

Quick Test Kit Determines Immunity Against COVID-19 and Its Variants

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As the COVID-19 pandemic continues, countries around the world are switching toward vaccinations and boosters to combat the pandemic. However, waning immunity against SARS-CoV-2 wild-type (WT) and variants have been widely reported. Booster vaccinations have shown to be able to increase immunological protection against new variants; however, the protection observed appears to decrease quickly over time suggesting a second booster shot may be appropriate. Moreover, heterogeneity and waning of the immune response at the individual level was observed suggesting a more personalized vaccination approach should be considered.



Image: COVID-19 antibodies test kits (right) and the digital reader device (left in black) (Photo courtesy of NTU Singapore)

To evaluate such a personalized strategy, it is important to have the ability to rapidly evaluate the level of neutralizing antibody (nAbs) response against variants at the individual level and ideally at a point of care setting. Now, scientists have developed a quick test kit that can tell if a person has immunity against COVID-19 and its variants, based on the antibodies detected in a blood sample.

Different from ART test kits – which look for the presence of viral proteins produced during a COVID-19 infection to determine if a person is infected – this rapid point-of-care test kit developed by a team of scientists from the Singapore-MIT Alliance for Research and Technology (SMART, Singapore), and Nanyang Technological University (NTU, Singapore) is a serology test that measures antibodies made by the patient. It requires a drop of blood and takes just 10 minutes to show results, as compared to the 24 to 72 hours required for conventional laboratory testing. The test kit detects the levels of neutralizing antibodies against SARS-COV-2, the virus causing COVID-19, and its variants such as Delta and Omicron, and can be easily adapted for new variants of concern and other diseases in the future. Using a paper-based assay that is coated with chemicals that bind to antibodies in the blood sample, the test kit is low-cost, fast and has up to 93% accuracy.

The test paves the way for personalized vaccination strategies, where people are only given vaccinations and booster shots when necessary, depending on their variance in antibody levels and immune response. Having an accurate and rapid serology test can enable governments and healthcare organizations to effectively manage limited vaccine resources, and address vaccine hesitancy, particularly concerning multiple booster doses. To address vaccine hesitancy and efficacy of vaccination against novel variants, a personalized vaccination approach could be more effective, one which offers booster doses to individuals assessed to be more at risk, such as healthcare workers and the elderly. For a personalized approach to be effective, healthcare workers need to be able to quickly evaluate the level of NAb response against variants at the individual level, using an easy-to-use point-of-care test kit in clinics, hospitals or vaccination centers.

“Our team’s work in the development of a rapid test kit has given us valuable insights into vaccine effectiveness and protection longevity,” said Professor Peter Preiser, Co-Lead Principal Investigator at SMART AMR and Associate Vice President for Biomedical and Life Sciences at NTU Singapore. “Our study proves that our new test kit can be a powerful tool, allowing healthcare organizations to screen

people and determine their vaccination needs, especially against the current and upcoming variants. This will help allay some people's fears that they will be 'over-vaccinated with a booster', since the results will inform them accurately if they are well-protected against COVID-19 or not."

"Over the course of the pandemic, several large studies have shown that NAb levels against the dominant variant at the time of the study are a reliable indicator of protection from infection," added Dr. Hadley Sikes, SMART AMR Principal Investigator, Associate Professor at MIT. "Some segments of the population have low tolerance for risk of infection. The test kit we developed can provide valuable, individualized information about how quickly or how slowly a person's antibodies levels have fallen, allowing them to stay informed of their health and, whenever required, get a necessary booster dose to protect themselves."