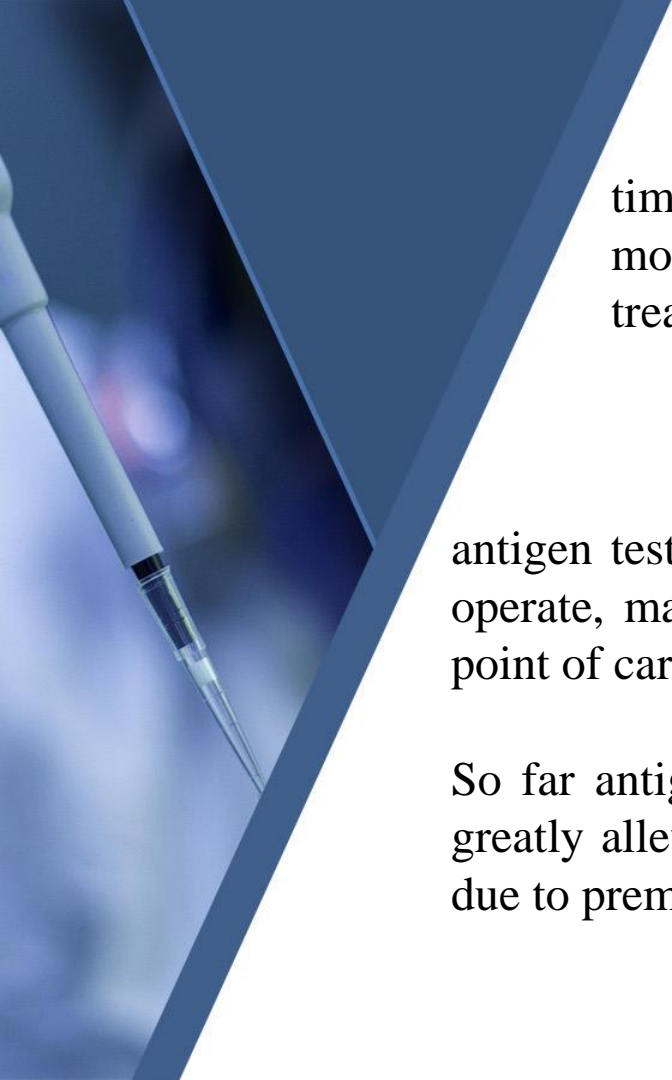




SARS-CoV-2 RAPID ANTIGEN TEST





timely detection of COVID-19 is extremely important for monitoring the scale of infection and for ensuring early treatment.

antigen tests are quick and in expensive, with some of them simple to operate, making them suitable for the purposes of use in-home, at the point of care (POC), and even self-testing.

So far antigen tests have been broadly used and proven to be able to greatly alleviate the testing demands when PCR resources are saturated due to prematurely relaxing lockdown measures in many countries.

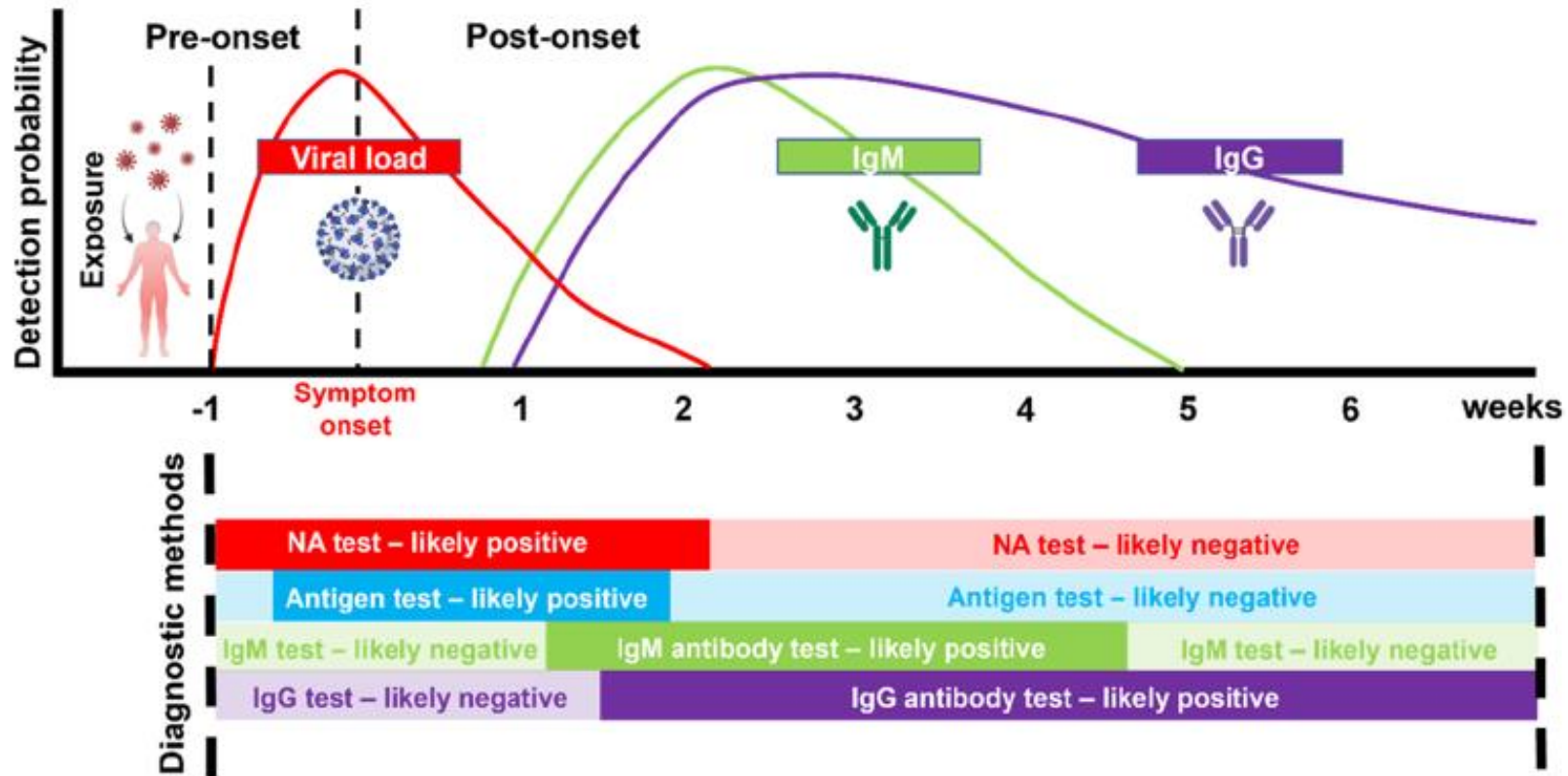
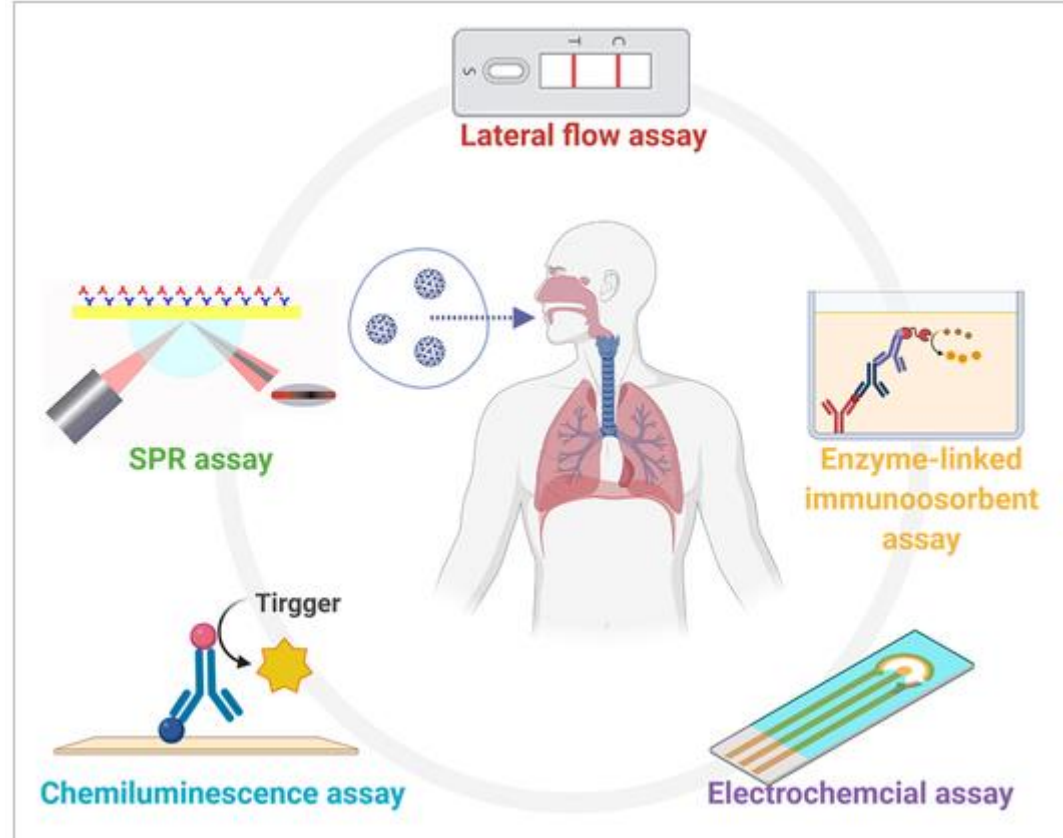


Figure. Estimated viral load and immune responses before and after symptom onset and appropriate diagnostic methods at different phases of infection. This figure was created with BioRender.com.

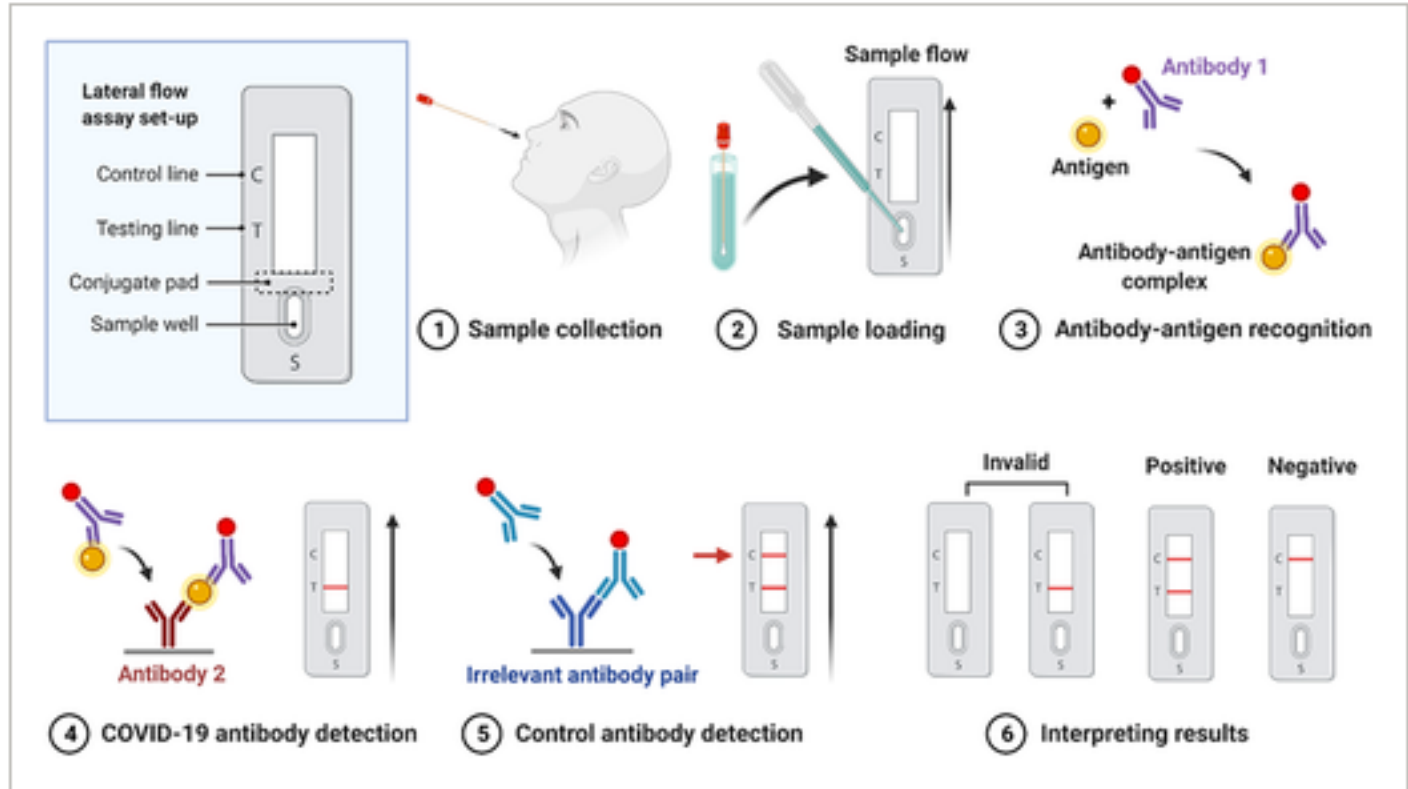
Principles of SARS-CoV-2 Antigen Tests

Based on the testing principles, the existing Sars-CoV-2 antigen tests can be categorized into :

- 1-lateral flow assay (LFA)
- 2-enzyme-linked immunosorbent assay (ELISA)
- 3-chemiluminescence assay (CLIA)
- 4-electrochemical assay
- 5-surface plasmon resonance (SPR) assay

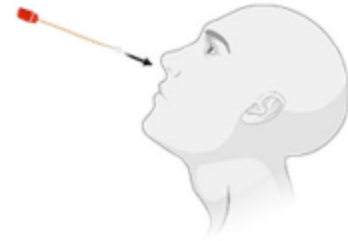


Lateral Flow Assay (LFA)



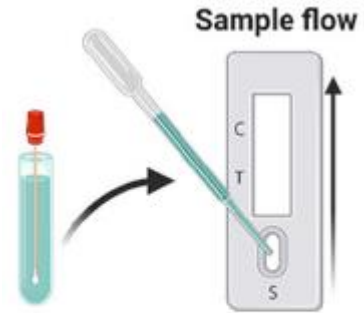
LFA is a multilayered paper-like substrate with functional components including a sample well, a conjugate pad, and a nitrocellulose membrane featured with testing and control lines

In a typical LFA test, buffer solution contains lysing components (i.e., Triton X-100) to decompose the viruses in a collected sample down to small antigen fragments



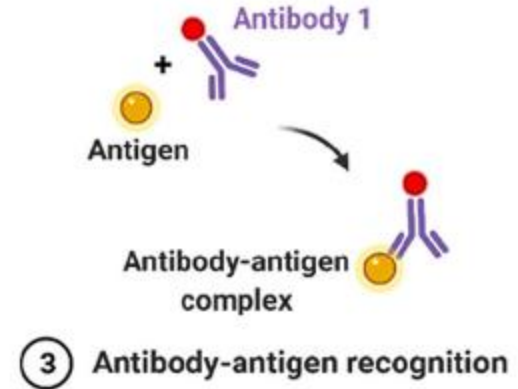
① Sample collection

Sample solution is added to the sample pad and flows toward the conjugated pad where gold nanoparticles conjugated to a specific COVID-19 antibody (Ab 1) are embedded

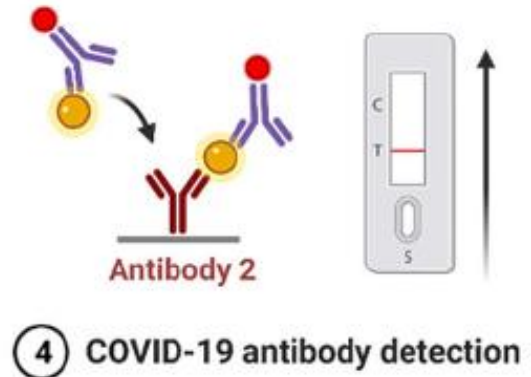


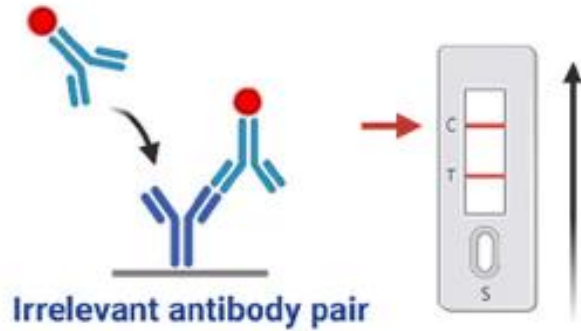
② Sample loading

The antigens in a positive sample bind to the Ab-1-conjugated nanoparticles and form complexes

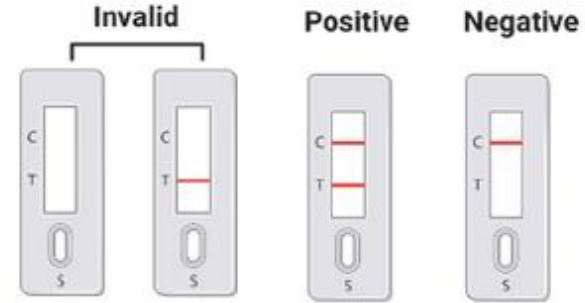


Migrate and are immobilized by another antibody (Ab 2) at the test line





⑤ Control antibody detection



⑥ Interpreting results

An irrelevant antibody pair is often employed with one conjugated to gold nanoparticles and the other at the control line




The limit of detection (LoD) of LFAs :

are reported to be around 10^3-10^4 viral copies per mL (equivalent to a Ct value in the range of 20–30 in qPCR assay)

SARSCoV-2 LFA is valuable as an alternative solution to NA testing for large-scale screening due to its easy operation, low cost, and fast readout.

Its accuracy has also been recognized by certain regions in the implementation of public health and travel Policies.



The major disadvantage of LFA lies in its relative low sensitivity compared with NA testing.

In addition, color appearance and intensity is based on subjective perception and thus a significant difference in test sensitivity was found between professional and self-trained users.

Smartphones and artificial intelligence have been employed to overcome this limitation by improving result interpretation and data collection.



Enzyme-Linked Immunosorbent Assay (ELISA)

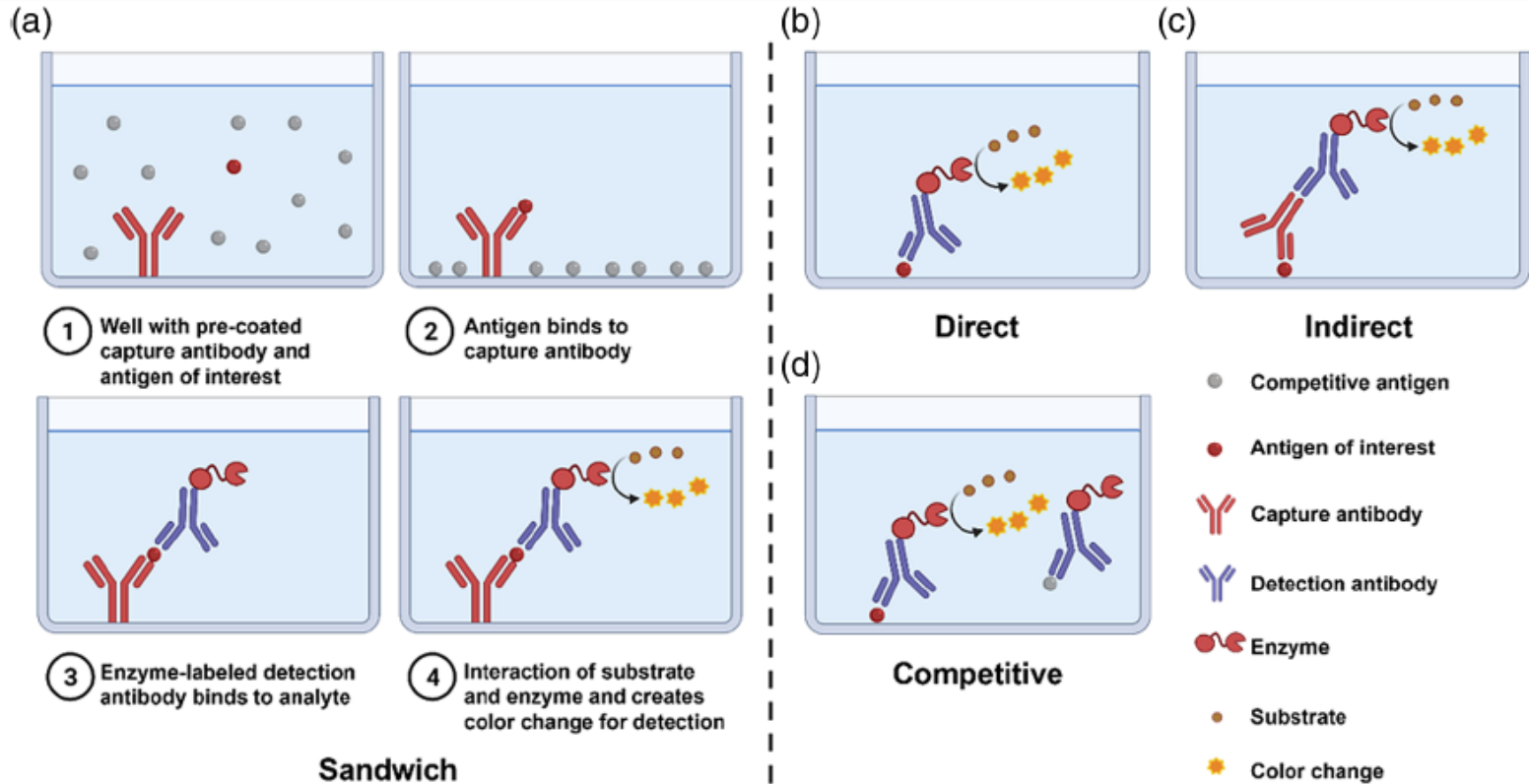
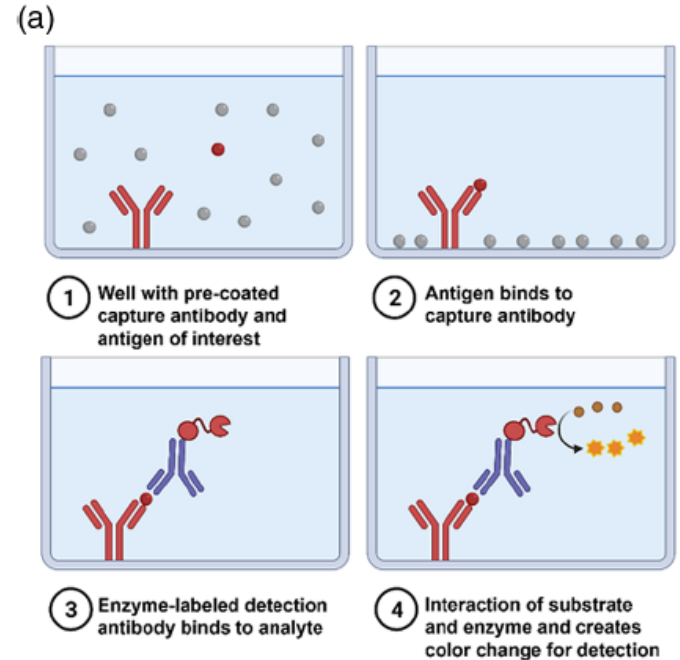


Figure. Basic setup and procedures of sandwich ELISA and principles of direct, indirect, and competitive ELISAs. This figure was created with BioRender.com.

ELISA method

The sandwich ELISA method is particularly suitable for the detection of unconcentrated targets in solution and is therefore the most widely used ELISA method for detection of COVID-19 antigens.



Sandwich



ELISA method

ELISA test can either qualitatively or quantitatively identify viral copies on the scale of 10^3 viral copies per mL.

Such sensitivity is close to the PCR-based NA tests and better than typical LFAs.

the signal intensities(absorbance or fluorescence) of ELISA are well correlated with the concentrations of the analyte.thus, it has been used as a standard tool for antibody screening and methodology evaluation.

the excellent LoD and sensitivity of ELISA are equipment dependent requiring a fluorescent/color signal reader, which inevitably increases the complexity of operation and time to result (typically 15 h), restricting its application in point of care testing (POCT) scenarios.



DIFERENT TYPE OF CORONAVIRUS TESTS

	Molecular tests	Antigen test	Antibody test
Also known as/types	Diagnostic test,Viral test,Nucleic acid amplification test(NAAT),RT-PCR,RT-LAMP test,Isothermal amplification assay	Rapid diagnostic tests	Serologic test,blood tests/ ELISA,CLIA,Neutralisation assay
Sample collected	Nasopharyngeal ,nasal or throat swab	Nasal or nasopharyngeal swab	Blood sample
Turn around time	8 to 10hours	15 to 30minutes	
Is another test needed	This test is typically highly accurate and usually does not need to be repeated	If the test shows positive result, it should be considered as true positive, and if negative confirm with a molecular test	Sometimes a second Ab test needed for accurate results.
What it shows....	Diagnoses active corona virus infection	Diagnoses active corona virus infection	Shows if infected by coronavirus in the past.
Timing	Most likely to be positive 2 days before the onset of symptoms,and in early days of symptomatic	In symptomatic infection,positive as symptoms develop and wanes over time.	Takes at least 7-14 days after symptom onset to develop antibodies,and varies depending on the

