Moderna COVID-19 Booster May Protect Against Variants

The findings suggest boosters not only lengthen immunity but help broaden and strengthen the immune response.

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Levels of antibodies that can neutralize SARS-CoV-2 begin to decline weeks after people receive the COVID-19 vaccine. Booster shots may be needed to extend protection, particularly against new variants.

Viruses also mutate over time. Several SARS-CoV-2 variants have emerged that can partially escape the immune response induced by the vaccine. Scientists have been working to understand how well boosters may protect against these variants. They're also investigating whether boosters need to be modified to match new mutations in the virus.

A team led by Drs. Barney Graham and Robert Seder of NIH's National Institute of Allergy and Infectious Diseases (NIAID) studied booster vaccines in rhesus macaques. Macaques are a good model of how vaccines perform in people. The animals were given either a booster of the Moderna COVID-19 vaccine or a slightly modified version tailored to the beta variant, which partly evades the immune response induced by the vaccine. Results appeared in Science on October 21, 2021.

The macaques were immunized with the two-dose Moderna vaccine series. About six months later, they received a booster dose. Some received a booster that had been altered to match changes to the virus' spike protein in the beta variant.

The researchers analyzed antibody responses at points before and after the boosters. They also measured T and B cells—immune cells vital to protecting against the virus and forming an immune memory in case the virus is encountered again.

Both boosters increased levels of neutralizing antibodies against all known SARS-CoV-2 variants of concern. The increases lasted for at least eight weeks after the boosters. Antibody levels were significantly higher post-boost than after the first two doses. While it's unknown what antibody levels are needed for immunity, higher levels indicate greater protection.

The researchers also saw evidence that the boosters improved immune memory. Boosters rapidly restored memory B cells and T cells important for long-term protection against COVID-19.

Nine weeks following the boosters, macaques were exposed to the beta COVID-19 variant. The boosters protected the animals, limiting the virus' ability to replicate in the lungs and nose. Viral levels were low or undetectable in the lungs and significantly reduced in the nose. This suggests that boosters may help limit the spread of infection in addition to protecting against disease.

Lastly, a measure of how the immune system adapts over time and increases the quality of the antibodies it produces continued to rise during the months after initial vaccination. Boosters caused a further improvement in this measure.

Taken together, the results suggest that boosters can help to ensure strong and lasting immune protection against SARS-CoV-2. Both forms of the booster performed equally well at inducing neutralizing antibodies and preventing infection.

"Our results suggest that COVID-19 booster vaccines may significantly increase immunity against the virus," Seder says. "Boosters may prevent severe illness or death, particularly among older adults and those with pre-existing health conditions. They could also potentially limit mild infection and transmission."

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