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REVIEW ARTICLE

The Importance of In Person School Activities Despite COVID-19: A Review of the Literature

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ABSTRACT

In Spring 2020, when the COVID-19 pandemic reached the United States, schools closed to mitigate the spread of the virus. While online learning platforms provided alternatives to in-person education, children of all ages and educational needs faced unique challenges adapting to new methods of education delivery. Developmental and educational effects varied between children at different grade levels. Through this review, we outline challenges faced by students based on their stage of education. We also consider the effects of the pandemic on special education, disadvantaged populations, and students with mental health challenges. Moreover, we suggest that in-person activities are paramount to a child's educational and personal development, and they should be continued in the setting of appropriate safety guidelines, even in the midst of a global pandemic.

Keywords: child development, in-person activities, COVID-19, virtual learning, education

1. Introduction:

As of February 2022, over 12 million children have tested positive for COVID-19 since the start of the pandemic.¹ While severe illness due to COVID-19 remains uncommon among children, there is growing need to collect data on the long-term impacts of the pandemic on children. From early on, there has been interest in how the pandemic would affect children's emotional and physical development. Much of this interest stems from the halt the pandemic placed on in-person activities including school: a place where most children spend at least 7 hours per day for 180 days of the year.

School closures were widely used as a risk mitigation technique before COVID-19 was even declared a global pandemic. It took less than a month from the first detected community transmission of COVID-19 in the United States for schools to begin closing their doors to students.² On February 25, 2020, Center for Disease Control (CDC) director Nancy Messonnier urged parents to ask their children's schools about plans for dismissal or closures.² Only two days later, Bothell High School in Seattle, Washington became the first school to close over coronavirus fears when one of its employees had traveled internationally with a sick family member who was being tested for the virus.³ On March 11, 2020, the Northshore school district, home of Bothell High School, launched the first online learning platform to arise from the pandemic.⁴ While it was short lived secondary to equity concerns, it paved the way for other school districts to find virtual alternatives to in-person learning.⁴ A number of schools closed during their 2020 spring break and did not reopen until fall 2020.

In fall 2020, nearly 48.1 million students enrolled in kindergarten through 12th grade.⁵ Despite planning to reopen in August and September of 2020, many schools delayed their start date or closed shortly after opening their doors due to record COVID-19 cases at the time.⁶ Several school districts offered a hybrid model of learning where the amount of time students received in a classroom varied, however, many families opted to enroll their children in an all-remote learning option.⁶

Over a year later, many children have returned back to their classrooms to participate in in-person learning. This transition was made possible after the decline in COVID-19 cases seen after the introduction of the Pfizer, Moderna, and Johnson & Johnson vaccines. On December 11,

2020, the U.S. Food and Drug Administration (FDA) provided an emergency use authorization (EUA) for the Pfizer-BioNTech COVID-19 vaccine for individuals 16 years and older. This EUA was later expanded to include children ages 12 – 15 on May 2021 after the CDC reported nearly 1.5 million cases of COVID-19 in children ages 11 – 17 between March 2020 to April 2021.⁷ As of late 2021, the EUA also includes children 5-11 years old.⁸ Moderna and Johnson & Johnson are following suit, continuing trials in children and adolescents under 18. In the meantime, the CDC now recommends everyone 5 and older get a COVID-19 vaccine to help protect against the virus.⁹

The CDC also recommends several other prevention strategies to lower spread of COVID-19. Universal indoor masking is recommended for students ages 2 and older, school staff, and visitors, regardless of vaccination status.¹⁰ In addition to masking, social distancing at a minimum of 3 feet is encouraged in classroom settings.¹⁰ In places where distancing is not possible, the CDC recommends alternative measures be enforced, including screening testing.¹⁰ The CDC encourages local school districts to be aware of the surrounding community's transmission and vaccination rates to guide decisions about implementing multifaceted mitigation strategies.¹¹

Throughout the pandemic, significant changes from fully in-person to fully virtual or hybrid learning have impacted student growth and development. Early in the pandemic, children from Pre-K to 12th grade were impacted by the quick transition to online learning. Subsequent interruptions to learning via pauses and delayed reopening's further interfered with students' traditional educational experiences. While improvements in mitigation strategies and vaccine development have allowed students to return to in-person learning once more, disturbances to classroom learning did not take place without consequences.

The ability of a student to acquire and retain information is critical to their development. A number of studies suggest that students of all grade levels struggled to retain information and attend class at the start of the pandemic. It has been demonstrated that in the absence of in-person instruction, distance learning leads to social isolation and negatively impacts students' abilities to acquire and retain information. One non-profit research organization, NWEA, developed a study dedicated to measuring growth and proficiency in K-12. Their study of 4.4 million American students ranging from

3rd-8th grade found that students were not as proficient in math during the fall 2020 semester as they were in fall 2019.¹² The transition to online instruction was also accompanied by higher rates of absenteeism than had been appreciated during fully in-person instruction. This contributed to missed opportunities early in the pandemic. The American Academy of Pediatrics (AAP) notes that of jurisdictions that recorded attendance in the 2020-2021 academic year, chronic absenteeism was more prevalent in students who engaged in remote learning.

However, in the years that preceded the pandemic, online education was largely growing as a platform to meet the unique needs of individual students.¹³ K-12 online education emerged as an option to expand educational options and access for students whom which traditional classroom learning was a hindrance, whether that be due to distance or lack of access to certain academic resources in their district.¹⁴ Although online education has the potential to accommodate and provide an appropriate alternative to in-person learning, most students require a team of supporters to have success in purely online courses.¹³ As the pandemic has demonstrated, a key part of this team—parents—may have difficulty providing that type of support when other responsibilities are also demanding of time—work, managing finances, other children, etc. Also, the children and parents who chose online education before COVID-19 represent a population that differs from the majority of parents who chose traditional in-person learning. Those parents and children had factors that made them believe their child could be successful in a purely online setting. Interestingly, even these parents and children may struggle with online education. In a study of Michigan schools in the 2015-2016 academic year, of which 44 schools offer fully virtual courses for students, wide variability was noted in student success (51% in some virtual learning environments vs. 81% in others).¹⁵

It is clear that students of all ages struggled to retain information and attend virtual classes at the start of the pandemic. In the following sections, we evaluate the unique challenges faced by students. Moreover, we describe the developmental consequences specific to each age group. Finally, we include guidelines for returning to in-person learning safely including the effectiveness of masks and social distancing by age group.

2.1 Impact of education on mental health and emotional development:

The mental health and development of children in all grade levels suffered with the transition from in-person to online learning.

In 2019, roughly 60% of children between the ages of 3 and 5 were enrolled in a Pre-K program.¹⁶ The goals of Pre-K are for students to develop social and cognitive language skills to interact with others in preparation for kindergarten programs. While Pre-K children faced closures as early as February 2020, few cases of COVID-19 were actually seen in this population. A Chinese study found that of the first 72,314 cases of COVID-19 to occur in China, only 419 cases (0.9%) occurred in children ages 0 – 9 years old.¹⁶ Not only are preschoolers rarely affected, daycare and school environments seem to have low transmission rates. While the exact mechanism is still unclear, data shows a clear age-protective effect for COVID-19 transmission.¹⁷ Despite low infection and mortality rates in children ages 0 - 5, COVID-19 has led to detrimental mental and physical health outcomes in this population.¹⁸ School closures forced by COVID-19 led to childhood isolation and a fourfold increase in reported rates of posttraumatic stress disorder (PTSD) in children.¹⁹

In a study of elementary schoolers, the data demonstrated that 89.7% of children in lower grades of elementary school had demonstrated the least understanding of the COVID-19 pandemic and the social restrictions than any other school group.²⁰ In-person education fosters emotional development, and elementary schoolers removed from their traditional learning environment were emotionally labile and dependent on parents and family members.²⁰ Lower grade elementary schoolers easily cried and complained during quarantine (12.4%) and had difficulties being calmed (15.9%) compared to students of other grades.²⁰

Models of adolescent development, primarily with middle school students, have shown that short periods of complete social isolation can lead to increased anxiety and hyperactivity,²¹ as well as predilection to addictions. Alarming, consequences of social deprivation, specifically reward-seeking behaviors, persist even after reintroduction to peer groups.²¹ Moreover, there are consequences that evolve from removing students from diverse classroom settings to more homogenous home environments. In the classroom, middle schoolers are traditionally exposed to students from a variety of backgrounds. This setting

helps children develop a sense of cultural appreciation and allows them to seek knowledge about other cultures through real-world relationships.²²

High schoolers also suffered from a decline in their emotional development as their sense of community with peers and teachers was negatively affected by the pandemic. In a survey of over 17,000 high school students, 50% report decreased strength of relationships with teachers, and 47% report decreased strength of relationships with peers.²³ Another study found 29% of students say do not feel connected at all to school adults, and a similar percentage do not feel connected to classmates or their school community.²⁴

2.2 Impact of education on physical development:

The physical development of children in all grade levels was stunted at the beginning of the pandemic with the introduction of virtual learning.

Social isolation has been linked to an increased risk of obesity and cardiovascular disease that can persist into adulthood.¹⁸ Forced isolation and social distancing measures led preschoolers to increase their daily screen time by nearly 4 hours.²⁵ As a result, children are spending less time being active.¹⁸ The combination of more screen time and less active time is associated with sleep disruption in preschoolers.²⁶

School closures also challenged the physical development of elementary school students. In a study comparing pre-pandemic measures to measures during the initial phases of the pandemic, elementary schoolers were found to exhibit more sedentary behaviors and increased screen time.²⁷ Moreover, adverse alterations to sleep and diet were noted.²⁷ These findings are especially concerning given the strong correlation between these factors and childhood obesity. The concern over the pandemic's contribution to the childhood obesity epidemic is further exacerbated by the challenges of continuing elementary physical education in a remote-learning setting. These include challenges with student access to online learning, teacher remote work arrangements, and communication barriers.²⁸ A number of elementary schoolers also rely on school as a place to receive daily meals. This is especially true of children to socioeconomically disadvantaged parents. A longitudinal model in rural Philadelphia demonstrated that food insecurity, negative parent and child mood, and child misbehavior significantly

increased when schools closed their doors to in-person classes.²⁹

Similar to the pattern seen in younger students, the incidence of sedentary behavior has increased in middle-schoolers in the setting of increased screen time.³⁰ In the early months of the pandemic, middle school-aged children were also less likely to participate in leisurely physical activity, such as biking and roller-skating, compared to elementary school-aged children.³⁰ This suggests middle school students suffered more than other age groups from the lack of structured physical education instruction when their classes transitioned to virtual platforms. Lack of physical activity in childhood has been linked to increased risk of many chronic diseases, including heart disease, obesity, and diabetes mellitus.³¹ Although there are no federal requirements for physical activity in public schools, 36 states mandate physical education as a portion of their middle school curricula.³² Therefore, many middle school children who attend class in-person get at least some amount of physical activity throughout the week.

The onset of the pandemic halted sports, decreased outdoor socialization with friends, and closed gyms, which may have decreased opportunities for physical activity in high school adolescents, as well. Obese adolescents have been found to have gained weight during the lockdown and that the primary cause of weight gain was decreased physical activity and increased sedentary behavior.³³ Diet contributed only minimally to weight gain during the pandemic.³³ Monitoring for excess weight gain, screening for comorbidities, and caring for obese adolescents are important considerations due to the pandemic. An analysis of adolescents aged 12 to 14 found that the COVID-19 confinement might have limited development in maximal oxygen intake while exercising due to prolonged COVID-19 confinement and lack of regular physical exercise.³⁴ Additionally, regular physical activity has been linked to improved mental health, suggesting that the decreased physical activity may in part be causing the mental health changes seen in the setting of the pandemic.

3. Special populations and virtual learning

Students with special needs and those from underserved backgrounds suffered disproportionately during the pandemic with the transition to virtual learning. This section elaborates on the specific considerations that should be made for students with these unique circumstances when it

comes to their mode of learning during the pandemic.

While a parent may understand their child's unique needs through the lens of a caretaker, they may not fully grasp the best way to implement their child's educational plan. During the COVID-19 pandemic, parents were forced to become educators when learning shifted online. Evidence suggests there has been an overall decrease in academic performance among children with disabilities during the pandemic. For example, in California, Maryland, and Virginia, the number of students with disabilities who earned D's or F's over the 2020-2021 academic year increased from years prior.³⁵ This section explores the special needs of students with unique learning needs and why these students benefit from continuing their in-person learning during a pandemic.

In-person school attendance greatly affects students' ability to learn and retain information, especially for children with special needs. Children with autism spectrum disorder (ASD) had a particularly difficult time adjusting to the abrupt change from in-person to virtual instruction at the onset of the pandemic. Generally, children with ASD struggle with adaptability and flexibility; schedules and routines are typically used to decrease the amount of stress felt with rapidly changing situations.³⁶ These traits made them vulnerable to the rapid transition to virtual or distance learning in response to the initial uncertainty of COVID-19. The transition disrupted implementation of personalized learning plans, such as Individualized Education Programs (IEPs), and changed day-to-day routines that were developed to help children cope with their disability. IEPs are individualized learning programs for children with disabilities that guide the delivery of educational support and services. Given the potential difficulties in utilizing traditional curriculum for autistic students, IEPs typically represent the cornerstone of their education. In May 2020, Parents Together Foundation conducted a survey of 1,594 parents of children with disabilities; the results suggested only 20% of children were receiving services as required by their IEPs and 39% were not receiving any services.³⁵

This trend is similar in non-autistic students with educational needs. A survey in Fall 2020 found that of 1,600 educators who work with children who have special education plans, 67% believed they could not meet the educational needs of their students through online learning.³⁷ The study also showed that in areas of high poverty or large

minority percentages, the ability to accommodate specialized remote learning plans for these students also decreased, which exaggerates disparities previously mentioned. In addition, the students with special needs who were able to continue in-person education with their teachers were more likely to complete assignments than those students who participated in remote learning.³⁷

Students' experiences of the pandemic also varied greatly based on affinity groups. Certain groups were more susceptible to the detrimental effects of transitioning to online learning, including those of specific gender, race, sexual orientation, origin, and socioeconomic status.

It has been suggested that female students had a different experience during the pandemic compared to male students. *Challenge Success/Stanford Survey of Adolescent School Experiences* surveyed over 75,000 high school students and found that 63% of students who identify as female reported increased school-related stress during the pandemic compared with 48% of students who identify as male.²³ Another study of high school students found that female students were more likely to worry about the pandemic as well as feel nervous, anxious, depressed, lonely, stressed, and worried about the pandemic's financial impact.³⁸ The causes of these differences are likely multifactorial, and special considerations should be taken for female students.

The U.S. Department of Education found that disparities between students of color and white students were worsened by the pandemic. In elementary and middle school students, rates of absenteeism for online learning were noted to be highest in non-White students.³⁹ Similarly, 63% of students who identify as Black and Hispanic/Latinx reported increased school-related stress compared with 55% of students who identify as white.³² Nearly 33% of teachers in majority Black schools reported their students lacked the necessary technology for virtual instruction compared to less than 20% in schools where less than 10% of students are Black.³² Moreover, Historically Black colleges and universities, minority serving institutions, and tribal colleges and universities saw declines in enrollment that far outpaced enrollment declines in predominantly white peer institutions.⁴⁰

Students who identify as part of the LGBTQ+ community were also disproportionately negatively impacted by the pandemic. 83% of LGBTQ+ students report problems with their schoolwork or well-being compared to 69% of their heterosexual/cis peers.⁴¹ Similarly, 30% of

LGBTQ+ students reported a decline in relationships with their classmates compared to 19% of heterosexual/cis peers. Moreover, 48% of LGBTQ students were unable to access mental health resources.⁴¹

Students from rural, suburban and urban areas each experienced unique challenges during the pandemic. Access to technology conducive to online learning varied greatly depending on where students were from. In a survey of students across Washington State, 80% of students in rural districts reported having access to an Internet-enabled device adequate for online learning compared to 90% of students in urban districts.⁴² Reliable broadband Internet adequate for online video conferences for class was available for 67% of rural respondents and 84% of urban respondents.⁴² Of note, university enrollment decreased by nearly 7% in fall 2020 compared to fall 2019 with the highest rates of decline found in urban and rural high schools compared to suburban schools.⁴³

Students of lower socioeconomic status faced additional struggles during the pandemic compared to their peers of higher socioeconomic status. Students from low-income households had higher rates of absenteeism with the transition to virtual school at the onset of the pandemic.⁴² Community college enrollment dropped the most in low-income high schools while high income high school enrollment in public four-year universities was unaffected.³⁹ In addition, higher-education institutions reported a drop-off in enrollment of students graduating from high-poverty high schools compared to pre-pandemic numbers. Similarly, in the Netherlands, a country that faced a similar lockdown period and distributes similar funding to education, data from students aged 8-11 showed that knowledge lost post-pandemic was most prominent among students from disadvantaged homes.⁴⁴

Identification and support of vulnerable groups is critical in the setting of the pandemic. Providing an equitable learning environment for students of all ages should be another reason to minimize virtual learning and allow students to attend in-person class during the pandemic.

4. Cautions with In-Person Learning

Early studies of COVID-19 in pediatric populations showed that most hospitalized patients were either older than 12 years old or young infants.⁴⁴ Additional studies found that risk of COVID-19 infection was increased with in-person school, but risk was not significant if some safety

measures were implemented including social distancing, symptom screening, etc.⁴⁵ Similarly, risks of transmission to members in the household are elevated with in-person school but may be reduced if the same safety measures mentioned before were implemented. In adult populations, comorbidities including advanced age, diabetes, and obesity were predictors for worse COVID-19 course. In comparison to adults, children tend to have better outcomes with COVID-19, but one predictor of poorer outcome is a comorbidity including chronic lung disease like asthma, immunodeficiencies, obesity, and other chronic conditions.^{46, 47} These children are at increased risk of severe COVID-19 disease course if they are infected. Additionally, children with family that are at risk of severe COVID-19 course due to vaccination status or comorbidities may be at increased risk of infection because of their children attending in-person school.

In situations where children may be at increased risk of personally acquiring COVID-19 and suffering a poor outcome or the consequences of spreading it to a close contact are potentially devastating, online learning should be considered an appropriate alternative to in-person attendance. This is especially true in settings where community transmission is particularly high or levels of compliance to social distancing and masking protocols are particularly low. In these cases, it should be up to the family unit to decide what is best for their individual family's needs. Of note, children's vaccination eligibility and status will likely further play a role in these decisions in the future.

It is important for future pandemic responses to take into account the detriment of shutdowns on childhood development and consider alternatives to blanket shutdowns. Pandemic responses from other countries can serve as important test cases to consider when deciding on alternative policies. For example, Sweden did not enforce shutdowns and kept schools open for children under the age of 17.⁴⁸ One of the benefits of this strategy is that public health reports have shown no decline in child mental health compared to previous years and the country has maintained very few cases of severe COVID-19 in children.⁴⁹ Denmark, a country with similar culture and geography as Sweden, implemented more widespread COVID testing in schools, which may have helped them achieve lower rates of COVID-19 incidence versus Sweden.⁵⁰ It is possible that a combination of lax shutdown restrictions for children younger than 17 and increased COVID-19 testing

could achieve a good balance between child development and safety.

Another potential alternative to allow for in-person learning is wider adoption of hybrid learning environments. These classrooms break students up into cohorts that alternate between in-person and virtual classes. The benefit of this format is that classroom sizes are reduced and able to be cleaned. It also allows schools to continue offering social services such as lunch and therapy for students in need, which could reduce socioeconomic disparities brought upon by the pandemic. An important consideration to consider for this option is the increased training and work burden placed on school staff members who will simultaneously be teaching students online and in-person.⁵¹

5. Conclusions

While multifaceted mitigation plans and the introduction of COVID-19 vaccines in children 5 and older have paved the way for a nearly full return to in-person learning, the interruption to traditional education during the pandemic did not take place without consequences. Children suffered from significantly more distractions and lower summative assessment scores, objectively quantifying the impact of virtual education delivery on learning. Moreover, school closures impacted student physical health as some children were deprived of physical education programs and

access to nutritious school meals. Removing children from their social support systems at school also lead to unprecedented levels of isolation in the pediatric population. Students who require additional attention and IEPs suffered even more when their individualized support suddenly came to a halt early in the pandemic.

These unintended consequences with foreseeable negative mental and physical health outcomes suggest that students should receive some in-person instruction, even during a pandemic. Data demonstrates that the pediatric risk of contracting COVID-19 and suffering from hospitalization or death is far less than risk to the general population. Studies also show that children of all ages have suffered numerous detrimental mental and physical health outcomes with the transition to online learning. Provided adequate safety measures such as masking and social distancing guidelines, prioritizing in-person education for children is vital in preventing the adverse effects of virtual learning. Students should receive in-person education to prevent detrimental developmental outcomes and provide them with the best chance of receiving a fulfilling academic experience enriched with social support.

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Figure 1 – Academic, Emotional and Physical Impacts by Education Level

Education Level	Academic, Emotional and Physical Impacts
Pre-K programs	<ul style="list-style-type: none"> • Academic: Fewer opportunities for social and language development • Emotional: Increased isolation, PTSD, and abuse • Physical: Worsened sleep patterns
Elementary school: K-5 th	<ul style="list-style-type: none"> • Academic: Lack of exposure to cultural skills and group play • Emotional: Emotional lability and dependence on parents • Physical: Sedentary behaviors and lack of nutritional support
Middle school: 6 th -8 th	<ul style="list-style-type: none"> • Academic: Lack of academic and social networks resulting in delayed cognitive development • Emotional: Anxiety and hyperactivity • Physical: Decreased time spent on leisurely physical activities
High school: 9 th -12 th	<ul style="list-style-type: none"> • Academic: Lack of student engagement and less time spent on academics each day • Emotional: Decreased sense of connection to others • Physical: Excessive weight gain in obese teens and decreased exercise tolerance

Figure 2 – Key Studies

Study	Education Level	Findings
Pietrobelli, A., et al. ²⁵ Mehta, N. S., et al. ¹⁶ Ismail, S. A., et al. ⁵²	Pre-K	<ul style="list-style-type: none"> • Screentime increased by 4 hours/day. • Of the first 72,314 cases of COVID-19 in China, only 0.9% of cases occurred in children ages 0 – 9 years old • Educational settings are an uncommon location for COVID-19 transmission
Nakachi, K., et al. ⁵³	Elementary school	<ul style="list-style-type: none"> • 89.7% had the least understanding of COVID-19 (compared to other grades) • 12.4% easily cried and complained • 15.9% were difficult to keep calm
Dunton, G., et al. ²²	Middle School	<ul style="list-style-type: none"> • About 46% of parents reported that their 9-13 yo children did “much less” physical activity in April-May 2020 vs February 2020 • Over 80% of parents of children 9-13 year olds perceived their children’s sedentary behavior to be “much more” or “somewhat more” in April-May 2020 vs February 2020
<i>Challenge Success</i> ⁵⁴	High school	<ul style="list-style-type: none"> • 41% reported putting forth less effort in school • 42% reported a decrease in engagement in learning • 47% reported decreased strength of relationships with peers • 50% reported decreased strength of relationships with teachers

References:

1. Children and COVID-19: State-Level Data Report. American Academy of Pediatrics. <https://www.aap.org/en/pages/2019-novel-coronavirus-covid-19-infections/children-and-covid-19-state-level-data-report>. Published February 2021. Accessed May 2021.
2. Lieberman M. Schools Should Prepare for Coronavirus Outbreaks, CDC Officials Warn. Education Week. <https://www.edweek.org/leadership/schools-should-prepare-for-coronavirus-outbreaks-cdc-officials-warn/2020/02>. Published February 25, 2020. Accessed May 1, 2021.
3. Bazzaz D, Blethen R. Bothell High School closed Thursday-Friday in 'abundance of caution' over coronavirus fears. The Seattle Times. <https://www.seattletimes.com/seattle-news/health/bothell-high-school-closed-thursday-in-an-abundance-of-caution-over-coronavirus-fears-after-staffer-traveled-internationally>. Published February 27, 2020. Accessed May 1, 2021.
4. Morton N. Northshore's lesson for Washington schools amid the coronavirus closure: Online learning is hard to get right. The Seattle Times. Retrieved from <https://www.seattletimes.com/education/lab/northshores-lesson-for-washington-schools-amid-the-coronavirus-closure-online-learning-is-hard-to-get-right>. Published April 12, 2020. Accessed May 1, 2021.
5. Back to school statistics. National Center for Education Statistics. NCES. Retrieved from <https://nces.ed.gov/fastfacts/display.asp?id=372>. Updated 2021. Accessed August 1, 2021.
6. Strauss V. Schools start closing – or delay reopening – as covid-19 cases jump across the country. The Washington Post. <https://www.washingtonpost.com/education/2020/11/14/schools-start-closing-or-delay-reopening-covid-19-cases-jump-across-country>. Published November 14, 2020. Accessed August 1, 2021.
7. Coronavirus (COVID-19) Update: FDA Authorizes Pfizer-BioNTech COVID-19 Vaccine for Emergency Use in Adolescents in Another Important Action in Fight Against Pandemic. U.S. Food and Drug Administration. <https://www.fda.gov/news-events/press-announcements/coronavirus-covid-19-update-fda-authorizes-pfizer-biontech-covid-19-vaccine-emergency-use>. Published May 10, 2021. Accessed August 1, 2021.
8. FDA Authorizes Pfizer-BioNTech COVID-19 Vaccine for Emergency Use in Children 5 through 11 Years of Age. U.S. Food and Drug Administration. <https://www.fda.gov/news-events/press-announcements/fda-authorizes-pfizer-biontech-covid-19-vaccine-emergency-use-children-5-through-11-years-age>. Published October 29, 2021. Accessed November 1, 2021.
9. COVID-19 Vaccines for Children and Teens. Centers for Disease Control and Prevention. https://www.cdc.gov/coronavirus/2019-ncov/vaccines/recommendations/children-teens.html?s_cid=11368:covid%20vaccine%20for%20children%20under%2016:sem.ga:p:R G:GM:gen:PTN:FY2. Updated 2021. Accessed August 1, 2021.
10. K-12 Schools. Centers for Disease Control and Prevention. <https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/k-12-guidance.html>. Published 2021. Accessed November 1, 2021.
11. COVID-19 Prevention Strategies Most Important for Safe In-Person Learning in K-12 Schools. Centers for Disease Control and Prevention. https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/k-12-guidance.html#anchor_1625661937509. Published 2021. Accessed November 1, 2021.
12. Lewis K, Kuhfeld M, Ruzek E, McEachin A. Learning during COVID-19: Reading and math achievement in the 2020-21 school year. NWEA. Published July 21, 2021. Accessed August 1, 2021.
13. Curtis H, Werth L. 2015. Fostering Student Success and Engagement in a K-12 online school. *Journal of Online Learning Research*, 1(2), 163–190. <https://eric.ed.gov/?id=EJ1148836>. Accessed August 1, 2021
14. Smith R, Clark T, Blomeyer R. 2005. A synthesis of new research on K-12 online learning. https://www.researchgate.net/profile/Tom-Clark-5/publication/304827914_A_Synthesis_of_New_Research_on_K-12_Online_Learning/links/577c06ca08aece6c20fccf6f/A-Synthesis-of-New-Research-on-K-12-Online-Learning.pdf. Accessed December 7, 2021.

15. Enrollment rates of young children. National Center for Education Statistics. <https://nces.ed.gov/programs/coe/indicator/cfa>. Updated May 2021. Accessed August 1, 2021.
16. Mehta NS, Mytton OT, Mullins EWS, Fowler TA, Falconer CL, Murphy OB, Langenberg C, Jayatunga WJP, Eddy DH, Nguyen-Van-Tam, JS (2020). SARS-CoV-2 (COVID-19): What Do We Know About Children? A Systematic Review. *Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America*, 71(9), 2469–2479. <https://doi.org/10.1093/cid/ciaa556>
17. Khera N, Santesmasses D, Kerepesi C, Gladyshev VN. COVID-19 mortality rate in children is U-shaped. *Aging*. 2021; 13(16), 19954–19962. <https://doi.org/10.18632/aging.203442>.
18. López-Bueno R, López-Sánchez GF, Casajús JA, Calatayud J, Tully MA, Smith L. Potential health-related behaviors for pre-school and school-aged children during COVID-19 lockdown: A narrative review. *Preventive Medicine*. 2021; 143, 106349. <https://doi.org/10.1016/j.ypmed.2020.106349>
19. Sprang G, Silman M. Posttraumatic stress disorder in parents and youth after health-related disasters. *Disaster Medicine and Public Health Preparedness*. 2013; 7(1), 105–110. <https://doi.org/10.1017/dmp.2013.22>
20. Burkart S, Parker H, Weaver RG, Beets MW, Jones A, Adams EL, Chaput JP, Armstrong B. Impact of the COVID-19 pandemic on elementary schoolers' physical activity, sleep, screen time and diet: A quasi-experimental interrupted time series study. *Pediatric obesity*. 2021; e12846. Advance online publication. <https://doi.org/10.1111/ijpo.12846>
21. Frazier A, Elder G Jr. Early childhood education today. *Association for Supervision and Curriculum Development*. 1968; 13, 465-473.
22. Dunton GF, Do B, Wang SD. Early effects of the COVID-19 pandemic on physical activity and sedentary behavior in children living in the U.S. *BMC public health*. 2020; 20(1), 1351. <https://doi.org/10.1186/s12889-020-09429-3>
23. Margolius, M., Doyle Lynch, A., Pufall Jones, E., Hynes, M. The State of Young People during COVID-19: Findings from a Nationally Representative Survey of High School Youth (ED606305). ERIC. 2020. <https://eric.ed.gov/?id=ED606305>. Accessed November 1, 2021.
24. SAT program results capture impact of COVID on class of 2021. College Board Newsroom. <https://newsroom.collegeboard.org/sat-program-results-capture-impact-of-covid-on-class-of-2021>. Published September 15, 2021. Accessed November 1, 2021.
25. Pietrobelli A, Pecoraro L, Ferruzzi A, Heo M, Faith M, Zoller T, Antoniazzi F, Piacentini G, Feambach SN, Heymsfield SB. Effects of COVID-19 Lockdown on Lifestyle Behaviors in Children with Obesity Living in Verona, Italy: A Longitudinal Study. *Obesity*. 2020; 28(8), 1382–1385. <https://doi.org/10.1002/oby.22861>
26. Janssen X, Martin A, Hughes AR, Hill CM, Kotronoulas G, Hesketh KR. Associations of screen time, sedentary time and physical activity with sleep in under 5s: A systematic review and meta-analysis. *Sleep Medicine Reviews*. 2020; 49, 101226. <https://doi.org/10.1016/j.smrv.2019.101226>
27. Pavlovic A, DeFina LF, Natale BL, Thiele SE, Walker TJ, Craig DW, Vint GR, Leonard D, Haskell WL, Kohl HW. Keeping children healthy during and after COVID-19 pandemic: meeting youth physical activity needs. *BMC public health*. 2021; 21(1), 485. <https://doi.org/10.1186/s12889-021-10545-x>
28. Steimle S, Gassman-Pines A, Johnson AD, Hines CT, Ryan RM. Understanding patterns of food insecurity and family well-being amid the COVID-19 pandemic using daily surveys. *Child development*. 2021; 92(5), e781–e797. <https://doi.org/10.1111/cdev.13659>
29. Mickells GE, Figueroa J, West KW, Wood A, McElhanon BO. Adherence to Masking Requirement During the COVID-19 Pandemic by Early Elementary School Children. *The Journal of school health*. 2021; 91(7), 555–561. <https://doi.org/10.1111/josh.13033>
30. Healthy Schools. Center for Disease Control and Prevention. <https://www.cdc.gov/healthyschools/physical-activity/facts.htm>. Updated 2021. Accessed November 25, 2021.
31. The State of Childhood Obesity. State Policies to Prevent Obesity. <https://stateofchildhoodobesity.org/state-policy/policies/pemiddle>. Published 2021. Accessed November 25, 2021.

32. COVID-19 Stats: Percentage of Middle and High School Students Aged 13–21 Years Attending In-Person Classes Who Reported Observing Fellow Students Wearing a Mask All the Time, by School Setting and Activity — United States, October 2020. *Morbidity Mortality Weekly Report*. 2021; 70:223. <http://dx.doi.org/10.15585/mmwr.mm7006a5>
33. López-Bueno R, Calatayud J, Andersen LL, Casana J, Ezzatvar Y, Casajus JA, Lopez-Sanchez GF, Smith L. Cardiorespiratory fitness in adolescents before and after the COVID-19 confinement: a prospective cohort study. *European Journal of Pediatrics*. 2021;180, 2287–2293. <https://doi.org/10.1007/s00431-021-04029-8>
34. Mueller AS, Diefendorf S, Abrutyn S, Beardall KA, Millar K, O'Reilly L, Steinberg H, Watkins JT. Youth mask-wearing and social-distancing behavior at in-person high school graduations during the COVID-19 pandemic. *Journal of Adolescent Health*. 2021; 68(3), 464–471. <https://doi.org/10.1016/j.jadohealth.2020.12.123>
35. Baweja R, Brown SL, Edwards EM, Murray MJ. COVID-19 Pandemic and Impact on Patients with Autism Spectrum Disorder. *Journal of autism and developmental disorders*. 2021; 1–10. Advance online publication. <https://doi.org/10.1007/s10803-021-04950-9>
36. Stelitano L, Mulhern C, Feistel K, Gomez-Bendaña H. How are teachers educating students with disabilities during the pandemic? RAND Corporation. https://www.rand.org/pubs/research_reports/RR1121-1.html. Published April 8, 2021. Accessed November 25, 2021.
37. Manivannan M, Jogalekar MP, Kavitha MS, Maran BAV, Gangadaran P. A mini-review on the effects of COVID-19 on younger individuals. *Experimental Biology and Medicine*. 2021; 246(3), 293–297. <https://doi.org/10.1177/1535370220975118>
38. Gazmararian J, Weingart R, Campbell K, Cronin T, Ashta J. Impact of covid -19 pandemic on the mental health of students from 2 semi-rural high schools in Georgia*. *Journal of School Health*. 2021; 91(5), 356–369. <https://doi.org/10.1111/josh.13007>
39. Education in a Pandemic: The Disparate Impacts of COVID-19 on America's Students. Department of Education of the United States of America. <https://www2.ed.gov/about/offices/list/ocr/docs/20210608-impacts-of-covid19.pdf>. Published 2021. Accessed November 1, 2021.
40. Hertz MF, Barrios LC. Adolescent mental health, COVID-19, and the value of school-community partnerships. *Injury Prevention*. 2020; 044050. <https://doi.org/10.1136/injuryprev-2020-044050>
41. Fegert JM, Vitiello B, Plener PL, Clemens V. Challenges and burden of the Coronavirus 2019 (COVID-19) pandemic for child and adolescent mental health: A narrative review to highlight clinical and research needs in the acute phase and the long return to normality. *Child and Adolescent Psychiatry and Mental Health*. 2020; 14, 20. <https://doi.org/10.1186/s13034-020-00329-3>
42. Graves JM, Abshire DA, Amiri S, Mackelprang JL. Disparities in technology and broadband internet access across Rurality. *Family & Community Health, Publish Ahead of Print*. 2021. <https://doi.org/10.1097/fch.0000000000000306>
43. Causey J, Harnack-Eber A, Ryu M, Shapiro D. High School Benchmarks: COVID-19 Special Analysis. Update & Correction. National College Progression Rates. ERIC. 2020. <https://eric.ed.gov/?id=ED613158>.
44. Kainth MK, Goenka PK, Williamson KA, Fishbein JS, Subramony A, Barone S, Belfer JA, Feld LM, Krief WI, Palumbo N, Rajan S, Rocker J, Scotto T, Sharma S, Sokoloff WC, Schleien C, Rubin LG. Early experience of COVID-19 in a US children's hospital. *Pediatrics*. 2020; 146(4). <https://doi.org/10.1542/peds.2020-003186>
45. Lessler J, Grabowski MK, Grantz KH, Badillo-Goicoechea E, Metcalf CJ, Lupton-Smith C, Azman AS, Stuart EA. Household covid-19 risk and in-person schooling. *Science*. 2021; 372(6546), 1092–1097. <https://doi.org/10.1126/science.abh2939>
46. Sinha IP, Harwood R, Semple MG, Hawcutt DB, Thursfield R, Narayan O, Kenny SE, Viner R, Hewer SL, Southern KW. Covid-19 infection in children. *The Lancet Respiratory Medicine*. 2020; 8(5), 446–447. [https://doi.org/10.1016/s2213-2600\(20\)30152-1](https://doi.org/10.1016/s2213-2600(20)30152-1)

47. Brisca G, Mariani M, Andrea Rotulo G, Pirlo D, Romanengo M, Castagnola E, Piccotti E, Moscatelli A. Clinical course of Covid-19 in children with pre-existing medical conditions. *Acta Paediatrica*. 2021; 110(4), 1291–1292. <https://doi.org/10.1111/apa.15730>
48. Ludvigsson JF. The first eight months of Sweden's COVID-19 strategy and the key actions and actors that were involved. *Acta Paediatrica*. 2020; 10.1111/apa.15582. <https://doi.org/10.1111/apa.15582>
49. Baral S, Chandler R, Prieto RG, Gupta S, Mishra S, Kulldorff M. Leveraging epidemiological principles to evaluate Sweden's COVID-19 response. *Annals of Epidemiology*. 2021; 54, 21–26. <https://doi.org/10.1016/j.annepidem.2020.11.005>
50. Mens H, Koch A, Chaine M, Bengaard Andersen A. The Hammer vs Mitigation—A comparative retrospective register study of the Swedish and Danish national responses to the COVID-19 pandemic in 2020. *Apmis*. 2021; 10.1111/apm.13133. <https://doi.org/10.1111/apm.13133>
51. Lohmann MJ, Randolph KM, Oh JH. Classroom Management Strategies for Hyflex Instruction: Setting Students Up for Success in the Hybrid Environment. *Early Childhood Education Journal*. 2021; 1–8. <https://doi.org/10.1007/s10643-021-01201-5>
52. Ismail SA, Saliba V, Lopez Bernal J, Ramsay ME, Ladhani SN. SARS-CoV-2 infection and transmission in educational settings: a prospective, cross-sectional analysis of infection clusters and outbreaks in England. *The Lancet Infectious diseases*. 2021; 21(3), 344–353. [https://doi.org/10.1016/S1473-3099\(20\)30882-3](https://doi.org/10.1016/S1473-3099(20)30882-3)
53. Nakachi K, Kawabe K, Hosokawa R, Yoshino A, Horiuchi F, Ueno SI. Differences in Psychological and Behavioral Changes between Children following School Closure due to COVID-19. *Psychiatry journal*. 2021; 5567732. <https://doi.org/10.1155/2021/5567732>
54. Kids Under Pressure. Challenge Success. <https://challengesuccess.org/wp-content/uploads/2021/02/CS-NBC-Study-Kids-Under-Pressure-PUBLISHED.pdf>. Published 2021. Accessed November 1, 2021.