

COVID-19 and Children: Adding Another Piece to the Puzzle

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One of the most important lessons of the pandemic thus far is that what is accepted as *fact* today may be very different from what we understand as true next month or even next week. This is exceptionally well-illustrated by our evolving understanding of SARS-CoV-2 infections in children.

Early reports suggested that children were infected less often than adults and many had mild or even asymptomatic disease.ⁱ We now know that children can get severe disease and that infections are more common in children than previously realized.ⁱⁱ As of July 7, 2020 in the United States, 200,184 total pediatric cases had been reported, representing 7.6% of all COVID-19 cases, and 63 children died.ⁱⁱⁱ

In this issue, Poline and colleagues have added another piece to the puzzle of COVID-19 and children.^{iv} Over a two week period, they systematically screened hospitalized pediatric patients for SARS-CoV-2 infection by rRT-PCR. Based on published reports in children, they cast a broad net in defining symptoms potentially associated with COVID-19 infection: fever, upper respiratory tract symptoms (cough, rhinitis, tonsillitis, odynophagia, otalgia, otitis, conjunctivitis), influenza-like illness (including asthenia, headache and myalgia), anosmia, dysgeusia, dyspnea, chest pain, vomiting or diarrhea, abdominal pain, skin involvement, arthritis or arthralgia, mucosal hemorrhage, Kawasaki syndrome, and myocarditis. No single symptom or combination of symptoms was sensitive identifying infected children. The challenge remains for pediatricians that COVID-19 is not clinically distinguishable from many other common viral illnesses in children.

Nearly half of the children who tested positive in this study (45%) were asymptomatic at hospital admission. This is higher than previously reported in some studies, including a large case series from China in which 4.4% of 2143 pediatric patients infected with COVID were asymptomatic.³ It is lower than predicted by one modeling study that suggested only 21% of infected 10 to 19 year olds may manifest symptoms.^v Median CT values (inversely related to viral loads) were similar in symptomatic and asymptomatic children. This phenomenon has been previously shown in both adults and children.^{vi,vii} Transmission from asymptomatic individuals—mostly adults-- is well described.^{viii} However, we still don't know what this means for infection prevention strategies in children's healthcare facilities.

One missing piece of the puzzle is just how likely children are to transmit infection to others. Emerging data suggest that transmission risk is likely to be age-related. In a much publicized study from South Korea, 18.5% of the household contacts of infected children 10-19 years of age tested positive for SARS-CoV-2, suggesting rates of transmission for school-age children are similar to older adults.^{ix} Rates of infection were lowest in the household contacts of children 0 to 9 years of age (5.3% [95% CI 1.3%–13.7%]) and transmission to non-household contacts was rare in both groups (~1% tested positive).

Data on transmission from children to others in community settings is largely based on investigations in school settings. Most, but not all reports, have demonstrated little to no transmission from children to classmates or teachers.^{x,xi,xii}

Few papers describe healthcare-associated transmission of SARS-CoV-2 from pediatric patients. In a prospective study of symptomatic healthcare personnel (HCP) conducted in two hospitals in France,

COVID-19 was diagnosed in 65 HCP who cared for children.^{xiii} Thirteen reported at least one close contact with an infected patient without personal protective equipment (PPE), raising the possibility of occupational transmission. Notably however, other exposures were common and not mutually exclusive. Seventeen in this cohort reported close contact with a household member with COVID-19, and 34 reported exposures to an infected colleague. Infected HCP described other behaviors that could have contributed to infection, including frequent close contact with work colleagues without masks and failure to always wear a mask in public.

A recent case report from South Korea illustrates that healthcare-associated transmission of SARS-CoV-2 from a hospitalized pediatric patient can occur, albeit rarely.^{xiv} A 9 year-old girl with fever and intracerebral hemorrhage was admitted to a 6-bed room on a pediatric ward as a transfer from another hospital. She had no respiratory symptoms, COVID-19 was not clinically suspected and a PCR for SARS-CoV-2 was negative on the day of admission. Five days later, she was identified as part of an outbreak investigation at the previous hospital and a SARS-CoV-2 PCR obtained was positive. Of 81 close and 1125 casual contacts, a single close contact, the mother of a hospital roommate, was subsequently found to be infected. This report provides limited evidence that infection from paucisymptomatic pediatric patients is limited in the healthcare setting, at least in the absence of aerosol-generating procedures (AGPs).

Even if transmission is uncommon, it is important to prioritize the safety of HCP and other patients. Poline et al. suggest that a systematic SARS-CoV-2 testing of children admitted to hospital should be considered to limit healthcare-associated transmission. Unfortunately, the availability of test kits would preclude this strategy at some hospitals.^{xv}

Current infection prevention recommendations in the United States acknowledge and attempt to mitigate the risk of spread from infected, asymptomatic individuals.^{xvi} As part of universal source control, HCP should wear a surgical mask at all times, while patients ≥ 2 years of age are advised to wear a cloth face covering or face mask throughout their stay. This is easier said than done with pediatric patients.

On June 19, 2020, the Centers for Disease Control and Prevention published updated recommendations for universal use of PPE for HCP working in communities with moderate to sustained SARS-CoV-2 transmission.¹⁶ When COVID-19 is *not suspected*, HCP are advised to wear eye protection and an N95 for equivalent/higher level respirator instead of a surgical mask for all AGPs. This also poses logistical challenges. As cases surge in many communities across the U.S., some facilities are dealing with shortages of PPE, including N95 masks.^{xvii}

Sounds like we are once again between the proverbial rock and hard place.

Disclaimer:

The opinion expressed here are her own and do not necessarily represent the views of PIDS.

Potential conflicts:

Dr. Bryant is the president of the Pediatric Infectious Diseases Society. Dr. Ristagno has no conflicts to disclose.

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References

1. Dong Y, Mo X, Hu Y, Qi X, Jiang F, Jiang Z, et al. Epidemiology of COVID-19 Among Children in China. *Pediatrics*. 2020; 145: e20200702.
2. DeBiasi RL, Song X, Delaney M, et al. Severe Coronavirus Disease-2019 in Children and Young Adults in the Washington, DC, Metropolitan Region. *J Pediatr*. 2020;223:199-203.e1. doi:10.1016/j.jpeds.2020.05.007.
3. American Academy of Pediatrics and the Children's Hospital Association. Children and COVID-19: State Data, Executive Summary, Version 7/9/2020.
4. Pouline, J, Gaschignard, J, Leblanc, C, et al. Systematic SARS-CoV-2 screening at hospital admission in children: a French prospective multicenter study. *Clin Infect Dis* 2020; in press.
5. Davies, NG, Klepac, P, Liu, Y et al. Age-dependent effects in the transmission and control of COVID-19 epidemics. *Nat Med* (2020). <https://doi.org/10.1038/s41591-020-0962-9>.
6. Zou L, Ruan F, Huang M, et al. SARS-CoV-2 Viral Load in Upper Respiratory Specimens of Infected Patients. *N Engl J Med*. 2020;382(12):1177-1179. doi:10.1056/NEJMc2001737.
7. Kam KQ, Yung CF, Cui L, et al. A Well Infant with Coronavirus Disease 2019 (COVID-19) with High Viral Load. *Clin Infect Dis* 2020;71(15):847-849. doi:10.1093/cid/ciaa201.
8. Huff HV, Singh A. Asymptomatic transmission during the COVID-19 pandemic and implications for public health strategies. *Clin Infect Dis* 2020;ciaa654. doi:10.1093/cid/ciaa654

9. Park YJ, Choe YJ, Park O, Park SY, Kim YM, Kim J, et al. Contact tracing during coronavirus disease outbreak, South Korea, 2020. *Emerg Infect Dis.* 2020
<https://doi.org/10.3201/eid2610.201315> Published online July 16, 2020.
10. Danis K, Olivier Epaulard O, et al. for the Investigation Team. Cluster of Coronavirus Disease 2019 (COVID-19) in the French Alps, February 2020. *Clin Infect Dis* 2020; 71(15):825-832. <https://doi.org/10.1093/cid/ciaa424>
11. Heavey L, Casey G, Kelly C, Kelly D, McDarby G. No evidence of secondary transmission of COVID-19 from children attending school in Ireland, 2020. *Euro Surveill.* 2020;25(21):2000903. doi:10.2807/1560-7917.ES.2020.25.21.2000903
12. Stein-Zamir C , Abramson N , Shoob H , et al. A large COVID-19 outbreak in a high school 10 days after schools' reopening, Israel, May 2020. *Euro Surveill.* 2020;25(29). <https://doi.org/10.2807/1560-7917.ES.2020.25.29.2001352> Published online July 23, 2020.
13. Contejean A, Leporrier J, Canoui E, et al. Comparing dynamics and determinants of SARS-CoV-2 transmissions among health care workers of adult and pediatric settings in central Paris [published online ahead of print, 2020 Jul 15]. *Clin Infect Dis.* 2020;ciaa977. doi:10.1093/cid/ciaa977
14. Jung J, Hong MJ, Kim EO, Lee J, Kim MN, Kim SH. Investigation of a nosocomial outbreak of coronavirus disease 2019 in a paediatric ward in South Korea: successful control by early detection and extensive contact tracing with testing [published online ahead of print, 2020 Jun 25]. *Clin Microbiol Infect.* 2020;S1198-743X(20)30365-7. doi:10.1016/j.cmi.2020.06.021

15. "What's Behind the Coronavirus Testing Shortage?" CBS13. Available at:
<https://gooddaysacramento.cbslocal.com/2020/07/07/whats-behind-the-coronavirus-testing-shortage/>. Accessed July 28, 2020.
16. Centers for Disease Control and Prevention. Interim Infection Prevention and Control Recommendations for Healthcare Personnel During the Coronavirus Disease 2019 (COVID-19) Pandemic. Available at: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html>. Accessed July 27, 2019.
17. Jacobs, A. "Grave Shortages of Protective Gear Flare Again as COVID Cases Surge." New York Times. Available at:
<https://www.nytimes.com/2020/07/08/health/coronavirus-masks-ppe-doc.html>.
Accessed July 28, 2020.
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