

## **Community Spread of COVID-19 – Children as Transmission Vectors?**

*To Go or Not To Go to School*

The State of Maryland’s closure of all public schools on March 16, 2020 was one part of the broad measures aimed at stopping the spread of COVID-19 and protecting lives. When calling for schools to reopen no later than March 1st, Governor Larry Hogan cited the academic, social, and mental health toll distance learning and isolation is having on our youth. Undoubtedly the school closures have widened the already alarming health and educational inequities that many children struggle with every day. However, concerns remain over in-person education being a potential vector for disease transmission – for students, parents, teachers, and the broader community.

Research into COVID-19 has largely ignored children because of their seemingly mild response to the virus. However, a deeper understanding of how this pandemic affects childhood development will be beneficial to supporting the future generation. To address concerns over the potential reopening of schools, we have examined county-level data from the United States (U.S.) that includes features such as age, race/ethnicity, gender, educational status, economic status, housing density, and underlying disease conditions to find contributing socio-demographic factors that are correlated with COVID-19 cases and deaths. We used a Random Forest Regressor as an AI model and SHAP values to determine the social factors most closely associated with COVID-19 cases and deaths.

### **This is the Time for Distance Learning**

Recent studies show evidence that there are more COVID-19 cases among children and adolescents compared to the elderly. In Maryland, the total number of cases among children under 10 years of age is 18,747 while 14,553 cases were reported for people over 80 years of age (Figure 1).

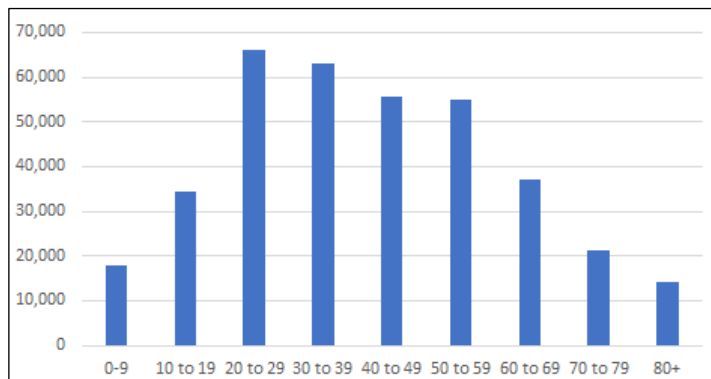


Figure 1: COVID-19 case distribution by age, State of Maryland.

In California, the age group from 0-17 years old accounted for 12.8% of positive cases while people 65+ years accounted for 10.6% of positive cases. Children make up between **6-18%** of the total testing from 11 U.S. states and their positivity rate ranged between **7-29.1%** for COVID-19

infections.<sup>1</sup> This suggests that given limited testing of children, we may not know how susceptible children actually are to COVID-19.

One modelling study found that when taken as an isolated measure, school closures were predicted to decrease cumulative deaths by approximately 2-4%.<sup>2</sup> Despite this, decreases in COVID-19 cases were noted after schools and daycares closed within many communities. This suggests that children or teachers and school administrators may be potential carriers and vectors of COVID-19 transmission. Initial COVID-19 studies focused on higher mortality risks among elderly age groups. Early on in the pandemic, explanations given for lower COVID-19 cases among children include fewer underlying medical conditions, healthier respiratory tracts due to less exposure to air pollution or cigarette smoke, and stronger innate immune responses. However, many explanations also emphasized the less developed ACE2 protein receptors in children. ACE2 has been shown to bind to the SARS-CoV-2 spike protein and promote internalization of the virus into human cells.

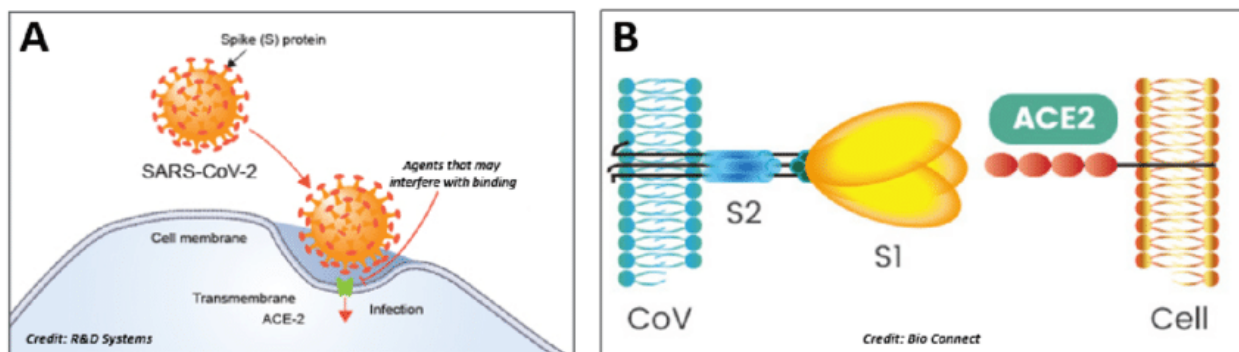


Figure 2: ACE2 protein receptor involved in COVID-19 infection.

Children have less mature, and therefore, decreased functionality of ACE2 protein receptors for SARS-CoV-2 entry into cells.<sup>3</sup> However, there is now supporting evidence that suggests that children are susceptible to COVID-19, potentially contradicting previous understandings of coronaviruses. Specifically, data showed that pediatric patients with COVID-19 had mild or asymptomatic disease accompanied by pneumonia in about half the cases.<sup>3</sup> Therefore, while children are less likely to die from COVID-19, their chances of catching and spreading the virus may be similar to other age groups.

One study into children as potential carriers has revealed that the virus was present in the respiratory tract of children for a mean (SD) of 17.6 (6.7) days regardless of whether they were

<sup>1</sup> [COVID-19 in children: the link in the transmission chain](#)

<sup>2</sup> [School closure and management practices during coronavirus outbreaks including COVID-19: a rapid systematic review](#)

<sup>3</sup> [Symptomatic and Asymptomatic Viral Shedding in Pediatric Patients Infected With Severe Acute Respiratory Syndrome Coronavirus 2 \(SARS-CoV-2\)](#)

asymptomatic.<sup>4</sup> When specifically looking at asymptomatic children, the average number of days in which the virus was detected was 14.1. This is concerning because unless they are tested or the virus is not infectious at that time, these groups of children may be able to spread COVID-19 and have a significant impact on community transmission.<sup>4</sup> Furthermore, another study found that while children were asymptomatic or pre-symptomatic, they had a much higher viral load in their upper airways compared to adults who were hospitalized.<sup>4</sup> Based on these observations, children, and therefore schools may be an important vector of significant COVID-19 transmission.

### **Be Cool – Go to School**

There are many factors that must be considered when determining whether to reopen schools. In addition to COVID-19 transmission, students' mental and emotional wellbeing must be taken into account, in addition to the exacerbation of health and educational inequities exposed by the school closures. In-person learning has many known and established benefits. In a classroom setting, students learn critical socio-emotional skills such as how to set and achieve positive goals and how to regulate their emotions. Due to pandemic-related school closures, many students have lost access to various school-based resources, such as mental health, nutrition, and special education programs. In the U.S., 64% of schools offer mental health treatment and 71% offer mental health disorder diagnostic assessments.<sup>5</sup> Moreover, the National School Lunch Program (NSLP) serves 20.1 million free lunches to American students every day, and provides 1.7 million reduced price lunches, in which students pay \$0.40 for their meal.<sup>6</sup> During the 2018-2019 academic year, 7.1 million, or 14% of all public school students between the ages of 3-21, received special education services under the Individuals with Disabilities Education Act (IDEA).<sup>8</sup> These services include speech, occupational, and physical therapy. Undoubtedly, for many children and adolescents, schools provide necessary resources they may be unable to receive at home or outside of a school setting. This is especially true for low-income parents who cannot afford such services and rely heavily on schools.

School districts have several options across the spectrum from fully remote to fully in-person to consider as they evaluate their reopening plans. Although remote learning may be safest in terms of COVID-19 exposure, students lack the attention and interaction afforded to them through live classroom instruction, and some lack the technological resources and access they need to succeed. Predominantly, the school closures have widened educational inequities that have been disproportionately affecting students for years. The “homework gap,” a term coined to describe the struggles students experience when working on homework assignments at home without

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<sup>4</sup> [Pediatric Severe Acute Respiratory Syndrome Coronavirus 2 \(SARS-CoV-2\): Clinical Presentation, Infectivity, and Immune Responses](#)

<sup>5</sup> [Explore Data on Mental Health Services in K-12 Public Schools for Mental Health Awareness Month](#)

<sup>6</sup> [School Meal Trends & Stats](#)

adequate access to the internet or laptops, compared to students who have sufficient access,<sup>7</sup> is widespread these days. 16.9 million students do not have access to high-speed home internet or a computer, causing them to fall behind.<sup>8</sup> This is especially prevalent in rural communities, where 1.7 million households do not have access to high-speed internet typically required for distance learning.<sup>9</sup> In addition, a classroom setting decreases the chances of students being distracted. This lack of engagement can also negatively impact student's social growth and development. Children are less able to apply the socio-emotional skills they learned while engaging in distance learning. During the pandemic, students were mostly at home with no interactions with other students, which affects the development of communication skills. An in-person school setting allows children to more easily learn how to behave in groups, develop and maintain friendships, and how to interact and form relationships with individuals outside of their family. Being able to interact regularly in social settings allows a child to build relationships with different people. The school environment allows children to meet, interact with, and form relationships with peers broadening their perspectives.

### **Where do we go from here?**

More research and investigation needs to be done on the impact of children as a vector of transmission to teachers, parents, and other community members. However, in light of these observations, it is important to understand the effect pandemic disease as well as disease countermeasures have on child development. This effort will help develop preventive measures necessary to protect the community health and wellbeing today while simultaneously ensuring childhood wellbeing and our collective future tomorrow.

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<sup>7</sup> [Students with Disabilities](#)

<sup>8</sup> [Students of Color Caught in the Homework Gap](#)