

Rapid Review Report

Review Title:	What laboratory surveillance testing strategies are effective for COVID-19 in school settings?
Abbreviated Title:	COVID-19 Surveillance Strategies Schools
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Key Findings

- The CDC does not recommend universal symptom screening (all students in K-12 grades) to be done by schools prior to entry
- Schools/districts should individually work with public health officials to determine the necessity and details of implementing any testing strategies
- European CDC recommends that all symptomatic individuals and asymptomatic high-risk close contacts should be referred for testing – fast and effective contact tracing following testing is key
- Large scale universal testing in school settings has not been studied and it's efficacy compared to implementation of other infection prevention control measures is unknown
- Large scale testing in school settings to date has largely been done in response to an outbreak, not as routine surveillance

Limitations

- Large scale testing in school settings to date only in response to outbreaks or at the beginning of pandemic prior to generalized lockdowns and school shutdowns in response to the presence of COVID-19 in a jurisdiction
- Recommendations for testing often accompany other infection prevention control measures such as distancing, cohorting, isolation and contact tracing

GRADE of Evidence: **D - Very Low**

A grade of "D" is assigned when the estimate of effect is very uncertain. The review may consist of expert opinion, no direct research evidence, and/or one or more studies with severe limitations.

For more information about how this rating was determined, visit https://www.essentialevidenceplus.com/product/ebm_loe.cfm?show=grade

Background/Context

With fall-term rapidly approaching and many jurisdictions preparing to send students back to school, recommendations have been published from numerous sources outlining infection prevention control measures to be taken by schools. Many recommendations focus on non-pharmaceutical interventions such as distancing, cohorting, parent/caretaker led screening, exclusion of sick individuals from school and rapid isolation of anyone found symptomatic at school. However, questions remain as to how to proceed with testing and contact tracing once SARS-CoV-2 cases are confirmed within a disease surveillance strategy.

Purpose

To assess the evidence for routine surveillance and outbreak management testing of SARS-CoV-2 in school settings.

Review Question(s)

- What laboratory surveillance testing strategies are effective for COVID-19 in school settings?

Method

For each Rapid Review, the initial question is posed by a decision-maker in the health care system seeking the evidence base for a specific policy decision. According to the subject of the question, the Evidence Task Group Intake Committee allocates this question to the appropriate Working Group. Each Working Group comprises a librarian, researcher, 1-2 clinicians, 1-2 subject matter experts, and a group leader. The Working Group and the decision-maker first discuss the question to ensure it was articulated in a clear, searchable manner. The librarians assigned to your team then conduct a thorough search of the indexed literature, grey literature, news sources, or other sources as agreed upon. Some reference lists for especially pertinent articles are also reviewed. An Evidence Search Report is thereby created. See Appendix for more details on the search strategy. A Rapid Review of the identified literature is then performed by the researcher using the methods of a systematic review, but without a double review or meta-analysis and in a more rapid fashion. Relevant evidence is summarized in both tabular and narrative form, key findings and limitations articulated, and the quality of the body of evidence evaluated using the GRADE hierarchy. The draft Rapid Review is reviewed and edited by the Working Group clinicians, experts, and leader. Once revisions are complete, the Rapid Review is submitted to the requesting decision-maker and placed in the COVID-19 Repository. For certain topics with rapidly changing evidence, after a period of time an updated evidence search is performed, the review process repeated, and an updated Rapid Review released.

Summary of Evidence

According to the CDC, universal testing of students (all students in K-12) and staff in school settings has not yet been studied. Further, modelling studies have found universal testing to be no more effective at prevention of transmission compared to more readily implemented infection prevention control measures such as distancing, the use of face masks and testing, contact tracing and isolating of symptomatic individuals. The CDC recommends that any school/district planning to undertake a testing system does so in collaboration with the relevant public health authorities, and cautions that while school-based healthcare providers, such as school nurses, may administer testing within the scope of their healthcare provider duties, teachers and other staff should not be expected to administer SARS-CoV-2 testing. The European CDC suggests similar protocols with only symptomatic individuals referred

to testing and thorough contact tracing. If testing capacity allows, the European CDC recommends that any asymptomatic individuals that are assessed as high-risk contacts be referred for testing as well, to allow for rapid contact tracing/isolation of any new cases they may generate.

Modelling studies indicate that testing alone does not prevent outbreaks, only when combined with other infection prevention control measures such as distancing and cohorting, and a system of rapid, effective testing and contact tracing. A UK modelling study estimates that if children are equally as infectious as adults, assuming that 68% of contacts could be traced, this means 75% of the symptomatic population would need to be tested for a safe full return to school, and 65% for a partial return to school. Those numbers would increase to 87% and 75%, respectively if only 40% of contacts could be traced. Another modelling study based on UK data found that isolation and household quarantine, combined with manual contact tracing reduced transmission by 64%. This finding is further confirmed by a modelling study using US data, which found that even testing 4.5% of the population daily is not enough to reduce daily death rates to an acceptable level at a re-opening of 70% pre-COVID physical interaction rates.

Conclusions

Mass testing in school settings as part of disease surveillance has not yet been studied. However, effective transmission control consists of strategies such as physical distancing, mask wearing, cohorting and test-contact trace-isolate measures. Mass testing that has occurred to date has been in response to school outbreaks. Modelling studies have shown that testing and isolation alone is unlikely to be effective in preventing outbreaks; that it must be combined with existing infection prevention control practices such as distancing, cohorting and mask wearing. A key feature of testing strategies is that it needs to be followed with rapid, effective contact tracing. Being able to detect and isolate cases quickly and comprehensively have far greater impact on outbreak control than testing symptomatic cases alone.

Glossary

(Optional, but useful if there are clinical/statistical terms being referenced in the document.)

Table 1: Summary of Literature

Reference	Context	Key Findings
<p>Centers for Disease Control & Prevention (US). Screening K-12 Students for Symptoms of COVID-19: Limitations and Considerations. [July 23, 2020]. Available from https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/symptom-screening.html</p>	<p>CDC guidance for screening K-12 students for COVID-19 symptoms</p>	<ul style="list-style-type: none"> - CDC does not currently recommend universal symptom screenings (screening all students K-12) be conducted by schools - parents or caregivers should be strongly encouraged to monitor their children for signs of infectious illness every day - symptom screenings will fail to identify some students who have SARS-CoV-2 infection – asymptomatic or pre-symptomatic, or very mild symptoms – around 16% of children do not develop symptoms - symptom screenings will identify only that a person may have an illness, not that the illness is COVID-19 – d/t overlapping nature of symptoms also present in many other respiratory illnesses - when there is more community transmission, the likelihood that individuals with symptoms actually have COVID-19 is higher, therefore, symptom screenings may be more helpful when COVID-19 transmission in the community is high
<p>Centers for Disease Control & Prevention (US). Interim Considerations for K-12 School Administrators for SARS-CoV-2 Testing. [June 30, 2020]. Available from https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/k-12-testing.html</p>	<p>CDC guidelines for school testing considerations</p>	<ul style="list-style-type: none"> - Schools should determine, in collaboration with health officials whether or not to implement any testing strategy, and if so, how to best do so - school staff are not expected to directly administer SARS-CoV-2 tests - In some circumstances, school-based HCP may conduct testing in their capacity as HCP, such as in school-based health centers - as a part of symptom screening, schools should be prepared to refer symptomatic individuals to an appropriate HCP or testing site - it is important that contacts of students or staff with COVID-19 be quickly identified and tested

		<ul style="list-style-type: none"> - universal testing of all students and staff in school settings has not yet been systematically studied, and it is not known if testing in school settings provides any additional reduction in person-to-person transmission beyond what would be expected with implementation of other IPC (e.g. social distancing, face covering, hand washing, enhanced cleaning and disinfecting)
<p>European Centre for Disease Prevention and Control. Objectives for COVID-19 Testing in School Settings. [August 10, 2020]. Available from https://www.ecdc.europa.eu/en/publications-data/objectives-covid-19-testing-school-settings</p>	<p>European CDC – Testing in school settings</p>	<ul style="list-style-type: none"> - all students and staff showing symptoms compatible with COVID-19 should be tested - contact tracing should be initiated promptly following identification of a confirmed case and should include contacts in their school, household and other settings as relevant - asymptomatic persons identified as high-risk exposure contacts of cases during contact tracing could be considered for testing – allows for prompt isolation of new potential cases and early contact tracing of the contacts of these new cases - if testing capacity is limited, the following groups should be prioritized for testing - symptomatic students and staff that are at high risk of developing severe disease due to age or pre-existing conditions - symptomatic students and staff in regular contact with people who are high risk of developing severe disease due to age, living in long-term care facilities or having pre-existing conditions - in a situation where a NP or other upper respiratory specimen is not acceptable and/or to increase the acceptance of children being tested, saliva could be considered as an alternative specimen - in the context of school settings, high risk exposure (close) contacts are defined as

		<ol style="list-style-type: none"> 1. students and staff who have shared a classroom with the confirmed case and during the same time period 2. other students and staff with whom the confirmed case has spent time (according to table, eg during breaks or sport activities, in the cafeteria, gym or school playground) 3. students and staff in boarding/residential schools – also those sleeping the same room or sharing a common kitchen, social space and/or bathroom
<p>Hospital for Sick Children (Toronto) COVID-19: Guidance for School Reopening. [July 29, 2020]. Available from https://www.sickkids.ca/PDFs/About-SickKids/81407-COVID19-Recommendations-for-School-Reopening-SickKids.pdf</p>	<p>General guidance for school re-opening</p>	<ul style="list-style-type: none"> - all staff and students who develop signs or symptoms consistent with COVID-19 should undergo testing in accordance with public health recommendations - should be clear testing recommendations by local public health units with information about where testing can be completed. - ditto contacts of confirmed cases - consideration must be given as to how to maintain confidentiality of confirmed cases within the school - symptom screening is recommended to be done by parents/caregivers prior to school daily vs. done by the school prior to entry - temperature checks or pulse oximeter not recommended d/t fever/hypoxia not being consistent symptoms in pediatric populations
<p>American Academy of Pediatrics COVID-19 Planning Considerations: Guidance for School Re-entry. [August 19, 2020]. Available from https://services.aap.org/en/pages/2019-novel-coronavirus-covid-19-infections/clinical-guidance/covid-19-planning-considerations-return-to-in-person-education-in-schools/</p>	<p>American Academy of Pediatrics – general guidance</p>	<ul style="list-style-type: none"> - based on CDC recommendation that universal testing of students/staff ids not recommended - serological testing has no place in considerations for entrance to or exclusion from school - in lieu of temperature checks and symptom screening performed before entry into school, methods to allow parent performing and reporting of symptoms and temperature checks performed at home may be considered - procedures using texting apps, phone systems or online reporting rely on parents report and may be most practical but possibly unreliable, depending on individual family's

		ability to use these communication processes, especially if not made available in their primary language or lack of electronic forms of communication
<p>Bracis C, Burns E, Moore M, et al. Widespread testing, case isolation and contact tracing may allow safe school reopening with continued moderate physical distancing: a modeling analysis of King County, WA data. medRxiv. 2020:2020.08.14.20174649. DOI: 10.1101/2020.08.14.20174649</p>	Simulation based on King County data with effectiveness of physical distancing combined with other non-pharmaceutical interventions	<ul style="list-style-type: none"> - gradually restoring 75% pre-COVID physical interactions for all age groups through summer resulted in ~350 daily deaths by September 2020 - Maintaining less than 45% pre-COVID physical interactions was required with current testing practices to keep low infection/death rates - increased testing, isolation of symptomatic infections and contact tracing allowed 60% pre-COVID physical interaction without significant increases in daily deaths before September, but may not be sufficient to eliminate community transmission - combination strategy of distancing and increased testing, isolation and contact tracing allowed opening of schools with <15 daily deaths - assumed that enhanced early testing will increase the daily probability that symptomatic individuals get tested to 10% - more than 50% of the symptomatic infections (more than 40% of all infections) are diagnosed - contact tracing allows for testing 5% of the asymptomatic and pre-symptomatic cases assuming 50% of the contacts of the diagnosed cases will be traced - random mass testing will add 0.5% to diagnostic testing rates among asymptomatic, pre-symptomatic and symptomatic cases (implies that at least 10,000 random tests are performed daily) - when applied at 75% pre-COVID physical interaction, test and isolate strategy is unlikely to prevent a massive epidemic resurgence - with the restoration of 75% pre-COVID physical interaction, only the implementation of the most comprehensive strategy (early testing, contact tracing,

		<p>isolation and COVID-19 treatment of cases and contacts may prevent unacceptable levels of excess deaths</p> <ul style="list-style-type: none"> - for safe restoration of 60% pre-COVID physical interactions, at least 2.5% of the population would need to be tested daily to keep daily deaths below 15 - not even 4.5% daily testing is sufficient at 70% pre-COVID physical interaction – diagnosing 20% of symptomatic cases daily will achieve a similar level of mortality reduction without contact tracing, as diagnosing 10% of asymptomatic cases daily if effective contact tracing is resumed - simulations of school reopening reiterate further need to keep <60% pre-COVID physical interaction and to include effective contact tracing - opening schools is likely to more rapidly increase the death count to >15/day if the only existing policy is diagnosing and isolating symptomatic cases – threshold of acceptable parameters reached September 22 - school reopening shows little impact if early infections are identified through contact tracing
<p>Cooper DM, Guay-Woodford L, Blazar BR, et al. Reopening Schools Safely: The Case for Collaboration, Constructive Disruption of Pre-Coronavirus 2019 Expectations, and Creative Solutions. J Pediatr. 2020;223:183-5. DOI: 10.1016/j.jpeds.2020.05.022</p>	<p>commentary</p>	<ul style="list-style-type: none"> - although community surveillance testing has yet to be standardized, large-scale viral nucleic acid and serological testing in children is needed to guide safe school reopening - require activation on nontraditional testing sites (eg homes and schools) and “child-friendly” self-collection methods - ensure test results are interpreted and communicated appropriately so as to inform, empower and protect families, school personnel and communities - as schools reopen, school-based health centers should be expanded; improve student health and educational outcomes and reduce healthcare disparities among vulnerable student populations while providing demonstrable cost savings

		<ul style="list-style-type: none"> - parents and caregivers, as well as viral surveillance and contact tracing teams likely will require more frequent monitoring of the school environments - what will happen if a child or caregiver refuses to comply with surveillance programs?
<p>Head JR, Andrejko K, Cheng Q, et al. The effect of school closures and reopening strategies on COVID-19 infection dynamics in the San Francisco Bay Area: a cross-sectional survey and modeling analysis. medRxiv. 2020. DOI: 10.1101/2020.08.06.20169797</p>	<p>Simulation based on data from Bay Area household surveys</p>	<ul style="list-style-type: none"> - used survey-derived estimates of contact patterns to develop a transmission model - simulated transmission under observed conditions – no school contacts, 28% workforce participation and community contacts derived from social contact survey - simulated the cumulative incidence that would have occurred over the period under scenarios where <ol style="list-style-type: none"> 1. schools remained open 2. workplaces remained open 3. non-essential community contacts (including impersonal encounters on non-essential outings and social gatherings) continues - assumed 50% of household members of symptomatic cases reduced their community contacts by 75% and their work or school contacts by 100% - simulated effect of school reopening strategies for the fall September under two susceptibility assumptions (peds half vs. equally as susceptible as adults) and two transmission contexts (high and moderate community transmission) <ul style="list-style-type: none"> - 6 reopening strategies <ol style="list-style-type: none"> 1. schools open without precautions 2a. classroom groups enforced, reducing other grade and school contacts by 50% (weak stable cohort) or 2b. 75% (strong stable cohort) 3. class sizes cut in half, and each half attends two staggered days each week 4. class sizes maintained, and half the school attends two staggered days each week according to grade groups 5. students and faculty wear masks

		<p>6a. faculty and/or students are tested with 85% sensitivity on a weekly basis</p> <p>6b. faculty and/or students are tested with 85% sensitivity on monthly basis</p> <ul style="list-style-type: none"> - at moderate levels of community transmission and with no precautions taken estimate an additional 21% of HS teachers, 13.4% MS teachers and 4.1% elementary teachers would experience symptomatic illness by Dec 20, daily hops rate would increase by an average of 0.53/10,000 - excess total death rate of 0.56/10,000 – most (287) among community members without students in their household and only one death expected among students - at high community transmission and no precautions, 33.3% HS teachers, 24.4% MS teachers and 9.1% elementary teachers - daily hospitalization rate increase by 1.56/10,000 - total excess death rate 1.73/10,000 (1,026/1,341 expected among community members and only 1 among students) - at moderate community transmission, strict adherence to staggered school weeks or combining stable cohorts with masks and monthly testing is needed to reduce excess risk of symptomatic illness for teachers to less than 1% - strong stable cohorts, 2-day staggered grades or strong cohorts + masks and testing would decrease the expected number of excess deaths by 85%, 95% and 95% - regardless of relative susceptibility of peds to adults, with both moderate and high transmission settings, a strict adherence to a combination of strong distancing interventions, mask wearing and monthly testing is needed to reduce the excess risk of symptomatic illness for HS teachers and all other school staff to less than 1% - combination of measures dependent on student age, but generally require some combination of staggered days,
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		stable cohorts, masks and regular testing to keep teacher infection <1%
<p>Heavey L, Casey G, Kelly C, et al. No evidence of secondary transmission of COVID-19 from children attending school in Ireland, 2020. Euro Surveill. 2020;25(21). DOI: 10.2807/1560-7917.Es.2020.25.21.2000903</p>	<p>Impact of school attendance in Ireland</p>	<ul style="list-style-type: none"> - first Irish case of COVID-19 in school-aged child returning from Italy in early March - closure of all schools mid-March in an effort to contain community spread - 3 peds cases and 3 adult cases with a history of school attendance identified prior to closure - epi data indicated that they had not been infected in the school settings - a total of 1,155 contacts of the 6 cases identified who were exposed at school in the classroom, during sports lessons, music lessons and during choir practice which involved a number of schools mixing in a church environment - 1,001 of the contacts were other children – no confirmed cases - in the school setting, 924 child contacts and 101 adult contacts with no confirmed cases - contacts told to isolate/monitor for 14d – those with any symptoms consistent with COVID-19 referred for testing - among all of the cases and contacts, transmission was observed in only one instance, which was outside the school environment between two of the adult cases and a third adult
<p>Kucharski AJ, Klepac P, Conlan AJK, et al. Effectiveness of isolation, testing, contact tracing, and physical distancing on reducing transmission of SARS-CoV-2 in different settings: a mathematical modelling study. Lancet Infect Dis. 2020. DOI: 10.1016/s1473-3099(20)30457-6</p>	<p>Modelling study based on UK data</p>	<ul style="list-style-type: none"> - found that combined testing and tracing strategies reduced the R_{eff} more than mass testing or self-isolation alone - In simulations, self-isolation and household quarantine with the addition of manual contact tracing of all contacts reduced transmission by 64%, the addition of manual contact tracing of acquaintances only led to a 57% reduction in transmission

		<ul style="list-style-type: none"> - contact tracing measures also substantially reduced the probability that a primary symptomatic case would generate more than one secondary case
<p>Macartney K, Quinn HE, Pillsbury AJ, et al. Transmission of SARS-CoV-2 in Australian educational settings: a prospective cohort study. The Lancet Child & adolescent health. 2020. DOI: 10.1016/s2352-4642(20)30251-0</p>	<p>Contact tracing of cases in Australia who attended school settings while infected</p>	<ul style="list-style-type: none"> - 15 schools and 10 early childcare centers had children (12) or adults (15) attend while infectious with 1,448 contacts monitored - 943.7% (633) had nucleic acid testing and/or antibody testing with 18 secondary cases identified - 5 secondary cases (of 914) in 2 schools - no secondary transmission in 9/10 early childcare centers among 497 contacts - one early childcare center outbreak involved transmission to 6 adults and 7 children - across all settings 5/18 secondary infections were asymptomatic (3 infants, one adolescent and one adult)
<p>Panovska-Griffiths J, Kerr CC, Stuart RM, et al. Determining the optimal strategy for reopening schools, the impact of test and trace interventions, and the risk of occurrence of a second COVID-19 epidemic wave in the UK: a modelling study. The Lancet Child & adolescent health. 2020. DOI: 10.1016/s2352-4642(20)30250-9</p>	<p>Modelling study based on UK data</p>	<ul style="list-style-type: none"> - Since March, strategy in UK has been to test people presenting with severe COVID-19 symptoms and ask them to self-isolate and as of June complemented by a strategy to trace contacts of those people who test positive for infection - model predicts that opening schools either full time or in a part-time rotational system, alongside relaxation of other social distancing measures will induce a second wave of COVID-19 in the absence of a scaled-up testing program - second wave would be 2-2.3 times larger than the first COVID wave in the UK - suggest that it might be possible to avoid a second wave across both school reopening scenarios if enough people with symptomatic infection can be tested and contacts of those diagnosed can be traced and effectively isolated - assuming 68% of contacts could be traced, estimate that 75% of those with symptomatic infection would need to be tested and isolated if school return full time or 65% for a part-time rotation

		<p>- if only 40% of contacts could be traced, these would increase to 87% and 75%, respectively</p> <p>- found that it is possible to avoid a second wave across all scenarios of school and society reopening and different tracing levels, if the test-trace-isolate strategy tests a sufficiently large proportion of the population with symptomatic infection and traces their contacts with sufficiently large coverage</p> <p>*assuming children transmit equally to adults, if half, at 68% tracing, 61% symptomatic need to be diagnosed/isolated for schools to return full time or 59% for a part-time rotation</p>
<p>Stein-Zamir C, Abramson N, Shoob H, et al. A large COVID-19 outbreak in a high school 10 days after schools' reopening, Israel, May 2020. Euro Surveill. 2020;25(29). DOI: 10.2807/1560-7917.Es.2020.25.29.2001352</p>	<p>Outbreak protocol in Israel</p>	<p>- first student source of infection unknown; household (4), teacher (14) and student (50) contacts were isolated.</p> <p>- second student different grade, not epidemiologically linked; 2 unrelated cases within 2 days = declared outbreak</p> <p>- mass testing: 151/152 staff members and 1,161/1,164 students</p> <p>- overall 153 students and 25 staff members tested positive</p> <p>- COVID-19 rates were higher in junior grades (7-9) than high grades (10-12); peak rates in 9th and 7th grade</p> <p>- crowded classes (35-38 students per class in 39-49m²); during extreme heatwave, AC functioned continuously (separate system for each class)</p> <p>- students attend 6 days a week from 6.3-6.7h average daily</p> <p>- by mid-June, 87 additional cases occurred among close contacts of the first school's cases – siblings that attended other schools, friends and participants in sports and dancing afternoon classes, students' parents and family members of school staff</p>

<p>Torres JP, Pinera C, De La Maza V, et al. SARS-CoV-2 antibody prevalence in blood in a large school community subject to a Covid-19 outbreak: a cross-sectional study. Clin Infect Dis. 2020;10:10.</p>	<p>School outbreak in Chile – antibody testing</p>	<ul style="list-style-type: none"> - 8-10 weeks after COVID-19 outbreak affecting mostly staff/parents and to a lesser extent, students (52 cases, 1 death) - school with 2,616 students in 14 grade levels with 318 staff members of which 195 are teachers - 36-38 students per class - self survey and antibody test kit - 1,029 child/parent participated – 20 (1.9%) eliminated d/t indeterminate/invalid results - 38% of student body participated, 74% of staff - antibody positivity rate 9.9% for students and 16.6% for staff - HS students had a lower positivity rate compared to younger levels
<p>Walger P, Heininger U, Knuf M, et al. Children and adolescents in the CoVid-19 pandemic: Schools and daycare centers are to be opened again without restrictions. The protection of teachers, educators, carers and parents and the general hygiene rules do not conflict with this. GMS Hygiene & Infection Control. 2020;15:1-9.</p>	<p>Recommendations from Germany</p>	<ul style="list-style-type: none"> - recommend prompt reopening of daycare centers, kindergartens, and elementary schools without excessive restrictions for children - children can be taught basic rules of hygiene such as handwashing and careful hygiene behavior - protection of teachers, educators and caregivers by maintenance of appropriate distance from others, use of medical masks, situation-dependent hand disinfection, when necessary, supported by regular pool testing - children over the age of 10 are capable of actively understanding and conforming to specific hygiene rules eg distance, masks
<p>Wise J. Covid-19: NHS Test and Trace must improve for schools to reopen safely, say researchers. BMJ. 2020;370:m3083. DOI: 10.1136/bmj.m3083</p>	<p>Commentary on NHS recommendations</p>	<ul style="list-style-type: none"> - based on Panovska-Girffiths modeling study - current NHS test-trace strategy is capturing about 50% of contacts - combined with schools opening allowing ~70% of parents to return to work in modelling study, increased sources of transmission

Yeng PK, Woldaregay AZ, Solvoll T, et al. Cluster Detection Mechanisms for Syndromic Surveillance Systems: Systematic Review and Framework Development. JMIR Public Health Surveill. 2020;6(2):e11512. DOI: 10.2196/11512	Systematic review on disease surveillance and cluster detection	- targeted at individuals and organizations who want to implement efficient syndromic surveillance systems for applications such as OTC medication, school and work absenteeism and disease surveillance relating to presymptomatic stages
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References Included in Summary

1. Centers for Disease Control & Prevention (US). Screening K-12 Students for Symptoms of COVID-19: Limitations and Considerations. [July 23, 2020]. Available from <https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/symptom-screening.html>
2. Centers for Disease Control & Prevention (US). Interim Considerations for K-12 School Administrators for SARS-CoV-2 Testing. [June 30, 2020]. Available from <https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/k-12-testing.html>
3. **European Centre for Disease Prevention and Control**. Objectives for COVID-19 Testing in School Settings. [August 10, 2020]. Available from <https://www.ecdc.europa.eu/en/publications-data/objectives-covid-19-testing-school-settings>
4. **Panovska-Griffiths J, Kerr CC, Stuart RM, et al. Determining the optimal strategy for reopening schools, the impact of test and trace interventions, and the risk of occurrence of a second COVID-19 epidemic wave in the UK: a modelling study. The Lancet Child & adolescent health. 2020. DOI: 10.1016/s2352-4642(20)30250-9**
5. **Kucharski AJ, Klepac P, Conlan AJK, et al. Effectiveness of isolation, testing, contact tracing, and physical distancing on reducing transmission of SARS-CoV-2 in different settings: a mathematical modelling study. Lancet Infect Dis. 2020. DOI: 10.1016/s1473-3099(20)30457-6**
6. **Bracis C, Burns E, Moore M, et al. Widespread testing, case isolation and contact tracing may allow safe school reopening with continued moderate physical distancing: a modeling analysis of King County, WA data. medRxiv. 2020:2020.08.14.20174649. DOI: 10.1101/2020.08.14.20174649**

Appendix: Evidence Search Details

Search Strategies

Database: Ovid MEDLINE(R) ALL <1946 to August 24, 2020> - August 25, 2020, 10:30am

Search Strategy:

#	Searches	Results
1	exp coronavirus/	27388
2	exp coronavirus infections/	28585
3	((corona* or corono*) adj1 (virus* or viral* or virinae*)).ti,ab,kw,kf.	1693
4	(coronavirus* or coronovirus* or coronavirinae* or CoV).ti,ab,kw,kf.	36631
5	("2019-nCoV" or 2019nCoV or nCoV2019 or "nCoV-2019" or "COVID-19" or COVID19 or "CORVID-19" or CORVID19 or "WN-CoV" or WNCov or "HCoV-19" or HCoV19 or "2019 novel*" or Ncov or "n-cov" or "SARS-CoV-2" or "SARSCoV-2" or "SARSCoV2" or "SARS-CoV2" or SARSCov19 or "SARS-Cov19" or "SARSCov-19" or "SARS-Cov-19" or Ncover or Ncorona* or Ncorono* or NcovWuhan* or NcovHubei* or NcovChina* or NcovChinese* or SARS2 or "SARS-2" or SARScoronavirus2 or "SARS-coronavirus-2" or "SARScoronavirus 2" or "SARS coronavirus2" or SARScoronavirus2 or "SARS-coronavirus-2" or "SARScoronavirus 2" or "SARS coronavirus2").ti,ab,kw,kf.	43155
6	(respiratory* adj2 (symptom* or disease* or illness* or condition*) adj10 (Wuhan* or Hubei* or China* or Chinese* or Huanan*)).ti,ab,kw,kf.	509
7	((("seafood market*" or "food market*" or pneumonia*) adj10 (Wuhan* or Hubei* or China* or Chinese* or Huanan*)).ti,ab,kw,kf.	1508
8	((outbreak* or wildlife* or pandemic* or epidemic*) adj1 (Wuhan* or Hubei* or China* or Chinese* or Huanan*)).ti,ab,kw.	288
9	"severe acute respiratory syndrome*".ti,ab,kw,kf.	9841
10	or/1-9	67489
11	real-time polymerase chain reaction/ or nucleic acid amplification techniques/ or serologic tests/ or sentinel surveillance/	93940
12	(LAMP assay? LAMP test? or loop-mediated isothermal amplification or isothermal amplification loop-mediated or LAMP technique? or loop mediated isothermal amplification or RT-LAMP assay? or RT-LAMP or RT-PCR? or RT-PCR test? or real time polymerase chain reaction? or real-time polymerase chain reaction? or real-time PCR? or real time PCR? or qRT-PCR or quantitative real-time polymerase chain reaction? or quantitative real time polymerase chain reaction? or quantitative real-time PCR? or quantitative real time PCR? or rapid antigen detection test? or RAD test? or direct viral antigen test? or rapid antigen test? or antigen detection test? or RDT or antigen test? or serologic* test* or serodiagnos#s or ((sentinel or syndromic or symptom*) adj1 surveillance) or biosurveillance system? or sentinel health event? or (symptom* adj2 (screening or surveillance or monitoring or testing)) or ((asymptomatic or a-symptomatic or presymptomatic or pre-symptomatic or never symptomatic or subclinical infection? or sub-clinical infection? or healthy carrier? or silent spread* or covert transmitter? or paucisymptomatic or oligosymptomatic) adj2 (screening or monitoring or surveillance or testing)) or genomic screening).tw,kf.	301803
13	11 or 12	360711
14	schools/ or schools, nursery/	39630

15	(kindergarten* or elementary school* or high school* or grade school* or primary school* or school-age* or preschool* or schoolchildren or nursery school*).tw,kf.	116302
16	14 or 15	142429
17	10 and 13 and 16	12
18	limit 17 to (english language and yr="2019 -Current")	2

Embase <1974 to 2020 August 24> - August 25, 2020 10:50am

#	Searches	Results
1	exp coronavirus/	17955
2	exp coronavirus infections/	18900
3	((corona* or corono*) adj1 (virus* or viral* or virinae*)).ti,ab,kw,hw.	1387
4	(coronavirus* or coronavir* or coronavirinae* or CoV).ti,ab,kw,hw.	65701
5	("2019-nCoV" or 2019nCoV or nCoV2019 or "nCoV-2019" or "COVID-19" or COVID19 or "CORVID-19" or CORVID19 or "WN-CoV" or WNCov or "HCoV-19" or HCoV19 or "2019 novel*" or Ncov or "n-cov" or "SARS-CoV-2" or "SARSCoV-2" or "SARSCoV2" or "SARS-CoV2" or SARSCov19 or "SARS-Cov19" or "SARSCov-19" or "SARS-Cov-19" or Ncovor or Ncorona* or Ncorono* or NcovWuhan* or NcovHubei* or NcovChina* or NcovChinese* or SARS2 or "SARS-2" or SARSCoronavirus2 or "SARS-coronavirus-2" or "SARSCoronavirus 2" or "SARS coronavirus2" or SARSCoronavirus2 or "SARS-coronavirus-2" or "SARSCoronavirus 2" or "SARS coronavirus2").ti,ab,kw,hw.	42742
6	(respiratory* adj2 (symptom* or disease* or illness* or condition*) adj10 (Wuhan* or Hubei* or China* or Chinese* or Huanan*)).ti,ab,kw,hw.	693
7	(("seafood market*" or "food market*" or pneumonia*) adj10 (Wuhan* or Hubei* or China* or Chinese* or Huanan*)).ti,ab,kw,hw.	1862
8	((outbreak* or wildlife* or pandemic* or epidemic*) adj1 (Wuhan* or Hubei* or China* or Chinese* or Huanan*)).ti,ab,kw,hw.	140
9	"severe acute respiratory syndrome*".ti,ab,kw,hw.	24148
10	or/1-9	75476
11	real-time polymerase chain reaction/ or nucleic acid amplification techniques/ or serologic tests/ or sentinel surveillance/	345598
12	(LAMP assay? LAMP test? or loop-mediated isothermal amplification or isothermal amplification loop-mediated or LAMP technique? or loop mediated isothermal amplification or RT-LAMP assay? or RT-LAMP or RT-PCR? or RT-PCR test* or real time polymerase chain reaction? or real-time polymerase chain reaction? or real-time PCR? or real time PCR? or qRT-PCR or quantitative real-time polymerase chain reaction? or quantitative real time polymerase chain reaction? or quantitative real-time PCR? or quantitative real time PCR? or rapid antigen detection test* or RAD test* or direct viral antigen test* or rapid antigen test* or antigen detection test* or RDT or antigen test* or serologic* test* or serodiagnos#s or ((sentinel or syndromic or symptom*) adj1 surveillance) or biosurveillance system? or sentinel health event? or (symptom* adj2 (screening or surveillance or monitoring or test*)) or ((asymptomatic or a-symptomatic or presymptomatic or pre-symptomatic or never symptomatic or subclinical infection? or sub-clinical infection? or healthy carrier? or silent spread* or covert transmitter? or	590916

	paucisymptomatic or oligosymptomatic) adj2 (screening or monitoring or surveillance or test*) or genomic screening).tw,hw,kw.	
13	11 or 12	655258
14	schools/ or schools, nursery/	52864
15	(kindergarten* or elementary school* or high school* or grade school* or primary school* or school-age* or preschool* or schoolchildren or nursery school*).tw,hw,kw.	661688
16	14 or 15	699328
17	10 and 13 and 16	267
18	limit 17 to (english language and yr="2019 -Current")	54

CINAHL – August 25, 2020, 11:21am

#	Query	Results
S1	(MH "Coronavirus+") OR (MH "Coronavirus Infections+") OR (MH "COVID-19")	13,916
S2	TI (((corona* or corono*) n1 (virus* or viral* or virinae*))) OR AB (((corona* or corono*) n1 (virus* or viral* or virinae*)))	223
S3	TI ((coronavirus* or coronovirus* or coronavirinae* or CoV)) OR AB ((coronavirus* or coronovirus* or coronavirinae* or CoV))	6,182
S4	TI (("2019-nCoV" or 2019nCoV or nCoV2019 or "nCoV-2019" or "COVID-19" or COVID19 or "CORVID-19" or CORVID19 or "WN-CoV" or WNCov or "HCoV-19" or HCoV19 or "2019 novel*" or Ncov or "n-cov" or "SARS-CoV-2" or "SARSCoV-2" or "SARSCoV2" or "SARS-CoV2" or SARSCov19 or "SARS-Cov19" or "SARSCov-19" or "SARS-Cov-19" or Ncover or Ncorona* or Ncorono* or NcovWuhan* or NcovHubei* or NcovChina* or NcovChinese* or SARS2 or "SARS-2" or SARScoronavirus2 or "SARS-coronavirus-2" or "SARScoronavirus 2" or "SARS coronavirus2" or SARScoronavirus2 or "SARS-coronavirus-2" or "SARScoronavirus 2" or "SARS coronavirus2") OR AB (("2019-nCoV" or 2019nCoV or nCoV2019 or "nCoV-2019" or "COVID-19" or COVID19 or "CORVID-19" or CORVID19 or "WN-CoV" or WNCov or "HCoV-19" or HCoV19 or "2019 novel*" or Ncov or "n-cov" or "SARS-CoV-2" or "SARSCoV-2" or "SARSCoV2" or "SARS-CoV2" or SARSCov19 or "SARS-Cov19" or "SARSCov-19" or "SARS-Cov-19" or Ncover or Ncorona* or Ncorono* or NcovWuhan* or NcovHubei* or NcovChina* or NcovChinese* or SARS2 or "SARS-2" or SARScoronavirus2 or "SARS-coronavirus-2" or "SARScoronavirus 2" or "SARS coronavirus2" or SARScoronavirus2 or "SARS-coronavirus-2" or "SARScoronavirus 2" or "SARS coronavirus2"))	12,248
S5	TI ((respiratory* n2 (symptom* or disease* or illness* or condition*) n10 (Wuhan* or Hubei* or China* or Chinese* or Huanan*))) OR AB ((respiratory* n2 (symptom* or disease* or illness* or condition*) n10 (Wuhan* or Hubei* or China* or Chinese* or Huanan*)))	133
S6	TI ((("wet market" or "seafood market*" or "food market*" or pneumonia*) n10 (Wuhan* or Hubei* or China* or Chinese* or Huanan*))) OR AB ((("wet market" or "seafood market*" or "food market*" or pneumonia*) n10 (Wuhan* or Hubei* or China* or Chinese* or Huanan*)))	344

S7	TI (((outbreak* or wildlife* or pandemic* or epidemic*) n1 (Wuhan* or Hubei* or China* or Chinese* or Huanan*))) OR AB (((outbreak* or wildlife* or pandemic* or epidemic*) n1 (Wuhan* or Hubei* or China* or Chinese* or Huanan*)))	275
S8	TI "severe acute respiratory syndrome*" OR AB "severe acute respiratory syndrome**"	1,896
S9	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8	19,465
S10	((MH "Population Surveillance+") OR (MH "Disease Surveillance")) OR (MH "Serologic Tests") OR (MH "Nucleic Acid Amplification Techniques") OR (MH "Polymerase Chain Reaction+")	74,398
S11	TI ((LAMP assay# LAMP test# or loop-mediated isothermal amplification or isothermal amplification loop-mediated or LAMP technique# or loop mediated isothermal amplification or RT-LAMP assay# or RT-LAMP or RT-PCR# or RT-PCR test* or real time polymerase chain reaction# or real-time polymerase chain reaction# or real-time PCR# or real time PCR# or qRT-PCR or quantitative real-time polymerase chain reaction# or quantitative real time polymerase chain reaction# or quantitative real-time PCR# or quantitative real time PCR# or rapid antigen detection test* or RAD test* or direct viral antigen test* or rapid antigen test* or antigen detection test* or RDT or antigen test* or serologic* test* or serodiagnos?s or ((sentinel or syndromic or symptom*) n1 surveillance) or biosurveillance system# or sentinel health event# or (symptom* n2 (screening or surveillance or monitoring or test*)) or ((asymptomatic or a-symptomatic or presymptomatic or pre-symptomatic or never symptomatic or subclinical infection# or sub-clinical infection# or healthy carrier# or silent spread* or covert transmitter# or paucisymptomatic or oligosymptomatic) n2 (screening or monitoring or surveillance or test*)) or genomic screening)) OR AB ((LAMP assay# LAMP test# or loop-mediated isothermal amplification or isothermal amplification loop-mediated or LAMP technique# or loop mediated isothermal amplification or RT-LAMP assay# or RT-LAMP or RT-PCR# or RT-PCR test* or real time polymerase chain reaction# or real-time polymerase chain reaction# or real-time PCR# or real time PCR# or qRT-PCR or quantitative real-time polymerase chain reaction# or quantitative real time polymerase chain reaction# or quantitative real-time PCR# or quantitative real time PCR# or rapid antigen detection test* or RAD test* or direct viral antigen test* or rapid antigen test* or antigen detection test* or RDT or antigen test* or serologic* test* or serodiagnos?s or ((sentinel or syndromic or symptom*) n1 surveillance) or biosurveillance system# or sentinel health event# or (symptom* n2 (screening or surveillance or monitoring or test*)) or ((asymptomatic or a-symptomatic or presymptomatic or pre-symptomatic or never symptomatic or subclinical infection# or sub-clinical infection# or healthy carrier# or silent spread* or covert transmitter# or paucisymptomatic or oligosymptomatic) n2 (screening or monitoring or surveillance or test*)) or genomic screening))	28,115
S12	S10 OR S11	92,030
S13	(MH "Schools") OR (MH "Schools, Elementary") OR (MH "Schools, Middle") OR (MH "Schools, Nursery") OR (MH "Schools, Secondary") OR (MH "Schools, Special") OR (MH "School Policies") OR (MH "Students, Elementary") OR (MH "Students, Disabled") OR (MH "Students, Middle School") OR (MH "Students, Minority") OR (MH "Teachers")	46,999
S14	TI ((kindergarten* or elementary school* or high school* or grade school* or primary school* or school-age* or preschool* or schoolchildren or nursery school*)) OR AB (54,490

	((kindergarten* or elementary school* or high school* or grade school* or primary school* or school-age* or preschool* or schoolchildren or nursery school*)	
S15	S13 OR S14	89,591
S16	S9 AND S12 AND S15	5
S17	S9 AND S12 AND S15 [limit to 2019-2020]	2

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((wuhan[tw] AND (coronavirus[tw] OR corona virus[tw])) OR coronavirus*[ti] OR COVID*[tw] OR nCov[tw] OR 2019 ncov[tw] OR novel coronavirus[tw] OR novel corona virus[tw] OR covid-19[tw] OR SARS-COV-2[tw] OR Severe Acute Respiratory Syndrome Coronavirus 2[tw] OR coronavirus disease 2019[tw] OR corona virus disease 2019[tw] OR new coronavirus[tw] OR new corona virus[tw] OR new coronaviruses[all] OR novel coronaviruses[all] OR "Severe Acute Respiratory Syndrome Coronavirus 2"[nm] OR 2019 ncov[tw] OR nCov 2019[tw] OR SARS Coronavirus 2[all]) AND (Polymerase Chain Reaction[mh] OR seroconversion[mh] OR serologic tests[mh] OR Reverse Transcriptase Polymerase Chain Reaction[mh] OR Nucleic Acid Amplification[mh] OR Enzyme-Linked Immunosorbent Assay[mh] OR PCR[tw] OR rt-PCR[tw] OR nucleic test*[tw] OR seroconvert*[tw] OR elisa [tw] OR laborator*[tw] OR serolog*[tw] OR Real Time Reverse Transcriptase Polymerase Chain[tw] OR LAMP assay[nm] OR assay[tw]) OR COVID-19 diagnostic testing[nm] OR antigen test*[tw] OR serologic* test*[tw] OR serodiagnoses[tw] OR serodiagnosis[tw] OR sentinel surveillance[tw] OR syndromic surveillance[tw] OR biosurveillance system*[tw] OR sentinel health event*[tw] OR genomic screening[tw]) AND (((school*[tw] OR student*[tw] OR kindergarten*[tw] OR elementary school*[tw] OR high school*[tw] OR grade school*[tw] OR primary school*[tw] OR school-age*[tw] OR preschool*[tw] OR schoolchildren[tw] OR nursery school*[tw]))) AND (2019/12[dp]:2020[dp])

Results - 260

Google Scholar

(students OR high-school OR middle-school OR elementary-school OR primary-school OR schoolchildren OR junior-high) AND (test OR testing OR screening OR mass-screening OR monitor OR surveillance OR bio surveillance) AND (PCR OR serological OR syndromic OR symptom OR asymptomatic OR genomic) AND (covid-19 OR coronavirus)

Sources

- Grey literature was searched for this report
- Refer to the evidence search report for extensive sources



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