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Benjamin Lee, MD and William V. Raszka, Jr., MD

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COVID-19 Transmission and Children: The Child is Not to Blame

Benjamin Lee, MD and William V. Raszka, Jr., MD

Affiliation: University of Vermont Larner College of Medicine, Burlington, Vermont

Address correspondence to:

William V. Raszka Jr.
Department of Pediatrics
University of Vermont, Larner College of Medicine
89 Beaumont Ave, Given Courtyard N210
Burlington VT 05405

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Abbreviations: COVID-19, coronavirus disease 2019; HHC, household contact; RT-PCR, reverse-transcription polymerase chain reaction; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2

COVID-19 presents arguably the greatest public health crisis in living memory. One surprising aspect of this pandemic is that children appear to be infected by SARS-CoV-2, the virus that causes COVID-19, far less frequently than adults, and when infected typically have mild symptoms,¹⁻³ although emerging reports of a novel Kawasaki disease-like multi-system inflammatory syndrome necessitate continued surveillance in pediatric patients.^{4,5} However, a major question remains unanswered: to what extent are children responsible for SARS-CoV-2 transmission? Resolving this issue is central to making informed public health decisions, ranging from how to safely re-open schools, childcare facilities, and summer camps, down to the precautions needed to obtain a throat culture in an uncooperative child. To date, few published data are available to help guide these decisions.

In this issue of *Pediatrics*, Posfay-Barbe and colleagues report on the dynamics of COVID-19 within families of children with reverse-transcription polymerase chain reaction (RT-PCR)-confirmed SARS-CoV-2 infection in Geneva, Switzerland.⁶ From March 10 – April 10, 2020, all children <16 years of age diagnosed at Geneva University Hospital (N=40) underwent contact tracing to identify infected household contacts (HHC). Of 39 evaluable households, in only three (8%) was a child the suspected index case, with symptom onset preceding illness in adult HHCs. In all other households, the child developed symptoms after or concurrent with adult HHCs, suggesting that the child was not the source of infection, and that children most frequently acquire COVID-19 from adults, rather than transmitting it to them.

These findings are consistent with other recently published household contact investigations in China. Of 68 children with confirmed COVID-19 admitted to Qingdao Women's and Children's Hospital from January 20 – February 27, 2020, and with complete epidemiological data, 65 (95.59%) cases were HHCs of previously infected adults.⁷ Of 10

children hospitalized outside Wuhan, China, in only one was there possible child to adult transmission, based on symptom chronology.⁸ Similarly, transmission of SARS-CoV-2 by children outside household settings seems uncommon, although information is limited. In an intriguing study from France, a nine year-old boy with respiratory symptoms associated with picornavirus, influenza A, and SARS-CoV-2 coinfection was found to have exposed over 80 classmates at three schools; no secondary contacts became infected, despite numerous influenza infections within the schools, suggesting an environment conducive to respiratory virus transmission.⁹ In New South Wales, Australia, nine students and nine staff infected with SARS-CoV-2 across 15 schools had close contact with a total of 735 students and 128 staff.¹⁰ Only two secondary infections were identified, none in adult staff; one student in primary school was potentially infected by a staff member, and one student in high school was potentially infected via exposure to two infected schoolmates.

Based on these data, SARS-CoV-2 transmission in schools may be less important in community transmission than initially feared. This would be another manner by which SARS-CoV-2 differs drastically from influenza, for which school-based transmission is well recognized as a significant driver of epidemic disease and forms the basis for most evidence regarding school closures as public health strategy.^{11,12} While two reports are far from definitive, they provide early reassurance that school-based transmission could be a manageable problem and school closures may not have to be a foregone conclusion, particularly for elementary school aged-children who appear to be at the lowest risk of infection. Additional support comes from mathematical models, which find that school closures alone may be insufficient to halt epidemic spread¹³ and have modest overall impacts compared to broader, community-wide physical distancing measures.¹⁴

These data all suggest that children are not significant drivers of the COVID-19 pandemic. It is unclear why documented SARS-CoV-2 transmission from children to other children or adults is so infrequent. In 47 COVID-19 infected German children, nasopharyngeal SARS-CoV-2 viral loads were similar to those in other age groups, raising concern that children could be as infectious as adults.¹⁵ Because SARS-CoV-2-infected children are so frequently mildly symptomatic, they may have weaker and less frequent cough, releasing fewer infectious particles into the surrounding environment. Another possibility is that because school closures occurred in most locations along with or prior to widespread physical distancing orders, most close contacts became limited to households, reducing opportunities for children to become infected in the community and present as index cases.

Almost six months into the pandemic, accumulating evidence and collective experience argue that children, particularly school-aged children, are far less important drivers of SARS-CoV-2 transmission than adults. Therefore, serious consideration should be paid towards strategies that allow schools to remain open, even during periods of COVID-19 spread. In doing so, we could minimize the potentially profound adverse social, developmental, and health costs that our children will continue to suffer until an effective treatment or vaccine can be developed and distributed, or failing that, until we reach herd immunity.^{16,17}

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