

## If Young Children's Risk of SARS-CoV-2 Infection Is Similar to That of Adults, Can Children Also Contribute to Household Transmission?

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**During the early phases** of the SARS-CoV-2 pandemic, children were sheltered and protected from exposures and infection with this new respiratory virus. They were also thought to be less susceptible and were not tested or diagnosed as



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often as adults.<sup>1</sup> Historically, young children are at unique high risk of infection and severe disease from respiratory viruses, as seen during the influenza A/H1N1 2009 pandemic.<sup>2</sup> However, SARS-CoV-2 initially appeared to affect primarily older adults, who experienced the highest morbidity and mortality of COVID-19.<sup>3</sup> As the pandemic evolved and children and adolescents were gradually allowed to resume social and school activities, and particularly with the relaxation of the use of public health measures such as masking and social distancing, the actual impact of SARS-CoV-2 in the pediatric population has become apparent. While relative to adults, children continue to be generally less affected from severe COVID-19, hospitalization, and death, the number of pediatric cases, hospitalizations, and complications such as multisystem inflammatory syndrome are not insignificant and continue to rise with the advent of the Delta variant in the United States.<sup>4,5</sup> Less clarity exists regarding the risk of SARS-CoV-2 infection in children.

In this issue of *JAMA Pediatrics*, Dawood et al<sup>6</sup> report the results of a large (1236 participants in 310 households) prospective household cohort study conducted from August 2020 to April 2021, encompassing the most active epidemic periods of COVID-19 prior to the emergence of the Delta variant. The study demonstrates that all along, children of all ages including infants and toddlers have had a similar risk of SARS-CoV-2 infection compared with adults.<sup>6</sup> In this study conducted by the US Centers for Disease Control and Prevention and investigators in Utah and New York City, New York, the incidence rates of infection were similar by age group among adolescents aged 12 to 17 years (5.9/1000 person-weeks), children aged 5 to 11 years (4.4/1000 person-weeks), and notably infants from birth to age 4 years (6.3/1000 person-weeks), compared with adults 18 years and older (5.1/1000 person-weeks). Therefore, children are not only capable of becoming infected, but are also capable of transmitting SARS-CoV-2.

The prospective and systematic assessment of infection through weekly self-testing independent from the presence of symptoms and the careful additional evaluation of symptomatic cases allowed for the measurement of true infection rates in the study by Dawood et al.<sup>6</sup> While infection rates were similar in all age groups, asymptomatic infection was definitely more common in pediatric groups, particularly children up to 11 years of age, in whom only half of the confirmed cases of

infection resulted in symptomatic disease compared with more than 88% of adults. The real-time ascertainment of both symptomatic and asymptomatic infection by molecular diagnostic testing in all age groups within the household during a period of high virus circulation is a notable strength of this study. Despite inherent limitations as described by the authors, the study design and clever approach for remote data collection, self-sampling, and real-time disease surveillance can be a model for the timely implementation of infection and transmission studies in areas of disease activity in future outbreaks and pandemics.

Dawood et al<sup>6</sup> estimated that in households with at least 1 documented case of pediatric infection, the risk of infection among household members was 52% (range, 11%-100%). This is a high rate of transmission, and it is likely to be higher with the Delta variant and other emerging variants with increased infectivity and transmissibility. The fact that children, and especially young children, can transmit SARS-CoV-2 is now established and more clearly understood. In another relevant study by Paul et al,<sup>7</sup> among 6289 households in Ontario, Canada, where a pediatric age (birth to age 17 years) index case of laboratory-confirmed SARS-CoV-2 was identified from June to December 2020, the youngest children from birth to age 3 years had the highest odds (adjusted odds ratio, 1.43; 95% CI, 1.17-1.75) of transmitting SARS-CoV-2 to household contacts when compared with adolescents aged 14 to 17 years.<sup>7</sup> Importantly, school-aged children aged 4 to 8 years in particular, but also those aged 9 to 13 years, also had a higher rate of household transmission than adolescents in this study. Other studies in the US and other countries have reported similar observations regarding the role of young children in SARS-CoV-2 transmission.<sup>7</sup> Interestingly, in a California elementary school outbreak with the Delta variant, the reported attack rate was 50%, showing that even in less enclosed environments, transmission can be high.<sup>8</sup>

The findings of Dawood et al<sup>6</sup> and Paul et al<sup>7</sup> have substantial implications for decision-making in regard to return-to-school planning and the participation of children in various group activities, including childcare, after-school programs, and camps. While there has been reluctance by some, the need for appropriate use of face masks, handwashing, and social distancing among pediatric populations is evident and necessary to protect children and their household contacts. Children play a key role in the transmission of respiratory viruses, and the start of the school year typically coincides with community spread of respiratory illnesses such as influenza. Therefore, it is likely that as SARS-CoV-2 establishes itself as a respiratory human pathogen, outbreaks associated with participation of chil-

dren in childcare, school, and other group activities will continue to occur and contribute to the perpetuation of this virus as a threat to communities in the United States and worldwide, especially where children and other populations remain unvaccinated.

The findings of the study by Dawood et al<sup>6</sup> also have implications for pandemic control. There is a need for the early inclusion of children in vaccine studies and vaccination strategies for their own protection, for protection of other children and the adults they are in contact with at home and in schools, and for the protection of the community. It is also imperative to include children in studies of preventive treatments such as monoclonal antibodies, antivirals, and other therapeutics for SARS-CoV-2. The delay in initiating such studies and subsequent

paucity of data to support the use of vaccines and therapeutics has resulted in delays in the development of evidence-based guidance for the care of children with COVID-19. This is painfully apparent today, as the Delta variant continues to ravage through vulnerable populations, unvaccinated individuals, and young individuals, children included.

If lessons are to be learned from our collective experience and if we agree to acknowledge the role of children in the transmission of respiratory viral infections, then pediatric populations, from infants to adolescents, must be included in pandemic preparedness, disease burden assessment, timely vaccine and therapeutics research, and strategies and policies for the control of outbreaks and pandemics from day 1 without delay.

#### ARTICLE INFORMATION

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#### REFERENCES

1. CDC COVID-19 Response Team. Coronavirus disease 2019 in children—United States, February 12–April 2, 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69(14):422–426. doi:10.15585/mmwr.mm6914e4
2. Shrestha SS, Swerdlow DL, Borse RH, et al. Estimating the burden of 2009 pandemic influenza A (H1N1) in the United States (April 2009–April 2010). *Clin Infect Dis*. 2011;52(suppl 1):S75–S82. doi:10.1093/cid/ciq012
3. Garg S, Kim L, Whitaker M, et al. Hospitalization rates and characteristics of patients hospitalized with laboratory-confirmed coronavirus disease 2019—COVID-NET, 14 states, March 1–30, 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69(15):458–464. doi:10.15585/mmwr.mm6915e3
4. Kim L, Whitaker M, O'Halloran A, et al; COVID-NET Surveillance Team. Hospitalization rates and characteristics of children aged <18 years hospitalized with laboratory-confirmed COVID-19—COVID-NET, 14 states, March 1–July 25, 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69(32):1081–1088. doi:10.15585/mmwr.mm6932e3
5. Centers for Disease Control and Prevention. COVID data tracker. Accessed August 29, 2021. <https://covid.cdc.gov/covid-data-tracker/#datatracker-home>
6. Dawood FS, Porucznik CA, Veguilla V, et al. Incidence rates, household infection risk, and clinical characteristics of SARS-CoV-2 infection among children and adults in Utah and New York City, New York. *JAMA Pediatr*. Published online October 8, 2021. doi:10.1001/jamapediatrics.2021.4217
7. Paul LA, Doneman N, Schwartz KL, et al. Association of age and pediatric household transmission of SARS-CoV-2 infection. *JAMA Pediatr*. Published online August 16, 2021. doi:10.1001/jamapediatrics.2021.2770
8. Lam-Hine T, McCurdy SA, Santora L, et al. Outbreak associated with SARS-CoV-2 B.1.617.2 (Delta) variant in an elementary school—Marin County, California, May–June 2021. *MMWR Morb Mortal Wkly Rep*. 2021;70(35):1214–1219. doi:10.15585/mmwr.mm7035e2