Study finds that children's immune response protects against COVID-19

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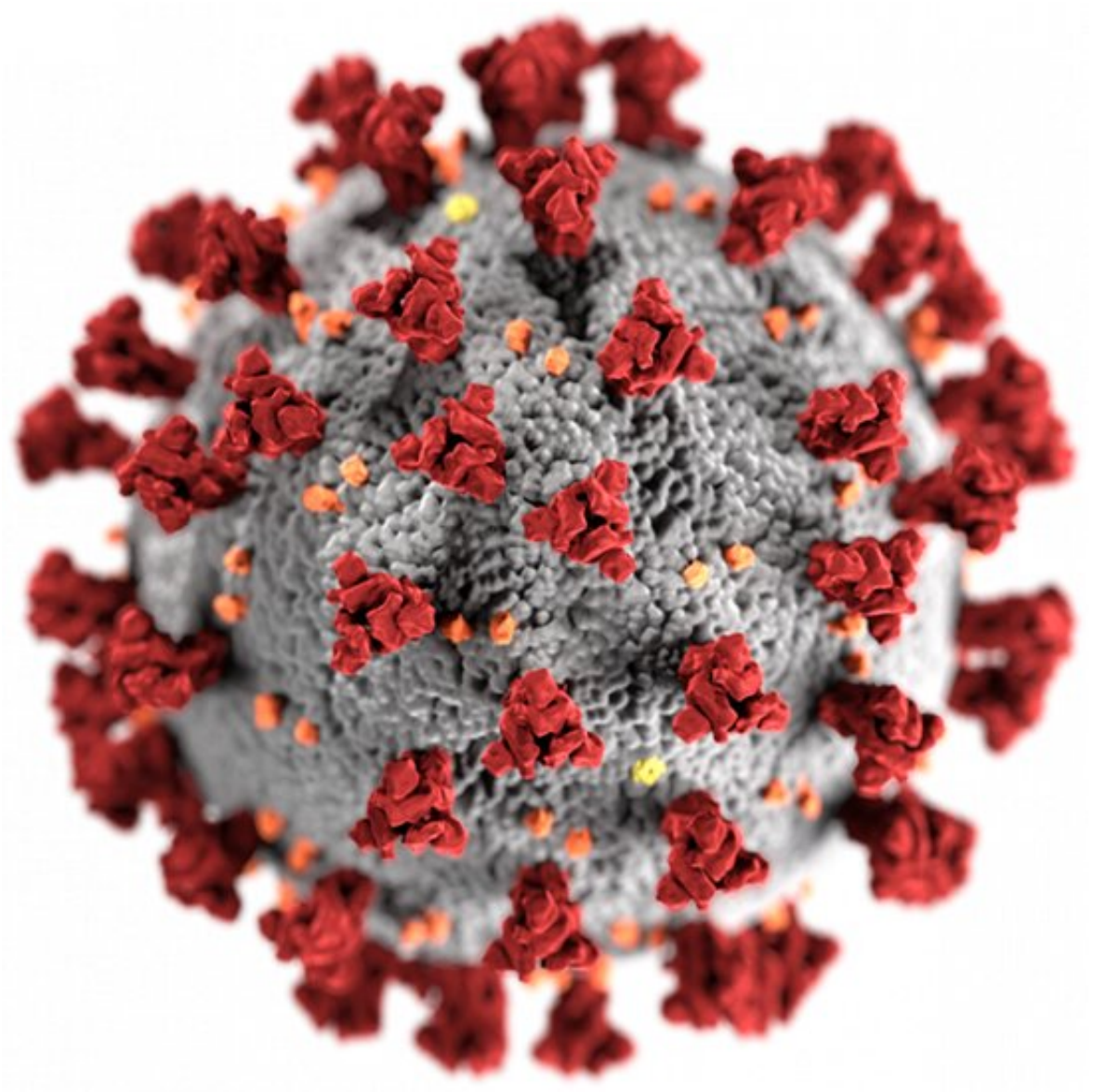

Image of the ultrastructural morphology exhibited by the 2019 Novel Coronavirus (2019-nCoV). Credit: CDC

The first study comparing the immune responses of adults and children with COVID-19 has detected key differences that may contribute to understanding why children usually have milder disease than adults. The findings also have important implications for vaccines and drugs being developed to curb COVID-19. The study was published today in *Science Translational Medicine* and was conducted by scientists at Albert Einstein College of Medicine, Children's Hospital at Montefiore (CHAM), and Yale University.

The study involved 60 adult COVID-19 patients and 65 pediatric COVID-19 patients (less than 24 years old) hospitalized at CHAM and Montefiore Health System between March 13 and May 17, 2020; 20 of the pediatric patients had the novel multi-system inflammatory syndrome (MIS-C). The patients' blood was tested for the presence of several types of immune cells, antibody responses, and the inflammatory proteins, known as cytokines, that immune cells produce.

Children with COVID-19 fared significantly better than adults. Twenty-two adults (37%) required mechanical ventilation compared with only five (8%) of the pediatric patients. In addition, 17 adults (28%) died in the hospital compared with two (3%) of the pediatric patients. No deaths occurred among pediatric patients with MIS-C.

"Our findings suggest that children with COVID-19 do better than adults because their stronger innate immunity protects them against SARS-CoV-2, the novel coronavirus that causes the disease," said co-senior author Betsy Herold, M.D., chief of infectious diseases and vice chair for research in the department of pediatrics at Einstein and CHAM. Kevan C. Herold, M.D., C.N.H. Long Professor of Immunology and of Medicine at Yale School of Medicine, was the other co-senior author on the study.

People have two types of immunity—innate and adaptive. Innate immunity, in which immune cells respond rapidly to invading pathogens of all kinds, is more robust during childhood. Adaptive immunity, the second type of immune response, is more specific and features antibodies and immune cells that target specific viruses or other microbes.

Compared with adult patients, pediatric COVID-19 patients in the study possessed significantly higher levels of certain cytokines associated with the innate immune response. This suggests that young people's more robust innate response protects them from developing acute respiratory distress syndrome (ARDS)—the hallmark of severe and often fatal COVID-19 cases. One cytokine in particular, known as IL-17A, was found at much higher levels in pediatric patients than in adults. "The high levels of IL-17A that we found in pediatric patients may be important in protecting them against progression of their COVID-19," said Dr. K. Herold.

Both pediatric and adult COVID-19 patients were found to make antibodies against the coronavirus' spike protein, which the virus uses to latch onto and infect cells. Those spike-protein antibodies include neutralizing antibodies, which block the coronavirus from infecting cells. Counterintuitively, the researchers found that neutralizing antibody levels in adult COVID-19 patients who died or required mechanical ventilation were higher than in those who recovered—and significantly higher than levels detected in pediatric patients.

"These results suggest that the more severe COVID-19 disease seen in adults is not caused by a failure of their adaptive immunity to mount T-cell or antibody responses," said Dr. K. Herold. "Rather, adult patients respond to coronavirus infection with an over-vigorous adaptive immune response that may promote the inflammation associated with ARDS."

The findings have important implications for COVID-19 therapies and vaccines. "Our adult COVID-19 patients who fared poorly had high levels of neutralizing antibodies, suggesting that convalescent plasma—which is rich in neutralizing antibodies—may not help adults who have already developed signs of ARDS," said Dr. B. Herold. "By contrast, therapies that boost innate immune responses early in the course of the disease may be especially beneficial."

As for vaccines, Dr. B. Herold notes that most vaccine candidates for protecting against SARS-CoV-2 infection are aimed at boosting neutralizing-antibody levels. "We may want to consider assessing vaccines that promote immunity in other ways, such as by bolstering the innate immune response," she said.

The paper is titled "Immune Responses to SARS-CoV-2 Infection in Hospitalized Pediatric and Adult Patients."

More information: "Immune Responses to SARS-CoV-2 Infection in Hospitalized Pediatric and Adult Patients." *Science Translational Medicine* (2020). stm.sciencemag.org/lookup/doi/ … scitranslmed.abd5487

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