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# The Effect of COVID-19 on Education



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## KEYWORDS

- COVID-19 • Education • Virtual learning • Special education
- Medical school education

## KEY POINTS

- Virtual learning has become a norm during COVID-19.
- Children requiring special learning services, those living in poverty, and those speaking English as a second language have lost more from the pandemic educational changes.
- For children with attention deficit disorder and no comorbidities, virtual learning has sometimes been advantageous.
- Math learning scores are more likely to be affected than language arts scores by pandemic changes.
- School meals, access to friends, and organized activities have also been lost with the closing of in-person school.

## BACKGROUND

The transition to an online education during the coronavirus disease 2019 (COVID-19) pandemic may bring about adverse educational changes and adverse health consequences for children and young adult learners in grade school, middle school, high school, college, and professional schools. The effects may differ by age, maturity, and socioeconomic class. At this time, we have few data on outcomes, but many oversight organizations have tried to establish guidelines, expressed concerns, and extrapolated from previous experiences.

## GENERAL EDUCATIONAL LOSSES AND DISPARITIES

Many researchers are examining how the new environment affects learners' mental, physical, and social health to help compensate for any losses incurred by this pandemic and to better prepare for future pandemics. There is a paucity of data at

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this juncture, but some investigators have extrapolated from earlier school shutdowns owing to hurricanes and other natural disasters.<sup>1</sup>

Inclement weather closures are estimated in some studies to lower middle school math grades by 0.013 to 0.039 standard deviations and natural disaster closures by up to 0.10 standard deviation decreases in overall achievement scores.<sup>2</sup> The data from inclement weather closures did show a more significant decrease for children dependent on school meals, but generally the data were not stratified by socioeconomic differences.<sup>3,4</sup> Math scores are impacted overall more negatively by school absences than English language scores for all school closures.<sup>4,5</sup>

The Northwest Evaluation Association is a global nonprofit organization that provides research-based assessments and professional development for educators. A team of researchers at Stanford University evaluated Northwest Evaluation Association test scores for students in 17 states and the District of Columbia in the Fall of 2020 and estimated that the average student had lost one-third of a year to a full year's worth of learning in reading, and about three-quarters of a year to more than 1 year in math since schools closed in March 2020.<sup>5</sup>

With school shifted from traditional attendance at a school building to attendance via the Internet, families have come under new stressors. It is increasingly clear that families depended on schools for much more than math and reading. Shelter, food, health care, and social well-being are all part of what children and adolescents, as well as their parents or guardians, depend on schools to provide.<sup>5,6</sup>

Many families have been impacted negatively by the loss of wages, leading to food insecurity and housing insecurity; some of loss this is a consequence of the need for parents to be at home with young children who cannot attend in-person school.<sup>6</sup> There is evidence that this economic instability is leading to an increase in depression and anxiety.<sup>7</sup> In 1 survey, 34.71% of parents reported behavioral problems in their children that they attributed to the pandemic and virtual schooling.<sup>8</sup>

Children have been infected with and affected by coronavirus. In the United States, 93,605 students tested positive for COVID-19, and it was reported that 42% were Hispanic/Latino, 32% were non-Hispanic White, and 17% were non-Hispanic Black, emphasizing a disproportionate effect for children of color.<sup>9</sup> COVID infection itself is not the only issue that affects children's health during the pandemic. School-based health care and school-based meals are lost when school goes virtual and children of lower socioeconomic class are more severely affected by these losses. Although some districts were able to deliver school meals, school-based health care is a primary source of health care for many children and has left some chronic conditions unchecked during the pandemic.<sup>10</sup>

Many families report that the stress of the pandemic has led to a poorer diet in children with an increase in the consumption of sweet and fried foods.<sup>11,12</sup> Shelter at home orders and online education have led to fewer exercise opportunities. Research carried out by Ammar and colleagues<sup>12</sup> found that daily sitting had increased from 5 to 8 hours a day and binge eating, snacking, and the number of meals were all significantly increased owing to lockdown conditions and stay-at-home initiatives. There is growing evidence in both animal and human models that diets high in sugar and fat can play a detrimental role in cognition and should be of increased concern in light of the pandemic.<sup>13</sup>

The family stress elicited by the COVID-19 shutdown is a particular concern because of compiled evidence that adverse life experiences at an early age are associated with an increased likelihood of mental health issues as an adult.<sup>14</sup> There is early evidence that children ages 6 to 18 years of age experienced a significant increase in their expression of "clinginess, irritability, and fear" during the early pandemic school

shutdowns.<sup>15</sup> These emotions associated with anxiety may have a negative impact on the family unit, which was already stressed owing to the pandemic.

Another major concern is the length of isolation many children have had to endure since the pandemic began and what effects it might have on their ability to socialize. The school, for many children, is the agent for forming their social connections as well as where early social development occurs.<sup>16</sup> Noting that academic performance is also declining the pandemic may be creating a snowball effect, setting back children without access to resources from which they may never recover, even into adulthood.

Predictions from data analysis of school absenteeism, summer breaks, and natural disaster occurrences are imperfect for the current situation, but all indications are that we should not expect all children and adolescents to be affected equally.<sup>4,5</sup> Although some children and adolescents will likely suffer no long-term consequences, COVID-19 is expected to widen the already existing educational gap from socioeconomic differences, and children with learning differences are expected to suffer more losses than neurotypical children.<sup>4,5</sup>

### **SPECIAL EDUCATION AND THE COVID-19 PANDEMIC**

Although COVID-19 has affected all levels of education reception and delivery, children with special needs have been more profoundly impacted. Children in the United States who have special needs have legal protection for appropriate education by the Individuals with Disabilities Education Act and Section 504 of the Rehabilitation Act of 1973.<sup>17,18</sup> Collectively, this legislation is meant to allow for appropriate accommodations, services, modifications, and specialized academic instruction to ensure that “every child receives a free appropriate public education . . . in the least restrictive environment.”<sup>17</sup>

Children with autism usually have applied behavioral analysis (ABA) as part of their individualized educational plan. ABA therapists for autism use a technique of discrete trial training that shapes and rewards incremental changes toward new behaviors.<sup>19</sup> Discrete trial training involves breaking behaviors into small steps and repetition of rewards for small advances in the steps toward those behaviors. It is an intensive one-on-one therapy that puts a child and therapist in close contact for many hours at a time, often 20 to 40 hours a week. This therapy works best when initiated at a young age in children with autism and is often initiated in the home.<sup>19</sup>

Because ABA workers were considered essential workers from the early days of the pandemic, organizations providing this service had the responsibility and the freedom to develop safety protocols for delivery of this necessary service and did so in conjunction with certifying boards.<sup>20</sup>

Early in the pandemic, there were interruptions in ABA followed by virtual visits, and finally by in-home therapy with COVID-19 isolation precautions.<sup>21</sup> Although the efficacy of virtual visits for ABA therapy would empirically seem to be inferior, there are few outcomes data available. The balance of safety versus efficacy quite early turned to in-home services with interruptions owing to illness and decreased therapist availability owing to the pandemic.<sup>21</sup> An overarching concern for children with autism is the possible loss of a window of opportunity to intervene early. Families of children and adolescents with autism spectrum disorder report increased stress compared with families of children with other disabilities before the pandemic, and during the pandemic this burden has increased with the added responsibility of monitoring in-home schooling.<sup>20</sup>

Early data on virtual schooling children with attention deficit disorder (ADD) and attention deficit with hyperactivity (ADHD) shows that adolescents with ADD/ADHD

found the switch to virtual learning more anxiety producing and more challenging than their peers.<sup>22</sup> However, according to a study in Ireland, younger children with ADD/ADHD and no other neurologic or psychiatric diagnoses who were stable on medication tended to report less anxiety with at-home schooling and their parents and caregivers reported improved behavior during the pandemic.<sup>23</sup> An unexpected benefit of shelter in home versus shelter in place may be to identify these stressors in face-to-face school for children with ADD/ADHD. If children with ADD/ADHD had an additional diagnosis of autism or depression, they reported increased anxiety with the school shutdown.<sup>23,24</sup>

Much of the available literature is anticipatory guidance for in-home schooling of children with disabilities rather than data about schooling during the pandemic. The American Academy of Pediatrics published guidance advising that, because 70% of students with ADHD have other conditions, such as learning differences, oppositional defiant disorder, or depression, they may have very different responses to in home schooling which are a result of the non-ADHD diagnosis, for example, refusal to attempt work for children with oppositional defiant disorder, severe anxiety for those with depression and or anxiety disorders, and anxiety and perseveration for children with autism.<sup>25</sup> Children and families already stressed with learning differences have had substantial challenges during the COVID-19 school closures.

### **HIGH SCHOOL, DEPRESSION, AND COVID-19**

High schoolers have lost a great deal during this pandemic. What should have been a time of establishing more independence has been hampered by shelter-in-place recommendations. Graduations, proms, athletic events, college visits, and many other social and educational events have been altered or lost and cannot be recaptured.

Adolescents reported higher rates of depression and anxiety associated with the pandemic, and in 1 study 14.4% of teenagers report post-traumatic stress disorder, whereas 40.4% report having depression and anxiety.<sup>26</sup> In another survey adolescent boys reported a significant decrease in life satisfaction from 92% before COVID to 72% during lockdown conditions. For adolescent girls, the decrease in life satisfaction was from 81% before COVID to 62% during the pandemic, with the oldest teenage girls reporting the lowest life satisfaction values during COVID-19 restrictions.<sup>27</sup> During the school shutdown for COVID-19, 21% of boys and 27% of girls reported an increase in family arguments.<sup>26</sup> Combine all of these reports with decreasing access to mental health services owing to pandemic restrictions and it becomes a complicated matter for parents to address their children's mental health needs as well as their educational needs.<sup>28</sup>

A study conducted in Norway measured aspects of socialization and mood changes in adolescents during the pandemic. The opportunity for prosocial action was rated on a scale of 1 (not at all) to 6 (very much) based on how well certain phrases applied to them, for example, "I comforted a friend yesterday," "Yesterday I did my best to care for a friend," and "Yesterday I sent a message to a friend." They also ranked mood by rating items on a scale of 1 (not at all) to 5 (very well) as items reflected their mood.<sup>29</sup> They found that adolescents showed an overall decrease in empathic concern and opportunity for prosocial actions, as well as a decrease in mood ratings during the pandemic.<sup>29</sup>

A survey of 24,155 residents of Michigan projected an escalation of suicide risk for lesbian, gay, bisexual, transgender youth as well as those youth questioning their sexual orientation (LGBTQ) associated with increased social isolation. There was also a 66% increase in domestic violence for LGBTQ youth during shelter in place.<sup>30</sup> LGBTQ

youth are yet another example of those already at increased risk having disproportionate effects of the pandemic.

Increased social media use during COVID-19, along with traditional forms of education moving to digital platforms, has led to the majority of adolescents spending significantly more time in front of screens. Excessive screen time is well-known to be associated with poor sleep, sedentary habits, mental health problems, and physical health issues.<sup>31</sup> With decreased access to physical activity, especially in crowded inner-city areas, and increased dependence on screen time for schooling, it is more difficult to craft easy solutions to the screen time issue.

During these times, it is more important than ever for pediatricians to check in on the mental health of patients with queries about how school is going, how patients are keeping contact with peers, and how are they processing social issues related to violence. Queries to families about the need for assistance with food insecurity, housing insecurity, and access to mental health services are necessary during this time of public emergency.

### **MEDICAL SCHOOL AND COVID-19**

Although medical school is an adult schooling experience, it affects not only the medical profession and our junior colleagues, but, by extrapolation, all education that requires hands-on experience or interning, and has been included for those reasons.

In the new COVID-19 era, medical schools have been forced to make drastic and quick changes to multiple levels of their curriculum to ensure both student and patient safety during the pandemic. Students entering their clinical rotations have had the most drastic alteration to their experience.

COVID-19 has led to some of the same changes high schools and colleges have adopted, specifically, replacement of large in-person lectures with small group activities small group discussion and virtual lectures.<sup>32</sup> The transition to an online format for medical education has been rapid and impacted both students and faculty.<sup>33,34</sup> In a survey by Singh and colleagues,<sup>33</sup> of the 192 students reporting 43.9% found online lectures to be poorer than physical classrooms during the pandemic. In another report by Shahrini and colleagues,<sup>35</sup> of 104 students surveyed, 74.5% students felt disconnected from their medical school and their peers and 43.3% felt that they were unprepared for their clerkships. Although there are no pre-COVID-19 data for comparison, it is expected that the COVID-19 changes will lead to increased insecurity and feelings of poor preparation for clinical work.

Gross anatomy is a well-established tradition within the medical school curriculum and one that is conducted almost entirely in person and in close quarters around a cadaver. Harmon and colleagues<sup>36</sup> surveyed 67 gross anatomy educators and found that 8% were still holding in-person sessions and 34 ± 43% transitioned to using cadaver images and dissecting videos that could be accessed through the Internet.

Many third- and fourth-year medical students have seen periods of cancellation for clinical rotations and supplementation with online learning, telemedicine, or virtual rounds owing to the COVID-19 pandemic.<sup>37</sup> A study from Shahrini and colleagues<sup>38</sup> found that an unofficial document from Reddit (a widely used social network platform with a subgroup for medical students and residents) reported that 75% of medical schools had canceled clinical activities for third- and fourth-year students for some part of 2020. In another survey by Harries and colleagues,<sup>39</sup> of the 741 students who responded, 93.7% were not involved in clinical rotations with in-person patient contact. The reactions of students varied, with 75.8% admitting to agreeing with the

decision, 34.7% feeling guilty, and 27.0% feeling relieved.<sup>39</sup> In the same survey, 74.7% of students felt that their medical education had been disrupted, 84.1% said they felt increased anxiety, and 83.4% would accept the risk of COVID-19 infection if they were able to return to the clinical setting.<sup>39</sup>

Since the start of the pandemic, medical schools have had to find new and innovative ways to continue teaching and exposing students to clinical settings. The use of electronic conferencing services has been critical to continuing education. One approach has been to turn to online applications like Google Hangouts, which come at no cost and offer a wide variety of tools to form an integrative learning environment.<sup>32,37,40</sup> Schools have also adopted a hybrid model of teaching where lectures can be prerecorded then viewed by the student asynchronously on their own time followed by live virtual lectures where faculty can offer question-and-answer sessions related to the material. By offering this new format, students have been given more flexibility in terms of creating a schedule that suits their needs and may decrease stress.<sup>37</sup>

Although these changes can be a hurdle to students and faculty, it might prove to be beneficial for the future of medical training in some ways. Telemedicine is a growing field, and the American Medical Association and other programs have endorsed its value.<sup>41</sup> Telemedicine visits can still be used to take a history, conduct a basic visual physical examination, and build rapport, as well as performing other aspects of the clinical examination during a pandemic, and will continue to be useful for patients unable to attend regular visits at remote locations. Learning effectively now how to communicate professionally and carry out telemedicine visits may better prepare students for a future where telemedicine is an expectation and allow students to learn the limitations as well as the advantages of this modality.<sup>41</sup>

Pandemic changes have strongly impacted the process of college applications, medical school applications, and residency applications.<sup>32</sup> For US medical residencies, 72% of applicants will, if the pattern from 2016 to 2019 continues, move between states or countries.<sup>42</sup> This level of movement is increasingly dangerous given the spread of COVID-19 and the lack of currently accepted procedures to carry out such a mass migration safely. The same follows for medical schools and universities.

We need to accept and prepare for the fact that medical students as well as other learners who require in-person training may lack some skills when they enter their profession. These skills will have to be acquired during a later phase of training. We may have less skilled entry-level resident physicians and nurses in our hospitals and in other clinical professions as well.

## SUMMARY

The COVID-19 pandemic has affected and will continue to affect the delivery of knowledge and skills at all levels of education. Although many children and adult learners will likely compensate for this interruption of traditional educational services and adapt to new modalities, some will struggle. The widening of the gap for those whose families cannot absorb the teaching and supervision of education required for in-home education because they lack the time and skills necessary are not addressed currently. The gap for those already at a disadvantage because of socioeconomic class, language, and special needs are most severely affected by the COVID-19 pandemic school closures and will have the hardest time compensating. As pediatricians, it is critical that we continue to check in with our young patients about how they are coping and what assistance we can guide them toward in our communities.

## CLINICS CARE POINTS

- Learners and educators at all levels of education have been affected by COVID-19 restrictions with rapid adaptations to virtual learning platforms.
- The impact of COVID-19 on learners is not evenly distributed and children of racial minorities, those who live in poverty, those requiring special education, and children who speak English as a second language are more negatively affected by the need for remote learning.
- Math scores are more impacted than language arts scores by previous school closures and thus far by these shutdowns for COVID-19.
- Anxiety and depression have increased in children and particularly in adolescents as a result of COVID-19 itself and as a consequence of school changes.
- Pediatricians should regularly screen for unmet needs in their patients during the pandemic, such as food insecurity with the loss of school meals, an inability to adapt to remote learning and increased computer time, and heightened anxiety and depression as results of school changes.

## DISCLOSURE

The authors have nothing to disclose.

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