How many antibodies guarantee immunity?

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After a coronavirus infection or a vaccination, the body produces antibodies against the virus' spike protein, which SARS-CoV-2 uses to dock onto the cells and penetrate them. This spike protein allows antibodies to recognise the virus and bind to it, making it visible to immune cells.

Scientists previously assumed that people vaccinated with mRNA vaccines such as the one produced by BioNTech-Pfizer had more than 90% protection against the virus — but that does not apply to the new delta variant. This variant is much more contagious than the ancestral virus and is spreading all over the world. Carsten Watzl, an immunologist at the Leibniz Institute of the Dortmund Technical University, estimates that the effectiveness of BioNTech-Pfizer mRNA vaccines is reduced from 90% in the case of the original virus to 88% with delta, and that of the AstraZeneca vector vaccine from 66% to 60%.

Data from Israel even indicates that protection against infection with the dangerous variant is only about 64% when the BioNTech-Pfizer vaccine is used. But the vaccine still offers 93% protection against a severe case of COVID-19. The Israeli Health Ministry is now considering offering people a third dose of the vaccine. After two shots, a majority of people are immune to the virus variants known so far — but Carsten Watzl cautions that this does not necessarily apply to everyone who is double-vaccinated.

"Vaccination alone is no guarantee for being immune," he says, adding that what matters is whether the body has built up sufficient immune protection. "But we can't measure that at the moment," he says. This is different with a tetanus vaccination, where tests can determine whether or not a body is sufficiently protected. A lab checks the blood for the level of antibody titers. If the number of antibodies is above a certain threshold, the person is immune to the tetanus virus. If the titer is too low, the patient needs a booster shot.

With the coronavirus, researchers have not yet reached that stage, Watzl says. "We don't know yet exactly what we need to measure to really determine whether someone is immune or not. Presumably, the neutralising antibodies play a key role — they bind the virus in such a way that it cannot infect any more cells."

But it is unclear how high the number of these antibodies has to be, he adds. Not only antibodies are important in the fight against an infection. Once the virus has entered the cell, the antibodies can no longer reach it, because they themselves cannot go into the cell. So the virus can replicate.

"To fight that, our immune system has T cells; they are able to kill such virus-infected cells — in other words, we would rather sacrifice a few cells in our body, namely the infected ones, than give the virus the opportunity to multiply," Watzl says. Both processes can be measured. In practice, however, it is more difficult to determine the number of T cells than that of antibodies. The T cell test is relatively time-consuming but quite useful.

“The antibodies alone don’t necessarily tell you anything about how well you are protected,” says Watzl: He says that a person might have hardly any antibodies and so could still become infected with the virus. “But the response of the T cells is so strong that the person doesn’t get seriously ill,” he says.

People with a high level of antibodies are probably well protected against the coronavirus, the immunologist says. But the reverse conclusion — that few antibodies mean no protection — is probably not true, according to him.

Coronavirus antibody tests employ various measurement methods. Normally, laboratory tests use a clear standard stipulating a minimum to a maximum value. This allows a doctor to see whether levels are within the normal range. The levels have not yet been defined for the coronavirus, however.