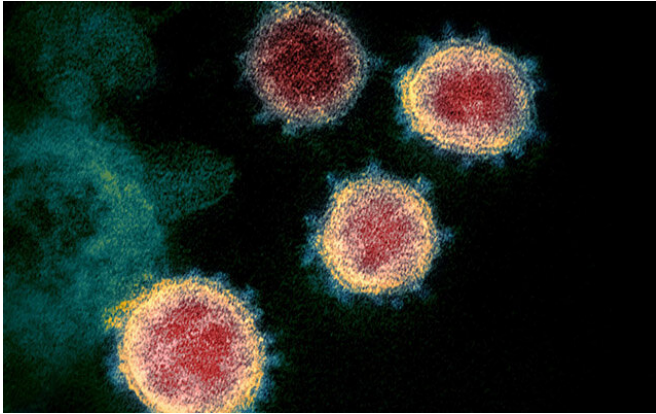


Researchers show children are silent spreaders of SARS-CoV-2

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A colored scanning electron micrograph of the SARS-CoV-2 virus. Credit: NIAID

In the most comprehensive study of COVID-19 pediatric patients to date, Massachusetts General Hospital (MGH) and Mass General Hospital for Children (MGHfC) researchers provide critical data showing that children play a larger role in the community spread of COVID-19 than previously thought. In a study of 192 children ages 0-22, 49 children tested positive for SARS-CoV-2, and an additional 18 children had late-onset, COVID-19-related illness. The infected children were shown to have a significantly higher level of virus in their airways than hospitalized adults in ICUs for COVID-19 treatment.

"I was surprised by the high levels of virus we found in [children](#) of all ages, especially in the first two days of infection," says Lael Yonker, MD, director of the MGH Cystic Fibrosis Center and lead author of the study, "Pediatric SARS-CoV-2: Clinical Presentation, Infectivity, and Immune Responses," published in the *Journal of Pediatrics*. "I was not expecting the [viral load](#) to be so high. You think of a hospital, and of all of the precautions taken to treat severely ill adults, but

the viral loads of these hospitalized patients are significantly lower than a 'healthy child' who is walking around with a high SARS-CoV-2 viral load."

Transmissibility or risk of contagion is greater with a high viral load. And even when children exhibit symptoms typical of COVID-19, like fever, runny nose and cough, they often overlap with common childhood illnesses, including influenza and the common cold. This confounds an accurate diagnosis of COVID-19, the illness derived from the SARS-CoV-2 coronavirus, says Yonker. Along with viral load, researchers examined expression of the viral receptor and antibody response in healthy children, children with acute SARS-CoV-2 infection and a smaller number of children with Multisystem Inflammatory Syndrome in Children (MIS-C).

Findings from nose and throat swabs and blood samples from the MGHfC Pediatric COVID-19 Biorepository carry implications for the reopening of schools, daycare centers and other locations with a high density of children and close interaction with teachers and staff members. "Kids are not immune from this infection, and their symptoms don't correlate with exposure and infection," says Alessio Fasano, MD, director of the Mucosal Immunology and Biology Research Center at MGH and senior author of the manuscript. "During this COVID-19 pandemic, we have mainly screened symptomatic subjects, so we have reached the erroneous conclusion that the vast majority of people infected are adults. However, our results show that kids are not protected against this virus. We should not discount children as potential spreaders for this virus."

The researchers note that although children with COVID-19 are not as likely to become as seriously ill as adults, as asymptomatic carriers or carriers with few symptoms attending [school](#), they can spread infection and bring the virus into their homes. This is a particular concern for families in certain socio-economic groups, which have been

harder hit in the pandemic, and multi-generational families with vulnerable older adults in the same household. In the MGHfC study, 51 percent of children with acute SARS-CoV-2 infection came from low-income communities compared to 2 percent from high-income communities.

In another breakthrough finding from the study, the researchers challenge the current hypothesis that because children have lower numbers of immune receptors for SARS-CoV2, this makes them less likely to become infected or seriously ill. Data from the group show that although younger children have lower numbers of the virus receptor than older children and adults, this does not correlate with a decreased viral load. According to the authors, this finding suggests that children can carry a high viral load, meaning they are more contagious, regardless of their susceptibility to developing COVID-19 infection.

The researchers also studied immune response in MIS-C, a multi-organ, systemic infection that can develop in children with COVID-19 several weeks after infection. Complications from the accelerated immune response seen in MIS-C can include severe cardiac problems, shock and acute heart failure. "This is a severe complication as a result of the immune response to COVID-19 infection, and the number of these patients is growing," says Fasano, who is also a professor of Pediatrics at Harvard Medical School (HMS). "And, as in adults with these very serious systemic complications, the heart seems to be the favorite organ targeted by post-COVID-19 immune response," adds Fasano.

Understanding MIS-C and post-infectious immune responses from pediatric COVID-19 patients is critical for developing next steps in treatment and prevention strategies, according to the researchers. Early insights into the immune dysfunction in MIS-C should prompt caution when developing vaccine strategies, notes Yonker.

As MGHfC pediatricians, both Yonker and Fasano are constantly fielding questions from parents about the safe return of their children to school and daycare. They agree that the most critical question is what steps the schools will implement "to keep the kids, teachers, and personnel safe."

Recommendations from their study, which includes 30 co-authors from MGHfC, MGH, HMS, Massachusetts Institute of Technology, Brigham and Women's Hospital and Harvard T.H. Chan School of Public Health, include not relying on body temperature or symptom monitoring to identify SARS-CoV-2 infection in the school setting.

The researchers emphasize infection control measures, including social distancing, universal mask use (when implementable), effective hand-washing protocols and a combination of remote and in-person learning. They consider routine and continued screening of all students for SARS-CoV-2 [infection](#) with timely reporting of the results an imperative part of a safe return-to-school policy.

"This study provides much-needed facts for policymakers to make the best decisions possible for schools, daycare centers and other institutions that serve children," says Fasano. "Kids are a possible source of spreading this virus, and this should be taken into account in the planning stages for reopening schools."

Fasano fears that a hurried return to school without proper planning could result in an uptick in cases of COVID-19 infections. "If schools were to reopen fully without necessary precautions, it is likely that children will play a larger role in this pandemic," the authors conclude.

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