COVID-19 Antigen Rapid Test Device

COV-S23

For in vitro diagnostic use only.

INTENDED USE

The COVID-19 Antigen Rapid Test Device is an in vitro immunoassay. The assay is for the direct and qualitative detection of SARS-CoV-2 viral nucleoprotein antigens from nasopharyngeal secretions collected from individuals suspected of COVID-19 within the first 5 days of symptom onset.

The COVID-19 Antigen Rapid Test Device is intended for use by trained healthcare professionals. For laboratory and point of care use.This assay is not intended for home testing (or self-testing).

Results are for the identification of SARS-CoV-2 viral nucleoprotein antigen. Antigen is generally detectable in nasopharyngeal secretions during the acute phase of infection. Positive results indicate the presence of viral antigens, but clinical correlation with patient history and other diagnostic information is necessary to determine infection status. Positive results do not rule out bacterial infection or co-infection with other viruses. The agent detected may not be the definite cause of disease. Laboratories are required to report all positive results to the appropriate public health authority.

Negative results do not rule out SARS-CoV-2 infection and should not be used as the sole basis for treatment or patient management decisions, including infection control decisions. Negative results should be considered in the context of a patient's recent exposures, history and the presence of clinical signs and symptoms consistent with COVID-19, and confirmed with a molecular assay, if necessary for patient management.

SUMMARY AND EXPLANATION OF THE TEST

Corona viruses are a large family of viruses that are common in many different species of animals, including camels, cattle, cats, and bats.

The virus is transmitted mainly via respiratory droplets that people sneeze, cough, or exhale. The incubation period for COVID-19 is currently estimated at between 2 and 14 days. Common symptoms of COVID-19 infection include fever, cough and respiratory symptoms such as shortness of breath and breathing difficulties. More serious cases develop severe pneumonia, acute respiratory distress syndrome, sepsis and septic shock that can lead to the death of the patient. People with existing chronic conditions seem to be more vulnerable to severe illness.

If people with COVID-19 are tested and diagnosed in a timely manner and rigorous infection control measures are applied, the likelihood of sustained human-to-human transmission in community settings is low.

PRINCIPLE

The COVID-19 Antigen Rapid Test Device detects SARS-CoV-2 viral antigens through visual interpretation of color development. Anti-SARS-CoV-2 antibodies are immobilized on the test region of the nitrocellulose membrane. Anti-SARS-CoV-2 antibodies conjugated to colored particles are immobilized on the conjugated pad. A sample is added to the extraction buffer which is optimized to release the SARS-CoV-2 antigens from specimen.

During testing, the extracted antigens bind to anti-SARS-CoV-2 antibodies conjugated to colored particles. As the specimen migrates along the strip by capillary action and interacts with reagents on the membrane, the complex will be captured by the anti-SARS-CoV-2 antibodies at the test region. Excess colored particles are captured at the internal control zone.

The presence of a colored band in the test region indicates a positive result for the SARS-CoV-2 viral antigens, while its absence indicates a negative result. A colored band at the control region serves as a procedural control, indicating that the proper volume of specimen has been added and membrane wicking is working.

MATERIALS

Materials Provided

- Individually packed test devices
- Extraction tube
- Individually packed swabs
- Package insert
- Negative control(If required)
- Extraction buffer
- Nozzle with filter
- Tube stand
- Positive control(If required)

Materials Required but Not provided

- Clock, timer or stopwatch

PRECAUTIONS

- For *in vitro* Diagnostic Use Only.
- This test has been authorized only for the detection of proteins from SARS-CoV-2, not for any other viruses or pathogens.
- Read the Package Insert prior to use. Directions should be read and followed carefully.
- Do not use kit or components beyond the expiration date.
- Specific training or guidance is recommended if operators are not experienced with specimen collection and handling procedures. Wear protective clothing such as laboratory coats, disposable gloves, and eye protection when specimens are collected and evaluated.
- The device contains material of animal origin and should be handled as a potential biohazard. Do not use if pouch is damaged or open.
- Test devices are packaged in foil pouches that exclude moisture during storage. Inspect each foil pouch before opening. Do not use devices that have holes in the foil or where the pouch has not been completely sealed. Erroneous result may occur if test reagents or components are improperly stored.
- Do not use the Extraction Buffer if it is discolored or turbid. Discoloration or turbidity may be a sign of microbial contamination.
- All patient specimens should be handled and discarded as if they are biologically hazardous. All specimens must be mixed thoroughly before testing to ensure a representative sample prior to testing.
- Failure to bring specimens and reagents to room temperature before testing may decrease assay sensitivity. Inaccurate or inappropriate specimen collection, storage, and transport may yield false negative test results.
- Avoid skin contact with buffer.
- If infection with SARS-CoV-2 is suspected based on current clinical and epidemiological screening criteria recommended by public health authorities, specimens should be collected with appropriate infection control precautions and sent to state or local health departments for testing.
- Viral isolation in cell culture and initial characterization of viral agents recovered in cultures of SARS-CoV-2 specimens are NOT recommended, except in a BSL3 laboratory using BSL3 work practices.

STORAGE AND STABILITY

- Store The COVID-19 Antigen Rapid Test Device at 2~30℃when not in use.
- **DO NOT FREEZE**.
- Kit contents are stable until the expiration dates marked on their outer packaging and containers.

SPECIMEN COLLECTION AND STORAGE

1) Remove the swab from its packing
2) Insert the swab into the nostril parallel to the palate. Rotating against the nasal wall. (to ensure swab contains cells as well as mucus)
3) Process the swab as soon as possible after collecting the specimen

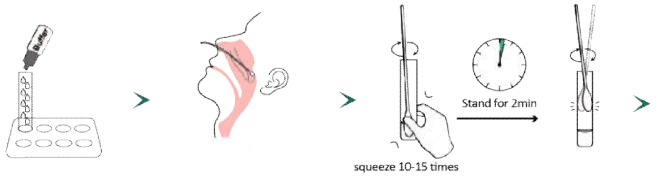
Note:

1. Use only synthetic fiber swabs with plastic shafts. Do not use calcium alginate swabs or swabs with wooden shafts, as they may contain substances that inactivate some viruses and inhibit further testing.
2. Swabs specimens should be tested as soon as possible after collection. Use freshly collected specimens for best test performance.
3. If not tested immediately, swab specimens may be stored at 2-8℃ for 24 hours after collection.
4. Do not use specimens that are obviously contaminate with blood, as it may interfere with the flow of sample with the interpretation of test results.

TEST PROCEDURE

Bring devices, reagents and specimens and/or controls to room temperature (15~30℃) before use.

1. For each specimen, open the foil pouch just before testing and remove the test device, and put it on a clean, level surface. Label the tube with the patient identification. For best results, the assay should be performed within one hour.
2. Gently mix extraction buffer. Add 10 drops into the extraction tube.
3. Insert the swab into the extraction tube. Mix well and squeeze the swab 10-15 times by compressing the walls of the tube against the swab.
   Stand for 2 minutes.
4. Roll the swab head against the inner wall of the tube as you remove it. Try to release as much liquid as possible. Dispose of the used swab in accordance with your biohazard waste disposal protocol.
   Stand for 2 minutes.
5. Insert nozzle into sample extraction tube. Invert the tube and add 2 dropsof solution into the sample well by gently squeezing the tube.
6. The result should be read at 15 minutes. Do not interpret the result after 30 minutes.



RESULT INTERPRETATION

POSITIVE:Two colored bands appear on the membrane. One band appears in the control region (C) and another band appears in the test region (T).

NEGATIVE: Only one colored band appears, in the control region (C). No apparent colored band appears in the test region (T).

INVALID: Control band fails to appear. Results from any test which has not produced a control band at the specified read time must be discarded. Please review the procedure and repeat with a new test. If the problem persists, discontinue using the kit immediately and contact your local distributor.

NOTE:

1. The color intensity in the test region (T) may vary depending on the concentration of analytes present in the specimen. Therefore, any shade of color in the test region should be considered positive. Note that this is a qualitative test only, and cannot determine the concentration of analytes in the specimen.
2. Insufficient specimen volume, incorrect operating procedure or expired tests are the most likely reasons for control band failure.

QUALITY CONTROL

Internal Procedural Controls

The COVID-19 Antigen Rapid Test Device has built-in (procedural) controls.Each test device has an internal standard zone to ensure proper sample flow. The user should confirm that the colored band located at the "C" region is present before reading the result.

External Positive and Negative Controls

Positive and negative control should be tested to ensure the proper performance of the assay. It is a recommended to test those positive and negative controls when a new lot of tests is open. When performed properly, in addition to the presence of C line, no line should be visible for the negative control and the T line is visible for the positive controls. Additional controls may be qualified and tested by the user

LIMITATIONS OF THE TEST

1. The COVID-19 Antigen Rapid Test Device is for professional *in vitro* diagnostic use, and should only be used for the qualitative detection of SARS-CoV-2 antigen. The intensity of color in a positive band should not be evaluated as "quantitative or semi-quantitative".
2. Both viable and nonviable SARS-CoV-2 viruses are detectable with The COVID-19 Antigen Rapid Test Device.
3. As with all diagnostic tests, a definitive clinical diagnosis should not be based on the results of a single test, but should only be made by the physician after all clinical and laboratory findings have been evaluated.
4. Failure to follow the TEST PROCEDURE and RESULT INTERPRETATION may adversely affect test performance and/or invalidate the test result.
5. Results obtained with this assay, particularly in the case of weak test lines that are difficult to interpret, should be used in conjunction with other clinical information available to the physician.
6. Negative results do not preclude SARS-CoV-2 infection and should be confirmed via molecular assay.
7. This assay is not intended for home testing (or self-testing).
8. Negative results do not preclude SARS-CoV-2 infection and should be confirmed via molecular assay.
9. This test cannot rule out diseases caused by other bacterial or viral pathogens.
10. If the differentiation of specific SARS viruses and strains is needed, additional testing, in consultation with state or local public health departments, is required.
11. The performance of this device has not been assessed in a population vaccinated against COVID-19.
12. The performance of the device has not been assessed on specimens from individuals who have been infected with emerging variants of SARS-CoV-2 of public health concern.

PERFORMANCE CHARACTERISTICS

Clinical Performance:

The performance of the COVID-19 Antigen Rapid Test Device was established with 230 direct nasopharyngeal swabs collected and enrolled from individual symptomatic patients who were suspected of COVID-19. Three (3) sites across the United States participated in the study. The specimen were tested fresh by minimally trained operators, and FDA EUA RT-PCR assay for

the detection of SARS-CoV-2 was utilized as the comparator method for the study.

Summary of the Performance of the COVID-19 Antigen Rapid Test Device Compared to RT-PCR

COVID-19 Antigen Rapid Test	RT-PCR		Total
	Positive	Negative	
Positive	50	3	53
Negative	3	174	177
Total	53	177	230
Positive Percent Agreement (PPA)	94.3 % (95% CI:84.6% ~ 98.1%)		
Negative Percent Agreement (NPA)	98.3 % (95% CI:95.1% ~ 99.4%)		
Overall Agreement:	97.4 % (95% CI:94.4% ~ 98.8%)		

The specimen positivity breakdown based on age of the patient:

Age	COVID-19 Antigen Rapid Test Device		
	Total #	Total Positive	Prevalence
≤5 years	11	2	18.2%
6 to 21 years	52	9	17.3%
22 to 59 years	133	37	27.1%
≥60 years	34	5	17.6%

The table below shows the positive results broken down by days since symptom onset:

Days Since Symptom Onset	Specimens Tested	RT-PCR Positive(+)	COVID-19 Antigen Rapid Test Device Positive(+)	PPA	95%CI
0	21	6	6	100.0%	61.0%-100.0%
1	38	17	17	100.0%	81.6%-100.0%
2	43	9	9	100.0%	70.1%-100.0%
3	25	7	7	100.0%	64.6%-100.0%
4	19	8	7	87.5%	52.9%-97.8%
5	12	2	2	100.0%	34.2%-100.0%
7	17	2	1	50.0%	9.4%-90.6%
8	4	1	1	100.0%	20.7%-100.0%
9	3	1	0	0.0%	0.0%-79.3%

Analytical Sensitivity (Limit of Detection):

The limit of detection was $2x10^{2.4}TCID_{50}$/mL, and was determined using inactivated SARS-CoV-2 virus spiked onto swabs.

Cross Reactivityand Microbial Interference:

There was no cross-reaction with the following organisms tested with the COVID-19 Antigen Rapid Test Device.

HCoV-HKU1	Influenza A (H5N1)	Coxsackie virus A16
HCoV-OC43	Influenza A (H7N9)	Norovirus
HCoV-NL63	Influenza A (H7N7)	Mump virus
HCoV-229E	Influenza B Victoria lineage	*Legionella pneumophila*
Measlesvirus	Influenza B Yamagata lineage	*Mycoplasma pneumoniae*
Streptococcuspneumoniae	Respiratory syncytial virus	*Chlamydia pneumoniae*
Epstein-Barrvirus	Adenovirus	*Streptococcus pyogenes*
Bordetella parapertussis	Parainfluenza 1/2/3/4 virus	*Streptococcus agalactiae*
Bordetella pertussis	Haemophilus influenzae	Candida albicans
InfluenzaA (H1N1)pdm09	Human metapneumovirus	Group C *Streptococcus*
Influenza A (H3N2)	Rhinovirus	*Staphylococcus aureus*
Mycobacterium tuberculosis	Pooled human nasal wash – representative of normal respiratory microbial flora	

Interfering Substances

The following substances, naturally present in respiratory specimens or that may be artificially introduced into the respiratory tract, were evaluated at the concentrations listed below. None of them were found to affect test performance of The COVID-19 Antigen Rapid Test Device.

Substance	Concentration	Substance	Concentration
3 OTC nasal sprays	10%	Guaiacol glyceryl ether	20 mg/ml
3 OTC mouthwashes	10%	Mucin	1%
3 OTC throat drops	10%	Mupirocin	250 μg/ml
4-acetamidophenol	10 mg/ml	Oxymetazoline	10 mg/ml
Acetylsalicylic acid	20 mg/ml	Phenylephrine	10 mg/ml
Albuterol	20 mg/ml	Phenylpropanolamine	20 mg/ml
Chlorpheniramine	5 mg/ml	Relenza ® (zanamivir)	20 mg/ml
Dexamethasone	5 mg/ml	Rimantadine	500 ng/ml
Dextromethorphan	10 mg/ml	Tamiflu ® (oseltamivir)	100 mg/ml
Diphenhydramine	5 mg/ml	Tobramycin	40 mg/ml
Doxylaminesuccinate	1 mg/ml	Triamcinolone	14 mg/ml
Flunisolide	3 mg/ml	Whole blood	4%

High-dose Hook Effect

The COVID-19 Antigen Rapid Test Device demonstrated that no hook effect at $1x10^{6.4}$ $TCID_{50}$/mL.

LITERATURE REFERENCES

1. Forni, D., Cagliani, R., Clerici, M. & Sironi, M. Molecular evolution of human coronavirus genomes. Trends Microbiol. 25, 35–48 (2017).
2. Ithete, N. L. et al. Close relative of human Middle East respiratory syndrome coronavirus in bat, South Africa. Emerg. Infect. Dis. 19, 1697–1699 (2013).

GLOSSARY OF SYMBOLS

ρ	Catalog number	ȣ	Temperature limitation
ι	Consult instructions for use	Λ	Batch code
I	*In vitro* diagnostic medical device	ε	Use by
μ	Manufacturer	σ	Do not reuse

μ

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