

**Note:** Medical and epidemiological research on COVID-19 in children is a rapidly evolving field. This review covers studies, reports, and news articles released on or before August 9, 2020. Research on COVID-19 has been conducted and released extremely quickly in order to facilitate its use in navigating the immediate crisis. As a result, some of the scholarly studies cited below are still undergoing peer review. Inclusion in this document should not be taken as an endorsement of any particular study – the intent of this review is to provide an overview of the current body of evidence and state of research.

Our intention is to maintain a ‘living document’ that will be updated to reflect scientists’ changing understandings of COVID-19. **When evidence conflicts or is insufficient to come to a solid conclusion, we strongly urge affiliates to advocate for those policies and practices that are most protective of students, educators, and families.**

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### What do we know about COVID-19 infection in children?

*Children may be less likely than adults to contract COVID-19, but contradictory evidence has emerged.*

- The key measure to consider in looking at the probability of children catching COVID-19 is the Attack Rate (AR), or the proportion of exposed children who subsequently become infected. In contrast to simply looking at infection rates, the Attack Rate takes into account the fact that children may be less likely than adults to be exposed to infected people.
- Multiple studies have shown that children have lower Attack Rates than adults. Across five high-quality studies, ARs for children ranged from 4% to 7.3% compared to 6.2% to 21.9% for adults.<sup>1</sup> In only one study was the child AR rate statistically indistinguishable from the adult rate. Similarly, an analysis of data from six countries estimates that those under 20 are about half as susceptible to contracting COVID-19 as older individuals.<sup>2</sup>
- However, in a recent case study of a COVID-19 outbreak in a summer camp in Georgia, children had higher Attack Rates than adults, with Attack rates by age group of: 51% for those ages 6-10, 44% for those 11-17, 33% for those 18-21, and 29% for those ages 22-59.<sup>3</sup> An important caveat to this finding is that campers were not required to wear masks, while staff members were, which may explain the higher ARs for children. In addition, the camp did not open windows and doors for increased ventilation in buildings, which likely contributed to the very high overall Attack Rates.

*Older children may be more likely to contract COVID-19 than younger children, but the evidence is still inconclusive.*

- A study in Iceland that involved 6% of the total population found that the probability of infection among children increases with age – within the general population, not a single case was identified in children under age 10. In a concurrent screening of higher-risk populations (those with symptoms or who had traveled recently to a COVID-19 hotspot), 6.7% of those under 10 tested positive compared to 13.7% of those 10 and older.<sup>4</sup>

- A study of a French high school that experienced a COVID-19 outbreak showed that there was no difference in infection rates among students ages 15-17 and staff, with about 40% of each group testing positive.<sup>5</sup>
- On the other hand, in the Georgia summer camp example cited above, the youngest age group (ages 6-10) had the highest Attack Rate.<sup>3</sup> While this may be due in part to the types of activities different age cohorts engaged in, it is still abundantly clear from this case that younger children are not immune from COVID-19.

*Children are underrepresented among confirmed COVID-19 cases in the United States – but over 250,000 children in the U.S. have had confirmed cases of COVID-19.*

- As of August 5, 2020, 5.8% of confirmed U.S. cases of COVID-19 were among children ages 5-17, and 1.6% were among children ages 0-4.<sup>6</sup> Children under age 18 are currently about 24% of the U.S. population but only 7.4% of confirmed cases, demonstrating a lower rate of infection compared to adults. The U.S. trend of children being underrepresented among COVID-19 cases is consistent with data from other nations<sup>1</sup> and in line with the research on Attack Rates described above.
- That said, over 250,000 children in the United States have had confirmed cases of COVID-19. It is likely that the confirmed case count underreports the true number of cases due to challenges in accessing testing and the tendency of children to have no or milder symptoms (see below).

*Child infection rates are on the rise and becoming a higher proportion of cases in the U.S.*

- In an analysis of state-level data, the American Academy of Pediatrics (AAP) and the Children’s Hospital Association (CHA) showed a 40% increase in child cases between July 16 and July 30 – jumping from 241,904 to 338,982.<sup>7</sup> (Note: The definition of ‘child’ varies considerably among states – from ages 0-14 to ages 0-24. In addition, New York did not provide an age distribution for cases outside of New York City, and Texas reported age for only 9% of cases and thus was excluded from the analysis.)
- Nationwide, the infection rate for children is 447 per 100,000. In nine states, the rate of infection for children was greater than 600 per 100,000: Arizona, South Carolina, Tennessee, Louisiana, Mississippi, Arkansas, Florida, Nevada, and Rhode Island. In Arizona, the rate is greater than 1,000 per 100,000.<sup>7</sup>
- The AAP/CHA data analysis further shows that children are becoming a greater proportion of U.S. cases over time. In April, only about 2% of COVID-19 cases were among children compared to 8.8% in late-July.<sup>7</sup> (This is slightly higher than the 7.4% reported by the CDC due to the different age categories included.)

*Race/ethnicity and socioeconomic status are linked to infection rates in children – and a plurality of U.S. children who have been diagnosed with COVID-19 are Hispanic/Latino.*

- Nearly half (45.9%) of all COVID-19 cases in the 5-17 age cohort were among Hispanic/Latino children, with a similar percent in children ages 0-4 (45.2%).<sup>6</sup> Only about a quarter of all U.S. children are Hispanic/Latino.<sup>8</sup> Hispanic/Latino individuals also make up a plurality of diagnosed cases within the key age groups for parents: 34.9% of those 18-29, 38% of those 30-39, and 38.6% of those 40-49.
- In contrast, white children make up about half of the under-17 population yet are only about a quarter of COVID-19 cases. Black and Native American children made up a slightly greater proportion of COVID-19 cases than they do the child population but were not overrepresented nearly to the degree of Hispanic/Latino children.
- Similarly, a study of children tested for COVID-19 in Washington, DC showed the highest positive rates for Hispanic/Latino children (46.4%), followed by Black children (30%), and then non-Hispanic white children (7.3%). Children from lower socioeconomic backgrounds were also more likely to test positive,

with those in the lowest median family income quartile far more likely to test positive than those in the highest quartile (37.7% vs. 8.7%).<sup>9</sup>

*The implications of contracting COVID-19 for children with preexisting medical conditions are still unclear.*

- Research is still in the early stages regarding children with preexisting conditions who contract COVID-19. Like adults, children with prior conditions who are diagnosed with COVID-19 are more likely to require hospitalization.<sup>10</sup> However, COVID-19 infection in these children does not, based on the small number of studies that exist, appear more likely to lead to complications or serious illness.<sup>10-12</sup>

### **What do we know about the prognosis for COVID-19 positive children and the potential for complications?**

*Children make up a very small fraction of U.S. deaths from COVID-19.*

- The two youngest age cohorts (ages 0-4 and ages 5-17) each make up less than 0.1% of COVID-19 deaths in the United States.<sup>6</sup> Among states reporting data, 0-0.2% of child COVID-19 cases resulted in death.<sup>7</sup>

*Children often exhibit milder and/or different symptoms than adults.*

- A recent review of research on COVID-19 in children concluded that children typically develop a milder form of the disease and rarely require treatment in intensive care units.<sup>13</sup> In addition, this review found that children with COVID-19 are more likely to exhibit fevers, vomiting, and diarrhea than adults are.

*Although they are rare, children can have serious cases of COVID-19.*

- The AAP/CHA state-level data analysis showed that hospitalization rates for children with COVID-19 range from 0.6% to 9.1% in the 20 states that reported data plus New York City.<sup>7</sup>

*MIS-C is a serious, but rare, complication of COVID-19.*

- Multisystem inflammatory syndrome in children (MIS-C – referred to as PIMS-TS, Pediatric inflammatory multisystem syndrome temporally associated with SARS-CoV-2, in Europe) involves inflammation of various organs, including the heart, lungs, kidneys, brain, skin, eyes, and/or gastrointestinal organs. MIS-C typically manifests 2-4 weeks after infection with COVID-19, but is rare, with only 570 cases diagnosed in the United States by the end of July.<sup>14</sup>
- As of the end of July 2020, the CDC had received reports of 570 cases of MIS-C in children and 10 deaths. A majority of cases (60.2%) have been among children ages 2-7, and a large majority (73.6%) have been among Hispanic/Latino or Black children.<sup>14</sup>
- Among these 570 cases, children had a median stay of six days in the hospital. A majority of children (63.9%) received intensive care, and 13.1% required mechanical ventilation. For 61.6% of children, 4-5 organ systems were affected, with gastrointestinal and cardiac symptoms appearing in more than 85% of patients.<sup>14</sup>

### **What do we know about the ability of children to transmit COVID-19?**

*It is clear that children **can** transmit COVID-19, although evidence is mixed about whether they do so at lower rates than adults or not.*

- One study of secondary transmission within households (i.e. spread from one member to other people living together) in China showed a rate of 4% for children compared to 17.1% for adults.<sup>15</sup> This suggests that children *can* transmit COVID-19, although their potential to do so is lower than that for adults.
- A large-scale, high-quality study in South Korea found that children under 10 were about half as likely to transmit the COVID-19 as adults. However, those ages 10-19 were at least as likely as adults to infect others.<sup>16</sup>
- Multiple accounts and studies of school, summer camp and child care center outbreaks indicate minimal or no transmission among children or from children to adults,<sup>17-20</sup> yet there are also many examples of significant spread within these settings.<sup>3,21-24</sup>
- A recent study found that young children carry higher amounts of the virus in their respiratory tracts than older children and adults. However, the link between this finding and transmission from children remains unclear.<sup>25</sup>
- New evidence that shows an association between school closures and lower community incidence and mortality rates, pointing to schools as a transmission site (the role of child vs. adult transmission within schools is not parsed out), but this research cannot untangle the effects of school closings from other concurrent measures (e.g., closing bars and restaurants).<sup>26</sup>

*Children are more likely to be asymptomatic than adults and many have a longer incubation rate, increasing their chances of their unwittingly spreading COVID-19.*

- In a comparison of 24 studies of over 48,000 COVID-19 patients of all ages with 11 studies of over 1,100 children, only 9% of the all-ages group was asymptomatic compared to 27.7% of children, a statistically significant difference.<sup>27</sup>
- There is some indication that children with COVID-19 have a longer incubation period – the time between when the virus is contracted and symptoms appear – suggesting that children are contagious for a longer period of time than adults.<sup>13</sup>

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