EDITORIAL

COVID-19 and School Closures

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To mitigate the spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the cause of coronavirus disease 2019 (COVID-19), US states enacted a suite of nonpharmaceutical interventions. School closures were among the most consistently applied of these interventions. Over a 10-day period in March, all 50 US states closed kindergarten-grade 12 schools and childcare centers; nearly all colleges and universities followed suit. These closures were unprecedented in scope, affecting 21 million children in childcare, 57 million students in kindergarten-grade 12, and 20 million college and university students.

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School closures were not limited to the US. By mid-April, 192 countries had closed schools, affecting more than 90% (nearly 1.6 billion) of the world's students.[1] With limited information regarding COVID-19 in children, state and local officials were guided by evidence from other respiratory viruses, such as influenza, in which children have a substantial role in transmission. Although the evidence on effectiveness is mixed, school closures have been promoted as effective mitigation strategies during pandemics.[2,3] Understanding the effect school closures had on COVID-19 outcomes in the spring of 2020 is crucial for informing preparations for the fall.

In this issue of *JAMA,* Auger et al[4] estimate the association of school closures with COVID-19 incidence and mortality. In this complex study, the authors used interrupted time series analyses of data from all 50 states on the timing of school closures (and other nonpharmaceutical interventions), and daily COVID-19 incidence and death counts. The analyses compared the change in outcomes before and after school closure, adjusting for state-level measures of testing capacity, population density, health status, and social vulnerability. To estimate the absolute differences associated with school closure, the authors compared projected incidence and mortality had schools remained open vs the modeled outcomes for school closure.

Auger et al[4] found that school closure was associated with a −62% (95% CI, −71% to −49%) relative change in COVID-19 incidence per week, corresponding to an estimated absolute difference of 423.9 (95% CI, 375.0 to 463.7) cases per 100 000. The authors also reported that school closure was associated with a −58% (95% CI, −68% to −46%) relative change in mortality per week, corresponding to an estimated absolute difference in mortality of 12.6 (95% CI, 11.8 to 13.6) deaths per 100 000. Extrapolating these results to the US population, the authors estimate that school closure may have been associated with 1.37 million fewer cases of COVID-19 over a 26-day period and 40 600 fewer deaths over a 16-day period during the spring of 2020. It is important to emphasize these are estimates.

The authors thoughtfully discuss the numerous challenges with such an ambitious analysis. First, school closures were enacted in close proximity (interquartile range, 2-14 days) to other physical distancing measures, such as nonessential business closures and stay-at-home orders, making it difficult to disentangle the potential effect of each intervention. Second, the analysis does not elucidate mechanisms through which school closures might affect viral transmission. Whether the estimated associations between school closures and COVID-19 outcomes derive from reducing contacts among children or among their parents and caregivers, who are also less mobile as a result, is not known.

Third, the analysis cannot discern the optimal duration, combination, and sequence of nonpharmaceutical interventions, including school closures. Had school closures occurred later than other interventions, the estimated associations may have been markedly different. Fourth, the study design and analysis are consistent with association and not causation. All of these limitations create challenges for using these estimates to predict the potential effect of school closures in the coming school year.

School officials should consider findings from Auger et al[4] in the context of an evolving evidence base on SARS-CoV-2. A recent National Academies of Sciences, Engineering, and Medicine (NASEM) committee reported that less than 5% of reported cases have been among those younger than 18 years, and concluded that children with COVID-19 are more likely than adults to have mild or no symptoms.[5] However, there remains substantial uncertainty regarding the role of children and youth in transmission of SARS-CoV-2, leading the NASEM report to conclude "there is insufficient evidence with which to determine how easily children and youth contract the virus and how contagious they are once they do." Without a significant advance in evidence on these points, school administrators will be left to make high-stakes decisions without certainty.

Although the findings from the study by Auger et al[4] suggest a role for school closures in virus mitigation, school and health officials must balance this with academic, health, and economic consequences. A key challenge is that these other outcomes are likely more diffuse, accrue over a longer time horizon, may have consequences that last decades, and are more difficult to count than COVID-19 outcomes, including cases, hospitalizations, and deaths, which are measured in real time and are widely reported. The harms associated with school closures are profound. Despite efforts by school districts to

deliver online instruction, US school closures translated to lost learning for many students. Economic analyses suggest that school disruptions due to war and teacher strikes are associated with projected annual income losses of 2% to 3% over the course of affected students' lifetimes.[6,7] A recent estimate places a hefty price tag on COVID-19 school closures: $2.5 trillion in the US (12.7% of annual GDP) in lost future earnings.[8]

Given the strong connection between education, income, and life expectancy,[9] school closures could have long-term deleterious consequences for child health, likely reaching into adulthood. School closures also affect parents' ability to work. One analysis estimated that a 12-week school closure could cost the US $128 billion in lost productivity, including a 19% reduction in work hours among health care personnel.[10] Adding to the massive educational and economic implications of school closures, the immediate effects on student health and well-being are significant. Kindergarten-grade 12 schools provide an essential source of meals and nutrition, health care including behavioral health supports, physical activity, social interaction, supports for students with special education needs and disabilities, and other vital resources for healthy development.[11,12]

As the number of SARS-CoV-2 cases continues to increase in many parts of the country, school districts confront major challenges planning for the new academic year. Similar to the NASEM report, the American Academy of Pediatrics has offered reopening guidance to school administrators, balancing safety for students and staff with students' learning, social, and health needs.[13] The American Academy of Pediatrics advocates that "all policy considerations for the coming school year should start with a goal of having students physically present in school."[13] In-person instruction, however, conflicts directly with the need for physical distancing during a poorly controlled pandemic. School districts may need to consider multiple factors in determining how much in-school instruction is possible, including geography, transportation, local prevalence, the comfort and behavior of parents, staff, and students (including the likelihood of wearing masks at school).

Equity considerations are also paramount. The pandemic has uncovered monumental inequalities in resources available to schools and families. Even though schools in better-resourced neighborhoods transitioned to online instruction without significant barriers, schools in less-resourced neighborhoods confronted countless inequities in instruction due to limited access to devices and the internet. Given that children from low-income families depend more on school-based services, and their families and their schools have less economic resources to cope with disruptions, school closures to reduce the spread of COVID-19 could significantly widen inequalities.

Bringing students back to school for in-person instruction may be feasible with a precision public health approach. Schools are considering hybrid online and in-person instruction, limiting after-school programs, and reconfiguring spaces, food preparation, and distribution. Rather than a one-size-fits-all recommendation, school districts should rely on best available evidence including local SARS-CoV-2 prevalence, policies and practices regarding mask wearing, and risk of transmission among children of different ages.[14] Interventions need to be developmentally appropriate and flexible enough to make corrections, with a preference for in-person instruction for younger children for whom virtual learning presents challenges (even for typically developing children).

A precision public health approach means having easy access to real-time data to evaluate the effectiveness of specific approaches and adjust accordingly. A precision public health approach also benefits from strong cross-sector collaborations. School nurses, administrators, parents, and educators need to perceive available data and the experts interpreting these data as trustworthy. Health practitioners involved in caring for children should consider formal partnerships with their local schools to help guide reopening and offer micro-level adjustments based on available information.

The US must learn from myriad choices school districts have for virus mitigation strategies. Districts may differ in whether they adopt 3 ft or 6 ft of distance between students, the sizes and schedules for class, and countless other public health interventions for which the evidence base in school children for SARS-CoV-2 is limited. Federal agencies should prioritize funding for research that facilitates rapid learning about which practices are most effective in educational settings. Given the high stakes, high degree of uncertainty, and need for unbiased evidence, randomized studies should be used when possible.

Schools also need federal financial support to meet the dual threats posed by COVID-19. There are increased costs associated with adhering to public health guidance and plummeting state and local tax revenues to finance education, especially in school districts that are overburdened and underresourced.[15] Giving schools the support they need to confront COVID-19 could result in safe, healthy, and thriving environments for children and youth and ultimately recognize education as a critical determinant of health.

The decision to reopen schools for in-person educational instruction during the fall of 2020 is among the greatest challenges that the US has faced in generations. The decision will have life-long implications for millions of children and their families. In many parts of the country this has become a contentious issue, with children, their families, and teachers expressing strong opinions about what is best for them. There has rarely been a more important time for open discussion and collaboration with a goal of reaching consensus on reopening schools, while protecting the health and well-being of students and educators during the COVID-19 pandemic.

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