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Is it Safe to Reopen Schools?

An Extensive Review of the Research

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Executive Summary

By the end of March 2020, all public schools in the United States were closed to slow the spread of the novel coronavirus SARS-CoV-2. More than 50.8 million children stayed home as school systems scrambled to transition to remote or hybrid learning platforms. While the decision to close schools was difficult, the debate over when and how to reopen safely and responsibly has grown increasingly complex and politically fraught.

State policymakers and local school leaders were forced to make hugely consequential decisions with incomplete and sometimes contradictory data. Were children key drivers in the transmission of the virus? How long should schools be closed for? How vulnerable were children to severe symptoms from COVID-19 infections?

Initial federal guidance focused mainly on *how* to safely operate schools with preventive measures, such as wearing masks, physically distancing students, and increasing ventilation. There was far less specific guidance on *when* it is safe to reopen schools, leaving it to state and local leaders to establish thresholds for community conditions and protocols for testing and managing inevitable cases.

The country's deeply polarized political and media atmosphere dramatically exacerbated all of these challenges. Confidence in the government and key institutions are at near-record lows, with just one in five American adults saying they trust the government "to do the right thing" most or all of the time.[1] Erosion of public trust has fueled skepticism of scientific research, noncompliance with protective measures, and outright antagonism over business restrictions and school closures.

Within local communities, many teachers expressed grave concern over the health risks, and parents worried about their children's safety. As a result, many school system leaders opted to continue with remote learning while the path to reopening remained uncertain.

One year later, however, a growing body of medical research and the firsthand experiences of school systems worldwide can provide a sound basis for determining a reopening strategy. This report examines the collective findings of more than 130 studies and considers their implications for adapting current policies. These studies cover a wide array of topics, including risks for children, transmissibility concerns, and the impact of school reopenings on community spread.

It is vitally important to weigh the public health benefits of school closures against the academic and social-emotional costs suffered by students, families, and society as a whole. Many of the trade-offs—steep learning loss, declines in mental health, and the economic impact on families—will have far-reaching consequences that could last for years beyond the pandemic.

We believe this report can be a starting point for evidenced-based conversations around reopening schools. There will be more studies of the coronavirus, its new variants, and the efficacy of mitigation measures, but they should be weighed against the substantial body of research already available.

The cumulative body of research provides answers we did not have a year ago and also provides a roadmap for how to safely resume in-person instruction:[2]

- The vast majority of research from around the world suggests that children comprise a small proportion of diagnosed COVID-19 cases, develop less severe illness, and have lower mortality rates. Attending school does not increase risk to children, particularly if health protocols are followed. Some children, faculty, and staff do face higher risks due to pre-existing health conditions and other social determinants of health. These individuals should have additional accommodations to protect them, including the option to teach or learn from home.
- Evidence points to schools mirroring the transmission rates of their communities. Schools themselves do not appear to drive community transmission. High school students are more likely to contract and spread infection, but there is considerably less risk in grade school children.
- Protective measures such as mask wearing, physically distancing, increasing hygiene regimens, and improving ventilation add layers of protection that can mitigate risks for students and school staff. COVID-19 vaccinations, symptomatic testing and isolating potentially infected individuals, and asymptomatic COVID-19 screening tests offer additional preventive benefits.
- Any public health benefit gained from school closures must be weighed against the significant—and potentially lasting—costs imposed on individual students and society as a whole. A growing body of research suggests children face greater health risks due to missed health screenings, food insecurity, and mental health challenges. Severe learning loss for many children, particularly children of color, will lead to lower educational attainment and lower future earnings.

As more research becomes available, leaders must continuously evolve their strategies. Managing the uncertainty and risks created by new variants of the coronavirus requires doubling-down on proven mitigation measures and protocols and refining the layers of mitigation measures used to protect teachers.

Closing schools should be a last resort and done only after all other community mitigation measures have been deployed. In such cases, there should be extreme urgency to reopen schools as quickly and safely as possible. State and local leaders should default to having students attend school in person and then adjust based on community risk factors and the capacity to implement essential health protocols.

Introduction

On March 11, 2020, the World Health Organization officially declared COVID-19 a global pandemic.[3] In an effort to slow the spread of coronavirus, governors and education leaders across the country began imposing restrictions on their communities, including school closures. Ohio issued the first statewide school closure on March 12 followed by thirteen more states the next day.[4] By March 25, all public school buildings across the country were closed, affecting more than 50.8 million children.

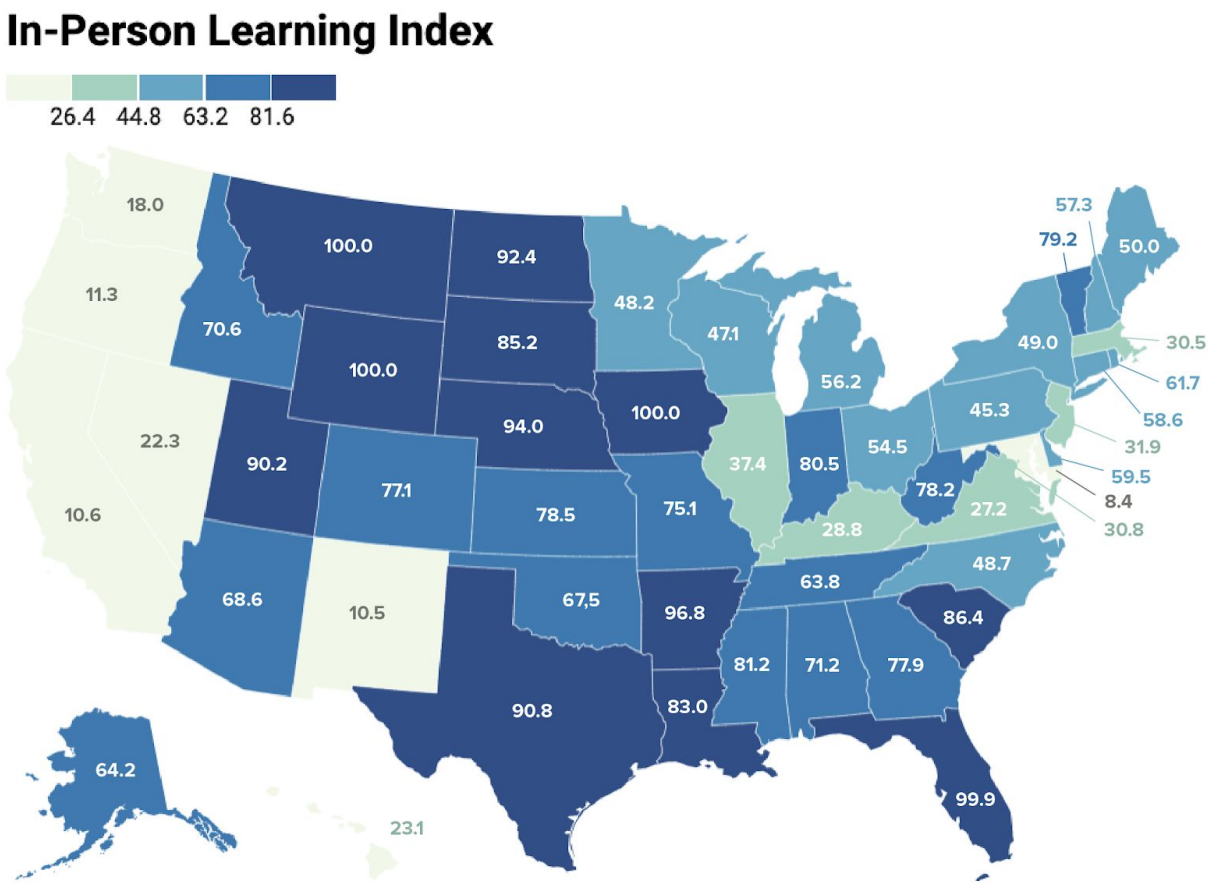
Closing schools early in the pandemic made sense given our limited understanding of SARS-CoV-2, how it was transmitted, and for whom it posed the greatest risk. Children are known to be efficient vectors for transmission of respiratory diseases like the flu and are also more vulnerable to infection and disease severity. [5] Research strongly suggested that closing schools early would both offer protections for children and also reduce transmission.[67]

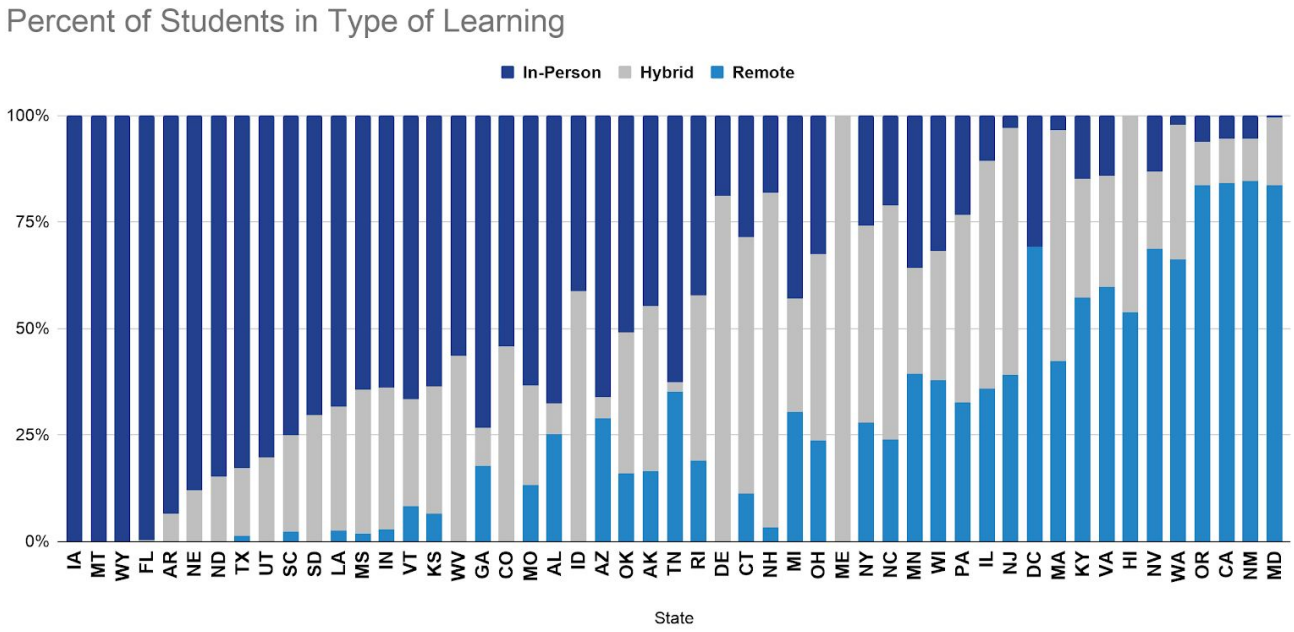
It may have been easier to close schools than reopen them. State and local leaders have struggled to weigh competing risks posed by reopening schools or keeping them closed. Bringing students back into buildings too soon or without adequate protections could expose children, teachers, and staff to the virus and, in turn, increase community spread. However, keeping students out of school for an extended period of time also poses risks that are harder to quantify in the short term but would likely be detrimental to learning and childrens' mental health and well-being, and lead to diminished educational attainment, economic prospects, and health outcomes in the long term.

Complicating these decisions were findings from early research on the virus that were inconclusive or even contradictory. While such inconsistencies are a standard part of scientific inquiry around a new virus, it only contributed to confusion and anxiety for parents, teachers, and school leaders. This uncertainty contributed not only to schools taking a more cautious approach to reopening, but also decisions parents made with keeping their children in remote learning.

In addition, the disproportionately higher rates of hospitalization and death from COVID-19 in communities of color has led to greater caution from Black and Latino parents around school reopenings. An Axios/Ipsos poll in February 2021 found 55 percent of Black parents and 40 percent of Latino parents reported feeling extremely or very concerned about schools in their community reopening too quickly, compared to just 25 percent of white parents.[8]

These factors have led to uneven efforts to reopen schools across the nation. Data from Burbio showed that by February 2021, 31 percent of students were learning remotely, 43 percent were in a traditional in-person setting, and 26 percent were learning in a hybrid model. However, across state lines there is enormous variation. Only 11 percent of students were experiencing in-person learning in California compared with more than 90 percent in Florida.





Source: Burbio K12 School Opening Tracker, February 2021

In the past ten months, our understanding of SARS-CoV-2 and its effect on children has evolved significantly. Unlike influenza viruses which are highly transmissible and often more severe in children than adults, COVID-19 is less likely to infect young children and is rarely severe when it does. Children who contract SARS-CoV-2 are generally asymptomatic and account for far fewer hospitalizations and deaths than adults. Severe illness is primarily associated with the elderly and those with preexisting health conditions.

Evidence points to schools mirroring the transmission rates of their communities, and schools themselves do not appear to drive community transmission. Numerous studies also agree that well-established health measures can provide layers of protection that mitigate many of the risks students and faculty face in a school setting.

This report provides an overview of the available scientific research and the experience of schools that have reopened in Europe and throughout the United States. It is intended to serve as a reference for leaders to ground their decisions in the scientific literature, deepen their understanding of the risks and trade-offs, and develop their own conclusions.

Given the breadth of the studies reviewed here, this type of analysis has its limitations. This report includes studies of all sizes, those published in peer-reviewed journals, and preprints. Findings from smaller studies may not be generalizable, and preprint study conclusions might change as they undergo peer review. However, they contribute to our best and most comprehensive collective understanding of COVID-19 at this moment. Evaluating science is a process, not a single event. Leaders need to continuously seek out and evaluate new research and adapt their strategies to mitigate the risks presented by SARS-CoV-2.[9]

Finally, as this report goes to print, concerns are growing over several new variants of SARS-CoV-2. The B.1.1.7 variant is believed to be 30 to 50 percent more contagious than the current virus and likely has a higher death rate.[10] CDC models project this strain will become dominant in the United States by March.[11] Researchers are also racing to determine if the South African variant, 501Y.V2, can evade immune responses triggered by vaccines and previous infection.[12]

The emergence of these variants introduces new uncertainty and complicates efforts to reopen schools. Early research suggests that children are half as likely as adults to transmit the new variant to others, essentially the same rate as the previous variant.[13] Fortunately, the United States, once again, has the benefit of learning from the experience of European countries. But the risks posed by these and other future variants require recommitting to the protective measures that have proven to be effective in managing the current variants of the coronavirus.

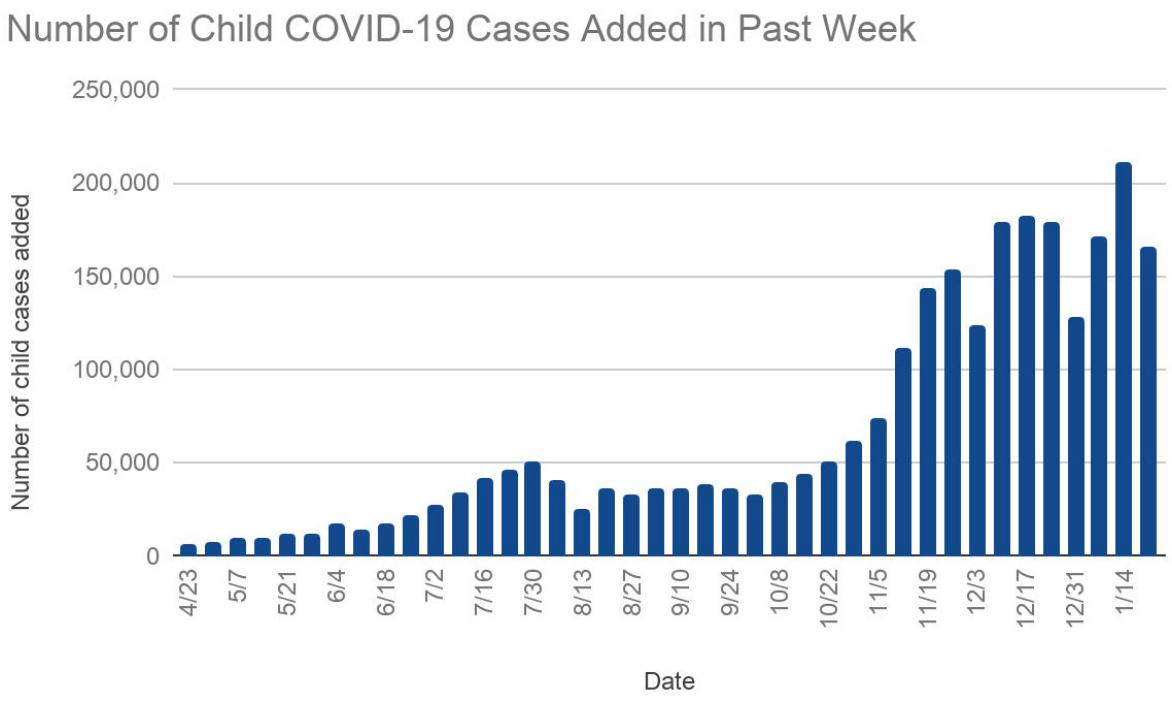
Disease Burden in Children

Research and data from around the world suggests that children comprise a small proportion of diagnosed COVID-19 cases, rarely develop severe illness, and have lower mortality rates.

Children have lower risks related to COVID-19 infections, hospitalizations, and deaths compared to adults. Studies from around the world indicate that children have a significantly lower risk of contracting COVID-19. Britain's Royal College of Paediatrics and Child Health conducted a meta-analysis of 32 studies from 21 countries involving over 41,000 children and 260,000 adults. They found that children have 44 percent lower odds of catching COVID-19 than adults, although the role that children play in transmission of the virus was still unclear.[14] Another analysis of 45 studies conducted early in the pandemic concluded that children only accounted for up to 5 percent of all cases. They typically have milder disease than adults, and deaths have been extremely rare.[15]

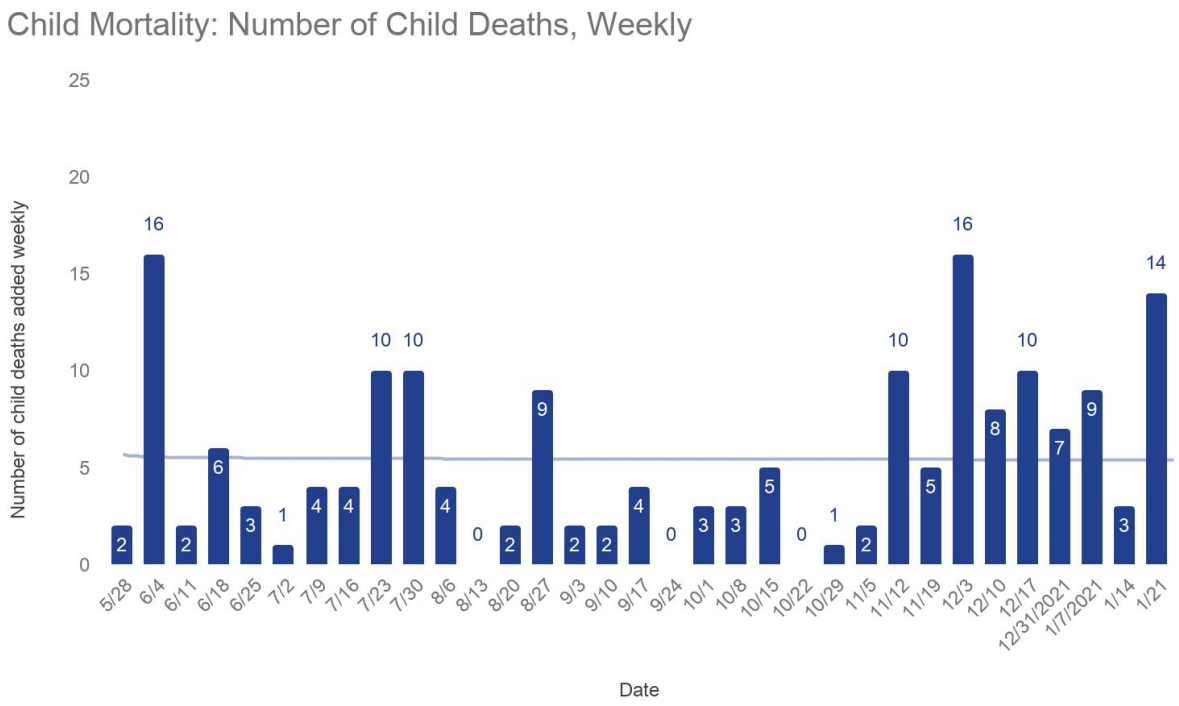
Similar patterns have emerged in the United States. As of February 2021, the American Academy of Pediatrics (AAP) reported 3,033,370 COVID-19 cases in children since March 2020, representing 13 percent of all cases. Children accounted for 1.2–2.9 percent of total reported hospitalizations and 0.00–0.25 percent of all COVID-19 deaths.[16]

Figure 1: Number of Child COVID-19 Cases Added in Past Week



Source: Analysis of child COVID-19 cases by the American Academy of Pediatrics and Children's Hospital Association, "Children and COVID-19: State Data Report," January 21, 2021.

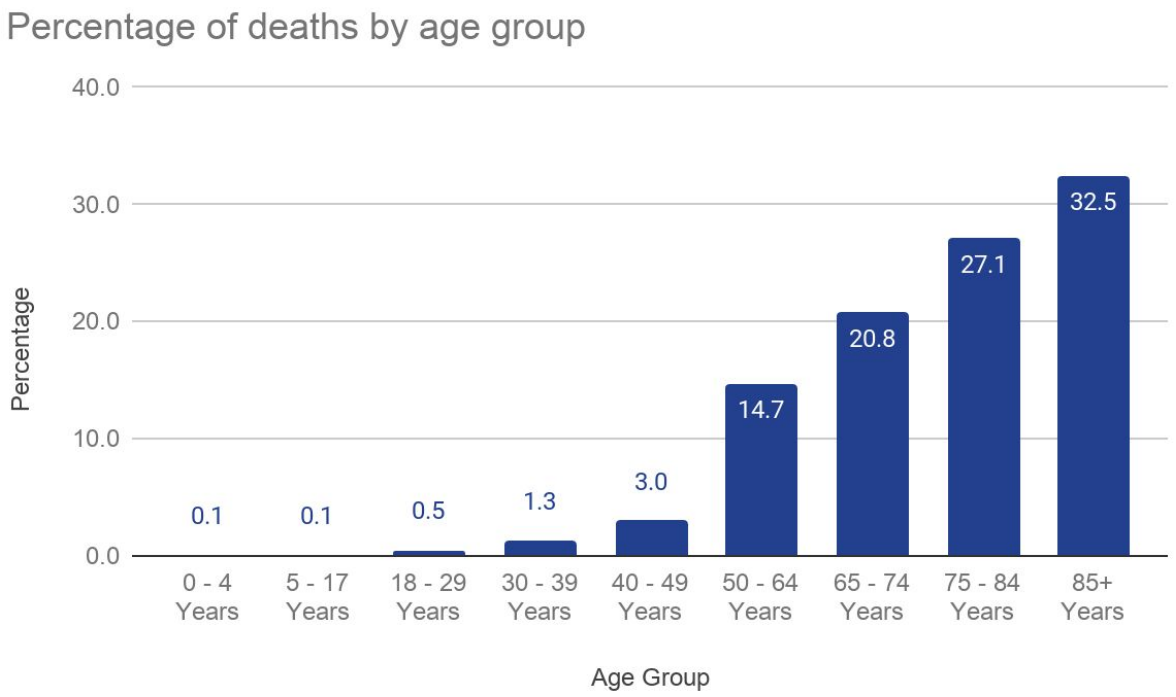
Figure 2: Child Mortality: Number of Child Deaths, Weekly



Source: Analysis of child COVID-19 cases by the American Academy of Pediatrics and Children's Hospital Association, "Children and COVID-19: State Data Report," January 21, 2021

An analysis of pediatric COVID-19 hospitalization data spanning 14 states from March through July, 2020, found the cumulative rate of COVID-19 hospitalization among children was more than 20 times lower than adults.[17] In contrast, adults, especially those over 60 or who have underlying health conditions, have higher risk for severe illness, hospitalization, and poor health outcomes.

Figure 3: Percentage of Deaths by Age Group



Source: CDC

Table 1. COVID-19 Hospitalization and Death by Age

Rate ratios compared to 5-17 year olds

Ages	0—4	5—17	18—29	30—39	40—49	50—64	65—74	75—84	85+
Cases	<1x	Reference group	3x	2x	2x	2x	2x	2x	2x
Hospitalization	2x	Reference group	7x	10x	15x	25x	35x	55x	80x
Death	2x	Reference group	15x	45x	130x	400x	1,100x	2,800x	7,900x

Source: CDC, February 2021

Children are more likely to be asymptomatic than adults. An analysis of over 800 pediatric cases showed that asymptomatic children have significantly lower levels of the virus than those who experience symptoms.[18] A study of health-care institutions across 25 European countries at the height of the first peak in April 2020 determined that COVID-19 was a mild disease for children, including infants, although several preexisting health conditions were found to increase a child's risk.[19] When researchers at Duke University School of Medicine asked selected local parents to track symptoms in children who tested positive for the coronavirus early in the pandemic, they found that more than one-third of the 6- to 13-year-olds were asymptomatic. [20]

As of October, the risk of children dying from COVID-19 was exceedingly low. They face far higher risks from accidental drug overdoses, suicide, and homicide than from the coronavirus. Joseph Allen, an associate professor and director of the Healthy Buildings program at Harvard University's T.H. Chan School of Public Health, explained how rare it was for a child to die from COVID-19: "Literally one in a million for kids 14 and younger… For those ages 15 to 24, the risk of dying from COVID-19 is 1 in 100,000. To put this in context, the study reported that school-age kids are 10 times more likely to die by suicide than COVID-19."[21]

Table 2. Age-Specific Mortality Rates (per Million) for COVID-19 (March-October 2020) and Other Leading Causes of Death (March-October 2018)

Age	COVID-19	Heart Disease	Chronic Lower Respiratory Disease	Transport Accidents	Accidental Drug Overdoses	Suicide	Homicide
<1	7.4	51.6	2.9	15.5	1.6	0.0	46.7
1-4	1.0	4.8	2.0	17.5	0.3	0.0	15.6
5-14	1.0	2.7	2.0	14.6	0.4	9.4	4.7
15-24	9.9	13.8	2.8	108.3	66.1	97.0	72.1
25-34	38.6	52.1	4.2	113.2	220.7	120.9	78.8
35-44	109.9	129.1	10.1	93.8	234.0	128.1	54.7
45-54	294.8	509.7	56.1	100.7	208.2	140.3	33.9
55-64	683.3	1,239.8	285.8	105.0	161.2	139.8	23.7
65-74	1,574.6	2,516.9	809.9	99.2	50.8	114.1	15.7
75-84	3,832.4	6,478.5	2,117.3	129.9	16.0	129.6	13.2
>85	10,699.7	24,530.2	4,278.4	139.1	14.7	133.4	13.3

Source: Steven H. Woolf, Derek A. Chapman, and Jong Hyung Lee, "COVID-19 as the Leading Cause of Death in the United States," The Journal of the American Medical Association, December 17, 2020

Children's immune systems may play a role.[22] [23] Researchers at Columbia University found that children and adults produce different types and amounts of antibodies in response to a COVID infection.[24] Dr. Matteo Porotto, an associate professor of viral molecular pathogenesis in Columbia's Department of Pediatrics, a co-lead on the study, commented, "In kids, the infectious course is much shorter and probably not as disseminated as in adults. Kids may clear this virus more efficiently than adults, and they may not need a strong antibody immune response to get rid of it."[25]

However, some populations of children do face greater risks. A number of studies point to the role social determinants of health play in increasing one's risk of infection and severity of illness. Social determinants of health refer to the complex circumstances in which individuals are born and live that affect their health. These can include household income levels, cultural differences, racial inequities, and place-based conditions such as access to health care, safe housing, and transportation. For example, a CDC study found evidence that children living in poverty were more susceptible to infection. Their examination of income-based disparities in Utah found that the risk of becoming infected in a low-income community could be three times greater than in a high-income one.[26] Lower-income families are less likely to be able to work from home, more likely to fill essential worker positions, and less likely to have health insurance—all of which can contribute to increased risk of infection.

Table 3. COVID-19 Cases, Hospitalizations, and Deaths by Race/Ethnicity

Rate Ratios vs. White*	Indigenous	Asian	Black	Hispanic/Latino/ Latinx
Cases	1.8x	0.6x	1.4x	1.7x
Hospitalizations	4.0x	1.2x	3.7x	4.1x
Deaths	2.6x	1.1x	2.8x	2.8x

*Non-Hispanic. Note: Race and ethnicity are risk markers for other underlying conditions that affect health, including socioeconomic status, access to healthcare, and exposure to the virus related to occupation

Source: Schoch-Spana M, Brunson E, Hosangadi D, Long R, Ravi S, Taylor M, Trotochaud M, Veenema TG on behalf of the Working Group on Equity in COVID-19 Vaccination. Equity in Vaccination: A Plan to Work with Communities of Color Toward COVID-19 Recovery and Beyond. Baltimore, MD: Johns Hopkins Center for Health Security; 2021.

These findings may help to explain why COVID-19 has so disproportionately affected Black and Hispanic Americans.[27] The National Urban League reported that Black and Latino Americans are more likely to live in crowded housing conditions, work in essential jobs that cannot be performed from home, and suffer from pre-existing conditions that increase the risk of severe illness. They are also overrepresented in low-wage jobs that offer the least flexibility and increase their risk of

exposure to the coronavirus.[28] As a result of these long-standing, systemic, social, and health inequalities, racial and ethnic minority group members of all ages have more risk factors that make them vulnerable to COVID-19 infection. [29]

A novel analysis from the Economic Innovation Group (EIG) shows these compounding disadvantages. In counties that are economically at risk or distressed, and have an above average share of Blacks and Hispanics, COVID-19 mortality rates are much higher than in similar counties that are above average white. EIG found the average COVID-19 mortality rate for a distressed county with an above average share of Hispanics is 211 deaths per 100,000, 201 for those with an elevated Black share, and 146 for those with an elevated white share.[30]

Finally, some children are developing a rare multisystem inflammatory syndrome (MIS-C), a condition in which different body parts can become inflamed, including the heart, lungs, kidneys, brain, skin, eyes, or gastrointestinal organs. Little is known about what causes MIS-C, but it appears that some affected children were previously infected with COVID-19. In one study of 186 pediatric patients with MIS-C, 70 percent of the children tested positive for SARS-CoV-2. The majority, 80 percent, needed intensive care, and 2 percent died.[31] The CDC reports that as of January, there are 1,659 MIS-C cases in 47 states and Washington D.C.[32] In a study that looked at New York City MIS-C incidences, more than 75 percent of reported cases occurred in children who are Hispanic or Latino (412 cases) or Black, Non-Hispanic (369 cases).[33]

Transmission Risks

The research on children's role in transmitting the coronavirus is inconclusive. Some research suggests that children can be asymptomatic carriers, while other studies have found low transmission rates from children to adults. Older children may transmit at higher rates than younger children.

Studies That Found Children Contribute to Transmission

Several studies suggest that children may be major contributors to transmitting COVID-19. One CDC study that examined COVID-19 trends among children between March and September 2020 found that monthly COVID-19 incidence increased approximately threefold among children ages 0–19, suggesting "that young persons might be playing an increasingly important role in community transmission."[34]

Researchers from the Princeton Environmental Institute, Johns Hopkins University, and the University of California, Berkeley analyzed contact tracing data from half a million people in India. They found that "enhanced transmission risk was apparent among children and young adults, who accounted for one-third of cases."[35] The researchers also discovered that 71 percent of infected individuals did not infect any of their contacts, but 8 percent of infected individuals served as "superspreaders" and accounted for 60 percent of new infections.

Researchers at the Center for Communicable Disease Dynamics, Department of Epidemiology at the Harvard T.H. Chan School of Public Health conducted a meta-study that found evidence of COVID-19 spread in schools that use limited mitigation measures, such as smaller class sizes, mask use, and quarantining of infected individuals. They also found limited spread of COVID-19 in primary schools compared to high schools, "which agrees with the evidence about lower susceptibility to infection in children under the age of 10 years compared to older children or adolescents." The authors recommend a more nuanced approach to school closures and openings: "Opening secondary/high schools is likely to contribute to the spread of SARS-CoV-2, and, if implemented, it should require both lower levels of community transmission and greater safeguards to reduce transmission. Compared to secondary/high schools, opening primary schools and daycare facilities may have a more limited effect on the spread of SARS-CoV-2 in the community, particularly under smaller class sizes and in the presence of mitigation measures."[36]

A literature review conducted by the University of Washington and the Washington State Department of Health came to a similar conclusion: "School age children have clearly been shown to be susceptible to SARS-CoV-2 infection and capable of transmitting the virus to other children and adults. While there is evidence that younger children (i.e. younger than 10 years old) may be less susceptible to infection and less likely to transmit to close contacts if they are infected, a relatively small number of well documented outbreaks involving school-age children demonstrate the potential

for widespread transmission among children, particularly when there are limited measures in place to stop transmission."[37]
A South Korea study of nearly 65,000 individuals detected COVID-19 in 11.8 percent of household contacts with higher rates for contacts of children than adults. They found the highest COVID-19 rate (18.6 percent) for household contacts of school-aged children and the lowest (5.3 percent) for household contacts of children age 0–9 in the middle of school closure. The findings suggest that children under age 10 transmit the virus but do so less effectively than adults.[38] A later study complicated the picture, as it suggested it was not clear who infected whom.[39] It could be that children and adults were infected at the same time.[40]

On March 13, 2020, Israel's government closed all schools and then reopened them on May 17, 2020. Ten days later, a major COVID-19 outbreak occurred in a Jerusalem high school. Overall, 13 percent of students and 17 percent of staff had SARS-CoV-2 infection. Forty-three percent of students and 76 percent of staff were symptomatic. The highest prevalence of SARS-CoV-2 was in grades 7-9 (17 percent to 33 percent). Researchers noted that several mitigation protocols were relaxed, including an exemption from wearing facemasks and continuous use of air-conditioning during an extreme heatwave. Classrooms were also crowded with more than 30 students per class in the affected schools.[41]

Studies That Found Children Play a Limited Role With Transmission

Emerging evidence suggests that while there is some transmission with children, they are not the super-spreaders they tend to be with other respiratory infections. [42]

This was a conclusion reached by several researchers early in the pandemic. A review of existing research as of May 2020 found that children accounted for a small fraction of COVID-19 cases around the world. Household transmission studies suggested that children were rarely the source of infection and seldom caused outbreaks. The researcher concluded, "Children are unlikely to be the main drivers of the pandemic. Opening up schools and kindergartens is unlikely to impact COVID-19 mortality rates in older people."[43]

One meta-analysis published in October 2020 found that while there is limited evidence available to quantify the extent of SARS-CoV-2 transmission in schools, the balance of evidence so far indicates that the overall positivity rates in the school environment are low, particularly with those implementing protective health measures[44]

A series of studies conducted throughout the pandemic by the National Centre for Immunisation Research and Surveillance (NCIRS) in South Wales, Australia found that children seemed to transmit the COVID-19 less than other respiratory viruses. No teacher was found to contract the virus from a student during the initial review in the spring.[45] A follow-up study published in October had similar findings, including that schools and early childhood centers had onward transmission of less than 1 percent.[46] "The findings of the report are consistent with other studies that have found children,

especially primary school age and younger, appear less likely than adults to transmit COVID-19 to others," said NCIRS Director Kristine Macartney.[47]
Researchers from the University of Oxford and London's School of Hygiene & Tropical Medicine studied 12 million adults in the U.K. between February and August 2020 to understand the risk of COVID-19 infections for those with and without children. They found that living with children does not carry greater risk and, surprisingly, appeared to *lower* the risk of dying from COVID-19. [48]

In an Irish study of COVID-19 cases in early March 2020, researchers identified no cases of onward transmission to other children or adults within the school and various other settings.[49] Ireland's Health Information and Quality Authority also analyzed several COVID-19 studies and concluded in August, "Children are not, to date, substantially contributing to the household transmission of SARS-CoV-2. From six school-based studies investigating transmission of SARS-CoV-2 in children, it appears that rates in this setting are also low."[50]

A study of 541 students and 46 teachers living in a small town outside of Paris, France found that there was no documented transmission from students to teachers. The study stated, in young children, SARS-CoV-2 infection was largely mild or asymptomatic, and there was no evidence of onward transmission from children in the school setting."[51] Based on these findings, the researchers said the "reopening of primary schools can be considered carefully, with continuous monitoring of possible resurgence in infections and strategies to limit transmission such as hand hygiene, physical distancing, respiratory etiquette and masks for older children."

A small study involving contact tracing of 40 children in Greece between March and April 2020 found that only 8 percent of the children were the source of the infection.[52] The study concluded that "transmission in schools may be less important in community transmission than initially feared."

From March 10 to April 10, 2020, all children under age 16 who were diagnosed with COVID-19 at Geneva University Hospital underwent contact tracing to identify infected household contacts. Of the 39 households evaluated, only three (8 percent) involved a child as the suspected source of infection. In all other households, the child developed symptoms after or at the same time as adults. The study suggests that children were not the source of infection and that children more frequently acquire COVID-19 from adults, rather than transmitting it to them.[53]

Children under age 10 in Iceland were found to be less likely to get infected than adults and less likely to become seriously ill. The study's authors concluded that "even if children do get infected, they are less likely than adults to transmit the disease to others. We have not found a single instance of a child infecting parents."[54]

Researchers used household data from Bnei Brak, Israel, to estimate the susceptibility and infectivity of children. They found that children under the age of 20 are about half as susceptible to COVID-19 infection as adults, and they are less likely to infect others.[55]

The Impact of School Reopenings on Community Spread

A critical question at the center of the debate around reopening schools is the degree to which children transmit the virus. Seasonal influenza, for example, can be spread by students who infect their classmates who then carry the virus into their homes and the broader community. Emerging evidence suggests that transmission in school settings is low and that infection rates in schools mirror the prevalence of COVID-19 in the community. This is an important distinction because students testing positive at school does not necessarily mean they were infected at school. Many faculty and staff infections seem to be traced back to other adults, including those in their households.

Multiple Countries

The emerging picture of studies and data suggests that schools that reopen with protective protocols in place do not lead to widespread transmission of COVID-19. Natural experiments presented themselves throughout Europe when schools reopened during the summer with in-person classes. Overall, school reopenings did not appear to trigger community outbreaks.

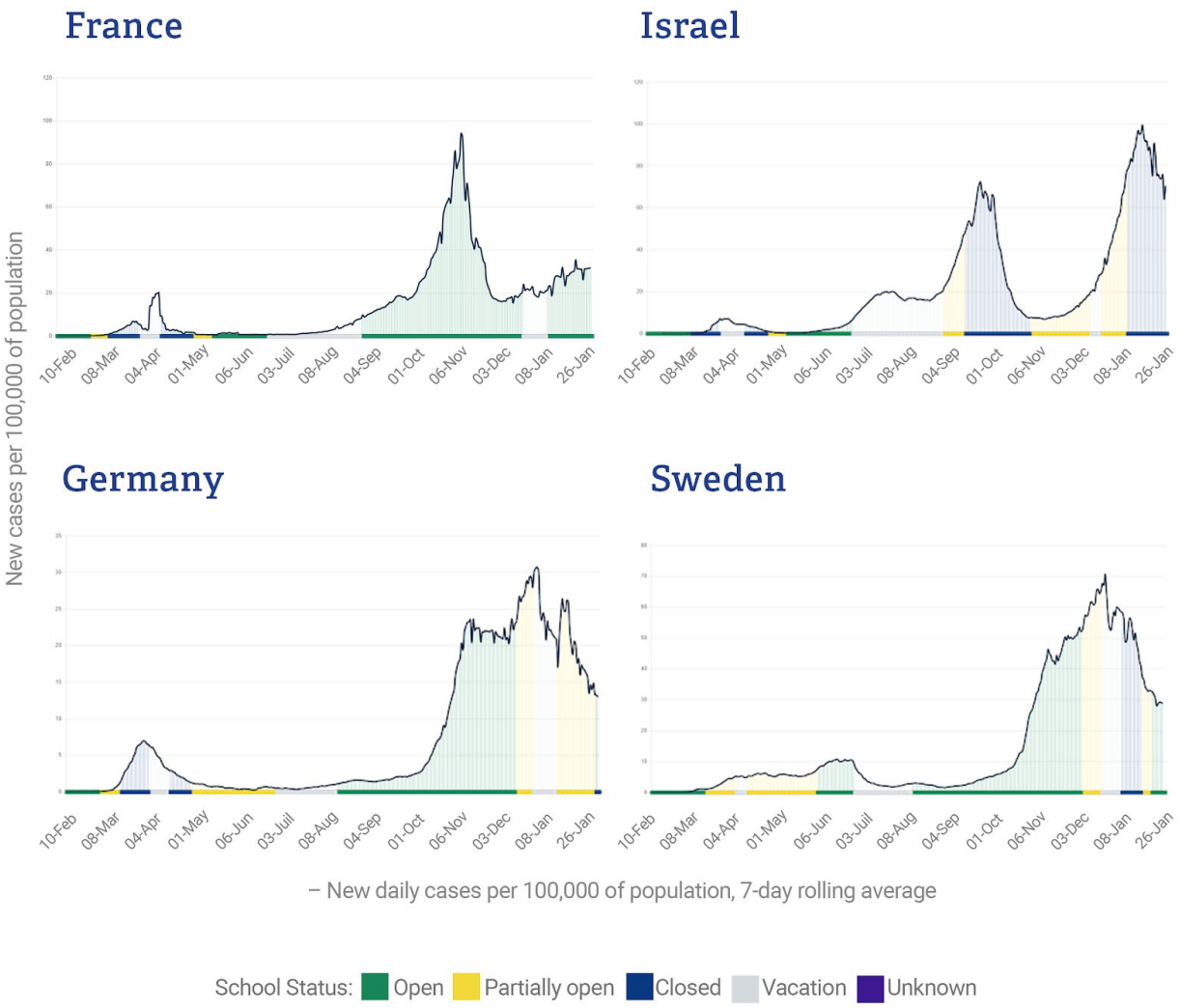
The London School of Hygiene and Tropical Medicine compiled a database of reported "superspreader" outbreaks around the world. They found that schools and childcare centers were only 2 percent of all incidents and only 0.8 percent of all cases. Gwen Knight, an assistant professor leading the effort observed, "Schools should be important given that so many networks come together [there]— with kids, parents and social life... But the signal doesn't seem to be very strong. We are finding it quite hard to find direct evidence of transmission within the school setting, but we are not doing enough testing."[56]

A review conducted by the London School of Hygiene & Tropical Medicine of 20,110 transmission clusters around the world in the spring found that only eight (3.8 percent) transmission clusters involved school transmission.[57] Rather, transmission occurred the most frequently within households.

Insights for Education collected data from 191 countries over a seven-month period, from February 10 to September 29, to compare policy decisions with new COVID-19 cases. They found no consistent pattern between school status and COVID-19 infection rates. Reopening schools was also not generally linked to rising COVID-19 rates.[58]

Insights for Education provides detailed data related to national positivity rates, the status of schools, and a chronological timeline of when restrictions were invoked and relaxed. The resulting graphs clearly show the second and third waves of the virus sweeping through Europe and other countries, but with little correlation relative to the status of school closures. Countries that closed schools saw surges in cases just as countries that kept schools opened.

School Reopening Status and Community Positivity Rates



Canada

In September, the National Collaborating Centre for Methods and Tools (NCCMT), in Ontario, Canada, published an rigorous analysis of existing research on the roles that schools and daycare centers play in the transmission of COVID-19. The review found that children are not significant spreaders of COVID-19 and are more likely to contract the disease from adults than from other children. Comprehensive data from the United States and United Kingdom where schools and daycare centers have reopened show "minimal secondary transmission in schools and daycares with implementation of infection control measures." "The bottom line, thus far, is that children under 10 years of age are unlikely to drive outbreaks of COVID-19 in daycares and schools and that, to date, adults were much more likely to be the transmitter of infection than children," said assistant professor Sarah Neil-Sztramko, of the NCCMT and McMaster University's Department of Health Research Methods, Evidence, and Impact.[59]

Europe

A study in Spain investigated cases three weeks after schools reopened. The analysis concluded, "global incidence evolution suggests no significant effects of the reopening of schools, and that, in most cases, there is either absence of increase in cases of pediatric ages or a slight increase that is compatible with current diagnostic effort in the schools."[60] Nowhere, the research found, was there a surge that coincided with reopening: "What we found is that the school [being opened] makes absolutely no difference," Enric Álvarez from the Universitat Politècnica de Catalunya told NPR.[61]

Several studies have explored the impact of schools reopening across the United Kingdom after being closed in the spring. The U.K.'s Office for National Statistics (ONS) found that between September and October teachers were no more likely to catch COVID-19 than those working in other frontline occupations.[62] An additional January 2021 assessment concluded that the rates of death involving COVID-19 of teaching and educational professionals "were not statistically significantly raised when compared with the rates seen in the population among those of the same age and sex."[63]

A study by Public Health England published in December 2020 examined coronavirus infections and outbreaks between June 1 and July 17 across the United Kingdom, when students returned to school for a final session before the summer.[64] During that time, about 928,000 students attended 38,000 childcare centers, 15,600 primary schools and 4,000 secondary schools. In all, 593,000 teachers and school staff were involved in the reopening effort. Researchers found only 343 total cases during the June-July break. That included 113 individual cases; nine "coprimary" cases, which usually involved two siblings from the same family; and 55 outbreaks. Given that nearly one million students returned to school, the researchers deemed school-based infections to be "uncommon."

Researchers from the University of Warwick analyzed data on school absences due to COVID-19 from September to December 2020. The results showed COVID-19 cases among teachers fell during the November lockdown even though schools remained open. While primary schools were considered to have much lower risk than secondary schools, the researchers found no evidence to suggest that school attendance was a significant driver of community outbreaks.[65]

More than 65,000 schools across Italy reopened in September, even as COVID cases were increasing within communities. Researchers found that only 1,212 schools had experienced outbreaks four weeks into reopening. In 93 percent of cases, only one infection was reported, and only one high school had a cluster of more than 10 infected people.[66]

Several studies from Germany confirm these findings. One recent study of 4,964 individuals found that seroprevalence of SARS-CoV-2 infection was threefold lower in children than their parents. Lower SARS-CoV-2 seroprevalence in young children indicates that children are highly unlikely to have contributed to the COVID-19 outbreak in southwest Germany during the period of the study. The researchers concluded, "The spread of SARS-CoV-2 infection during a period of lockdown in southwest Germany was particularly low in children aged 1 to 10 years. Accordingly, it is unlikely that children have boosted the pandemic. This SARS-CoV-2 prevalence study, which appears to be the largest focusing on children, is instructive for how ad hoc mass testing provides the basis for rational political decision-making in a pandemic."[67]

An IZA Institute of Labor Economics analysis used official daily case counts by age across all 401 German counties to estimate the effect of reopening schools.[68] It found that when schools reopened, cases actually *decreased* rather than increased. The authors of the study theorized that schools that reopened under strict hygiene and containment measures, including mandatory mask wearing, helped to effectively mitigate the spread of coronavirus. There was also robust testing to detect infected individuals who were immediately quarantined. The authors concluded that, "school reopenings in Germany under strict hygiene measures combined with quarantine and containment measures have not increased the number of newly confirmed cases."

Researchers at the University Hospital in Dresden sought to analyze antibody levels during the first COVID-19 wave, the reopening of schools, and after the summer. They analyzed blood samples from almost 1,500 children and 500 teachers from 13 schools in May and June with follow-up visits in September and October. Researchers found low levels of antibodies among students, which led them to conclude that "schools do not play a crucial role in driving the SARS-CoV-2 pandemic in a low prevalence setting. Transmission in families occurs very infrequently, and the number of unreported cases is low in this age group. These observations do not support school closures as a strategy for fighting the pandemic in a low prevalence setting."[69] Reinhard Berner from the University Hospital of Dresden said the findings suggest that "children may even act as a brake on infection."[70]

A similar conclusion was reached by researchers who studied 30,000 workers in Scotland.[71] One of the more surprising findings was that adults in households with young children (up to age 11) had a modestly reduced risk of catching COVID-19 and a reduced risk of hospitalization. "The risk of

hospitalization with COVID-19 was lower in those with one child and lower still in those with two or more children." It is not clear from the research as to why this may be the case.

As a country that intentionally eschewed lockdown measures, Sweden provides one of the most interesting case studies on coronavirus spread. The Swedish government did not mandate mask wearing or impose the restrictions on businesses and restaurants that many other European countries did. Swedish schools remained open for in-person instruction in kindergarten through grade 9, but upper secondary schools were closed from March through June 2020. Health officials encouraged students and teachers to regularly wash their hands and keep some physical distance when possible. Neither teachers nor students wore masks in schools. As a result, the country serves as a natural experiment to compare transmission and infection rates compared to the countries that took more aggressive measures, including closing schools.

One group of researchers found that among the 1.95 million children between the ages of 1 to 16, only 15 (equal to 1 child in 130,000) were diagnosed and admitted to an ICU.[72]

Another group of researchers conducted a novel analysis of health data in Sweden, examining infection rates of teachers and parents. They compared infection rates in teachers who taught in-person in lower secondary schools (grades seven to nine) with those who taught remotely at upper secondary schools (grades 10 to 12). In addition, they compared infection rates of the spouses of teachers in these two types of school settings. The analysis showed that keeping schools open with minimal mitigation measures roughly doubled teachers' risk of becoming infected. This trend also affected the spouses of teachers who taught in less protected settings—their risk of infection was 29 percent higher than spouses of teachers who taught remotely. Parents of students who attended in-person school were 17 percent more likely to be diagnosed with COVID-19 than those whose children were in remote learning. Researchers concluded that keeping the lower-secondary schools open had only a minor impact on the overall spread of SARS-CoV-2 in the broader community. The study also underscored the importance of masks as a mitigation measure.[73]

A Stockholm University analysis found taxi and bus drivers faced a greater risk of dying from COVID-19 than other workers, as did older individuals living with service workers. Teachers were not in the high-risk group which was surprising giving that schools were open and the limited mitigation measures employed.[74]

United States

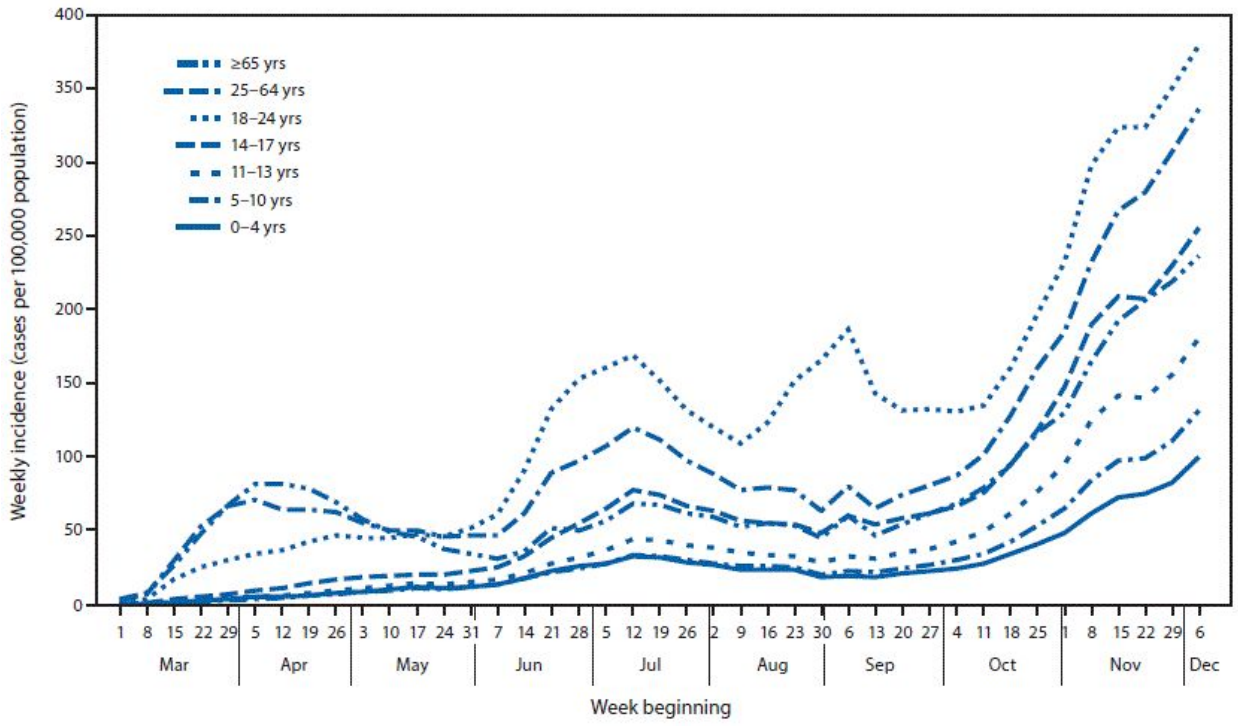
National Studies

In a first-of-its-kind study, researchers at the National Center for Research on Education Access and Choice examined the impact of school reopenings on local hospitalization rates, a novel way to assess actual sickness.[75] Their analysis "found no evidence that reopening schools in-person or in a hybrid form increased COVID hospitalizations in the 75 percent of counties that had low COVID

hospitalization rates during the summer, prior to reopening schools." However, in counties where reopening occurred with higher hospitalization rates, the results were inconclusive. The study included an important caveat that even when schools were open for in-person instruction, they gave families the option of continuing to learn remotely.

A national study published by the CDC in January 2021 reviewed the data for nearly three million COVID-19 infections in children between March 1 and December 12, 2020. Researchers compared the data from K-12 students who are learning remotely with those who have resumed in-person schooling. They found that in-person instruction does not appear to lead to increases in COVID-19 cases in the community. Similar to other studies, they found the number of positive COVID-19 cases was lower among children 10 and younger as compared to older children and young adults. Cases did increase over time but at the same rate as community spread. Researchers concluded that "when community transmission is higher, cases in schools should be expected, and as with any group setting, schools can contribute to COVID-19 transmission, especially when mitigation measures such as universal and proper masking are not implemented or followed." [76]

Figure 6: CDC COVID-19 Weekly Incidence, by Age Group, March 1–December 12, 2020



Source: Eva Leidman et al., "COVID-19 Trends Among Persons Aged 0–24 Years — United States, March 1–December 12, 2020," Centers for Disease Control and Prevention, January 13, 2021,

On January 28, 2021, CDC scientists published a paper that evaluated a number of studies and data from the fall of 2020. The researchers concluded, "As many schools have reopened for in-person instruction in some parts of the US as well as internationally, school-related cases of COVID-19 have been reported, but there has been little evidence that schools have contributed meaningfully to increased community transmission." The researchers noted the importance of mitigation measures, such as everyone wearing masks, distancing, improving ventilation in the room, and regular testing.[77]

State Studies

Michigan and Wisconsin

A team of researchers from the Center for Education Data and Research (CEDR), the National Center for Analysis of Longitudinal Data in Education Research (CALDER), and the Education Policy Innovation Collaboration (EPIC) took the school/community inquiry a step further. They linked county-level data on COVID-19 infections in Michigan and Washington with the modality of instruction offered by school districts—online, hybrid, or in-person—to determine the relationship between in-person instruction and COVID-19 transmission. They concluded that hybrid and in-person instruction do not contribute to community spread as long the community positivity rates are low.[78] However, they did find some evidence that in-person learning is associated with increased COVID-19 spread in communities with relatively high pre-existing levels of COVID-19.

A CDC study of 17 rural Wisconsin schools also found limited transmission. All students wore masks, practiced social distancing, and were organized in small cohorts of 11-20 to minimize spread. The Legacy Foundation of Central Wisconsin provided a $150,000 grant that covered the costs of masks for every student. All other costs were covered by the schools. Researchers found that of the 191 cases identified in students and staff members, only seven (3.7 percent) cases, all among students, were linked to in-school spread. The researchers concluded that "with masking requirements and student cohorting, transmission risk within schools appeared low, suggesting that schools might be able to safely open with appropriate mitigation efforts in place."[79]

The University of Wisconsin School of Medicine and Public Health sought to explore the role of student sports with COVID transmission.[80] Surveys were completed by 207 schools that had restarted sports in September, representing over 30,000 student-athletes who had engaged in more than 16,000 practices and 4,000 competitive games. The number of positive cases was actually *lower* than those reported by the Wisconsin Department of Health Services for the general population between the ages of 14-17. In addition, the survey found that no sport had a statistically higher incidence rate than that of non-athlete teenagers during the same period. The survey identified only one case—or 0.5 percent of the reported cases— that could be attributed to transmission during sports activities.

North Carolina

The Duke School of Medicine and the Duke Clinical Research Institute coordinate the ABC Science Collaborative involving 50 school districts and local health departments in North Carolina. They collected and analyzed COVID-19 data in 11 school districts with more than 100,000 students during the first nine weeks of in-person schooling. Districts were required to follow the mitigation strategies outlined by the NC Department of Health and Human Services (NCDHHS), wearing a mask, distancing six feet, and washing hands. Schools also performed daily symptom monitoring and temperature checks.[81]

Although community spread was high, researchers found just 32 cases of in-school transmission.[82] Of those, six were in pre-kindergarten, 11 were in elementary schools, six were in middle schools, five were in high schools and four were in schools that included kindergarten through 12th grade. None of the cases involved a child infecting an adult. The researchers concluded that "transmission of SARS-CoV-2 was rare in North Carolina schools that reopened last fall and utilized face coverings, distancing, and hand-washing."

Illinois

The Chicago Department of Public Health (CDPH) analyzed data from the Chicago Archdiocese, the largest Catholic school system in the nation. While Chicago Public Schools chose to begin the school year remotely, the Archdiocese elected to reopen with in-person instruction across 91 schools serving more than 19,500 students and 2,750 teachers and staff. Archdiocese schools were required to follow CDPH's reopening protocols, including mandatory masking, physical distancing, daily on-site temperature and symptom checks, access to hand hygiene supplies in every room, and quarantining of cohorts whenever a positive individual was identified.[83] COVID-19 testing was not required. The Archdiocese had a certification process for every school and conducted on-site visits to ensure compliance with mitigation strategies. Schools were also required to report all suspected or confirmed school-related COVID-19 cases to CDPH.

CDPH researchers analyzed data for the first seven weeks of the 2020-21 school year during which there was a moderate to high COVID-19 incidence throughout the community. The Archdiocese reported a total of 59 COVID-19 cases at 31 Archdiocese schools. Forty-nine cases were classified as being associated with a school: 35 in students and 14 in staff. The estimated COVID-19 attack rate (defined as the proportion of those who became ill after a specified exposure) among students at Archdiocese schools was 0.2 percent—significantly lower than the 0.4 percent rate for all Chicago children. For school staff, the estimated attack rate was 0.5 percent, compared to 0.7 percent for working-age adults in Chicago. CDPH concluded that "data collected in the nation's largest Catholic school system suggest that implementation of layered mitigation strategies creates a low- but not zero-risk environment for in-person learning in public schools."[84]

Mississippi

A CDC study of nearly 400 children in Mississippi found that in-person attendance at school or child care was not associated with a positive test for SARS-CoV-2. Instead, researchers found that it was contact with individuals with COVID-19 through social gatherings with people outside the immediate household that led to increased cases. They also found the lack of consistent mask use in school that was associated with COVID-19 infections.[85]

New York City

Researchers from the City University of Hong Kong, the Chinese Academy of Sciences, and Rensselaer Polytechnic Institute ran thousands of simulations of the pandemic response in New York City with variations in social distancing behavior at home, in schools, and in the workplace. In these simulations, school closures were not effective in preventing serious cases of COVID-19. The study concluded "the total infections and deceased cases are nearly the same as the results of those without any control (theoretical no intervention)."[86]

Research Suggesting School Closures Were Effective at Decreasing Community Transmission

One study found that schools that had closed between March 9 and May 7, 2020 were associated with a temporary decrease in COVID-19 incidence and mortality. States that closed schools earlier, when incidence of COVID-19 was low, had the largest relative reduction in incidence and mortality. However, the researchers noted that some of the reduction may have been related to other concurrent nonpharmaceutical interventions.[87]

Another study suggested that the reopening of schools in Florida was followed by higher COVID-19 positivity rates at schools, especially high schools. According to data analyzed by Ben-Gurion University of the Negev, Harvard Medical School, and Tel Aviv University researchers, infections rose nearly 30 percent in high school children ages 14-17 and approximately 20 percent among elementary school children ages 6-13.[88]

The CDC published a study in February 2021 that investigated COVID-19 spread within eight Georgia public elementary schools in the same school district between December 1, 2020 and January 22, 2021, a period that spanned 24 in-person learning days. There were nine transmission clusters in elementary schools, including one cluster where 16 teachers, students and relatives of students at home became infected. In only one of the nine clusters was a student clearly the first documented case, while a teacher was the first documented case in four clusters. The study noted that students were spaced less than 3 feet apart and there were instances of small group instruction sessions when educators and students were in closer proximity to one another. While the school district mandated masks, CDC researchers discovered specific instances "involving lack of or inadequate mask use by students [which] likely contributed to spread in five clusters."[89] The study concluded that "initial infections among educators played a substantial role in in-school SARS-CoV-2 transmission and subsequent chains of infection to other educators, students, and households." They also emphasized the importance of school mitigation measures and COVID-19 vaccinations for

educators when available. These additional protections for educators could potentially reduce in-school SARS-CoV-2 transmission and minimize interruptions to in-person learning.

Data From School Reopenings

The United States lacks a comprehensive, national database of COVID-19 infections in schoolsAs of September 2020, only 12 states provided any public information on school-based COVID-19 cases which has severely hampered our ability to understand the impact of school reopenings on community spread and the effectiveness of mitigation strategies.[90] Additional contextual information is also critical such as school size, the type of school model employed at the time of infection, and the protocols triggered when a case was identified, such as quarantining individuals or closing the school. [91]

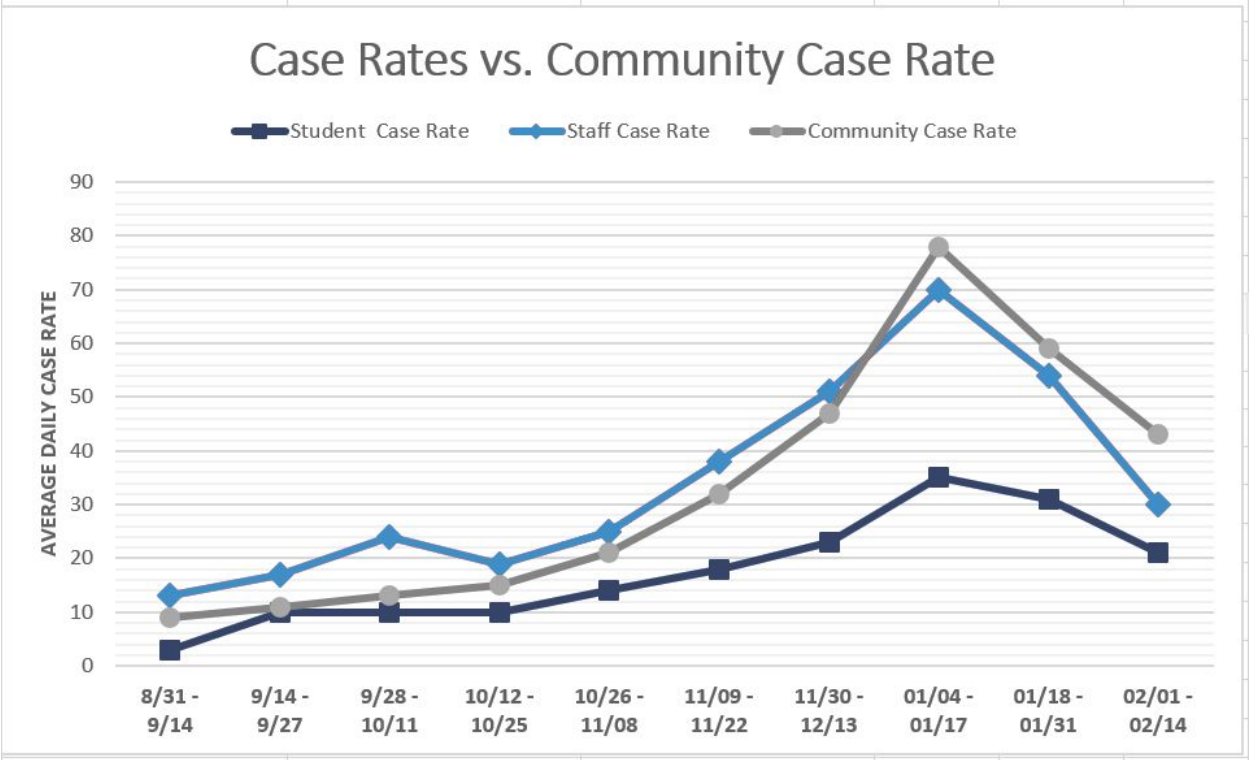
Many school districts, and even some state government agencies, claim that this data cannot be collected or shared due to student privacy concerns. However, the Future of Privacy Forum and the School Superintendents Association point out that federal privacy laws provide a health or safety emergency exception that would apply to the current pandemic:

> "If a school determines that there is an articulable and significant threat to the health or safety of a student or other individuals and that someone needs personally identifiable information (PII) from education records to protect the student's or other individuals' health or safety, it may disclose that information to the people who need to know it without first gaining the student's or parent's consent."[92]

Researchers have stepped in to fill the void of available data. The National COVID-19 School Response Data Dashboard was created through a partnership with Qualtrics, the School Superintendents Association, the National Association of Secondary School Principals, the National Association of Elementary School Principals, and Brown University.[93] Data is collected through biweekly schools and school district surveys as well as state dashboards. Two weeks into the reopening of schools in the United States the project found that 0.23 percent of students had a confirmed or suspected case. Among teachers, it was 0.49 percent. Looking only at confirmed cases, the rates were even lower: 0.078 percent for students and 0.15 percent for teachers.[94]

In an October 2020 *Atlantic* essay, Brown University economics professor Dr. Emily Oster wrote that preliminary findings suggested that schools are not superspreaders. By that point, their data involved 200,000 students across 47 states showing an infection rate of 0.13 percent among students and 0.24 percent among staff. "We are starting to get an evidence-based picture of how school reopenings and remote learning are going," Oster observed, "and the evidence is pointing in one direction. Schools do not, in fact, appear to be major spreaders of COVID-19."[95]

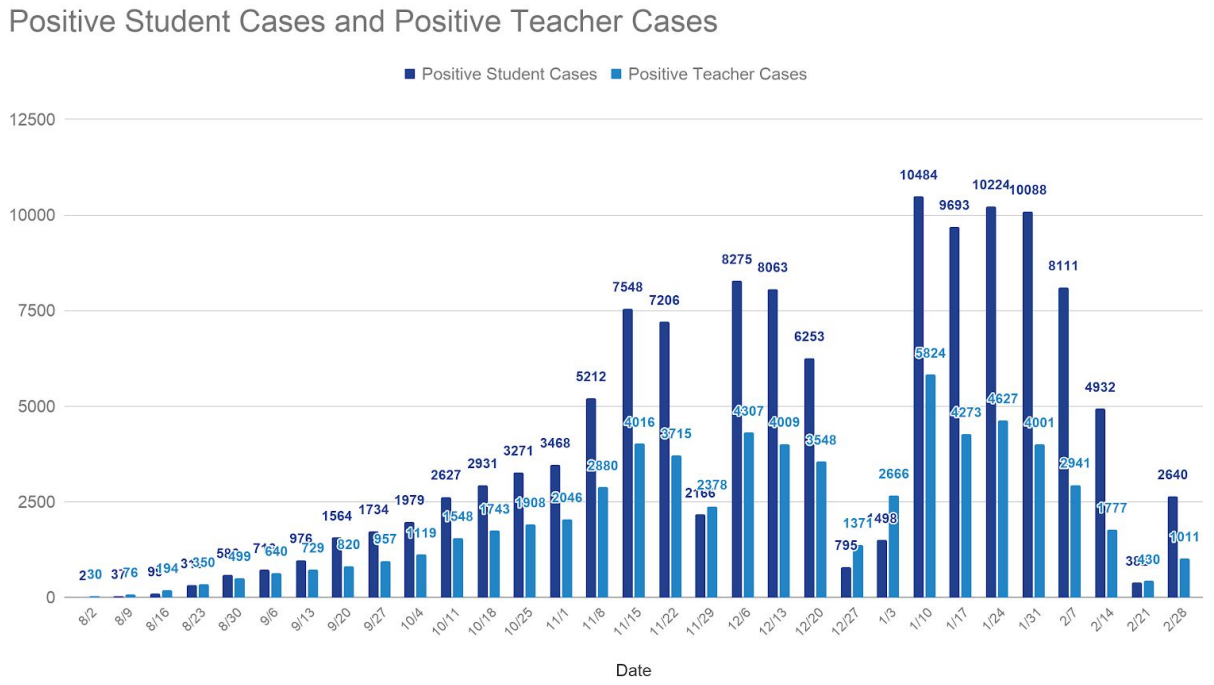
By February 2021, the dataset included approximately 12 million students, 6 million of which were in-person and continued to suggest that schools are not super-spreaders. Dr. Oster commented, "In general, we see school rates move with community rates. School staff show up with similar rates to the community, students with lower rates. This is what we would expect if there was relatively little in-school transmission. Basically, schools reflect their communities because staff and students live in these communities."[96]

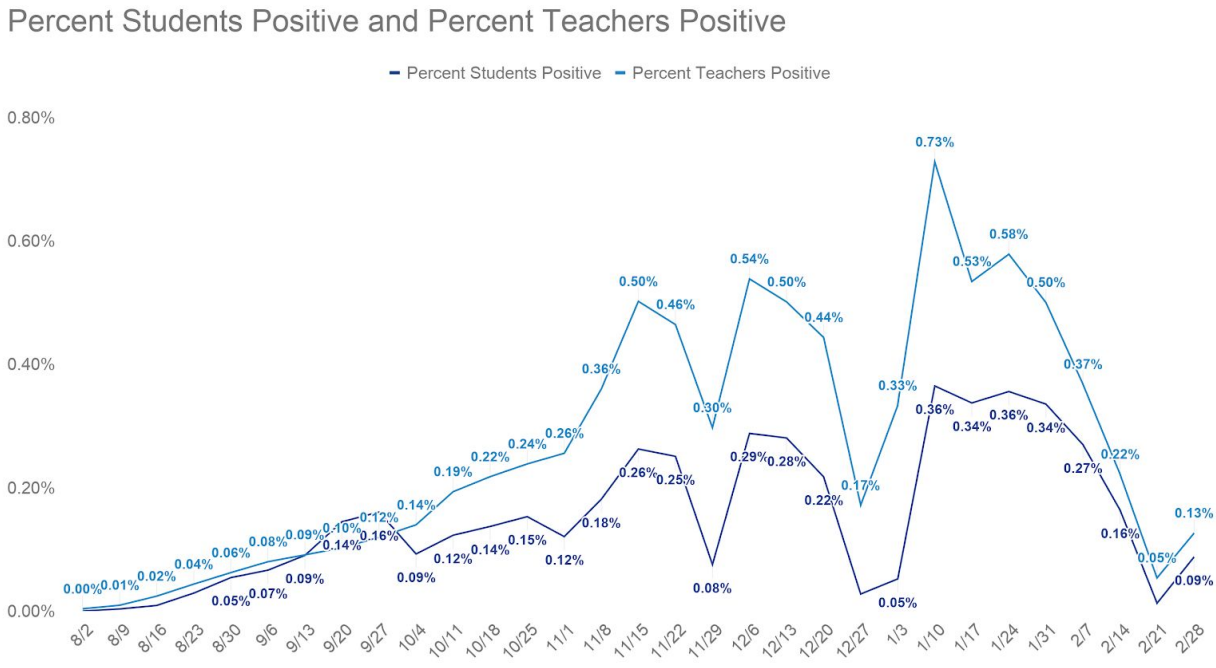


Source: School Dashboard Update, March 1, 2021

State reporting reveals similar trends. The Texas Education Agency reported only 1,732 (0.16 percent) positive cases out of 1.08 million students attending school in September. It was even lower for staff, with just 0.12 percent of reported cases. The highest peak came during mid-November, when student cases rose to 7,467 which represented 0.26 percent of all students. By the end of November, cases fell to less than 1,460 (a rate of just 0.05 percent of all students on campuses). In other words, even with more students attending school, Texas saw far fewer students and staff testing positive.[97]

Figures 4 and 5: Positive Cases Among Students and Staff by Week in Texas[98]





Source: Texas Health and Human Services, "Texas Public Schools COVID-19 Data," December 23, 2020

In early October, New York City launched a mandatory in-school testing program that randomly selects groups of staff and students and tests them on a weekly basis. Between 10 to 20 percent of a school's population is tested, depending on the size of the school. Of the more than 205,322 tests conducted between October and December, only 753 came back positive, a positivity rate of just 0.37 percent.[99]

Table 4: New York City's School Based Testing Report

Citywide	Total	Students	Staff
Tests Conducted	472,395	203,702	261,135
Total Positive Tests Identified	2,557	1,379	1,178
Citywide Survey Testing Positivity Rate	0.37%	0.68%	0.45%

Source: Cumulative Testing Summary Citywide, New York City Department of Education, February 11, 2021

Dr. Oster also analyzed data published by the New York State government over a four-week period from October 12 through November 6, 2020. She compared the prevalence on COVID-19 in communities (based on zip codes) and compared it to the prevalence of COVID-19 among elementary and middle school students; high school students; and faculty and staff at all schools. For high school students and staff, the rates are similar to population case rates. For elementary and middle school students, they are lower which makes sense given that younger children seem to have lower infection rates in general. The data also showed that approximately 80 percent of schools in the state reported no COVID-19 cases at all. Of those that did report a COVID-19 case, nearly 90 percent had only one or two cases.[100]

Summer Camps

Investigating experiences of children in group settings outside of the classroom might provide additional insights for school leaders. A CDC study of Maine sleepaway camps involving 1,022 children from 41 states found limited transmission of the coronavirus. This was attributed to health protocols that were used, including testing before and after campers arrived, placing children into cohorts, wearing masks, keeping some element of physical distance, and maximizing outdoor activity.[101]

The CDC also studied a camp in Georgia that saw a surge of cases when 260 campers and staff tested positive out of 344 test results. Among those aged 6-10, 51 percent tested positive for the coronavirus; age 11–17, 44 percent; and age 18–21, 33 percent. The researchers concluded that the virus "spread efficiently in a youth-centric overnight setting, resulting in high attack rates among persons in all age groups," with many showing no symptoms.[102] They noted that there were few

protective measures in place. The camp did not require masks and there was decreased ventilation in the buildings. In addition, campers engaged "daily vigorous singing and cheering," activities likely to contribute increased transmission.

Childcare Centers

The experiences of childcare centers that remained open for essential workers also contribute to our understanding of the risks posed by bringing young children into buildings and classroom settings. Yale University researchers conducted a large-scale assessment of 57,000 child care providers across all 50 states. They found that child care providers were *not* more likely to contract COVID-19, whether their workplace closed or stayed open.[103] "We found there was absolutely no relationship between working in child care settings and contracting the virus" said Yale professor Walter Gilliam, who led the study.[104]

However, a smaller CDC study of three summer childcare facilities in Utah found that 12 children became infected but had mild to no symptoms. Through contact tracing, researchers determined that the children infected at least one in four of their close contacts—usually mothers and siblings—suggesting that children do in fact transmit the virus.[105] Another CDC study of household transmission in Tennessee and Wisconsin came to a similar conclusion.[106] There is some debate as to whether the children became infected in the childcare setting or if they were infected within their household.

Finally, researchers in France looked at infections among children from 5 months to 4 years who attended daycare during the spring lockdown. The children had low rates of infection, and those who contracted COVID-19 were more likely to have been infected at home rather than at the centers. Infection rates for staff were comparable to adults working in other fields. The study suggests that educational settings can open with certain safety measures in place. [107]

Assessments of Available Research by Government Entities and Medical Associations

Our collective understanding of COVID-19 is evolving based on ongoing research and data from all over the world. A number of government entities and medical associations have developed conclusions and recommendations based on their examination of the research. The following are excerpts from their assessments.

The Centers for Disease Control and Prevention (CDC)

The CDC has always maintained a small element of skepticism about the effectiveness of school closures during COVID-19. On March 13, 2020 the CDC released guidance related to school closures, expressing doubts that short-term shutdowns are effective:[108]

> "Available modeling data indicate that early, short-to-medium closures do not impact the epi curve of COVID-19 or available health care measures (e.g., hospitalizations). There may be some impact of much longer closures (8 weeks, 20 weeks) further into community spread, but that modeling also shows that other mitigation efforts (e.g., handwashing, home isolation) have more impact on both spread of disease and health care measures."[109]

During a November 19, 2020 briefing of the White House Coronavirus Taskforce, CDC Director Dr. Robert Redfield reiterated many of these conclusions:[110]

> "For example, as was mentioned, last spring, CDC did not recommend school closures, nor did we recommend their closures today. I will say, back in the spring, there was limited data; today, there's extensive data … to confirm that K-12 schools can operate with face-to-face learning, and they can do it safely and they can do it responsibly. The infections that we've identified in schools were not acquired in schools. They were actually acquired in the community and in the household. Today, our big threat for transmission is not the public square; it's small family gatherings—family gatherings where people become more comfortable; they remove their face mask and they get together. And it's a silent epidemic that begins to transmit. But it's not intra-school transmission. The truth is, for kids K through 12, one of the safest places they can be, from our perspective, is to remain in school. And it's really important that—following the data, making sure we don't make emotional decisions about what to close and what not to close. And I'm here to say clearly: The data strongly supports that K-12 schools, as well as institutes of higher learning, really are not where we're having our challenges. And it would be counterproductive, from a public health point of view, if there was an emotional response to say, "Let's close the schools."

On January 27, 2021, President Biden's CDC Director Dr. Rochelle Walensky said the available evidence suggests schools do not result in the rapid spread of the coronavirus when mitigation measures are followed. She commented, "CDC recommends that K-12 schools be the last settings to close after all other mitigation measures have been employed and the first to reopen when they can

do so safely." On February 3, she also added "There is increasing data to suggest that schools can safely reopen and that safe reopening does not suggest that teachers need to be vaccinated...Vaccinations of teachers is not a prerequisite for safely reopening schools."[111]

Report: *"Transmission of SARS-CoV-2 in K-12 schools", February 12, 2021* [112]

Excerpts:

- "Although children can be infected with SARS-CoV-2, can get sick from COVID-19, and can spread the virus to others, less than 10% of COVID-19 cases in the United States have been among children and adolescents aged 5–17 years."
- "Children are less likely to develop severe illness or die from COVID-19."
- "Based on the data available, in-person learning in schools has not been associated with substantial community transmission."
- "Increases in case incidence among school-aged children and school reopenings do not appear to pre-date increases in community transmission."
- "For schools to provide in-person learning, associations between levels of community transmission and risk of transmission in school should be considered. If community transmission is high, students and staff are more likely to come to school while infectious, and COVID-19 can spread more easily in schools."
- "Some studies have found that it is possible for communities to reduce incidence of COVID-19 while keeping schools open for in-person instruction."
- "Significant secondary transmission of SARS-CoV-2 infection can and does occur in school settings when mitigation strategies are not implemented or are not followed."
- "Evidence suggests that staff-to-staff transmission is more common than transmission from student to staff, staff to student, or student to student."
- "When mitigation strategies—especially mask use and physical distancing—are consistently and correctly used, the risk of transmission in the school environment is decreased."
- "Use of multiple strategies—sometimes called layered mitigation—provides greater protection in breaking transmission chains than implementing a single strategy. The guidance recommends layering two or more mitigation strategies, with particular emphasis on universal use of masks and physical distancing."

The United Kingdom Department for Education

Report: *Overview of Scientific Advice and Information on Coronavirus (COVID-19)*, May 2020 [113]

Excerpts:

- "There is a high degree of confidence that the severity of disease in children is lower than in adults."
- "There is a moderate to high degree of confidence that the susceptibility to clinical disease of younger children (up to age 11 to 13) is lower than for adults. For older children there is not enough evidence yet to determine whether susceptibility to disease is different to adults."
- "The susceptibility to infection of younger children (up to age 11 to 13) might be lower than for adults, but the degree of confidence in this is low. For older children there is not enough evidence yet to determine whether susceptibility to infection is different to adults."
- "There is no evidence to suggest that children transmit the virus any more than adults. Some studies suggest younger children may transmit less, but this evidence is mixed and provides a low degree of confidence at best."

The American Academy of Pediatrics

Report: *COVID-19 Planning Considerations: Guidance for School Re-entry*, June 2020 [114]

Excerpts:

- "The preponderance of evidence indicates that children and adolescents are less likely to be symptomatic and less likely to have severe disease."
- "At present, it appears that children younger than 10 years may be less likely to become infected and less likely to spread infection to others, although further studies are needed. More recent data suggest children older than 10 years may spread SARS-CoV-2 as efficiently as adults, and this information should be part of the considerations taken in determining how to safely and effectively open schools."
- "The AAP strongly advocates that all policy considerations for the coming school year should start with a goal of having students physically present in school. Unfortunately, in many parts of the United States, there is currently uncontrolled spread of SARS-CoV-2. Although the AAP strongly advocates for in-person learning for the coming school year, the current widespread circulation of the virus will not permit in-person learning to be safely accomplished in many jurisdictions."

Report: *COVID-19 Guidance for Safe Schools*, January 2021 [115]

Excerpts:

- "New information tells us that opening schools does not significantly increase community transmission of the virus. However, it is critical for schools to closely follow guidance provided by public health officials," said Dr. Lee Beers, president of the AAP.

- "To be able to keep schools safe, it is vitally important that communities take all necessary measures to limit the spread broadly of SARS-CoV-2 throughout the community.
    - It is critical to use science and data to guide decisions about the pandemic and school COVID-19 plans.
    - School transmission mirrors but does not drive community transmission.
    - Community-wide approaches to mitigation are needed for schools to open and remain open.
    - Adequate and timely COVID-19 testing resources must be accessible."
- "The AAP strongly advocates that all policy considerations for school COVID-19 plans should start with a goal of having students physically present in school. Although the AAP strongly advocates for in-person learning, the current widespread circulation of the virus will require jurisdictions to review the local data as well as the current evidence on transmission in schools to determine the feasibility of in-person instruction. The importance of in-person learning is well-documented, and there is already evidence of the negative impacts on children because of school closures in 2020."
- "Although children and adolescents play a major role in amplifying influenza outbreaks, to date, this does not appear to be the case with SARS-CoV-2."

National Academies of Sciences, Engineering, and Medicine

Report: *Reopening K-12 Schools During the COVID-19 Pandemic: Prioritizing Health, Equity, and Communities*, July 2020 [116]

Excerpts:

- "Evidence to date suggests that children and youth (aged 18 and younger) are at low risk of serious, long-term consequences or death as a result of contracting COVID-19. However, there is insufficient evidence with which to determine how easily children and youth contract the virus and how contagious they are once they do."
- "While some measures—such as physical distancing, avoiding large gatherings, handwashing, and wearing masks—are clearly important for limiting transmission, there is no definitive evidence about what suite of strategies is most effective for limiting transmission within a school setting when students, teachers, and other staff are present. The fact that evidence is inadequate in both of these areas—transmission and mitigation—makes it extremely difficult for decision-makers to gauge the health risks of physically opening schools and to create plans for operating them in ways that reduce transmission of the virus."
- "Given the importance of in-person interaction for learning and development, districts should prioritize reopening with an emphasis on providing full-time, in-person instruction in grades K-5 and for students with special needs who would be best served by in-person instruction."
- "Although it is clear that onward transmission from infected children is possible, it is not yet clear whether children are less likely to transmit than are adults, on average. Several studies have shown that viral loads in symptomatic children are similar to those of adults. However, studies of viral load do not always correlate well with infectiousness, and little information is

available on the infectiousness of asymptomatic or subclinically infected children. These uncertainties make it difficult to evaluate the epidemiological risks of reopening schools. If children are efficient transmitters, evidence from influenza suggests that physically reopening schools (without mitigation measures) could contribute substantially to community spread. However, if children are not efficient transmitters or if such mitigation measures as use of face coverings are very effective, physically reopening will be safer."

European Centre for Disease Prevention and Control (ECDC)

Report: *COVID-19 in children and the role of school settings in COVID-19 transmission*, August 2020 [117]

Excerpts:

- "When diagnosed with COVID-19, children are much less likely to be hospitalised or have fatal outcomes than adults.
- "Children are more likely to have a mild or asymptomatic infection, meaning that the infection may go undetected or undiagnosed."
- "While very few significant outbreaks of COVID-19 in schools have been documented, they do occur, and may be difficult to detect due to the relative lack of symptoms in children."
- "Investigations of cases identified in school settings suggest that child-to-child transmission in schools is uncommon and not the primary cause of SARS-CoV-2 infection in children whose onset of infection coincides with the period during which they are attending school, particularly in preschools and primary schools."
- "Available evidence appears to suggest that transmission among children in schools is less efficient for SARS-CoV-2 than for other respiratory viruses such as influenza."
- "Closures of childcare and educational institutions are unlikely to be an effective single control measure for community transmission of COVID-19 and such closures would be unlikely to provide significant additional protection for the health of children, most of whom develop a very mild form of COVID-19 disease, if any."
- "Deaths among cases of individuals under 18 years of age were extremely uncommon; only six out of 19,654 (0.03 percent) deaths reported were among children. This corresponds to a crude case-fatality of 0.03 percent among those aged under 19 years, compared to 5.8 percent among those aged 18 years and above, driven largely by deaths in cases aged 60 years and above, where case-fatality rates increase to 36 percent among those aged 90 years or above."
- "In summary, clusters in educational facilities were identified in several of the 15 reporting countries, however those that occurred were limited in number and size, and were rather exceptional events. Several countries specifically said that they had no indication that school settings played a significant role in the transmission of COVID-19. Secondary transmission in schools, either from child-to-child or from child-to-adult, was perceived to be rare."

British Columbia Centre for Disease Control (BCCDC)

Report: *Impact of School Closures on Learning, Child and Family Well-Being During the COVID-19 Pandemic*, September 2020 [118]

Excerpts:

- "Transmission among children is lower than adults, with evidence suggesting children in school and daycare settings are consistently less likely to become infected than adults."
- "Contract tracing studies of school outbreaks have identified limited transmission by children to other household members, other students, or staff."
- "Virus transmission from children to adults is uncommon, and within families, transmission of the virus tends to be from adults to children."
- "While transmission does occur in schools, global evidence suggests schools have not been a major source of outbreaks. Data compiled from four studies of school exposures suggests a 0.01 percent attack rate within schools."
- "In Canada, there have been 9,302 cases in children and youth 0-19 years, with 132 hospital admissions, 26 ICU admissions and 1 death as of Aug 5, 2020."

World Health Organization (WHO)

Q&A*: Coronavirus Disease (COVID-19): Schools*, September 2020 [119]

Excerpts:

- "So far, data suggests that children under the age of 18 years represent about 8.5 percent of reported cases, with relatively few deaths compared to other age groups and usually mild disease. However, cases of critical illness have been reported. As with adults, pre-existing medical conditions have been suggested as a risk factor for severe disease and intensive care admission in children."
- "The role of children in transmission is not yet fully understood. To date, few outbreaks involving children or schools have been reported. However, the small number of outbreaks reported among teaching or associated staff to date suggests that spread of COVID-19 within educational settings may be limited."
- "Transmission from staff-to-staff was most common; among staff and students was less common; and student-to-student spread was more rare." UK's Children's Task and Finish Group for Scientific Advisory Group for Emergencies (SAGE)

Report: *Risks Associated with the Reopening of Education Settings*, September 2020 [120]

Excerpts:

- "There is high confidence that the severity of COVID-19 is lower in children than adults, and moderate confidence that children are less susceptible to infection."

- "There is evidence that adults have higher susceptibility to infection (low confidence) and clinical disease (high confidence) than children. It follows that staff in educational settings have a higher risk of experiencing severe symptoms than students. There is some, but limited evidence, that children play a lesser role in transmission than adults (moderate confidence). There is little direct evidence of transmission from pupils to teachers."
- "This suggests that any risk to teachers may be less associated with contact with students, and more associated with potential contacts with other school staff, or parents/carers. For many school staff the risk of severe health outcomes will be lower than people of retirement age."
- "In countries where schools have been open for some time, data suggests that school opening has made little difference to community transmission."
- "Evidence indicates that children/adolescents have lower susceptibility to SARS-CoV-2 infection (low confidence) and clinical disease (high confidence) than adults, although evidence on any underlying mechanism is less clear."

Report: *Update on Children, Schools and Transmission*, November 2020 [121]

Excerpts:

- "In the second wave, prevalence has risen significantly in school age children, with the rise increasing initially among those in school year 12 (age 16/17) – age 24 and young people (e.g. secondary school age). The rising prevalence was first visible around the time that schools reopened. While this may be indicative of a potential role for school opening, causation, including the extent to which transmission is occurring in schools, is unproven and difficult to establish."
- "ONS data from 2 September to 16 October show no difference in the positivity rates of pre-school, primary and secondary school teachers and staff, relative to other workers of a similar age (medium confidence)."
- "ONS COVID-19 Infection Survey (CIS) and REACT-1 data show continued increases in the prevalence of infection in those aged 2-24 between September and October, with earlier increases and higher prevalence in those in school year 12 (age 16/17) – age 24 and school year 7-11 (high confidence)."
- "Evidence suggests that mixing outside the home continued to occur during school closures. Following school opening in September, the reported number of contacts for children aged 5-11 and 12-17 in England increased overall and in schools (medium-high confidence). Overall reported contacts at this time occurred primarily within schools, but also in the home and community (low confidence)."
- "Children can transmit within households as well as in educational settings. As the prevalence of infection in children aged 12-16 increased between September and October, ONS analysis suggests that children aged 12-16 played a significantly higher role in introducing infection into households (medium confidence). The difference is less marked for younger children (medium confidence). The relative rate of external exposure (i.e. bringing infection into the household) for children aged 2-16 was found to be higher than for adults. For those aged 12-16 there was a marked increase in the period after schools opened."

Report: *Update on Children, Schools and Transmission*, December 2020 [122]

Excerpts:

- "Overall, accumulating evidence is consistent with increased transmission occurring amongst school children when schools are open, particularly in children of secondary school age (high confidence): multiple data sources show a reduction in transmission in children following schools closing for half term, and transmission rates increasing again following the post-half term return to school (medium confidence). It is difficult to quantify the size of this effect, and it remains difficult to quantify the level of transmission taking place specifically within schools compared to other settings."
- "ONS CIS data to 12 Dec 2020 show the rates of those testing positive for SARS-CoV-2 continue to be highest in secondary school age (11/12 to 15/16 years) children in England; between 13th Nov – 3rd Dec also show the highest prevalence in children aged 13-17 years (high confidence)."
- "Multiple available data sources (DfE analysis 4 of ONS Covid-19 Infection Survey and Pillar 2 data) suggest that secondary school-aged children became infected at a slower rate during half term than during the preceding term-time period (medium confidence). This pattern is consistent with there being an effect of schools being open on increasing the spread of the virus amongst children. There is not enough evidence to quantify the size of the effect of school closures, or indicate what the impact is (if any) on the wider community."
- "Children can transmit within households as well as in educational settings. Previous analysis of ONS data discussed at SAGE 65 indicated that children aged 12-16 were playing a higher role in introducing infection into households than those 17 or over (i.e. being the index case). An update of this analysis with data until 2nd Dec 2020 still supports this, however the increased likelihood has reduced (medium confidence). The difference remains less marked for those under 12 (medium confidence)."
- "ONS CIS data from 2 Sept-16th Oct show no evidence of difference in the rates of teachers/education workers testing positive for SARS-CoV-2 compared to key workers and other professions (medium confidence). This is seen even when combining different categories of school staff in the analysis."

Netherland's National Institute for Public Health and the Environment

Report*: Children, School and COVID-19*, January 2021[123]

The agency released a series of data on children with COVID-19. Children accounted for lower hospitalization rates not only in the spring, but also in the fall when schools reopened.

They also found that 94.5 percent of all cases resulted from a patient older than 18 years old. Only 0.7 percent of cases were source patients between the ages of 4-11 and 4.6 percent between the ages of 12-17. They concluded that "children only play a minor role in spreading the novel coronavirus compared to adults. However, the number of infections in children and how contagious

they are do increase as they get older." An investigation of clusters at secondary schools led by the Municipal Public Health Services (GGDs) found that COVID-19 spread outside of schools in over half of the cases.

Table 5. Hospital Admissions

	June 1 to September 17		September 18 to January 4	
Age group	Hospitalization	Percentage	Hospitalization	Percentage
0 to 3	14	2.0%	102	1.3%
4 to 11	3	0.4%	17	0.2%
12 to 17	4	0.6%	24	0.3%
Adults	677	97.0%	7,761	98.2%

Source: National Institute for Public Health and the Environment, "Children, School and COVID-19," Netherlands, January 6, 2021

The Costs of School Closures

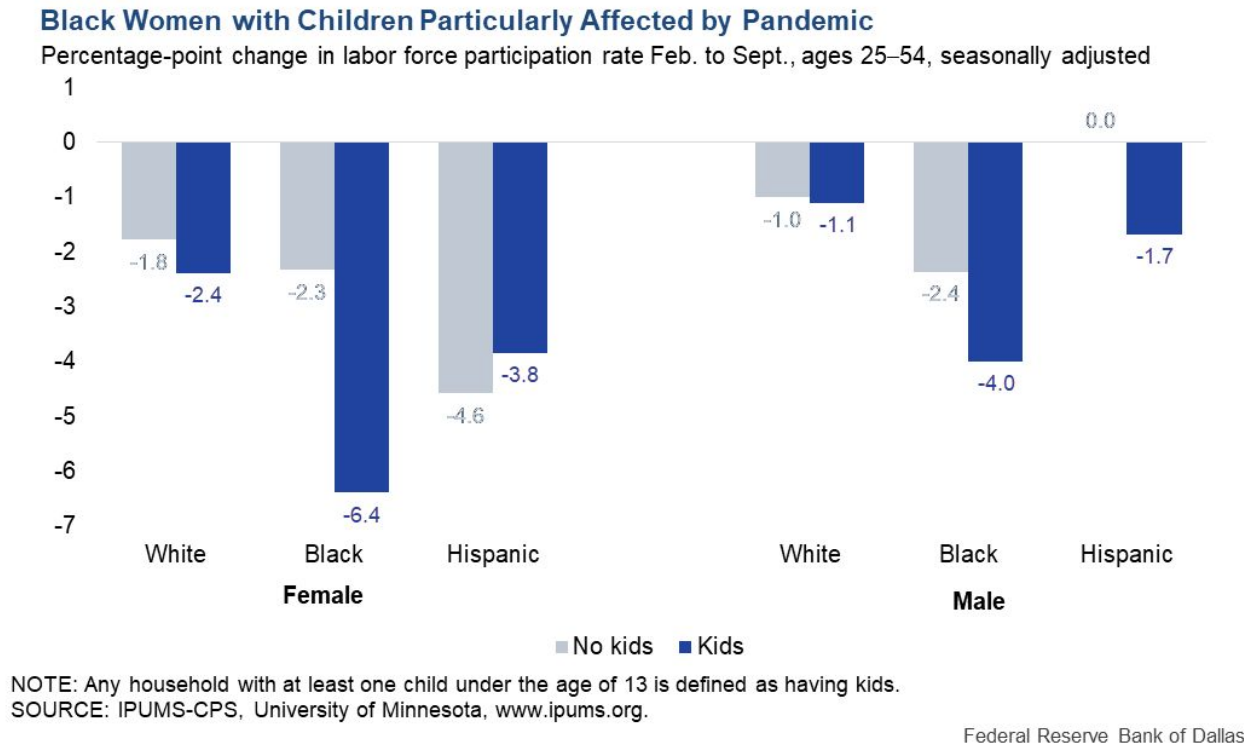
Any public health benefits from closing schools must be weighed against the costs—educational, economic, and social/emotional—imposed on students and their families. Children are suffering the collateral consequences of the pandemic and economic recession. A Child Trends analysis of the Census Household Pulse Survey found that 29 percent of Latino and 31 percent of Black households with children are experiencing three or more concurrent health and economic hardships. These include unemployment, difficulty paying expenses, rent or mortgage, food insecurity, physical health problems, symptoms of anxiety or depression, and lack of health insurance.[124] At least 10 percent of school-age children had a COVID-19-related death in the family, 18 percent had a parent lose a job, and 45 percent of households suffered a drop in income.[125] A growing body of research over the last ten months reveals some of these short-term and long-term effects.

Economic Impact on Parents

At least 20 million children are living in a household with someone who lost a job.[126] The economic effects have been particularly devastating for mothers. A Washington University in St. Louis study found that at the beginning of the 2019-20 school year, the labor participation rate with mothers was, on average, 18 percentage points less than fathers. By September 2020, the gap grew to over 23 percentage points in states where schools primarily offered remote instruction. In comparison, in states where in-person instruction was most common, the gender gap in parents' labor force participation grew by less than 1 percentage point, to 18.4 percent.[127]

The Federal Reserve Bank of Dallas also found that women were more likely to leave the labor force to care for their children at home with the transition to remote school. More than twice as many Black women with children had left the workforce since the beginning of the pandemic than white women with children.[128] [129] There are 1.6 million fewer mothers in the labor force than would be expected without school closures.[130]

Figure 7: Black Women with Children Particularly Affected by Pandemic



NOTE: Any household with at least one child under the age of 13 is defined as having kids.
SOURCE: IPUMS-CPS, University of Minnesota, www.ipums.org.

Federal Reserve Bank of Dallas

Student Learning Loss

The shift to online learning and the uneven reopening of schools in the fall raises serious questions about the detrimental impact on student learning, particularly for the most vulnerable students. Without the usual assessments and testing during the pandemic, the dearth of standardized data has created gaping blind spots in educators' understanding of the depth and breadth of their students' deficits.

Given the urgent nature of the school closures, instruction shifted online—in some cases, practically overnight—with little time for planning or professional development for teachers. Initially, many families simply did not have the devices or connectivity needed to access their coursework or participate in live videoconferenced instruction. An analysis by Boston Consulting Group and Common Sense Media estimated this digital divide affected as many as 15 million students.[131] As with so many other challenges of the pandemic, Black and Latino students are disproportionately impacted, with 30 percent and 26 percent lacking connectivity, respectively. This lack of connectivity also presents challenges for reopening schools given the reliance on hybrid learning models and other online learning to complement in-person instruction.

Often, even those students who could connect found a less-than-interactive experience. By May 12, parents reported only 4.2 hours of live virtual contact between their children and teachers *over the*

previous seven days.[132] Even by December 2020, 22 percent of households earning less than $22,000 reported no live contact with their teachers compared to just 7 percent of families earning more than $100,000.

Table 6: Days Spent in Live Contact with Teachers, in the Last 7 Days

	None	1 day	2-3 days	4 or more days
Less than $25,000	22%	5%	12%	62%
$25,000 - $34,999	11%	5%	16%	67%
$35,000 - $49,999	16%	4%	17%	63%
$50,000 - $74,999	12%	3%	17%	67%
$75,000 - $99,999	13%	7%	15%	66%
$100,000 - $149,999	10%	2%	16%	71%
$150,000 - $199,999	7%	4%	15%	74%
$200,000 and above	6%	1%	14%	79%

Source: United States Census Bureau, "Week 21 Household Pulse Survey: December 9-December 21," January 6, 2021,

Researchers from the University of Pennsylvania, Northwestern University, University of Amsterdam, and Yale University developed a model to provide preliminary estimates of the impacts on children who switched to remote learning. "Children from poorer families do relatively worse with virtual compared to regular schooling," they concluded. "They are less likely to benefit from positive peer spillovers during the crisis; and their parents are less likely to work from home and hence less likely to be able to provide them with maximum support for virtual schooling. The end result is that learning gaps grew during the pandemic. Our model also predicts that wider achievement gaps will persist until children finish high school, suggesting that children's long term prospects are at risk."[133]

What is clear is that many students suffered a dramatic loss of learning this year. Stanford University's Center for Research on Education Outcomes analyzed data from 19 states and found that the average student lost between 57 and 183 days of learning in reading and between 136 and 232 days of learning in math in the spring.[134] Bellwether Education Partners estimates as many as 3 million of the most at-risk students may not have received any formal education, virtual or in-person, since schools closed in March.[135] Individual school district reports paint a similarly bleak picture. For example, the Los Angeles Unified School District reported that 50,000 of its Black and Latino middle and high school students did not regularly participate in online instruction.[136]

The impact on student education outcomes is deeply troubling. McKinsey & Company analyzed assessment data from the Curriculum Associates' i-Ready platform and found that students in their sample learned only 67 percent of the math and 87 percent of the reading that grade-level peers would typically have learned by the fall. Following those trends, students could lose as much as nine months of learning in math by the end of the year. Students of color could lag behind by a full year. [137]

The i-Ready data also provided a baseline for comparison with schools that reopened for in-person instruction. For example, while Chicago Public Schools continued with remote learning, the city's Catholic schools had 80 percent of their students resume in-person instruction with 20 percent opting for remote learning. More than 17 percent of in-person students participated in an i-Ready assessment in which they outperformed learning growth expectations in both reading and math (105 percent in math and 130 percent in reading.)[138]

Figure 8: Most Students Are Falling Behind, but Students of Color Are Faring Worse

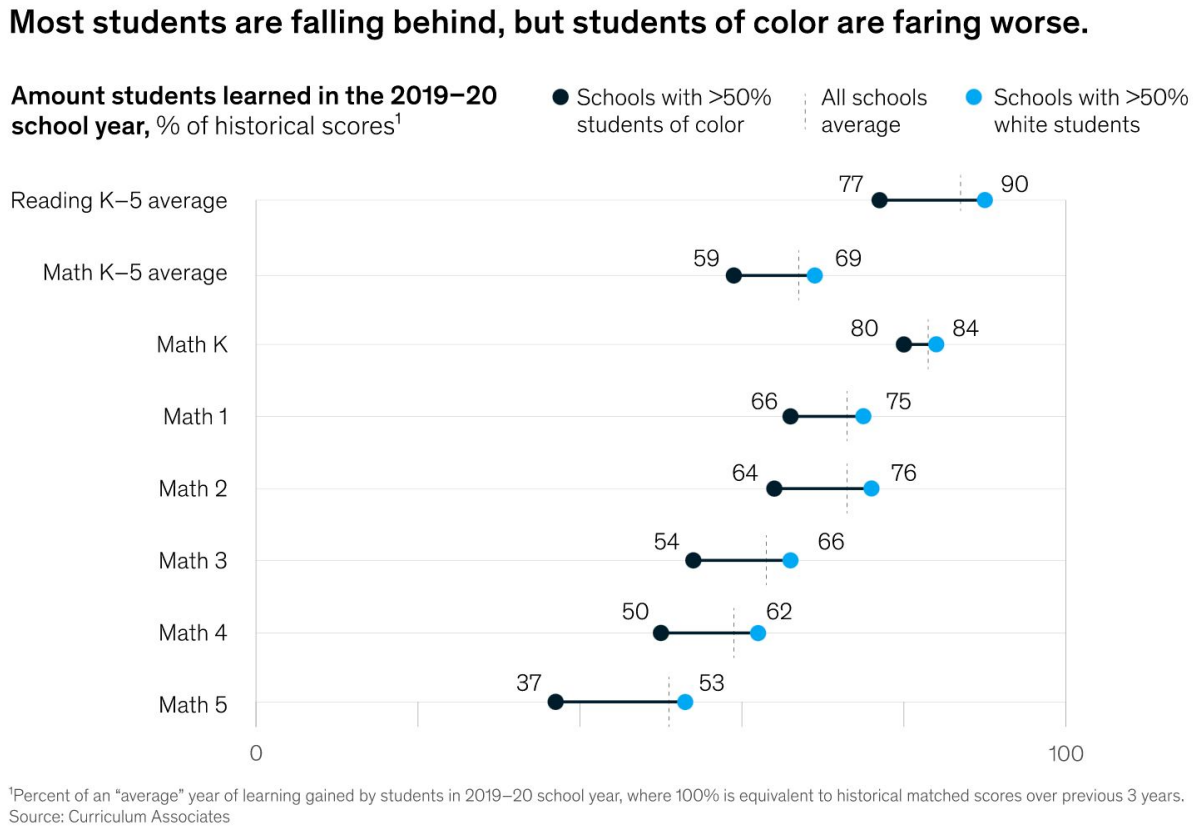
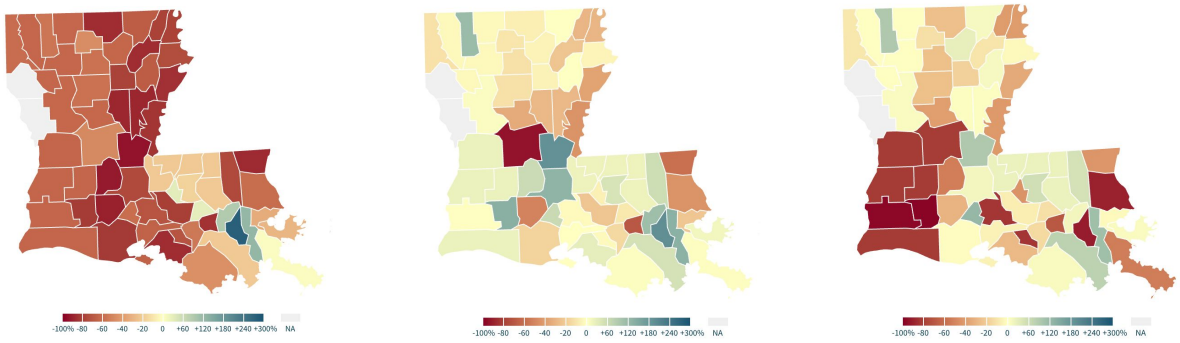


Exhibit from "COVID-19 and learning loss – disparities grow and students need help", December 2020, McKinsey & Company.

Data from Zearn, a nonprofit math learning platform and curriculum, highlights how learning loss disproportionately affects students in low-income communities. Zearn Math data in the Opportunity Insights Economic Tracker[139] reveals that no meaningful participation gap existed between low- and high-income communities pre-pandemic; however, when schools began closing in the spring, a stark divergence in student participation emerged between high and low-income schools. By late April 2020, participation was down 25 percent overall for the sample set of schools. However when the data was sliced by income level, a disturbing discrepancy emerged: In high-income zip codes, participation was up 3 percent, while low-income zip codes showed a steep decline of 39 percent.

When schools reopened in the fall, the gap between high- and low-income communities narrowed but persisted. In mid-November 2020, Zearn participation overall was down 10 percent relative to January 2020 levels. For high-income communities, it was up 1 percent but down 15 percent for low-income communities.

Zearn data from April 26, October 4, and January 24 show the variation of student math progress in different regions throughout Louisiana. The real-time insights help to illustrate where students are accelerating and where some students continue to fall behind.



Source: *Opportunity Insights Economic Tracker*

This national variation isn't consistent region-by-region. The impact of school closures has differed across states, counties and metropolitan regions. In some places, low-income students were indeed continuing to learn during the spring. For example, in Connecticut specifically, participation in April 2020 was up 56 percent overall, and up an even greater 111 percent in low-income communities.

An analysis comparing DIBELS benchmark data from the beginning of the 2019-20 and 2020–21 school years highlight the effects of COVID-19 disruptions. Approximately 400,000 students in

1,400 schools across 41 states were included in the analysis. First grade had the biggest decrease in the percentage of students on track and a corresponding increase in the percentage of students needing intensive intervention. The increase from 27 percent deemed "well-below grade level" in 2019 to 40 percent in 2020 represents a nearly 50 percent increase in the number of students entering that grade at risk.[140]

Renaissance Learning analyzed a sample of more than five million students in grades 1–8 from all 50 states plus Washington, D.C. who took their Star Early Literacy, Star Reading, or Star Math assessments during both fall 2019 and fall 2020. Students in some grades performed close to expectations in reading, but in others they were as far as seven weeks behind. In math, all grades showed students performing below expectations, with some grades 12 or more weeks behind. Researchers estimated fifth and sixth graders would need as many as twelve or more weeks of additional instruction in math to reach beginning-of-year expectations. For reading, Renaissance estimated children in fourth through seventh grades would need four to seven weeks to catch up.[141] Students in other grades would need somewhat less instructional time to catch up.

The North West Evaluation Association (NWEA) examined MAP Growth assessment data from nearly 4.4 million students in grades 3-8 across more than 8,000 schools who took the test in both fall 2019 and fall 2020. In math, students scored 5 to 10 percentile points lower than same-grade students last year, but reading results were mostly the same. However, there are important caveats to this research, as a large number of students who typically would take the test were missing, including many students who were at the most risk. [142]

An analysis of data from the Ohio Third-Grade English Language Arts (ELA) assessment by Ohio State University researchers revealed an average drop in scores equivalent to one-third of a year's worth of learning. Declines in the test scores of Black students were nearly 50 percent greater than white students, representing a total loss of one-half of a year's worth of learning. Achievement declines were more severe in districts that began the academic year using fully remote instruction compared with districts using either hybrid or in-person instruction.[143]

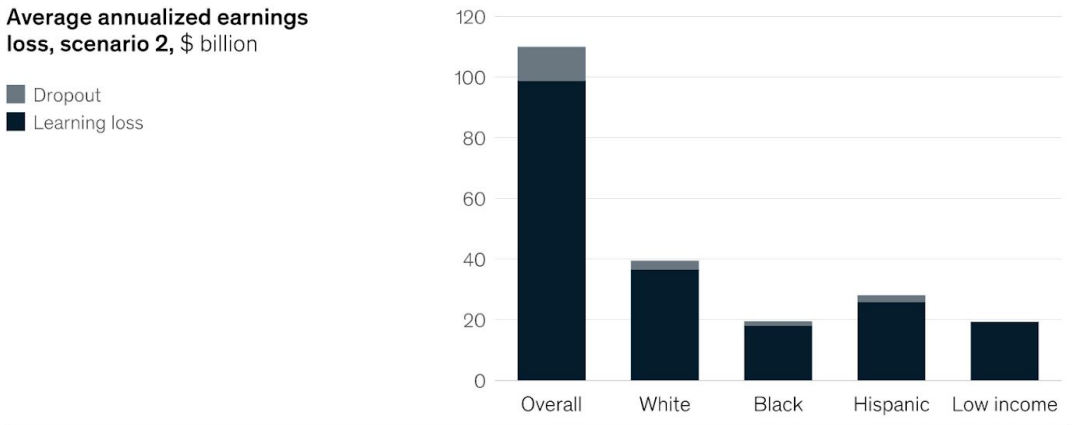
The PACE research center (led by faculty directors at Stanford University, the University of Southern California, the University of California Davis, the University of California Los Angeles, and the University of California Berkeley) analyzed assessment data for grades 4–10 across the 18 school districts within the CORE Data Collaborative. Fifth graders lost approximately two points on NWEA's Measures of Academic Progress assessment in reading and math, whereas they would have gained 10 points in a typical year. On the Renaissance STAR assessment, sixth graders lost almost 30 points in reading. Researchers found concerning equity gaps as well. In some grades, students from socioeconomically disadvantaged backgrounds experienced learning loss, while higher income students saw their learning accelerate. Researchers warned, "These differences in learning rates continue to widen achievement gaps that already existed between individual students in these groups." [144]

Learning deficits and widening achievement gaps are difficult to remedy and can have lifelong consequences as measured by high school graduation, college attainment, income earnings, and even mortality rates.

Longer Term Consequences for Students

These short-term educational shocks have long term economic consequences for students. Separate analyses conducted by McKinsey & Company[145] and Opportunity Insights[146] arrived at the same conclusion: The average student could lose between $61,000 to $88,000 in lifetime earnings, attributed solely to these learning losses. These costs are significantly higher for Black and Hispanic Americans. Black students are estimated to earn $2,186 less per year; Hispanic students $1.809 less per year, and white students $1,348 less per year.

Figure 9: Average Annualized Earnings Loss by Race and Ethnicity



Estimated effect of learning loss					
Number of students affected, million	55.3	27.1	8.3	14.3	11.8
Average annual earnings lost, $	1,785	1,348	2,186	1,809	1,642
Average lifetime earnings lost, %[1]	2.2	1.6	3.3	3.0	4.0
Estimated effect of higher number of dropouts					
Average number of high-school dropouts, thousand	648	263	114	233	NA
Average annual earnings lost, $[2]	17,218	10,951	11,879	9,280	NA
Average lifetime earnings lost, %[1]	21.2	13.2	18.1	15.2	NA

Exhibit from "COVID-19 and student learning in the United States: The hurt could last a lifetime." June 2020, McKinsey & Company. Copyright (c) 2021 McKinsey & Company. All rights reserved. Reprinted by permission.

Michael Strain, director of economic policy studies at the American Enterprise Institute, also quantified the economic costs of these learning deficits. The consensus among economists is that an additional year of schooling increases wages by roughly 9 percent. Strain estimates that school closures could translate into a loss of over $30,000 in earnings per decade for a typical worker who graduated high school but did not attend college.[147]

Such losses have implications for the country's macro-economy as well. A working paper from the Organisation for Economic Co-operation and Development (OECD) estimates that pandemic learning losses could result in a 1.5 percent decrease (nearly $14 trillion) in future gross domestic product (GDP). Eric Hanushek and Ludger Woessmann warn that "just returning schools to where they were in 2019 will not avoid such losses. Only making them better can."[148] A paper from the Federal Reserve Bank of San Francisco also projects learning disruptions will decrease annual economic output a quarter of a percentage point on average over the next 70 years. Although these impacts may not be immediately felt, the consequences will peak in 25 years when today's students reach prime working age.[149]

Child Well-Being

Less visible is the emotional toll on children caused by the isolation and anxiety that come with school closures and shelter-in-place orders. In a June 2020 Gallup survey, 29 percent of parents reported that their child had already experienced emotional or mental health challenges because of social distancing and school closures.[150] According to the CDC, the proportion of mental health related visits for children ages 5–11 and 12–17 increased by approximately 24 percent and 31 percent, respectively, from 2019.[151]

The CDC also reported at the end of June 2020 that the number of children suffering from anxiety and depression were higher than in previous years. Nearly 11 percent of all respondents said they had "seriously considered" suicide in the past 30 days. That number more than doubled among young people ages 18 to 24, where 1 in 4 had considered suicide.[152]

News reports from around the country illustrate this alarming trend. Pima County in Arizona experienced a 67 percent increase in suicides this year among children ages 12 to 17.[153] The *New York Times* reported that an alert system used by the Clark County School District in Nevada flagged more than 3,100 potential suicide risks based on student writing on school-issued iPads. By December, 18 students had taken their own lives.[154] UCSF Benioff Children's Hospital of Oakland reported a 66 percent increase in the number of suicidal children in the ER, a doubling of adolescents hospitalized for eating disorders, and a 75 percent increase in youth seeking mental health services who required immediate hospitalization.[155]

Schools also serve an important role in a well-functioning and integrated child welfare system, often providing multiple points of assessment and intervention for children and parents. The closure of schools disrupted that system leaving many children vulnerable. For example, researchers from the

University of Alabama and University of Michigan used two studies conducted early in the pandemic to evaluate maltreatment risk which revealed disturbing conditions One study of parents found increased physical and verbal conflict and neglect.[156] Financial concerns doubled the odds of verbal aggression, and loneliness was associated with a 176 percent increase in the odds of neglecting their children. Parents who felt "worried" were associated with a 178 percent increase in the odds of more conflict and a 148 percent increase in the odds of hitting their children more often.
A number of research studies also point to other health issues resulting from school closures. An NIH paper estimates that COVID-19 school closures will cause 1.27 million new cases of childhood obesity.[157] The CDC and Blue Cross Blue Shield Association (BCBSA) have seen a steep decline in routine childhood vaccinations (as much as 26 percent), compared with 2019.[158] According to BCBSA, children were likely to miss an estimated 9 million vaccine doses in 2020, a decrease of 26 percent for measles and a decrease of 16 percent for polio.[159]

A University of Chicago paper sought to understandthe impact of isolation and job loss on deaths of despair—deaths due to drug overdose, suicide, or alcohol. The pandemic and recession were associated with a 10 to 60 percent increase in deaths of despair above already high pre-pandemic levels. Men, including those as young as 15, were most disportionately affected.[160]

A Path To Reopening

Over the course of the past year, through scientific research and lived experiences, our deepening understanding of the significant costs of school closures has sparked new urgency to return children to in-person classrooms. Medical breakthroughs and increasingly robust scientific research provide a promising backdrop for better informed decision making by state and local officials as they craft their reopening strategies.

Risks for Children and School Staff

The vast majority of research from around the world suggests that children comprise a small proportion of diagnosed COVID-19 cases, develop less severe illness, and have lower mortality rates. Attending school does not increase risk to children, particularly if mitigation measures are followed.

Multiple studies also indicate that teachers face no greater risk than other comparable essential worker occupations, including bus drivers, grocery store clerks, retail workers, and health aides. These risks can be further mitigated through the use of protective mitigation measures, such as masks. In most instances where school transmission occurred, it was due to lax enforcement of these protective measures.

Some children, faculty, and staff do face higher risks due to pre-existing health conditions and other social determinants of health. These individuals should have additional accommodations to protect them, including the option to teach or learn from home.

The public health benefits from school closures are also questionable. "The policy and ethical implications of ongoing mandatory school closures, in order to protect others, need urgent reassessment in light of the very limited data of public health benefit," wrote a group of international researchers as far back as August 2020.[161] The majority of studies have since shown that closing schools did little to control the spread of the coronavirus.

Schools Are Not Super-Spreaders

While the degree to which children transmit the coronavirus is still unknown, they do not seem to be super-spreaders. We now have over eleven months of experiences with school closures and reopenings, including several natural experiments that occurred throughout Europe and the United States with schools that stayed open while others shifted to remote only. Schools that reopened with strong health protections in place have had limited impact on community-transmission rates. School outbreaks seem to come from the community, not the other way around. Higher positivity rates in schools mostly reflect community rates, with transmission likely occurring in households or at gatherings outside of school, often in settings with no protective measures.

Combining Multiple Measures to Protect Teachers

Combining multiple protective measures can reduce the overall risk teachers face from SARS-CoV-2 transmission. Every measure has limitations, including vaccines, which is why layers of protection are needed to mitigate risks.

Primary Mitigation Strategies

Research broadly confirms that well-established health measures are effective at reducing SARS-CoV-2 transmission in classroom settings. The most important are wearing masks, physical distancing, hand washing; cleaning and maintaining healthy facilities; and contact tracing in combination with isolation and quarantine.[162]

Masks in particular have proven to be one of the most effective public health tools in the fight against COVID infections. If everyone in a building wears a mask, the efficacy of masks essentially doubles because pathogens face two material barriers—those worn by the inhaler and the exhaler. Two masks that are 70 percent efficient essentially combine to reduce 91 percent of particles.[163] Upgrading to N95 quality masks provides event greater protections.[164] Given this, prioritizing higher quality masks or double masking can be critical for schools, particularly in providing additional protection against new variants of the coronavirus.[165]

There is also broad agreement on the importance of physically distancing students in a classroom but still an ongoing debate as to the minimal distance. The CDC has recommended that students be spaced out at least six feet. But the guidance frequently uses qualifiers such as "when feasible" and "as much as possible" and "should be maximized to the greatest extent possible" which seem to suggest the CDC's standard is an ideal, not a rigid rule. In fact, a number of other medical experts including the AAP, the World Health Organization, the Harvard T.H. Chan School of Public Health, and the National Academies of Sciences, Engineering, and Medicine have all said three feet can provide adequate protection particularly when other health measures are employed.[166] Massachusetts, Virginia, and Indiana all adopted three feet for their schools and did not experience a surge of cases compared to schools that used the more conservative six foot standard.

The six foot distancing standard has its origins going back to a study conducted in 1941 which found that the tiny droplets exhaled when people talk generally fall to the ground within six feet.[167] But more recent scientific evidence suggests that three feet can provide adequate protection, particularly when other protective measures such as masks are employed. An evaluation of 172 studies from 16 countries showed a significant reduction in risk with distancing of at least three feet, but no additional benefit at six feet.[168] Another study published in August 2020 suggested that we evaluate the risks not based simply on distance but instead the combined risk factors or occupancy of a room, ventilation, mask wearing, and whether individuals are speaking or shouting.[169] Less stringent distancing requirements are needed for lower-risk scenarios.

Graphic: Risk of SARS-CoV-2 transmission from asymptomatic people in different settings and for different occupation times, venting, and crowding levels

Source: Jones Nicholas R, Qureshi Zeshan U, Temple Robert J, Larwood Jessica P J, Greenhalgh Trisha, Bourouiba Lydia et al. Two metres or one: what is the evidence for physical distancing in covid-19? BMJ 2020; 370

The CDC estimates that the costs for implementation of their recommended strategies range from $55 (materials and consumables only) to $442 (materials and consumables, additional custodial staff members, and potential additional transportation) per student. The upper bound of their estimates suggest a total cost of $31.6 billion for all students over the entire 2020-2021 academic year.[170] The White House estimates $9.5 billion is needed to cover the associated costs of PPE.[171] These costs are likely to be offset by the more than $67.2 billion for K-12 schools provided under the federal Coronavirus Aid, Relief, and Economic Security (CARES) Act ($13.2 billion) and December COVID relief package ($54 billion).[172]

Additional Prevention Strategies

The CDC issued guidance in late February 2021 outlining ways schools can improve ventilation by opening windows, using portable air cleaners, and improving building-wide filtration systems.[173] The Harvard Healthy Building program has a five-step guide for checking ventilation rates in the classroom including monitoring CO2 levels.[174] Since CO2 is exhaled with aerosols containing SARS-CoV-2 by people infected with COVID-19, low-cost CO2 sensors can often be good indicators of the concentration of COVID-19 indoors.[175] [176] The state of Rhode Island has taken this guidance and provided calculation tools for schools to use as part of their classroom risk assessments.[177] There is also evidence that asymptomatic testing, in the form of surveillance or screening programs, can provide an additional layer of protection as well as detect new cases to reduce the risk of further transmission.[178]

The Rockefeller Foundation conducted COVID testing pilots in Kentucky; Los Angeles; New Orleans, Louisiana; Tulsa, Oklahoma; and Rhode Island using Abbott BinaxNOW tests.[179] The pilot sites were supported with a testing framework developed by the Duke-Margolis Center for Health Policy and the Johns Hopkins Center for Health Security that guided the number and frequency of tests based on various health thresholds.[180]

The early evaluation of these pilots is promising. Mathematica researchers found that weekly screening testing of all students, teachers, and staff can reduce in-school infections by an estimated 50 percent. Screening only teachers and staff was less effective, with estimated reductions in in-school infections ranging from 5 percent for monthly testing to 20 percent for twice weekly testing. Achieving these outcomes came at significant costs and logistical complexity that the study suggested may be challenging for schools to sustain. The study also suggested that other mitigation measures, including wearing masks, social distancing, and opening windows are less expensive and complex to adopt. When widely used, "the expected number of in-school infections may be low to begin with—meaning that a testing program may add relatively little value on top of these other measures."[181]

Regular testing also offers additional assurance to parents and teachers by providing objective data on a daily and weekly basis about the context of the buildings that students and teachers are entering. San Antonio ISD began regular COVID-19 testing in November and found that even as community positivity rates rose above 10 percent, the districts' rate stayed at 1 percent. When tests came back positive, contact tracing almost always led back to family gatherings or infections at home, Superintendent Pedro Martinez called it "assurance testing" as it gave teachers and parents the assurance needed to keep kids in school and continue doing what works—social distancing, hand washing and mask wearing.[182]

The availability of vaccines will help provide an important measure of protection for teachers and eventually children. Teachers should be prioritized for vaccinations. As of March 1, 2021 Education Week's research shows that at least 34 states, the District of Columbia, and Puerto Rico have made some or all teachers eligible to receive the coronavirus vaccine.

Community Conditions

Finally, the decision to open or close schools must be made in the context of broader community indicators, including transmission rates and hospitalizations. The available evidence suggests that different decisions can and should be made for different student populations based on their relative risk. The Harvard Global Health Institute developed a framework to help state and community leaders make these important decisions and determine the most appropriate mitigation strategies through a continuum of risk based on community indicators.[183] One of the primary strengths of this approach is that it differentiates the risks for students of different ages. Depending on the community positivity rates, it may be safer to bring younger students back into the classroom but keep older students in a remote learning environment.

Table 7: COVID-19 Risk Incidence Levels

Covid Risk Level	Case Incidence	
Red	**>25**	daily new cases per 100,000 people
Orange	**10<25**	daily new cases per 100,000 people
Yellow	**1<10**	daily new cases per 100,000 people
Green	**<1**	daily new case per 100,000 people

Risk Levels	Strategy for Pandemic Resilient Teaching and Learning
Red	Stay-at-home orders in place; all learning remote for all learners; districts, states, and federal government invests in remote learning.
Orange	**1st priority for re-opening:** Grades preK-5 and in-person special education services at grade levels preK-8 open if conditions for pandemic resilient teaching and learning spaces can be achieved at scale; districts, states, and federal government invest in healthy buildings and healthy classrooms; in the absence of conditions for pandemic resilient teaching and learning spaces, schools continue with remote learning. **2nd priority for re-opening:** Grades 6-8 and in-person special education services at grade levels 9-12 open if conditions for pandemic resilient teaching and learning spaces can be achieved at scale; districts, states, and federal government invest in healthy buildings and healthy classrooms; in the absence of conditions for pandemic resilient teaching and learning spaces, schools continue with remote learning. **Not a priority for re-opening:** Grades 9-12 maintain remote learning for all learners; districts, states, and federal government invest in remote learning.
Yellow	**1st priority for re-opening:** Grades preK-5 and in-person special education services at grade levels preK-8 open if conditions for pandemic resilient teaching and learning spaces can be achieved at scale; districts, states, and federal government invest in healthy buildings and healthy classrooms; in the absence of conditions for pandemic resilient teaching and learning spaces, schools continue with remote learning. **2nd priority for re-opening:** Grades 6-8 and in-person special education services at grade levels 9-12 open if conditions for pandemic resilient teaching and learning spaces can be achieved at scale; districts, states, and federal government invest in healthy buildings and healthy classrooms; in the absence of conditions for pandemic resilient teaching and learning spaces, schools continue with remote learning. In-person opportunities for special needs students at grade-levels preK-8 are also included. **3rd priority for re-opening:** If sufficient pandemic resilient learning space is available AFTER allocation to K-8, grades 9-12 open on a hybrid schedule, with only a subset of students on campus at any particular point of time to facilitate de-densification; districts, states, and federal government invest in healthy buildings and healthy classrooms AND in remote learning.
Green	All schools open if conditions for pandemic resilient teaching and learning spaces can be achieved at scale; districts, states, and federal government invest in healthy buildings and healthy classrooms

Source: "The Path to Zero and Schools: Achieving Pandemic Resilient Teaching and Learning Spaces," Harvard Global Health Institute

The CDC also provided indicators of community transmission that could be used by schools back in September and were subsequently updated in February 2021.[184] The CDC said the thresholds are intended to help schools assess the risk and inform their mitigation strategies. CDC spokesperson Benjamin Haynes said, "It is not the case that we are saying that schools that are currently open should close because they are in counties in the 'red.' Our recommendation is that schools in red areas can, in fact, provide in-person instruction, as long as they are strictly implementing mitigation and monitoring cases in the school community."[185]

Conclusion

The COVID-19 pandemic presented extraordinary challenges for school systems across the country this year. The crisis also exposed and exacerbated existing inequities and educational gaps in the most vulnerable communities. Early on, state officials and school leaders were forced to act swiftly and make sweeping decisions with incomplete data and scarce federal guidance. Leaders also had to contend with the understandable fears of parents and teachers as well as shoulder responsibility for the potential role of schools in community spread of the virus. What followed was a contentious year marked by confusion, frustration, and, sadly, dramatic learning loss—most significantly in communities of color.

Fortunately, medical advances and a far more rigorous body of research are paving the way for leaders to generate evidence-based plans for reopening schools. Communities need clear and consistent information about the risks, trade-offs, and mitigation strategies for containing COVID-19. We hope this report and its review of the best available body of evidence can provide decision makers with solid grounding to move forward in guiding their communities and schools toward safe school reopenings.

Resources

Considerations for Operating Schools During COVID-19
The Centers for Disease Control and Prevention
https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/index.html
CDC's guidance for school operations, protecting staff, contract tracing, and other resources.

Reopening K-12 Schools During the COVID-19 Pandemic: Prioritizing Health, Equity, and Communities
National Academies of Sciences, Engineering, and Medicine
https://www.nap.edu/catalog/25858/reopening-k-12-schools-during-the-covid-19-pandemic-prioritizing
A report weighing the health risks of reopening K-12 schools against the educational risks of providing no in-person instruction. The report provides a series of evidenced-based recommendations for safely reopening schools.

COVID-19 Guidance for Safe Schools
American Academy of Pediatrics (AAP)
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/
This report provides recommendations for creating policies for safe schools during the COVID-19 pandemic that foster the overall health of children, adolescents, educators, staff, and communities and are based on available evidence.

Schools and the Path to Zero: Strategies for Pandemic Resilience in the Face of High Community Spread
Harvard's Edmond J. Safra Center for Ethics, Brown School of Public Health, and New America
https://globalepidemics.org/2020/12/18/schools-and-the-path-to-zero/
A report offering guidance schools need to develop the organizational capacity to deliver infection control with the goal of achieving zero or near-zero in-school transmission even in contexts of high community spread.

Covid-19 Testing in K-12 Settings: A Playbook for Educators and Leaders
Developed by Testing for America, a nonprofit dedicated to helping organizations reopen safely with expanded Covid-19 testing with support from The Rockefeller Foundation and the Skoll Foundation.
https://www.rockefellerfoundation.org/report/covid-19-testing-in-k-12-settings-a-playbook-for-educators-and-leaders/
This playbook is designed to offer detailed, step-by-step guidance to help educators, leaders and their public health partners design and implement effective COVID-19 testing programs in schools.

Roadmap To Recovery
Opportunity Labs
https://roadmap2recovery.org/
An Opportunity Labs resource providing actions that spur student health and academic recovery and renewal.

A Blueprint for Back to School
American Enterprise Institute (AEI)
https://www.aei.org/research-products/report/a-blueprint-for-back-to-school/
A bipartisan blueprint developed by 21 former state chiefs, superintendents, federal education officials, and charter school network leaders.

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Appendix A: List of Studies

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