lumiraDx™ SARS-CoV-2 Ag Test

For Professional Use Only
For *In Vitro* Diagnostic Use Only

SPEC-32312 R# ART-00571 R10

ENGLISH

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The LumiraDx Severe Acute Respiratory Syndrome (SARS) CoV-2 Antigen (Ag) Test Strips (hereafter referred to as Test Strips) are to be used with the LumiraDx Platform. The LumiraDx Platform is a point of care system for professional use which is used for *in vitro* diagnostic tests. It comprises a portable LumiraDx Instrument and a LumiraDx Test Strip for the required test. This test is for **HEALTHCARE PROFESSIONAL USE ONLY** and allows users to perform tests using small sample volumes and to view results quickly on the Instrument touchscreen.

Intended use:

TThe LumiraDx SARS-CoV-2 Ag Test is a rapid microfluidic immunofluorescence assay for use with the LumiraDx Platform intended for the qualitative detection of the nucleocapsid protein antigen to SARS-CoV-2 in nasal swab and nasopharyngeal swab samples. Samples are collected from individuals suspected of COVID-19 infection within the first twelve days of symptom onset or from asymptomatic individuals. The Test aids in the diagnosis of current SARS-CoV-2 infection by detection of SARS-CoV-2 antigen.

Positive results indicate the presence of viral antigens from infective virus, but clinical correlation with individual's history and other diagnostic information is necessary to confirm infection status.

Negative results do not rule out SARS-CoV-2 infection and should be considered in the context of an individual's recent exposures, history and presence of clinical signs and symptoms consistent with COVID-19.

Results should not be used as the sole basis for treatment or case management decisions, including infection control decisions.

The LumiraDx SARS-CoV-2 Ag Test is intended for use by individuals trained in point of care settings and proficient in performing tests using the LumiraDx Platform.

Caution: For *in vitro* diagnostic use.

	Before you start testing, if you are new to the LumiraDx Instrument and LumiraDx Platform, you must read the LumiraDx Platform User Manual, the LumiraDx SARS-CoV-2 Ag Test Quick Reference Instructions and this entire Product Insert. In addition, please watch the LumiraDx Platform Training Video. All these materials are available at **lumiradx.com**.

Summary and explanation of the Test:

The World Health Organisation (WHO) have named the disease caused by SARS-CoV-2 virus as coronavirus 2019 or COVID-19[1]. The most common symptoms of COVID-19 are fever, tiredness, and dry cough. Some patients may have aches and pains, nasal congestion, headache, conjunctivitis, sore throat, diarrhoea, loss of taste or smell, or a rash on skin or discoloration of fingers or toes. These symptoms are usually mild and begin gradually. Some people become infected but do not develop any symptoms and do not feel unwell. However, the disease can develop rapidly and have high morbidity in certain populations, especially those with underlying health conditions. The disease can spread from person to person through small droplets from the nose or mouth which are spread when a person with COVID-19 coughs or exhales. Most estimates of the incubation period for COVID-19 range from 2-14 days[2].

The use of a LumiraDx SARS-CoV-2 Ag Test will enable the physician to verify infection quickly, begin proper treatment and to initiate isolation precautions helping prevent further spread of infection.

Principle of the assay:

The LumiraDx SAR-CoV-2 Ag Test is a single use fluorescence immunoassay device designed to detect the presence of the nucleocapsid protein antigen from SARS-CoV-2 in nasal swab and nasopharyngeal swab samples.

The test procedure involves collecting a nasal swab or nasopharyngeal swab sample using a recommended swab which is eluted into a vial containing Extraction Buffer. A single drop of the sample in Extraction Buffer is added to the Test Strip using the vial dropper cap provided. The LumiraDx Instrument is programmed to perform the test protocol using the dried reagents contained within the strip. The test result is determined from the amount of fluorescence the Instrument detects within the measurement zone of the Test Strip. The concentration of the analyte in the sample is proportional to the fluorescence detected. The results are displayed on the Instrument touchscreen within 12 minutes from the addition of the sample.

Materials provided:

- LumiraDx Test Strips packed individually in sealed desiccant foil pouches.
- LumiraDx Test Product Insert
- RFID (Radio frequency ID) Tag held inside the Test Strip carton
- Extraction Buffer Vials
- Dropper Lids

Materials required but not provided with the Test Strip carton:

- LumiraDx Instrument
- Standard nasal swab and nasopharyngeal swab collection equipment. Please refer to the Limitations section of this product insert for information on recommended swabs.
- LumiraDx SARS-CoV-2 Ag Test Quick Reference Instructions
- LumiraDx SARS-CoV-2 Ag Quality Controls (as required to meet local and organisational compliance)
- LumiraDx Connect if connectivity required (refer to LumiraDx Connect User Manual)

Warnings and precautions

- For *in vitro* diagnostic use only
- Do not open the test strip until ready for immediate use.
- Discard and do not use any damaged or dropped Test Strips or other materials.
- Inadequate or inappropriate sample collection, storage, and transport can result in incorrect results.
- The test cannot be visually interpreted; the LumiraDx Instrument must be used to generate results.
- Do not use the kit components beyond the expiration date
- Do not reuse any kit components.
- Samples must be processed as indicated in the Sample Extraction and Performing a Test sections of this Product Insert. Failure to follow the instructions for use can result in inaccurate results.

- All components of this kit should be discarded as Biohazard waste according to local regulations and procedures.
- Refer to the product safety data sheet for risk and safety phrases and disposal information. The product safety data sheet is available via our website at **https://lumiradx.com/uk-en/what-we-do/diagnostics/test-technology/antigen-test**.
- Exercise the normal precautions required for handling all laboratory reagents. Wear protective clothing such as laboratory coats, disposable gloves, and eye protection when samples are collected and evaluated.
- Proper laboratory safety techniques should be followed at all times when working with SARS-CoV-2 patient samples. Patient swabs, used Test Strips and used Extraction Buffer vials may be potentially infectious. Proper handling and disposal methods should be established by the laboratory in accordance with local regulations and procedures.
- Reagents encapsulated within the Test Strip are present in extremely small amounts and where any component is of animal origin, the source is certified as free from infectious or contagious material – however, should any reagent become exposed it should be treated as potentially infectious.

Storing the Test Strips:

Store the Test Strips in their original carton. You can store the Test Strips at a temperature between 2°C and 30°C (36°F and 86°F). Avoid freezing or storing in any area that could exceed 30°C. When stored properly, the Test Strips can be used until the expiration date printed on the Test Strip foil pouch and the Test Strip carton. Discard the Test Strips if they are passed the expiration date.

Handling the Test Strips:

When you are ready to perform a test, open the Test Strip carton, take out a Test Strip, and remove it from the foil pouch. After removing the Test Strip from the foil pouch, it should be used immediately. Do not use the Test Strip if there are any visible signs of damage to the foil pouch such as tears or holes.

Sample material:

The following samples can be used with the LumiraDx SARS-CoV-2 Ag Test Strip:

- Nasal Swab Sample (NS)
- Nasopharyngeal Swab Sample (NP)

The Test device contains:

- Rabbit and mouse monoclonal antibodies
- Fluorescent particles
- Magnetic particles
- Buffer and stabilising agents

Preparing the Instrument to perform a Test:

Power on the Instrument by pressing the power button at the rear of the Instrument. You will hear the Instrument powering on, and the display will be a blank black screen for several seconds before starting up. If the screen is just dimmed tap the touch-screen to wake up the Instrument.

Refer to the section on **Performing a Test** in this Product Insert for information on how to test a Patient sample. The LumiraDx Quick Reference Instructions (QRI) provide an illustrated step-by-step procedure on how to run a Test.

The Instrument will prompt to install the Lot Calibration File when inserting a new Test Strip Lot. Once installed, the Instrument will have all the information required to process the test, and any future tests from the same Lot of Test Strips.

Lot Calibration File installation

Lot Calibration Files are required to provide the Instrument with the information needed to perform diagnostic tests. This only needs to be completed once for each Test Strip Lot. The Instrument will prompt to install the Lot Calibration File when inserting a new Test Strip Lot.

RFID strip code reader

Locate ((•)) symbol on Instrument.

Installation

Touch back of Test Strip Carton ((•)) symbol to install.

The Instrument will sound and a confirmation message will be displayed.

When indicated by the touchscreen, open the foil pouch just before use and insert the LumiraDx Test Strip into the LumiraDx Instrument. The Instrument will indicate when it is ready for the sample to be applied.

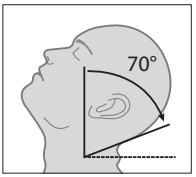
The LumiraDx SARS-CoV-2 Ag Test results should be evaluated by a Healthcare Professional in the context of all available clinical and laboratory data.

Instructions for sample collection:

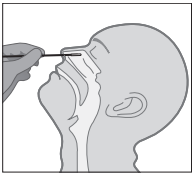
When collecting any type of sample, follow universal collection precautions and guidelines according to your organization. For collection of nasal swabs and nasopharyngeal swabs, follow appropriate swab collection guidelines and swab manufacturers' recommendations. Users should be trained in appropriate sample collection and handling procedures.

The steps that follow apply to a nasal swab and a nasopharyngeal swab. For information on recommended swabs to use with the LumiraDx SARS-CoV-2 Ag Test, please refer to the Limitations section of this Product Insert.

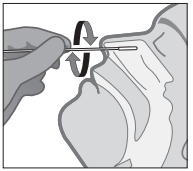
Sampling from a nasal swab:



1. Tilt patient's head back 70°

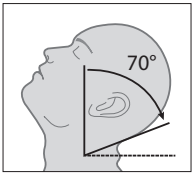


2. A swab sample is needed from both nostrils, and this is taken using the same swab. While gently rotating the swab, insert swab less than one inch into the first nostril until resistance is met at Turbinates. (Turbinates are the small structures inside the nose).

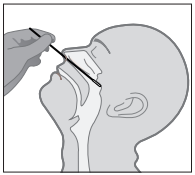


3. Rotate the swab several times against the nasal wall. Remove and repeat this process by using the same swab into the second nostril. Then place the swab into the Extraction Vial. See instructions for Sample Extraction.

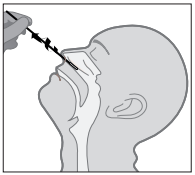
Sampling from a nasopharyngeal swab:



1. Tilt patient's head back 70°



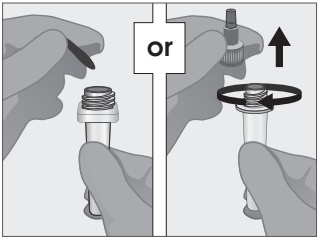
2. Hold the swab firmly between the fingers and insert swab into nostril. The swab should reach depth equal to distance from nostrils to outer opening of the ear. Leave Swab in place for several seconds to absorb secretions.



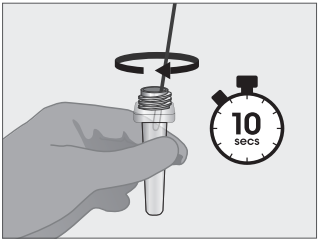
3. Slowly remove the swab while rotating it. Remove and then place the swab in the extraction vial. See instructions for Sample Extraction.

After patient swabbing, process the swab in the Extraction Vial as soon as possible. Do not place the swab back into the swab packaging sleeve after sample collection.

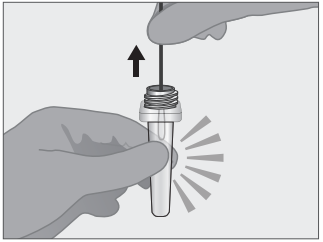
Instructions for sample extraction:



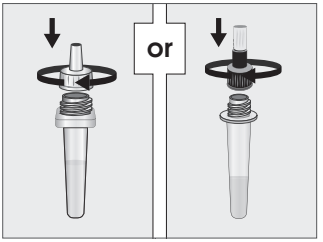
1. **Remove the seal or blue screw cap** from the top of the Extraction Vial containing the Extraction Buffer.



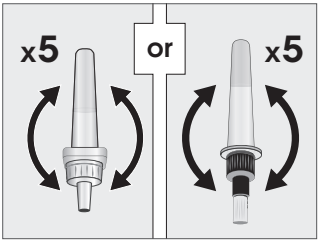
2. **Place and soak the patient swab** in the Extraction Buffer for 10 seconds and then stir well by rotating the swab against the side of the vial 5 times.



3. **Squeeze swab.** Remove the patient swab while squeezing the middle of the Extraction Vial to remove the liquid from the swab. Discard the swab in biohazard waste.



4. **Firmly attach the clear or purple Dropper Lid** to the top of the Extraction Vial. The extracted sample must be used within 5 hours of preparation when stored at room temperature. Extracted nasal swab or nasopharyngeal swab samples may be frozen at -80°C and used up to 5 days after freezing.



5. **Gently invert the Extraction Vial** five times just before applying the sample to the Test Strip.

Performing a Test (refer to the Quick Reference Instructions to make sure that your Instrument has been prepared before starting this step). If using a frozen sample, the sample must be at room temperature before testing.

1. **Gently invert** the Extraction Vial five times (5x) just before applying the sample to the Test Strip.
2. **Apply the extracted sample from the Extraction Vial** onto the Sample Application Area of the inserted Test Strip. To do this gently press the sides of the extraction vial until **one whole drop** is visible and allow it to touch the Sample Application Area of the Test Strip. The sample will then be drawn by capillary action into the Test Strip. When the sample is detected the Instrument will sound (if sounds are enabled) and a confirmation message will be displayed. The touchscreen of the LumiraDx Instrument will request the user to **immediately close the door (Note: you have 10 seconds only to close the door).**
3. **Do not add more than one drop of sample.** Do not open the door while the test is in progress. The touchscreen will indicate test progress.
4. **The result** will appear on the Instrument touchscreen within 12 minutes of applying the sample and starting the test. The results will be displayed as a positive or negative result SARS-CoV-2 Ag on the Instrument screen (see Fig 1 and Fig 2).
5. **Dispose** of the swab, Extraction Vial and Test Strip in the appropriate clinical waste.
6. **Disinfection** of the Instrument with LumiraDx approved materials is recommended if contamination is suspected. A list of approved disinfecting materials is available at lumiradx.com. Use the wipe until the surface of the Instrument is visibly wet. Allow the surface to remain wet for 1 minute and let air dry.
7. **If you need to retest,** you will use a new Test Strip. Use the same extraction vial and repeat the test. The extracted sample must be used within 5 hours of preparation when stored at room temperature. Extracted nasal swab or nasopharyngeal swab samples may be frozen at -80°C and used up to 5 days after freezing.

Result interpretation:

The results will be displayed on the Instrument screen - **examples of result screen display:**

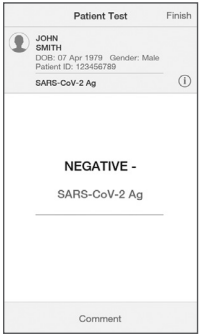


Fig 1: Negative result for SARS-CoV-2 Ag

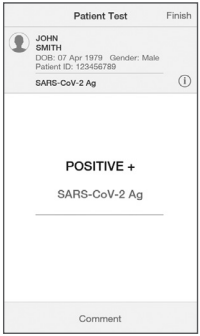
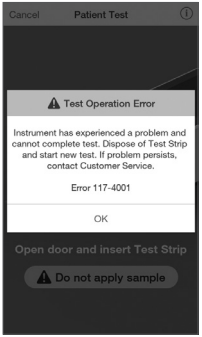


Fig 2: Positive result for SARS-CoV-2 Ag

NOTE: A negative result, from patients with symptoms onset beyond twelve days, should be treated as presumptive and confirmation with a molecular assay, if necessary, for patient management, may be performed.

Invalid test results

If an issue occurs, a message will be displayed on the Instrument touch-screen. Alert messages include useful information and are highlighted by an orange banner. Error messages also include a ⚠ symbol. All messages will contain a description of the Instrument status or error and an instruction. Error messages contain an identifying code that may be used for further troubleshooting purposes. Refer to the LumiraDx Platform User Manual if an error message is displayed on the LumiraDx Instrument touch-screen and contact LumiraDx Customer Services on customerservices@lumiradx.com.



Example of an error screen: : If the On Board Control (OBC) fails, an error message will be shown and no test result will be returned. Follow the on screen instructions to dispose of the Test Strip and start a new test. If the problem persists, contact Customer Services.

Built-in controls:

The instrument reads the 2D bar code on each Test Strip and can identify if the strip has exceeded the expiry date for use, and if the strip Lot Calibration file has not yet been loaded, at which point it will request it.

The LumiraDx Instrument and LumiraDx SARS-CoV-2 Ag Test Strips have several quality control functions integrated to ensure validity of each test run. These checks ensure that the volume of sample added is sufficient and the assay sequence of the Test Strip is as expected. The checks also ensure that the Test Strip has not been damaged or used previously. If these checks are not verified, the test run will be rejected and an error message displayed on the Instrument touchscreen.

The LumiraDx Instrument ensures the quality of test results obtained through the following features:

- Automated checks of the correct functioning of the Instrument at power on and during operation.
- This includes electrical component operation, heater operation, battery charge state, mechanical actuators and sensors and optical system performance.
- Monitoring of Test Strip performance and controls during test runtime.
- Ability to perform Quality Control Tests using LumiraDx Quality Control solutions to meet regulatory compliance requirements.

External Quality Controls:

External liquid Quality Controls for SARS-CoV-2 Ag are available from LumiraDx and may be used to demonstrate that the Test is functioning properly by demonstrating the expected Quality Control results and correct test performance by the operator.

External Quality Control requirements should be established in accordance with local, state, and federal regulations or accreditations requirements. It is recommended that external control testing be performed with each new operator and before using a new lot or shipment of the LumiraDx SARS-CoV-2 Ag Test. Refer to the LumiraDx SARS-CoV-2 Ag Quality Controls pack insert available at lumiradx.com for detailed instructions.

LumiraDx SARS-CoV-2 Ag Quality Controls are purchased separately.

If the LumiraDx SARS-CoV-2 Ag Quality Controls do not perform as expected, repeat the QC Test and if the problems persists, do not report patient results and contact LumiraDx Customer Services.

Cleaning and disinfection

Cleaning and disinfection of the Instrument should follow and be performed according to established site protocols and schedules.

To clean the Instrument wipe the external surfaces with a soft, slightly damp cloth when it appears visibly dirty.

It is recommended to disinfect the Instrument after each patient test or if contamination is suspected with LumiraDx approved materials. Details of LumiraDx approved disinfectant materials can be found at lumiradx.com. Use the material until the surface of the Instrument is visibly wet. Allow the surface to remain wet for **1 minute** and let air dry. **Avoid USB ports and power inlet. Do not spray or pour solution directly onto the Instrument. Do not put any objects or cleaning materials into the Test Strip slot.**

Limitations

- This test detects both viable (live) and non-viable, SARS-CoV and SARS-CoV-2. Test performance depends on the amount of virus (antigen) in the sample and may or may not correlate with viral culture results performed on the same sample.
- Failure to follow the instructions for use may adversely affect test performance and/or invalidate the test result.
- Test results should be considered in the context of all available clinical and diagnostic information, including patient history and other test results.
- Positive test results do not differentiate between SARS-CoV and SARS-CoV-2.
- Negative test results are not intended to rule in other non-SARS viral or bacterial infections.
- Negative results, from patients with symptom onset beyond twelve days, should be treated as presumptive and confirmation with a molecular assay, if necessary for patient management, may be performed.
- If the differentiation of specific SARS viruses and strains is needed, additional testing, in consultation with state or local public health departments, is required.
- Clinical performance was established on frozen samples and performance may be different with fresh clinical samples.
- Users should test samples as quickly as possible after sample collection.
- Extracted nasal samples or nasopharyngeal samples may be frozen at -80°C and used up to 5 days after freezing.
- Swab samples and Extraction Buffer must be at room temperature before testing.

- Positive test results do not rule out co-infection with other pathogens
- A false negative result may occur if the level of viral antigen in a sample is below the detection limit of the test or if the sample was collected inappropriately, therefore a negative test result does not rule out the possibility of SARS-CoV-2 infection.
- The amount of antigen in a sample may decrease as the duration of illness increases. Samples collected after 12 days are more likely to be negative compared to RT-PCR.
- The contents of this kit are for qualitative detection of SARS-CoV-2 antigens from nasal swab and nasopharyngeal swab samples only.
- For information on swabs have been validated for use with the LumiraDx SARS-CoV-2 Ag Test please visit lumiradx.com.

Clinical performance – Nasal Swab

Patient demographics

Patient demographics (gender, age, time elapsed since onset of symptoms) are available for the 257 samples used in the study. The table below shows the positive results broken down by age of the patient:

Age	LumiraDx SARS-CoV-2 Ag (n = 81)		
	Total #	Positive	Prevalence
≤ 5 years	13	0	N/A
6 to 21 years	29	6	20.7%
22 to 59 years	200	70	35.0%
≥ 60 years	15	5	33.3%

Positive results broken down by days since symptom onset:

Days since symptom onset	Cumulative RT-PCR Positive(+)	Cumulative LumiraDx Positive(+)	PPA	95% Confidence interval	
0	6	6	100.0%	61.0%	100.0%
1	12	12	100.0%	75.8%	100.0%
2	28	28	100.0%	87.9%	100.0%
3	37	37	100.0%	90.6%	100.0%
4	55	54	98.2%	90.4%	99.7%
5	61	60	98.4%	91.3%	99.7%
6	67	66	98.5%	92.0%	99.7%
7	73	72	98.6%	92.6%	99.8%
8	75	74	98.7%	92.8%	99.8%
9	75	74	98.7%	92.8%	99.8%
10	77	76	98.7%	93.0%	99.8%
11	80	79	98.8%	93.3%	99.8%
12	83	81	97.6%	91.6%	99.3%

The performance of the LumiraDx SARS-CoV-2 Ag Test was established with 257 direct nasal swabs prospectively collected from individual subjects during the 2020 COVID-19 pandemic. Samples were collected from sequentially enrolled subjects who presented with symptoms of COVID-19 (159) or key workers (98) at increased risk of infection. No positive results were observed from patients without symptoms or beyond 12 days of symptom onset. Dual nasal swabs were simultaneously collected and then randomly allocated to testing with the LumiraDx test or the Roche Cobas 6800. Samples were collected from 6 sites across the United States (5) and United Kingdom (1), including four sites in which minimally trained operators collected and tested fresh samples.

Swabs were collected and extracted into the LumiraDx Extraction Buffer without transport media. Samples were tested fresh or frozen within 1h of collection and stored until tested. Samples were thawed and sequentially tested according to the Product Insert, with operators blinded to the PCR result. The performance of the LumiraDx SARS-CoV-2 Ag Test was compared to the results from nasal swabs collected into 3ml universal transport medium (UTM) and tested with the Roche Cobas 6800 PCR method.

Final data analysis is presented below:

Reference RT-PCR Assay							95% Wilson Score CI	
							LCI	UCI
LumiraDx SARS-CoV-2 Ag Test		POS	NEG	Total	PPA	97.6%	91.6%	99.3%
	POS	81	6	87	NPA	96.6%	92.7%	98.4%
	NEG	2	168	170	PPV	93.1%	85.8%	96.8%
	TOTAL	83	174	257	NPV	98.8%	95.8%	99.7%
					Prevalence	32.3%	26.9%	38.2%
					OPA	96.9%	94.0%	98.4%

100% positive agreement* was achieved with samples with cycle threshold values (ct) < 33 (*Roche Cobas 6800 SARS-CoV-2 reference method).

Evidence[3] suggests that patients with Ct values above 33-34 are no longer contagious.

Published literature shows that RT- PCR Ct values from symptomatic and asymptomatic subjects are similar[4,5]. The LumiraDx Antigen Test detects the nucleocapsid protein antigen in extracted nasal samples in both symptomatic and asymptomatic subjects.

PPA - Positive Percent Agreement (Sensitivity)

NPA – Negative Percent Agreement (Specificity)

PPV – Positive Predictive Value

NPV- Negative Predictive Value

OPA – Overall Percent Agreement

CI - Confidence Interval

LCI – Lower Confidence Interval

UCI – Upper Confidence Interval

Clinical performance – Nasopharyngeal Swabs

Patient demographics

Patient demographics (gender, age, time elapsed since onset of symptoms) are available for the 255 samples used in the study. The table below shows the positive results broken down by age of the patient:

Age	LumiraDx SARS-CoV-2 Ag (n = 39)		
	Total #	Positive	Prevalence
≤ 5 years	22	0	0.0%
6 to 21 years	59	9	15.3%
22 to 59 years	150	28	18.7%
≥ 60 years	24	2	8.3%

Positive and negative results broken down by days since symptom onset:

Days since symptom onset	Cumulative RT-PCR Positive(+)	LumiraDx Positive(+)	PPA	LCI	UCI	NPA	LCI	UCI
0	2	2	100.0%	34.2%	100.0%	100.0%	75.8%	100.0%
1	6	6	100.0%	61.0%	100.0%	100.0%	93.4%	100.0%
2	9	9	100.0%	70.1%	100.0%	100.0%	96.2%	100.0%
3	17	17	100.0%	81.6%	100.0%	98.6%	94.9%	99.6%
4	22	22	100.0%	85.1%	100.0%	98.8%	95.7%	99.7%
5	23	23	100.0%	85.7%	100.0%	98.4%	95.3%	99.4%
6	26	26	100.0%	87.1%	100.0%	98.5%	95.6%	99.5%
7	34	34	100.0%	89.8%	100.0%	98.5%	95.7%	99.5%
8	36	36	100.0%	90.4%	100.0%	98.6%	95.8%	99.5%
9	36	36	100.0%	90.4%	100.0%	98.6%	95.9%	99.5%
10	39	38	97.4%	86.8%	99.5%	98.1%	95.2%	99.3%
11	40	39	97.5%	87.1%	99.6%	97.7%	94.6%	99.0%
12	40	39	97.5%	87.1%	99.6%	97.7%	94.7%	99.0%

Final data analysis is presented below:

Reference RT-PCR Assay							95% Wilson Score CI	
							LCI	UCI
LumiraDx SARS-CoV-2 Ag Test		POS	NEG	Total	PPA	97.5%	87.1%	99.6%
	POS	39	5	44	NPA	97.7%	94.7%	99.0%
	NEG	1	210	211	PPV	88.6%	76.0%	95.0%
	TOTAL	40	215	255	NPV	99.5%	97.4%	99.9%
					Prevalence	15.7%	11.7%	20.7%
					OPA	97.6%	95.0%	98.9%

100% positive agreement* was achieved with samples with cycle threshold values (ct) < 33 (*Roche Cobas 6800 SARS-CoV-2 reference method).

Evidence[3] suggests that patients with Ct values above 33-34 are no longer contagious.

Published literature shows that RT- PCR Ct values from symptomatic and asymptomatic subjects are similar[4,5].

The performance of the SARS-CoV-2 Ag Test was established with 255 nasopharyngeal swabs prospectively collected from individual subjects during the 2020 COVID pandemic. Subjects were presenting with symptoms of COVID-19 being screened for infection. Samples were collected from 6 sites across the United States. Swabs were collected and extracted into the LumiraDx Extraction Buffer. Samples were tested fresh within 1h of collection and tested according to the Product Insert. The performance of the LumiraDx SARS-COV-2 Ag Test was compared to the results from nasopharyngeal samples collected into 3ml universal transport medium (UTM) and tested with an EUA authorized PCR method.

Analytical performance

Limit of Detection - LoD (Analytical sensitivity):

Limit of Detection (LoD) studies determined the lowest detectable concentration of SARS-CoV-2 at which 100% of all (true positive) replicates test positive. The LoD for the LumiraDx SARS-CoV-2 Ag Test was established using limiting dilutions of gamma-irradiated SARS-CoV-2 (BEI Resources NR-52287). The NR-52287 is a preparation of SARS-Related Coronavirus 2 (SARS-CoV-2)), isolate USA WA1/2020, that has been inactivated by gamma-irradiation at 5 x 10^6 RADs. The material was supplied frozen at a concentration of 2.8 x 10^5 $TCID_{50}$/mL.

Limit of Detection (LoD) screening

An initial LoD screening study was performed using a 5-fold serial dilutions (six dilutions in total) of the gamma-irradiated virus made in pooled negative human nasal matrix starting at a test concentration of 2 x 10^4 $TCID_{50}$/mL (as shown in table below) and processed for each study as described above. These dilutions were tested in triplicate. The lowest concentration at which all (3 out of 3 replicates) were positive was chosen for LoD Range finding. This was 32 $TCID_{50}$/mL.

SARS-CoV-2 tested ($TCID_{50}$/mL)	Test result
20000	3/3 positive
4000	3/3 positive
800	3/3 positive
160	3/3 positive
32	3/3 positive
6.2	0/3 positive

Limit of Detection range finding

Using the 32 $TCID_{50}$/mL concentration, the LoD was further refined using a 2-fold dilution series (four dilutions in total) of the gamma-irradiated SARS-CoV-2 virus made in pooled negative human nasal matrix. These dilutions were tested in triplicate. The lowest concentration at which all (3 out of 3 replicates) were positive was treated as the tentative LoD for the LumiraDx SARS-CoV-2 Ag Test. This was 32 $TCID_{50}$/mL.

SARS-CoV-2 tested ($TCID_{50}$/mL)	Test result
32	3/3 positive
16	0/3 positive
8	1/3 positive
4	0/3 positive

Limit of Detection (LoD) confirmation

The LoD of the LumiraDx SARS-CoV-2 Ag Test was then confirmed by testing 20 replicates with concentrations at the tentative Limit of Detection. The final LoD of the LumiraDx SARS-CoV-2 Ag Test was determined to be the lowest concentration resulting in positive detection of twenty (20) out of twenty (20) replicates. Based on this testing the LoD for nasal swab samples was confirmed as: 32 $TCID_{50}$/mL.

Starting Material Concentration	Estimated LoD	No. Positive/Total	% Positive
2.8 x 10^5 $TCID_{50}$/mL	32 $TCID_{50}$/mL	20/20	100

Cross-reactivity (analytical specificity) and microbial interference studies

Cross-reactivity and interference of the LumiraDx SARS-CoV-2 Ag Test was evaluated by testing a panel of related pathogens, high prevalence disease agents and normal or pathogenic flora including various microorganisms and viruses and negative matrix that are reasonably likely to be encountered in the clinical sample and could potentially cross-react or interfere with the LumiraDx SARS CoV-2 Ag Test. Each organism and virus were tested in the absence or presence of heat inactivated SARS-CoV-2 at 3 x LoD.

Microorganism	Source	Concentration	Cross-reactivity (Yes/No)	Interference (Yes/No)
Human coronavirus 229E	Zeptometrix	1 x 10^5 PFU/mL	No (3/3 negative)	No (3/3 positive)
Human coronavirus OC43	Zeptometrix	1 x 10^5 PFU/mL	No (3/3 negative)	No (19/20 positive)
Human coronavirus NL63	Zeptometrix	9.87 x 10^3 PFU/mL	No (3/3 negative)	No (3/3 positive)
MERS coronavirus	Zeptometrix	7930 PFU/mL	No (2/2 negative)	No (3/3 positive)
Adenovirus (e.g. C1 Ad. 71)	Zeptometrix	1 x 10^5 PFU/mL	No (3/3 negative)	No (3/3 positive)
Human Metapneumovirus (hMPV)	Zeptometrix	1 x 10^5 PFU/mL	No (3/3 negative)	No (3/3 positive)
Parainfluenza virus Type 1	Zeptometrix	1 x 10^5 PFU/mL	No (3/3 negative)	No (3/3 positive)
Parainfluenza virus Type 2	Zeptometrix	1 x 10^5 PFU/mL	No (3/3 negative)	No (3/3 positive)
Parainfluenza virus Type 3	Zeptometrix	1 x 10^5 PFU/mL	No (3/3 negative)	No (3/3 positive)

Microorganism	Source	Concentration	Cross-reactivity (Yes/No)	Interference (Yes/No)
Parainfluenza virus Type 4a	Zeptometrix	1 x 10^5 PFU/mL	No (3/3 negative)	No (3/3 positive)
Influenza A H3N2 (Wisconsin/67/05)	Zeptometrix	8.82 x 10^4 PFU/mL	No (3/3 negative)	No (3/3 positive)
Influenza A H1N1	Zeptometrix	1 x 10^5 PFU/mL	No (3/3 negative)	No (3/3 positive)
Influenza B (Malaysia/2506/04)	Zeptometrix	2.92 x 10^4 PFU/mL	No (3/3 negative)	No (19/20 positive)
Enterovirus	Zeptometrix	1 x 10^5 PFU/mL	No (3/3 negative)	No (3/3 positive)
Respiratory syncytial virus	Zeptometrix	1 x 10^5 PFU/mL	No (3/3 negative)	No (3/3 positive)
Rhinovirus	Zeptometrix	4.17 x 10^5 PFU/mL	No (3/3 negative)	No (3/3 positive)
Haemophilus influenzae	Zeptometrix	1 x 10^6 CFU/mL	No (3/3 negative)	No (3/3 positive)
Streptococcus pneumoniae	Zeptometrix	1 x 10^6 CFU/mL	No (3/3 negative)	No (3/3 positive)
Streptococcus pyogenes	Zeptometrix	1 x 10^6 CFU/mL	No (3/3 negative)	No (3/3 positive)
Candida albicans	Zeptometrix	1 x 10^6 CFU/mL	No (3/3 negative)	No (3/3 positive)
Pooled human nasal wash	LumiraDx	14% v/v	No (3/3 negative)	No (3/3 positive)
Bordetella pertussis	Zeptometrix	1 x 10^6 CFU/mL	No (3/3 negative)	No (3/3 positive)
Mycoplasma pneumoniae	ATCC	1 x 10^6 CFU/mL	No (3/3 negative)	No (3/3 positive)
Chlamydia pneumoniae	ATCC	1 x 10^6 CFU/mL	No (3/3 negative)	No (3/3 positive)
Legionella pneumophila	Zeptometrix	1 x 10^6 CFU/mL	No (3/3 negative)	No (3/3 positive)
Mycobacterium tuberculosis	Zeptometrix	1 x 10^6 CFU/mL	No (3/3 negative)	No (3/3 positive)
Pneumocystis jirovecii	Zeptometrix	1 x 10^6 CFU/mL	No (3/3 negative)	No (3/3 positive)
Pseudomonas Aeruginosa	Zeptometrix	1 x 10^6 CFU/mL	No (3/3 negative)	No (3/3 positive)
Staphylococcus Epidermidis	Zeptometrix	1 x 10^6 CFU/mL	No (3/3 negative)	No (3/3 positive)
Streptococcus Salivarius	Zeptometrix	1 x 10^6 CFU/mL	No (3/3 negative)	No (3/3 positive)

To estimate the likelihood of cross-reactivity with SARS-CoV-2 of organisms that were not available for wet testing, *in silico* analysis using the Basic Local Alignment Search Tool (BLAST) managed by the National Center for Biotechnology Information (NCBI) was used to assess the degree of protein sequence homology.

- For Human Coronavirus HKU1, homology exists between the SARS-CoV-2 nucleocapsid protein and Human Coronavirus HKU1. BLAST results showed 30 sequence IDs, all nucleocapsid protein, showing homology. Sequence ID AGW27840.1 had the highest alignment score and was found to be 39.1% homologous across 76% of the sequences, this is relatively low but cross-reactivity cannot be fully ruled out.
- For SARS-Coronavirus, high homology exists between the SARS-CoV-2 nucleocapsid protein and SARS-Coronavirus. BLAST results showed 68 sequence IDs, mostly nucleocapsid protein, showing homology. Sequence ID AAR87518.1, had the highest alignment score isolated from a human patient and was found to be 90.76% homologous across 100% of the sequence. This is high and cross-reactivity is likely.
- For MERS-Coronavirus, high homology exists between the SARS-CoV-2 nucleocapsid protein and MERS-Coronavirus. BLAST results showed at least 114 sequence IDs, mostly nucleocapsid protein, showing homology. Sequence IDs AHY61344.1 and AWH65950.1, had the highest alignment scores isolated from a human patient and were found to be 49.4% and 50.3% homologous across 88% of the sequence. Whilst this potentially represents moderate cross-reactivity testing of the MERS virus at 7930 PFU/mL showed no reactivity (see table above).

Endogenous interference studies

A study was performed to demonstrate that potentially interfering substances that may be found in the upper respiratory tract in symptomatic subjects (including over the counter medications) do not cross-react or interfere with the detection of SARS-CoV-2 in the LumiraDx SARS-CoV-2 Ag Test. Each substance was tested in triplicate in the absence or presence of SARS-CoV-2 at 3 x LoD. The final concentration of the substances tested are documented in the Table.

Interfering substance	Concentration	Interference (Yes/No)
Benzocaine	150 mg/dL	No (3/3 Negative, 3/3 Positive)
Blood (human)	5%	No (3/3 Negative, 3/3 Positive)
Mucin	5 mg/mL	No (3/3 Negative, 3/3 Positive)
Naso GEL (NeilMed)	5% v/v	No (3/3 Negative, 3/3 Positive)
CVS Nasal Drops (phenylephrine)	15% v/v	No (3/3 Negative, 3/3 Positive)
Afrin (Oxymetazoline)	15% v/v	No (3/3 Negative, 3/3 Positive)
CVS Nasal Spray (Cromolyn)	15% v/v	No (3/3 Negative, 3/3 Positive)
Zicam Cold Remedy	5% v/v	No (3/3 Negative, 3/3 Positive)
Homeopathic (Alkalol)	10 % v/v	No (3/3 Negative, 3/3 Positive)
Sore Throat Phenol Spray	15% v/v	No (3/3 Negative, 3/3 Positive)
Tobramycin	3.3 mg/dL	No (3/3 Negative, 3/3 Positive)
Mupirocin	0.15 mg/dL	No (3/3 Negative, 3/3 Positive)
Fluticasone	0.000126 mg/dL	No (5/5 Negative, 4/4 Positive)
Tamiflu (Oseltamivir phosphate)	500 mg/dL	No (3/3 Negative, 3/3 Positive)
Budenoside	0.00063 mg/dL	No (3/3 Negative, 3/3 Positive)
Biotin	0.35 mg/dL	No (3/3 Negative, 3/3 Positive)
Methanol	150 mg/dL	No (19/20 Negative, 3/3 Positive)
Acetylsalicylic Acid	3 mg/dL	No (3/3 Negative, 3/3 Positive)
Diphenhydramine	0.0774 mg/dL	No (3/3 Negative, 3/3 Positive)
Dextromethorphan	0.00156 mg/dL	No (19/20 Negative, 3/3 Positive)
Dexamethasone	1.2 mg/dL	No (3/3 Negative, 3/3 Positive)
Mucinex	5%	No (3/3 Negative, 3/3 Positive)

High dose hook effect

High Dose Hook Effect studies determine the level at which false negative results can be seen when very high levels of target are present in a tested sample. To determine if the LumiraDx SARS-CoV-2 Ag Test suffers from any high dose hook effect, increasing concentrations of gamma-irradiated SARS-CoV-2 virus (BEI Resources NR-52287) were tested up to a concentration of 1.4 x 10^5 $TCID_{50}$/mL. In this study, the starting material was spiked into a volume of pooled human nasal matrix obtained from healthy donors and confirmed negative for SARS-CoV-2. At each dilution, 50 µL samples were added to swabs and the swabs processed for testing on the LumiraDx SARS-CoV-2 Ag Test as per the Product Insert using the procedure appropriate for patient nasal swab samples.

No impact on test performance or high dose hook effect was observed up to 1.4 x 10^5 $TCID_{50}$/mL of gamma-irradiated SARS-CoV-2 with the LumiraDx SARS-CoV-2 Ag Test.

Test Dilution	Concentration ($TCID_{50}$/mL)	Mean Signal (ADC Units)
1	0	495
2	62.5	26100.6
3	250	63013.8
4	1000	83451.8
5	1.4 x 10^5	86220

Point of care use

The LumiraDx SARS-CoV-2 Ag Test was used by 8 untrained users in 4 sites across the United States. Untrained users tested 132 patients and ran 148 tests.

References:

1. World Health Organisation **www.who.int**
2. Centers for Disease Control and Prevention **www.cdc.gov**
3. La Scola B., Le Bideau M., Andreani J., Hoang V.T., Grimaldier C., Colson P. Viral RNA load as determined by cell culture as a management tool for discharge of SARS-CoV-2 patients from infectious disease wards. Eur J Clin Microbiol Infect Dis. 2020:1–3.
4. Kissler, SM., et al., Viral dynamics of SARS-CoV-2 infection and 1 the predictive value of repeat testing **https://www.medrxiv.org/content/10.1101/2020.10.21.20217042v1**
5. Lavenzo, E., et al., Suppression of a SARS-CoV-2 outbreak in the Italian municipality of Vo'. Nature 584, 2020: 425–429

Symbols glossary

Symbol	Meaning
	Temperature limitation
	Manufacturer
IVD	*In vitro* diagnostic medical device
REF	Catalogue Number
	Contains sufficient for 12 **or** 24 **or** 48 Tests
CE	"CE Mark ". This product fulfils the requirements of the European Directive 98/79/EC on *in vitro* diagnostic medical devices.
LOT	Lot Number
	Use-by Date – indicates the date after which the unopened IVD/Quality Control Material cannot be used
	Refer to instructions for use
	Do not re-use
	Indicates the presence of the Radio Frequency Identification (RFID) reader/tag.
EC REP	Authorized Representative in the European community

LumiraDx customer services:

For product inquiries please contact LumiraDx Customer Services at **customerservices@lumiradx.com** or find telephone contact details at **lumiradx.com**.

Any adverse results experienced with the use of this product, and/or quality problems should also be reported to LumiraDx Customer Services by email: **customerservices@lumiradx.com** or at **lumiradx.com**.

For return policy

If there is a problem with the LumiraDx SARS-CoV-2 Ag Test Strips you may be asked to return them. Before returning tests please obtain a return authorization number from LumiraDx Customer Services. This return authorization number must be on the shipping carton for return. For ordinary returns following purchase, please contact LumiraDx Customer Services for terms and conditions.

Limited warranty

LumiraDx SARS-CoV-2 Ag Test Strips – As per shelf life.

Unused strips must be stored according to the required storage conditions as printed in this product insert and they can be used only up to the expiry date printed on the Test Strip pouch and Test Strip box. For the applicable warranty period, LumiraDx warrants that each product shall be (i) of good quality and free of material defects, (ii) function in accordance with the material specifications referenced in the product insert, and (iii) approved by the proper governmental agencies required for the sale of products for their intended use (the "limited warranty"). If the product fails to meet the requirements of the limited warranty, then as customer's sole remedy, LumiraDx shall either repair or replace, at LumiraDx's discretion, the Test Strips. Except for the limited warranty stated in this section, LumiraDx disclaims any and all warranties, express or implied, including but not limited to, any warranty of merchantability, fitness for a particular purpose and non-infringement regarding the product. LumiraDx's maximum liability with any customer claim shall not exceed the net product price paid by the customer. Neither party shall be liable to the other party for special, incidental or consequential damages, including, without limitation, loss of business, profits, data or revenue, even if a party receives notice in advance that these kinds of damages might result. The Limited Warranty above shall not apply if the customer has subjected the LumiraDx SARS-CoV-2 Ag Test to physical abuse, misuse, abnormal use, use inconsistent with the LumiraDx Platform User Manual or Product Insert, fraud, tampering, unusual physical stress, negligence or accidents. Any warranty claim by Customer pursuant to the Limited Warranty shall be made in writing within the applicable Limited Warranty period.

Intellectual property:

The LumiraDx Instrument, Test Strips and all provided LumiraDx documentation ('Products') are protected by law. The Intellectual Property of the LumiraDx Products remains at LumiraDx. Details of relevant Intellectual Property regarding our products can be found at lumiradx.com/IP.

Legal notices:

Manufacturer information:

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CE mark applies to LumiraDx Instrument, Test Strips, Quality Controls and Connect Hub only.