Cass Regional Medical Center

COVID-19 Testing: PCR and Antibody Tests Explained

There are two types of tests available to us for COVID-19: polymerase chain reaction (PCR), antigen, and antibody (serology) testing. PCR and antigen tests detect whether a person is currently infected, and serology detects whether a person currently has an active infection (IgM) or had an infection in the past (IgG). This document is designed to explain the differences between PCR and serology testing, and when one might be used over another.

Topic	PCR Test	Antibody (Serology) Test
Why is the test used?	PCR tests look for pieces of SARS-CoV-2, the virus that causes COVID-19, in the nose, throat, or others areas in the respiratory tract to determine if the person has an **active infection.**	Serology looks for antibodies against SARS-CoV-2 in the blood to determine if they have been exposed to the virus or there was a past infection. Antibody tests should not be used as the sole test for diagnostic decisions.
How is the test performed?	A nasal or nasopharyngeal swab is taken by a healthcare provider and tested. Depending on the testing platform, the test can either take a few minutes to result, or the swab is sent to a lab for testing.	In most cases, a blood sample is taken and sent to a lab for testing.
What does a positive test result mean?	A positive PCR test means that the person being tested has an active COVID-19 infection.	• A positive IgM antibody indicates that you may have been infected and that your immune system has started responding to the virus. **This should be followed up with PCR testing.** • A positive IgG antibody test means that the person being tested was infected with COVID-19 in the past and that their immune system has developed antibodies to protect you from future infection. It is unknown at this point how much protection antibodies might provide against infection.

Topic	PCR Test	Antibody (Serology) Test
What does a negative test result mean?	A negative PCR test means that person was probably not infected at the time their sample was collected. However, it doesn't mean they won't get sick – it only means that they didn't have COVID-19 at the time of testing.	A negative antibody test means that the person may not have had COVID-19 in the past. However, they could still have a current infection, and the antibody test was collected too soon to give a positive result.
When it is helpful?	- It can be used to determine who has an active infection. - It can help to identify people who are contagious to others.	- It can identify people who had an infection in the past, even if they had no symptoms of the illness. - In some cases, it could help determine when COVID-19 illness occurred, since we know that IgM is formed before IgG. - It can help determine who qualifies to donate convalescent plasma (a blood product that contains antibodies against COVID-19 and can be used as a COVID-19 treatment. - If lots of people take the test in a community, it can help public health leaders and researchers know what percentage of the population has already had COVID-19.
When it is not as helpful?	- It does not determine who had an infection in the past. - It also does not help determine if a person who was exposed to COVID-19 will develop active infection during the two weeks after exposure. In some people, the virus can only be found by PCR for a few days at the beginning of the infection, so the test might not find the virus if the swab is taken more than a few days after the illness starts. - In some people, the virus can be found by PCR in the nose and throat for several weeks, even longer than the time that they are actually contagious to other people. - This test requires certain kinds of swabs that may be in short supply.	- It may be negative if it is used too close to the beginning of an infection, which is why it should not be used to detect active COVID-19 infection. - In areas where there have not been many cases of COVID-19, many of the positive test results will actually be false positives. Some antibody tests have low sensitivity and specificity and thus may not produce reliable results. - Some antibody tests may cross-react with other coronaviruses that are not SARS-CoV-2, the virus that causes COVID-19, leading to false test results. - We do not know yet if having antibodies to the virus that causes COVID-19 can protect someone from getting infected again or, if they do, how long this protection might last. Until scientists get more information about whether antibodies protect against reinfection with this virus, everyone should continue to protect themselves and others, including staying at least 6 feet away from other people outside of their home (social distancing), even if they have had a positive antibody test.

Antibodies are formed by the body to fight off infections. Immunoglobulin M (IgM) is the first antibody that is formed against a germ, so it appears on tests first, usually within 1-2 weeks. The body then forms immunoglobulin G (IgG), which appears on tests about 2 weeks after the illness starts. IgM usually disappears from the blood within a few months, but IgG can last for years. Some antibody tests test for IgM and IgG, and some only test for IgG.

Positive predictive value is a measure of how likely it is that a positive test is a true positive rather than a false positive. This is dependent on how many people in the population being tested have had the disease. When there are very few people in the population that have had the disease, then there is a higher chance that a positive test is a false positive. When there are many people in a population that have had the disease, then there is a higher chance that a positive test is a true positive.

Sensitivity is sometimes called the "true positive rate." It measures how frequently the test is positive when the person being tested actually has the disease. For example, when a test has 80% sensitivity, the test detects 80% of patients with the disease (true positives). However, 20% of patients with the disease are not detected (false negatives) by the test.

Specificity is sometimes called the "true negative rate." It measures how frequently the test is negative when the person being tested doesn't have the disease. For example, when a test has 80% specificity, the test correctly reports 80% of patients without the disease as test negative (true negatives). However, 20% of patients without the disease are incorrectly identified as testing positive (false positives) by the test.

What public health activities will be conducted?	- If positive, the health department will conduct a case investigation. Contact tracing will be performed to identify individuals who might have been exposed to the PCR-positive person when they could have spread COVID-19. - If negative, no public health activities will be performed.	- If IgM positive, the provider should have the individual tested by PCR. If the PCR is positive, the health department will conduct a case investigation. Contact tracing will be performed to identify individuals who might have been exposed to the PCR-positive person when they could have spread COVID-19. - If IgG positive, no public health activities will be performed. - If negative, no public health activities will be performed.

Resources:

Interim Guidelines for COVID-19 Antibody Testing
https://www.cdc.gov/coronavirus/2019-ncov/lab/resources/antibody-tests-guidelines.html

COVID-19 Testing: PCR, Antigen, and Antibody Tests Explained
https://dshs.texas.gov/coronavirus/docs/COVID19-PCRvsSerologyTesting.pdf

COVID-19 Serological Testing Quick Facts from Missouri DHSS
https://www.mhanet.com/mhaimages/COVID-19/Serological%20Testing%20Quick%20Facts%20for%20Providers.pdf