Antibody, Antigen or RT-PCR?

How The Tests Compare

PRESCOUTER

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All sound testing strategies must be built on RT-PCR testing

While there are three major diagnostic test types that can be used to diagnose COVID-19, Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) is the golden standard diagnostic technique to diagnose infectious diseases, including SARS-CoV-2.

Currently, the RT-PCR is the only test type that can be used to determine whether employees can return to work. A consecutive double negative RT-PCR test proves, beyond a reasonable doubt, that a person is not infectious to their surroundings.

RT-PCR is not only far superior to other test types in its analytical sensitivity (the ability to pick up a positive case), but also specificity (the ability of a test to measure exclusively what it intends to measure).

Another huge advantage of RT-PCR strategies is that saliva samples can be used to reliably detect viral genetic material. Because testing options require frequent testing, less invasive sampling strategies will be key to increase the willingness of employees to participate in diagnostic or preventative screening. When saliva is used as the sample for RT-PCR, no healthcare workers are required on-site to administer samples.

The 3 Types of COVID-19 Tests

RT-PCR

Serology (Antibody)

Antigen

During this pandemic, PreScouter is leveraging its network of 4000+ experts, lab partners and prototyping firms to provide clients with the testing expertise and resources they need to safeguard their workplaces. While this report provides general recommendations, we welcome inquiries to help determine what may be best for your specific situation.

Contact us at covid19@prescouter.com or (708) 613-7132

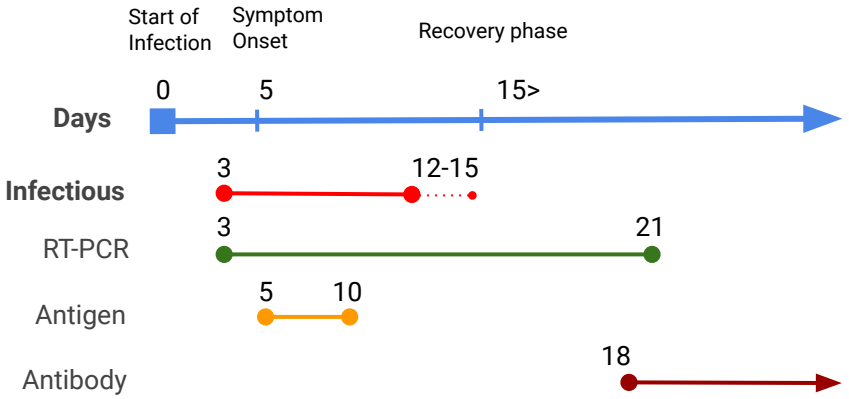
RT-PCR is the only method that detects infections over the full time period during which people are believed to be infectious.

People are infectious, on average, for 9-12 days. **RT-PCR** is the only test that will reliably cover this time period during which a person is infectious. RT-PCR is able to do this because it detects low amounts of viral RNA through amplification of the signal.

In contrast, **antigen tests** cover a short 'peak period' and will miss positive cases beyond that period. **Antibodies** only detect past infections that are in the recovery phase.

RT-PCR test will show a positive result for a short period after a person is infectious, but this is the tradeoff for having coverage over the full window of when a person is infectious.

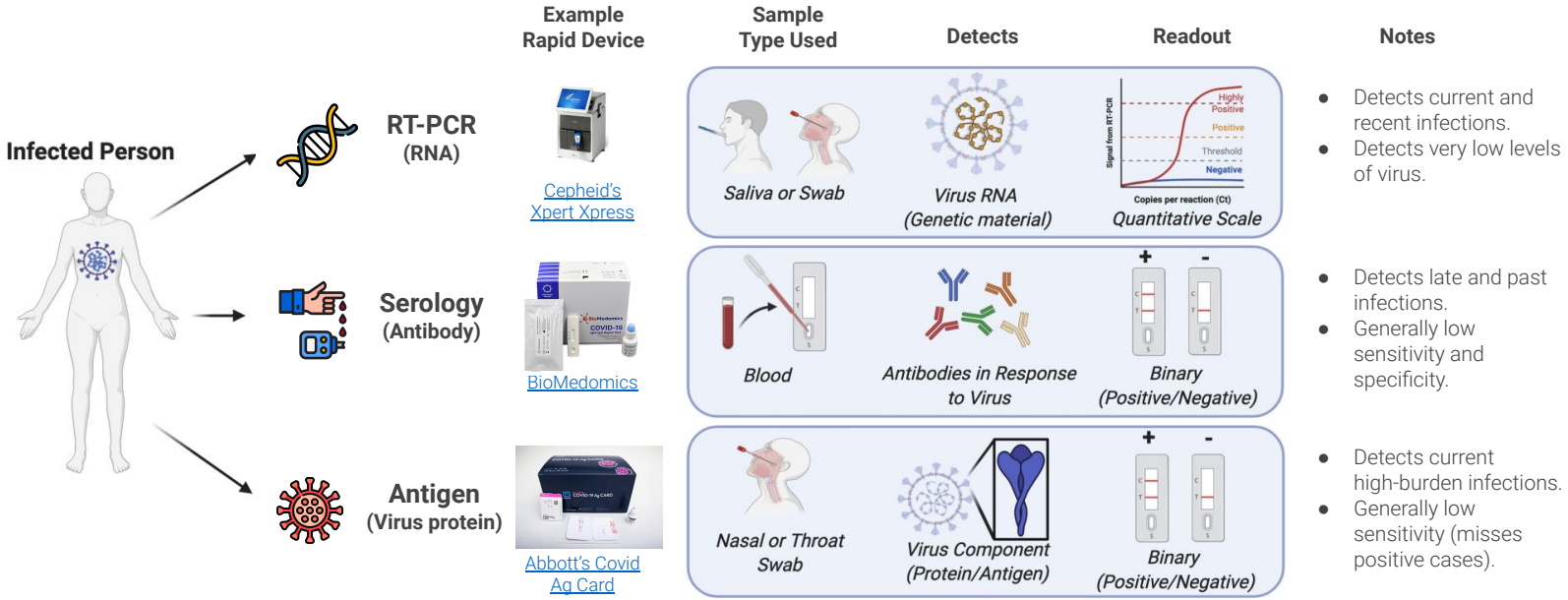
Timeline indicating the window during which the infection can be detected by the three test types, over the lifecycle of an infection



Adapted from Prof. Dr. David Liu
Professor of Chemistry and Chemical Biology at Harvard University

Each of the three test types detects a different molecule or protein arising from a person having COVID-19.

All three test types can be deployed by sending samples to a laboratory to be processed through conventional methods, as well as through ‘rapid’ devices. We highlight here examples of those rapid devices, and how they work.



RT-PCR tests detect the actual viral RNA from SARS-CoV-2, the COVID-19 virus, from either saliva or swab samples.

Advantages:

- Can be used to determine return-to-work status.
- Highly sensitive and reliably detects infections.

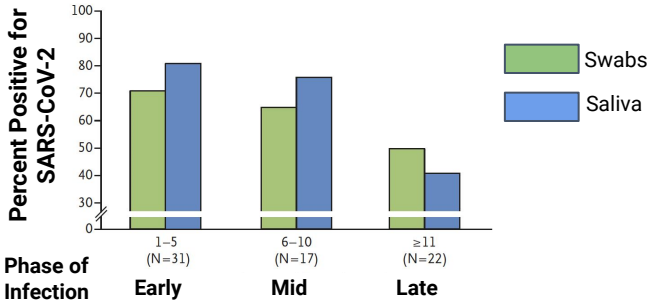
Disadvantages:

- No instant result (1 to 2 day window to result).
- Requires a contract with a lab partner.

Case Example: Cepheid's Xpert Xpress

The Xpert Xpress is highly accurate, but is difficult to procure, due to lack of availability. It may be a good future option of companies willing to make a $50k++ investment for results within an hour. Companies will also need a local nurse and to obtain State regulatory approval.

Saliva vs Swabs



A research group has shown that, compared to nasopharyngeal swabs, saliva samples can detect a larger average number of SARS-CoV-2 virus. This means that the saliva test is more sensitive than swabs.

The same research group that published this paper has shown that saliva samples can be pooled to increase testing capacity.

Additionally, they developed SalivaDirect, an inexpensive RT-PCR method which is currently used by the NBA to do high-frequency COVID-19 diagnostics.

Adapted from Wyllie et al. New. Engl. J. Med. (2020)

Serology (antibody) tests detect the antibodies that are created in response to SARS-CoV-2.

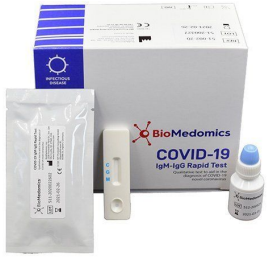
Advantages:

- Rapid antibody tests could be used on-site if companies have a healthcare worker or lab technician on staff that can draw blood.
- A confirmed positive test means that the person has an active antibody response against SARS-CoV-2.

Disadvantages:

- Tests have lower sensitivity/specificity than RT-PCR.
- Antibody tests can't be used to decide whether people can go (back) to work.
- Requires a healthcare professional to draw blood and administer the test.
- Reporting of cases falls under the employer's responsibility.

Case Example: BioMedomics IgM-IgG Rapid Test



Images from: BioMedomics

BioMedomics IgM-IgG Rapid Test can be used in 10-15 minutes. The test requires a blood sample as input and therefore companies should have a nurse on staff. These types of antibody tests have a relatively low sensitivity (BioMedomics: 81.8%, 20 days after infection) and specificity (BioMedomics: 87.9%, 20 days after infection), which can lead to false-positive results.

Currently, there is no added value for employers to invest in rapid antibody testing, because there is no real use case for this test in a workplace environment.

Antigen tests detect the peak of current infections by measuring viral components of SARS-CoV-2 derived from nasal or throat swabs.

Advantages:

- Antigen tests exclusively detect active infections.
- Rapid tests can be used on-site if companies have a healthcare worker or lab technician on staff.
- Could be used to supplant RT-PCR.

Disadvantages:

- The tests have a far lower sensitivity/specificity than RT-PCR and can only detect the peak of infection.
- Antigen tests can't be used to decide whether people can go (back) to work.
- Requires a healthcare professional or lab specialist to operate tests.
- Reporting of cases falls under the employer's responsibility.

Case Example: Abbott's Covid Ag Card

Images from: Abbott

Abbott's COVID-19 Antigen Test is a rapid (15-minute) lateral flow test that has to be administered by healthcare professionals or lab technicians, on-site. The test requires a naso-pharyngeal or nasal swab as sample input.

Rapid antigen tests can only detect very high amounts of virus (the test needs 1000x more virus particles to detect a positive sample compared with RT-PCR). This means it is prone to miss infections. For instance, the Quidel Sofia2 was found to miss an estimated 7 out of 10 infected cases. Therefore, use of this test would always have to be combined with a golden standard RT-PCR to reliably diagnose COVID-19.

ABOUT PRESCOUTER

DURING THIS PANDEMIC, PRESCOUTER IS LEVERAGING ITS NETWORK OF 4000+ EXPERTS, LAB PARTNERS AND PROTOTYPING FIRMS TO PROVIDE CLIENTS WITH THE TESTING EXPERTISE AND RESOURCES THEY NEED.

PreScouter traditionally provides corporate innovation and R&D leaders with expertise on emerging technologies and markets. During this pandemic, PreScouter is vetting, selecting and promoting *best in class* testing solutions from lab partners, to provide clients with the unbiased expertise and the resources they need to deploy testing to safeguard their workplaces.

To learn more, contact us at covid19@prescouter.com or (708) 613-7132.

EXAMPLES OF OTHER PRESCOUTER PROJECTS:

Technologies and tactics for reducing disinfection time: What tools can companies use to automate disinfection and other safety practices.

Supply Chain Disruption: When traditional resources or raw materials are not available during a pandemic, PreScouter helps clients find alternative solutions - uncovering connections around the world.

Driving Consumer Confidence: Tactics that give workers and consumers confidence that they are in a safe environment, to ultimately drive their re-engagement in economic activity.

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