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The Role of School Closures and the Education System in Pandemic Preparedness and Response

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ABSTRACT

Reflecting public health experience with managing influenza, countries worldwide closed schools during COVID-19 (coronavirus) as a precautionary measure, even before the availability of direct evidence of the epidemiological role of children and adolescents in transmission. There remains no consensus regarding whether closing schools, or preventive actions in schools that did not close, had meaningful consequences for the transmission of COVID-19 in either the school population or the general population. In contrast, global evidence clearly shows significant negative consequences for human capital formation and well-being of learners, more so in vulnerable populations: school closures in the context of the pandemic led to 6–12 months of lost learning. The closures had additional unforeseen societal consequences, including increased rates of early pregnancy for school-age girls, inappropriate labor for school-age children, and substantial dropout from school. This experience of removing support from schoolchildren and adolescents has spurred national governments to reestablish and strengthen investments in school-based services, especially national school meals programs. Lessons learned can shape evidence-based policies regarding schools in subsequent pandemics, which will again need to weigh any potential trade-offs between protecting public health and ensuring the integrity of the school system.

INTRODUCTION

In addition to the millions of excess deaths, for many people today among the worst long-term legacies of the COVID-19 pandemic are the social and economic

consequences of the countermeasures, particularly the worldwide school closures. Despite continuing evidence on post-COVID-19 condition (long COVID),[1] from a health perspective the pandemic is mostly over. The health focus now, as in most of this volume, is on the lessons learned by the health community. However, for the 1.6 billion children affected by school closures at the peak of the lockdowns, and for their parents and their political representatives, the consequences are still real and present; for many, those consequences are among the most salient and lingering of the pandemic.

The next section of this chapter explains why schools matter, beyond schooling, and explores the mutually positive relationship between health, well-being, and education that existed before the COVID-19 pandemic. The third section examines how the historical role of schools as a social safety net for children became subsumed in the effort to respond urgently to the emerging pandemic. The fourth section tracks the evolution of the decision to close (or sometimes adapt) schools as a contribution to reducing transmission and examines the evidence for health and epidemiological benefits from those choices. The fifth section looks beyond health to explore the wider social and economic consequences of the global school closures, and the subsequent section tells the story, less salient to the health community, of how countries across the world and across income groups have come together to rebuild and enhance the ability of schools to contribute to the well-being and social development of the world's children. Finally, the chapter begins to look at the question of whether closing schools was an appropriate response to COVID-19 and, very important from a health perspective, whether that experience has made it a reasonable expectation that countries will ever again close their schools at the behest of health considerations.

WHY SCHOOLS MATTER: THE MUTUAL BENEFITS OF SCHOOLS FOR COMMUNITY EDUCATION, HEALTH, AND WELL-BEING

This section explores the importance of the first 20 years of life for the creation of human capital, which includes everything that allows individuals to realize their potential to contribute meaningfully to society. The period of development from conception to adulthood is increasingly called the "first 8,000 days," indicating the importance of continuing support from the crucial "first 1,000 days" to secure early gains, provide opportunities for catch-up, and ensure well-being during later vulnerable phases, such as puberty and the brain rewiring of adolescence. This section examines the role of schools as a platform for delivering both education and well-being more broadly (Bundy et al. 2017; Ross et al. 2020), and sets the scene for the role of schools in health and education before the pandemic.

The Importance of Well-Being, Education, and Development during the First 8,000 Days

Almost all societies worldwide have adopted compulsory, universal access to education as a guiding principle for the development of children and young people. The concept that health and well-being are essential counterparts to educational achievement is more recent. *Disease Control Priorities, Third Edition* (*DCP3*)

and other analyses conclude that the condition of learners is essential to their learning, through direct effects on cognitive engagement and indirect effects such as incentivizing attendance at school (Global Financing Facility 2021; Schultz, Appleby, and Drake 2018; UNESCO, UNICEF, and WFP 2022), and that children and adolescents undergo transformative physical, emotional, and cognitive changes during their school-age years (Bundy et al. 2018; Bundy and Horton 2017). The exceptional success of country efforts to achieve the Millenium Development Goal of universal primary education access by 2015 has brought the world the nearest it has ever been to universal provision. We have also learned, however, that just attending school is not sufficient to get the desired outcomes from education. The Sustainable Development Goals, adopted by the United Nations (UN) in 2015, replaced the Millenium Development Goals and underscored the importance of actual learning. Quality education not only helps determine individual economic success but is also central to the long-run growth of national economies and to achieving other laudable goals in the Sustainable Development Goals, such as poverty reduction and gender equality (Hanushek and Woessmann 2008; Lange, Wodon, and Carey 2018).

Together, these policy considerations help explain why schools and education systems play a key role in creating human capital. School systems provide a platform that allows all-day, daily access to children throughout middle childhood and adolescence, and that can deliver learning while also contributing to good health, well-being, and the development of lifelong healthy behaviors. In this virtuous cycle, health promotes learning, education supports good health, and both together contribute to young people's achieving their human capital potential throughout the life course. For instance, health and nutrition in adolescence show significant associations with adult outcomes, such as health status, employment, violence exposure and perpetration, and education in later life (Banati et al., forthcoming).

Even though human capital—the aggregated skills and knowledge of a population—is now recognized as essential for the growth and development of economies (Hanushek and Woessmann 2008; Lange, Wodon, and Carey 2018), much of the world is unprepared to participate in a modern economy (Gust, Hanushek, and Woessmann 2024). Overall, data from the 2020 World Bank Human Capital Index suggest that 70–80 percent of the wealth of high-income countries is attributable to human capital, but that the share can be as low as 30–40 percent in low-income countries. Most countries with the lowest global rankings in terms of human capital are in Africa, where the median age of the population is as low as 15–16 years and where school enrollment is lowest (Lange, Wodon, and Carey 2018; World Bank 2019). The cost of inaction is high, given that education has numerous other benefits to societies, including playing a vital role in peacebuilding before, during, and after crises; each year, countries may lose up to 7 percent of their projected total gross domestic product (GDP) because of death, illness, or injury (WHO 2024a).

Bringing the skills of populations of all countries up to minimal levels is estimated to result in substantially faster growth of world GDP than now possible. The present value of added growth over the twenty-first century is about five times

current world GDP (Gust, Hanushek, and Woessmann 2024). Although developing countries would gain the most, the world's high-income countries would also gain. The COVID-19 pandemic has made this situation more challenging, and the need to improve skills is even greater today.

Supporting Human Capital with School-Based Health and Nutrition Services

For the health and nutrition conditions prevalent among school-age children and adolescents, schools can provide a cost-effective platform to deliver an integrated package of services. The *DCP3* Child and Adolescent Health and Development volume described an essential school-based package of health services appropriate for school-age children (Fernandes and Aurino 2017), including interventions to improve cognition and learning. Those interventions include the provision of deworming tablets in endemic settings, vision screening and provision of spectacles, promotion of oral health, the use of insecticide-treated bed nets in malaria-endemic areas, nutrition education and nutritious school meals, and tetanus-toxoid and human papillomavirus (HPV) vaccinations. This package was evaluated as (1) good value for money in multiple settings; (2) able to address a significant disease burden; and (3) feasible to implement in a range of low- and lower-middle-income countries, making it suitable for inclusion within essential health benefit packages (Watkins et al. 2018). Depending on the country-specific epidemiological context, guidelines from the World Health Organization (WHO) on school health services discuss a broader package of services that includes mental health, sexual and reproductive health, violence, and substance use prevention services (WHO 2021).

Because learners typically spend some 7,500 hours in the classroom over 8–10 years during primary and lower-secondary school, school-based health and nutrition services can build on existing infrastructure and education systems to support the learners' holistic health and well-being (WHO 2023a; WHO and UNESCO 2021). Schools can encourage health promotion through policies and governance, the physical and social environment, curricula including health literacy, links with parents, and access to school health and nutrition services (Baltag et al. 2022). The evidence for the effectiveness of such approaches is mixed. On the one hand, a Cochrane review in 2015 provided an equivocal assessment (Langford et al. 2015). On the other hand, such whole-school approaches, also called health-promoting schools, may improve education outcomes and can influence students' depressive symptoms, bullying, violence, attitudes about gender, and knowledge of sexual and reproductive health (Langford et al. 2014; WHO 2023a), with a potential for high benefit-cost ratios (Sheehan et al. 2023). Some 72 percent of countries participating in a WHO policy survey in 2023 report having national standards for health-promoting schools, a 7 percent increase from the previous round.[2]

A Decade of Expansion of School-Based Health and Nutrition Programs and Policy Guidance

The decade leading up to the arrival of the global pandemic in 2020 saw a substantial increase in cross-sectoral policy guidance focused on school-age children and

adolescents, including systems approaches to school health at all levels of the educational system (such as the Global Partnership for Education, WHO, and the United Nations Educational, Scientific and Cultural Organization), the role of diets and food systems in schools (such as the Food and Agriculture Organization of the United Nations, UN Nutrition, and the World Food Programme), and the role of the school in human capital development (such as the Global Financing Facility, US Agency for International Development, and World Bank Group) (Schultz et al. 2025).

Globally, the number of children receiving daily school meals increased by 9 percent between 2013 and 2020, reaching 388 million children, equivalent to half of the world's primary school population, with the fastest increase (86 percent) in lower-middle-income countries (WFP 2020). Of these mostly government-owned programs, 98 percent are supported by domestic funds and 87 percent are formally part of national policy. These programs are also increasingly self-reliant even in low-income countries, where the proportion of domestic funding on school meals increased from 17 percent to 28 percent between 2013 and 2020 (WFP 2020).

By January 2020, national school meals programs were clearly established as the world's most extensive social safety net, and nearly every country offered some form of school-based health or nutrition services, with many delivering comprehensive and affordable interventions at scale (WFP 2020). In terms of complementary health interventions, more than 100 countries offered school-based vaccination, nearly all integrated health education in their curriculum, and schoolchildren had received more than 3.3 billion school-based deworming treatments since 2010 (Baltag, Pachyna, and Hall 2015; Montresor et al. 2020; UNESCO, UNICEF, and WFP 2022).

HOW THE ADVANCING PANDEMIC UNDERMINED THE ROLE OF SCHOOLS AS A SOCIAL SAFETY NET

This section examines why school health and school meals programs became the world's most extensive social safety net during the decade leading to 2020. It also explores the process that led to the closing of schools and the removal of the safety net from schoolchildren and adolescents worldwide during the pandemic. Much of the focus is on national school meals programs as a proxy for school-based health and nutrition interventions generally.

The 2008 Food, Fuel, and Financial Crisis Relative to School Health and School Meals

Even before the pandemic, governments identified their school meals programs as having multiple objectives across several sectors, going beyond health and education and including social protection. Results of a 2019 questionnaire survey by the Global Child Nutrition Foundation illustrate the wide range of objectives and how they differ across income groups (table 8.1). Although respondents most frequently reported objectives involving education and health, the social safety net and income transfer role comes in a close third and is most popular in low- and lower-middle-income countries. The importance of this social protection role was recognized as an outcome of the 2008 food, fuel, and financial crisis (Bundy et al. 2009).

Table 8.1 Objectives of School Meals Programs, by Country Income Level, 2021

Percent of programs

Objective	Low-income	Lower-middle-income	Upper-middle-income	High-income	Total
Agriculture	62.5	48.9	30.3	30.2	42.1
Average number of objectives per program	3.0	2.2	1.7	2.1	2.2
Education	100	91.5	78.8	69.8	83.6
Health and nutrition	90.0	93.6	93.9	93.7	92.9
Income transfer	85.0	78.7	69.7	63.5	73.2
Obesity mitigation	5.0	17.0	30.3	68.3	34.4

Source: Bundy et al. 2024.

Note: Table shows results from 185 respondents of a 2021 questionnaire survey by the Global Child Nutrition Foundation.

The 2008 crisis highlighted the interconnectedness of school-based health and nutrition interventions and social protection objectives, as low-income countries leveraged World Bank emergency agricultural funds to expand the coverage of national school meals programs (Bundy et al. 2024). Although offered the funds as crisis response to make food more affordable, many low-income countries decided instead to expand what for many was their largest extant safety net for their children. The response was seen first in low-income countries; however, as the recession deepened worldwide in 2010, many middle- and high-income countries that may not have previously viewed school meals as a social protection measure—such as Italy, Scotland, and Spain (Bundy et al. 2009)—leveraged school meals programs to reach more children, even during vacations.

In 2009, the World Bank publication *Rethinking School Feeding* explored the origin and structures of that country-led demand, drawing from the education, health, and social protection sectors, as well as from UN and development partners (Bundy et al. 2009). The report marked a sea change in thinking about the role of school meals as a multisectoral intervention and accelerated the introduction and expansion of school meals programs taking a social protection perspective, for countries and for UN agencies. For example, as part of their support for emerging from the global recession, China and the Russian Federation independently launched national school meals programs using *Rethinking School Feeding* as the empirical rationale (Bundy et al. 2024). The World Food Programme, the world's primary source of school meals program support, introduced a new school meals policy in 2013 to support nation building as well as to protect the well-being and education of school-age children and adolescents in low-resource settings (WFP 2020, 2023).

Factors Early in the Pandemic Leading to School Closures and Loss of Safety Net

In the early days of COVID-19, little was known regarding the extent to which the school environment constituted an engine for broader transmission of the disease. Despite children's relatively high vulnerability to influenza, it was established quite early in the pandemic that children (and young adults) had a low COVID-19 case

fatality rate (Levin et al. 2020) and that children were unlikely to suffer severe disease and might be refractory to infection (Davies et al. 2020; Ferguson et al. 2020; Viner et al. 2020). The choice before governments, however, was stark: countries faced a dangerous new epidemic and had very few public health control options open to them. Closing schools was one of the few non-pharmaceutical interventions for which there was good evidence of effectiveness at reducing influenza transmission and that, by implication, might be effective against COVID-19. In response, almost all governments closed their schools within the first couple of months of the pandemic, leaving over 90 percent of students out of school. Lower-income countries in particular struggled with providing continued education at a distance, and children also missed school meals: 370 million in April 2020 alone (WFP 2023).

At least five convergent factors may have contributed to that outcome. First, governments are naturally precautionary (Cronert 2022), preferring to do something rather than nothing and to make the seemingly safe decision, especially given societal expectations regarding the short-term safety and protection of children. This tendency is especially true for electoral democracies. In the United States, for example, most counties were under emergency orders (99.4 percent) and closed schools (98 percent) before reporting a single COVID-19 case (Yan et al. 2021). A study examining county-level differences in closures in the United States explored the importance of local politics, finding that political party affiliation was strongly correlated with the number of days of closure but that COVID-19 case rates were not (Jack and Oster 2023). The study also found that counties with a higher composition of minorities (and lower broadband usage) had more closure, heightening preexisting disparities. Once countries had policies in place, a desire for consistency and an aversion to anything that might resemble admitting being wrong, along with weak evidence-to-policy mechanisms in many countries, led to continuation of initial policy decisions despite shifts and improvements in the understanding of the situation.

Second, the technical side of the pandemic response was, appropriately, informed by health experts, including virologists and modelers, which may have resulted in the downplaying of factors important to other sectors. Relatedly, almost all existing pandemic preparedness plans focused on influenza. Although the public debate on this front often revolved around lives versus the economy, the tension was perhaps even more stark, but less publicly recognized until later, with respect to education and safety nets. Refer also to WHO Regional Office for Europe (2022) for more discussion of some of these trade-offs in the context of Europe in particular.

Third, education sector staff, especially teachers, had understandable concerns about the risks to themselves of in-person schooling. Evidence from the United States, for example, suggests that school reopening decisions were closely tied to the strength of local teachers' unions (Grossmann et al. 2021).

Fourth, the role and perceptions of parents changed over time. At first, parents tended to advocate for school closures in order to protect their children, especially

given the early uncertainty about the later recognized strong correlation between age and fatality rates. Regardless of whether schools formally closed, many parents initially kept their children at home, for example in the United Kingdom (Adams, Weale, and Bannock 2020). Later, many parents demanded that schools reopen, especially with the removal of strict lockdowns and with parents' return to work, raising the salience of schools as safe places to spend the day. Furthermore, many countries put in place considerable efforts to try to reduce the risk of transmission in schools. Examples include mask-wearing, ventilation, and increased social distancing. Surveys of US parents revealed that most became increasingly concerned about children's falling behind academically and about negative impacts to their emotional well-being without in-person school attendance (Menasce Horowitz 2022).

Fifth, low-income countries were less prone to reopen schools even with the emergence of data showing that children are less affected by the infection and that safe school reopening is possible. From March 2020 through February 2022, schools worldwide were fully or partially closed for 41 weeks on average (WHO Regional Office for Europe 2022). Although low- and middle-income countries had different circumstances and considerations—including larger class sizes, a higher likelihood of having a parent at home, lower feasibility of hybrid education options, and so on—their children also faced higher costs of closure, suggesting increased importance of the ability to act rapidly in the face of relevant evidence.

Two other contexts may have been important, but we have no specific evidence about them in the case of school closures. First, general evidence shows that, throughout the pandemic and across many geographies, voluntary behavior change was a major driver, above and beyond formal regulations: in many situations people had already acted before any formal lockdown or other mandate (Jamison et al. 2021). This might imply that, for the behavioral reasons related to staff and parents, mentioned earlier, school closures were inevitable, whether mandated or not. Second, despite significant variability in school closure, as with lockdowns (Jamison 2020), low-income countries appeared to follow the lead of high-income nations.

On average, COVID-19 led to 199 days of full or partial school closure (the equivalent of 12 months of learning), affecting 1.6 billion children globally. According to Stacy and Lambrechts (2023), the period of closure was related in a complex way to income level. High-income countries had, on average, 148 days of closure; low-income countries, 158 days; and lower-middle-income countries, 236 days.

THE ROLE OF SCHOOLS IN THE TRANSMISSION OF COVID-19

Before the COVID-19 pandemic a substantial literature already existed on the role of schools in the transmission of respiratory viruses, as perhaps most clearly demonstrated by the role of the school year cycle as a driver of epidemics.

This history was also supported by the projections of mathematical models and the observational data sets pointing to the role of schools in the transmission of respiratory viruses, and it aligned with the common-sense perceptions of parents. In addition, evidence showed that transmission occurred in school settings where children mixed outside the classroom, such as at sporting events (Boutzoukas et al. 2022). All these reasons appear to have contributed to the closing of schools worldwide as part of the overall global effort to control COVID-19. This section reviews the evidence that led to that decision and the subsequent consequences.

Previous Knowledge about the Role of School Closures in Managing Viral Disease Transmission

Long before the arrival of the COVID-19 pandemic, an established literature indicated that children, particularly in schools, played an important role in influenza transmission, because of the high incidence of social contact and physical interaction among this age group (Cauchemez et al. 2009; Mossong et al. 2008). Furthermore, mathematical modeling, for example of data from the 2009 avian influenza A (H1N1) pandemic had made a strong case for the potential effectiveness of extensive school closures to mitigate the role of schools as drivers of influenza epidemics (Ferguson et al. 2006; Germann et al. 2006).

Those and similar studies led to the proposition that school closure or other forms of school dismissal that avoided the aggregation of school-age children represented a potentially important part of interventions for mitigating pandemic influenza (Bell et al. 2006; Cauchemez et al. 2009), and perhaps viral epidemics generally. Although some evidence suggested greater effectiveness of school closures implemented in the early phase of any outbreak (Cauchemez et al. 2009; Germann et al. 2006; Haber et al. 2007), others suggested that "heterogeneity in the data available means that the optimum strategy (eg, the ideal length and timing of closure) remains unclear" (Jackson et al. 2013, 1). Nevertheless, countries had an imperative to act quickly because they faced a public health crisis and because early interventions tend to be more effective (Jackson et al. 2014). When the COVID-19 pandemic emerged and countries considered the potential of school closures as a control measure, a key question related to the generalizability of influenza findings to SARS-CoV-2.

Evolving Understanding of the Impact of School Closures on COVID-19 Transmission

The earliest evidence, from the start of 2020 when most schools remained open but attendance had dropped precipitously, suggested low transmission within schools.[3] A study in Australia of 27 primary cases (56 percent of which were staff) identified only 18 secondary cases when nearly half of 1,448 close contacts were tested virologically or serologically (Macartney et al. 2020); a study of six confirmed cases (50 percent adults) in Ireland identified no secondary cases from the pediatric cases (Heavey et al. 2020). Other studies suggested that the probability of transmission among students was age-dependent. For instance, France had high attack rates in secondary-school students ages 14–18 years and staff (38 percent and 49 percent,

respectively) but no convincing evidence of any secondary transmission within primary schools (Fontanet et al. 2021; Fontanet et al. 2020). Household contact tracing in the Republic of Korea suggested that rates were lower when the index case was younger than the age of 10 years (3 of 57, or 5 percent) and higher when the case was over 10 but less than 19 years (43 of 231, or 19 percent) (Park et al. 2020).

As noted earlier, countries needed to make a decision needed before the epidemic became established if their action was to be effective. Although the emerging evidence did not suggest higher attack rates in children than in adults, some 90 percent of countries decided to close their schools beginning in April 2020. Most countries monitored the situation, with plans as early as July 2020 to carefully monitor the impact of reopening schools (for example, refer to Public Health England 2021) and recognition that it was "becoming increasingly clear that governments around the world need to find solutions that allow children and young adults to return to full-time education as safely and as quickly as possible" (Edmunds 2020, 797). A framework for reopening schools, published in June 2020 by UN agencies and the World Bank, advised that the "timing of school reopenings should be guided by the best interest of the child and overall public health considerations, based on an assessment of the associated benefits and risks and informed by cross-sectoral and context-specific evidence, including education, public health and socio-economic factors" (UNESCO et al. 2020, 2).

As the pandemic wore on, the evidence in support of reopening schools did not become more definite. On the one hand, an extensive assessment of the partial reopening of schools in the United Kingdom mid-2020 identified few SARS-CoV-2 outbreaks despite a median of 928,000 children attending and that any secondary cases linked to within-school exposure occurred more frequently among teaching and administrative staff (Ismael et al. 2021). On the other hand, a variety of other sources, mainly based on mathematical modeling projections, suggested that such passive surveillance must have missed or underestimated many outbreaks, and that secondary schools in particular might play a considerable role in transmission between households (Flasche and Edmunds 2021). Although the risk of reopening schools was still evaluated, the substantial risks of keeping them closed were already known before the pandemic started. For the beginning of the new school year, WHO, UNESCO, and UNICEF (2020) recommended therefore that a risk-based approach—considering not only the local epidemiology of COVID-19 but also other social, health, and well-being impacts—should guide the decision to close or open schools.

During 2021, growing reaction to the social, logistical, and economic consequences of continued school closures—as well as rising concerns about the long-term consequences for educational attainment and the generation of human capital—culminated in a global movement focused on the safe reopening of schools. During this phase multiple studies and systematic reviews sought to assess the impact of school closures and in-school mitigation measures on SARS-CoV-2 transmission (Jamison et al. 2021; Li et al. 2021).

Attempts in 2022 and 2023 to undertake analysis of these reviews aimed to clarify the conclusions, but many difficulties in interpretation remained. For instance, a review of 26 systematic reviews found only one of high confidence, the remainder being of low (10) or critically low (15) confidence (Hume, Brown, and Mahtani 2023). That review noted:

> Both school closures and in-school mitigations were associated with reduced COVID-19 transmission, morbidity and mortality in the community. School closures were also associated with reduced learning, increased anxiety and increased obesity in pupils. We found no SRs [systematic reviews] that assessed potential drawbacks of in-school mitigations on pupils. The certainty of evidence according to GRADE [Grading of Recommendations, Assessment, Development, and Evaluations] was mostly very low." (Hume, Brown, and Mahtani 2023, 164)

Most countries implemented school closures as mitigating measures for COVID-19 (Hale et al. 2021), but the literature on effectiveness is still controversial and shows mixed results (Haug et al. 2020; Viner et al. 2020). Available data suggest that in many cases young adults, but not school-age children, were a main driving force for COVID-19 transmission (Monod et al. 2021; Tran Kiem et al. 2021). In some settings where, for example, most adolescents and adults were vaccinated, however, the role of schools may become more important, as suggested by the UK Office of National Statistics Prevalence surveys, which at times showed the highest prevalence of infection among school-age children.

Effectiveness of School-Based Mitigation Measures Short of Complete Closure

School closure was only one of many school-based or education system interventions that sought to reduce the transmission of SARS-CoV-2. In considering the implications of the lack of clear evidence that widespread school closures had an important impact on transmission, other interventions become more interesting as potential alternatives for addressing future coronavirus epidemics even when schools remain open. Examples include reducing the opportunity for contact (for example, via scheduling), improved ventilation, increased handwashing, and regular screening with isolation as necessary. As technology improves, including artificial intelligence, it may also be increasingly feasible to operate hybrid or part-time systems even in resource-constrained settings.

This topic is the subject of a recently updated Cochrane review of 15 empirical studies of schools, with 12 of those studies from the Americas (Littlecott et al. 2024). The authors of that review conclude in their abstract that, across all bodies of evidence, certainty of evidence ratings limits confidence in the findings. Another Cochrane review looks at the unintended consequences of school measures other than school closures (Kratzer et al. 2022). A set of evidence-based school guidelines during COVID-19 has been developed in Germany, which used the Cochrane results and the WHO-INTEGRATE framework to formally assess all criteria, adopting a whole-of-society, multisectoral perspective. Each recommendation has a multipage assessment, and table 8.2 summarizes the assessment for schools.

Table 8.2 Evidence-Based Guidelines during COVID-19 for Suspected Cases among Students without Known Risk Contact, Weighing Benefits and Harms of the Measure in German Schools

Weighing benefits and harms of the measure
Benefits
• Prevention of infections and secondary cases of quarantine, which as a result do not occur among students, teachers, in the household, and in the community.
Harms
• Consequences of the quarantine for students and their associated absence from school, interruption of social contacts and social participation.
• Consequences for parents and guardians due to the increased need for care and supervision of the students in quarantine, in particular social and financial consequences due to reduced availability to work.
• Consequences for society and economy through the frequent and unpredictable absence of employees.
Overall assessment
• While the individual in quarantine is always harmfully affected by the measure, there is only a benefit from the measure if the person is actually infected with SARS-CoV-2 after a risk exposure.
• Therefore, the assessment of the probability of an infection depending on the kind of contact is critical.

Source: AWMF 2022.

These analyses illustrate the considerable efforts undertaken to clarify the role of schools, school-based mitigation measures, and school closures in SARS-CoV-2 transmission and health. The main conclusion at the current stage of analysis is that, despite those considerable efforts, the role of schools and school-based interventions in reducing transmission in schools or from schools to the general population remains unclear. Policy analyses suggest that safe reopening is possible, with the creation of safe conditions, and desirable from both the public health and societal perspectives, and that school closures should be a solution of last resort (ECDC 2020).

THE ECONOMIC AND SOCIAL CONSEQUENCES OF SCHOOL CLOSURES DURING THE PANDEMIC

This section explores what we now understand to have been the "nonhealth" consequences of the pandemic due to school closures. It focuses first on the long-term human capital consequences for the generation of children who lost educational opportunities during the pandemic, and then on the longer-term sociological consequences for the children who were shut out of school.

Impact on Human Capital Outcomes

Although most countries attempted to continue education through remote learning modalities—whether through digital, TV, radio, or paper-based approaches—those efforts had mixed effectiveness (Andrabi, Daniels, and Das 2023; Munoz-Najar et al. 2021). In high- and middle-income countries, digital instruction frequently substituted for in-person instruction during initial closure

periods. In Africa, however, it is estimated that less than 10 percent of children had access to digital sources for distance education (Wang et al. 2021). In some countries, schools reopened relatively quickly, whereas many countries had a disruptive cycle of reopening and reclosing. For some countries, the withdrawal of schooling was long term: for example, schools in the Philippines and Uganda only reopened more than two years later. It is now recognized that generations of children have lost out on educational opportunities—with lifelong consequences. The World Bank estimates that in low-income countries the already poor level of educational achievement has deteriorated further: the proportion of children in Africa unable to read a simple age-appropriate sentence has increased from 53 percent to 70 percent, as compared to before the pandemic (World Bank, UNESCO, and UNICEF 2021). Evidence from Ethiopia shows that because of school closures children in primary school "learned only 30–40% as much in math as they would during a normal year, and the learning gap between urban and rural students increased" (Kim et al. 2021).

Recent cross-country student test data show significant declines in student performance over the pandemic, with larger losses where closures were longer (Jakubowski, Gajderowicz, and Patrinos 2024). Those declines add to the existing low levels of achievement found in low-income countries before the pandemic (Gust, Hanushek, and Woessmann 2024). For example, the latter study provides prepandemic estimates of the percentage of children lacking the basic skills needed to participate in a modern economy (table 8.3). Although one-third of the world's youth are not in secondary education, those in school show considerable skill deficits—deficits worsened by the pandemic.

Substantial international evidence exists that achievement levels strongly influence individuals' lifetime incomes (Hanushek et al. 2015). Although the returns to skills vary across countries, those returns are clearly significant across the range of economic development. Moreover, the long-run growth of nations relates closely to the skills of the population as measured by the international tests (Hanushek and Woessmann 2015). A common rule of thumb is that each additional year of schooling leads to about 10 percent higher annual income in adulthood (Montenegro and Patrinos 2014); therefore, school closures—even if partially offset by versions of remote learning—could likely lead to substantial declines in lifetime earnings for the entire affected cohort. Previous research has found this relationship to hold causally; for instance, teacher strikes in Argentina, which closed schools for an average of 88 days, led to 2–3 percent lower annual labor market earnings (Jaume and Willen 2019). Despite the lack of complete data about the educational impacts of COVID-19 from all countries, much less the ultimate human capital consequences, a clear picture is emerging: learning losses equal somewhere between half and one year of education, with the most disadvantaged students and those affected by longer school closures bearing the worst impacts. In the case of reading scores, students lost more than a year of learning (Jakubowski, Gajderowicz, and Patrinos 2024).

Table 8.3 Percentage of Children below Basic Skill Levels before COVID-19 Pandemic, by Country Income Level

	Low-income	Lower-middle-income	Upper-middle-income	High-income	World total
% with less than basic skill	95.6	85.8	42.3	25.5	67.2

Source: Adapted from Gust, Hanushek, and Woessmann 2024, which draws on available data from before the COVID-19 pandemic; this analysis anchors its measure in mastering at least the most basic level of the Programme for International Student Assessment (PISA)—that is, PISA Level 1 skills—using the most recent assessment available for each country from before the pandemic.

Some of the best data on test scores come from the United States, where the National Assessment of Educational Progress tests 13-year-olds every year. Comparing the most recent 2023 data to scores from just before the pandemic, math scores fell by nine points—erasing all gains since 1990—and reading scores by four points—sufficient to erase all gains since 1975 (Hanushek 2023). Given historical patterns, these numbers correspond to 6 percent lower lifetime earnings for the average student in school during the pandemic. One recent analysis, combining estimated learning impacts with the types of virus-control impacts discussed earlier, finds that school closure scored extremely poorly in terms of cost-effectiveness (Irons and Raftery 2024). Meanwhile, estimates from Italy (Carlana, La Ferrara, and Lopez 2023) and elsewhere in Europe similarly suggest large declines in test scores, especially in mathematics (0.14 standard deviation) but also in reading; and preliminary evidence from early-grade reading assessments in five Sub-Saharan African countries suggests learning losses of almost one year (Angrist et al. 2021). Modeling suggests that such early deficits can compound over time, as students who are already behind struggle to catch up when faced with standard curricula; a similar dynamic was observed after the 2005 earthquake in Pakistan (Andrabi, Daniels, and Das 2023).

Another striking empirical regularity is that, in essentially all cases, school closures (whose extent was driven by sociodemographic differences) exacerbated existing sociodemographic inequalities. Both within and across countries, the schools in lower-resource settings were less equipped to provide remote or hybrid learning options, and parents or caregivers were less able to support at-home learning. For instance the same data set from Italy shows larger declines in test scores for low socioeconomic status and immigrant students, whereas a large data set from over 2 million students across the United States exhibited widening achievement gaps by race and income level (Goldhaber et al. 2023). That the poorest children would experience the worst effects from school closures during COVID-19 is consistent with earlier evidence from Ebola. Furthermore, COVID-19 also resulted in bigger learning losses for girls and for children in earlier grades in lower-income countries (World Bank, UNESCO, and UNICEF 2021). Overall, school closures hurt the most vulnerable children most, in terms of educational attainment, future opportunities, and (as discussed in the next subsection) other health and well-being indicators.

Tracking of education sector finance during the pandemic, by the Education Finance Watch, suggests that financing for education has not fully responded to the damage inflicted or adequately addressed the learning crisis (World Bank and UNESCO 2023). The pandemic exacerbated the global learning crisis, and government education spending is insufficient to close the learning gap. Along with a slight rise in annual real spending on education, government per capita education spending increased in 2021. In low- and middle-income countries, even when there were (previously planned) spending increases, they were far from sufficient to make a dent in the large learning gap (World Bank and UNESCO 2023). Now that external support is needed most, official development assistance is falling—and could be spent more efficiently. Aid to education fell by 7 percent, from US$19.3 billion in 2020 to US$17.8 billion in 2021, because of the reduction in general budget support. Since then, responses and finance levels have varied greatly across countries but have not generally been sufficient to overcome the accumulated shortfall in outcomes from the height of the pandemic.

Impact on School Dropout, Early Pregnancy, and Entrance into the Workforce

The indirect impact of lengthy school closures and travel restrictions altered the educational trajectory and widened gender and health disparities for the most vulnerable school-age children and adolescents. Although adolescents were spared much of the morbidity and mortality caused by the COVID-19 pandemic, school closures largely eliminated access to the broad range of preventive health interventions previously delivered through the school platform, such as immunizations, child protection, and psychosocial support services. The disruption in daily school meals provision was salient, and attempts to mitigate the loss of school meals by alternative means were much more costly and much less efficient (WFP 2023). Those efforts were particularly important because one in three people worldwide did not have access to adequate food in 2020 (FAO et al. 2021). Households in Nigeria, for example, reported a 9 percent higher increase in skipping meals after the interruption in school meals provision (Abay et al. 2021).

As the pandemic wore on, many families lost their livelihoods and 60 million more children lived in monetarily poor households in 2021 than in 2019 (Save the Children and UNICEF 2021). Although not a direct impact of school closure, this poverty resulted in the first increase in child labor in two decades and shows how household poverty can increase the opportunity cost of staying in school. Children ages 5–11 years accounted for just over half of the 160 million child laborers in 2021, with at least half engaging in hazardous work (ILO and UNICEF 2021). In response to economic hardships, an estimated 10 million additional girls entered into early marriage to relieve financial pressure on their families (UNICEF 2021). Despite the lack of data on the increase in gender-based

violence due to school closures, programs working closely with girls saw increases in the number of cases reported, for example in East Africa (Girls' Education Challenge and UK Aid 2021).

School dropout rates among older adolescents remained elevated two years later (Moscoviz and Evans 2022). In Malawi, adolescent boys most often cited financial constraints to reenrolling, whereas girls cited marriage and pregnancy (Kadzamira et al. 2021). For adolescent girls, the combination of economic fragility, school closures, and social isolation increased their likelihood of early marriage and unplanned pregnancies. A study in Kenya found that female adolescents who experienced disrupted schooling were more likely than their peers who sat for exams to drop out of school (9.7 percent vs. 3.0 percent), initiate sex (47.4 percent vs. 25.5 percent), and become pregnant (10.9 percent vs. 5.2 percent) (Meherali et al. 2021). Access to reproductive health services, counseling, and commodities was disrupted in nearly 60 percent of countries (WHO 2020b), putting adolescent girls at risk of unintended pregnancies and sexually transmitted infections.

As the education system builds back from the pandemic, increasing evidence indicates the need to consider the mental health status of students. The most recent World Happiness Report included a specific focus on children and adolescents for the first time, showing a global decline in well-being after the pandemic (Marquez et al. 2024). Data from 12 longitudinal studies from across geographies reveal that adolescent depressive symptoms worsened during the pandemic (Barendse et al. 2023), and evidence suggests that symptoms persisted two years later (Thorisdottir et al. 2023). For the most vulnerable children, for whom school-based mental health programs are often the only accessible source of services, school closures have exacerbated the issues (WHO 2020a).

STRENGTHENING SCHOOL-BASED HEALTH AND NUTRITION AS A LEGACY OF PANDEMIC SCHOOL CLOSURES

The scale and near universality of school closures in response to the COVID-19 pandemic helped highlight to many governments the vital role schools play in protecting the health and well-being of learners and in developing the human capital that is key to national development. The world's first attempt to simultaneously close all its schools has provided convincing counterfactual evidence of what happens when school-based health services are no longer provided. It led to recommendations for continuity of health promotion and school health services when distance or virtual learning is required (for example, in response to a public health emergency and diverse learner needs) as a standard of practice (WHO and UNESCO 2021).

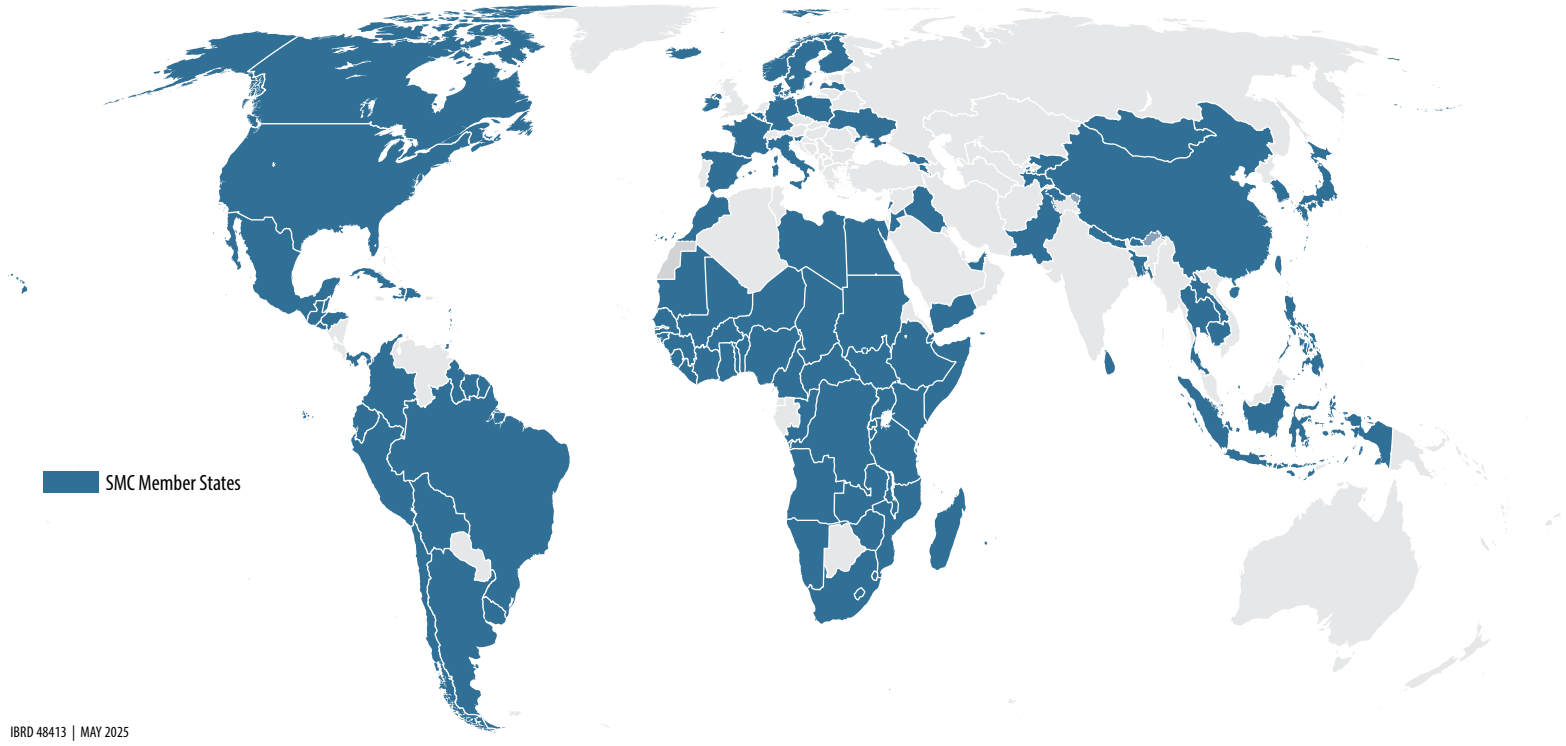
Also as a result of learnings from COVID-19, the updated WHO benchmarks for strengthening health emergency capacities now include new benchmarks related to the continuity of essential health services and education during a health emergency (WHO 2023b). Thus, the benchmark on the protection of livelihoods, business continuity, and continuity of education and learning systems says that a country has a demonstrated capacity to deal with emergencies if it has "integrated emergency preparedness and response strategies into national education policies, to sustain continuous and inclusive learning opportunities during health emergencies, as well as continuity of school-based and school-linked social protection and healthcare services" (WHO 2023b, 325).

As early as July 2020, this experience had begun to strengthen the resolve of countries to reestablish their investment in their school-age children. This resolve included both reopening education systems and strengthening the investment in the well-being of the children, with the objectives of improving education through better access, participation, and learning. Countries sought to achieve these objectives in various ways, and one of the most visible and important health-related initiatives was the creation of a multicountry, multilateral School Meals Coalition at the October 2021 UN Food System Summit. The coalition aims to rebuild the school-based services severely damaged by the pandemic closures and to ensure the well-being of current and future generations of schoolchildren.

Today, 109 countries, comprising more than 67 percent of the world's population have signed onto the coalition (map 8.1). Those countries identified three specific goals: (1) to restore national school meals and complementary school health programs to prepandemic coverage by 2023; (2) to develop new approaches to reach by 2030 an additional 73 million of the most in-need children who had not previously been reached; and (3) to raise the quality of school health and nutrition programs globally by 2030.[4]

Governments and international development organizations are delivering on this response. At the Food Systems Stocktaking +2 event in Rome in July 2023, the School Meals Coalition was recognized as the most substantial coalition to arise from the pandemic. This momentum is also confirmed by the rebound in coverage of programs: today, 418 million children receive a daily meal in school, exceeding levels before the COVID-19 pandemic by 7 percent (WFP 2023). Universal schemes, representing 44 percent of all programs, provide meals to 186 million children daily, with more than half of all national school meals programs anticipated to become universally offered by 2024 (Cohen et al. 2023). This result suggests that the coalition has largely achieved its first goal, but the trend has not been observed consistently across income groups. High-income, upper-middle-income, and lower-middle-income countries show a consistent, modest increase, but low-income countries experienced a net decline in coverage of 4 percent (figure 8.1).

Map 8.1 Signatories of the Declaration of Commitment to the School Meals Coalition, as of March 2025



Source: Original map created for this publication.
Note: SMC = School Meals Coalition.

Figure 8.1 Change in the Number of Children Receiving School Meals, by Country Income Level, 2020 and 2022

Source: WFP 2023.

Note: BRICS = Brazil, Russian Federation, India, China, and South Africa

It was already apparent in 2024 that the School Meals Coalition has helped provide new momentum for rebuilding school-based health services more broadly, including bringing back to school the most vulnerable, reintegration programs, mental health services, and other lines of actions discussed during the Transforming Education Summit. This achievement is particularly impressive because these programs continue to be more than 98 percent supported by domestic funds despite the severe constraints on fiscal space occasioned by the COVID-19 pandemic (WFP 2023). The global investment in school meals has increased by US$5 billion to fund the national programs, rising to US$48 billion in 2022 (WFP 2023). This increase in domestic funding is offset by a 6 percent decrease in aid and multilateral development funding for school meals programming in low-income countries since 2020, following slower GDP growth, reduced revenue collection, and external debt pressures (WFP 2023). Importantly, low-income countries have increased the proportion of the costs of school meals from domestic budgets: up to 45 percent from 30 percent before the pandemic (WFP 2023).

School meals have proved important in elevating school participation and attendance, especially because chronic absenteeism has gone up after the pandemic-driven closures (DiMarco 2023). As noted earlier, however, their economic impact is highly dependent on school quality. The reactions to COVID-19 clearly harmed quality of education during the pandemic, and education systems have been finding

it difficult to get back to their prepandemic levels. Importantly, just getting back to prepandemic levels will leave countries permanently worse off because the pandemic cohort of students will be less skilled than other workers and will be a drag on long-term economic growth (Hanushek and Woessmann 2020). Thus, countries must necessarily work to improve school quality and learning for all if they are to fully recover from the pandemic. These actions go well beyond just ensuring student access and attendance, even in the presence of school meals.

IMPLICATIONS FOR THE ROLE OF SCHOOL CLOSURES IN MANAGING FUTURE PANDEMICS

The COVID-19 pandemic is often framed as a public health issue. The evidence collected for this chapter shows that in the case of school closures there were indeed important public health implications, but also major social, educational, and economic consequences that went far beyond the health outcomes. As shown by the continuing levels of uncertainty in the evidence, these complex interactions have yet to be fully unraveled, but understanding them will again be necessary when the world faces the next pandemic.

It is not the role of the DCP series to make specific recommendations, and normative agencies have since published legal considerations for health emergency measures in schools (WHO 2024b). In concluding this chapter, however, two main areas would especially reward more in-depth analysis: the need to consider consequences beyond public health, and assurance that decisions to close schools are based on sound evidence.

Understanding the Balance of Consequences across Sectors and Society, beyond Public Health Alone

Even today with benefit of hindsight, and despite systematic reviews, the evidence for the cross-sectoral impact of school closures is mixed and sometimes contradictory. From a public health perspective, there is generally low confidence in the evidence that closing schools, or preventive actions in schools that did not close, had meaningful consequences for the transmission of SARS-CoV-2 infection for either the primary school population or the general population. That belief does not imply that school closure had no effect, or no other implications for public health, but rather that an effect is hard to detect when closing just one of the multiple routes of transmission.

Evidence does show that school closures in the context of the COVID-19 pandemic have had strong and long-lasting negative impacts for education, human capital creation, and the prospects of the "COVID generation." The impacts on learning and education attainment, with implications for employment, lifelong earnings, adult health, and human capital creation, are estimated to have reduced learning by nine points in the standardized US national progress test, corresponding to 6 percent lower lifetime earnings. This impact was associated with major social consequences in some settings, such as increased rates of early marriage and early pregnancy for school-age girls and of inappropriate labor for all school-aged children. The closures

have caused substantial and often irreversible dropout from school, reinforcing the cycle of educational underachievement.

For many governments, the counterfactual experience of closing schools, and removing most forms of support to schoolchildren and adolescents, has become the most salient long-term consequence of the COVID-19 pandemic. It has caused national governments to prioritize the reestablishment and strengthening of investments in school-based services to support the well-being of schoolchildren, as seen in the example of the 109 countries participating in the creation of a School Meals Coalition. The combination of the uncertain benefits and significant negative consequences of closing schools contributed to this global momentum for rebuilding, strengthening, and protecting school systems as a safety net and a key contributor to human capital creation.

Having the Right Information to Make Well-Founded Early Decisions

During the pandemic, the initial thinking about a potential role of school closures in reducing SARS-CoV-2 transmission reflected the public health experience that targeted school closures could reduce influenza transmission. This experience indicated that the effectiveness of school closures depended upon the timeliness of the decision, and this experience in turn led to the recognition that for the SARS-CoV-2 epidemic the decision had to be made at a time of the greatest parameter uncertainty. Adding to the pressures were new political and sociological factors that quickly emerged. The COVID-19 experience showed that in some cases societies reacted more quickly than policy makers to the pandemic, with teachers staying away from schools and parents keeping children at home before formal closures—and before direct evidence of harm or benefits. Evidence also shows a change in the direction of public opinion during the pandemic, with a strong later movement toward reopening schools. In hindsight, it may have been preferable for the original closure decisions to have been simultaneously paired with a clear evidence-based process regarding reopening. In preparing for the next pandemic, understanding the implications of these issues of public policy may be as instrumental as better understanding of the epidemiology.

In conclusion, when faced by the next pandemic, governments will again have to consider taking action in schools while simultaneously balancing public health concerns. The COVID-19 experience shows that it may be considered dangerous and lacking in prudence not to take near immediate precautionary action. Yet that decision will inevitably be made at a time when least is known, especially with regard to the epidemiological role of children and adolescents, and in communities for which the COVID-19 experience has established bodies of opinion that may strongly and negatively shape their reactions to the next event. The experiences described in this chapter show the considerable differences in overall consequences between school closures, which have massive and often unforeseen side effects that often exacerbate existing inequalities, versus protecting the integrity of the school system and introducing specific school-based measures, which are a research topic on their own. Better understanding of the implications of these two options may be crucial to appropriate decision-making when we face the next pandemic.

NOTES

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2. WHO, "Maternal, Newborn, Child and Adolescent Health and Ageing" (accessed April 22, 2024), https://platform.who.int/data/maternal-newborn-child-adolescent-ageing/national-policies#:~:text=Through%20the%20SRMNCAH%20policy%20survey,that%20are%20relevant%20to%20SRMNCAH.
3. Finnish Institute for Health and Welfare, "Coronavirus Infections in Schools" (accessed April 22, 2024), https://thl.fi/en/topics/infectious-diseases-and-vaccinations/what-s-new/coronavirus-covid-19-latest-updates/situation-update-on-coronavirus/coronavirus-infections-in-schools.
4. For more on the School Meals Coalition, refer to its website, https://schoolmealscoalition.org.

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