Rapid COVID-19 Antigen Test

INTENDED USE

The Rapid COVID-19 Antigen Test is an *in vitro* immunochromatographic assay for the qualitative detection of nucleocapsid protein antigen from SARS-CoV-2 in direct nasopharyngeal (NP) swab specimens directly from individuals who are suspected of COVID-19 by their healthcare provider. It is intended to aid in the rapid diagnosis of SARS-CoV-2 infections. The Rapid COVID-19 Antigen Test does not differentiate between SARS-CoV and SARS-CoV-2.

This test has not been reviewed by the FDA.

Negative results do not rule out SARS-CoV-2 infection, particularly I those who have been in contact with the virus. Follow up testing with a molecular diagnostic test should be considered to rule out infection in these individuals.

Use of this test is limited to laboratories certified to perform **high complexity testing**, including testing at point-of-care when the site is covered by the laboratory's CLIA certificate of high-complexity testing.

This test is not for home-use or at-home specimen collection.

SUMMARY AND EXPLANATION

The novel coronaviruses belong to the β genus. COVID-19 is an acute respiratory infectious disease. People are generally susceptible. Currently, the patients infected by the novel coronavirus are the main source of infection; asymptomatic infected people can also be an infectious source. Based on the current epidemiological investigation, the incubation period is 1 to 14 days, mostly 3 to 7 days. The main manifestations include fever, fatigue, and dry cough. Nasal congestion, runny nose, sore throat, myalgia, and diarrhea are found in a few cases.

This test is for detection of SARS-CoV-2 nucleocapsid protein antigen. Antigen is generally detectable in upper respiratory specimens during the acute phase of infection. Rapid diagnosis of SARS-CoV-2 infection will help healthcare professionals treat patients and control the disease more efficiently and effectively.

PRINCIPLE OF THE TEST

The Rapid COVID-19 Antigen Test is an immunochromatographic membrane assay that uses highly sensitive monoclonal antibodies to detect nucleocapsid protein antigen from SARS-CoV-2 in direct nasopharyngeal (NP) swab specimens. The test strip is composed of the following sample pad, reagent pad, reaction membrane, and absorbing pad. The reagent pad contains colloidal-gold conjugated with monoclonal antibodies against the nucleocapsid protein of SARS-CoV-2; the reaction membrane contains secondary antibodies for nucleocapsid protein of SARS-CoV-2. The whole strip is fixed inside a plastic device. When the sample is added into the sample well, conjugates dried in the reagent pad are dissolved and migrate along with the sample. If SARS-CoV-2 nucleocapsid antigen is present in the sample, a complex forms between the anti-SARS-2 conjugate and the virus will be captured by the specific anti-SARS-2 monoclonal antibodies coated on the test line region (T). Absence of the test line (T) suggests a negative result. To serve as a procedural control, a red line will always appear in the control line region (C) indicating that a proper volume of sample has been added and membrane wicking has occurred.

MATERIALS PROVIDED

(20) Test Cassettes
(20) Sterile Swabs
(20) Extraction Tubes and Tips
(2) Extraction Buffer Vials
(1) Workstation
(1) Package insert.

MATERIALS REQUIRED BUT NOT PROVIDED

1. Clock, timer, or stopwatch

WARNINGS AND PRECAUTIONS

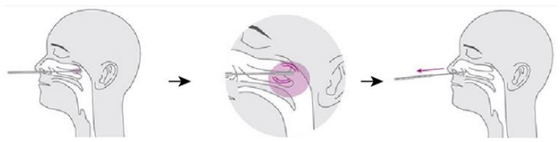
1. For in vitro diagnostic use only.
2. The test device should remain in the sealed pouch until use.
3. Do not use kit past its expiration date.
4. Swabs, tubes, and test devices are for single use only.
5. Solutions that contain sodium azide may react explosively with lead or copper plumbing. Use large quantities of water to flush discarded solutions down a sink.
6. Do not interchange or mix components from different kit lots.
7. Testing should only be performed using the swabs provided within the kit.
8. To obtain accurate results, do not use visually bloody or overly viscous samples.
9. Wear suitable protective equipment gloves when handling specimen and the contents of this kit.
10. Inadequate or inappropriate specimen collection and storage can adversely affect results.
11. Humidity and temperature can adversely affect results.
12. Dispose of test device and materials as biohazardous waste in accordance with federal, state, and local requirements.

STORAGE AND STABILITY

1. The kit can be stored at room temperature or refrigerated (2-30˚C).
2. Do not freeze any of the test kit components.
3. Do not use test device and reagents after expiration date.
4. Test devices that have been outside of the sealed pouch for more than 1 hour should be discarded.
5. Close the kit box and secure its contents when not in use.

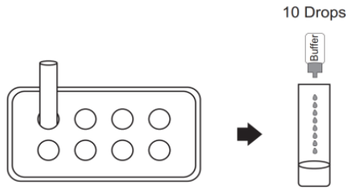
SPECIMEN COLLECTION

1. Using the sterile nasopharyngeal swab provided in the kit, carefully insert the swab in the patient's nostril.
2. Swab over the surface of the posterior nasopharynx and rotate the swab several times.
3. Withdraw the swab from the nasal cavity.

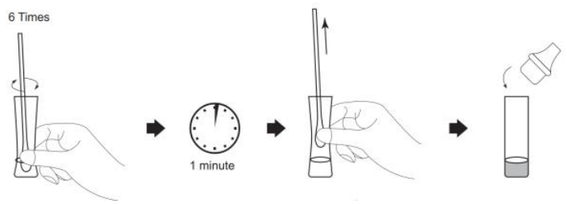


SAMPLE PREPARATION PROCEDURE

1. Insert the test extraction tube into the workstation provided in the kit. Make sure that the tube is standing upright and reaches the bottom of the workstation.
2. Add 0.3 mL (approximately 10 drops) of the sample extraction buffer into the extraction tube.



3. Insert the swab into the extraction tube containing 0.3 mL of the extraction buffer.
4. Roll the swab at least 6 times while pressing the head against the bottom and side of the extraction tube.
5. Leave the swab in the extraction tube for 1 minute.
6. Squeeze the tube several times from the outside to immerse the swab. Remove the swab.



SPECIMEN TRANSPORT AND STORAGE

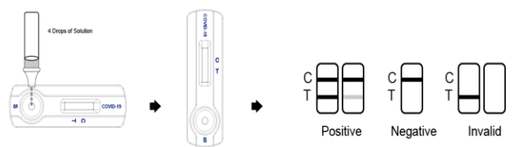
Do not return the nasopharyngeal swab to the original paper packaging.

Specimen should be tested immediately after collection. If immediate testing of specimen is not possible, insert the swab into an unused general-purpose plastic tube. Ensure the breakpoint swab is level with the tube opening. Bend the swab shaft at a 180 degrees angle to break it off at the breaking point. You may need to gently rotate the swab shaft to complete the breakage. Ensure the swab fits within the plastic tube and secure a tight seal. The specimen should be disposed and recollected for retesting if untested for longer than 1 hour.

TEST PROCEDURE

Allow the test device, test sample and buffer to equilibrate to room temperature (15-30˚C) prior to testing.

1. Just prior to testing, remove the test device from the sealed pouch and lay flat on clean work bench.
2. Push the nozzle which contains the filter onto the extraction tube. Ensure the nozzle has a tight fit.
3. Hold the extraction tube vertically and add 4 drops (approximately 100 µL) of test sample solution into the sample well.
4. Start the timer.
5. Read the results at 15 minutes. Do not interpret the result after 20 minutes.



INTERPRETATION OF RESULTS

POSITIVE:

The presence of two lines, the control line (C) and test line (T), within the result window indicates a positive result.

NEGATIVE:

The presence of only the control line (C) within the result window indicates a negative result.

INVALID:

If the control line (C) is not visible within the result window after performing the test, the result is considered invalid. Some causes of invalid results include failure to correctly follow directions or the test was used beyond its expiration date. It is recommended that the specimen be re-tested using a new test.

NOTE:

1.The intensity of color in the test line region (T) may vary depending on the concentration of analyses present in the specimen. Therefore, any shade of color in the test line region (T) should be considered positive. Please 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

A procedural control is included in the test. A red line appearing in the control line region (C) is the internal procedural control. It confirms sufficient specimen volume and correct procedural technique. Control standards are not supplied with this test. However, it is recommended that positive and negative controls are sourced from a competent local authority and tested as a good laboratory practice, to confirm the test procedure and verify the test performance.

LIMITATIONS

1. The etiology of respiratory infection caused by microorganisms other than SARS-CoV-2 will not be established with this test. The Rapid COVID-19 Antigen Test can detect both viable and non-viable SARS-CoV-2. The performance of the Rapid COVID-19 Antigen Test depends on antigen load and may not correlate with viral culture results performed on the same specimen.
2. Failure to follow the TEST PROCEDURE may adversely affect test performance and/or invalidate the test result.
3. If the test result is negative and clinical symptoms persist, additional testing using other clinical methods is recommended. A negative result does not at any time rule out the presence of SARS-CoV-2 antigens in specimen, as they may be present below the minimum detection level of the test or if the sample was collected or transported improperly.
4. As with all diagnostic tests, a confirmed diagnosis should only be made by a physician after all clinical and laboratory findings have been evaluated.
5. Positive test results do not rule out co-infections with other pathogens.
6. Positive test results do not differentiate between SARS-CoV and SARS-CoV-2.
7. Negative results should be treated as presumptive and confirmed with an FDA authorized molecular assay, if necessary, for clinical management, including infection control.

PERFORMANCE CHARACTERISTICS

1. Clinical Sensitivity, Specificity and Accuracy

Clinical performance was evaluated at four POC sites with a total of 298 direct nasal swabs prospectively collected and enrolled form individuals with COVID-19 symptoms or exposed to COVID-19 patients, who are suspected of COVID-19 infection. Samples were collected by qualified healthcare staff within four POC sites located at various geographically across the United States.

Nasopharyngeal swabs were collected and tested immediately according to the Quick Reference Instruction and Package Insert. The performance of the rapid antigen test was compared to Emergency Use Authorization RT-PCR assays for SARS-CoV-2 detection. Overall study results are shown in Table 1.

Table 1: Summary Results

Method		RT-PCR	
		Pos	Neg
Rapid COVID-19 Antigen Test	Pos	45	1
	Neg	2	250
Total Results		47	251

Positive Agreement: 45/47=95.74% (95%CI:85.46%--99.48%)

Negative Agreement: 250/251=99.60% (95%CI:97.80%--99.99%)

Accuracy: 295/298=98.99% (95%CI:97.09%--99.79%)

2. Limit of Detection (LOD)

LOD studies determine the lowest detectable concentration of SARS-CoV-2 at which approximately 95% of all (true positive) replicates test positive. Heat inactivated SARS-CoV-2 virus, with a stock concentration of 4.6 x 10^5 $TCID_{50}$ / mL, was spiked into negative specimen and serially diluted. Each dilution was ran in triplicate on the Rapid COVID-19 Antigen Test. The Limit of Detection of the Rapid COVID-19 Antigen Test is 1.15 x 10^2 $TCID_{50}$ / mL (Table 2).

Table 2: Limit of Detection (LOD) Study Results

Concentration	No. Positive/Total	Positive Agreement
1.15 x 10^2 $TCID_{50}$ / mL	180/180	100%

3. High Dose Hook Effect

No high dose hook effect was observed when testing up to a concentration of 4.6 x 10^5 $TCID_{50}$/mL of heat inactivated SARS-CoV-2 virus.

4. Cross Reactivity

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

Pathogens	Concentration
Respiratory syncytial virus Type A	5.5×10^7 PFU/mL
Respiratory syncytial virus Type B	2.8×10^5 $TCID_{50}$/mL
Novel influenza A H1N1 virus (2009)	1×10^6 PFU/mL
Seasonal influenza A H1N1 virus	1×10^5 PFU/mL
Influenza A H3N2 virus	1×10^6 PFU/mL
Influenza A H5N1 virus	1×10^6 PFU/mL
Influenza B Yamagata	1×10^5 PFU/mL
Influenza B Victoria	1×10^6 PFU/mL
Rhinovirus	1×10^6 PFU/mL
Adenovirus 3	$5\times10^{7.5}$ $TCID_{50}$/mL
Adenovirus 7	2.8×10^6 $TCID_{50}$/mL
EV-A71	1×10^5 PFU/mL
Mycobacterium tuberculosis	1×10^3 bacteria/mL
Mumps virus	1×10^5 PFU/mL
Human coronavirus 229E	1×10^5 PFU/mL
Human coronavirus OC43	1×10^5 PFU/mL
Human coronavirus NL63	1×10^6 PFU/mL
Human coronavirus HKU1	1×10^6 PFU/mL

Pathogens	Concentration
Parainfluenza virus 1	7.3×10^6 PFU/mL
Parainfluenza virus 2	1×10^6 PFU/mL
Parainfluenza virus 3	5.8×10^6 PFU/mL
Parainfluenza virus 4	2.6×10^6 PFU/mL
Haemophilus influenzae	5.2×10^6 CFU/mL
Streptococcus pyogenes	3.6×10^6 CFU/mL
Streptococcus pneumoniae	4.2×10^6 CFU/mL
Candida albicans	1×10^7 CFU/mL
Bordetella pertussis	1×10^4 bacteria/mL
Mycoplasma pneumoniae	1.2×10^6 CFU/mL
Chlamydia pneumoniae	2.3×10^6 IFU/mL
Legionella pneumophila	1×10^4 bacteria/mL
Enterovirus species D type 68, USA	8.9×10^6 bacteria/mL

5. Interfering Substance

The following substances, naturally present in respiratory specimens or that may be artificially introduced into the nasal cavity or nasopharynx, were evaluated with the Rapid COVID-19 Antigen Test at the concentrations listed below and were found not to affect test performance.

Substance	Concentration
Human blood (EDTA anticoagulated)	20% (v/v)
Mucin	5 mg/mL
Oseltamivir phosphate	5 mg/mL
Ribavirin	5 mg/mL
Levofloxacin	5 mg/mL
Azithromycin	5 mg/mL
Meropenem	5 mg/mL
Tobramycin	2 mg/mL
Phenylephrine	20% (v/v)
Oxymetazoline	20% (v/v)
0.9% sodium chloride	20% (v/v)
A natural soothing ALKALOL	20% (v/v)
Beclomethasone	20% (v/v)
Hexadecadrol	20% (v/v)
Flunisolide	20% (v/v)
Triamcinolone	20% (v/v)
Budesonide	20% (v/v)
Mometasone	20% (v/v)
Fluticasone	20% (v/v)
Fluticasone propionate	20% (v/v)

6. Microbial Interference

The following microbes were tested to evaluate whether potential microorganisms in clinical samples interfere with the detection of SARS-CoV-2 to produce false negative results. Each pathogenic microorganism was tested in triplicate in the presence of heat inactivated SARS-CoV-2 virus ($2.3x10^2$ TCID50/swab). No interference was seen with the microorganisms listed in the table below.

Microorganism	Concentration
Respiratory syncytial virus Type A	5.5×10^7PFU/ml
Respiratory syncytial virus Type B	$2.8\times10^5TCID_{50}$/ml
Novel influenza A H1N1 virus (2009)	1×10^6PFU/ml
Seasonal influenza A H1N1 virus	1×10^5PFU/ml
Influenza A H3N2 virus	1×10^6PFU/ml
Influenza A H5N1 virus	1×10^6PFU/ml
Influenza B Yamagata	1×10^5PFU/ml
Influenza B Victoria	1×10^6PFU/ml
Rhinovirus	1×10^6PFU/ml
Adenovirus 1	1×10^6PFU/ml
Adenovirus 2	1×10^5PFU/ml
Adenovirus 3	$5\times10^{7.5}TCID_{50}$/ml
Adenovirus 4	1×10^6PFU/ml
Adenovirus 5	1×10^5PFU/ml
Adenovirus 7	$2.8\times10^6TCID_{50}$/ml
Adenovirus 55	1×10^5PFU/ml
EV-A71	1×10^5PFU/ml
EV-B69	1×10^5PFU/ml

Microorganism	Concentration
EV-D70	1×10^5PFU/ml
Mycobacterium tuberculosis	1×10^3bacterium/ml
Mumps virus	1×10^5PFU/ml
Varicella zoster virus	1×10^6PFU/ml
Human coronavirus 229E	1×10^5PFU/ml
Human coronavirus OC43	1×10^5PFU/ml
Human coronavirus NL63	1×10^6PFU/ml
Human coronavirus HKU1	1×10^6PFU/ml
Human Metapneumovirus (hMPV)	1×10^6PFU/ml
Parainfluenza virus 1	7.3×10^6PFU/ml
Parainfluenza virus 2	1×10^6PFU/ml
Parainfluenza virus 3	5.8×10^6PFU/ml
Parainfluenza virus 4	2.6×10^6PFU/ml
Haemophilus influenzae	5.2×10^6CFU/ml
Streptococcus pyogenes	3.6×10^6CFU/ml
Streptococcus agalactiae	7.9×10^7CFU/ml
Streptococcus pneumoniae	4.2×10^6CFU/ml
Candida albicans	1×10^7CFU/ml
Bordetella pertussis	1×10^4bacterium/ml
Mycoplasma pneumoniae	1.2×10^6CFU/ml
Chlamydia pneumoniae	2.3×10^6IFU/ml
Legionella pneumophila	1×10^4bacterium/ml
Pooled human nasal wash	N/A

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	Consult instructions for use		Tests per kit	EC REP	Authorized Representative
IVD	For *in vitro* diagnostic use only		Use by		Do not reuse
2°C 30°C	Store between 2~30°C	LOT	Lot Number	REF	Catalog#

Revision Date: 2020-12-29

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