

Evidence Review of Reopening Schools During the COVID-19 Pandemic

Brookline Remote Learning Expert Advisory Panel on Public Health, Safety, and Logistics

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Overview

In considering how to operate public schools in Brookline during the pandemic in 2020-2021, our expert advisory panel continues to review and analyze emerging evidence from published studies in several areas: 1) The risk of COVID infection and serious illness in children; 2) School-based outbreaks and risks to teachers, staff, and other students; and 3) Effect of school closures on overall community COVID rates.

Risks of COVID Infection in Children:

Multiple peer-reviewed studies and [reviews](#) show that children are significantly less likely to become infected with COVID, including in population-based studies that tested all individuals even those without symptoms, and when schools were still open:

- In a [study](#) of 2766 people in Switzerland that tested for antibodies to the virus causing COVID, children ages 5-9 were 60% less likely to have been infected than adults.
- A population-based screening [study](#) in Iceland (which did not close schools) found infection rates increased with age, with the infection rates in children under 10 half that of adults.
- Another population-based screening [study](#) in a high-incidence town in Italy at the beginning of the town's lockdown found a 3.0% infection prevalence among adults, 1.2% among children 11-20, and 0% (0 out of 217 tests) among children 0-10.
- An [international study](#) of 6 countries estimated that individuals younger than 20 were half as likely to become infected as adults over 20 years old.
- A [meta-analysis](#) of 54 household contact studies found that children were roughly half as likely to get infected by a family member with COVID than adults were. Overall, infection rates were 18% for household contacts of symptomatic family members, vs. just 0.7% for household contacts of asymptomatic family members with COVID.
- While children with COVID can be asymptomatic, as can adults, recent [evidence](#) shows that among children tested as part of contact tracing, the majority (58%) who tested positive for COVID did have symptoms. Furthermore, as noted above, [multiple studies](#) show a “lack of substantial transmission from observed asymptomatic index cases.”

There is also evidence to suggest that younger children have lower infection rates than older children:

- A serial testing [program in the UK](#) has generally found higher COVID rates among children older than age 10 compared to those 10 and younger.
- Results from the Italian population-screening [study](#) mentioned above similarly showed the lowest infection rates among children under 10 year old.
- A [meta-analysis](#) of 32 studies found that children were roughly half as likely to become infected after exposure than adults, with lowest rates of infection among those less than 10 years old.

Among those who do get infected, the risk of serious illness among children due to COVID is very low:

- A [study](#) in China showed that 1.6% of children with confirmed COVID-19 had severe or critical disease, most of whom (7 of 9) had underlying medical conditions. Another [study](#) from China showed that 5.2% of infected children had severe disease and 0.6% had critical disease. Two of the combined 2686 infected children in these two studies died (0.07%).
- Data from the [UK](#) indicate that among hospitalized children, risks of serious complications are highest among infants and those with other pre-existing serious illness.

Some studies have analyzed molecular or biological pathways that may make infection and transmission of COVID-19 higher or lower in different age groups: For instance, [two studies](#) showed *higher* levels of viral RNA in the noses of children with COVID compared to adults, while another [study](#) showed lower viral levels in children without symptoms than with symptoms. Other studies show *lower* levels of the [key receptor](#) in children (vs. adults) that allows the COVID-19 virus into the body, and *fewer respiratory droplets* in the exhalations of children. Another study found that more than half of children under age 16

have pre-existing antibodies that can provide [partial immunity](#) to COVID-19, in contrast to just 5% among adults. The first two studies suggest that children might be higher transmitters of infection, the latter three suggest the opposite, and asymptomatic children may be less infectious than those with symptoms. Our panel’s assessment is that these laboratory or mechanism-based studies must be interpreted in the context of more direct studies of disease transmission by age group.

Rates of childhood infection have increased as overall national case rates have [risen](#), but complication rates for children remain quite low. The Centers for Disease Control and Prevention (CDC) [reported](#) that from the start of the pandemic through July 2020 the rate of infection requiring hospitalization for 5 to 17 year-olds was roughly 1 out of 22,000 children. These statistics also demonstrate large racial and ethnic [disparities](#), with rates of hospitalization for COVID higher among Black and Latino children than white children, which must be considered alongside evidence that the [harms of school closures](#) have also had disproportionately negative [impacts](#) on children of color and low-income families. Clearly, multiple factors affecting health equity are at play in the epidemic and school reopening policies, which must be monitored closely.

School-Based Outbreaks and Risks:

Studies of schools with known cases of COVID-19 show that infection risk among other teachers and students are low. In most cases, schools did not close but used contact tracing and quarantining instead:

- A [study](#) from Australia tracked 27 individuals (12 students, and 15 teachers/staff) with confirmed COVID-19 infections during times they were present at school or early childhood education centers. Of the 1448 people who came into contact with these individuals, 1.2% contracted COVID-19 (2.4% of early childhood contacts, and 0.5% of K-12 school contacts)
- In a French [case study](#) of a 9-year old child who attended 3 schools while symptomatic with respiratory symptoms later confirmed to be COVID-19, 176 contacts were identified, including 84 who had shared a classroom with the child. There were zero confirmed COVID-19 cases in this group, after close surveillance and testing of symptomatic individuals.
- A [study](#) in Ireland tracked 6 episodes where students (3) or teachers/other adults (3) at schools were confirmed to have COVID. Of the 924 students and 101 adults that came into contact with these individuals at school, there were zero confirmed cases of COVID-19, after close follow-up, contact tracing, and testing of symptomatic individuals.
- Evidence on rates of transmission by age group is somewhat mixed. A population-based [study](#) from South Korea indicates that children 0-9 years old are only half as likely to transmit the infection to household members as adults are, while older children/teens may have rates of transmission – once infected – at least as high as adults. A subsequent [analysis](#) of the same data found that after removing children who were infected at the same time as the adults in their household, the risk of child-to-adult spread was extremely low – just 0.5%. A related [study](#) found that risks to close contacts outside the household are substantially lower than within the household. However, a large contact tracing study in India showed that risks of transmission may be higher between children of the same [age group](#) and that overall secondary infection rates for children were similar to those of adults.
- Increasing [direct evidence](#) and [modeling studies](#) suggests that consistent mask use in indoor spaces can significantly reduce the risk of viral spread, which is most relevant for adults and older children who may be at higher risk of transmission. [Face shields](#) provide an additional level of protection, with one recent study in India showing that adopting the use of face shields cut the infection rate among community health workers from 19% to 0% over the course of more than 18,000 house visits (including 2600 homes with people who later tested positive for COVID).
- A 2021 [study](#) in Sweden, which did not close schools, found that age-adjusted rates of severe illness among school teachers was roughly half as high that of the general population, and also reported no COVID deaths among 1.9 million children. Similarly, the [Netherlands](#) reported in June 2020 that the infection rate for teachers and childcare workers who were tested was less than

half the rate of the general population. A government report from the [UK](#) found that teachers and staff for preschool, elementary, and high schools all had infection rates similar to those of non-teachers in other professions.

- A large [U.S. study](#) found that exposure to child care had no significant effect on rates of infection among child care providers, indicating that adults working with children had similar risks of COVID compared to those who were not working with children.
- Outbreaks of COVID have occurred among students after reopening schools in Israel without classroom size limits or consistent social distancing practices. It is unclear whether all of these infections were transmitted in schools, as Israel reopened [large adult gatherings](#) at the same time. Overall [numbers](#) show nearly 2000 student and teacher cases through early July, out of more than [2 million](#) school children in the country. The largest [outbreak](#) occurred in a middle/high school, with poor ventilation and lack of masks due to a heat wave implicated as key contributors.
- A CDC [analysis](#) of day care centers in Rhode Island found a confirmed or probably COVID infection rate during the summer of 30 children out of approximately 19,000; teachers accounted for another 20 cases and parents 2. Only four cases led to any secondary transmission. This contrasts with a large overnight camp [outbreak](#) in Georgia, which the CDC attributed to lack of mask use and poor ventilation in cabins. Another CDC [study](#) of 3 Utah day care programs with outbreaks found that 19% of close contacts (24 of 124) developed infections; mask use was required for staff only at 2 sites and for neither staff nor children at the third.
- [Preliminary evidence](#) in the U.S. shows that confirmed or suspected COVID cases in schools were recorded among 0.23% of students and 0.49% of teachers between Aug. 31-Sept 13, which corresponds to 16 per 100,000 daily cases for students and 35 per 100,000 daily for teachers. However, these results have important limitations – they are self-reported from survey responders, many regions with open schools have infection rates far higher than Brookline and Massachusetts, and these figures do not indicate whether these individuals became infected at school or in the community. Random testing in [New York City](#) Schools showed a positive rate of 0.17% out of more than 16,000 people over 3 weeks of school – corresponding to a daily rate of roughly 8 per 100,000.
- A [CDC study](#) from December 2020 assessed risk factors for COVID infection among US children and found that attending social gatherings and having visitors in their home were linked to higher infection rates, but attending in-person school or child care was not a significant risk factor.
- Longer term evidence on school reopening comes from education ministers in [22 European countries](#), who reported that reopening schools has not led to a rise in COVID-19. Reopenings in several Asian nations have had been associated with only small and [infrequent](#) outbreaks. A [UK report](#) showed school reopening had led to only rare outbreaks, which usually occurred in areas that already had high community rates of COVID. A recent [report](#) from the European Union’s CDC described that the majority of countries had not identified any school-based outbreaks, and only one reported a cluster of more than 10 cases related to schools (13 confirmed infections). They concluded that “schools have not been a major outbreak environment for COVID-19 in the EU.”
- It is important to note that these findings all largely predate the development of new potentially more transmissible strains of the virus causing COVID-19. We do not have robust evidence on the effects of these new strains on school-based transmission, which could be higher than in these previous studies. One recent infectious disease [expert](#) stated, “There is no convincing evidence that this variant has special propensity to infect or cause disease in children,” but new data will need to be monitored closely.

Role of School Closures and Re-Opening in Community Spread

Having students in school has implications for the broader community. Infections from school can be brought home. Studies on the broader effect of school closures on COVID community spread have found

that social distancing steps as a whole are critical to slowing COVID infection, but findings are mixed on whether school closures are effective and whether re-openings increase infection rates. These studies are challenging to conduct, however, since many school closures occur at or near the same time as other social distancing policies, which may account for the mixed findings:

- One [study](#) of county-rates of COVID across the U.S. found “no evidence that school closures influenced the growth rate” in COVID infections, while another [found](#) that school closures were associated with significant reductions in COVID infections and deaths, though this paper did not account for other closure policies like large gathering bans, restaurant closures, or non-essential business closures.
- An [analysis](#) of 11 European nations found large reductions in COVID spread from lock-downs, but no significant effect from school closures on their own. Another [analysis](#) of social distancing policies in Italy, France, and the United States found no significant effect of school closures on COVID growth rates. A third [study](#) found a significant reduction in COVID transmission after school and university closures in Europe, but was unable to determine whether school closures, university closures, or both were responsible for this result.
- A study of [schools reopening](#) across 131 countries found significantly higher community transmission rates (24% increase) in the weeks after students returned to school, though the study’s authors caution they were unable to account for what types of school precautions were in place and how those changes affect rates of community infections. A [non peer reviewed analysis](#) of 191 countries did not find any consistent pattern in school reopening and community rates, with most nations keeping schools open even as they experience second waves of COVID cases.
- An epidemiological [study](#) that used detailed contact tracing results to predict the effects of school reopening concluded that reopening with appropriate mitigation strategies would not lead to increased community spread of COVID, and that reopening schools for younger children in particular had the least impact on disease transmission.
- While most studies have assessed schools’ effects on rates of COVID infection, one study looked at hospitalization rates, as a gauge of more severe health outcomes. This [study](#) found no effect of in-person school reopening on COVID hospitalization rates.

State and International Guidance & Conclusions:

The decision to educate students in person during the pandemic is not simple. Our committee’s consensus is that several major factors have changed since March 2020, when schools were closed throughout the state.

- We now have stronger evidence that children are at lower risk for being infected by the virus and may also be at lower risk for transmitting it to others.
- We have more evidence on tools that can reduce risks of COVID. The combined effects of physical distancing, masks, improved hand hygiene and cleaning, and use of well ventilated indoor and outdoor space all reduce risks of re-opening. Because COVID can be spread by [asymptomatic carriers](#), these tools are critical for reducing risks of school-based transmission. In addition, having a clear testing strategy and contact tracing – which Brookline has put into place – is critical to allow public health and school authorities to respond to and reassess the risks as the epidemic evolves.
- We have increasing evidence that school-based transmission rates of COVID are generally low when precautions are in place.

However, community rates of COVID are a key risk factor for transmission in schools, and our recommendations around schools must account for the broader environment.

Overall, the goal is not zero risk – that is not feasible. With or without COVID, schools have always had to consider and manage risks such as influenza and other infections, traffic safety for children

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getting to school, playground injuries, etc. In all cases, the imperative is to educate our children while appropriately managing and reducing the risks to students, staff and teachers, and the broader community.

[Guidance](#) from the Massachusetts Department of Elementary and Secondary Education reiterates these points: “Based on current data and research – the medical community supports the return of our students to in-person learning, with appropriate health and safety guardrails in place. With adherence to a comprehensive set of critical health and safety requirements, we can bring our students, staff, and families safely back to school.”

An October 2020 [review](#) from the World Health Organization also echoes several of these key findings, highlighting that younger children are less likely to be infected, most infections in children come from home not from school, and school outbreaks are relatively rare.

While the evidence summarized here is our best current guide, new information may change this assessment in the future and we will continue to update this review periodically. We look forward to continue our work with school leadership, teachers, parents, students, and community members in an ongoing way to best balance the benefits of in-person schooling for our students and COVID risk management.