COVID-19 Antigen Nasal Test Kit
COV-S35002Pen

INTENDED USE

The COVID-19 Antigen Nasal Test Kit is an *in vitro* immunoassay. The assay is for the direct and qualitative detection of SARS-CoV-2 viral nucleocapsid protein from nasal secretions. The kit is in aid of diagnosis of COVID-19.

The COVID-19 Antigen Nasal Test Kit 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 saliva samples 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.

PRINCIPLE

The COVID-19 Antigen Nasal Test Kit detects SARS-CoV-2 viral antigens through visual interpretation of color development. Anti-SARS-CoV-2 antibodies are immobilized at the test region of the nitrocellulose membrane. Anti-SARS-CoV-2 antibodies conjugated to colored particles are immobilized on the conjugated pad.

The nasal secretion, collected by the intended user, is supposed to be mixed with the extraction buffer, which is individually packed in the kit.

During testing, target antigens, if present in the nasal secretions, will be released into the extraction buffer. As the specimen migrates along the strip by capillary action and then interacts with reagents on the sample pad, the target antigens will bind to anti-SARS-CoV-2 antibodies on the conjugate pad. Consequently, the antigen-antibody complex will be captured by the anti-SARS-CoV-2 antibodies immobilized at the test region. Excess colored particles will be captured at the control region of the NC membrane.

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, generally indicating that a proper volume of specimen has been added and membrane wicking is working.

MATERIALS

Materials Provided

- 20 Individual packaged test
- 1 Package insert

Materials Required but Not provided

- Clock, timer or stopwatch

PRECAUTIONS

- For *in vitro* Diagnostic Use Only.
- Each device is for single use only and cannot be reused
- **Caution should be taken when inserting the sample collector into the nasal cavity.**
- **DO NOT ingest.**
- Read the *Package Insert* prior to use. Directions should be read and followed carefully.
- Do not use kit or components beyond the expiration date.
- 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 kit when any component including test device, protector, extraction buffer, package insert is missing.
- 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.
- The buffer components include salts and surfactants, the preservative is sodium azide and water is the solvent. Avoid skin or eyes contact with buffer.
- Avoid skin or eyes contact with buffer before, during or after testing.
- 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.
- Do not puncture the membrane in the extraction tube before 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.
- There may be false negatives due to new unknown variants of SARS-Cov-2 prior to validation data available

STORAGE AND STABILITY

- Store The COVID-19 Antigen Nasal Test Kit 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.

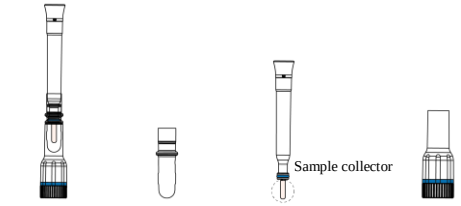
TEST PROCEDURE

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

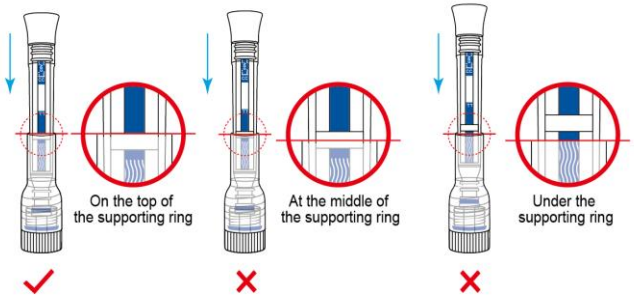
1. Remove the test from its packing. Label the test with the patient's identification. For best results, the assay should be performed within one hours.
2. 1) Take the test device out of the extraction tube.
   2) Remove the protector.
3. Gently insert the sample collector (the circle part in the picture) until resistance is met (about 1-2 cm into the nostril).
4. Rotate the collector five times against the nasal wall and remove from the nostril.
5. Repeat the sample collection procedure for the other nostril to ensure that sufficient specimen be collected from both nasal cavities.

Note: 1). It is important to obtain as much secretion as possible.
2). This may feel uncomfortable. Do not insert the collector any deeper if you feel strong resistance. Children aged 2-15 years should be tested by an adult (18+ years old).

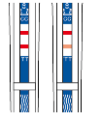
6. Place the test device vertically into the extraction tube until the top edge of the extraction tube reach the top of the supporting ring.
7. Read the results at 15 minutes.



Note:
When placing the test device vertically into the extraction tube, the edge of the extraction tube must reach the top of the supporting ring. If not, this may lead to lateral flow failure, resulting in an incorrect result or invalid result.

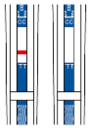


RESULT INTERPRETATION



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. Note that this is a qualitative test only, and cannot determine the concentration of analytes in the specimen.

QUALITY CONTROL

Internal Procedural Controls

The COVID-19 Antigen Nasal Test Kit has built-in (procedural) controls. Each test 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.

LIMITATIONS OF THE TEST

1. The COVID-19 Antigen Nasal Test Kit 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 Nasal Test Kit.
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.

PERFORMANCE CHARACTERISTICS

Analytical Sensitivity (Limit of Detection):

The limit of detection was determined with a quantified SARS-CoV-2 virus and has been evaluated at $1\times10^{2.4}$ $TCID_{50}$/mL.

The limit of detection was also determined with recombinant SARS-CoV-2 nucleoprotein and has been evaluated at 370 pg/mL.

Clinical Evaluation:

A total of 508 clinical specimens were collected to verify the performance of COVID-19 Antigen Nasal Test Kit. There were 106 positive specimens from the individuals who were suspected of COVID-19 within 7 days of symptom and 402 negative clinical specimens confirmed by FDA EUA RT-PCR. The results were summarized below:

Table: COVID-19 Antigen Nasal Test Kit vs. RT-PCR

		RT-PCR		Total
		Positive	Negative	
COVID-19 Antigen Rapid Test	Positive	104	1	105
	Negative	2	401	403
Total		106	402	508

Relative Sensitivity: 98.1 % (93.4% ~ 99.5%)*

Relative Specificity: 99.8 % (98.6% ~ 100.0%)*

Overall Agreement: 99.4 % (98.3% ~ 99.8%)*

*95% Confidence Interval

Cross Reactivity:

Cross reactivity with the following organisms has been studied. Samples positive for the following organisms were found negative when tested with the COVID-19 Antigen Nasal Test Kit.

Adenovirus 1	MERS-coronavirus	*Bordetellaparapertussis*
Adenovirus 2	SARS-coronavirus	*Bordetella pertussis*
Adenovirus 3	Human metapneumovirus	*Candida albicans*
Adenovirus 4	Influenza A (H1N1)pdm09	*Chlamydia pneumoniae*
Adenovirus 5	Influenza A (H3N2)	*Group C Streptococcus*
Adenovirus 7	Influenza B Victoria lineage	*Haemophilusinfluenzae*
Adenovirus 55	Influenza B Yamagata lineage	*Legionella pneumophila*
Epstein-Barr virus	Norovirus	*Mycoplasma pneumoniae*
Enterovirus EV70	Parainfluenza virus 1	*Mycobacterium tuberculosis*
Enterovirus EV71	Parainfluenza virus 2	*Staphylococcus aureus*
Enterovirus A16	Parainfluenza virus 3	*Staphylococcus epidermidis*
Enterovirus A24	Parainfluenza virus 4	*Streptococcus agalactiae*
Enterovirus B1	Respiratory syncytial virus A	*Streptococcus pneumoniae*
Echovirus 6	Respiratory syncytial virus B	*Streptococcus pyogenes*
HCoV-229E	Rhinovirus A30	
HCoV-OC43	Rhinovirus B52	
HCoV-NL63		

In silico analysis:

For Human Coronavirus HKU1, homology exists between the SRAS-COV-2 nucleocapsid protein and Human Coronavirus HKU1. Blast results showed 36 sequence IDs, mostly nucleocapsid protein showing homolody. Sequence ID AXT92485.1 had the highest alignment scores and was found to be 36.7% homologous across 82% of the sequence. This is relatively low but cross-reactivity cannot be fully ruled out.

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 Nasal Test Kit.

Substance	Concentration	Substance	Concentration
3 OTC nasal sprays	10%	Guaiacol glyceryl ether	20mg/mL
3 OTC mouth washes	10%	Mucin	1%
3 OTC throat drops	10%	Whole blood	4%
4-acetamidophenol	10 mg/mL	Mupirocin	250 μg/mL
Acetylsalicylic acid	10 mg/mL	Oxymetazoline	25 μg/mL
Albuterol	10 mg/mL	Phenylephrine	10 mg/mL
Chlorpheniramine	5 mg/mL	Phenylpropanolamine	1mg/mL
Dexamethasone	50μg/mL	Zanamivir	10mg/mL
Dextromethorphan	10μg/mL	Adamantanamine	500 ng/mL
Diphenhydramine	5 mg/mL	Oseltamivir phosphate	10mg/mL
Doxylamine succinate	1 mg/mL	Tobramycin	10mg/mL
Flunisolide	25μg/mL	Triamcinolone	14mg/mL

Precision:

The COVID-19 Antigen Nasal Test Kit demonstrates the expected test repeatability and reproducibility with three different lots at three different sites in 5 days by three difference operators.

Hook effect:

The study demonstrated that no false negatives occurred on virus level at $1\times10^{6.4}TCID_{50}$/mL and recombinant SARS-CoV-2 nucleocapsid protein level at 1.48mg/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

REF	Catalog number		Temperature limitation
	Consult instructions for use	LOT	Batch code
IVD	In vitro diagnostic medical device		Use by
	Manufacturer		Contains sufficient for <n> tests
	Do not reuse	EC REP	Authorized representative in the European Community
CE	CE marking according to IVD Medical Devices Directive 98/79/EC		

IVD

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