT: BACKGROUND: If the different transmission risks of respiratory infectious diseases according to the type of confined space and associated factors could be discovered, this kind of information will be an important basis for devising future quarantine policies. However, no comprehensive systematic review or meta-analysis for this topic exists.

OBJECTIVE: The objective of this study is to analyze different transmission risks of respiratory infectious diseases according to the type of confined space. This information will be an important basis for devising future quarantine policies.

METHODS: A medical librarian searched MEDLINE, EMBASE, and the Cochrane Library (until December 01, 2020).

RESULTS: A total of 147 articles were included. The risk of transmission in all types of confined spaces was approximately 3 times higher than in open space (combined RR, 2.95 (95% CI 2.62-3.33)). Among them, school or workplace showed the highest transmission risk (combined RR, 3.94 (95% CI 3.16-4.90)). Notably, in the sub-analysis for SARS-CoV-2, residential space and airplane were the riskiest space (combined RR, 8.30 (95% CI 3.30-20.90) and 7.30 (95% CI 1.15-46.20), respectively).

DISCUSSION: Based on the equation of the total number of contacts, the order of transmission according to the type of confined space was calculated. The calculated order was similar to the observed order in this study. The transmission risks in confined spaces can be lowered by reducing each component of the aforementioned equation. However, as seen in the data for SARS-CoV-2, the closure of one type of confined space could increase the population density in another confined space. The authority of infection control should consider this paradox. Appropriate quarantine measures targeted for specific types of confined spaces with a higher risk of transmission, school or workplace for general pathogens, and residential space/airplane for SARS-CoV-2 can reduce the transmission of respiratory infectious diseases. Copyright © 2021 Elsevier Inc. All rights reserved.

URL: <https://pubmed.ncbi.nlm.nih.gov/34265349/>

48. Mossong J, Mombaerts L, Veiber L, et al. SARS-CoV-2 transmission in educational settings during an early summer epidemic wave in Luxembourg, 2020. BMC Infect Dis. 2021;21(1):417.

ABSTRACT: BACKGROUND: Following a first wave in spring and gradual easing of lockdown, Luxembourg experienced an early second epidemic wave of SARS-CoV-2 before the start of summer school holidays on 15th July. This provided the opportunity to investigate the role of school-age children and school settings for transmission.

METHODS: We compared the incidence of SARS-CoV-2 in school-age children, teachers and the general working population in Luxembourg during two epidemic waves: a spring wave from March-April 2020 corresponding to general lockdown with schools being closed and May-July 2020 corresponding to schools being open. We assessed the number of secondary transmissions occurring in schools between May and July 2020 using routine contact tracing data.

RESULTS: During the first wave in March-April 2020 when schools were closed, the incidence in pupils peaked at 28 per 100,000, while during the second wave in May-July 2020 when schools were open, incidence peaked 100 per 100,000. While incidence of SARS-CoV-2 was higher in adults than in children during the first spring wave, no significant difference was observed during the second wave in early summer. Between May and July 2020, we identified a total of 390 and 34 confirmed COVID-19 cases among 90,150 school-age children and 11,667 teachers, respectively. We further estimate that 179 primary cases caused 49 secondary cases in schools. While some small clusters of mainly student-to-student transmission within the same class were identified, we did not observe any large outbreaks with multiple generations of infection.

CONCLUSIONS: Transmission of SARS-CoV-2 within Luxembourg schools was limited during an early summer epidemic wave in 2020. Precautionary measures including physical distancing as well as easy access to testing, systematic contact tracing appears to have been successful in mitigating transmission within educational settings.

URL: <https://bmcinfectdis.biomedcentral.com/articles/10.1186/s12879-021-06089-5>

49. Murray AF, Emanuels A, Wolf C, et al. School-Based Surveillance of Respiratory Pathogens on "High-Touch" Surfaces. Frontiers in Pediatrics. 2021;9 (no pagination)(686386).

ABSTRACT: In order to assess the presence of respiratory pathogens on "high-touch" surfaces and inform sanitation practices at schools, pre-selected surfaces in elementary schools in Seattle, WA, USA were sampled weekly and tested by RT-PCR for 25 viral respiratory pathogens (including SARS-CoV-2 retrospectively) and *S. pneumoniae* during 2019-2020 winter respiratory illness season. Viral pathogens (rhinovirus, adenovirus, influenza) known to cause respiratory

illness were detected on commonly touched surfaces, especially wooden surfaces, and matched the patterns of circulating virus in the community. © Copyright © 2021 Murray, Emanuels, Wolf, Franko, Starita, Englund and Chu.
URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8257953/>

50. Neuberger F, Grgic M, Diefenbacher S, et al. COVID-19 infections in day care centres in Germany: Social and organisational determinants of infections in children and staff in the second and third wave of the pandemic. medRxiv. 2021:2021.06.07.21257958. DOI: 10.1101/2021.06.07.21257958

ABSTRACT: Background During the SARS-CoV-2 pandemic, German early childhood education and care (ECEC) centres organised childrens attendance variably (i.e., reduced opening hours, emergency support for few children only or full close-down). Further, protection and hygiene measures like fixed children/staff groups, ventilation and surface disinfection were introduced among ECEC centres. To inform or modify public health measures in ECEC, we investigate the occurrence of SARS-CoV-2 infections among children and staff of ECEC centres in light of social determinants (socioeconomic status of the children) and recommended structural and hygiene measures. We focus on the question if the relevant factors differ between the 2nd (when no variant of concern (VOC) circulated) and the 3rd wave (when VOC B.1.1.7 (Alpha) predominated). Methods Based on panel data from a weekly online survey of ECEC centre managers (calendar week 36/2020 to 22/2021, ongoing) including approx. 8500 centres, we estimate the number of SARS-CoV-2 infections in children and staff using random-effect-within-between (REWB) panel models for count data in the 2nd and 3rd wave. Results Centres with a high proportion of children with low socioeconomic status (SES) have a higher risk of infections in staff and children. Strict contact restrictions between groups like fixed group assignments among children and fixed staff assignments to groups prevent infections. Both effects tend to be stronger in the 3rd wave. Contribution ECEC centres with a large proportion of children from a low SES background and lack of using fixed child/staff cohorts experience higher COVID-19 rates. Centres should be supported in maintaining recommended measures over the long run. Preventive measures such as vaccination of staff should be prioritised in centres with large proportions of low SES children. Competing Interest Statement The authors have declared no competing interest. Funding Statement The research presented in this work was supported by the German Federal Ministry of Family Affairs (Bundesministeriums fuer Familie, Senioren, Frauen und Jugend) and the German Federal Ministry of Health (Bundesministerium fuer Gesundheit). Author Declarations I confirm all relevant ethical guidelines have been followed, and any necessary IRB and/or ethics committee approvals have been obtained. Yes The details of the IRB/oversight body that provided approval or exemption for the research described are given below: Ethical approval for the study was waived by the Ethics Committee of the German Youth Institute (Head: Sarah Hanke; Members: Christina Boll, PhD; Kathja Flaeming, PhD; Peter Furthmueller, PhD; Heinz Kindler, Prof.; Jens Pothmann, PhD; Frank Tillmann, PhD; Sabine Walter, Prof.; Herwig Reiter, PhD; all German Youth Institute). We do not require a vote of the ethics committee as the data used in this study is survey data from organizations only (day care centers) and in no way assignable to persons. The only ethically relevant points are questions of privacy and data protection. All data is anonymised and subject to strict data protection guidelines, as approved by the data protection experts of the German Youth Institute, the German Federal Ministry of Family Affairs (Bundesministerium fuer Familie, Senioren, Frauen und Jugend) and the Federal Commissioner for Data Protection and Freedom of Information (Bundesbeauftragter fuer den Datenschutz und die Informationsfreiheit). All necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived. Yes I understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance). Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable. Yes Anonymized data will be passed on to external researchers after the project has been finalized (Dec. 2021), provided that they are used for the purpose of scientific secondary and subsequent use and under the conditions of the DJI Research Data Centre (incl. deletion periods, thematic limitation, citation, etc.). The anonymised survey data and research results are stored for 10 years as proof of good scientific practice and in accordance with the funding regulations. CW Calendar week DJI German Youth Institute (Deutsches Jugendinstitut) ECEC Early childhood education and care IfSG German Protection against Infection Act (Infektionsschutzgesetz) LHA Local health authority REWB Random-effect-within-between RKI Robert Koch-Institute SES Socioeconomic status VOC Variant of concern

URL: <http://medrxiv.org/content/early/2021/07/03/2021.06.07.21257958.abstract>

DOI: 10.1101/2021.06.07.21257958

51. Nikolopoulou GB, Maltezou HC. COVID-19 in children: where do we stand? Arch med res. 2021.

ABSTRACT: From the beginning of the coronavirus disease 2019 (COVID-19) pandemic it became evident that children infected with the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) remain mostly asymptomatic or mildly symptomatic. We reviewed the epidemiologic and clinical features of children with SARS-CoV-2 infection. The true prevalence of asymptomatic SARS-CoV-2 infection is most likely underestimated, as asymptomatic children are less frequently tested. Serologic surveys indicate that half of children tested positive for SARS-CoV-2 report no symptoms. Anosmia/ageusia is not frequent in children but it is the strongest predictor of a positive SARS-CoV-2 test. In general, children with COVID-19 are at lower risk of hospitalization and life-threatening complications. Nevertheless, cases of severe disease or a post-infectious multisystem hyperinflammatory syndrome named multisystem inflammatory syndrome in children (MIS-C) have been described. Rarely children with severe COVID-19 develop neurologic complications. In addition, studies indicate that school closures have a limited impact on SARS-CoV-2 transmission, much less than other social distancing measures. The past months new SARS-CoV-2 variants emerged with higher transmissibility and an increased impact on morbidity and deaths. The role of children in the transmission dynamics of these variants must be elucidated. Lastly, preliminary results from COVID-19 vaccine trials indicate very good efficacy and tolerability in children. Very recently the United States Centers for Disease Control and Prevention and other public health authorities recommend vaccination of children 12 years or older to protect them but mostly to contribute to the achievement of herd immunity.

URL: <https://dx.doi.org/10.1016/j.arcmed.2021.07.002>

52. Panovska-Griffiths J, Stuart RM, Kerr CC, et al. Modelling the impact of reopening schools in the UK in early 2021 in the presence of the alpha variant and with roll-out of vaccination against SARS-CoV-2. medRxiv. 2021:2021.02.07.21251287. DOI: 10.1101/2021.02.07.21251287

ABSTRACT: Background Following the resurgence of the COVID-19 epidemic in the UK in late 2020 and the emergence of the alpha (also known as B117) variant of the SARS-CoV-2 virus, a third national lockdown was imposed from January 4, 2021. Following the decline of COVID-19 cases over the remainder of January 2021, the question of when and how to reopen schools became an increasingly pressing one in early 2021. This study models the impact of a partial national lockdown with social distancing measures enacted in communities and workplaces under different strategies of reopening schools from March 8, 2021 and compares it to the impact of continual full national lockdown remaining until April 19, 2021. Methods We used our previously published agent-based model, Covasim, to model the emergence of the alpha variant over September 1, 2020 to January 31, 2021 in presence of Test, Trace and Isolate (TTI) strategies. We extended the model to incorporate the impacts of the roll-out of a two-dose vaccine against COVID-19, with 200,000 daily vaccine doses prioritised by age starting with people 75 years or older, assuming vaccination offers a 95% reduction in disease acquisition risk and a 30% reduction in transmission risk. We used the model, calibrated until January 25, 2021, to simulate the impact of a full national lockdown (FNL) with schools closed until April 19, 2021 versus four different partial national lockdown (PNL) scenarios with different elements of schooling open: 1) staggered PNL with primary schools and exam-entry years (years 11 and 13) returning on March 8, 2021 and the rest of the schools years on March 15, 2021; 2) full-return PNL with both primary and secondary schools returning on March 8, 2021; 3) primary-only PNL with primary schools and exam critical years (years 11 and 13) going back only on March 8, 2021 with the rest of the secondary schools back on April 19, 2021 and 4) part-rota PNL with both primary and secondary schools returning on March 8, 2021 with primary schools remaining open continuously but secondary schools on a two-weekly rota-system with years alternating between a fortnight of face-to-face and remote learning until April 19, 2021. Across all scenarios, we projected the number of new daily cases, cumulative deaths and effective reproduction number R until April 30, 2021. Results Our calibration across different scenarios is consistent with alpha variant being around 60% more transmissible than the wild type. We find that strict social distancing measures, i.e. national lockdowns, were essential in containing the spread of the virus and controlling hospitalisations and deaths during January and February 2021. We estimated that a national lockdown over January and February 2021 would reduce the number of cases by early March to levels similar to those seen in October 2020, with R also falling and remaining below 1 over this period. We estimated that infections would start to increase when schools reopened, but found that if other parts of society remain closed, this resurgence would not be sufficient to bring R above 1. Reopening primary schools and exam critical years only or having primary schools open continuously with secondary schools on rotas was estimated to lead to lower increases in cases and R than if all schools opened. Without an increase in vaccination above the levels seen in January and February, we estimate that R could have increased above 1 following the reopening of society, simulated here from April 19, 2021. Findings Our findings

suggest that stringent measures were integral in mitigating the increase in cases and bringing R below 1 over January and February 2021. We found that it was plausible that a PNL with schools partially open from March 8, 2021 and the rest of the society remaining closed until April 19, 2021 would keep R below 1, with some increase evident in infections compared to continual FNL until April 19, 2021. Reopening society in mid-April, without an increase in vaccination levels, could push R above 1 and induce a surge in infections, but the effect of vaccination may be able to control this in future depending on the transmission blocking properties of the vaccines.

Competing Interest StatementThe authors have declared no competing interest.

Funding StatementCCK, DM, KR and DJK are funded by the Bill and Melinda Gates Foundation.

Author DeclarationsI confirm all relevant ethical guidelines have been followed, and any necessary IRB and/or ethics committee approvals have been obtained. YesThe details of the IRB/oversight body that provided approval or exemption for the research described are given below:This is a modelling study for which publicly available data from <https://coronavirus.data.gov.uk> were used and no ethical approval was required.All necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived. YesI understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as [ClinicalTrials.gov](https://clinicaltrials.gov). I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance). YesI have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable. YesAll data and numerical code used in this analysis are available at <https://github.com/Jasminapg/Covid-19-Analysis>

URL: <http://medrxiv.org/content/early/2021/07/22/2021.02.07.21251287.abstract>

DOI: [10.1101/2021.02.07.21251287](https://doi.org/10.1101/2021.02.07.21251287)

53. Park S, Choi Y, Song D, et al. Natural ventilation strategy and related issues to prevent coronavirus disease 2019 (COVID-19) airborne transmission in a school building. *Sci Total Environ.* 2021;789:147764.

ABSTRACT: The World Health Organization (WHO) announced that severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) may spread through aerosols, so-called airborne transmission, especially in a poorly ventilated indoor environment. Ventilation protects the occupants against airborne transmission. Various studies have been performed on the importance of sufficient ventilation for diluting the concentration of virus and lowering any subsequent dose inhaled by the occupants. However, the ventilation situation can be problematic in public buildings and other shared spaces, such as shops, offices, schools, and restaurants. If ventilation is provided by opening windows, the outdoor airflow rate depends strongly on the specific local conditions (opening sizes, relative positions, climatic and weather conditions). This study uses field measurements to analyze the natural ventilation performance in a school building according to the window opening rates, positions, and weather conditions. The ventilation rates were calculated by the tracer gas decay method, and the infection risk was assessed using the Wells-Riley equation. Under cross-ventilation conditions, the average ventilation rates were measured at 6.51 h⁻¹ for 15% window opening, and 11.20 h⁻¹ for 30% window opening. For single-sided ventilation, the ventilation rates were reduced to about 30% of the values from the cross-ventilation cases. The infection probability is less than 1% in all cases when a mask is worn and more than 15% of the windows are open with cross-ventilation. With single-sided ventilation, if the exposure time is less than 1 h, the infection probability can be kept less than 1% with a mask. However, the infection probability exceeds 1% in all cases where exposure time is greater than 2 h, regardless of whether or not a mask is worn. Also, when the air conditioner was operated with a window opening ratio of 15%, power consumption increased by 10.2%. Copyright © 2021 Elsevier B.V. All rights reserved.

URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8123370/>

54. pei y, Elena A, Nicholas O, et al. School and Community Reopening During the COVID-19 Pandemic: A Mathematical Modeling Study. 2021.

ABSTRACT: Background: The closure of communities, including schools, has been adopted to control the coronavirus disease 2019 (COVID-19) epidemic in most countries. Operating schools safely during the pandemic requires a balance between health risks and the need for in-person learning. We use compartmental models to explore school reopening scenarios. Methods: Using demographic and epidemiological data between July 31 and November 23, 2020 from the city of Toronto, we developed a Susceptible-Exposed-Asymptomatic-Infectious-Recovered-Hospitalized-Isolated model. Our model with age, household, and community transmission allow us to study the impact of schools open in September 2020. The model mimics the transmission in households, the community, and schools, accounting for differences in infectiousness between adults and children and youth and adults' working

status. We assessed the extent to which school opening may have contributed to COVID-19 resurgence in the fall and simulated scenarios for the safe reopening of schools up to May 31, 2021. We further considered the impact of the introduction of the new variant of concern. Findings: Though a slight increase in infections among adults (2.8%) and children (5.4%) is anticipated by the end of the year, safe school opening is possible with stringent nonpharmaceutical interventions (NPIs) decreasing the risk of transmission in the community and the household. We found that while school reopening was not the key driver in virus resurgence, but rather it was community spread that determined the outbreak trajectory, brief school closures did reduce infections when transmission risk within the home was low. When considered possible cross-infection amongst households, communities, and schools, we found that home transmission was crucial for mitigating the epidemic and safely operating schools. Simulating the introduction of a new strain with higher infectiousness, we observed substantial increases in infections, even when both schools and communities are closed. Interpretation: Schools can open safely under strict maintenance of strict public health measures in the community. The gradual opening of schools and communities can only be achieved by maintaining NPIs and mitigating household transmission risk to avoid the broader escape of infections acquired in schools into the community via households. If the new COVID-19 strain is more infectious for children, public spaces, including schools, should be closed, and additional NPIs, including the use of masks, should be extended to toddlers. Funding: This research was supported by Canadian Institutes of Health Research (CIHR), Natural Sciences and Engineering Research Council of Canada and York University Research Chair program. Declaration of Interests: The authors declare no conflict of interest.

URL: <http://www.epistemonikos.org/documents/33646efadaff31f553ba4c366495821dc2faf7ad>

55. Ratmann O, Bhatt S, Flaxman S. Implications of a highly transmissible variant of SARS-CoV-2 for children. Arch Dis Child. 2021;30:30.

URL: <https://adc.bmj.com/content/archdischild/early/2021/03/29/archdischild-2021-321903.full.pdf>

56. Reynolds C, Ng S, Yang W. Factors affecting the transmission of SARS-CoV-2 in school settings. MedRxiv : the Preprint Server for Health Sciences. 2021;22:22.

ABSTRACT: Background: Several studies have reported SARS-CoV-2 outbreaks in schools, with a wide range of secondary attack rate (SAR; range: 0-100%). We aimed to examine the key risk factors to better understand transmission in school settings.

Methods: We collected records of SARS-CoV-2 school outbreaks globally published from January 2020 to January 2021 and compiled information on hypothesized risk factors. We utilized the directed acyclic graph (DAG) to conceptualize the risk mechanisms, used logistic regression to examine each risk-factor group, and further built multiple variable models based on the marginal analysis. Adjusted odds ratios (aOR) and 95% confidence intervals (CI) were calculated.

Results: From 17 relevant articles, 26 school clusters were included for analysis. The best-fit model showed that the intensity of community transmission (aOR: 1.26; 95% CI: 1.22 - 1.30, for each increase of 10 cases per 100,000 persons per week), social distancing (aOR: 0.26; 95% CI: 0.18 - 0.37), mask-wearing (aOR: 0.52; 95% CI: 0.35 - 0.78) were associated the risk of SARS-CoV-2 infection in schools. Compared to students in pre-schools, the aOR was 0.12 (95% CI: 0.07 - 0.19) for students in primary schools and 1.31 (95% CI: 0.93 - 1.87) for students in high schools.

Conclusions: Preventive measures in both schools (e.g. social distancing and mask-wearing) and communities (additionally, vaccination) should be taken to collectively reduce transmission and protect children in schools. Flexible reopening policies may be considered for different levels of schools given their risk differences.

Key messages: We collected published records of COVID-19 school outbreaks globally to investigate the considerable heterogeneity in secondary attack rates (SAR) reported from school outbreaks and compiled information regarding potential risk factors. Higher community death and case rates are associated with higher SARs in children in school settings. Mask-wearing and social distancing are associated with lower SARs. When compared to pre-schools and early childhood education centers, primary schools have lower rates of transmission of SARS-CoV-2 however high schools have higher rates.

URL: <https://pubmed.ncbi.nlm.nih.gov/34189533/>

57. Riley S, Wang H, Eales O, et al. REACT-1 round 12 report: resurgence of SARS-CoV-2 infections in England associated with increased frequency of the Delta variant. medRxiv. 2021:2021.06.17.21259103. DOI: 10.1101/2021.06.17.21259103

ABSTRACT: Background England entered a third national lockdown from 6 January 2021 due to the COVID-19 pandemic. Despite a successful vaccine rollout during the first half of 2021, cases and hospitalisations have started to increase since the end of May as the SARS-CoV-2 Delta (B.1.617.2) variant increases in frequency. The final step of relaxation of COVID-19 restrictions in England has been delayed from 21 June to 19 July 2021. Methods The REal-time Assessment of Community Transmission-1 (REACT-1) study measures the prevalence of swab-positivity among random samples of the population of England. Round 12 of REACT-1 obtained self-administered swab collections from participants from 20 May 2021 to 7 June 2021; results are compared with those for round 11, in which swabs were collected from 15 April to 3 May 2021. Results Between rounds 11 and 12, national prevalence increased from 0.10% (0.08%, 0.13%) to 0.15% (0.12%, 0.18%). During round 12, we detected exponential growth with a doubling time of 11 (7.1, 23) days and an R number of 1.44 (1.20, 1.73). The highest prevalence was found in the North West at 0.26% (0.16%, 0.41%) compared to 0.05% (0.02%, 0.12%) in the South West. In the North West, the locations of positive samples suggested a cluster in Greater Manchester and the east Lancashire area. Prevalence in those aged 5-49 was 2.5 times higher at 0.20% (0.16%, 0.26%) compared with those aged 50 years and above at 0.08% (0.06%, 0.11%). At the beginning of February 2021, the link between infection rates and hospitalisations and deaths started to weaken, although in late April 2021, infection rates and hospital admissions started to reconverge. When split by age, the weakened link between infection rates and hospitalisations at ages 65 years and above was maintained, while the trends converged below the age of 65 years. The majority of the infections in the younger group occurred in the unvaccinated population or those without a stated vaccine history. We observed the rapid replacement of the Alpha (B.1.1.7) variant of SARS-CoV-2 with the Delta variant during the period covered by rounds 11 and 12 of the study. Discussion The extent to which exponential growth continues, or slows down as a consequence of the continued rapid roll-out of the vaccination programme, including to young adults, requires close monitoring. Data on community prevalence are vital to track the course of the epidemic and inform ongoing decisions about the timing of further lifting of restrictions in England. Competing Interest Statement The authors have declared no competing interest. Funding Statement The study was funded by the Department of Health and Social Care in England. Author Declarations I confirm all relevant ethical guidelines have been followed, and any necessary IRB and/or ethics committee approvals have been obtained. Yes The details of the IRB/oversight body that provided approval or exemption for the research described are given below: We obtained research ethics approval from the South Central-Berkshire B Research Ethics Committee (IRAS ID: 283787). All necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived. Yes I understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance). Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable. Yes The datasets generated or analysed, or both, during this study are not publicly available because of governance restrictions.

URL: <http://medrxiv.org/content/early/2021/06/21/2021.06.17.21259103.abstract>

DOI: [10.1101/2021.06.17.21259103](https://doi.org/10.1101/2021.06.17.21259103)

58. Sahbudak Bal Z, Ozkul A, Bilen M, et al. The Longest Infectious Virus Shedding in a Child Infected With the G614 Strain of SARS-CoV-2. *Pediatr Infect Dis J.* 2021;40(7):e263-e5.

ABSTRACT: COVID-19 spread globally and caused over 97 million cases with more than 2 million deaths. There is still ongoing discussion on the duration of infectious interval SARS-CoV-2 infection. Symptomatic children had longer virus shedding and there are some reports of prolonged infectious virus shedding in adults particularly patients having an immunocompromised status. A missense mutation, D614G, in the spike protein of SARS-CoV-2, which has emerged as a predominant clade in Europe and is spreading worldwide that can result in higher viral loads in patients. Herein, we described the longest infectious virus shedding in a previously healthy child infected with SARS-CoV-2 expressing spike D614G substitution. Copyright © 2021 Wolters Kluwer Health, Inc. All rights reserved.

URL: <https://pubmed.ncbi.nlm.nih.gov/33990523/>

59. Schenk B, Hoehl S, Rudych O, et al. Longitudinal testing for SARS-CoV-2 RNA in day care centers in Hesse, Germany, during increased local incidence and with VOC Alpha as dominant variant: Results of the SAFE KiDS 2 and SAFE KiDS 3 study. *medRxiv.* 2021:2021.06.29.21259633. DOI: [10.1101/2021.06.29.21259633](https://doi.org/10.1101/2021.06.29.21259633)

ABSTRACT: In the summer of 2020, we investigated the rate of inapparent shedding of SARS-CoV-2 in a representative sample of day care centers from Hesse, Germany, and found a low positivity rate during a period of low local community spread. To investigate the influence of a high local incidence setting, we conducted the SAFE KiDS 2 study. 577 children and 334 staff members of 47 day care centers were tested for respiratory and gastrointestinal shedding of SARS-CoV-2, and three infections with SARS-CoV-2 in the infectious period were detected. We conclude that viral shedding occurred infrequently while the original "wild-type" variant was dominant. The more transmissible SARS-CoV-2 variant Alpha (B.1.1.7) became the dominant strain after SAFE KiDS 2 was concluded. The SAFE KiDS 3 study investigated the impact of the Alpha variant of SARS-CoV-2 on inapparent viral shedding in the day care setting. In this study, 756 children and 226 staff members from 46 day care centers provided self-collected saliva swabs, the so-called "Lollipop" swabs, which were tested by RT-PCR. In the four-week study period, none of the participants tested positive for SARS-CoV-2 RNA, demonstrating that inapparent shedding of SARS-CoV-2 in the day care setting was also rare during the dominance of the Alpha variant. The influence of the variant of concern Delta on day care centers has yet to be studied. Competing Interest Statement S.C. received research grants and a speaker's fees from Roche diagnostics. S.H. received research support from Roche diagnostics. Clinical Trial DRKS00025612 Funding Statement The SAFE KiDS 2 and the SAFE KiDS 3 study were commissioned by the Hessian Ministry of Social Affairs and Integration and were supported by Roche, Basel, Switzerland. The funder of the study did not contribute to study design, data collection, data analysis, data interpretation, or writing and submitting of the report for publication. Author Declarations I confirm all relevant ethical guidelines have been followed, and any necessary IRB and/or ethics committee approvals have been obtained. Yes The details of the IRB/oversight body that provided approval or exemption for the research described are given below: This study protocol was approved by the ethics board of the University Hospital Frankfurt, Goethe University Frankfurt am Main, Germany. All necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived. Yes I understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance). Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable. Yes The authors confirm that the data supporting the findings of this study are available within the article.

URL: <http://medrxiv.org/content/early/2021/07/03/2021.06.29.21259633.abstract>

DOI: 10.1101/2021.06.29.21259633

60. Sebastiani G, Palu G. COVID-19 Pandemic: Influence of Schools, Age Groups, and Virus Variants in Italy. *Viruses*. 2021;13(7). DOI: 10.3390/v13071269 10.3390/v13071269.

ABSTRACT: The estimated smooth curve of the percentage of subjects positive to SARS-CoV-2 started decreasing in Italy at the beginning of January 2021, due to the government containment measures undertaken from Christmas until 7 January. Approximately two weeks after releasing the measures, the curve stopped to decrease and remained approximately constant for four weeks to increase again in the middle of February. This epidemic phase had a public health care impact since, from the beginning of the fourth week of February, the curve of the intensive care unit's occupancy started to grow. This wave of infection was characterized by the presence of new virus variants, with a higher than 80% dominance of the so-called "English" variant, since 15 April. School activities in Italy started at different times from 7 January until 8 February, depending on every region's decision. Our present data on the incidence of SARS-CoV-2 in different age groups in Italy are in agreement with literature reports showing that subjects older than 10 years are involved in virus transmission. More importantly, we provide evidence to support the hypothesis that also individuals of age 0-9 years can significantly contribute to the spread of SARS-CoV-2.

URL: <https://www.ncbi.nlm.nih.gov/pubmed/34209828>

DOI: 10.3390/v13071269

10.3390/v13071269.

61. Shapiro Ben David S, Rahamim-Cohen D, Tasher D, et al. COVID-19 in children and the effect of schools reopening on potential transmission to household members. *Acta Paediatr*. 2021;110(9):2567-73.

ABSTRACT: AIM: The effect of reopening schools on children's contribution to SARS-CoV-2 transmission, especially within households, remains controversial. This study describes the clinical presentation of a large ambulatory COVID-

19 paediatric cohort and evaluates the role of children in household transmission prior to and following school reopening.

METHODS: A retrospective database cohort study was conducted in a large Health Maintenance Organization in Israel. Data of all paediatric, laboratory-confirmed Coronavirus cases between 28/2/2020 and 20/6/2020 were extracted. All cases were analysed for household contacts and primary cases within each family cluster.

RESULTS: A total of 1,032 cases under 18 years old (median age 12 years) were included. Of these cases, 432 (41.9%) were asymptomatic; 122 (11.8%) cases acquired the infection at school, and 45 of them were part of two school clusters; 846 children had at least one positive household contact, in 498 family clusters, and among them, 293 primary cases were identified. Only 27 (9.2%) primary cases were under 18 years of age and six (2%) were below 10. The proportion of primary cases did not change after the re-opening of educational facilities.

CONCLUSION: Children, particularly under 10 years of age, are less likely to be the vector for SARS-CoV-2 infection within household settings. Opening educational facilities did not change transmission dynamics. Copyright ©2021 Foundation Acta Paediatrica. Published by John Wiley & Sons Ltd.

URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8222890/>

62. Somekh I, Sharabi A, Dory Y, et al. Intrafamilial Spread and Altered Symptomatology of SARS-CoV-2, during Predominant Circulation of Lineage B.1.1.7 Variant in Israel. *Pediatr Infect Dis J.* 2021;E310-E1.

ABSTRACT: The dynamics of intrafamilial spread of SARS-CoV-2 during January-February 2021 when variant B.1.1.7 predominated were compared with data from April to May 2020, when other circulating variants prevailed. Much higher intrafamilial transmission rates among all age groups, in particular in young children, and lower rates of sensory impairment were demonstrated during January-February 2021. Copyright © 2021 Wolters Kluwer Health, Inc. All rights reserved.

URL: <https://pubmed.ncbi.nlm.nih.gov/34117202/>

63. Southall E, Holmes A, Hill EM, et al. An analysis of school absences in England during the COVID-19 pandemic. *BMC Med.* 2021;19(1):137.

ABSTRACT: **BACKGROUND:** The introduction of SARS-CoV-2, the virus that causes COVID-19 infection, in the UK in early 2020, resulted in the introduction of several control policies to reduce disease spread. As part of these restrictions, schools were closed to all pupils in March (except for vulnerable and key worker children), before re-opening to certain year groups in June. Finally, all school children returned to the classroom in September.

METHODS: Here, we analyse data on school absences in late 2020 as a result of COVID-19 infection and how that varied through time as other measures in the community were introduced. We utilise data from the Department for Education Educational Settings database and examine how pupil and teacher absences change in both primary and secondary schools.

RESULTS: Our results show that absences as a result of COVID-19 infection rose steadily following the re-opening of schools in September. Cases in teachers declined during the November lockdown, particularly in regions previously in tier 3, the highest level of control at the time. Cases in secondary school pupils increased for the first 2 weeks of the November lockdown, before decreasing. Since the introduction of the tier system, the number of absences with confirmed infection in primary schools was observed to be (markedly) lower than that in secondary schools. In December, we observed a large rise in the number of absences per school in secondary school settings in the South East and London, but such rises were not observed in other regions or in primary school settings. We conjecture that the increased transmissibility of the new variant in these regions may have contributed to this rise in secondary school cases. Finally, we observe a positive correlation between cases in the community and cases in schools in most regions, with weak evidence suggesting that cases in schools lag behind cases in the surrounding community.

CONCLUSIONS: We conclude that there is no significant evidence to suggest that schools are playing a substantial role in driving spread in the community and that careful monitoring may be required as schools re-open to determine the effect associated with open schools upon community incidence.

URL: <https://bmcmmedicine.biomedcentral.com/articles/10.1186/s12916-021-01990-x>

64. Stage HB, Shingleton J, Ghosh S, et al. Shut and re-open: the role of schools in the spread of COVID-19 in Europe. *Philosophical Transactions of the Royal Society of London - Series B: Biological Sciences.* 2021;376(1829):20200277.

ABSTRACT: We investigate the effect of school closure and subsequent reopening on the transmission of COVID-19, by considering Denmark, Norway, Sweden and German states as case studies. By comparing the growth rates in daily

hospitalizations or confirmed cases under different interventions, we provide evidence that school closures contribute to a reduction in the growth rate approximately 7 days after implementation. Limited school attendance, such as older students sitting exams or the partial return of younger year groups, does not appear to significantly affect community transmission. In countries where community transmission is generally low, such as Denmark or Norway, a large-scale reopening of schools while controlling or suppressing the epidemic appears feasible. However, school reopening can contribute to statistically significant increases in the growth rate in countries like Germany, where community transmission is relatively high. In all regions, a combination of low classroom occupancy and robust test-and-trace measures were in place. Our findings underscore the need for a cautious evaluation of reopening strategies. This article is part of the theme issue 'Modelling that shaped the early COVID-19 pandemic response in the UK'.

URL: <https://pubmed.ncbi.nlm.nih.gov/34053270/>

65. Sundaram N, Bonell C, Ladhani S, et al. Implementation of preventive measures to prevent COVID-19: a national study of English primary schools in summer 2020. Health Educ Res. 2021;36(3):272-85.

ABSTRACT: We examined the feasibility of implementing preventive measures to prevent SARS-CoV-2 transmission across 105 English primary schools in summer 2020 via a survey and interviews with headteachers. High rates of implementation of most recommended measures were noted with the exception of requiring 2 m distance for students, fitting hand sanitizers in classrooms and introducing one-way systems in school corridors. Measures such as regular handwashing and stopping assemblies were considered easy to implement. Majorly challenging measures included distancing between individuals (for students: 51%, N = 99; for staff: 34%; N = 98; for parents: 26%, N = 100), spacing out desks (34%, N = 99), keeping same staff assigned to each student group (33%, N = 97) and staggering break times (25%, N = 99). Rapid implementation was facilitated by staff commitment and communication among stakeholders, but hampered by limitations with guidance received, physical environments, resources, parental adherence and balancing preventive measures with learning. Difficulties with distancing for younger children suggest that smaller bubbles with fewer distancing requirements within these may be a policy option. Schools require further financial, human resource and other support for effective implementation of preventive measures. Copyright © The Author(s) 2021. Published by Oxford University Press.

URL: <https://pubmed.ncbi.nlm.nih.gov/33860299/>

66. Tan W. School closures were over-weighted against the mitigation of COVID-19 transmission: A literature review on the impact of school closures in the United States. Medicine. 2021;100(30):e26709.

ABSTRACT: **BACKGROUND:** The pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has spread wildly across the world. In March of 2020, almost all kindergarten through 12th grade (K-12) schools were closed in the United States in an urgent attempt to curb the pandemic in the absence of effective therapeutics or vaccination. Thirteen months since then, schools remain partially closed. Accumulated evidence suggests that children and adolescents are not the primary facilitators of transmission, limiting the restrictive effects of school closures on disease transmission. The negative effects of school closures on K-12 students need to be systematically reviewed. **METHODS:** Following the guideline of Preferred Reporting Items for Systematic Reviews and Meta-analyses, a comprehensive literature search from PubMed, EMBASE, Cochrane Library, Scopus, and Web of Science regarding school closures and its impact on K-12 students was conducted. The primary outcomes included the impact of school closures on the mitigation of the pandemic and the resulting public health concerns of K-12 students. **RESULTS:** Prolonged school closures possessed negative effects on K-12 students' physical, mental, and social well-being and reduced the number of health and social workers, hindering the reopening of the country. **CONCLUSIONS:** School closures were over-weighted against the mitigation of coronavirus disease 2019 (COVID-19) transmission. A safe reopening of all K-12 schools in the United States should be of top priority. Copyright © 2021 the Author(s). Published by Wolters Kluwer Health, Inc.

URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8322504/>

67. Tatapudi H, Das TK. Impact of school reopening on pandemic spread: A case study using an agent-based model for COVID-19. Infectious Disease Modelling. 2021;6:839-47.

ABSTRACT: This article examines the impact of partial/full reopening of school/college campuses on the spread of a pandemic using COVID-19 as a case study. The study uses an agent-based simulation model that replicates community spread in an urban region of U.S.A. via daily social mixing of susceptible and infected individuals. Data representing population demographics, SARS-CoV-2 epidemiology, and social interventions guides the model's behavior, which is calibrated and validated using data reported by the government. The model indicates a modest but

significant increase (8.15%) in the total number of reported cases in the region for a complete (100%) reopening compared to keeping schools and colleges fully virtual. For partial returns of 75% and 50%, the percent increases in the number of reported cases are shown to be small (2.87% and 1.26%, respectively) and statistically insignificant. The AB model also predicts that relaxing the stringency of the school safety protocol for sanitizing, use of mask, social distancing, testing, and quarantining and thus allowing the school transmission coefficient to double may result in a small increase in the number of reported infected cases (2.14%). Hence for pandemic outbreaks from viruses with similar characteristics as for SARS-CoV-2, keeping the schools and colleges open with a modest campus safety protocol and in-person attendance below a certain threshold may be advisable. Copyright © 2021 The Authors.
URL: <https://pubmed.ncbi.nlm.nih.gov/34258483/>

68. Thompson DA, Abbasizanjani H, Fry R, et al. Staff-pupil SARS-CoV-2 infection pathways in schools in Wales: a population-level linked data approach. *BMJ Paediatrics Open.* 2021;5(1):e001049.

ABSTRACT: Background: Better understanding of the role that children and school staff play in the transmission of SARS-CoV-2 is essential to guide policy development on controlling infection while minimising disruption to children's education and well-being.

Methods: Our national e-cohort (n=464531) study used anonymised linked data for pupils, staff and associated households linked via educational settings in Wales. We estimated the odds of testing positive for SARS-CoV-2 infection for staff and pupils over the period August- December 2020, dependent on measures of recent exposure to known cases linked to their educational settings.

Results: The total number of cases in a school was not associated with a subsequent increase in the odds of testing positive (staff OR per case: 0.92, 95% CI 0.85 to 1.00; pupil OR per case: 0.98, 95% CI 0.93 to 1.02). Among pupils, the number of recent cases within the same year group was significantly associated with subsequent increased odds of testing positive (OR per case: 1.12, 95% CI 1.08 to 1.15). These effects were adjusted for a range of demographic covariates, and in particular any known cases within the same household, which had the strongest association with testing positive (staff OR: 39.86, 95% CI 35.01 to 45.38; pupil OR: 9.39, 95% CI 8.94 to 9.88).

Conclusions: In a national school cohort, the odds of staff testing positive for SARS-CoV-2 infection were not significantly increased in the 14-day period after case detection in the school. However, pupils were found to be at increased odds, following cases appearing within their own year group, where most of their contacts occur. Strong mitigation measures over the whole of the study period may have reduced wider spread within the school environment. Copyright © Author(s) (or their employer(s)) 2021. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

URL: <https://bmjpaedsopen.bmj.com/content/5/1/e001049>

69. Trigg CR, Bansal D, Ding H, et al. A Comprehensive Review of Viral Characteristics, Transmission, Pathophysiology, Immune Response, and Management of SARS-CoV-2 and COVID-19 as a Basis for Controlling the Pandemic. *Front Immunol.* 2021;12:631139.

ABSTRACT: COVID-19 emerged from China in December 2019 and during 2020 spread to every continent including Antarctica. The coronavirus, SARS-CoV-2, has been identified as the causative pathogen, and its spread has stretched the capacities of healthcare systems and negatively affected the global economy. This review provides an update on the virus, including the genome, the risks associated with the emergence of variants, mode of transmission, immune response, COVID-19 in children and the elderly, and advances made to contain, prevent and manage the disease. Although our knowledge of the mechanics of virus transmission and the immune response has been substantially demystified, concerns over reinfection, susceptibility of the elderly and whether asymptomatic children promote transmission remain unanswered. There are also uncertainties about the pathophysiology of COVID-19 and why there are variations in clinical presentations and why some patients suffer from long lasting symptoms-"the long haulers." To date, there are no significantly effective curative drugs for COVID-19, especially after failure of hydroxychloroquine trials to produce positive results. The RNA polymerase inhibitor, remdesivir, facilitates recovery of severely infected cases but, unlike the anti-inflammatory drug, dexamethasone, does not reduce mortality. However, vaccine development witnessed substantial progress with several being approved in countries around the globe. Copyright © 2021 Trigg, Bansal, Ding, Islam, Farag, Hadi and Sultan.

URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7952616/>

70. Truong TT, Ryutov A, Pandey U, et al. Increased viral variants in children and young adults with impaired humoral immunity and persistent SARS-CoV-2 infection: A consecutive case series. EBioMedicine. 2021;67:103355. DOI: 10.1016/j.ebiom.2021.103355 10.1016/j.ebiom.2021.103355. Epub 2021 Apr 26.

ABSTRACT: BACKGROUND: There is increasing concern that persistent infection of SARS-CoV-2 within immunocompromised hosts could serve as a reservoir for mutation accumulation and subsequent emergence of novel strains with the potential to evade immune responses. METHODS: We describe three patients with acute lymphoblastic leukemia who were persistently positive for SARS-CoV-2 by real-time polymerase chain reaction. Viral viability from longitudinally-collected specimens was assessed. Whole-genome sequencing and serological studies were performed to measure viral evolution and evidence of immune escape. FINDINGS: We found compelling evidence of ongoing replication and infectivity for up to 162 days from initial positive by subgenomic RNA, single-stranded RNA, and viral culture analysis. Our results reveal a broad spectrum of infectivity, host immune responses, and accumulation of mutations, some with the potential for immune escape. INTERPRETATION: Our results highlight the potential need to reassess infection control precautions in the management and care of immunocompromised patients. Routine surveillance of mutations and evaluation of their potential impact on viral transmission and immune escape should be considered.

URL: <https://www.ncbi.nlm.nih.gov/pubmed/33915337>

DOI: 10.1016/j.ebiom.2021.103355

10.1016/j.ebiom.2021.103355. Epub 2021 Apr 26.

71. Tupper P, Colijn C. COVID-19 in schools: Mitigating classroom clusters in the context of variable transmission. PLoS Comput Biol. 2021;17(7):e1009120. DOI: 10.1371/journal.pcbi.1009120 10.1371/journal.pcbi.1009120. eCollection 2021 Jul.

ABSTRACT: Widespread school closures occurred during the COVID-19 pandemic. Because closures are costly and damaging, many jurisdictions have since reopened schools with control measures in place. Early evidence indicated that schools were low risk and children were unlikely to be very infectious, but it is becoming clear that children and youth can acquire and transmit COVID-19 in school settings and that transmission clusters and outbreaks can be large. We describe the contrasting literature on school transmission, and argue that the apparent discrepancy can be reconciled by heterogeneity, or "overdispersion" in transmission, with many exposures yielding little to no risk of onward transmission, but some unfortunate exposures causing sizeable onward transmission. In addition, respiratory viral loads are as high in children and youth as in adults, pre- and asymptomatic transmission occur, and the possibility of aerosol transmission has been established. We use a stochastic individual-based model to find the implications of these combined observations for cluster sizes and control measures. We consider both individual and environment/activity contributions to the transmission rate, as both are known to contribute to variability in transmission. We find that even small heterogeneities in these contributions result in highly variable transmission cluster sizes in the classroom setting, with clusters ranging from 1 to 20 individuals in a class of 25. None of the mitigation protocols we modeled, initiated by a positive test in a symptomatic individual, are able to prevent large transmission clusters unless the transmission rate is low (in which case large clusters do not occur in any case). Among the measures we modeled, only rapid universal monitoring (for example by regular, onsite, pooled testing) accomplished this prevention. We suggest approaches and the rationale for mitigating these larger clusters, even if they are expected to be rare.

URL: <https://www.ncbi.nlm.nih.gov/pubmed/34237051>

DOI: 10.1371/journal.pcbi.1009120

10.1371/journal.pcbi.1009120. eCollection 2021 Jul.

72. Ulyte A, Radtke T, Abela IA, et al. Evolution of SARS-CoV-2 seroprevalence and clusters in school children from June 2020 to April 2021 reflect community transmission: prospective cohort study Ciao Corona. medRxiv. 2021. DOI: 10.1101/2021.07.19.21260644

ABSTRACT: Objectives: To longitudinally assess severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) seroprevalence and clustering of seropositive children within school classes in March-April 2021 compared to June-July and October-November 2020. To examine the evolution of symptoms and the extent of under-detection of SARS-CoV-2 in children. Design: Prospective cohort study of randomly selected schools and classes. Setting: Schools remained open for physical attendance in Switzerland from May 2020 to the end of 2020/2021 school year. Lower school level (age range 7-10 years) and middle school level (8-13 years) children in primary schools, and upper school

level (12-17 years) children in secondary schools were invited for SARS-CoV-2 serological testing in the Ciao Corona study in the canton of Zurich, Switzerland. Three testing rounds were completed in June-July 2020 (T1; after the first wave of SARS-CoV-2 infections), October-November 2020 (T2; during the peak of the second wave), and March-April 2021 (T3; after the second wave and with SARS-CoV-2 variants of concern becoming dominant). Parents completed questionnaires on sociodemographic information and symptoms. Participants: 2487 children (median age 12 years, age range 7-17 years) recruited from 275 classes in 55 schools participated in the testing in March-April 2021; total of 2974 children participated in at least one of the 3 testing rounds. Main outcome measures: SARS-CoV-2 serology results; clustering of seropositive children within classes; reported symptoms. Results: The proportion of children who were SARS-CoV-2 seropositive increased from 1.5% (95% credible interval (CrI) 0.6% to 2.6%) in June-July 2020, to 6.6% (95% CrI 4.0% to 8.9%) in October-November, and to 16.4% (95% CrI 12.1% to 19.5%) in March-April 2021. By March-April 2021, children in upper school level (12.4%; 95% CrI 7.3% to 16.7%) were less likely to be seropositive than those in middle (19.5%; 95% CrI 14.2% to 24.4%) or lower school levels (16.0%; 95% CrI 11.0% to 20.4%). Children in the upper school level had a 5.1% (95% CI -9.4% to -0.7%) lower than expected seroprevalence by March-April 2021 than those in middle school level, based on difference-in-differences analysis. The ratio of PCR-diagnosed to all seropositive children changed from 1 to 21.7 (by June-July 2020) to 1 to 3.5 (by March-April 2021). Symptoms were reported by 37% of newly seropositive and 16% seronegative children. Potential clusters of 3 or more newly seropositive children were detected in 24 of 119 (20%) classes with a high participation rate, from which a median of 17 clusters could be expected due to random distribution of seropositive children within the classes. Clustering was lowest in middle and upper school levels. Retention rate in the cohort was high (84% of T1 participants attended T3). Among participants, supporting society and research were reported more commonly for participation than personal reasons. Fear of blood sampling was the most frequently reported reason for non-participation, reported for 64% of children. Conclusions: By March-April 2021, 16.4% of children and adolescents were seropositive in the canton of Zurich, Switzerland. The majority of clusters of SARS-CoV-2 seropositive children in school classes could be explained by community rather than intra-class transmission of infections. Seroprevalence and clustering was lowest in upper school levels during all timepoints. Trial registration: ClinicalTrials.gov NCT04448717. Key words: SARS-CoV-2, COVID-19, children, adolescents, school, SARS-CoV-2 symptoms, non-participation, participation rate, cohort.

URL: <http://www.epistemonikos.org/documents/491ee64eda820c9d6a2ef7ad8be9a092f13650a8>

DOI: 10.1101/2021.07.19.21260644

73. Ulyte A, Radtke T, Abela IA, et al. Variation in SARS-CoV-2 seroprevalence across districts, schools and classes: baseline measurements from a cohort of primary and secondary school children in Switzerland. *BMJ Open*. 2021;11(7):e047483.

ABSTRACT: OBJECTIVES: To determine the variation in SARS-CoV-2 seroprevalence in school children and the relationship with self-reported symptoms.

DESIGN: Baseline measurements of a longitudinal cohort study (Ciao Corona) from June to July 2020.

SETTING: 55 schools stratified by district in the canton of Zurich, Switzerland.

PARTICIPANTS: 2585 children (1339 girls; median age: 11 years, age range: 6-16 years), attending grades 1-2, 4-5 and 7-8.

MAIN OUTCOME MEASURES: Variation in seroprevalence of SARS-CoV-2 in children across 12 cantonal districts, schools and grades, assessed using Luminex-based test of four epitopes for IgG, IgA and IgM (Antibody Coronavirus Assay, ABCORA 2.0). Clustering of cases within classes. Association of seropositivity and symptoms. Comparison with seroprevalence in adult population, assessed using Luminex-based test of IgG and IgA (Sensitive Anti-SARS-CoV-2 Spike Trimer Immunoglobulin Serological test).

RESULTS: Overall seroprevalence was 2.8% (95% CI 1.5% to 4.1%), ranging from 1.0% to 4.5% across districts. Seroprevalence in grades 1-2 was 3.8% (95% CI 2.0% to 6.1%), in grades 4-5 was 2.4% (95% CI 1.1% to 4.2%) and in grades 7-8 was 1.5% (95% CI 0.5% to 3.0%). At least one seropositive child was present in 36 of 55 (65%) schools and in 44 (34%) of 131 classes where ≥ 5 children and $\geq 50\%$ of children within the class were tested. 73% of children reported COVID-19-compatible symptoms since January 2020, with the same frequency in seropositive and seronegative children for all symptoms. Seroprevalence of children and adults was similar (3.2%, 95% credible interval (CrI) 1.7% to 5.0% vs 3.6%, 95% CrI 1.7% to 5.4%). The ratio of confirmed SARS-CoV-2 cumulative incidence-to-seropositive cases was 1:89 in children and 1:12 in adults.

CONCLUSIONS: SARS-CoV-2 seroprevalence was low in children and similar to that in adults by the end of June 2020. Very low ratio of diagnosed-to-seropositive children was observed. We did not detect clustering of SARS-CoV-2-

seropositive children within classes, but the follow-up of this study will shed more light on transmission within schools.

TRIAL REGISTRATION NUMBER: NCT04448717. Copyright © Author(s) (or their employer(s)) 2021. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

URL: <https://bmjopen.bmj.com/content/11/7/e047483>

74. van den Berg P, Schechter-Perkins EM, Jack RS, et al. Effectiveness of three versus six feet of physical distancing for controlling spread of COVID-19 among primary and secondary students and staff: A retrospective, state-wide cohort study. Clin Infect Dis. 2021;10:10.

ABSTRACT: BACKGROUND: National and international guidelines differ about the optimal physical distancing between students for prevention of SARS-CoV-2 transmission; studies directly comparing the impact of ≥ 3 versus ≥ 6 feet of physical distancing policies in school settings are lacking. Thus, our objective was to compare incident cases of SARS-CoV-2 in students and staff in Massachusetts public schools among districts with different physical distancing requirements. State guidance mandates masking for all school staff and for students in grades 2 and higher; the majority of districts required universal masking.

METHODS: Community incidence rates of SARS-CoV-2, SARS-CoV-2 cases among students in grades K-12 and staff participating in-person learning, and district infection control plans were linked. Incidence rate ratios (IRR) for students and staff members in districts with ≥ 3 versus ≥ 6 feet of physical distancing were estimated using log-binomial regression; models adjusted for community incidence are also reported.

RESULTS: Among 251 eligible school districts, 537,336 students and 99,390 staff attended in-person instruction during the 16-week study period, representing 6,400,175 student learning weeks and 1,342,574 staff learning weeks. Student case rates were similar in the 242 districts with ≥ 3 feet versus ≥ 6 feet of physical distancing between students (IRR, 0.891, 95% CI, 0.594-1.335); results were similar after adjusting for community incidence (adjusted IRR, 0.904, 95% CI, 0.616-1.325). Cases among school staff in districts with ≥ 3 feet versus ≥ 6 feet of physical distancing were also similar (IRR, 1.015, 95% CI, 0.754-1.365).

CONCLUSIONS: Lower physical distancing policies can be adopted in school settings with masking mandates without negatively impacting student or staff safety. Copyright Published by Oxford University Press for the Infectious Diseases Society of America 2021.

URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7989511/>

75. Villanueva F, Notario A, Cabanas B, et al. Assessment of CO₂ and aerosol (PM_{2.5}, PM₁₀, UFP) concentrations during the reopening of schools in the COVID-19 pandemic: The case of a metropolitan area in Central-Southern Spain. Environ Res. 2021;197:111092.

ABSTRACT: Public health authorities have been paramount in guaranteeing that adequate fresh air ventilation is promoted in classrooms to avoid SARS-CoV-2 transmission in educational environments. In this work it was aimed to assess ventilation conditions (carbon dioxide, CO₂) and suspended particulate matter (PM_{2.5}, PM₁₀ and UFP) levels in 19 classrooms - including preschool, primary and secondary education - located in the metropolitan area of Ciudad Real, Central-Southern Spain, during the school's reopening (from September 30th until October 27th, 2020) after about 7 months of lockdown due to COVID-19 pandemic. The classrooms that presented the worst indoor environmental conditions, according to the highest peak of concentration obtained, were particularly explored to identify the possible influencing factors and respective opportunities for improvement. Briefly, findings suggested that although ventilation promoted through opening windows and doors according to official recommendations is guaranteeing adequate ventilation conditions in most of the studied classrooms, thus minimizing the risk of SARS-CoV-2 airborne transmission, a total of 5 (26%) surveyed classrooms were found to exceed the recommended CO₂ concentration limit value (700 ppm). In general, preschool rooms were the educational environments that registered better ventilation conditions, while secondary classrooms exhibited the highest peak and average CO₂ concentrations. In turn, for PM_{2.5}, PM₁₀ and UFP, the concentrations assessed in preschools were, on average about 2-fold greater than the levels obtained in both primary and secondary classrooms. In fact, the indoor PM_{2.5} and PM₁₀ concentrations substantially exceeded the recommended limits of 8hr-exposure, established by WHO, in 63% and 32% of the surveyed classrooms, respectively. Overall, it is expected that the findings presented in this study will assist the establishment of evidence-based measures (namely based on ensuring proper ventilation rates and air filtration) to mitigate preventable environmental harm in public school buildings, mainly at local and national levels. Copyright © 2021 Elsevier Inc. All rights reserved.

URL: <https://www.sciencedirect.com/science/article/abs/pii/S0013935121003868>

76. Volpp KG, Kraut BH, Ghosh S, et al. Minimal SARS-CoV-2 Transmission After Implementation of a Comprehensive Mitigation Strategy at a School - New Jersey, August 20-November 27, 2020. MMWR - Morbidity & Mortality Weekly Report. 2021;70(11):377-81.

ABSTRACT: During fall 2020, many U.S. kindergarten through grade 12 (K-12) schools closed campuses and instituted remote learning to limit in-school transmission of SARS-CoV-2, the virus that causes COVID-19 (1,2). A New Jersey grade 9-12 boarding school with 520 full-time resident students, 255 commuter students, and 405 faculty and staff members implemented a comprehensive mitigation strategy that included universal masking, testing, upgraded air-handling equipment to improve ventilation, physical distancing of ≥ 6 ft, contact tracing, and quarantine and isolation protocols to prevent and control transmission of SARS-CoV-2 among students, faculty, and staff members. Mandatory twice-weekly screening using real-time reverse transcription-polymerase chain reaction (RT-PCR) testing of all students and staff members during August 20-November 27, 2020, resulted in the testing of 21,449 specimens. A total of 19 (5%) of 405 faculty and staff members and eight (1%) of 775 students received positive test results; only two identified cases were plausibly caused by secondary transmission on campus. Comprehensive mitigation approaches including frequent testing and universal masking can help prevent outbreaks in in-person high school settings even when community transmission is ongoing.

URL: <https://www.cdc.gov/mmwr/volumes/70/wr/pdfs/mm7011a2-H.pdf>

77. White P, Ceannt R, Kennedy E, et al. Children are safe in schools: a review of the Irish experience of reopening schools during the COVID-19 pandemic. Public Health. 2021;195:158-60.

ABSTRACT: OBJECTIVES: Schools in the Republic of Ireland reopened to students and staff in late August 2020. We sought to determine the test positivity rate of close contacts of cases of coronavirus disease 2019 (COVID-19) in schools during the first half-term of the 2020/2021 academic year.

METHODS: National-level data from the schools' testing pathway were interrogated to determine the positivity rate of close contacts of cases of COVID-19 in Irish primary, postprimary and special schools during the first half-term of 2020/2021 academic year. The positivity rates among adult and child close contacts were compared and the proportion of national cases of COVID-19 who were aged 4-18 years during the observation period was calculated to assess whether this proportion increased after schools reopened.

RESULTS: Of all, 15,533 adult and child close contacts were tested for COVID-19 through the schools' testing pathway during the first half-term of the 2020/2021 academic year. Three hundred and ninety-nine close contacts tested positive, indicating a positivity rate of 2.6% (95% confidence interval: 2.3-2.8%). The positivity rates of child and adult close contacts were similarly low (2.6% vs 2.7%, $P = 0.7$). The proportion of all national cases of COVID-19 who were aged 4-18 years did not increase during the first half-term of the 2020/2021 school year.

CONCLUSIONS: The low positivity rate of close contacts of cases of COVID-19 in schools indicate that transmission of COVID-19 in Irish schools during the first half-term of the 2020/2021 academic year was low. These findings support policies to keep schools open during the pandemic. Copyright © 2021 The Royal Society for Public Health. Published by Elsevier Ltd. All rights reserved.

URL: <https://pubmed.ncbi.nlm.nih.gov/34130002/>

78. White P, O'Sullivan MB, Murphy N, et al. An investigation into the rates of transmission of SARS-CoV-2 during the first 6 weeks of the 2020-2021 academic year in primary and post-primary schools in Cork and Kerry, Ireland. Ir J Med Sci. 2021;01:01.

ABSTRACT: BACKGROUND: Schools in Ireland closed in March 2020 as part of a national strategy to contain the spread of severe acute respiratory syndrome (SARS-CoV-2). The extent to which schools contribute to the overall propagation of SARS-CoV-2 was continuing to evolve internationally.

AIMS: To examine regional data on SARS-CoV-2 transmission in primary, post-primary and special schools in Cork and Kerry, two counties in southwest Ireland, during the first 6 weeks of the 2020-2021 academic year and determine the rate of in-school transmission.

METHODS: Data were obtained from the Computerised Infectious Disease Reporting (CIDR) system and supplemented with digital records from the regional Department of Public Health (Dept PH) and from the Health Service Executive (HSE) Covid Care Tracker application. The positivity rate among school close contacts was calculated to determine the rate of in-school SARS-CoV-2 transmission.

RESULTS: The overall rate of in-school transmission of SARS-CoV-2 was low at 4.1%. Positivity rates among students and staff who were close contacts were similarly low (3.1% vs. 6.9%, $p = 0.07$). One secondary case of coronavirus

disease 2019 (COVID-19) emerged, on average, for every 7.6 infectious days spent by an index case in school. Schools accounted for 2.2% of all notified cases of COVID-19 in the region during the observation period.

CONCLUSIONS: During the first 6 weeks of the academic year, the rate of in-school SARS-CoV-2 transmission in the region was low, and schools did not contribute substantially to the overall burden of COVID-19.

URL: <https://pubmed.ncbi.nlm.nih.gov/33792855/>

79. Willyard C. COVID and schools: the evidence for reopening safely. *Nature*. 2021;595(7866):164-7.

URL: <https://www.nature.com/articles/d41586-021-01826-x>

80. Xu Y, Cai J, Li S, et al. Airborne infection risks of SARS-CoV-2 in U.S. schools and impacts of different intervention strategies. *Sustainable Cities and Society*. 2021;74:103188.

ABSTRACT: The potential airborne transmission of SARS-CoV-2 has triggered concerns as schools continue to reopen and resume in-person instruction during the current COVID-19 pandemic. It is critical to understand the risks of airborne SARS-CoV-2 transmission under different epidemiological scenarios and operation strategies for schools to make informed decisions to mitigate infection risk. Through scenario-based analysis, this study estimates the airborne infection risk of SARS-CoV-2 in 111,485 U.S. public and private schools and evaluates the impacts of different intervention strategies, including increased ventilation, air filtration, and hybrid learning. Schools in more than 90% of counties exhibit infection risk of higher than 1%, indicating the significance of implementing intervention strategies. Among the considered strategies, air filtration is found to be most effective: the school average infection risk when applying MERV 13 is over 30% less than the risk levels correlating with the use of increased ventilation and hybrid learning strategies, respectively. For most schools, it is necessary to adopt combined intervention strategies to ensure the infection risk below 1%. The results provide insights into airborne infection risk in schools under various scenarios and may guide schools and policymakers in developing effective operations strategies to maintain environmental health. Copyright © 2021 Elsevier Ltd. All rights reserved.

URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8290078/>

81. Zar HJ. COVID-19 in children and adolescents in South Africa: The impact of variant virus. *Pediatr Pulmonol*. 2021;56 (SUPPL 2):S31-S3.

ABSTRACT: South Africa reported the first case of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2; COVID-19) on March 5 2020; subsequently 2 distinct waves of the pandemic have occurred. The first wave occurred from June 7 to August 29 2020 (weeks 24 to 35) while the second wave [November 22 2020 to February 6 2021; weeks 48 to week 5 of 2021] was driven predominantly by the emergence of a variant virus, the South African variant B.1.351.1. Non-pharmaceutical interventions to prevent transmission were widely, rapidly implemented including a national lockdown, with school closures from March 18 2020 and measures restricting travel and trade from March 25 2020. Restrictions were eased from May 1 2020; limited reopening of schools occurred from June 8 2020 with all schools reopened by September 1 2020. Widespread use of public health interventions including hand hygiene, social distancing, universal wearing of masks, identification and isolation of infected people and tracing of contacts were implemented nationally. By April 13th 2021, there were a cumulative total of 1.56 million cases and 53 356 deaths.² However more than 150 000 excess deaths have been reported, suggesting that COVID-associated mortality may be substantially higher. Even with conservative estimates, mortality rates from COVID are amongst the highest globally. As of April 2021, only 0.5% of the South African population have been vaccinated, with limited targeted vaccination of health care workers occurring slowly.³ Strong national surveillance systems for detection of infections through a laboratory-based surveillance system operated by the National Institute for Communicable Diseases (NICD) were established. In parallel, a prospective surveillance program with electronic collection of data on hospitalizations (DATCOV) was established at sentinel hospitals encompassing 513 facilities (100% of all private sector facilities and 88% of all public sector hospitals).⁴ Similar to data reported from high income countries, children in South Africa predominantly developed mild disease or were asymptomatic. Of SARS-CoV2 infections, children constituted a small proportion of cases, with approximately 136 153 (9.2%) occurring in children or adolescents under 19 years of age.⁵ The median age of infection was 14 years (interquartile range [IQR] 8.0 - 17.0 years; 44% male) with 3586 (2.6%) occurring in infants. The cumulative incidence of laboratory-confirmed infections in children was almost 6-fold lower than adults (623.8 per 100 000 population vs. 3551.2 per 100 000 population). Weekly incidence was highest (32 per 100 000) in the first wave in week 28 and during the second wave (55.2 per 100 000 in week 1 of 2021). The epidemiology of infections followed adult curves, with substantially higher numbers of infections occurring in the 2nd compared to the first wave and increases in numbers of infections across age groups. Amongst hospitalizations, a

minority were in children or adolescents, representing approximately 3.8% of all COVID-related hospitalizations.⁵ Median age at hospitalization was 10.2 years (IQR 1.4 -17.0 years); 47% were male. Adolescents aged 15-19 years had the highest numbers of hospitalizations (36%), while infants accounted for 21%. Weekly number of admissions and admission rates were higher in the second wave compared to those in the first wave; the rate of admission in infants increased substantially during the second wave. However, admission rates to ICU (6.7%) and in-hospital mortality (3.6%) were similar in the first and second waves. Mortality rates were much lower than those older than 19 yrs; most children who died had underlying conditions. In-hospital case fatality rates were 3.6% in children or adolescents compared to 23.7% among those older than 19 years. A small number of children were hospitalized with multi-inflammatory system disease. There was no association between school opening or closing and either infections or hospitalization in children.⁵ While an increased number of infections occurred in children and adolescents in the second wave, in contrast to adults, there was no increase in severity of disease with rates of ICU admission and mortality similar to that in the first wave. The indirect effects of the pandemic on child health globally and in South Africa have been a concern.⁶⁻⁸ Downscaling or reduced access to regular child and maternal health services has had an impact on immunization, antenatal and nutritional programs, and other diseases such as tuberculosis. Delays in seeking care for sick children, have led to more severe illness at presentation and lower uptake of effective preventive interventions such as childhood vaccination. Closure of schools with impact on child mental health, learning, the ability of parents to work and less access to school feeding programs has been a concern. Reopening of schools in the context of COVID has been challenging, especially for students from the most deprived communities who have been more severely affected. In more disadvantaged schools, access to water and soap for hand washing, over-crowding and inability to implement public health measures to prevent transmission were key challenges. Safe re-opening of schools required improved access to water, universal use of masks, environmental controls, operational changes (such as smaller classroom sizes, social distancing in classes), screening of staff and students for symptoms and exclusion of high-risk staff. Lockdowns with widespread unemployment in SA, food and housing insecurity, have a major impact on the economy, further compromising child health. However, major reductions in influenza cases and admissions for RSV-associated respiratory disease occurred through the pandemic, reflecting less transmission of these viral pathogens, attributable to the effectiveness of nonpharmacological interventions.⁹ Despite children and adolescents constituting approximately a third of the South African population, and despite the high prevalence of risk factors such as TB, HIV, malnutrition or poverty that could predispose to more severe COVID¹⁰, children developed remarkably little serious infection and have been largely spared from the direct effects of COVID. While the SA variant virus has led to more infections in all age groups of children, due to its higher transmissibility compared to original virus, disease severity has not been more severe in these age groups.⁵ In contrast, higher severity of disease in adults due to the SA variant has been reported compared to that occurring from the original virus. Transmission is unrelated to school opening or closing, indicating that community or household transmission is the major source of transmission. However, the indirect effects of the pandemic on children have been substantial. The current crisis has exacerbated global inequities in health, but also provided new opportunities to strengthen child health.

82. Zhang Y, Johnson K, Lich KH, et al. COVID-19 Projections for K12 Schools in Fall 2021: Significant Transmission without Interventions. medRxiv. 2021:2021.08.10.21261726. DOI: 10.1101/2021.08.10.21261726

ABSTRACT: Background Millions of primary school students across the United States are about to return to in-person learning. Amidst circulation of the highly infectious Delta variant, there is danger that without the appropriate safety precautions, substantial amount of school-based spread of COVID-19 may occur. Methods We used an extended Susceptible-Infected-Recovered computational model to estimate the number of new infections during 1 semester among a student population under different assumptions about mask usage, routine testing, and levels of incoming protection. Our analysis considers three levels of incoming protection (30%, 40%, or 50%; denoted as "low", "mid", or "high"). Universal mask usage decreases infectivity by 50%, and weekly testing may occur among 50% of the student population; positive tests prompt quarantine until recovery, with compliance contingent on symptom status. Results Without masking and testing, more than 75% of susceptible students become get infected within three months in all settings. With masking, this values decreases to 50% for "low" incoming protection settings ("mid"=35%, "high"=24%). Testing half the masked population ("testing") further drops infections to 22% (16%, 13%). Conclusion Without interventions in place, the vast majority of susceptible students will become infected through the semester. Universal masking can reduce student infections by 26-78%, and biweekly testing along with masking reduces infections by another 50%. To prevent new infections in the community, limit school absences, and maintain in-person learning, interventions such as masking and testing must be implemented widely, especially among elementary school settings in which children are not yet eligible for the vaccine. Competing Interest Statement Dr. Ivy reported receiving grants

from the CDC, CSTE, NCATS, and NC State University during the conduct of the study. Dr. Mayorga reported receiving grants from the NCATS/NIH, CSTE, CDC, and NC State University during the conduct of the study. Dr. Keskinocak reported receiving grants from CDC, CSTE, and Georgia Institute of Technology during the conduct of the study. Dr. Swann reported receiving grants from NCATS/NIH, CDC, CSTE, and NC State University during the conduct of the study. No other disclosures were reported.

Funding Statement This research was supported by grant UL1TR002489 from the NCATS/NIH; Cooperative Agreement NU38OT000297 from the CSTE and the CDC; grant KL2TR002490 from the NCATS/NIH; The research also received partial support from the Georgia Institute of Technology and NC State University. The funders had no role in the design and conduct of the study, collection, management, analysis, and interpretation of the data, preparation, review, or approval of the manuscript, and the decision to submit the manuscript for publication.

Author Declarations I confirm all relevant ethical guidelines have been followed, and any necessary IRB and/or ethics committee approvals have been obtained. Yes The details of the IRB/oversight body that provided approval or exemption for the research described are given below: This study was exempted by the UNC Institutional Review Board (#20-2087). All necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived. Yes I understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance). Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable. Yes All data utilized for the development of this model is available upon request.

URL: <http://medrxiv.org/content/early/2021/08/11/2021.08.10.21261726.abstract>
DOI: 10.1101/2021.08.10.21261726

83. Wada K, Okabe N, Shobugawa Y. Infection and transmission of COVID-19 among students and teachers in schools in Japan after the reopening in June 2020. BMJ Paediatrics Open. 2020;4(1):e000854.

ABSTRACT: We aimed to investigate the confirmed COVID-19 cases among students and teachers in elementary schools (ages 6-12 years) and junior high schools (ages 13-15 years) in Japan between 1 June and 31 July 2020. We requested all schools to provide reports when students or teachers tested positive for COVID-19. A total of 207 cases were reported among students. Household transmission was identified as the dominant transmission route, confirmed in 71.4% of elementary schools and 60.3% of junior high schools. A total of 39 cases were reported among teachers, of which transmission route was unknown in 72.4% of elementary schools and 90.0% of junior high schools. Copyright © Author(s) (or their employer(s)) 2020. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

URL: <https://bmjpaedsopen.bmj.com/content/4/1/e000854>

Appendix 1: Evidence Search Details

Filters, Limits & Exclusions:	English only March 9, 2021 – August 17, 2021 ...
Sources Searched:	<ul style="list-style-type: none"> • Alberta Health Services • CanCOVID • CDC • CEBM • COVID-END • COVID-19 Immunity Taskforce • Embase • European Centre for Disease Control • Ministry of Health Ontario • NCCMT • Newfoundland Quick Response Reports • NHS • Norwegian Institute of Public Health • PHAC • Prevent Pandemics

- Evidence Check Australia
- GOARN
- Google
- Google Scholar
- HSE
- L-OVE
- McMaster Forum
- McMaster Plus Evidence Alerts
- Medline
- medRxiv
- Public Health England
- Public Health Ontario
- Rapid Research Information Forum
- Special for Pediatrics
- SPOR
- TRIP Pro
- USHER
- WHO
- WHO Global Research
- Veterans Affairs Database

Librarian(s): Brianna Howell-Spooner, Clinical Librarian, Saskatchewan Health Authority
Lukas Miller, Clinical Librarian, Saskatchewan Health Authority

Appendix 2: Search Strategies

Medline – March 9, 2021 – August 17, 2021

#	Searches	Results
1	(coronavirus/ or betacoronavirus/ or coronavirus infections/) and (disease outbreaks/ or epidemics/ or pandemics/)	40070
2	(nCoV* or 2019nCoV or 19nCoV or COVID19* or COVID or SARS-COV-2 or SARSCOV-2 or SARSCOV2 or Severe Acute Respiratory Syndrome Coronavirus 2 or Severe Acute Respiratory Syndrome Corona Virus 2).ti,ab,kf,nm,ox,rx,px.	160028
3	((new or novel or "19" or "2019" or Wuhan or Hubei or China or Chinese) adj3 (coronavirus* or corona virus* or betacoronavirus* or CoV or HCoV)).ti,ab,kf.	49636
4	((coronavirus* or corona virus* or betacoronavirus*) adj3 (pandemic* or epidemic* or outbreak* or crisis)).ti,ab,kf.	9159
5	((Wuhan or Hubei) adj5 pneumonia).ti,ab,kf.	356
6	or/1-5	166256
7	6 and ((WHO or World Health Organization) adj2 (alpha or beta or gamma)).ti,kf.	0
8	((british or UK or united kingdom or england or english or south african or south africa or brazil or Brazilian or brasil or brasilian or california? or new york or india?) adj2 (strain? or mutation? or variant?)).ti,kf.	879
9	((variant? or mutation? or strain? or lineage?) adj2 (virus* or viral* or coronavirus* or COVID-19 or SARS-COV-2 or COVID19 or nCoV* or "of concern" or "of interest")).ti,kf.	7508

10	((genetic or new or newer or newest or novel) adj1 (variant or mutation? or lineage? or strain?)).ti,kf.	14586
11	("20I/S:501Y.V1" or "20I/501Y.V1" or "B.1.1.7" or "B117" or "501YV1" or "GR/501Y.V1" or "GRY" or (alpha adj1 variant?)).ti,kf.	345
12	("B.1.351" or "B1351" or "20H/501Y.V2" or "GH/501Y.V2" or "20H/S:501Y.V2" or "501YV2" or (beta adj1 variant?)).ti,kf.	166
13	("P.1" or "P1" or "20J/501Y.V3" or "501YV3" or "GR/501Y.V3" or "20J/S:501Y.V3" or (gamma adj1 variant?)).ti,kf.	4045
14	("B.1.617.2" or "B16172" or "G/452R.V3" or "G/452RV3" or "G452RV3" or "G452R.V3" or "21A/S:478K" or (delta adj1 variant?)).ti,kf.	61
15	7 or 8 or 9 or 10 or 11 or 12 or 13 or 14	27078
16	(WHO adj2 (epsilon or zeta or eta or theta or iota or kappa)).ti,kf.	0
17	("B.1.427" or "B.1.429" or "B.1.427/B.1.429" or "GH/452R.V1" or "20C/S.452R" or (epsilon adj1 variant?)).ti,kf.	17
18	("P.2" or "P2" or "GR" or "20B/S.484K" or (zeta adj1 variant?)).ti,kf.	5182
19	("B.1.525" or "B1525" or "G/484K.V3" or "20A/S484K" or (eta adj1 variant?)).ti,kf.	4
20	("P.3" or "P3" or "GR" or "20B/S:265C" or (theta adj1 variant?)).ti,kf.	3800
21	("B.1.526" or "B1526" or "GH" or "20C/S:484K" or (iota adj1 variant?)).ti,kf.	6678
22	("B.1.617.1" or "B16171" or "G/452R.V3" or "21A/S:154K" or (kappa adj1 variant?)).ti,kf.	6
23	(or/16-22) and (variant? or lineage? or clade? or mutation?).ti,kf.	357
24	15 or 23	27387
25	(vaccinat* or vaccine? or inoculat* or immunization? or immunize? or immunogenicity).ti,kf.	235770
26	6 and 25	8753
27	(moderna? or mrna-1273 or mrna1273).ti,ab.	500
28	(pfizer* or biontech* or tozinameran or BNT162b2).ti,ab.	3948
29	(astrazeneca or astra zeneca or "ChAdOx1-S" or ChAdOx1* or COVISHIELD or COVIDSHIELD or (oxford adj3 astrazeneca)).ti,ab.	1701
30	(janssen? or "ad26.cov2.s" or ad26cov2s or ad26cov2* or (johnson adj2 johnson)).ti,ab.	13499
31	(sinovac or coronavac or sinopharm or bbibp-cov or sputnik v or sputnik 5 or gam-covid-vac or covaxin or bbv152).ti,ab.	149

32	or/26-31	26440
33	24 and 32	307
34	exp *pediatrics/ or exp *infant/ or exp *child/ or exp *juvenile/ or exp *adolescent/	114179
35	(child? or children or childhood or p?ediatric* or baby or babies or newborn? or new-born? or neonat* or perinat* or infant? or toddler? or preschooler? or pre-schooler* or boy? or girl? or adolescen* or teen* or youth? or juvenile? or pre-adolescenc* or pre-teen? or preadolescenc* or preteen?).ti,ab.	2513957
36	schools/ or schools, nursery/	44213
37	(school* or playschool? or education* or student?).ti,ab.	989064
38	or/34-37	3249561
39	exp *epidemiology/ or exp disease exacerbation/ or epidemiol*.tw,kf.	646575
40	((disease or clinical or illness) adj2 (course or trajector* or characteristi* or progress*)).ti,ab.	332144
41	(natural adj2 histor*).ti,ab.	51513
42	exp probability/ or ((rate* or trend* or likelihood or probabilit* or proportion) adj2 (symptom* or asymptom* or mortali* or death* or hospitali*)).ti,ab.	1642083
43	(sever* adj3 case?).ti,ab.	66833
44	disease transmission, infectious/ or Basic Reproduction Number/ or (R0 or reproduction number or reproduction rate or reproductive number or reproductive rate or Rt or effective reproduction number or positive oractive case? or new case? or daily average or transmission).ti,ab.	653578
45	or/39-44	3063290
46	33 and 38 and 45	1
47	24 and 38 and 45	504
48	32 and 38 and 45	526
49	or/46-48	1029
50	limit 49 to dt=20210309-20210817	129
#	Searches	Results
1	(coronavirus/ or betacoronavirus/ or coronavirus infections/) and (disease outbreaks/ or epidemics/ or pandemics/)	40070

2	(nCoV* or 2019nCoV or 19nCoV or COVID19* or COVID or SARS-COV-2 or SARSCOV-2 or SARSCOV2 or Severe Acute Respiratory Syndrome Coronavirus 2 or Severe Acute Respiratory Syndrome Corona Virus 2).ti,ab,kf,nm,ox,rx,px.	160028
3	((new or novel or "19" or "2019" or Wuhan or Hubei or China or Chinese) adj3 (coronavirus* or corona virus* or betacoronavirus* or CoV or HCoV)).ti,ab,kf.	49636
4	((coronavirus* or corona virus* or betacoronavirus*) adj3 (pandemic* or epidemic* or outbreak* or crisis)).ti,ab,kf.	9159
5	((Wuhan or Hubei) adj5 pneumonia).ti,ab,kf.	356
6	or/1-5	166256
7	6 and ((WHO or World Health Organization) adj2 (alpha or beta or gamma)).ti,kf.	0
8	((british or UK or united kingdom or england or english or south african or south africa or brazil or Brazilian or brasil or brasilian or california? or new york or india?) adj2 (strain? or mutation? or variant?)).ti,kf.	879
9	((variant? or mutation? or strain? or lineage?) adj2 (virus* or viral* or coronavirus* or COVID-19 or SARS-COV-2 or COVID19 or nCoV* or "of concern" or "of interest")).ti,kf.	7508
10	((genetic or new or newer or newest or novel) adj1 (variant or mutation? or lineage? or strain?)).ti,kf.	14586
11	("20I/S:501Y.V1" or "20I/501Y.V1" or "B.1.1.7" or "B117" or "501YV1" or "GR/501Y.V1" or "GRY" or (alpha adj1 variant?)).ti,kf.	345
12	("B.1.351" or "B1351" or "20H/501Y.V2" or "GH/501Y.V2" or "20H/S:501Y.V2" or "501YV2" or (beta adj1 variant?)).ti,kf.	166
13	("P.1" or "P1" or "20J/501Y.V3" or "501YV3" or "GR/501Y.V3" or "20J/S:501Y.V3" or (gamma adj1 variant?)).ti,kf.	4045
14	("B.1.617.2" or "B16172" or "G/452R.V3" or "G/452RV3" or "G452RV3" or "G452R.V3" or "21A/S:478K" or (delta adj1 variant?)).ti,kf.	61
15	7 or 8 or 9 or 10 or 11 or 12 or 13 or 14	27078
16	(WHO adj2 (epsilon or zeta or eta or theta or iota or kappa)).ti,kf.	0
17	("B.1.427" or "B.1.429" or "B.1.427/B.1.429" or "GH/452R.V1" or "20C/S.452R" or (epsilon adj1 variant?)).ti,kf.	17
18	("P.2" or "P2" or "GR" or "20B/S.484K" or (zeta adj1 variant?)).ti,kf.	5182
19	("B.1.525" or "B1525" or "G/484K.V3" or "20A/S484K" or (eta adj1 variant?)).ti,kf.	4
20	("P.3" or "P3" or "GR" or "20B/S:265C" or (theta adj1 variant?)).ti,kf.	3800

21	("B.1.526" or "B1526" or "GH" or "20C/S:484K" or (iota adj1 variant?)).ti,kf.	6678
22	("B.1.617.1" or "B16171" or "G/452R.V3" or "21A/S:154K" or (kappa adj1 variant?)).ti,kf.	6
23	(or/16-22) and (variant? or lineage? or clade? or mutation?).ti,kf.	357
24	15 or 23	27387
25	(vaccinat* or vaccine? or inoculat* or immunization? or immunize? or immunogenicity).ti,kf.	235770
26	6 and 25	8753
27	(moderna? or mrna-1273 or mrna1273).ti,ab.	500
28	(pfizer* or biontech* or tozinameran or BNT162b2).ti,ab.	3948
29	(astrazeneca or astra zeneca or "ChAdOx1-S" or ChAdOx1* or COVISHIELD or COVIDSHIELD or (oxford adj3 astrazeneca)).ti,ab.	1701
30	(janssen? or "ad26.cov2.s" or ad26cov2s or ad26cov2* or (johnson adj2 johnson)).ti,ab.	13499
31	(sinovac or coronavac or sinopharm or bbibp-corv or sputnik v or sputnik 5 or gam-covid-vac or covaxin or bbv152).ti,ab.	149
32	or/26-31	26440
33	24 and 32	307
34	exp *pediatrics/ or exp *infant/ or exp *child/ or exp *juvenile/ or exp *adolescent/	114179
35	(child? or children or childhood or p?ediatric* or baby or babies or newborn? or new-born? or neonat* or perinat* or infant? or toddler? or preschooler? or pre-schooler* or boy? or girl? or adolescen* or teen* or youth? or juvenile? or pre-adolescenc* or pre-teen? or preadolescenc* or preteen?).ti,ab.	2513957
36	schools/ or schools, nursery/	44213
37	(school* or playschool? or education* or student?).ti,ab.	989064
38	or/34-37	3249561
39	exp probability/ or ((rate* or trend* or likelihood or probabilit* or proportion) adj2 (symptom* or asymptom* or mortali* or death* or hospitali*)).ti,ab.	1642083
40	disease transmission, infectious/ or Basic Reproduction Number/ or (R0 or reproduction number or reproduction rate or reproductive number or reproductive rate or Rt or effective reproduction number or positive oractive case? or new case? or daily average or transmission or spread* or transfer* or diffusion or dispersion or profusion? or proliferation? or reach or scope).ti,ab.	2323402
41	39 or 40	3867619
42	6 and 26 and 33 and 38 and 41	0

43	6 and 38 and 41	6060
44	limit 43 to english language	5897
45	limit 44 to dt=20210309-20210817	2052
46	from 45 keep 1118, 1133, 1166, 1171, 1226, 1252...	10
47	(transmission or spread* or transfer* or diffusion or dispersion or profusion? or proliferation? or reach or scope).ti,ab.	2098503
48	45 not 46	2042
49	48 and 47	1605
50	36 or 37	994369
51	49 and 50	994
52	(school* or playschool? or education* or student?).ab. /freq=2	388185
53	51 and 52	521

Embase – March 9, 2021 – August 17, 2021

#	Searches	Results
1	(coronavirus/ or betacoronavirus/ or coronavirus infections/) and (disease outbreaks/ or epidemics/ or pandemics/)	10399
2	(nCoV* or 2019nCoV or 19nCoV or COVID19* or COVID or SARS-COV-2 or SARSCOV-2 or SARSCOV2 or Severe Acute Respiratory Syndrome Coronavirus 2 or Severe Acute Respiratory Syndrome Corona Virus 2).ti,ab,kw,hw.	162116
3	((new or novel or "19" or "2019" or Wuhan or Hubei or China or Chinese) adj3 (coronavirus* or corona virus* or betacoronavirus* or CoV or HCoV)).ti,ab,kw.	48030
4	((coronavirus* or corona virus* or betacoronavirus*) adj3 (pandemic* or epidemic* or outbreak* or crisis)).ti,ab,kw.	8851
5	((Wuhan or Hubei) adj5 pneumonia).ti,ab,kw.	397
6	or/1-5	166954
7	6 and ((WHO or World Health Organization) adj2 (alpha or beta or gamma)).ti,kw.	0
8	((british or UK or united kingdom or england or english or south african or south africa or brazil or Brazilian or brasil or brasilian or california? or new york or india?) adj2 (strain? or mutation? or variant?)).ti,kw.	953

9	((variant? or mutation? or strain? or lineage?) adj2 (virus* or viral* or coronavirus* or COVID-19 or SARS-COV-2 or COVID19 or nCoV* or "of concern" or "of interest")).ti,kw.	7126
10	((genetic or new or newer or newest or novel) adj1 (variant or mutation? or lineage? or strain?)).ti,kw.	18957
11	("20I/S:501Y.V1" or "20I/501Y.V1" or "B.1.1.7" or "B117" or "501YV1" or "GR/501Y.V1" or "GRY" or (alpha adj1 variant?)).ti,kw.	307
12	("B.1.351" or "B1351" or "20H/501Y.V2" or "GH/501Y.V2" or "20H/S:501Y.V2" or "501YV2" or (beta adj1 variant?)).ti,kw.	154
13	("P.1" or "P1" or "20J/501Y.V3" or "501YV3" or "GR/501Y.V3" or "20J/S:501Y.V3" or (gamma adj1 variant?)).ti,kw.	5088
14	("B.1.617.2" or "B16172" or "G/452R.V3" or "G/452RV3" or "G452RV3" or "G452R.V3" or "21A/S:478K" or (delta adj1 variant?)).ti,kw.	52
15	7 or 8 or 9 or 10 or 11 or 12 or 13 or 14	32192
16	(WHO adj2 (epsilon or zeta or eta or theta or iota or kappa)).ti,kw.	0
17	("B.1.427" or "B.1.429" or "B.1.427/B.1.429" or "GH/452R.V1" or "20C/S.452R" or (epsilon adj1 variant?)).ti,kw.	20
18	("P.2" or "P2" or "GR" or "20B/S.484K" or (zeta adj1 variant?)).ti,kw.	7149
19	("B.1.525" or "B1525" or "G/484K.V3" or "20A/S484K" or (eta adj1 variant?)).ti,kw.	3
20	("P.3" or "P3" or "GR" or "20B/S:265C" or (theta adj1 variant?)).ti,kw.	5411
21	("B.1.526" or "B1526" or "GH" or "20C/S:484K" or (iota adj1 variant?)).ti,kw.	10027
22	("B.1.617.1" or "B16171" or "G/452R.V3" or "21A/S:154K" or (kappa adj1 variant?)).ti,kw.	5
23	(or/16-22) and (variant? or lineage? or clade? or mutation?).ti,kw.	515
24	15 or 23	32659
25	(vaccinat* or vaccine? or inoculat* or immunization? or immunize? or immunogenicity).ti,kw.	261761
26	6 and 25	8327
27	(moderna? or mrna-1273 or mrna1273).ti,ab.	437
28	(pfizer* or biontech* or tozinameran or BNT162b2).ti,ab.	10595
29	(astrazeneca or astra zeneca or "ChAdOx1-S" or ChAdOx1* or COVISHIELD or COVIDSHIELD or (oxford adj3 astrazeneca)).ti,ab.	6592
30	(janssen? or "ad26.cov2.s" or ad26cov2s or ad26cov2* or (johnson adj2 johnson)).ti,ab.	22009

31	(sinovac or coronavac or sinopharm or bbibp-corv or sputnik v or sputnik 5 or gam-covid-vac or covaxin or bbv152).ti,ab.	158
32	or/26-31	40224
33	24 and 32	256
34	exp *pediatrics/ or exp *infant/ or exp *child/ or exp *juvenile/ or exp *adolescent/	249736
35	(child? or children or childhood or p?ediatric* or baby or babies or newborn? or new-born? or neonat* or perinat* or infant? or toddler? or preschooler? or pre-schooler* or boy? or girl? or adolescen* or teen* or youth? or juvenile? or pre-adolescen* or pre-teen? or preadolescen* or preteen?).ti,ab.	3110253
36	schools/ or schools, nursery/	55905
37	(school* or playschool? or education* or student?).ti,ab.	1285593
38	or/34-37	4079706
39	exp *epidemiology/ or exp disease exacerbation/ or epidemiol*.tw,kw.	1128380
40	((disease or clinical or illness) adj2 (course or trajector* or characteristi* or progress*)).ti,ab.	546567
41	(natural adj2 histor*).ti,ab.	70849
42	exp probability/ or ((rate* or trend* or likelihood or probabilit* or proportion) adj2 (symptom* or asymptom* or mortali* or death* or hospitali*)).ti,ab.	416896
43	(sever* adj3 case?).ti,ab.	96437
44	disease transmission, infectious/ or Basic Reproduction Number/ or (R0 or reproduction number or reproduction rate or reproductive number or reproductive rate or Rt or effective reproduction number or positive oractive case? or new case? or daily average or transmission).ti,ab.	884965
45	or/39-44	2875033
46	33 and 38 and 45	3
47	24 and 38 and 45	714
48	32 and 38 and 45	1100
49	or/46-48	1811
50	limit 49 to dd=20210609-20210817	309
51	limit 50 to medline	4
52	50 not 51	305
53	limit 52 to english language	304
54	6 and 33 and 38 and 45	2

55	6 and 24 and 38 and 45	17
56	54 or 55	17
57	53 not 56	302
58	6 and 38 and 45	6183
59	limit 58 to dd=20210609-20210817	679
60	limit 59 to english language	661
61	60 not 50	617
62	limit 61 to medline	124
63	61 not 62	493

Other Sources

(children child youth adolescent school pediatrics student students pupils pediatrics paediatrics pediatric or paediatric)



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