Medical Xpress

Booster critical as COVID-19 vaccine-induced antibodies wane in 6 months, don't protect against Omicron

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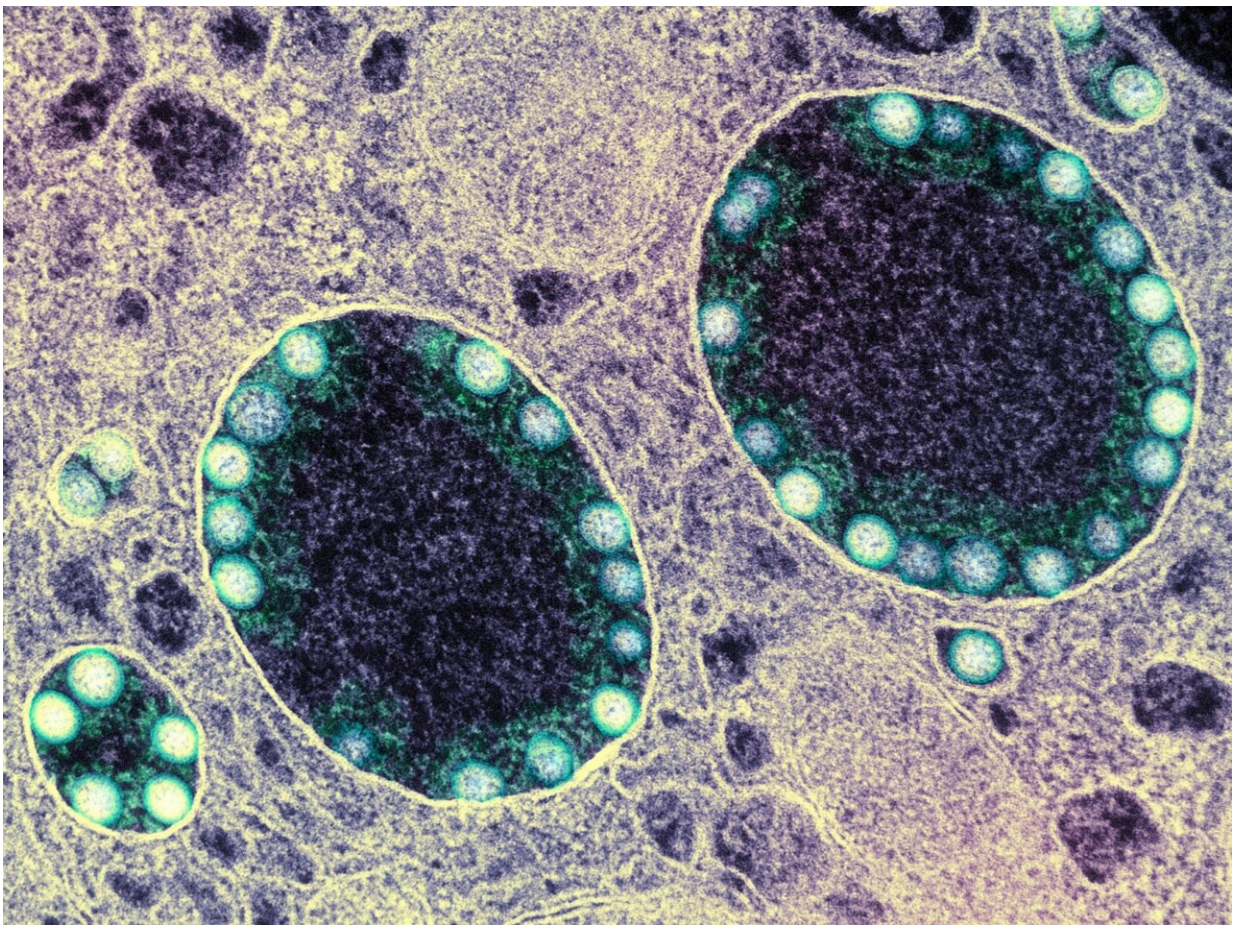

SARS-CoV-2 virus particles are visible inside a heavily infected nasal cell. Credit: NIAID

A new study using serum from human blood samples suggests neutralizing antibody levels produced by two-dose mRNA vaccines against the original and early variants of the SARS-CoV-2 virus wane substantially over time, and offer essentially no protection against the Omicron variant.

The same Ohio State University lab found in a previous study, posted on the preprint server bioRxiv, that a third COVID-19 mRNA vaccine booster shot did produce effective levels of neutralizing antibodies against Omicron. This study has not yet been peer-reviewed.

"Our new work shows that two doses of mRNA vaccine do not offer protection against Omicron, and even having a breakthrough infection on top of vaccine does not help much. But our earlier study showed that the booster can really rescue the shortcomings of the two doses," said Shan-Lu Liu, the senior author of both studies and a virology professor in the Department of Veterinary Biosciences at Ohio State.

The new research is published online as a First Release paper in the journal *Science Translational Medicine*.

The researchers examined antibodies in serum samples from 48 health care professionals with experimental versions of the parent virus and the alpha, beta, delta and Omicron variants. Serum samples were collected pre-vaccination, three to four weeks after a first vaccine dose, three to four weeks after a second vaccine dose and six months after the second vaccine.

"There was a substantial increase in neutralizing antibodies after the second dose against every variant except the Omicron variant," said first study author John Evans, a Ph.D. student in Ohio State's Molecular, Cellular and Developmental Biology Program who works in Liu's lab. "From the second dose to six months later, there was an at least five-fold

drop in immunity, even against the parent virus."

Neutralizing antibodies that block viral particles' entry into host cells are considered the gold standard of protection against COVID-19 infection.

Twelve of the samples came from people suspected to have had a COVID-19 infection—at time points ranging from before vaccination to after two vaccine doses—based on a different kind of antibody testing. And though the findings suggested a breakthrough COVID-19 infection on top of vaccination increased immunity against most versions of the virus, antibodies from only one individual with previous infection reached levels that could put up a reasonable fight against Omicron.

"Overall, nobody in this study had good immunity against Omicron," said Liu, also an investigator in the university's Center for Retrovirus Research and a program co-director of the Viruses and Emerging Pathogens Program in Ohio State's Infectious Diseases Institute.

The experimental viruses were what are called pseudoviruses—a non-infectious viral core decorated with different SARS-CoV-2 spike proteins on the surface structured to match known mutations in the variants studied.

The researchers used a special method to detect neutralizing antibodies in the health professionals' blood samples to account for the varying levels of antibodies produced by individuals.

"Individuals did respond very differently to the first dose, and the same was true for the second dose," Liu said.

Results also showed that people who received the Pfizer-BioNTech mRNA vaccine produced about two-fold lower levels of neutralizing antibodies than those who received the Moderna vaccine. Men also had

significantly higher antibody levels compared to women against all variants over the post-vaccination time points.

Liu said the dramatic reduction in immunity six months after two vaccine doses and the earlier paper's finding that a booster protects against Omicron highlight how important a third shot is to avoiding infection.

"After the second vaccine dose, the neutralizing antibodies effective against Omicron dropped 23-fold, but with a booster shot, immunity dropped only three- to four-fold—which is comparable to booster effectiveness previously reported against the delta variant," he said. "Similar observations have been made by other labs."

More information: John P. Evans et al, Neutralizing antibody responses elicited by SARS-CoV-2 mRNA vaccination wane over time and are boosted by breakthrough infection, *Science Translational Medicine* (2022). DOI: 10.1126/scitranslmed.abn8057

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