Rev. 01, July 2026

QIAstat-Dx® Respiratory Panel Plus Instructions for Use

IVD For In Vitro Diagnostic Use

For use with QIAstat-Dx Analyzer 2.0

This Instructions for Use is applicable for:

	Σ	REF	Version
QIAstat-Dx Respiratory Panel Plus	6	691224	Version 1

QIAGEN, GmbH, QIAGEN Strasse 1, 40724 Hilden, GERMANY

Sample to Insight

Table of Contents

1. Intended Use 4
2. Description and Principle 5
    2.1. Pathogen information 5
    2.2. Summary and explanation 6
    2.3. Principle of the procedure 8
    2.4. Sample collection and cartridge loading 8
    2.5. Sample preparation, nucleic acid amplification, and detection 9
3. Materials Provided 11
    3.1. Kit contents 11
4. Materials Required but Not Provided 12
    4.1. Platform and software 12
5. Warnings and Precautions 13
    5.1. Safety information 13
    5.2. Precautions 14
6. Disposal 16
7. Storage and Handling 17
    7.1. Cartridge storage and handling 17
    7.2. Specimen storage and handling 17
8. Procedure 19
    8.1. Sample collection, transport, and storage 19
    8.2. Loading a sample into the QIAstat-Dx Respiratory Panel Plus Cartridge 19
    8.3. Running a test on the QIAstat-Dx Analyzer 2.0 23
    8.4. Viewing results with the QIAstat-Dx Analyzer 2.0 29
9. Interpretation of Results 31
    9.1. Internal Control interpretation 31
    9.2. Pathogen result interpretation 31
    9.3. Viewing amplification curves with the QIAstat-Dx Analyzer 2.0 32
    9.4. Viewing test details of the QIAstat-Dx Analyzer 2.0 34
    9.5. Browsing results from previous tests of the QIAstat-Dx Analyzer 2.0 35
10. Quality Control 42
11. Limitations 43
12. Performance Characteristics 46
    12.1. Analytical performance 46
    12.2. Clinical performance 98

13. References 132
14. Troubleshooting Guide 134
15. Symbols 135
16. Contact Information 138
17. Appendices 139
    17.1. Appendix A: Installing the Assay Definition File 139
    17.2. Appendix B: Glossary 141
18. Ordering Information 143
19. Document Revision History 144

1. Intended Use

The QIAstat-Dx® Respiratory Panel Plus is a multiplexed nucleic acid test intended for use with the QIAstat-Dx system for the simultaneous in vitro qualitative detection and identification of multiple respiratory viral and bacterial nucleic acids in nasopharyngeal swabs (NPS) obtained from individuals with clinical signs and symptoms of respiratory tract infections, including Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2).

The following organism types and subtypes are identified using the QIAstat-Dx Respiratory Panel Plus: Adenovirus, Human Coronavirus 229E, Human Coronavirus HKU1, Human Coronavirus NL63, Human Coronavirus OC43, Human Metapneumovirus, Influenza A, Influenza A H1, Influenza A H1N1 pdm09, Influenza A H3, Influenza B, Parainfluenza Virus 1, Parainfluenza Virus 2, Parainfluenza Virus 3, Parainfluenza Virus 4, Respiratory Syncytial Virus, Human Rhinovirus/Enterovirus (not differentiated), SARS-CoV-2, *Bordetella pertussis, Chlamydophila pneumoniae,* and *Mycoplasma pneumoniae*.

Nucleic acids from viral and bacterial organisms identified by this test are generally detectable in NPS specimens during the acute phase of infection. Detecting and identifying specific viral and bacterial nucleic acids from individuals presenting with signs and symptoms of a respiratory infection aids in the diagnosis of respiratory infection, if used in conjunction with other clinical, epidemiological, and laboratory findings. The results of this test should not be used as the sole basis for diagnosis, treatment, or other patient management decisions.

Negative results in the presence of a respiratory illness may be due to infection with pathogens that are not detected by the test, or due to lower respiratory tract infection that is not detected by a NPS specimen.

Conversely, positive results are indicative of the presence of the identified microorganism, but do not rule out co-infection with other pathogens not detected by the QIAstat-Dx Respiratory Panel Plus. The agent(s) detected by the QIAstat-Dx Respiratory Panel Plus may not be the definite cause of disease.

The use of additional laboratory testing (e.g., bacterial and viral culture, immunofluorescence, and radiography) may be necessary when evaluating a patient with possible respiratory tract infection.

2. Description and Principle

2.1. Pathogen information

Acute respiratory infections can be caused by a variety of pathogens, including bacteria and viruses, and generally present with nearly indistinguishable clinical signs and symptoms. The rapid and accurate determination of the presence or absence of potential causative agent(s) helps make timely decisions regarding treatment, hospital admission, infection control, and return of the patient to work and family. It may also greatly support improved antimicrobial stewardship and other important public health initiatives.

The QIAstat-Dx Respiratory Panel Plus Cartridge is a single-use cartridge that includes all reagents needed for nucleic acid extraction, nucleic acid amplification, and detection of 22 bacteria and viruses (or their subtypes), including SARS-CoV-2 that cause respiratory symptoms (1). Testing requires a small sample volume and minimal hands-on time, and the results are available in approximately one hour.

The SARS-CoV-2 target was designed in early 2020 upon alignment of the first available 170 genomic sequences in public databases from the SARS-CoV-2 identified as the causative agent of the viral pneumonia (COVID-19) outbreak that originated in Wuhan, Hubei, China. Up to date, a coverage of more than 16 million of available genome sequences support the inclusivity and good performance of the SARS-CoV-2 detection. The SARS-CoV-2 assay in this panel targets 2 genes of the virus genome (*Orf1b* poly gen *(RdRp* gene) and *E* genes) detected with the same fluorescent channel. The 2 targets are not differentiated, and amplification of either one or both regions leads to a fluorescence signal.

Pathogens (and subtypes) that can be detected and identified with the QIAstat-Dx Respiratory Panel Plus are listed in Table 1 (2–15).

Table 1. Pathogens detected by the QIAstat-Dx Respiratory Panel Plus

Pathogen	Classification (genome type)
Adenovirus	Adenovirus (DNA)
Human Coronavirus 229E	Coronavirus (RNA)
Human Coronavirus HKU1	Coronavirus (RNA)
Human Coronavirus NL63	Coronavirus (RNA)

Table 1. Pathogens detected by the QIAstat-Dx Respiratory Panel Plus (continued)

Pathogen	Classification (genome type)
Human Coronavirus OC43	Coronavirus (RNA)
Human Metapneumovirus A+B	Paramyxovirus (RNA)
Influenza A	Orthomyxovirus (RNA)
Influenza A subtype H1	Orthomyxovirus (RNA)
Influenza A subtype H1N1 pdm09	Orthomyxovirus (RNA)
Influenza A subtype H3	Orthomyxovirus (RNA)
Influenza B	Orthomyxovirus (RNA)
Parainfluenza Virus 1	Paramyxovirus (RNA)
Parainfluenza Virus 2	Paramyxovirus (RNA)
Parainfluenza Virus 3	Paramyxovirus (RNA)
Parainfluenza Virus 4	Paramyxovirus (RNA)
Respiratory Syncytial Virus A+B	Paramyxovirus (RNA)
Human Rhinovirus/Enterovirus	Picornavirus (RNA)
SARS-CoV-2	Coronavirus (RNA)
Bordetella pertussis	Bacterium (DNA)
Chlamydophila pneumoniae	Bacterium (DNA)
Mycoplasma pneumoniae	Bacterium (DNA)

Note: Enterovirus and Rhinovirus are both detected, but not differentiated, with the QIAstat-Dx Respiratory Panel Plus

2.2. Summary and explanation

2.2.1. QIAstat-Dx Respiratory Panel Plus Cartridge description

The QIAstat-Dx Respiratory Panel Plus Cartridge is a disposable plastic device that allows performance of fully automated molecular assays for the detection of respiratory pathogens (16). The main features of the QIAstat-Dx Respiratory Panel Plus Cartridge include compatibility with nasopharyngeal swabs resuspended in transport medium (liquid samples), hermetical containment of the pre-loaded reagents necessary for testing, and true walk-away operation. All sample preparation and assay testing steps are performed within the cartridge.

All reagents required for the complete execution of a test run are pre-loaded and self-contained in the QIAstat-Dx Respiratory Panel Plus Cartridge. The user does not need to come in contact with and/or manipulate any reagents. During the test, reagents are handled within the cartridge in the Analytical Module of the QIAstat-Dx Analyzer 2.0 by pneumatically-operated microfluidics and make no direct contact with the actuators. The QIAstat-Dx Analyzer 2.0 houses air filters for both incoming and outgoing air, further safeguarding the environment. After testing, the cartridge stays hermetically closed at all times, greatly enhancing its safe disposal.

Within the cartridge, multiple steps are automatically performed in sequence using pneumatic pressure to transfer samples and fluids via the transfer chamber to their intended destinations (17).

After the QIAstat-Dx Respiratory Panel Plus Cartridge containing the sample is introduced into the QIAstat-Dx Analyzer 2.0, the following assay steps occur automatically:

- Resuspension of Internal Control;
- Cell lysis using mechanical and/or chemical means;
- Membrane-based nucleic acid purification;
- Mixing of the purified nucleic acid with lyophilized master mix reagents;
- Transfer of defined aliquots of eluate/master mix to different reaction chambers;
- Performance of multiplex real-time RT-PCR testing within each reaction chamber.

Note: An increase in fluorescence, indicating detection of the target analyte, is detected directly within each reaction chamber.

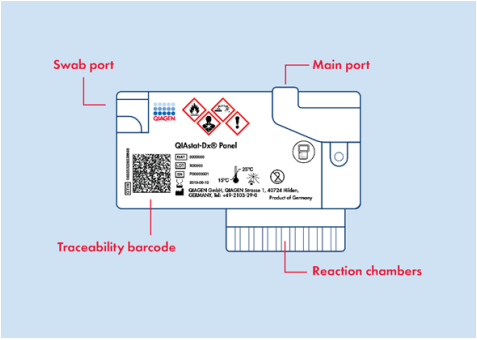


Figure 1. Layout of the QIAstat-Dx Respiratory Panel Plus Cartridge and its features.

Note: The swab port is not used for the QIAstat-Dx Respiratory Panel Plus.

2.3. Principle of the procedure

2.3.1. Description of the process

Diagnostic tests with the QIAstat-Dx Respiratory Panel Plus are performed on the QIAstat-Dx Analyzer 2.0. All of the sample preparation and analysis steps are performed automatically by the QIAstat-Dx Analyzer 2.0. Samples are collected and loaded manually into the QIAstat-Dx Respiratory Panel Plus Cartridge:

A transfer pipette provided with the test kit is used for dispensing transport medium liquid sample into the main port (Figure 2).

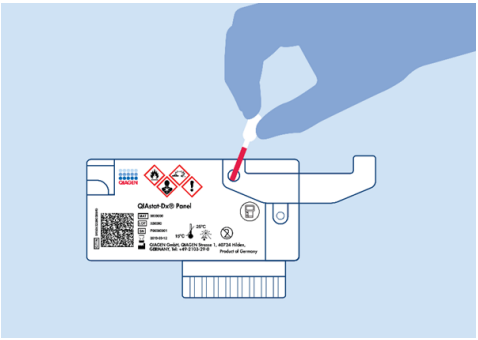


Figure 2. Dispensing transport medium liquid sample into the main port.

2.4. Sample collection and cartridge loading

The collection of samples and their subsequent loading into the QIAstat-Dx Respiratory Panel Plus Cartridge should be performed by personnel trained in safe handling of biological samples.

The following steps are involved and must be executed by the user:

1. A single-use nasopharyngeal swab sample is collected.
2. The nasopharyngeal swab is placed into a single-use transport medium.
3. The sample information is manually written on a sample label affixed to the top of a QIAstat-Dx Respiratory Panel Plus Cartridge.

4. Transport medium liquid sample is loaded manually into the QIAstat-Dx Respiratory Panel Plus Cartridge.
5. 300 µL of sample is transferred into the main port of the QIAstat-Dx Respiratory Panel Plus Cartridge using one of the included transfer pipettes.

   Note: When loading transport medium liquid sample, the user performs a visual check of the sample inspection window (see image below) to confirm that the liquid sample has been loaded (Figure 3).

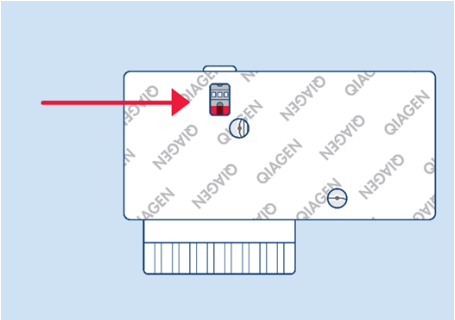


Figure 3. Sample inspection window (red arrow).

6. The sample barcode and the QIAstat-Dx Respiratory Panel Plus Cartridge QR code are scanned in the QIAstat-Dx Analyzer 2.0.

   Important: Do not scan the barcode from the cartridge packaging.
7. The QIAstat-Dx Respiratory Panel Plus Cartridge is introduced into the QIAstat-Dx Analyzer 2.0.
8. The test is started on the QIAstat-Dx Analyzer 2.0.

2.5. Sample preparation, nucleic acid amplification, and detection

The extraction, amplification, and detection of nucleic acids in the sample are performed automatically by the QIAstat-Dx Analyzer 2.0.

1. The liquid sample is homogenized and cells are lysed in the lysis chamber of the QIAstat-Dx Respiratory Panel Plus Cartridge, which includes a rotor that turns at high speed.
2. Nucleic acids are purified from the lysed sample via binding to a silica membrane in the purification chamber of the QIAstat-Dx Respiratory Panel Plus Cartridge in the presence of chaotropic salts and alcohol.

3. The purified nucleic acids are eluted from the membrane in the purification chamber and are mixed with the lyophilized PCR chemistry in the dried-chemistry chamber of the QIAstat-Dx Respiratory Panel Plus Cartridge.
4. The mixture of sample and PCR reagents is dispensed into the QIAstat-Dx Respiratory Panel Plus Cartridge PCR chambers, which contain lyophilized, assay-specific primers and probes.
5. The QIAstat-Dx Analyzer 2.0 creates the optimal temperature profiles to carry out effective multiplex real-time RT-PCR and performs real-time fluorescence measurements to generate amplification curves.
6. The QIAstat-Dx Analyzer 2.0 software interprets the resulting data and process controls and delivers a test report.

3. Materials Provided

3.1. Kit contents

QIAstat-Dx Respiratory Panel Plus **Catalog no.** **Number of tests**	 **691224** **6**
QIAstat-Dx Respiratory Panel Plus Cartridge	6*
Transfer pipettes	6†
QIAstat-Dx Respiratory Panel Plus Product Information Card	1

* Individually packaged cartridges containing all reagents needed for sample preparation and multiplex real-time RT-PCR, plus Internal Control.

† Individually packaged transfer pipettes for dispensing liquid sample into the QIAstat-Dx Respiratory Panel Plus Cartridge.

4. Materials Required but Not Provided

4.1. Platform and software

The QIAstat-Dx Respiratory Panel Plus is designed for use with the QIAstat-Dx Analyzer 2.0. Before beginning a test, make sure the following are available:

- QIAstat-Dx Analyzer 2.0
  - at least one Operational Module PRO and one Analytical Module must be assembled together to work with software version 1.6 or later
  - *QIAstat-Dx Analyzer 2.0 User Manual* (for use with software version 1.6 or later)
- QIAstat-Dx's latest Assay Definition File software for the QIAstat-Dx Respiratory Panel Plus on the Operational Module PRO

5. Warnings and Precautions

For in vitro diagnostic use. The QIAstat-Dx Respiratory Panel Plus is to be used by laboratory professionals trained in the use of the QIAstat-Dx Analyzer 2.0.

Pertussis is a nationally notifiable infectious disease. If *Bordetella pertussis* is detected, notify state and/or local health departments.

5.1. Safety information

When working with chemicals, always wear a suitable lab coat, disposable gloves, and protective goggles. For more information, please consult the appropriate safety data sheets (SDSs). These are available online in convenient and compact PDF at **www.qiagen.com/safety** where you can find, view, and print the SDS for each QIAGEN kit and kit component.

Samples are potentially infectious. Discard sample and assay waste according to your local safety procedures.

Always wear appropriate personal protective equipment, including but not limited to disposable powder-free gloves, a lab coat, and protective eyewear. Protect skin, eyes, and mucus membranes. Change gloves often when handling samples.

Handle all samples, used cartridges, and transfer pipettes as if they are capable of transmitting infectious agents. Always observe safety precautions as outlined in relevant guidelines, such as the Clinical and Laboratory Standards Institute® (CLSI) *Protection of Laboratory Workers from Occupationally Acquired Infections; Approved Guideline* (M29) [18], or other appropriate documents provided by:

- OSHA®: Occupational Safety and Health Administration (United States of America)
- ACGIH®: American Conference of Government Industrial Hygienists (United States of America)

Follow your institution's safety procedures for handling biological samples. Dispose of samples, QIAstat-Dx Respiratory Panel Plus Cartridges, and transfer pipettes according to the appropriate regulations.

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.

If infection with a novel Influenza A virus is suspected based on current clinical and epidemiological screening criteria recommended by public health authorities, specimens should be collected with appropriate infection control precautions for novel virulent influenza viruses and sent to a state or local health department for testing. Viral culture should not be attempted in these cases unless a BSL 3+ facility is available to receive and culture specimens.

The QIAstat-Dx Respiratory Panel Plus Cartridge is a closed, single-use device that contains all reagents needed for sample preparation and multiplex real-time RT-PCR within the QIAstat-Dx Analyzer 2.0. Do not use a QIAstat-Dx Respiratory Panel Plus Cartridge that is past its expiration date, appears damaged, or leaks fluid. Dispose of used or damaged cartridges in accordance with all national, state, and local health and safety regulations and laws.

Observe standard laboratory procedures for keeping the working area clean and contamination-free. Guidelines are outlined in publications such as the *Biosafety in Microbiological and Biomedical Laboratories from the Centers for Disease Control and Prevention and the National Institutes of Health* (**www.cdc.gov/labs/BMBL**).

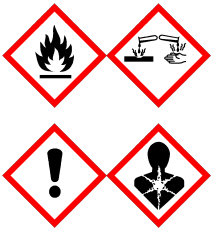
5.1.1. Emergency information

CHEMTREC

USA & Canada 1-800-424-9300

5.2. Precautions

The following hazard and precautionary statements apply to components of the QIAstat-Dx Respiratory Panel Plus.



Contains: ethanol; guanidine hydrochloride; guanidine thiocyanate; isopropanol; proteinase K; t-Octylphenoxypolyethoxyethanol.

Danger! Highly flammable liquid and vapour. Harmful if swallowed or if inhaled. May be harmful in contact with skin. Causes severe skin burns and eye damage. May cause allergy or asthma symptoms or breathing difficulties if inhaled. May cause drowsiness or dizziness. Harmful to aquatic life with long lasting effects. Contact with acids liberates very toxic gas. Corrosive to the respiratory tract. Keep away from heat/sparks/open flames/hot surfaces. No smoking. Avoid breathing dust/fume/gas/mist/vapours/spray. Wear protective gloves/protective clothing/eye protection/face protection. Wear respiratory protection. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IF exposed or concerned: Immediately call a POISON CENTER or doctor/ physician. Remove person to fresh air and keep comfortable for breathing.

6. Disposal

Dispose of QIAstat-Dx Respiratory Panel Plus Cartridges as hazardous waste in compliance with local and national regulations. This also applies to unused products. In case of damaged cartridge, please refer to "Safety information" on page 13.

Follow recommendations in the Safety Data Sheet (SDS).

7. Storage and Handling

7.1. Cartridge storage and handling

Store the QIAstat-Dx Respiratory Panel Plus Cartridges in a clean and dry storage space at room temperature (15–25°C). Do not remove the QIAstat-Dx Respiratory Panel Plus Cartridges or the transfer pipettes from their individual packaging until actual use. Once the cartridge is removed from the pouch, it should be protected from sunlight.

Under these conditions, the QIAstat-Dx Respiratory Panel Plus Cartridges can be stored until the expiration date printed on the individual packaging. The expiration date is also included in the QIAstat-Dx Respiratory Panel Plus Cartridge barcode, and is read by the QIAstat-Dx Analyzer 2.0 when the cartridge is inserted into the instrument to run a test.

Attention should be paid to expiration dates and storage conditions printed on the box and labels of all components. Do not use expired or incorrectly stored components. In the event of cartridge damage, please refer to "Safety information" on page 13.

7.1.1. In-use stability

After the cartridge package is opened, sample should be introduced into the QIAstat-Dx Respiratory Panel Plus Cartridge within 30 minutes. Sample-loaded cartridges should be loaded into the QIAstat-Dx Analyzer 2.0 within 90 minutes.

7.2. Specimen storage and handling

The QIAstat-Dx Respiratory Panel Plus is for use with Nasopharyngeal swab samples*. All samples should be treated as potentially infectious. Discard sample and assay waste according to your local safety procedures.

Nasopharyngeal samples should be collected and handled according to the manufacturer's recommended procedures.

Recommended storage conditions for NPS (nasopharyngeal swab) resuspended in UTM specimens are listed below:

*Specimen collection material (NPS and UTM) is not provided with the QIAstat-Dx Respiratory Panel Plus.

- Room temperature up to 4 hours at 15–25°C;
- Refrigerated up to 3 days at approximately 4°C;
- Frozen up to 14 days at –20°C.

8. Procedure

Important points before starting

- Ensure all materials required but not provided are available.
- Select the QIAstat-Dx Respiratory Panel Plus Cartridge (cat. no. 691224). Respiratory panel cartridge identification is supported by a blue-colored bar on the label and an icon indicating respiratory tract ( ).
- All operators should wear appropriate personal protective equipment, such as gloves, lab coat, and protective glasses when handling the QIAstat-Dx Analyzer 2.0 touchscreen and cartridges.

8.1. Sample collection, transport, and storage

Collect nasopharyngeal swab samples according to the swab manufacturer's recommended procedures and place the swab into Universal Transport Medium.

8.2. Loading a sample into the QIAstat-Dx Respiratory Panel Plus Cartridge

1. Open the package of a QIAstat-Dx Respiratory Panel Plus Cartridge using the tear notches on the sides of the packaging (Figure 4).

   Important: After the package is opened, sample should be introduced into the QIAstat-Dx Respiratory Panel Plus Cartridge within 30 minutes.

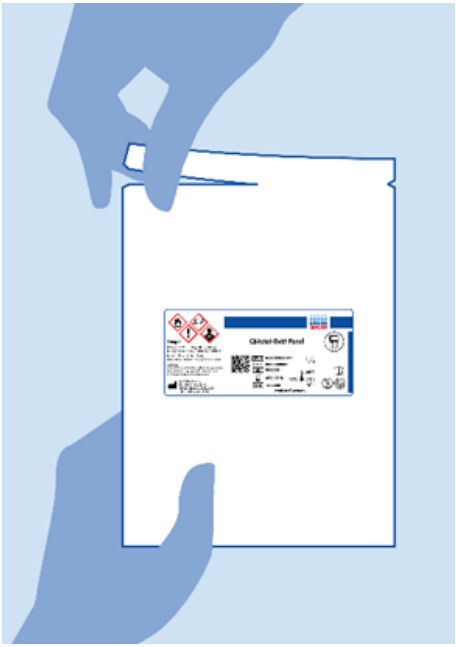


Figure 4. Opening the QIAstat-Dx Respiratory Panel Plus Cartridge.

2. Remove the QIAstat-Dx Respiratory Panel Plus Cartridge from the packaging and position it so that the QR code on the label faces you.
3. For the QIAstat-Dx Analyzer 2.0, manually write the sample information or place a sample information label on the top of the QIAstat-Dx Respiratory Panel Plus Cartridge. Make sure that the label is properly positioned and does not block the lid opening (Figure 5).

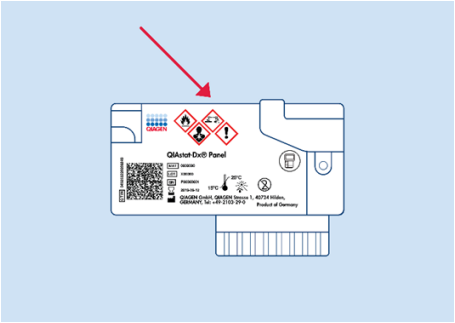


Figure 5. Sample information placement on top of the QIAstat-Dx Respiratory Panel Plus Cartridge.

4. Open the sample lid of the main port on the front of the QIAstat-Dx Respiratory Panel Plus Cartridge (Figure 6).

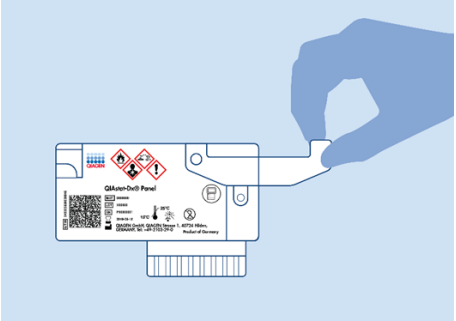


Figure 6. Opening the sample lid of main port.

5. Open the tube with the sample to be tested. Use the supplied transfer pipette to draw up fluid to the third fill line on the pipette (i.e., 300 µL) (Figure 7).

   Important: Avoid drawing air into the pipette. If Copan® UTM® Universal Transport Medium is used as transport medium, take care not to aspirate any of the beads present in the tube. If air or beads are drawn into the pipette, carefully expel the sample fluid in the pipette back into the sample tube and draw up fluid again. Use alternative individually packed graduated pipettes in case all 6 pipettes provided with the kit have been used.

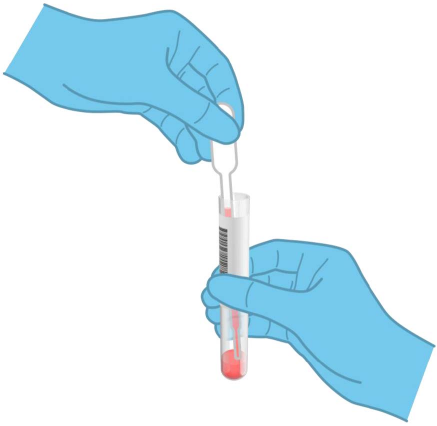


Figure 7. Drawing up sample into the supplied transfer pipette.

6. Carefully transfer 300 µL of sample volume into the main port of the QIAstat-Dx Respiratory Panel Plus Cartridge using the supplied single-use transfer pipette (Figure 8).

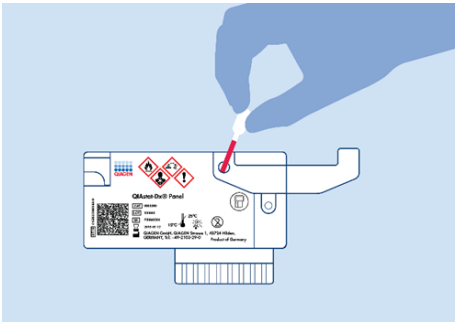


Figure 8. Transferring sample to main port of the QIAstat-Dx Respiratory Panel Plus Cartridge.

7. Firmly close the sample lid of the main port until it clicks (Figure 9).

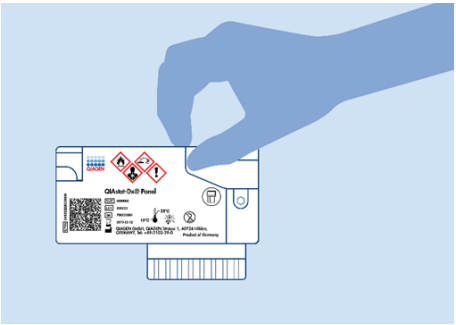


Figure 9. Closing the sample lid of the main port.

8. Visually confirm that the sample has been loaded by checking the sample inspection window of the QIAstat-Dx Respiratory Panel Plus Cartridge (Figure 10).

   Important: After the sample is placed inside the QIAstat-Dx Respiratory Panel Plus Cartridge, the cartridge must be loaded into the QIAstat-Dx Analyzer 2.0 within 90 minutes.

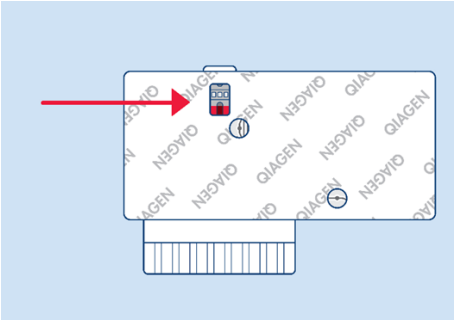


Figure 10. Sample inspection window (red arrow).

8.3. Running a test on the QIAstat-Dx Analyzer 2.0

8.3.1. Starting the QIAstat-Dx Analyzer 2.0

Warning: All operators should wear appropriate personal protective equipment, such as gloves, lab coat, and protective glasses when handling the QIAstat-Dx Analyzer 2.0 touchscreen and cartridges.

1. First, make sure the power switch at the back of the Analytical Module is set in the "I" position. Then, press the **ON/OFF** button on the front of the QIAstat-Dx Analyzer 2.0 to start the instrument.

   Note: The QIAstat-Dx Analyzer 2.0 status indicators will turn blue.

2. Wait until the Main screen appears and the QIAstat-Dx Analyzer 2.0 status indicators turn green and stop blinking.
3. Log in to the QIAstat-Dx Analyzer 2.0 by entering the username and password.

   Note: The Login screen will appear if **User Access Control** is activated. If the **User Access Control** is disabled, no username/password will be required and the Main screen will appear.
4. If the Assay Definition File software has not been installed on the QIAstat-Dx Analyzer 2.0, follow the installation instructions prior to running the test (see "Appendix A: Installing the Assay Definition File" on page 139 for additional information).

5. Press **Run Test** at the top right corner of the touchscreen of the QIAstat-Dx Analyzer 2.0.
6. When prompted, scan the sample ID barcode on the UTM tube containing the sample, or scan the specimen information barcode located on the top of the QIAstat-Dx Respiratory Panel Plus Cartridge (see step 3 from the section Procedure - Running a test on the QIAstat-Dx Analyzer 2.0) using the integrated front barcode reader of the QIAstat-Dx Analyzer 2.0 (Figure 11).

   Note: It is also possible to enter the sample ID using the virtual keyboard of the touchscreen by selecting the **Sample ID** field.

   Note: Depending on the chosen system configuration, entering the patient ID may also be required at this point.

   Note: Instructions from the QIAstat-Dx Analyzer 2.0 appear in the Instructions Bar at the bottom of the touchscreen.

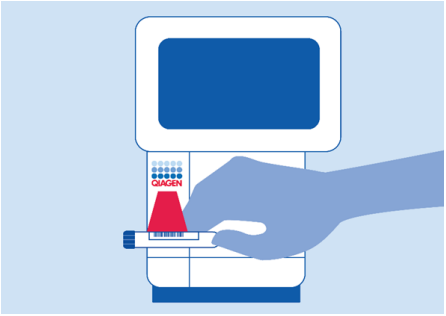


Figure 11. Scanning sample ID barcode.

7. When prompted, scan the barcode of the QIAstat-Dx Respiratory Panel Plus Cartridge to be used (Figure 12). The QIAstat-Dx Analyzer 2.0 automatically recognizes the assay to be run based on the cartridge barcode.

   Note: The QIAstat-Dx Analyzer 2.0 will not accept QIAstat-Dx Respiratory Panel Plus Cartridges with lapsed expiration dates, previously used cartridges, or cartridges for assays that have not been installed on the unit. An error message will be shown in these cases and the QIAstat-Dx Respiratory Panel Plus Cartridge will be rejected. Refer to the *QIAstat-Dx Analyzer 2.0 User Manual* for further details on how to install assays.

   IMPORTANT: Do not scan the barcode from the cartridge packaging.

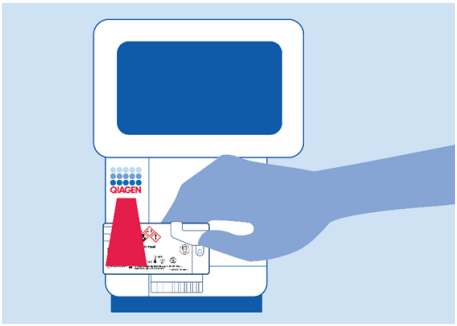


Figure 12. Scanning the QIAstat-Dx Respiratory Panel Plus Cartridge barcode.

8. The **Confirm** screen will appear. Review the entered data and make any necessary changes by selecting the relevant fields on the touchscreen and editing the information.

9. Press **Confirm** when all the displayed data are correct. If needed, select the appropriate field to edit its content, or press **Cancel** to cancel the test (Figure 13).

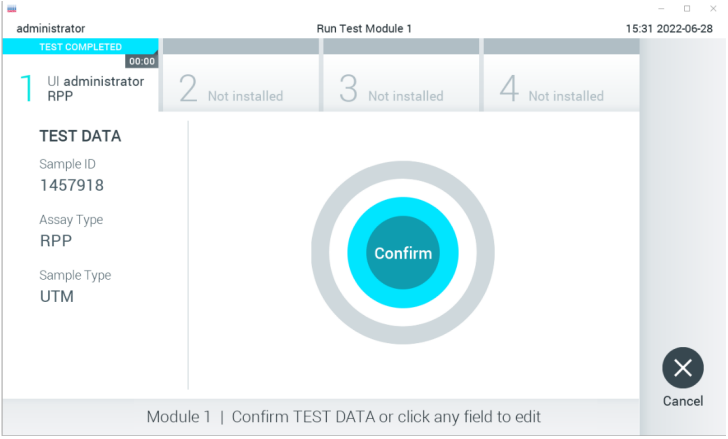


Figure 13. Confirming data entry.

10. Make sure that the lids of the swab port and main port of the QIAstat-Dx Respiratory Panel Plus Cartridge are firmly closed. When the cartridge entrance port on the top of the QIAstat-Dx Analyzer 2.0 automatically opens, insert the QIAstat-Dx Respiratory Panel Plus Cartridge with the barcode facing to the left and the reaction chambers facing down (Figure 14).

    Note: There is no need to push the QIAstat-Dx Respiratory Panel Plus Cartridge into the QIAstat-Dx Analyzer 2.0. Position it correctly into the cartridge entrance port and the QIAstat-Dx Analyzer 2.0 will automatically move the cartridge into the Analytical Module.

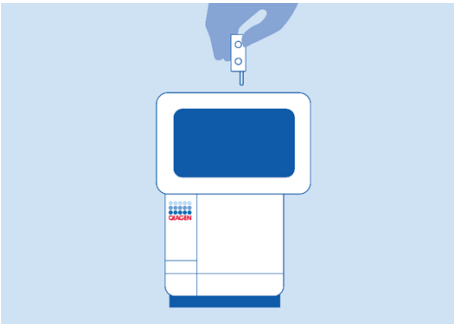


Figure 14. Inserting the QIAstat-Dx Respiratory Panel Plus Cartridge into the QIAstat-Dx Analyzer 2.0.

11. Upon detecting the QIAstat-Dx Respiratory Panel Plus Cartridge, the QIAstat-Dx Analyzer 2.0 will automatically close the lid of the cartridge entrance port and start the test run. No further action from the operator is required to start the run.

    Note: The QIAstat-Dx Analyzer 2.0 will not accept a QIAstat-Dx Respiratory Panel Plus Cartridge other than the one used and scanned during the test setup. If a cartridge other than the one scanned is inserted, an error will be generated and the cartridge will be automatically ejected.

    Note: Up to this point, it is possible to cancel the test run by pressing **Cancel** at the bottom-right corner of the touchscreen.

    Note: Depending on the system configuration, the operator may be required to re-enter their user password to start the test run.

    Note: The lid of the cartridge entrance port will close automatically after 30 seconds if a QIAstat-Dx Respiratory Panel Plus Cartridge is not positioned in the port. If this occurs, please press **Cancel** at the lower-right corner of the screen of the QIAstat-Dx Analyzer 2.0 and repeat the procedure starting with step 9.9

12. While the test is running, the remaining run time is displayed on the touchscreen.
13. After the test run is completed, the **Eject** screen will appear (Figure 15) and the Module status bar will display the test result as one of the following options:
    - **TEST COMPLETED**: The test was completed successfully.
    - **TEST FAILED**: An error occurred during the test.
    - **TEST CANCELED**: The user canceled the test.

    Important: If the test fails, refer to the "Troubleshooting" section in the *QIAstat-Dx Analyzer 2.0 User Manual* for possible reasons and instructions on how to proceed.

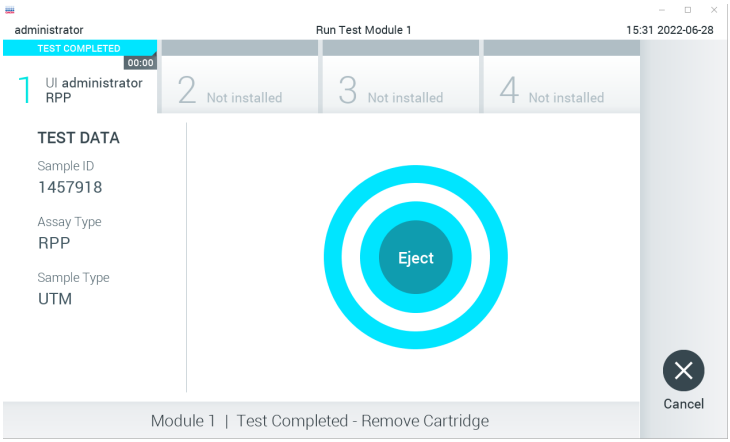


Figure 15. Eject screen display.

14. Press **Eject** on the touchscreen to remove the QIAstat-Dx Respiratory Panel Plus Cartridge and dispose of it as biohazardous waste in accordance with all national, state, and local health and safety regulations and laws. The QIAstat-Dx Respiratory Panel Plus Cartridge should be removed when the cartridge entrance port opens and ejects the cartridge. If the cartridge is not removed after 30 seconds, it will automatically move back into the QIAstat-Dx Analyzer 2.0, and the cartridge entrance port lid will close. If this occurs, press **Eject** to open the lid of the cartridge entrance port again, and then remove the cartridge.

    Important: Used QIAstat-Dx Respiratory Panel Plus Cartridges must be discarded. It is not possible to re-use cartridges for tests for which the execution was started but then subsequently canceled by the operator, or for which an error was detected.

15. After the QIAstat-Dx Respiratory Panel Plus Cartridge has been ejected, the results Summary screen will appear. Refer to "Interpretation of Results" on page 31 for further details. To begin the process for running another test, press **Run Test**.

    Note: For further information on the use of the QIAstat-Dx Analyzer 2.0, refer to the *QIAstat-Dx Analyzer 2.0 User Manual*.

8.4. Viewing results with the QIAstat-Dx Analyzer 2.0

The QIAstat-Dx Analyzer 2.0 automatically interprets and saves test results. After ejecting the QIAstat-Dx Respiratory Panel Plus Cartridge, the results Summary screen is automatically displayed (Figure 16).

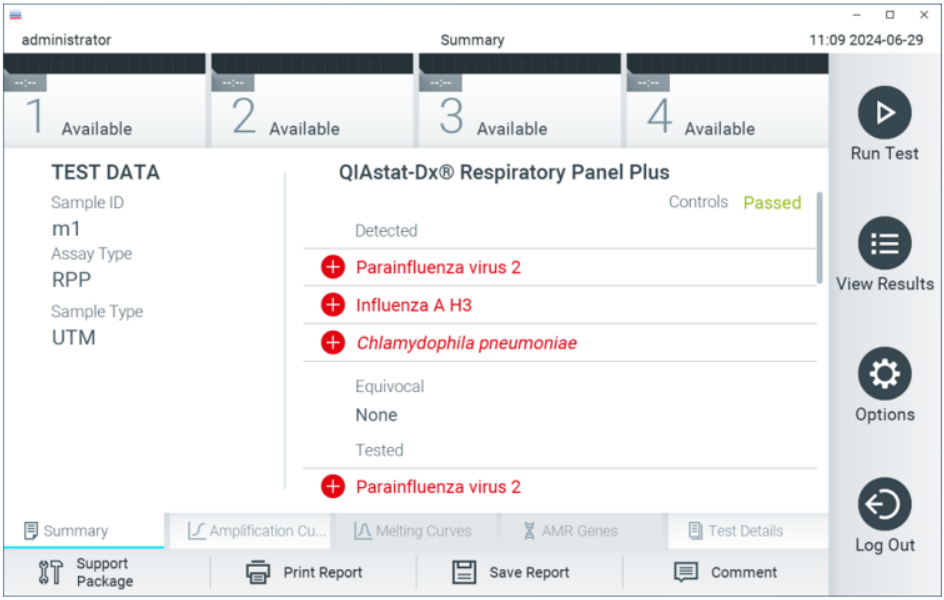


Figure 16. Results summary screen example showing Test Data on the left panel and Test Summary in the main panel for QIAstat-Dx Analyzer 2.0.

The QIAstat-Dx Analyzer 2.0 includes an additional tab:

- **AMR Genes**: It is disabled for the QIAstat-Dx Respiratory Panel Plus.

The main part of the screen provides the following 3 lists and uses color-coding and symbols to indicate the results:

- The first list includes all pathogens detected and identified in the sample, preceded by a ⊕ sign and are colored red.
- The second list includes all equivocal pathogens, preceded by a yellow question mark ?,

in the event any of the subtypes H1, H3, and/or H1N1 pdm09 are detected and identified in the sample, but Influenza A is not detected.

Note: Pathogens detected and identified in the sample are shown in all lists.

If the test failed to complete successfully, a message will indicate “Failed”, followed by the specific Error Code.

The following Test Data is shown on the left side of the screen:

- Sample ID
- Assay Type
- Sample Type

Further data about the assay is available, depending on the operator’s access rights, through the tabs at the bottom of the screen (e.g., amplification plots and test details). For additional details, please see "Viewing amplification curves with the QIAstat-Dx Analyzer 2.0" on page 32.

9. Interpretation of Results

9.1. Internal Control interpretation

The QIAstat-Dx Respiratory Panel Plus Cartridge includes a full process Internal Control which is titered MS2 bacteriophage. The MS2 bacteriophage is a single-stranded RNA virus that is included in the cartridge in dried form and is rehydrated upon sample loading. This Internal Control material verifies all steps of the analysis process, including sample resuspension/homogenization, lysis, nucleic acid purification, reverse transcription, and PCR.

A positive signal for the Internal Control indicates that all processing steps performed by the QIAstat-Dx Respiratory Panel Plus Cartridge were successful.

A negative signal of the Internal Control does not negate any positive results for detected and identified targets, but it does invalidate all negative results in the analysis. Therefore, the test should be repeated if the Internal Control signal is negative.

Internal Control results are to be interpreted according to Table 2.

Table 2. Interpretation of Internal Control results

Control result	Explanation	Action
Passed	The Internal Control amplified successfully.	The run was completed with success. All results are valid and can be reported. Detected pathogens are reported as "positive" and undetected pathogens are reported as "negative".
Failed	The Internal Control failed.	Positively detected pathogen(s) are reported, but all negative results (tested but not detected pathogen[s]) are invalid. Repeat the testing using a new QIAstat-Dx Respiratory Panel Plus Cartridge.

9.2. Pathogen result interpretation

9.2.1. Result interpretation information for Influenza A

A result for a respiratory organism is interpreted as "Positive" when the corresponding PCR assay is positive (see exceptions for Influenza A below). The Influenza A assay in the QIAstat-Dx Respiratory Panel Plus is designed to detect Influenza A as well as Influenza A subtype H1N1/pdm09, Influenza A subtype H1, or Influenza A subtype H3. In particular, this means:

- If Influenza A H1 strain is detected by the QIAstat-Dx Respiratory Panel Plus assay, both Influenza A generic and Influenza A H1 will be detected, but only Influenza A H1 will be displayed on the screen.

  Note: In case only the subtype H1 signal is obtained (and not the generic Influenza A signal), Influenza A H1 will be reported as "equivocal".
- If Influenza A H3 strain is detected by the QIAstat-Dx Respiratory Panel Plus assay, both Influenza A generic and Influenza A H3 will be detected, but only Influenza A H3 will be displayed on the screen.

  Note: In case only the subtype H3 signal is obtained (and not the generic Influenza A signal), Influenza A H3 will be reported as "equivocal".
- If an Influenza A H1N1 pdm09 strain is detected by the QIAstat-Dx Respiratory Panel Plus assay, both Influenza A generic and Influenza A H1N1 pdm09 will be detected, but only Influenza A H1N1 pdm09 will be displayed on the screen.

  Note: In case only the subtype H1N1 pdm09 signal is obtained (and not the generic Influenza A signal), Influenza A H1N1 pdm09 will be reported as "equivocal".

  Note: It is acceptable if only the Influenza A signal is obtained, which would be indicated as "Influenza A (no subtype detected)".

Important: If only an Influenza A signal is present and no additional signal for any of the subtypes is generated, it can be due to either low concentration; or, in very rare cases, a new variant, or any Influenza A strain other than H1 and H3 (e.g., H5N1, which can infect humans). In cases where only an Influenza A signal is detected and there is a clinical suspicion of non-seasonal Influenza A, retesting is recommended. If the same results are obtained upon retesting, contact the appropriate public health authorities for confirmatory testing.

9.2.2. Result interpretation for all other pathogens

For every other pathogen that can be detected with the QIAstat-Dx Respiratory Panel Plus, only one signal will be generated if the pathogen is present in the sample.

9.3. Viewing amplification curves with the QIAstat-Dx Analyzer 2.0

To view test amplification curves of pathogens detected, press the Amplification Curves tab (Figure 17).



Figure 17. Amplification Curves screen (PATHOGENS tab).

Details about the tested pathogens and controls are shown on the left, and the amplification curves are shown in the center.

Note: If **User Access Control** is enabled on the QIAstat-Dx Analyzer 2.0, the Amplification Curves screen is only available for operators with access rights.

Press the **PATHOGENS** tab on the left side to display the plots corresponding to the tested pathogens. Press the pathogen name to select which pathogens are displayed in the amplification plot. It is possible to select single, multiple, or no pathogens. Each pathogen in the selected list will be assigned a color corresponding to the amplification curve associated with the pathogen. Unselected pathogens will be shown in gray.

The corresponding Ct and endpoint fluorescence (EP) values are shown below each pathogen name.

Press the **CONTROLS** tab on the left side to view the controls in the amplification plot. Press the circle next to the control name to select or deselect it (Figure 18).



Figure 18. Amplification Curves screen (CONTROLS tab).

The amplification plot displays the data curve for the selected pathogens or controls. To alternate between logarithmic or linear scale for the Y-axis, press **Lin** or **Log** at the bottom left corner of the plot.

The scale of the X-axis and Y-axis can be adjusted using the blue pickers on each axis. Press and hold a blue picker and then move it to the desired location on the axis. Move a blue picker to the axis origin to return to the default values.

9.4. Viewing test details of the QIAstat-Dx Analyzer 2.0

Press **Test Details** in the Tab Menu bar at the bottom of the touchscreen to review the results in more detail. Scroll down to see the complete report. The following Test Details are shown in the center of the screen (Figure 19):

- User ID
- Cartridge SN (serial number)
- Cartridge Expiration Date
- Module SN (serial number)
- Test Status (Completed, Failed, or Canceled by operator)
- Error Code (if applicable)
- Test Start Date and Time

- Test Execution Time
- Assay Name
- Test ID
- Test Result:
  - Positive (if at least one respiratory pathogen is detected/identified)
  - Positive with warning (at least one respiratory pathogen is detected but the Internal Control failed)
  - Negative (no respiratory pathogen is detected)
  - Invalid
- List of analytes tested in the assay, with Ct and endpoint fluorescence in the event of a positive signal
- Internal control, with Ct and endpoint fluorescence

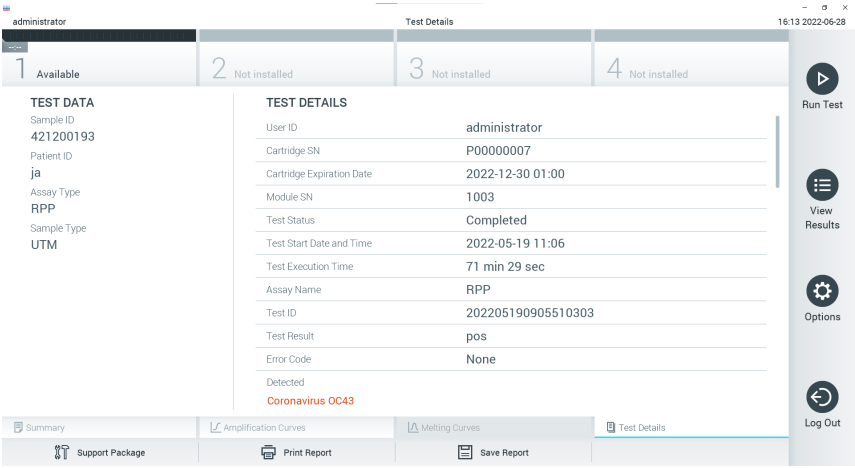


Figure 19. Example screen showing Test Data on the left panel and Test Details in the main panel.

9.5. Browsing results from previous tests of the QIAstat-Dx Analyzer 2.0

To view results from previous tests that are stored in the results repository, press View Results on the Main Menu bar (Figure 20).

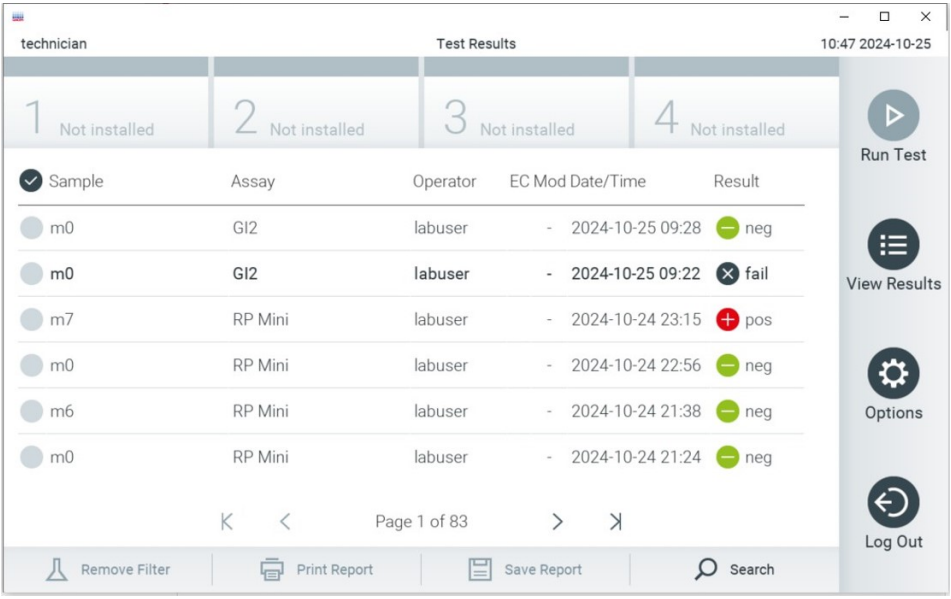


Figure 20. Example View Results screen.

The following information is available for every executed test:

- Sample ID
- Assay (name of test assay)
- Operator ID
- Mod (Analytical Module on which the test was executed)
- Date/Time (date and time when the test was finished)
- Result (outcome of the test: positive [pos], positive with warning [pos*], negative [neg], failed [fail], or successful [suc])

Note: If **User Access Control** is enabled on the QIAstat-Dx Analyzer 2.0, the data for which the user has no access rights will be hidden with asterisks.

Select one or more test results by pressing the gray circle to the left of the sample ID. A checkmark will appear next to selected results. Unselect test results by pressing this **checkmark**. The entire list of results can be selected by pressing the checkmark circle in the top row (Figure 21).

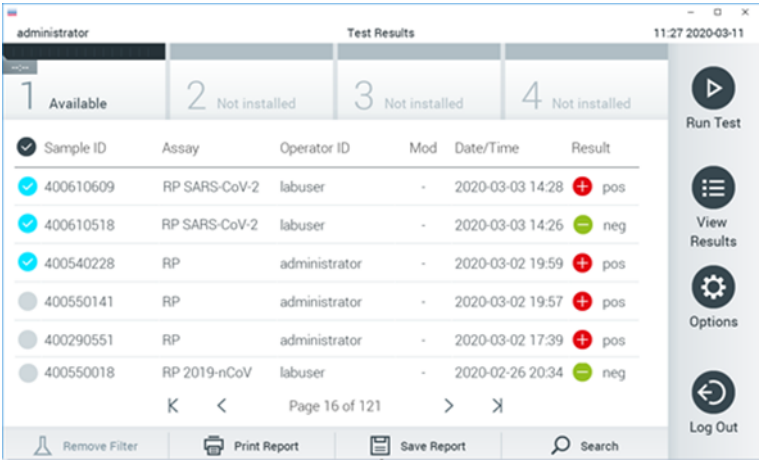


Figure 21. Example of selecting Test Results in the View Results screen.

Press anywhere in the test row to view the result for a particular test.

Press a column headline (e.g., Sample ID) to sort the list in ascending or descending order according to that parameter. The list can be sorted according to only one column at a time.

The Result column shows the outcome of each test (Table 3):

Table 3. Description of the test results

Outcome	Result	Description	Action
Positive	pos	At least one pathogen is positive.	Refer to the Summary Result Screen or Result Printout for pathogen specific results.
Positive with warning	pos*	At least one pathogen is positive, but the Internal Control failed.	Refer to the Summary Result Screen or Result Printout for pathogen specific results.
Negative	neg	No pathogens were detected.	Refer to the Summary Result Screen or Result Printout for pathogen specific results.

Table 3. Description of the test results (continued)

Outcome	Result	Description	Action
Failed	fail	The test failed because either an error occurred, the test was canceled by the user, or no pathogens were detected and the Internal Control failed.	Repeat the test using a new cartridge. Accept the results of the repeat testing. If the error persists, contact QIAGEN Technical Support for further instructions.
Successful	suc	The test is either positive or negative, but the user does not have the access rights to view the test results.	Login from a user profile with rights to view the results.

Select the report type: **List of Tests** or **Test Reports**.

Press **Search** to search the test results by Sample ID, Assay, and Operator ID. Enter the search string using the virtual keyboard, and press **Enter** to start the search. Only the records containing the searched text will be displayed in the search results.

If the results list has been filtered, the search will only apply to the filtered list.

Press and hold a column headline to apply a filter based on that parameter. For some parameters, such as Sample ID, the virtual keyboard will appear so the search string for the filter can be entered.

For other parameters, such as Assay, a dialog box will open with a list of assays stored in the repository. Select one or more assays to filter only the tests that were performed with the selected assays.

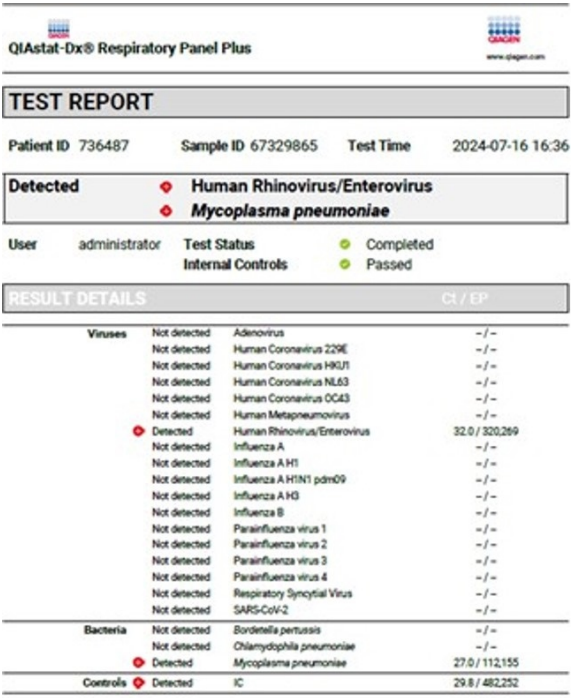
The symbol to the left of a column headline indicates that the column's filter is active. A filter can be removed by pressing **Remove Filter** in the Submenu bar.

9.5.1. Exporting results to a USB drive from the QIAstat-Dx Analyzer 2.0

From any tab of the View Results screen, select **Save Report** to export and save a copy of the test results in PDF to a USB drive. The USB port is located on the front of the QIAstat-Dx Analyzer 2.0. The interpretation of the results in the PDF file is shown on Table 4.

Table 4. Interpretation of test results on PDF reports

	Outcome	Symbol	Description
Pathogen result	Detected		Pathogen detected.
	Equivocal		Equivocal result. An Influenza A subtype is detected but not the Influenza A.
	Not Detected	No symbol	Pathogen not detected.
	Invalid	No symbol	The Internal Control failed there is not valid result for this target and the sample should be retested.
Test Status	Completed		The test was completed and the Internal Control and/or one or more targets were detected.
	Failed		The test failed.
Internal Controls	Passed		The Internal Control passed.
	Failed		The Internal Control failed.



QIAstat-Dx® Respiratory Panel Plus

TEST REPORT

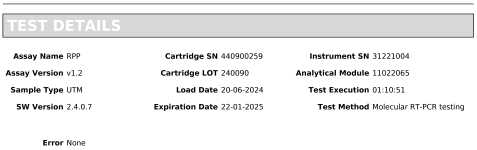
Patient ID 736487 Sample ID 67329865 Test Time 2024-07-16 16:36

Detected
- Human Rhinovirus/Enterovirus
- *Mycoplasma pneumoniae*

User administrator Test Status Completed
Internal Controls Passed

RESULT DETAILS			Ct / EP
Viruses	Not detected	Adenovirus	-/-
	Not detected	Human Coronavirus 229E	-/-
	Not detected	Human Coronavirus HKU1	-/-
	Not detected	Human Coronavirus NL63	-/-
	Not detected	Human Coronavirus OC43	-/-
	Not detected	Human Metapneumovirus	-/-
	Detected	Human Rhinovirus/Enterovirus	32.0 / 320,269
	Not detected	Influenza A	-/-
	Not detected	Influenza A H1	-/-
	Not detected	Influenza A H1N1 pdm09	-/-
	Not detected	Influenza A H3	-/-
	Not detected	Influenza B	-/-
	Not detected	Parainfluenza virus 1	-/-
	Not detected	Parainfluenza virus 2	-/-
	Not detected	Parainfluenza virus 3	-/-
	Not detected	Parainfluenza virus 4	-/-
	Not detected	Respiratory Syncytial Virus	-/-
	Not detected	SARS-CoV-2	-/-
Bacteria	Not detected	*Bordetella pertussis*	-/-
	Not detected	*Chlamydophila pneumoniae*	-/-
	Detected	*Mycoplasma pneumoniae*	27.0 / 112,155
Controls	Detected	IC	29.8 / 482,252

Figure 22. Sample test report.



TEST DETAILS

Assay Name RPP **Cartridge SN** 440900259 **Instrument SN** 31221004
Assay Version v1.2 **Cartridge LOT** 240090 **Analytical Module** 11022065
Sample Type UTM **Load Date** 20-06-2024 **Test Execution** 01:10:51
SW Version 2.4.0.7 **Expiration Date** 22-01-2025 **Test Method** Molecular RT-PCR testing

Error None

Figure 23. Sample test report showing details about the test.

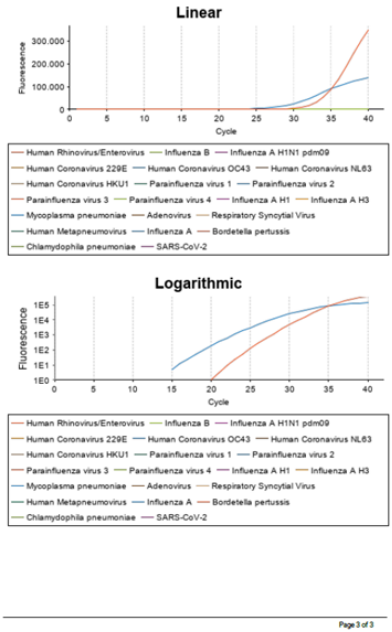


Figure 24. Sample test report showing assay data.

9.5.2. Printing results of the QIAstat-Dx Analyzer 2.0

Make sure a printer is connected to the QIAstat-Dx Analyzer 2.0 and the proper driver is installed. Press **Print Report** to send a copy of the test results to the printer.

10. Quality Control

In accordance with QIAGEN's ISO-certified Quality Management System, each lot of QIAstat-Dx Respiratory Panel Plus is tested against predetermined specifications to ensure consistent product quality. External controls are not provided with the QIAstat-Dx Respiratory Panel Plus. Quality control requirements should be performed in conformance with local, state, and/or federal regulations or accreditation requirements and your laboratory's standard quality control procedures.

11. Limitations

- Results from the QIAstat-Dx Respiratory Panel Plus are not intended to be used as the sole basis for diagnosis, treatment, or other patient management decisions.
- The performance of this test has not been established for immunocompromised individuals.
- The performance of this test has not been established for patients without signs and symptoms of respiratory infection.
- Positive results do not rule out co-infection with organisms not included in the QIAstat-Dx Respiratory Panel Plus. The agent detected may not be the definitive cause of the disease.
- Negative results do not preclude infection of the upper respiratory tract. Not all agents of acute respiratory infection are detected by this assay and sensitivity in some clinical settings may differ from that described in the Instructions for Use.
- A negative result with the QIAstat-Dx Respiratory Panel Plus does not exclude the infectious nature of the syndrome. Negative assay results may originate from several factors and their combinations, including sample handling mistakes, variation in the nucleic acid sequences targeted by the assay, infection by organisms not included in the assay, organism levels of included organisms that are below the limit of detection for the assay and use of certain medications, therapies, or agents.
- The QIAstat-Dx Respiratory Panel Plus is not intended for testing of samples other than those described in these Instructions for Use. Test performance characteristics have been established only with nasopharyngeal swab samples collected in universal transport media (UTM), from individuals with acute respiratory symptoms.
- The QIAstat-Dx Respiratory Panel Plus is intended to be used in conjunction with standard of care culture for organism recovery, serotyping, and/or antimicrobial susceptibility testing where applicable.
- The results from the QIAstat-Dx Respiratory Panel Plus must be interpreted by a trained healthcare professional within the context of all relevant clinical, laboratory, and epidemiological findings.
- The QIAstat-Dx Respiratory Panel Plus can be used only with the QIAstat-Dx Analyzer 2.0.
- The QIAstat-Dx Respiratory Panel Plus is a qualitative assay and does not provide a quantitative value for detected organisms.
- Viral and bacterial nucleic acids may persist in vivo, even if the organism is not viable or infectious. Detection of a target marker does not imply that the corresponding organism is the causative agent of the infection or the clinical symptoms.
- Detection of viral and bacterial nucleic acids depends on proper sample collection, handling, transportation, storage, and loading into the QIAstat-Dx Respiratory Panel Plus

Cartridge. Improper operations for any of the aforementioned processes can cause incorrect results, including false-positive or false-negative results.

- The performance of this test has not been established for screening of blood or blood products.
- The performance of this test has not been established in individuals who received Influenza vaccine. Recent administration of a nasal Influenza vaccine may cause false positive results for Influenza A and/or Influenza B.
- The QIAstat-Dx Respiratory Panel Plus Cartridge may not be able to distinguish between existing viral strains and new variants as they emerge. For example, the QIAstat-Dx Respiratory Panel Plus can detect H3N2 Influenza but may not be able to distinguish H3N2 from H3N2 variant (H3N2v).
- The QIAstat-Dx Respiratory Panel Plus detects the multi-copy IS481 insertion sequence present in multiple *Bordetella* species. False positive *B. pertussis* results are possible if the specimen is contaminated with non-pertussis *Bordetella* species.
- The assay sensitivity and specificity, for the specific organisms and for all organisms combined, are intrinsic performance parameters of a given assay and do not vary depending on prevalence. In contrast, both the negative and positive predictive values of a test result are dependent on the disease/organism prevalence. False negative test results are more likely during peak activity when prevalence of disease is high. False positive test results are more likely during periods when prevalence is moderate or low.
- Do not attempt viral culture in cases of positive results for SARS-CoV-2 and/or any similar microbial agents, unless a facility with an appropriate level of laboratory biosafety (e.g., BSL-3 or higher) is available to receive and culture specimens.
- If infection with a novel Influenza A virus is suspected based on current clinical and epidemiological screening criteria recommended by public health authorities, specimens should be collected with appropriate infection control precautions for novel virulent Influenza viruses and sent to state or local health departments for testing. Viral culture should not be attempted in these cases unless a BSL-3+ facility is available to receive and culture specimens.
- Clinical performance has not been established with all circulating variants but is anticipated to be reflective of the prevalent variants in circulation at the time and location of the clinical evaluation. Performance at the time of testing may vary depending on the variants circulating, including newly emerging strains of SARS-CoV-2 and their prevalence, which change over time.
- Performance characteristics for Influenza A were established when Influenza A/H3 and Influenza A/H1-2009 were the predominant Influenza strains.
- This test has been evaluated for use with human specimen material only.

- The performance of QIAstat-Dx Respiratory Panel Plus has not been validated for the testing of pooled specimens.
- The performance of QIAstat-Dx Respiratory Panel Plus has not been established for monitoring treatment of infection with any of the panel organisms.
- The QIAstat-Dx Respiratory Panel Plus Influenza A/H1 and A/H3 subtyping assays target the Influenza A hemagglutinin (H) gene only; they do not detect or differentiate the Influenza A/H1 and A/H3 neuraminidase (N) subtypes.
- The QIAstat-Dx Respiratory Panel Plus Influenza A/H1N1pdm09 subtyping assay targets the Influenza A neuraminidase (N) gene only; it does not detect or differentiate the Influenza A/H1N1pdm09 hemagglutinin (H) subtype.
- Due to the genetic similarity between Human Rhinovirus and Enterovirus, the QIAstat-Dx Respiratory Panel Plus cannot differentiate them. A QIAstat-Dx Respiratory Panel Plus Human Rhinovirus/Enterovirus Detected result should be followed-up using an alternate method (e.g., cell culture or sequence analysis) if differentiation between the viruses is required.
- If a specimen yields a repeated positive result for Influenza A but produces negative test results for all specific Influenza A subtypes intended to be differentiated (i.e., H1, H1N1pdm09, and H3), this result requires notification of appropriate local, state, or federal public health authorities to determine necessary measures for verification.
- Due to the small number of positive specimens collected during the prospective and the retrospective clinical studies, performance characteristics for Influenza A H1 and Parainfluenza Virus 2 were established primarily using contrived clinical specimens.
- In silico analyses of the SARS-CoV-2 primer/probe sequences indicated that they may cross-react with pangolin and bat coronaviruses, causing a false positive SARS-CoV-2 result. Pangolin and bat coronaviruses are not currently known to circulate in the human population; and thus the risk of a false positive SARS-CoV-2 result due to these organisms in a human specimen is low.

12. Performance Characteristics

12.1. Analytical performance

12.1.1. Limit of detection for SARS-CoV-2

A limit of detection study (LoD) was performed to evaluate the analytical sensitivity of the SARS-CoV-2 assay of the QIAstat-Dx Respiratory Panel Plus. For this study, 5 SARS-CoV-2 strains were evaluated individually by testing serial dilutions prepared in NPS matrix. Testing was broken into 2 parts: preliminary and confirmatory LoD testing. For the preliminary LoD study, a serial dilution series consisting of 4 concentrations was tested in replicates of 4 per dilution. The preliminary LoD for each strain was defined as the lowest concentration at which 100% of replicates were positive for SARS-CoV-2. The confirmed LoD was established by testing 20 replicates at the concentration determined from the preliminary LoD for each strain. The LoD for each strain was confirmed if ≥95% of the replicates were positive. To further confirm the LoD, at least one dilution below the LoD was tested for each strain and was also tested in 20 replicates and was required to result in less than 95% positivity. The confirmed LoD for SARS-CoV-2 is summarized in Table 5.

Table 5. Confirmatory LoD results for SARS-CoV-2 with QIAstat-Dx Respiratory Panel Plus

Pathogen	Strain	Source	Concentration (copies/mL)	Detection rate
SARS-CoV-2	Not available	WHO, NIBSC, 20/146	316	19/20
SARS-CoV-2	USA-WA1-2020	ZeptoMetrix 0810587CFH	3160	19/20
SARS-CoV-2	Not available	Vall d'Hebron hospital S1229	1.9E+04	20/20
SARS-CoV-2	Not available	Vall d'Hebron hospital S1231	1.9E+04	20/20
SARS-CoV-2	Not available	STAT-Dx 243	600	20/20

In addition, a subset of the original panel analytes (QIAstat-Dx Respiratory Panel, K183597) was tested side-by-side with the QIAstat-Dx Respiratory Panel Plus. It was demonstrated that the addition of the SARS-CoV-2 target does not impact the performance of targets in the other reaction chambers.

12.1.2. Limit of detection for non-SARS-CoV-2 targets

The Analytical Sensitivity, or Limit of Detection (LoD), is defined as the lowest concentration at which ≥95% of the tested samples generate a positive call.

The LoD for each of the QIAstat-Dx Respiratory Panel Plus pathogen was determined by analyzing serial dilutions of analytical samples prepared from culture isolates from commercial suppliers (e.g. ZeptoMetrix® and ATCC®), confirmed clinical isolates, or artificial samples for commercially unavailable target analytes on QIAstat-Dx Analyzer.

The LoD concentration was determined for a total of 51 pathogen strains. The LoD of the QIAstat-Dx Respiratory Panel Plus was determined per analyte using selected strains representing individual pathogens that are possible to detect with the QIAstat-Dx Respiratory Panel Plus. Pathogens were spiked into simulated NPS sample matrix (cultured human cells in Copan UTM) and tested in at least 20 replicates, and 300 µL transferred to the cartridge. Additional testing of samples prepared using negative clinical NPS matrix was conducted to assess equivalency.

At least 3 different cartridge lots and at least 3 different QIAstat-Dx Analyzers were used for LoD determination for every pathogen.

Individual LoD values for each QIAstat-Dx Respiratory Panel Plus target are shown in Table 6.

Table 6. LoD values obtained for the different respiratory target strains in NPS sample matrix tested with the QIAstat-Dx Respiratory Panel Plus

Pathogen	Strain	Source	Concentration*	Detection rate
Influenza A H1N1†	A/New Jersey/8/76	ATCC VR-897	341.3 $CEID_{50}$/mL	Flu A: 20/20 H1: 20/20
Influenza A H1N1†	A/Brisbane/59/07	ZeptoMetrix 0810244CFHI	4.0 $TCID_{50}$/mL	Flu A: 20/20 H1: 20/20
Influenza A H1N1†	A/New Caledonia/20/99	ZeptoMetrix 0810036CFHI	15 $TCID_{50}$/mL	Flu A: 20/20 H1: 19/20

Table 6. LoD values obtained for the different respiratory target strains in NPS sample matrix tested with the QIAstat-Dx Respiratory Panel Plus (continued)

Pathogen	Strain	Source	Concentration*	Detection rate
Influenza A H3N2	A/Virginia/ATCC6/2012	ATCC AV-VR-1811	0.1 PFU/mL	Flu A: 20/20 H3: 20/20
Influenza A H3N2†	A/Port Chalmers/1/73	ATCC VR-810	499.3 $CEID_{50}$/mL	Flu A: 20/20 H3: 20/20
Influenza A H3N2	A/Wisconsin/67/2005	ZeptoMetrix 0810252CFHI	3.8 $TCID_{50}$/mL	Flu A: 20/20 H3: 20/20
Influenza A H1N1 pdm09†	A/Virginia/ATCC1/2009	ATCC VR-1736	67 PFU/mL	Flu A: 20/20 H1N1: 20/20
Influenza A H1N1 pdm09†	A/SwineNY/03/2009	ZeptoMetrix 0810249CFHI	56.2 $TCID_{50}$/mL	Flu A: 20/20 H1N1: 20/20
Influenza B	B/Virginia/ATCC5/2012	ATCC VR-1807	0.03 PFU/mL	20/20
Influenza B†	B/FL/04/06	ATCC VR-1804	1080 $CEID_{50}$/mL	20/20
Influenza B†,‡	B/Taiwan/2/62	ATCC VR-295	5000 $CEID_{50}$/mL	19/20
Coronavirus 229E†	Not available	ATCC VR-740	0.2 $TCID_{50}$/mL	20/20
Coronavirus 229E	Not available	ZeptoMetrix 0810229CFHI	3.6 $TCID_{50}$/mL	20/20
Coronavirus OC43†	Not available	ATCC VR-1558	0.1 $TCID_{50}$/mL	20/20
Coronavirus OC43	Not available	ZeptoMetrix 0810024CFHI	0.1 $TCID_{50}$/mL	20/20

Table 6. LoD values obtained for the different respiratory target strains in NPS sample matrix tested with the QIAstat-Dx Respiratory Panel Plus (continued)

Pathogen	Strain	Source	Concentration*	Detection rate
Coronavirus NL63†	Not available	ZeptoMetrix 0810228CFHI	0.01 $TCID_{50}$/mL	20/20
Coronavirus HKU1†	Not available	Clinical Sample S510	4E+04 copies/mL	20/20
Parainfluenza Virus 1 (PIV1)	C35	ATCC VR-94	0.2 $TCID_{50}$/mL	19/20
Parainfluenza Virus 1 (PIV1)†	Not available	ZeptoMetrix 0810014CFHI	0.2 $TCID_{50}$/mL	19/20
Parainfluenza Virus 2 (PIV2)†	Greer	ATCC VR-92	7.3 $TCID_{50}$/mL	20/20
Parainfluenza Virus 2 (PIV2)	Not available	ZeptoMetrix 0810015CFHI	1.3 $TCID_{50}$/mL	19/20
Parainfluenza Virus 3 (PIV3)†,‡	C 243	ATCC VR-93	2.3 $TCID_{50}$/mL	20/20
Parainfluenza Virus 3 (PIV3)	Not available	ZeptoMetrix 0810016CFHI	11.5 $TCID_{50}$/mL	20/20
Parainfluenza Virus 4a (PIV4a)†	M-25	ATCC VR-1378	0.5 $TCID_{50}$/mL	20/20
Parainfluenza Virus 4b (PIV4b)	Not available	ZeptoMetrix 0810060BCFHI	9.5 $TCID_{50}$/mL	20/20
Enterovirus†	US/IL/14-18952 (enterovirus D68)	ATCC VR-1824	8.9 $TCID_{50}$/mL	19/20
Enterovirus	Echovirus 6	ATCC VR-241	0.9 $TCID_{50}$/mL	19/20
Rhinovirus	1059 (rhinovirus B14)	ATCC VR-284	8.9 $TCID_{50}$/mL	20/20
Rhinovirus†,‡	HGP (rhinovirus A2)	ATCC VR-482	8.9 $TCID_{50}$/mL	19/20
Rhinovirus	11757 (rhinovirus C16)	ATCC VR-283	50.0 $TCID_{50}$/mL	20/20

Table 6. LoD values obtained for the different respiratory target strains in NPS sample matrix tested with the QIAstat-Dx Respiratory Panel Plus (continued)

Pathogen	Strain	Source	Concentration*	Detection rate
Rhinovirus	Type 1A	ATCC VR-1559	8.9 $TCID_{50}$/mL	20/20
Adenovirus†,‡	GB (adenovirus B3)	ATCC VR-3	4993.0 $TCID_{50}$/mL	19/20
Adenovirus	RI-67 (adenovirus E4)	ATCC VR-1572	15.8 $TCID_{50}$/mL	20/20
Adenovirus	Adenoid 71 (adenovirus C1)	ATCC VR-1	69.5 $TCID_{50}$/mL	20/20
Adenovirus	Adenoid 6 (adenovirus C2)	ATCC VR-846	28.1 $TCID_{50}$/mL	20/20
Adenovirus	Tonsil 99 (adenovirus C6)	ATCC VR-6	88.8 $TCID_{50}$/mL	20/20
Adenovirus	Adenoid 75 (adenovirus C5)	ATCC VR-5	7331.0 $TCID_{50}$/mL	20/20
Respiratory Syncytial virus A (RSV A)	A2	ATCC VR-1540	12.0 PFU/mL	20/20
Respiratory Syncytial virus A (RSV A)	Long	ATCC VR-26	33.0 PFU/mL	20/20
Respiratory Syncytial virus B (RSV B)	18537	ATCC VR-1580	0.03 PFU/mL	20/20
Respiratory Syncytial virus B (RSV B)†	CH93(18)-18	ZeptoMetrix 0810040CFHI	0.4 $TCID_{50}$/mL	19/20
Human Metapneumovirus (hMPV)	Peru6-2003 (type B2)	ZeptoMetrix 0810159CFHI	0.01 $TCID_{50}$/mL	19/20
Human Metapneumovirus (hMPV)†	hMPV-16, IA10-2003 (A1)	ZeptoMetrix 0810161CFHI	0.5 $TCID_{50}$/mL	20/20
Human Metapneumovirus (hMPV)	hMPV-20, IA14-2003 (A2)	ZeptoMetrix 0810163CFHI	0.4 $TCID_{50}$/mL	19/20
Human Metapneumovirus (hMPV)	hMPV-3, Peru2-2002 (B1)	ZeptoMetrix 0810156CFHI	1479.9 $TCID_{50}$/mL	19/20

Table 6. LoD values obtained for the different respiratory target strains in NPS sample matrix tested with the QIAstat-Dx Respiratory Panel Plus (continued)

Pathogen	Strain	Source	Concentration*	Detection rate
Mycoplasma pneumoniae	M129-B7 (type 1)	ATCC 29342	0.1 CCU/mL	20/20
Mycoplasma pneumoniae†,‡	PI 1428	ATCC 29085	1.0 CCU/mL	20/20
Chlamydophila pneumoniae†	TW183	ATCC VR-2282	14.2 IFU/mL	20/20
Chlamydophila pneumoniae	CWL-029	ATCC VR-1310	120.0 IFU/mL	19/20
Bordetella pertussis†	I028	ATCC BAA-2707	0.3 CFU/mL	19/20
Bordetella pertussis	18323	ATCC 9797	2.6 CFU/mL	19/20

*The highest LoD is reported.

† The LoD has been obtained in clinical matrix.

‡ Pathogen used as representative panel analyte from the original panel (QIAstat-Dx Respiratory Panel Plus, K183597) to confirm LoD with the QIAstat-Dx Respiratory Panel Plus assay.

12.1.3. Exclusivity (analytical specificity)

The analytical specificity study was carried out by in silico analysis and in vitro testing to assess the cross-reactivity and exclusivity of the QIAstat-Dx Respiratory Panel Plus. On-panel organisms were tested to assess the potential for intra-panel cross-reactivity and off-panel organisms were tested to evaluate panel exclusivity. These organisms included those which are related to, but distinct from QIAstat-Dx Respiratory Panel Plus organisms or that could be present in specimens collected from the intended test population. Selected organisms are clinically relevant (colonizing the upper respiratory tract or causing respiratory symptoms), are common skin flora or laboratory contaminants, or are microorganisms by which much of the population may have been infected. Both on-panel and off-panel organisms tested are shown in Table 7a–Table 7e.

Samples were prepared by spiking potential cross-reactive organisms into simulated nasopharyngeal swab sample matrix at the highest concentration possible based on the

organism stock, preferably 10^5 $TCID_{50}$/mL for viral targets and 10^6 CFU/mL for bacterial and fungal targets.

Table 7a. List of analytical specificity pathogens tested (Bacteria, On-Panel)

Pathogen	Strain	Source
C. pneumoniae	TWAR strain TW-183	ATCC VR-2282
	AR-39	ATCC 53592
B. pertussis	E431	ZeptoMetrix 0801460
	18323	ATCC 9797‡
M. pneumoniae	UTMB-10P	ATCC 49894
	M129	ZeptoMetrix 0801579

Table 7b. List of analytical specificity pathogens tested (Virus, On-Panel)

Pathogen	Strain	Source
Influenza A H1N1	A/New Jersey/8/76	ATCC VR-897
	New Cal/20/99	ZeptoMetrix 0810036CFHI‡
Influenza A H3N2	A/Switzerland/971529/2013	ATCC VR-1837
	A/Virginia/ATCC6/2012	ATCC VR-1811
Influenza A H1N1 pdm09	A/California/07/2009 NYMC X-179A	ATCC VR-1884
	A/Virginia/ATCC1/2009	ATCC VR-1736
Influenza B	B/Florida/04/06	ATCC VR-1804
Coronavirus 229E	Not available	ZeptoMetrix 0810229CFHI
	Not available	ZeptoMetrix 0810229CF
	Not available	ATCC VR-740‡
Coronavirus OC43	Not available	ZeptoMetrix 0810024CFHI
	Not available	ATCC VR-1558‡
Coronavirus NL63	Not available	Bei Resources NR-470
Coronavirus HKU1	Not available	QIAGEN S506*
Parainfluenza Virus 1	C35	ATCC VR-94
Parainfluenza Virus 2	Greer	ATCC VR-92
Parainfluenza Virus 3	C 243	ATCC VR-93‡

Table 7b. List of analytical specificity pathogens tested (Virus, On-Panel) (continued)

Pathogen	Strain	Source
Parainfluenza Virus 4	PIV4B PIV4A	ZeptoMetrix 0810060BCFHI ZeptoMetrix 0810060CFHI
Respiratory Syncytial virus	A2 Long	ATCC VR-1540 ATCC VR-26‡
Human Metapneumovirus	A1 (hMPV-16, IA10-2003)	ZeptoMetrix 0810161CFHI#
Adenovirus A12	Huie	ATCC VR-863‡
Adenovirus C	Adenoid 71 (Adenovirus C1)	ATCC VR-1
Adenovirus B	Gomen (Adenovirus B7)	ATCC VR-7
Enterovirus D68	US/IL/14-18952	ATCC VR-1824‡
Rhinovirus	2060 (Type 1A)	ATCC VR-1559‡
Echovirus 6	D-1 (Cox)	ATCC VR-241‡
SARS-CoV–2	Not available	Hospital Clinic S243*

Table 7c. List of analytical specificity pathogens tested (Bacteria, Off-Panel)

Pathogen	Strain	Source
Acetinobacter calcoaceticus	Z160	ZeptoMetrix 0804096
Bordetella avium	Z338	ZeptoMetrix 0804316
Bordetella bronchiseptica	NRRL B-140	ATCC 4617
Bordetella hinzii	Not available LMG 13501	Vircell MC089 ATCC 51783
Bordetella holmesii	CDC F5101 F061	ATCC 51541 ZeptoMetrix 0801464
Bordetella parapertussis	A747	ZeptoMetrix 0801461
Chlamydia trachomatis	BOUR	ATCC VR-348-B
Corynebacterium diphteriae	48255 Z116	ATCC 11913‡ ZeptoMetrix 0801882
Enterobacter aerogenes	NCDC 819-56 Z052	ATCC 13048 ZeptoMetrix 0801518

Table 7c. List of analytical specificity pathogens tested (Bacteria, Off-Panel) (continued)

Pathogen	Strain	Source
Escherichia coli (0157)	O157:H7; EDL933	ZeptoMetrix 0801622
Haemophilus influenzae	L-378 AMC 36-A-7 AMC 36-A-1	ATCC 49766 ATCC 8142‡ ATCC 10211‡
Klebsiella oxytoca	LBM 90.11.033	ATCC 700324
Klebsiella pneumoniae	NCTC 9633 [NCDC 29853, NCDC 41068]	ATCC 13883
Lactobacillus acidophilus	Scav [IFO 13951, M. Rogosa 210X, NCIB 8690, P.A. Hansen L 917]	ATCC 4356
Lactobacillus plantarum	17-5	ZeptoMetrix 0801507
Legionella bozemanii	CIP 103872 (ATCC 33217; CCUG 11880; NCTC 11368)	CECT 7276
Legionella dumofii	CCUG 11881 (ATCC 33279; CCUG 11881; CIP 103876; NCTC 11370; strain NY 23)	CECT 7349
Legionella feeleii	Not available Ly166.96	Vircell MC092 ATCC 700514
Legionella longbeacheae	Long Beach 4	ZeptoMetrix 0801577
Legionella micdadei	Tatlock	ZeptoMetrix 0801576
Legionella pneumophila	Philadelphia-1 Philadelphia	ATCC 33152‡ ZeptoMetrix 0801645‡
Legionella pneumophila	Los Angeles-1	ATCC 33156‡
Moraxella catarrhalis (Branhamella catarrhalis)	N9 [P. Baumann N4] Ne 11 [CCUG 353, LMG 11192, NCTC 11020]	ATCC 25240 ATCC 25238
Mycobacterium tuberculosis§	Not available	ATCC 25177DQ
Mycoplasma genitalium	SEA-1	ZeptoMetrix 0804094-I
Mycoplasma hominis	Not available Z317	ATCC 27545 ZeptoMetrix 080411

Table 7c. List of analytical specificity pathogens tested (Bacteria, Off-Panel) (continued)

Pathogen	Strain	Source
Mycoplasma orale	CH 19299 [NCTC 10112]	ATCC 23714
Neisseria elongata	Z071	ZeptoMetrix 0801510
Neisseria gonorrhoeae	Z017	ZeptoMetrix 0801482
Neisseria meningitidis	Serogroup Y FAM18 Serogroup A	ATCC 35561 ATCC 700532DQ ATCC 13077‡
Proteus mirabilis	Z050 LRA 08 01 73 [API SA, DSM 6674]	ZeptoMetrix 0801544 ATCC 35659
Pseudomonas aeruginosa	PRD-10 [CIP 103467, NCIB 10421, PCI 812]	ATCC 15442‡
Serratia marcescens	PCI 1107	ATCC 14756
Staphylococcus aureus	Subsp. Aureus, FDA 209	ATCC CRM-6538‡
Staphylococcus epidermidis	FDA strain PCI 1200	ATCC 12228
Staphylococcus epidermidis	Fussel	ATCC 14990‡
Stenotrophomonas maltophilia	810-2 [MDB strain BS 1640, NCIB 9203, NCPPB 1974, NCTC 10257, NRC 729, R.Y. Stanier 67, RH 1168]	ATCC 13637
Streptococcus agalactiae	Z2019 NCTC 8181 [G19]	ZeptoMetrix 0801545 ATCC 13813
Streptococcus pneumoniae	Z022, 19F	ZeptoMetrix 0801439#
Streptococcus pyogenes	Lancefield's group A/C203 S Z018	ATCC 14289 ZeptoMetrix 0801512
Streptococcus salivarius	C699 [S30D]	ATCC 13419‡
Streptococcus salivarius	Z127	ZeptoMetrix 0801896‡
Ureaplasma urealyticum	T-strain 960 (CX8) [960, CIP 103755, NCTC 10177]	ATCC 27618

Table 7d. List of analytical specificity pathogens tested (Virus, Off-Panel)

Pathogen	Strain	Source
Bocavirus	Type 1	Kansas University*
Cytomegalovirus	Towne AD-169	ZeptoMetrix 0810499CFHI‡ ZeptoMetrix NATCMV-0005
Epstein-Barr Virus	B958	ATCC VR-1492PQ
Herpes Simplex Virus 1	ATCC-20111	ATCC VR-1778/ VR-1789‡
Herpes Simplex Virus 2	ATCC-2011-2	ATCC VR-1779/ VR-734
Measles Virus	Edmonston	ATCC VR-24
Middle East Respiratory Syndrome (MERS) Coronavirus	England-1 Not available	Vircell MC121 ATCC VR-3248SD
Mumps	Enders	ATCC VR-106
Severe Acute Respiratory Syndrome (SARS)	Not available	IDT (gBlocks)†

Table 7e. List of analytical specificity pathogens tested (Fungus, Off-Panel)

Pathogen	Strain	Source
Aspergillus Flavus	Z013 Harvard 997	ZeptoMetrix 0801598 Vircell MC064
Aspergillus fumigatus	Z014 MCV-C#10	ZeptoMetrix 0801716 Vircell MBC002
Candida albicans	3147 [CBS 6431, CCY 29-3-106, CIP 48.72, DSM 1386, IFO 1594, NCPF 3179, NCYC 1363, NIH 3147, VTT C-85161]	ATCC CRM-10231
Candida albicans	CBS 562	ATCC 18804‡
Cryptococcus neoformans	CBS 132 [CCRC 20528, DBVPG 6010, IFO 0608, NRRL Y2534]	ATCC 32045

*Clinical sample obtained in STAT-Dx Life, S.L (a QIAGEN company) (HKU1), Kansas University, US (Bocavirus), and Hospital Clinic, Barcelona (SARS-CoV-2).

† Artificial genomic fragments were used for SARS.

‡ Pathogen tested in combination with SARS-CoV-2 at 3xLoD resulting in no impact on assay performance.

§ *Mycobacterium tuberculosis* genomic DNA tested

All on-panel pathogens resulted in specific detection, and all off-panel pathogens tested showed a negative result and no cross-reactivity was observed in the QIAstat-Dx Respiratory Panel Plus.

The only exception is *Bordetella* species (*Bordetella holmesii* and *Bordetella bronchiseptica*). The target gene used for *Bordetella pertussis* detection (insertion element IS481) is a transposon also present in other *Bordetella* species (19,20), and a certain level of cross-reactivity was predicted by preliminary sequence analysis (21) and was observed when high concentrations of *Bordetella holmesii* and some strains of *Bordetella bronchiseptica* were tested. In accordance with the CDC guidelines for assays that use the IS481 as a target region, when using the QIAstat-Dx Respiratory Panel Plus if the Ct value for *Bordetella pertussis* is Ct>29, a confirmatory specificity test is recommended. No cross-reactivity was observed with *Bordetella parapertussis* at high concentrations.

12.1.4. Inclusivity (analytical reactivity)

The Analytical Reactivity (Inclusivity) study was performed to analyze the detection of a variety of strains that represent the genetic diversity of each respiratory panel target organism ("Inclusivity Strains").

A total of 131 inclusivity strains were included in the study, representative of the species/types of the different organisms (e.g., a range of Influenza A strains isolated from different geographical areas and in different calendar years were included). Results of the Inclusivity Strains wet testing are shown in Table 8.

Table 8. List of inclusivity strains tested

Pathogen	Subtype/ Serotype	Strain	Source	x LoD detected	QIAstat-Dx result
Influenza A	H1N1	A/Brisbane/59/07	ZeptoMetrix 0810244CFHI*	1x LoD	Influenza A H1
		A/New Caledonia/20/99	ZeptoMetrix 0810036CFHI†	0.3x LoD	Influenza A H1
		A/New Jersey/8/76	ATCC VR-897	1x LoD	Influenza A H1
		A/Denver/1/57	ATCC VR-546	0.1x LoD	Influenza A H1
		A/Mal/302/54	ATCC VR-98	1x LoD	Influenza A H1
		A/Weiss/43	ATCC VR-96	0.1x LoD	Influenza A H1
		A/PR/8/34	ATCC VR-1469	3x LoD	Influenza A H1
		A/Fort Monmouth/1/1947	ATCC VR-1754	0.1x LoD	Influenza A H1
		A/WS/33	ATCC VR-1520	0.1x LoD	Influenza A H1
		A/Swine/Iowa/15/1930	ATCC VR-333	1x LoD	Influenza A H1

Table 8. List of inclusivity strains tested (continued)

Pathogen	Subtype/ Serotype	Strain	Source	x LoD detected	QIAstat-Dx result
Influenza A	H3N2	A/Virginia/ATCC6/2012	ATCC VR-1811†	1x LoD	Influenza A H3
		A/Port Chalmers/1/73	ATCC VR-810*	1x LoD	Influenza A H3
		A/Wisconsin/67/2005	ZeptoMetrix 0810252CFHI†	1x LoD	Influenza A H3
		A/Wisconsin/15/2009	ATCC VR-1882	1x LoD	Influenza A H3
		A/Victoria/3/75	ATCC VR-822	1x LoD	Influenza A H3
		A/Aichi/2/68	ATCC VR-1680	10x LoD	Influenza A H3
		A/Hong Kong/8/68	ATCC VR-1679	10x LoD	Influenza A H3
		A/Alice (recombinant, carries A/England/42/72)	ATCC VR-776	10x LoD	Influenza A H3
		MRC-2 (recombinant A/England/42/72 and A/PR/8/34 strains)	ATCC VR-777	100x LoD	Influenza A H3
		A/Switzerland/9715293/2013	ATCC VR-1837	1x LoD	Influenza A H3
Influenza A	H1N1 pdm09	A/Virginia/ATCC1/2009	ATCC VR-1736*	1x LoD	Influenza A H1N1 pdm09
		A/SwineNY/03/2009	ZeptoMetrix 0810249CFHI†	1x LoD	Influenza A H1N1 pdm09
		A/Virginia/ATCC2/2009	ATCC VR-1737	0.1x LoD	Influenza A H1N1 pdm09

Table 8. List of inclusivity strains tested (continued)

Pathogen	Subtype/ Serotype	Strain	Source	x LoD detected	QIAstat-Dx result
		A/Virginia/ATCC3/2009	ATCC VR-1738	100x LoD	Influenza A H1N1 pdm09
		Swine NY/01/2009	ZeptoMetrix 0810248CFHI	0.3x LoD	Influenza A H1N1 pdm09
		Swine NY/02/2009	ZeptoMetrix 0810109CFNHI	10x LoD	Influenza A H1N1 pdm09
		A/California/07/2009 NYMC X-179A	ATCC VR-1884	0.1x LoD	Influenza A H1N1 pdm09
		Canada/6294/09	ZeptoMetrix 0810109CFJHI	3x LoD	Influenza A H1N1 pdm09
		Mexico/4108/09	ZeptoMetrix 0810166CFHI	0.1x LoD	Influenza A H1N1 pdm09
		Netherlands/2629/2009	BEI Resources NR-19823	0.3x LoD	Influenza A H1N1 pdm09

Table 8. List of inclusivity strains tested (continued)

Pathogen	Subtype/ Serotype	Strain	Source	x LoD detected	QIAstat-Dx result
Influenza A	H1N2‡	Recombinant Kilbourne F63, A/NWS/1934 (HA) x A/Rockefeller Institute/5/1957 (NA) (nucleic acids)	BEI Resources NR-9677	100x LoD	Influenza A H1
	H2N2‡	Japan/305/1957 (nucleic acid)	BEI Resources NR-2775	1x LoD	Influenza A
		Korea/426/1968 x Puerto Rico/8/1934 (nucleic acid)	BEI Resources NR-9679	0.3x LoD	Influenza A
	H2N3‡	Genomic RNA from Influenza A Virus, A/duck/Germany/1215/1973 (H2N3) (nucleic acid)	BEI Resources	Not applicable§	Influenza A
	H5N2‡	Genomic RNA from Influenza A Virus, A/duck/Pennsylvania/10218/1984 (H5N2) (nucleic acid)	BEI Resources	Not applicable§	Influenza A
	H5N3‡	A/Duck/Singapore/645/1997 (nucleic acid)	BEI Resources NR-9682	1x LoD	Influenza A
	H7N7‡	Genomic RNA from Influenza A Virus, A/equine/Prague/1956 (H7N7) (nucleic acid)	BEI Resources	Not applicable§	Influenza A
	H10N7‡	Chicken/Germany/N/49 (nucleic acid)	BEI Resources NR-2765	10x LoD	Influenza A
Influenza B	Not Available	B/Virginia/ATCC5/2012	ATCC VR-1807*	1x LoD	Influenza B
		B/FL/04/06	ATCC VR-1804†	1x LoD	Influenza B

Table 8. List of inclusivity strains tested (continued)

Pathogen	Subtype/ Serotype	Strain	Source	x LoD detected	QIAstat-Dx result
		B/Taiwan/2/62	ATCC VR-295†	0.3x LoD	Influenza B
		B/Allen/45	ATCC VR-102	Not detected	Negative**
		B/Hong Kong/5/72	ATCC VR-823	Not detected	Negative**
		B/Maryland/1/59	ATCC VR-296	0.1x LoD	Influenza B
		B/GL/1739/54	ATCC VR-103	1x LoD	Influenza B
		B/Wisconsin/1/2010	ATCC VR-1883	0.1x LoD	Influenza B
		B/Massachusetts/2/2012	ATCC VR-1813	3x LoD	Influenza B
		B/Florida/02/06	ZeptoMetrix 0810037CFHI	Impaired detectability	Influenza B or negative††
		B/Brisbane/60/2008	BEI Resources NR-42005	0.1x LoD	Influenza B
		B/Malaysia/2506/2004	BEI Resources NR-9723	0.3x LoD	Influenza B
Coronavirus 229E	Not available	Not available	ATCC VR-740	0.3x LoD	Coronavirus 229
		Not available	ZeptoMetrix 0810229CFHI*	1x LoD	Coronavirus 229
Coronavirus OC43	Not available	Not available	ATCC VR-1558*	1x LoD	Coronavirus OC43
		Not available	ZeptoMetrix 0810024CFHI	1x LoD	Coronavirus OC43

Table 8. List of inclusivity strains tested (continued)

Pathogen	Subtype/ Serotype	Strain	Source	x LoD detected	QIAstat-Dx result
Coronavirus NL63	Not available	Not available	ZeptoMetrix 0810228CFHI*	1x LoD	Coronavirus NL63
		Not available	BEI Resources NR-470	1x LoD	Coronavirus NL63
Coronavirus HKU1	Not available	Not available	ZeptoMetrix NATRVP-IDI*	1x LoD	Coronavirus HKU1
		Not available	QIAGEN Barcelona‡‡ S510	3x LoD	Coronavirus HKU1
		Not available	QIAGEN Barcelona‡‡ S501	1x LoD	Coronavirus HKU1
		Not available	QIAGEN Barcelona‡‡S496	1x LoD	Coronavirus HKU1
Parainfluenza Virus 1	Not available	C35	ATCC VR-94†	1x LoD	Parainfluenza Virus 1
		Not available	ZeptoMetrix 0810014CFHI*	1x LoD	Parainfluenza Virus 1
		Not available	ZeptoMetrix NATRVP-IDI	10x LoD	Parainfluenza Virus 1

Table 8. List of inclusivity strains tested (continued)

Pathogen	Subtype/ Serotype	Strain	Source	x LoD detected	QIAstat-Dx result
Parainfluenza Virus 2	Not available	Greer	ATCC VR-92*	1x LoD	Parainfluenza Virus 2
		Not available	ZeptoMetrix 0810015CFHI†	0.3x LoD	Parainfluenza Virus 2
		Not available	ZeptoMetrix 0810504CFHI	0.1x LoD	Parainfluenza Virus 2
Parainfluenza Virus 3	Not available	C 243	ATCC VR-93†	1x LoD	Parainfluenza Virus 3
		Not available	ZeptoMetrix 0810016CFHI*	1x LoD	Parainfluenza Virus 3
		Not available	ZeptoMetrix NATRVP-IDI	0.1x LoD	Parainfluenza Virus 3
Parainfluenza Virus 4	A	M-25	ATCC VR-1378*	1x LoD	Parainfluenza Virus 4
		Not available	ZeptoMetrix 0810060CFHI	0.1x LoD	Parainfluenza Virus 4
	B	Not available	ZeptoMetrix 0810060BCFHI†	0.3x LoD	Parainfluenza Virus 4
		CH 19503	ATCC VR-1377	0.3x LoD	Parainfluenza Virus 4

Table 8. List of inclusivity strains tested (continued)

Pathogen	Subtype/ Serotype	Strain	Source	x LoD detected	QIAstat-Dx result
Respiratory Syncytial Virus	A	A2	ATCC VR-1540†	0.3x LoD	Respiratory Syncytial Virus A+B
		Long	ATCC VR-26†	1x LoD	Respiratory Syncytial Virus A+B
		Not available	ZeptoMetrix 0810040ACFHI	0.1x LoD	Respiratory Syncytial Virus A+B
	B	18537	ATCC VR-1580†*	1x LoD	Respiratory Syncytial Virus A+B
		CH93(18)-18	ZeptoMetrix 0810040CFHI†	1x LoD	Respiratory Syncytial Virus A+B
		B WV/14617/85	ATCC VR-1400	1x LoD	Respiratory Syncytial Virus A+B

Table 8. List of inclusivity strains tested (continued)

Pathogen	Subtype/ Serotype	Strain	Source	x LoD detected	QIAstat-Dx result
Human Metapneumovirus	A1	IA10-2003	ZeptoMetrix 0810161CFHI*	1x LoD	Human Metapneumovirus A+B
		IA3-2002	ZeptoMetrix 0810160CFHI	3x LoD	Human Metapneumovirus A+B
	A2	IA14-2003	ZeptoMetrix 0810163CFHI†	1x LoD	Human Metapneumovirus A+B
		IA27-2004	ZeptoMetrix 0810164CFHI	1x LoD	Human Metapneumovirus A+B
	B1	Peru2-2002	ZeptoMetrix 0810156CFHI†	1x LoD	Human Metapneumovirus A+B
		Peru3-2003	ZeptoMetrix 0810158CFHI	1x LoD	Human Metapneumovirus A+B

Table 8. List of inclusivity strains tested (continued)

Pathogen	Subtype/ Serotype	Strain	Source	x LoD detected	QIAstat-Dx result
	B2	Peru6-2003	ZeptoMetrix 0810159CFHI†	1x LoD	Human Metapneumovirus A+B
		IA18-2003	ZeptoMetrix 0810162CFHI	1x LoD	Human Metapneumovirus A+B
		Peru1-2002	ZeptoMetrix 0810157CFHI	10x LoD	Human Metapneumovirus A+B
Adenovirus A	12	Not available	ATCC VR-863	0.3x LoD	Adenovirus
Adenovirus B	3	GB	ATCC VR-3†	0.3x LoD	Adenovirus
	7	Not available	ATCC VR-7	0.1x LoD	Adenovirus
	11	Not available	ATCC VR-12	10x LoD	Adenovirus
	21	Not available	ATCC VR-256	0.3x LoD	Adenovirus
	34	Not available	ATCC VR-716	0.3x LoD	Adenovirus
	35	Not available	ATCC VR-718	0.3x LoD	Adenovirus
Adenovirus C	1	Adenoid 71	ATCC VR-1†	1x LoD	Adenovirus
	2	Adenoid 6	ATCC VR-846†	0.3x LoD	Adenovirus
	5	Adenoid 75	ATCC VR-5†	0.3x LoD	Adenovirus
	6	Tonsil 99	ATCC VR-6*	1x LoD	Adenovirus

Table 8. List of inclusivity strains tested (continued)

Pathogen	Subtype/ Serotype	Strain	Source	x LoD detected	QIAstat-Dx result
Adenovirus D	8	Not available	ATCC VR-1815	0.3x LoD	Adenovirus
Adenovirus E	4	RI-67	ATCC VR-1572†	0.3x LoD	Adenovirus
Adenovirus F	40	Not available	ATCC VR-931	0.1x LoD	Adenovirus
	41	Not available	ATCC VR-930	3x LoD	Adenovirus
Enterovirus A	EV-A71	Not available	ATCC VR-1432	1x LoD	Rhinovirus/ Enterovirus
	CV-A10	Not available	ATCC VR-168	10x LoD	Rhinovirus/ Enterovirus
Enterovirus B	E-6	D-1 (Cox)	ATCC VR-241†	0.3x LoD	Rhinovirus/ Enterovirus
	E-11	Not available	ATCC VR-41	10x LoD	Rhinovirus/ Enterovirus
	E-30	Not available	ATCC VR-1660	1x LoD	Rhinovirus/ Enterovirus
	CV-A9	Not available	ATCC VR-1311	0.3x LoD	Rhinovirus/ Enterovirus
	CV-B1	Not available	ATCC VR-28	0.3x LoD	Rhinovirus/ Enterovirus
	CV-B2	Not available	ATCC VR-29	3x LoD	Rhinovirus/ Enterovirus

Table 8. List of inclusivity strains tested (continued)

Pathogen	Subtype/ Serotype	Strain	Source	x LoD detected	QIAstat-Dx result
	CV-B3	Not available	ATCC VR-30	0.3x LoD	Rhinovirus/ Enterovirus
	E-17	Not available	ATCC VR-47	10x LoD	Rhinovirus/ Enterovirus
Enterovirus C	CV-A21	Not available	ATCC VR-850	10x LoD	Rhinovirus/ Enterovirus
Enterovirus D	EV-D68	/US/IL/14-18952	ATCC VR-1824*	1x LoD	Rhinovirus/ Enterovirus
Rhinovirus A	1	2060	ATCC VR-1559†	0.1x LoD	Rhinovirus/ Enterovirus
	2	HGP	ATCC VR-482†	1x LoD	Rhinovirus/ Enterovirus
	16	11757	ATCC VR-283†	0.3x LoD	Rhinovirus/ Enterovirus
Rhinovirus B	14	1059	ATCC VR-284*	1x LoD	Rhinovirus/ Enterovirus
	3	Not available	ATCC VR-483	1x LoD	Rhinovirus/ Enterovirus
	17	Not available	ATCC VR-1663	3x LoD	Rhinovirus/ Enterovirus
SARS-CoV-2§§	Not available	WHO reference material	NIBSC 20/146	1x LoD	SARS-CoV-2

Table 8. List of inclusivity strains tested (continued)

Pathogen	Subtype/ Serotype	Strain	Source	x LoD detected	QIAstat-Dx result
M. pneumoniae	1	M129-B7	ATCC 29342†	1x LoD	*Mycoplasma pneumoniae*
	1	PI 1428	ACC 29085*	1x LoD	*Mycoplasma pneumoniae*
	2	Not available	ATCC 15531	0.1x LoD	Mycoplasma pneumoniae
B. pertussis	Not available	I028	ATCC BAA-2707*	1x LoD	*Bordetella pertussis*
		19323	ATCC 9797†	1x LoD	*Bordetella pertussis*
		Not available	ATCC 10380	0.3x LoD	*Bordetella pertussis*
C. pneumoniae	Not available	TW183	ATCC VR-2282*	1x LoD	*Chlamydophila pneumoniae*
		CWL-029	ATCC VR-1310†	1x LoD	*Chlamydophila pneumoniae*

Table 8. List of inclusivity strains tested (continued)

Pathogen	Subtype/ Serotype	Strain	Source	x LoD detected	QIAstat-Dx result
		Not available	ATCC 53592	0.3x LoD	*Chlamydophila pneumoniae*

*Strains tested in LoD and used for calculation of sensitivity level (X times LoD)

† Strains tested in LoD study.

‡ For all non-human Flu A strains, Influenza A/Brisbane/59/07 (ZeptoMetrix, 0810244CFHI) taken as reference strain to calculate the x-fold LoD detected.

§ Three non-human Flu A strains were not available for in vitro testing, and analysis was performed in silico.

** Both Flu B strains are derivative from B/Lee/40 ancestral lineage, currently not in circulation.

†† Impaired detectability. In silico analysis supports detectability.

‡‡ Clinical sample obtained in STAT-Dx Life, S.L , Spain (HKU1).

§§ SARS-CoV-2 WHO reference material was tested in laboratory as representative strain. Additional analysis was run for SARS-CoV-2 to cover all variants and lineages.

In addition, in silico analysis was done to characterize inclusivity coverage of on-panel pathogens against available genomic sequences in publicly available databases.

SARS-CoV-2 in silico evaluation included a total of 8,118,241 available genomes (since the beginning of the SARS-CoV-2 outbreak (January 01, 2020 until May 06, 2022) extracted from GISAID data base. This period includes all major SARS-CoV-2 lineages (Variants of Concern *Alpha*, *Beta*, *Gamma*, *Delta*, and *Omicron*; together with Variants of Interest *Lambda* and *Mu*). 7,932,071 (97.71%) of the analyzed sequence genomes showed no evidence of mismatches among the assay's oligonucleotides binding region. For the rest of analyzed genomes, only 19,045 (0.23%) presented any mismatch with potentially critical impact in assay performance with a prevalence of >0.2%. Laboratory validation of those mismatches was performed at LoD level using artificial genomic fragments including corresponding mutations, confirming no loss of performance. As a conclusion, QIAstat-Dx Respiratory Panel Plus was inclusive for all analyzed SARS-CoV-2 genomes, including all known variants, lineages and sublineages. Additional analysis was also performed to include SARS-CoV-2 genomic sequences available until July 07, 2023, with no additional critical mismatch found. New sequences and variants are periodically monitored for potential impact on the QIAstat-Dx Respiratory Panel Plus performance. Refer to QIAGEN website for most recent data (**https://www.qiagen.com/us/applications/infectious-disease/coronavirus**).

For those on-panel organisms with known biological subtype differentiation, coverage was also analyzed. Inclusivity for Influenza A (Table 9), Rhinovirus/Enterovirus (Table 10), and Adenovirus (Table 11) were evaluated based on sequences available in GenBank database. In all cases, the QIAstat-Dx Respiratory Panel Plus was to detect all described types or subtypes.

For all other organisms, a BLAST-based homology analysis also confirmed that all available target sequences in GenBank database are predicted to be detected. This applies to Influenza B (Victoria and Yamagata lineages), Coronavirus 229E, Coronavirus OC43, Coronavirus NL63, Coronavirus HKU1, PIV1, PIV2, PIV3, PIV4 (including PIV4a and PIV4b), RSV (including RSVA and RSVB) hMPV (including hMPVA1, hMPVA2, hMPB1, and hMPVB2 subtypes), *Mycoplasma pneumoniae*, *Chlamydophila pneumoniae*, and *Bordetella pertussis*.

Table 9. Inclusivity of General Influenza A assay

Detected by BLAST/Sequence alignment*

H/N serotype combination	N1	N2	N3	N4	N5	N6	N7	N8	N9
H1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
H2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
H3	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
H4	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
H5	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
H6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
H7	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
H8	Yes	Yes	Yes	Yes	N/A	Yes	N/A	Yes	N/A
H9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
H10	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
H11	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
H12	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
H13	N/A	Yes	Yes	N/A	N/A	Yes	N/A	Yes	Yes
H14	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A
H15	N/A	N/A	N/A	Yes	Yes	Yes	Yes	N/A	Yes
H16	N/A	N/A	Yes	N/A	N/A	N/A	N/A	Yes	Yes

*N/A: not applicable (no sequences available in Genbank database).

Table 10. Inclusivity of Rhinovirus/Enterovirus assay

HRV/HEV subtype	Detected by BLAST/Sequence alignment*
Enterovirus A	• Coxsackievirus A10, A12, A14, A16, A2, A3, A4, A5, A6, A7, A8 • Enterovirus A114, A119, A120, A121, A123, A124, A125, A71, A76, A89, A90, A91, A92 • Simian Enterovirus 19
Enterovirus B	• Coxsackievirus A9, B1, B2, B3, B4, B5, B6 • Echovirus E1, E11, E12, E13, E14, E15, E16, E17, E18, E19, E2, E20, E21, E24, E25, E26, E27, E29, E3, E30, E31, E32, E33, E4, E5, E6, E7, E8, E9 • Enterovirus B100, B101, B106, B107, B110, B111, B69, B73, B74, B75, B77, B79, B80, B81, B82, B83, B84, B85, B86, B87, B88, B93, B97, B98 • Enterovirus Yanbian 96-83csf, Yanbian 96-85csf, Simian agent 5, Swine vesicular disease virus
Enterovirus C	• Coxsackievirus A1, A11, A13, A15, A17, A18, A19, A20, A21, A22, A24 • Enterovirus C102, C104, C105, C109, C113, C116, C117, C118, C95, C96, C99 • Human poliovirus 1, 2, 3
Rhinovirus A	• Human rhinovirus A44, A95 • Rhinovirus A1, A10, A100, A101, A103, A105, A106, A11, A12, A13, A15, A16, A18, A19, A1B, A2, A20, A21, A22, A23, A24, A25, A28, A29, A30, A31, A32, A33, A34, A36, A38, A39, A40, A41, A43, A45, A46, A47, A49, A50, A51, A53, A54, A55, A56, A57, A58, A59, A60, A61, A62, A63, A64, A65, A66, A67, A68, A7, A71, A73, A74, A75, A76, A77, A78, A8, A80, A81, A82, A85, A88, A89, A9, A90, A94, A96, A98
Rhinovirus C	• Rhinovirus C1, C11, C13, C15, C17, C19, C2, C20, C23, C26, C27, C28, C3, C30, C31, C32, C33, C34, C35, C36, C4, C40. C41, C43, C44, C47, C5, C50, C51, C53, C54, C55, C56, C6, C7, C8, C9

*Rest of Rhinovirus/Enterovirus strains not included in table correspond to no target gene sequences available to corroborate positive detection.

Table 11. Inclusivity of Adenovirus assay

Adenovirus subtype	Detected by BLAST/Sequence alignment
Adenovirus A	• Human Adenovirus A12, A18, A31, A61
Adenovirus B	• Human Adenovirus B3, B3+11p, B3+7, B7, B11, B50, B55, B1, B2
Adenovirus C	• Human Adenovirus C1, C2, C5, C6, C57

Table 11. Inclusivity of Adenovirus assay (continued)

Adenovirus subtype	Detected by BLAST/Sequence alignment
Adenovirus D	• Human Adenovirus D15, D15/H9, D17, D19, D20, D22, D23, D24, D25, D26, D27, D28, D29, D30, D32, D33, D36, D38, D39, D42, D43, D44, D45, D46, D47, D48, D49, D51, D53, D54, D58, D60a, D62, D63, D64, D65, D67, D69, D71, D81, D10, D13, D37, D8, D9
Adenovirus E	• Human Adenovirus E4 • Simian Adenovirus 23, 24, 25, 26, 30, 36, 37, 38, 39, E22 • Chimpanzee adenovirus Y25, Gorilla gorilla adenovirus E1
Adenovirus F	• Adenovirus F40, F41
Adenovirus G	• Adenovirus G52

Based on wet testing and in silico analysis, the QIAstat-Dx Respiratory Panel Plus primers and probes are predicted to be inclusive for clinically prevalent and relevant strains for each pathogen.

12.1.5. Reproducibility

Reproducibility testing of contrived samples was performed at three test sites including one internal site (site 1) and two external sites (site 2 and site 3). The study incorporated a range of potential variation introduced by sites, days, replicates, cartridge lots, operators, and QIAstat-Dx Analyzers. For each site, testing was performed across 5 days with 4 replicates per day (leading to a total of 20 replicates per target, concentration, and site), a minimum of 2 different QIAstat-Dx Analyzers per site, and at least 2 operators on each testing day. A total of 12 sample mixes were prepared with at least 3 replicates tested per sample mix. Each pathogen was spiked into HeLa in UTM combined samples in a final concentration of 0.1x LoD, 1x LoD, or 3x LoD, respectively. Table 12 summarizes the results for 0.1x LoD concentration where it is observed that the detection rate for 24 of the 24 targets was <95%.

Table 12. Detection rate per target at 0.1x LoD concentration for each site of reproducibility study and 2-sided 95% Confidence Interval by target.

Target (0.1x LoD)	Site	Detection rate (# positive)	% detection rate (# positive)	95% Confidence Interval (%)
Adenovirus (ATCC VR-3)	SITE 1	10/20	50.0	29.9–70.1
	SITE 2	9/19	47.4	27.3–68.3
	SITE 3	10/19	52.6	31.7–72.7
	All sites (overall)	29/58	50.0	37.5–62.5
B. pertussis (BAA-2707)	SITE 1	9/20	45.0	25.8–65.8
	SITE 2	7/19	36.8	19.1–59.0
	SITE 3	9/20	45.0	25.8–65.8
	All sites (overall)	25/59	42.4	30.6–55.1
C. pneumoniae (ATCC VR-2282)	SITE 1	11/20	55.0	34.2–74.2
	SITE 2	11/19	57.9	36.3–76.9
	SITE 3	14/20	70.0	48.1–85.5
	All sites (overall)	36/59	61.0	48.3–72.4
Coronavirus 229E (ATCC VR-740)	SITE 1	9/20	45.0	25.8–65.8
	SITE 2	12/19	63.2	41.0–80.9
	SITE 3	5/20	25.0	11.2–46.9
	All sites (overall)	26/59	44.1	32.2–56.7

Table 12. Detection rate per target at 0.1x LoD concentration for each site of reproducibility study and 2-sided 95% Confidence Interval by target. (continued)

Target (0.1x LoD)	Site	Detection rate (# positive)	% detection rate (# positive)	95% Confidence Interval (%)
Coronavirus HKU1 (NATRVP-IDI)	SITE 1	17/20	85.0	64.0–94.8
	SITE 2	10/19	52.6	31.7–72.7
	SITE 3	9/20	45.0	25.8–65.8
	All sites (overall)	36/59	61.0	48.3–72.4
Coronavirus NL63 (0810228CFHI)	SITE 1	13/20	65.0	43.3–81.9
	SITE 2	12/19	63.2	41.0–80.9
	SITE 3	14/19	73.7	51.2–88.2
	All sites (overall)	39/58	67.2	54.4–77.9
Coronavirus OC43 (ATCC VR-1558)	STAT	13/20	65.0	43.3–81.9
	SITE 2	15/20	75.0	53.1–88.8
	SITE 3	15/20	75.0	53.1–88.8
	All sites (overall)	43/60	71.7	59.2–81.5
Enterovirus (ATCC VR-1824)	SITE 1	8/20	40.0	21.9–61.3
	SITE 2	6/19	31.6	15.4–54.0
	SITE 3	7/20	35.0	18.1–56.7
	All sites (overall)	21/59	35.6	24.6–48.3

Table 12. Detection rate per target at 0.1x LoD concentration for each site of reproducibility study and 2-sided 95% Confidence Interval by target. (continued)

Target (0.1x LoD)	Site	Detection rate (# positive)	% detection rate (# positive)	95% Confidence Interval (%)
Human Metapneumovirus (0810161CF)	SITE 1	6/20	30.0	14.5–51.9
	SITE 2	9/19	47.4	27.3–68.3
	SITE 3	9/20	45.0	25.8–65.8
	All sites (overall)	24/59	40.7	29.1–53.4
Influenza A (0810249CFHI)	SITE 1	19/20	95.0	76.4–99.1
	SITE 2	18/20	90.0	69.9–97.2
	SITE 3	20/20	100	83.9–100
	All sites (overall)	57/60	95.0	86.3–98.3
Influenza A (ATCC VR-810)	SITE 1	10/20	50.0	29.9–70.1
	SITE 2	9/19	47.4	27.3–68.3
	SITE 3	16/19	84.2	62.4–94.5
	All sites (overall)	35/58	60.3	47.5–71.9
Influenza A (ATCC VR-897)	SITE 1	14/20	70.0	48.1–85.5
	SITE 2	9/19	47.4	27.3–68.3
	SITE 3	12/20	60.0	38.7–78.1
	All sites (overall)	35/59	59.3	46.6–70.9

Table 12. Detection rate per target at 0.1x LoD concentration for each site of reproducibility study and 2-sided 95% Confidence Interval by target. (continued)

Target (0.1x LoD)	Site	Detection rate (# positive)	% detection rate (# positive)	95% Confidence Interval (%)
Influenza A H1 (ATCC VR-897)	SITE 1	13/20	65.0	43.3–81.9
	SITE 2	13/19	68.4	46.0–84.6
	SITE 3	15/20	75.0	53.1–88.8
	All sites (overall)	41/59	69.5	56.9–79.7
Influenza B (ATCC VR-295)	SITE 1	7/20	35.0	18.1–56.7
	SITE 2	9/19	47.4	27.3–68.3
	SITE 3	8/20	40.0	21.9–61.3
	All sites (overall)	24/59	40.7	29.1–53.4
Influenza H1N1 pdm09 (0810249CFHI)	SITE 1	14/20	70.0	48.1–85.5
	SITE 2	16/20	80.0	58.4–91.9
	SITE 3	15/20	75.0	53.1–88.8
	All sites (overall)	45/60	75.0	62.8–84.2
Influenza H3 (ATCC VR-810)	SITE 1	13/20	65.0	43.3–81.9
	SITE 2	16/19	84.2	62.4–94.5
	SITE 3	17/19	89.5	68.6–97.1
	All sites (overall)	46/58	79.3	67.2–87.7

Table 12. Detection rate per target at 0.1x LoD concentration for each site of reproducibility study and 2-sided 95% Confidence Interval by target. (continued)

Target (0.1x LoD)	Site	Detection rate (# positive)	% detection rate (# positive)	95% Confidence Interval (%)
M. pneumoniae (29085)	SITE 1	13/20	65.0	43.3–81.9
	SITE 2	14/20	70.0	48.1–85.5
	SITE 3	14/20	70.0	48.1–85.5
	All sites (overall)	41/60	68.3	55.8–78.7
Parainfluenza Virus 1 (0810014CFHI)	SITE 1	14/20	70.0	48.1–85.5
	SITE 2	12/19	63.2	41.0–80.9
	SITE 3	9/19	47.4	27.3–68.3
	All sites (overall)	35/58	60.3	47.5–71.9
Parainfluenza Virus 2 (ATCC VR-92)	SITE 1	9/20	45.0	25.8–65.8
	SITE 2	11/19	57.9	36.3–76.9
	SITE 3	12/20	60.0	38.7–78.1
	All sites (overall)	32/59	54.2	41.7–66.3
Parainfluenza Virus 3 (ATCC VR-93)	SITE 1	13/20	65.0	43.3–81.9
	SITE 2	17/20	85.0	64.0–94.8
	SITE 3	17/20	85.0	64.0–94.8
	All sites (overall)	47/60	78.3	66.4–86.9

Table 12. Detection rate per target at 0.1x LoD concentration for each site of reproducibility study and 2-sided 95% Confidence Interval by target. (continued)

Target (0.1x LoD)	Site	Detection rate (# positive)	% detection rate (# positive)	95% Confidence Interval (%)
Parainfluenza Virus 4 (ATCC VR-1378)	SITE 1	10/20	50.0	29.9–70.1
	SITE 2	11/19	57.9	36.3–76.9
	SITE 3	9/20	45.0	25.8–65.8
	All sites (overall)	30/59	50.9	38.4–63.2
Respiratory Syncytial Virus A (ATCC VR-1540)	SITE 1	6/20	30.0	14.5–51.9
	SITE 2	7/20	35.0	18.1–56.7
	SITE 3	9/20	45.0	25.8–65.8
	All sites (overall)	22/60	36.7	25.6–49.3
Respiratory Syncytial Virus B (0810040CF)	SITE 1	14/20	70.0	48.1–85.5
	SITE 2	15/19	79.0	56.7–91.5
	SITE 3	10/20	50.0	29.9–70.1
	All sites (overall)	39/59	66.1	53.4–76.9
Rhinovirus (ATCC VR-482)	SITE 1	15/20	75.0	53.1–88.8
	SITE 2	15/20	75.0	53.1–88.8
	SITE 3	18/20	90.0	69.9–97.2
	All sites (overall)	48/60	80.0	68.2–88.2

Table 13 summarizes the results for 1x LoD concentration where it is observed that the detection rate for 24 of the 24 targets was ≥95%.

Table 13. Detection rate per target at 1x LoD concentration for each site of reproducibility study and 2-sided 95% Confidence Interval by target

Target (1x LoD)	Site	Detection rate (# positive)	% detection rate (# positive)	95% Confidence Interval (%)
Adenovirus (ATCC VR-3)	SITE 1	20/20	100	83.9–100
	SITE 2	18/18	100	82.4–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	58/58	100	93.8–100
B. pertussis (BAA-2707)	SITE 1	18/20	90.0	69.9–97.2
	SITE 2	20/20	100	83.9–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	58/60	96.7	88.6–99.1
C. pneumoniae (ATCC VR-2282)	SITE 1	20/20	100	83.9–100
	SITE 2	20/20	100	83.9–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	60/60	100	94.0–100
Coronavirus 229E (ATCC VR-740)	SITE 1	18/20	90.0	69.9–97.2
	SITE 2	20/20	100	83.9–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	58/60	96.7	88.6–99.1
Coronavirus HKU1 (NATRVP-IDI)	SITE 1	20/20	100	83.9–100
	SITE 2	20/20	100	83.9–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	60/60	100	94.0–100

Table 13. Detection rate per target at 1x LoD concentration for each site of reproducibility study and 2-sided 95% Confidence Interval by target (continued)

Target (1x LoD)	Site	Detection rate (# positive)	% detection rate (# positive)	95% Confidence Interval (%)
Coronavirus NL63 (0810228CFHI)	SITE 1	20/20	100	83.9–100
	SITE 2	18/18	100	82.4–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	58/58	100	93.8–100
Coronavirus OC43 (ATCC VR-1558)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/59	100	93.9–100
Enterovirus (ATCC VR-1824)	SITE 1	19/20	95.0	76.4–99.1
	SITE 2	20/20	100	83.9–100
	SITE 3	19/20	95.0	76.4–99.1
	All sites (overall)	58/60	96.7	88.6–99.1
Human Metapneumovirus (0810161CF)	SITE 1	19/20	95.0	76.4–99.1
	SITE 2	20/20	100	83.9–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/60	98.3	91.1–99.7
Influenza A (0810249CFHI)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/59	100	93.9–100

Table 13. Detection rate per target at 1x LoD concentration for each site of reproducibility study and 2-sided 95% Confidence Interval by target (continued)

Target (1x LoD)	Site	Detection rate (# positive)	% detection rate (# positive)	95% Confidence Interval (%)
Influenza A (ATCC VR-810)	SITE 1	19/20	95.0	76.4–99.1
	SITE 2	18/18	100	82.4–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	57/58	98.3	90.9–99.7
Influenza A (ATCC VR-897)	SITE 1	19/20	95.0	76.4–99.1
	SITE 2	20/20	100	83.9–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/60	98.3	91.1–99.7
Influenza A H1 (ATCC VR-897)	SITE 1	20/20	100	83.9–100
	SITE 2	20/20	100	83.9–100
	SITE 3	19/20	95.0	76.4–99.1
	All sites (overall)	59/60	98.3	91.1–99.7
Influenza B (ATCC VR-295)	SITE 1	19/20	95.0	76.4–99.1
	SITE 2	20/20	100	83.9–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/60	98.3	91.1–99.7
Influenza H1N1 pdm09 (0810249CFHI)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/59	100	93.9–100

Table 13. Detection rate per target at 1x LoD concentration for each site of reproducibility study and 2-sided 95% Confidence Interval by target (continued)

Target (1x LoD)	Site	Detection rate (# positive)	% detection rate (# positive)	95% Confidence Interval (%)
Influenza H3 (ATCC VR-810)	SITE 1	20/20	100	83.9–100
	SITE 2	18/18	100	82.4–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	58/58	100	93.8–100
M. pneumoniae (29085)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/59	100	93.9–100
Parainfluenza Virus 1 (0810014CFHI)	SITE 1	20/20	100	83.9–100
	SITE 2	18/18	100	82.4–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	58/58	100	93.8–100
Parainfluenza Virus 2 (ATCC VR-92)	SITE 1	19/20	95.0	76.4–99.1
	SITE 2	20/20	100	83.9–100
	SITE 3	19/20	95.0	76.4–99.1
	All sites (overall)	58/60	96.7	88.6–99.1
Parainfluenza Virus 3 (ATCC VR-93)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/59	100	93.9–100

Table 13. Detection rate per target at 1x LoD concentration for each site of reproducibility study and 2-sided 95% Confidence Interval by target (continued)

Target (1x LoD)	Site	Detection rate (# positive)	% detection rate (# positive)	95% Confidence Interval (%)
Parainfluenza Virus 4 (ATCC VR-1378)	SITE 1	20/20	100	83.9–100
	SITE 2	20/20	100	83.9–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	60/60	100	94.0–100
Respiratory Syncytial Virus A (ATCC VR-1540)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/59	100	93.9–100
Respiratory Syncytial Virus B (0810040CF)	SITE 1	20/20	100	83.9–100
	SITE 2	20/20	100	83.9–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	60/60	100	94.0–100
Rhinovirus (ATCC VR-482)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/59	100	93.9–100

Table 14 summarizes the results for 3x LoD concentration where it is observed that detection rate for all 24 of the 24 targets was ≥95%.

Table 14. Detection rate per target at 3x LoD concentration for each site of reproducibility study and 2-sided 95% Confidence Interval by target.

Target (3x LoD)	Site	Detection rate (# positive)	% detection rate (# positive)	95% Confidence Interval (%)
Adenovirus (ATCC VR-3)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/59	100	93.9–100
B. pertussis (BAA-2707)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/59	100	93.9–100
C. pneumoniae (ATCC VR-2282)	SITE 1	20/20	100	83.9–100
	SITE 2	19/20	95.0	76.4–99.1
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/60	98.3	91.1–99.7
Coronavirus 229E (ATCC VR-740)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/59	100	93.9–100
Coronavirus HKU1 (NATRVP-IDI)	SITE 1	20/20	100	83.9–100
	SITE 2	20/20	100	83.9–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	60/60	100	94.0–100

Table 14. Detection rate per target at 3x LoD concentration for each site of reproducibility study and 2-sided 95% Confidence Interval by target. (continued)

Target (3x LoD)	Site	Detection rate (# positive)	% detection rate (# positive)	95% Confidence Interval (%)
Coronavirus NL63 (0810228CFHI)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/59	100	93.9–100
Coronavirus OC43 (ATCC VR-1558)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	19/19	100	83.2–100
	All sites (overall)	58/58	100	93.8–100
Enterovirus (ATCC VR-1824)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/59	100	93.9–100
Human Metapneumovirus (0810161CF)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/59	100	93.9–100
Influenza A (0810249CFHI)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	19/19	100	83.2–100
	All sites (overall)	58/58	100	93.8–100

Table 14. Detection rate per target at 3x LoD concentration for each site of reproducibility study and 2-sided 95% Confidence Interval by target. (continued)

Target (3x LoD)	Site	Detection rate (# positive)	% detection rate (# positive)	95% Confidence Interval (%)
Influenza A (ATCC VR-810)	SITE 1	20/20	100	83.9—100
	SITE 2	19/19	100	83.2–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/59	100	93.9–100
Influenza A (ATCC VR-897)	SITE 1	20/20	100	83.9–100
	SITE 2	20/20	100	83.9–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	60/60	100	94.0–100
Influenza A H1 (ATCC VR-897)	SITE 1	19/20	95.0	76.4–99.1
	SITE 2	20/20	100	83.9–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/60	98.3	91.1–99.7
Influenza B (ATCC VR-295)	SITE 1	19/20	95.0	76.4–99.1
	SITE 2	19/19	100	83.2–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	58/59	98.3	91.0–99.7
Influenza H1N1 pdm09 (0810249CFHI)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	19/19	100	83.2–100
	All sites (overall)	58/58	100	93.8–100

Table 14. Detection rate per target at 3x LoD concentration for each site of reproducibility study and 2-sided 95% Confidence Interval by target. (continued)

Target (3x LoD)	Site	Detection rate (# positive)	% detection rate (# positive)	95% Confidence Interval (%)
Influenza H3 (ATCC VR-810)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/59	100	93.9–100
M. pneumoniae (29085)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	19/19	100	83.2–100
	All sites (overall)	58/58	100	93.8–100
Parainfluenza Virus 1 (0810014CFHI)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/59	100	93.9–100
Parainfluenza Virus 2 (ATCC VR-92)	SITE 1	19/20	95.0	76.4–99.1
	SITE 2	20/20	100	83.9–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/60	98.3	91.1–99.7
Parainfluenza Virus 3 (ATCC VR-93)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	19/19	100	83.2–100
	All sites (overall)	58/58	100	93.8–100

Table 14. Detection rate per target at 3x LoD concentration for each site of reproducibility study and 2-sided 95% Confidence Interval by target. (continued)

Target (3x LoD)	Site	Detection rate (# positive)	% detection rate (# positive)	95% Confidence Interval (%)
Parainfluenza Virus 4 (ATCC VR-1378)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	59/59	100	93.9–100
Respiratory Syncytial Virus A (ATCC VR-1540)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	19/19	100	83.2–100
	All sites (overall)	58/58	100	93.8–100
Respiratory Syncytial Virus B (0810040CF)	SITE 1	20/20	100	83.9–100
	SITE 2	20/20	100	83.9–100
	SITE 3	20/20	100	83.9–100
	All sites (overall)	60/60	100	94.0–100
Rhinovirus (ATCC VR-482)	SITE 1	20/20	100	83.9–100
	SITE 2	19/19	100	83.2–100
	SITE 3	19/19	100	83.2–100
	All sites (overall)	58/58	100	93.8–100

A representative panel of analytes (Influenza B, Coronavirus HKU1, Parainfluenza virus 3, Rhinovirus, Adenovirus, *Mycoplasma pneumoniae,* and SARS-CoV-2) was tested in one site to confirm that the SARS-CoV-2 analyte had the expected behavior. A set of selected samples composed of low-concentrated analytes (3x LoD and 1x LoD) and negative samples was tested in simulated sample matrix (HeLa cells in UTM). At least 90 replicates per each analyte and concentration were tested. 3x and 1x LoD concentrations showed ≥95% detection rate for all targets, and negative concentration showed 0% detection rate for all targets.

12.1.6. Carryover

A carryover study was performed to evaluate the potential occurrence of cross-contamination between consecutive runs when using the QIAstat-Dx Respiratory Panel Plus on the QIAstat-Dx Analyzer.

Samples of simulated NPS matrix, with alternating high-positive and negative samples, were tested on 2 QIAstat-Dx Analyzer. No carryover between samples was observed in the QIAstat-Dx Respiratory Panel Plus.

12.1.7. Interfering substances (analytical specificity)

The effect of potentially interfering substances on the detectability of the QIAstat-Dx Respiratory Panel Plus organisms was evaluated. The interfering substances include endogenous as well as exogenous substances that are normally found in the nasopharynx or may be introduced into NPS specimens during specimen collection, respectively. Potentially interfering substances were added to contrived samples at a level predicted to be above the concentration of the substance likely to be found in an authentic NPS specimen. The contrived samples (also referred to as combined samples) were each comprised of a mix of organisms tested at a concentration of 3x or 5x LoD.

Endogenous substances such as whole blood, human genomic DNA, and several pathogens were tested alongside exogenous substances like antibiotics, nasal sprays, and different workflow contaminants.

The combined samples were tested with and without addition of an inhibitory substance allowing direct sample-to-sample comparison. Additionally, for substances that may contain genetic material (such as blood, mucin, DNA, and microorganisms), negative specimens (blank artificial NPS sample matrix with no organism mix) were spiked with only the test substance to evaluate the potential for false positive results due to the test substance itself.

Combined samples not spiked with any test substance served as a positive control and blank artificial NPS sample matrix with no organism mix as negative controls.

All pathogen-containing samples without spiked interferent generated positive signals for all pathogens present in the respective combined sample. Negative signals were obtained for all pathogens not present in the same sample but detected by the QIAstat-Dx Respiratory Panel Plus.

None of the substances tested showed inhibition, except for the nasal influenza vaccines. This was due to the fact that the selection of substances concentration was higher than the concentrations expected to be present in a sample. In addition, nasal influenza vaccines (Fluenz Tetra and FluMist®) were predicted to be reactive with the QIAstat-Dx Respiratory Panel Plus Influenza A (subtype) and Influenza B assays. Final dilution without observable interfering effect was 0.000001% v/v for both vaccines.

No impact on performance is expected when clinical NPS samples are examined in the presence of the substances tested.

The results of interfering substance testing are provided in Table 15.

Table 15. Outcome of potential interfering substances tested

Substance tested	Concentration tested	Results
Endogenous substances		
Human genomic DNA 200 ng/µL	20 ng/µL	No Interference
Human blood (+NaCitrate)	1% v/v	No Interference
Mucin from bovine submaxillary	1% v/v	No Interference
Exogenous substances		
Tobramycin	0.6 mg/mL	No Interference
Mupirocin	2% w/v	No Interference
Saline nasal spray with preservatives	1% v/v	No Interference
Afrin®, severe congestion nasal spray (Oxymetazoline HCl)	1% v/v	No Interference
Analgesic ointment (Vicks® VapoRub®)	1% w/v	No Interference

Table 15. Outcome of potential interfering substances tested (continued)

Substance tested	Concentration tested	Results
Petroleum Jelly (Vaseline®)	1% w/v	No Interference
FluMist nasal influenza vaccine*	0.00001% v/v	Interference
	0.000001% v/v	No Interference
Fluenz Tetra nasal influenza vaccine*	0.00001% v/v	Interference
	0.000001% v/v	No Interference
Chiroflu Influenza Vaccine (surface antigen inactivated)*	0.000001% v/v	No Interference
Disinfecting/cleaning substances		
Disinfecting wipes	½ inches2/1 mL UTM	No Interference
DNAZap	1% v/v	No Interference
RNaseOUT†	1% v/v	No Interference
ProtectRNA™ RNase Inhibitor 500x Concentrate†	1% v/v	No Interference
Bleach	5% v/v	No Interference
Ethanol	5% v/v	No Interference
Specimen collection materials		
Swab Copan 168C	1 swab/1 mL UTM	No Interference
Swab Copan FloQ	1 swab/1 mL UTM	No Interference
Swab Copan 175KS01	1 swab/1 mL UTM	No Interference
Swab Puritan 25-801 A 50	1 swab/1 mL UTM	No Interference
VTM Sigma Virocult	100%	No Interference
VTM Remel® M4-RT	100%	No Interference
VTM Remel M4‡	100%	No Interference

Table 15. Outcome of potential interfering substances tested (continued)

Substance tested	Concentration tested	Results
VTM Remel M5‡	100%	No Interference
VTM Remel M6‡	100%	No Interference
VTM RT‡	100%	No Interference
BD Universal Viral Transport	100%	No Interference
Delta Swab Virus	100%	No Interference

* SARS-CoV-2 was tested with Chiroflu nasal influenza vaccine instead of FluMist and Fluenz Tetra nasal vaccines.

† SARS-CoV-2 was tested with Protect RNA instead of RNAseOUT.

‡ SARS-CoV-2 were tested with VTM RT instead of VTM Remel M4, VTM Remel M5 and VTM Remel M6.

12.1.8. Microbial interference

A microbial interference study was conducted to assess the inhibitory effects of select non-target organisms on the ability to detect SARS-CoV-2. Clinically relevant and challenging concentrations (1.00E+06 CFU/mL for bacteria/fungi, 1.00E+05 PFU/mL for viruses unless otherwise noted) of non-target organisms were individually mixed with SARS-CoV-2 at 3x LoD in simulated NPS matrix. Testing was performed in triplicate with 2 additional tests performed if SARS-CoV-2 was not detected in any one of the original 3 replicates. All combinations and replicates successfully detected SARS-CoV-2 except for 3 samples, one *Legionella pneumophila*, one *Streptococcus salivarius* sample, and one *H.influenzae* sample. For these, additional replicates successfully detected SARS-CoV-2. Where available, at least one additional strain of *L. pneumophila, S. salivarius*, or *H. influenzae* was also tested in triplicate with all samples successfully detecting SARS-CoV-2. See Table 16 for a list of the strains tested and the result summary.

Table 16. Microbial interference study results

Non-Target Organism	Strain/Isolate	Source/ Catalog no.	No. of SARS-CoV-2 detected/valid runs
*Staphylococcus aureus**	FDA 209	ATCC CRM-6538	3/3

Table 16. Microbial interference study results (continued)

Non-Target Organism	Strain/Isolate	Source/ Catalog no.	No. of SARS-CoV-2 detected/valid runs
Streptococcus pneumoniae	Z022 19F	ZeptoMetrix 0801439	3/3
Streptococcus salivarius	C699 [S30D]	ATCC 13419	3/3
Streptococcus salivarius	Z127	ZeptoMetrix 0801896	4/5
Haemophilus influenzae	AMC 36-A-7	ATCC 8142	3/3
Haemophilus influenzae	AMC 36-A-1	ATCC 10211	3/3
Candida albicans	CBS 562	ATCC 18804	3/3
Herpes Simplex Virus 1	ATCC-2011-9	ATCC VR-1789	3/3
Staphylococcus epidermidis	Fussel	ATCC 14990	4/5
Pseudomonas aeruginosa	PRD-10	ATCC 15442	3/3
Legionella pneumophila	Philadelphia†	ZeptoMetrix 0801645	3/5
Legionella pneumophila	Philadelphia-1†	ATCC 33152	3/3
Legionella pneumophila	Los Angeles-1	ATCC 33156	3/3
*Neisseria meningitidis**	serogroup A	ATCC 13077	3/3
*Corynebacterium diphtheriae**	48255	ATCC 11913	3/3
Human Cytomegalovirus (CMV)*	Towne	ZeptoMetrix 0810499 CFHI	3/3

* *S. aureus* was evaluated at 4.5×10^8 CFU/mL, *N. meningitidis* at 1.0×10^3 CFU/mL, *C. diphtheriae* at 1.0×10^3 CFU/mL, and CMV at 1.0×10^4 $TCID_{50}$/mL.

† Philadelphia and Philadelphia-1 are both designations of strain Philadelphia serogroup-1, differences in naming are due to supplier.

12.1.9. Competitive inhibition

Clinically relevant co-infections testing demonstrated that when at least 2 QIAstat-Dx Respiratory Panel Plus pathogens of different concentrations are simultaneously present in one sample, all targets can be detected by the assay. SARS-CoV-2 at 3x LoD has been tested in combination with the on-panel pathogens listed in Table 17 at high concentrations (10E+05 for viral targets, 10E+06 for bacterial targets), with no impact on assay performance.

Table 17. On-panel pathogens tested for competitive inhibition

On-panel pathogen	Concentration tested
Coronavirus 229E	1.00E+05 $TCID_{50}$/mL
Coronavirus OC43	1.00E+05 $TCID_{50}$/mL
Adenovirus A12	1.00E+05 $TCID_{50}$/mL
Parainfluenza Virus 3	1.00E+05 $TCID_{50}$/mL
Bordetella pertussis	1.00E+06 CFU/mL
Enterovirus D68	1.00E+05 $TCID_{50}$/mL
Echovirus 6	1.00E+05 $TCID_{50}$/mL
Respiratory Syncytial Virus	1.00E+05 PFU/mL
Rhinovirus	1.00E+05 PFU/mL
hMPV	1.00E+05 $TCID_{50}$/mL
Influenza A H1N1	1.00E+05 $TCID_{50}$/mL

12.2. Clinical performance

The clinical performance of the QIAstat-Dx Respiratory Panel Plus was established in 2 separate clinical studies. The first study was conducted between December 2017 and April 2019 to establish the performance for all targets excluding SARS-CoV-2. The performance for SARS-CoV-2 was established in a second study conducted between February and May 2023 and February 2024.

12.2.1. Clinical performance for all targets excluding SARS-CoV-2

The clinical performance of the QIAstat-Dx Respiratory Panel was established during a multi-center study conducted at 6 geographically diverse study sites: 5 U.S. sites and one international site that covered all targets excluding SARS-CoV-2.

Residual NPS specimens in UTM were tested with the QIAstat-Dx Respiratory Paneland an FDA-cleared molecular comparator, in accordance with product instructions for use. Specimens tested in the clinical study were collected using the Universal Transport Medium (UTM) (Copan Diagnostics [Brescia, Italy and CA, USA]), MicroTest™ M4®, M4RT®, M5®, M6® (Thermo Fisher Scientific®, MA, USA), BD™ Universal Viral Transport (UVT) System (Becton Dickinson, NJ, USA), Universal Transport Medium (UTM) System (HealthLink® Inc., FL, USA), Universal Transport Medium (Diagnostic Hybrids®, OH, USA), V-C-M Medium (Quest Diagnostics®, NJ, USA) and UniTranz-RT® Universal Transport Media (Puritan® Diagnostics, ME, USA) collection kits.

A total of 2304 residual NPS specimens (1994 prospective, 310 archived) were tested in this comparison study. Between December 2017 to April 2019, specimens were prospectively collected from all comers meeting the study inclusion criteria and immediately frozen for later testing by the study site as frozen prospective specimens (N=1093). No frozen specimens were distributed amongst sites. At time of testing, specimens were thawed and tested on both the QIAstat-Dx Respiratory Panel and comparator method.

Between February and August 2018, specimens were prospectively collected from all comers meeting the study eligibility criteria and tested fresh (N=901) on both the QIAstat-Dx Respiratory Panel and comparator method in accordance with product instructions as fresh

prospective specimens. One specimen was withdrawn from the study due to an incorrect specimen type.

Table 18 provides the summary of demographic information for the 1994 subjects that participated in the first prospective study.

Table 18. Demographic summary for the first prospective study

		Overall	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Sex	Male	924 (46.3%)	186	0	196	177	170	195
	Female	1070 (53.7%)	232	0	230	271	133	204
Age	≤5 years	627 (31.4%)	126	0	103	49	216	133
	6–21 years	239 (11.9%)	34	0	40	38	79	48
	22–49 years	330 (16.5%)	110	0	56	107	7	50
	50+ years	798 (40.0%)	148	0	227	254	1	168
Status	Outpatient	788 (39.5%)	272	0	50	44	145	277
	Hospitalized	686 (34.4%)	145	0	318	0	101	122
	Emergency	67 (3.4%)	0	0	9	34	24	0
	ICU	153 (7.7%)	1	0	49	70	33	0
	Not provided/ unknown	300 (15.0%)	0	0	0	300	0	0
	Total	**1994**	**418**	**0**	**426**	**448**	**303**	**399**

A total of 1994 specimens were evaluated for all panel members in the first prospective study. The performance of the QIAstat-Dx was evaluated by comparing the QIAstat-Dx Respiratory Panel test results with those from an FDA-cleared multiplexed respiratory pathogen panel.

Positive Percent Agreement (PPA) for each analyte was calculated as 100% x (TP/[TP+FN]). True Positive (TP) indicates that both the QIAstat-Dx Respiratory Panel and the comparator method yielded a "Detected" result of that specific analyte. A False Negative (FN) indicates that the QIAstat-Dx Respiratory Panel was "Not Detected" while the comparator method was "Detected" for that specific analyte. Negative Percent Agreement (NPA) was calculated as 100% x (TN/[TN+FP]). True Negative (TN) indicates that both the QIAstat-Dx Respiratory Panel and the comparator method resulted in "Not Detected" for that specific analyte. A False Positive (FP) indicates that the QIAstat-Dx Respiratory Panel was "Detected" while the comparator method was "Not Detected" for that specific analyte.

Binomial 2-sided 95% Confidence Intervals were calculated using the Wilson Score Method.

The QIAstat-Dx Respiratory Panel prospective performance data in positive percent and negative percent agreements against the comparator methods are presented by analyte in Table 19.

Table 19. QIAstat-Dx Respiratory Panel prospective clinical performance summary

		Positive Percent Agreement			Negative Percent Agreement		
Target	**Sample type**	**TP/(TP+FN)**	**%**	**95 % CI (%)**	**TN/(TN+FP)**	**%**	**95 % CI (%)**
			Virus				
Adenovirus*	Fresh	55/58	94.8	85.6–98.9	833/ 839	99.3	98.4–99.7
	Frozen	31/32	96.9	83.8–99.9	1047/ 1057	99.1	98.3–99.5
	Overall	86/90	95.6	89.0–98.8	1880/ 1896	99.2	98.6–99.5
Coronavirus 229E	Fresh	8/9	88.9	51.8–99.7	886/ 886	100.0	99.6–100.0
	Frozen	0/0	N/A	N/A	1089/ 1089	100.0	99.7–100.0
	Overall	8/9	88.9	51.8–99.7	1975/ 1975	100.0	99.8–100.0
Coronavirus HKU1†	Fresh	3/3	100.0	29.2–100.0	890/ 892	99.8	99.2–100.0
	Frozen	48/49	98.0	89.1–99.9	1035/ 1040	99.5	98.9–99.8
	Overall	51/52	98.1	89.7–100.0	1925/ 1932	99.6	99.3–99.9
Coronavirus NL63‡	Fresh	4/5	80.0	28.4–99.5	890/ 890	100.0	99.6–100.0
	Frozen	36/42	85.7	71.5–94.6	1046/ 1048	99.8	99.3–100.0
	Overall	40/47	85.1	71.7–93.8	1936/ 1938	99.9	99.6–100.0

Table 19. QIAstat-Dx Respiratory Panel prospective clinical performance summary (continued)

		Positive Percent Agreement			Negative Percent Agreement		
Target	**Sample type**	**TP/(TP+FN)**	**%**	**95 % CI (%)**	**TN/(TN+FP)**	**%**	**95 % CI (%)**
Coronavirus OC43§	Fresh	3/3	100.0	29.2–100.0	892/ 892	100.0	99.6–100.0
	Frozen	23/26	88.5	69.8–97.6	1059/ 1063	99.6	99.0–99.9
	Overall	26/29	89.7	72.6–97.8	1951/ 1955	99.8	99.5–99.9
Human Metapneumovirus¶	Fresh	62/67	92.5	83.4–97.5	828/ 829	99.9	99.3–100.0
	Frozen	53/55	96.4	87.5–99.6	1030/ 1034	99.6	99.0–99.9
	Overall	115/122	94.3	88.5–97.7	1858/ 1863	99.7	99.4–99.9
Influenza A	Fresh	132/133	99.2	95.9–100.0	752/756	99.5	98.7–99.9
	Frozen	111/112	99.1	95.1–100.0	971/976	99.5	98.8–99.8
	Overall	243/245	99.2	97.1–99.9	1723/1732	99.5	99.0–99.8
Influenza A H1**	Fresh	0/1	0.0	0.0–97.5	894/ 894	100.0	99.6–100.0
	Frozen	0/0	N/A	N/A	1089/ 1089	100.0	99.7–100.
	Overall	0/1	0.0	0.0–97.5	1983/ 1983	100.0	99.8–100.0

Table 19. QIAstat-Dx Respiratory Panel prospective clinical performance summary (continued)

		Positive Percent Agreement			Negative Percent Agreement		
Target	**Sample type**	**TP/(TP+FN)**	**%**	**95 % CI (%)**	**TN/(TN+FP)**	**%**	**95 % CI (%)**
Influenza A H1N1 pdm09 ††	Fresh	62/63	98.4	91.5–100.0	826/ 831	99.4	98.6–99.8
	Frozen	18/18	100.0	81.5–100.0	1071/ 1071	100.0	99.7–100.0
	Overall	80/81	98.8	93.3–100.0	1897/ 1902	99.7	99.4–99.9
Influenza A H3‡‡	Fresh	67/67	100.0	94.6–100.0	825 / 826	99.9	99.3–100.
	Frozen	89/90	98.9	94.0–100.0	992/ 998	99.4	0 98.7–99.8
	Overall	156/157	99.4	96.5–100.0	1817/ 1824	99.6	99.2–99.8
Influenza B§§	Fresh	64/67	95.5	87.5–99.1	826/827	99.9	99.3–100.0
	Frozen	58/62	93.5	84.3–98.2	1027/1027	100.0	99.6–100.0
	Overall	122/129	94.6	89.1–97.8	1853/1854	99.9	99.7–100.0
Parainfluenza Virus 1¶¶	Fresh	3/3	100.0	29.2–100.0	892/ 892	100.0	99.6–100.0
	Frozen	13/14	92.9	66.1–99.8	1072/ 1075	99.7	99.2–99.9
	Overall	16/17	94.1	71.3–99.9	1964/ 1967	99.8	99.6–100.0

Table 19. QIAstat-Dx Respiratory Panel prospective clinical performance summary (continued)

		Positive Percent Agreement			Negative Percent Agreement		
Target	**Sample type**	**TP/(TP+FN)**	**%**	**95 % CI (%)**	**TN/(TN+FP)**	**%**	**95 % CI (%)**
Parainfluenza Virus 2	Fresh	2/2	100.0	15.8–100.0	893/ 893	100.0	99.6–100.0
	Frozen	0/0	N/A	N/A	1089/ 1089	100.0	99.7–100.0
	Overall	2/2	100.0	15.8–100.0	1982/ 1982	100.0	99.8–100.0
Parainfluenza Virus 3 ***	Fresh	102/104	98.1	93.2–99.8	788/ 793	99.4	98.5–99.8
	Frozen	9/9	100.0	66.4–100.0	1081/ 1081	100.0	99.7–100.0
	Overall	111/113	98.2	93.8–99.8	1869/ 1874	99.7	99.4–99.9
Parainfluenza Virus 4 †††	Fresh	3/3	100.0	29.2–100.0	892/ 892	100.0	99.6–100.0
	Frozen	0/0	N/A	N/A	1087/ 1089	99.8	99.3–100.0
	Overall	3/3	100.0	29.2–100.0	1979/ 1981	99.9	99.6–100.0
Respiratory Syncytial Virus A+B‡‡‡	Fresh	73/76	96.1	88.9–99.2	819/ 820	99.9	99.3–100.0
	Frozen	139/144	96.5	92.1–98.9	941/ 945	99.6	98.9–99.9
	Overall	212/220	96.4	93.0–98.4	1760/ 1765	99.7	99.3–99.9

Table 19. QIAstat-Dx Respiratory Panel prospective clinical performance summary (continued)

		Positive Percent Agreement			Negative Percent Agreement		
Target	**Sample type**	**TP/(TP+FN)**	**%**	**95 % CI (%)**	**TN/(TN+FP)**	**%**	**95 % CI (%)**
Rhinovirus/ Enterovirus§§§	Fresh	144/157	91.7	86.3–95.5	715/ 739	96.8	95.2–97.9
	Frozen	124/137	90.5	84.3–94.9	941/ 953	98.7	97.8–99.3
	Overall	268/294	91.2	87.3–94.1	1656/ 1692	97.9	97.1–98.5
				Bacteria			
Bordetella pertussis¶¶¶	Fresh	2/2	100.0	15.8–100.0	893 / 893	100.0	99.6–100.0
	Frozen	1/1	100.0	2.5–100.0	1082 / 1088	99.4	98.8–99.8
	Overall	3/3	100.0	29.2–100.0	1975 / 1981	99.7	99.3–99.9
*Chlamydophila pneumoniae*****	Fresh	4/4	100.0	39.8–100.0	891 / 891	100.0	99.6–100.0
	Frozen	1/1	100.0	2.5–100.0	1087 / 1088	99.9	99.5–100.0
	Overall	5/5	100.0	47.8–100.0	1978 / 1979	99.9	99.7–100.0
Mycoplasma pneumoniae††††	Fresh	18/18	100.0	81.5–100.0	875 / 877	99.8	99.2–100.0
	Frozen	1/1	100.0	2.5–100.0	1085 / 1088	99.7	99.2–99.9

Table 19. QIAstat-Dx Respiratory Panel prospective clinical performance summary (continued)

		Positive Percent Agreement			Negative Percent Agreement		
Target	**Sample type**	**TP/(TP+FN)**	**%**	**95 % CI (%)**	**TN/(TN+FP)**	**%**	**95 % CI (%)**
	Overall	19/19	100.0	82.4–100.0	1960 / 1965	99.7	99.4–99.9

* Adenovirus was detected in 3/4 FN specimens using an independent molecular method. Adenovirus was detected in 6/16 FP specimens using an independent molecular method.

† The single FN specimen was negative for Coronavirus HKU1 when tested using an independent molecular method. Coronavirus HKU1 was detected 0/7 FP specimens using an independent molecular method.

‡ Coronavirus NL63 was detected in 7/7 FN specimens using an independent molecular method. Coronavirus NL63 was detected in 1/2 FP specimens using an independent molecular method.

§ The 3 FN specimens were negative for Coronavirus OC43 when tested using an independent molecular method. Coronavirus OC43 was detected in 3/4 FP specimens using an independent molecular method.

¶ Human metapneumovirus (hMPV) was detected in 4/7 FN specimens using an independent molecular method. hMPV was detected in 3/5 FP specimens using an independent molecular method.

** Influenza A H1 was detected in 1/1 FN specimen by an independent molecular method. Note: Non-2009 H1 has not been in circulation since being replaced by the 2009 H1 and thus this discrepancy test result is likely false.

†† Influenza A H1N1 pdm09 was detected in 1/1 FN by an independent molecular method. Influenza A H1 was detected in 3/5 FP specimens by an independent molecular method.

‡‡ Influenza A H3 was detected in 1/1 FN by an independent molecular method. Influenza H3 was detected in 7/7 FP specimens by an independent molecular method.

§§ Influenza B was detected in 6/6 FN specimens available for testing by an independent molecular method; one discordant sample was not tested by an independent molecular method. Influenza B was detected in 1/1 FP specimens available for testing by an independent molecular method.

¶¶ The single FN specimen was negative for Parainfluenza virus 1 by an independent molecular method. Parainfluenza virus 1 was detected in 3/3 FP specimens by an independent molecular method.

*** Parainfluenza virus 3 was detected in 1/2 FN specimens by an independent molecular method. Parainfluenza 3 was detected in 3/5 FP specimens by an independent molecular method.

††† Parainfluenza virus 4 was detected in 2/2 FP specimens by an independent molecular method.

‡‡‡ Respiratory Syncytial Virus was detected in 2/8 FN specimens by an independent molecular method. Respiratory Syncytial Virus was detected in 3/5 FP specimens by an independent molecular method.

§§§ Rhinovirus was detected in 18/26 FN specimens using an independent molecular method. Rhinovirus was detected in 14/36 FP specimens using an independent molecular method

¶¶¶ *Bordetella pertussis* was detected in 1/6 FP specimens by an independent molecular method.

**** *Chlamydophila pneumoniae* was detected in 1/1 FP specimens by an independent molecular method.

†††† *Mycoplasma pneumoniae* was detected in 1/4 specimens by an independent molecular method.

12.2.2. Co-infection summary for all targets excluding SARS-CoV-2

The QIAstat-Dx Respiratory Panel detected a total of 191 specimens with distinctive multiple organism detections (9.6% of all specimens) in the prospective study.

All distinct co-infection combinations, as detected by the QIAstat-Dx Respiratory Panel during prospective study, are presented in Table 20.

Table 20. Distinct co-infection combinations detected by QIAstat-Dx Respiratory Panel for all targets excluding SARS-CoV-2

Analyte 1	Analyte 2	Analyte 3	Analyte 4	Total co-infections	Number of discrepant co-infections	Discrepant analyte(s)
Adenovirus	Rhinovirus / Enterovirus	Coronavirus NL63		2	0	N/A
Adenovirus	Rhinovirus / Enterovirus			12	3	Rhinovirus/Enterovirus (1); Adenovirus (2)
Adenovirus	Respiratory Syncytial Virus			11	1	Respiratory Syncytial Virus (1)
Adenovirus	Mycoplasma pneumoniae			2	1	Mycoplasma pneumoniae (1)
Adenovirus	Coronavirus HKU1			3	1	Coronavirus HKU1 (1)
Coronavirus HKU1	Adenovirus	Respiratory Syncytial Virus		1	1	Coronavirus HKU1 (1)
Coronavirus HKU1	Human Meta-pneumovirus			3	1	Human Metapneumovirus (1)
Coronavirus HKU1	Parainfluenza Virus 3	Rhinovirus/ Enterovirus		1	0	N/A
Coronavirus HKU1	Parainfluenza Virus 4			1	1	Coronavirus HKU1, Parain-fluenza Virus 4 (1)
Coronavirus HKU1	Respiratory Syncytial Virus			8	1	Coronavirus HKU1 (1)
Coronavirus HKU1	Rhinovirus/ Enterovirus	Respiratory Syncytial Virus		1	0	N/A

Table 20. Distinct co-infection combinations detected by QIAstat-Dx Respiratory Panel for all targets excluding SARS-CoV-2 (continued)

Analyte 1	Analyte 2	Analyte 3	Analyte 4	Total co-infections	Number of discrepant co-infections	Discrepant analyte(s)
Coronavirus HKU1	Rhinovirus/ Enterovirus			4	1	Rhinovirus/Enterovirus (1)
Coronavirus NL63	Adenovirus	Respiratory Syncytial Virus		1	0	N/A
Coronavirus NL63	Adenovirus			1	1	Adenovirus (1)
Coronavirus NL63	Bordetella pertussis			2	2	Bordetella pertussis (2)
Coronavirus NL63	Parainfluenza Virus 1			1	0	N/A
Coronavirus NL63	Respiratory Syncytial Virus			2	0	N/A
Coronavirus NL63	Rhinovirus / Enterovirus			2	0	N/A
Coronavirus OC43	Adenovirus			2	0	N/A
Coronavirus OC43	Human Metapneumovirus			2	0	N/A
Coronavirus OC43	Parainfluenza Virus 3	Rhinovirus/ Enterovirus		1	0	N/A
Coronavirus OC43	Respiratory Syncytial Virus			4	0	N/A
Coronavirus OC43	Rhinovirus / Enterovirus	Respiratory Syncytial Virus		2	0	N/A
Coronavirus OC43	Rhinovirus / Enterovirus			2	2	N/A
Coronavirus 229E	Respiratory Syncytial Virus			1	0	N/A
Human Metapneumovirus	Adenovirus			2	1	Adenovirus (1)

Table 20. Distinct co-infection combinations detected by QIAstat-Dx Respiratory Panel for all targets excluding SARS-CoV-2 (continued)

Analyte 1	Analyte 2	Analyte 3	Analyte 4	Total co-infections	Number of discrepant co-infections	Discrepant analyte(s)
Human Metapneumovirus	Respiratory Syncytial Virus			2	0	N/A
Human Metapneumovirus	Rhinovirus / Enterovirus			9	3	Rhinovirus/ Enterovirus (3)
Human Metapneumovirus	Rhinovirus / Enterovirus	Adenovirus	Coronavirus 229E	1	1	Adenovirus, Rhinovirus/Enterovirus (1)
Influenza A (no subtype)	Respiratory Syncytial Virus	Adenovirus		1	1	Influenza A, Adenovirus (1)
Influenza A (no subtype)	Respiratory Syncytial Virus			1	0	N/A
Influenza A H1N1 pdm09	Coronavirus NL63			1	0	N/A
Influenza A H1N1 pdm09	Coronavirus OC43	Adenovirus		1	1	Adenovirus (1)
Influenza A H1N1 pdm09	Rhinovirus / Enterovirus			2	0	N/A
Influenza A H1N1 pdm09	Rhinovirus / Enterovirus	*Bordetella pertussis*		1	0	N/A
Influenza A H1N1 pdm09	Respiratory Syncytial Virus			1	0	N/A
Influenza A H3	Adenovirus			2	1	Adenovirus (1)
Influenza A H3	Coronavirus NL63	Parainfluenza Virus 1		1	0	N/A
Influenza A H3	Coronavirus NL63	Bordetella pertussis		1	1	Bordetella pertussis (1)
Influenza A H3	Coronavirus NL63			1	1	NL63 (1)

Table 20. Distinct co-infection combinations detected by QIAstat-Dx Respiratory Panel for all targets excluding SARS-CoV-2 (continued)

Analyte 1	Analyte 2	Analyte 3	Analyte 4	Total co-infections	Number of discrepant co-infections	Discrepant analyte(s)
Influenza A H3	Coronavirus OC43	Adenovirus	Respiratory Syncytial Virus	1	1	Coronavirus OC43, Adenovirus (1)
Influenza A H3	Rhinovirus / Enterovirus			4	2	Rhinovirus/Enterovirus (2)
Influenza A H3	Parainfluenza Virus 1			2	0	N/A
Influenza A H3	Parainfluenza Virus 3			2	0	N/A
Influenza A H3	Respiratory Syncytial Virus			1	0	N/A
Influenza A H3	Coronavirus 229E			1	0	N/A
Influenza B	Coronavirus HKU1			3	0	N/A
Influenza B	Coronavirus NL63			1	0	N/A
Influenza B	Respiratory Syncytial Virus			2	0	N/A
Influenza B	Rhinovirus / Enterovirus			7	4	Rhinovirus/Enterovirus (4)
Mycoplasma pneumoniae	Coronavirus HKU1			1	1	Coronavirus HKU1 (1)
Mycoplasma pneumoniae	Rhinovirus / Enterovirus			1	0	N/A
Parainfluenza Virus 1	Adenovirus			1	0	N/A
Parainfluenza Virus 1	Respiratory Syncytial Virus			1	1	Parainfluenza Virus 1 (1)
Parainfluenza Virus 1	Rhinovirus / Enterovirus			2	0	N/A

Table 20. Distinct co-infection combinations detected by QIAstat-Dx Respiratory Panel for all targets excluding SARS-CoV-2 (continued)

Analyte 1	Analyte 2	Analyte 3	Analyte 4	Total co-infections	Number of discrepant co-infections	Discrepant analyte(s)
Parainfluenza Virus 1	Rhinovirus / Enterovirus	*Mycoplasma pneumoniae*		1	1	Rhinovirus/Enterovirus (1)
Parainfluenza Virus 3	Adenovirus			3	2	Adenovirus (2)
Parainfluenza Virus 3	Adenovirus	Rhinovirus/ Enterovirus		3	1	Parainfluenza virus 3 (1)
Parainfluenza Virus 3	Human Metapneumovirus			2	1	Human Metapneumovirus (1)
Parainfluenza Virus 3	Respiratory Syncytial Virus			2	1	Parainfluenza Virus 3 (1)
Parainfluenza Virus 3	Rhinovirus / Enterovirus			14	3	Rhinovirus/ Enterovirus (2), Parainfluenza Virus 3 (1)
Parainfluenza Virus 4	Respiratory Syncytial Virus			1	0	N/A
Parainfluenza Virus 4	Rhinovirus / Enterovirus			2	0	N/A
Respiratory Syncytial Virus	Human Metapneumovirus	Rhinovirus/ Enterovirus		1	0	N/A
Respiratory Syncytial Virus	Human Metapneumovirus	Rhinovirus/ Enterovirus		2	1	Human Metapneumovirus, Rhinovirus / Enterovirus (1)
Respiratory Syncytial Virus	Rhinovirus / Enterovirus			29	6	Rhinovirus/Enterovirus (5), Respiratory Syncytial Virus (1)
Rhinovirus/Enterovirus	Respiratory Syncytial Virus	Adenovirus		2	0	N/A
Total co-infections				**191**	**51**	

Table 20. Distinct co-infection combinations detected by QIAstat-Dx Respiratory Panel for all targets excluding SARS-CoV-2 (continued)

Analyte 1	Analyte 2	Analyte 3	Analyte 4	Total co-infections	Number of discrepant co-infections	Discrepant analyte(s)
Total double infections				**166**	**42**	
Total triple infections				**22**	**7**	
Total quadruple infections				**3**	**2**	

The 3 organisms most prevalent in multiple detections by the QIAstat-Dx Respiratory Panel in prospective study were Rhinovirus/Enterovirus (108/191, 56.5%), Respiratory Syncytial Virus (77/191, 40.8%), and Adenovirus (53/191, 27.7%). The prevalence of individual organisms in each multiple detection are shown in Table 21.

Table 21. The prevalence of individual organisms in each QIAstat-Dx Respiratory Panel multiple detection from the prospective study

Analyte	Prevalence in multiple detections (N=191)
Viruses	
Adenovirus	53 (27.7%)
Coronavirus 229E	3 (1.6%)
Coronavirus HKU1	26 (13.6%)
Coronavirus NL63	16 (8.4%)
Coronavirus OC43	15 (7.9%)
Human Metapneumovirus	24 (12.6%)
Rhinovirus/Enterovirus	108 (56.5%)
Influenza A H1	0 (0.0%)
Influenza A H1N1 pdm09	6 (3.1%)
Influenza A H3	16 (8.4%)
Influenza B	13 (6.8%)
Parainfluenza Virus 1	9 (4.7%)
Parainfluenza Virus 2	0 (0.0%)
Parainfluenza Virus 3	28 (14.7%)
Parainfluenza Virus 4	4 (2.1%)
Respiratory Syncytial Virus	78 (40.8%)
Bacteria	
Bordetella pertussis	4 (2.1%)
Chlamydophila pneumoniae	0 (0.0%)
Mycoplasma pneumoniae	5 (2.6%)

Additional distinct co-infection combinations detected by the comparator method but not detected by the QIAstat-Dx Respiratory Panel in the first prospective clinical trial are presented in Table 22.

Table 22. Additional distinct co-infection combinations detected by the comparator method but not by the QIAstat-Dx Respiratory Panel in the first prospective study

Distinct co-infection combinations detected by the comparator method

Analyte 1	Analyte 2	Analyte 3	Total Co-infections
Adenovirus	Coronavirus HKU1	Respiratory Syncytial Virus	1
Adenovirus	Coronavirus OC43	Coronavirus NL63	1
Adenovirus	Respiratory Syncytial Virus	Coronavirus NL63	1
Adenovirus	Rhinovirus/Enterovirus	Respiratory Syncytial Virus	1
Coronavirus HKU1	Coronavirus OC43		1
Coronavirus HKU1	Respiratory Syncytial Virus		1
Coronavirus HKU1	Coronavirus NL63	Respiratory Syncytial Virus	1
Coronavirus HKU1	Coronavirus NL63		1
Coronavirus HKU1	Parainfluenza Virus 1	Rhinovirus/Enterovirus	1
Coronavirus NL63	Respiratory Syncytial Virus		1
Coronavirus NL63	Rhinovirus/Enterovirus		1
Coronavirus NL63	Influenza A H3		1
Coronavirus OC43	Respiratory Syncytial Virus		1
Human Metapneumovirus	Parainfluenza virus 3	Rhinovirus/Enterovirus	1
Human Metapneumovirus	Rhinovirus/Enterovirus		1
Rhinovirus/Enterovirus	Adenovirus		1
Rhinovirus/Enterovirus	Influenza A H3		2
Rhinovirus/Enterovirus	Parainfluenza Virus 3		1
Rhinovirus/Enterovirus	Parainfluenza Virus 3	Respiratory Syncytial Virus	1

Table 22. Additional distinct co-infection combinations detected by the comparator method but not by the QIAstat-Dx Respiratory Panel in the first prospective study (continued)

Distinct co-infection combinations detected by the comparator method

Analyte 1	Analyte 2	Analyte 3	Total Co-infections
Rhinovirus/Enterovirus	Parainfluenza Virus 4		2
Influenza A H3	Respiratory Syncytial Virus		1
Influenza B	Influenza A (Equivocal)		1
		Total co-infections	**24**
		Total double infections	**16**
		Total triple infections	**8**

A total of 1994 prospective clinical specimens were tested and analyzed during the first prospective clinical evaluation. Of these, 95.9% (1912/1994) yielded valid results on the first attempt (i.e., first loaded cartridge). Invalid or no result were obtained for the remaining 82 specimens (4.11%). Forty-two specimens were invalid due to cartridge Internal Control failure (2.11%). Of these, 20 (1.00%) provided a result for positively detected targets and 22 (1.10%) had no detections. For 40 (2.00%) specimens, no results were obtained due to incomplete runs. Of these, 1 specimen was aborted by users (0.05%), 21 were due to instrument errors (1.05%) and 18 were due to cartridge-related errors (0.90%). Seventy-two of the 82 initially failed (no result or invalid) specimens yielded valid results after a single retesting using a new cartridge/sample. The remaining 10 specimens failed on the second attempt (2 due to cartridge failures, 1 due to instrument errors and 7 due to Internal Control failures). Of these Internal Control failures, detected pathogens were reported for 4 specimens.

12.2.3. Preselected archived specimens

Some of the analytes on the QIAstat-Dx Respiratory Panel were of low prevalence and were not encountered in sufficiently large numbers during the first prospective study to adequately demonstrate clinical performance. To supplement the results of the first prospective clinical study, an evaluation of preselected frozen archived retrospective specimens was performed. The specimens selected for testing had previously tested positive for one of the following

targets at the clinical laboratory by their standard of care method: *Bordetella pertussis*, Coronavirus 229E, Coronavirus HKU1, Coronavirus NL63, Coronavirus OC43, Influenza A H1N1 2009, *Mycoplasma pneumoniae*, *Chlamydophila pneumoniae*, Parainfluenza Virus 1, Parainfluenza Virus 2, and Parainfluenza Virus 4. Testing was performed by operators who were blinded to the expected test result. A total of 310 clinical samples were included within the frozen archived retrospective sample tested arm. Samples were tested by both the comparator method and the QIAstat-Dx Respiratory Panel. If the comparator method did not confirm the preselected target as positive, it was excluded from the data analysis for that target.

A summary of the demographic information available for the archived specimens is provided in Table 23.

Table 23. Demographic summary for the retrospective study arm

		Overall (%)
Sex	Male	158 (50.8%)
	Female	152 (49.2%)
Age	≤5 years	139 (44.9%)
	6–21 years	85 (27.4%)
	22–49 years	53 (17.1%)
	50+ years	33 (10.7%)
Status	Outpatient	224 (72.3%)
	Hospitalized	68 (21.9%)
	Emergency	8 (2.6%)
	ICU	8 (2.6%)
	Other	2 (0.6%)
Total		**310**

The QIAstat-Dx Respiratory Panel retrospective specimens testing performance data against the comparator method are provided in Table 24 by analyte.

Table 24. Overall retrospective clinical study performance

Analyte	TP/(TP+FN)	Sensitivity/PPA (%)	95% CI	TN/(TN+FP)	Specificity/NPA (%)	95% CI
			Viruses			
Adenovirus*	9/9	100.0	70.1–100.0	297/304	97.8	95.4–98.9
Coronavirus 229E	26/27	96.3	81.7–99.3	286/286	100.0	98.7–100.0
Coronavirus HKU1†	14/14	100.0	78.5–100.0	298/299	99.7	98.1–99.9
Coronavirus NL63‡	24/24	100.0	86.2–100.0	286/288	99.3	97.5–99.8
Coronavirus OC43	28/29	96.6	82.8–99.4	279/279	100.0	98.6–100.0
Human Metapneumovirus	2/2	100.0	34.2–100.0	311/311	100.0	98.7–100.0
Rhinovirus/ Enterovirus§	44/49	89.8	78.2–95.5	254/264	96.2	93.2–97.9
Influenza A	17/17	100.0	81.5–100.0	296/296	100.0	98.7–100.0
Influenza A H1	0/0	N/A	N/A	313/313	100.0	98.8–100.0
Influenza A H1N1 pdm09¶	7/8	87.5	52.9–97.8	304/304	100.0	98.8–100.0
Influenza A H3	8/8	100.0	67.5–100.0	305/305	100.0	98.8–100.0
Influenza B	1/1	100.0	20.7–100.0	312/312	100.0	98.8–100.0
Parainfluenza Virus 1	40/40	100.0	91.2–100.0	267/267	100.0	98.6–100.0

Table 24. Overall retrospective clinical study performance (continued)

Analyte	TP/(TP+FN)	Sensitivity/PPA (%)	95% CI	TN/(TN+FP)	Specificity/NPA (%)	95% CI
Parainfluenza Virus 2	3/3	100.0	43.8–100.0	309/309	100.0	98.8–100.0
Parainfluenza Virus 3**	1/4	25.0	4.6–69.9	309/309	100.0	98.8–100.0
Parainfluenza Virus 4††	22/24	91.7	74.2–97.7	278/278	100.0	98.6–100.0
Respiratory Syncytial Virus (RSV)‡‡	11/12	91.7	64.6–98.5	300/301	99.7	98.4–99.9
Bacteria						
Bordetella pertussis	33/33	100.0	89.6–100.0	261/261	100.0	98.5–100.0
Chlamydophila pneumoniae§§	54/61	88.5	78.2–94.3	250/250	100.0	98.5–100.0
Mycoplasma pneumoniae	25/25	100.0	86.7–100.0	287/288	99.7	98.1–99.9

* Adenovirus was detected in 3/5 FP specimens using an independent molecular method. 2 FP did not undergo discordant analysis.

† The single FP Coronavirus HKU1 specimen was negative when tested using an independent molecular method.

‡ The single FP Coronavirus NL63 specimen was negative when tested using an independent molecular method.

§ Rhinovirus was detected in 1/2 FN when tested using an independent molecular method. Rhinovirus was detected in 4/10 FP specimens using an independent molecular method.

¶ Influenza H1N1 pdm09 was detected in the single FN specimen.

** Parainfluenza Virus 3 was detected in 1/3 FN specimens by an independent molecular method.

†† Parainfluenza Virus 4 was detected in 1/2 FN specimens by an independent molecular method.

‡‡ The single FN Respiratory Syncytial Virus was negative for that target by an independent molecular method. The single FP Respiratory Syncytial Virus was negative for that target by an independent molecular method.

§§ *Chlamydophila pneumoniae* was detected in 4/5 FN specimens by an independent molecular method.

12.2.4. Testing of contrived specimens

Influenza A H1, Parainfluenza Virus 2, Parainfluenza Virus 4, Coronavirus 229E, and *Chlamydophila pneumoniae*, despite all prospective and retrospective testing efforts, were insufficient to demonstrate system performance. Therefore, contrived specimens were used as surrogate clinical specimens to supplement and test the sensitivity and specificity of the above analytes. Residual negative clinical specimens were spiked with the pathogens at 3x, 5x, and 10x LoD levels (50 of each).

Contrived samples were provided a unique study identification number and the individual who contrived the samples did not test them therefore the status of each contrived specimen was unknown at the time of testing. Results of contrived specimen testing are provided in Table 25.

Table 25. Contrived specimen results

		Positive Predictive Agreement		
	x LoD	**TP/(TP + FN)**	**%**	**95% CI (%)**
Influenza A H1*	3	24/24	100	86.2–100
	5	27/27	100	87.5–100
	10	24/24	100	86.2–100
Coronavirus 229E	3	16/16	100	80.6–100
	5	18/18	100	82.4–100
	10	16/16	100	80.6–100
Parainfluenza Virus 2	3	16/16	100	80.6–100
	5	18/18	100	82.4–100
	10	16/16	100	80.6–100
Parainfluenza Virus 4	3	15/16	93.8	71.7–98.9
	5	18/18	100	82.4–100
	10	16/16	100	80.6–100

Table 25. Contrived specimen results (continued)

	Positive Predictive Agreement			
	x LoD	**TP/(TP + FN)**	**%**	**95% CI (%)**
Chlamydophila pneumoniae	3	16/16	100	80.6–100
	5	18/18	100	82.4–100
	10	16/16	100	80.6–100

* One Influenza A H1 strain [VR-897] was initially spiked incorrectly, yielding unexpected results across all LoD concentrations [3x LoD = 4/8 (50%), 5x LoD = 2/9 (22.2%) and 10x LoD = 6/8 (75.0%). A replacement strain [0810244CFHI] was sent to the testing site for spiking and strain VR-897 was also repeated to confirm that the issue was isolated to a procedural error and not an instrument failure.

12.2.5. Expected values for all targets excluding SARS-CoV-2

A total of 1994 eligible prospective nasopharyngeal swab (NPS) specimens were collected and tested at 5 sites across the US (4) and Europe (1) from December 2017 through June 2018. The number and percentage of positive cases, as determined by the QIAstat-Dx Respiratory Panel, calculated by testing site or by age group are presented in Table 26, Table 27, and Table 28.

Table 26. Expected value (EV) (as determined by the QIAstat Dx Respiratory Panel) summary overall and by site for all targets excluding SARS-CoV-2 (N = number)

	Overall (n=1994)		**Site 1 (n=418)**		**Site 2 (n=426)**		**Site 3 (n=448)**		**Site 4 (n=303)**		**Site 5 (n=399)**	
Organism	**N**	**EV (%)**	**N**	**EV (%)**	**N**	**EV (%)**	**N**	**EV (%)**	**N**	**EV (%)**	**N**	**EV (%)**
Viruses												
Adenovirus	102	5.1	44	10.5	9	2.1	12	2.7	30	9.9	7	1.8
Coronavirus 229E	8	0.4	1	0.2	0	0.0	0	0.0	7	2.3	0	0.0
Coronavirus HKU1	58	2.9	4	1.0	11	2.6	14	3.1	12	4.0	17	4.3
Coronavirus NL63	42	2.1	4	1.0	1	0.2	15	3.3	11	3.6	11	2.8

Table 26. Expected value (EV) (as determined by the QIAstat Dx Respiratory Panel) summary overall and by site for all targets excluding SARS-CoV-2 (N = number) (continued)

	Overall (n=1994)		Site 1 (n=418)		Site 2 (n=426)		Site 3 (n=448)		Site 4 (n=303)		Site 5 (n=399)	
Organism	**N**	**EV (%)**	**N**	**EV (%)**	**N**	**EV (%)**	**N**	**EV (%)**	**N**	**EV (%)**	**N**	**EV (%)**
Coronavirus OC43	30	1.5	0	0.0	5	1.2	6	1.3	12	4.0	7	1.8
Human Metapneumovirus	120	6.0	42	10.0	24	5.6	14	3.1	14	4.6	26	6.5
Human Rhinovirus/Enterovirus	304	15.2	59	14.1	78	18.3	39	8.7	53	17.5	75	18.8
Influenza A	251	12.6	120	28.7	0	0.0	58	12.9	38	12.5	35	8.8
Influenza A H1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Influenza A H1N1 pdm 2009	85	4.3	67	16.0	0	0.0	4	0.9	10	3.3	4	1.0
Influenza H3	163	8.2	52	12.4	0	0.0	52	11.6	28	9.2	31	7.8
Influenza B	123	6.2	58	13.9	0	0.0	32	7.1	7	2.3	26	6.5
Parainfluenza Virus 1	19	1.0	2	0.5	1	0.2	2	0.4	4	1.3	10	2.5
Parainfluenza Virus 2	2	0.1	2	0.5	0	0.0	0	0.0	0	0.0	0	0.0
Parainfluenza Virus 3	116	5.8	23	5.5	19	4.5	16	3.6	23	7.6	35	8.8
Parainfluenza Virus 4	5	0.3	1	0.2	0	0.0	1	0.2	0	0.0	3	0.8
Respiratory Syncytial Virus	217	10.9	64	15.3	40	9.4	35	7.8	40	13.2	38	9.5
Bacteria												
Bordetella pertussis	9	0.5	2	0.5	1	0.2	0	0.0	6	2.0	0	0.0
Chlamydophila pneumoniae	6	0.3	2	0.5	1	0.2	1	0.2	1	0.3	1	0.3
Mycoplasma pneumoniae	24	1.2	19	4.5	0	0.0	2	0.4	1	0.3	2	0.5

Table 27. Expected value (EV) (as determined by the QIAstat-Dx Respiratory Panel) summary by age category for the prospective clinical evaluation (N = number)

	Overall		≤5 years (n=627)		6–21 years (n=239)		22–49 years (n=330)		>49 years (n=798)	
	N	EV (%)	N	EV (%)	N	EV (%)	N	EV (%)	N	EV (%)
				Viruses						
Adenovirus	102	5.1	78	12.4	7	2.9	11	3.3	6	0.8
Coronavirus 229E	8	0.4	4	0.6	4	1.7	0	0.0	0	0.0
Coronavirus HKU1	58	2.9	29	4.6	5	2.1	8	2.4	16	2.0
Coronavirus NL63	42	2.1	25	4.0	3	1.3	5	1.5	9	1.1
Coronavirus OC43	30	1.5	20	3.2	2	0.8	4	1.2	4	0.5
Human Metapneumovirus	120	6.0	46	7.3	3	1.3	17	5.2	54	6.8
Human Rhinovirus/Enterovirus	304	15.2	186	29.7	35	14.6	22	6.7	61	7.6
Influenza A	251	12.6	47	7.5	36	15.1	64	19.4	104	13.0
Influenza A H1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Influenza A H1N1 pdm 2009	85	4.3	20	3.2	6	2.5	30	9.1	29	3.6
Influenza H3	163	8.2	25	4.0	30	12.6	35	10.6	73	9.1
Influenza B	123	6.2	11	1.8	22	9.2	27	8.2	63	7.9
Parainfluenza virus 1	19	1.0	11	1.8	0	0.0	4	1.2	4	0.5
Parainfluenza virus 2	2	0.1	1	0.2	0	0.0	0	0.0	1	0.1
Parainfluenza virus 3	116	5.8	70	11.2	4	1.7	6	1.8	36	4.5
Parainfluenza virus 4	5	0.3	4	0.6	0	0.0	0	0.0	1	0.1
Respiratory Syncytial Virus	217	10.9	135	21.5	11	4.6	17	5.2	54	6.8

Table 27. Expected value (EV) (as determined by the QIAstat-Dx Respiratory Panel) summary by age category for the prospective clinical evaluation (N = number) (continued)

	Overall		≤5 years (n=627)		6–21 years (n=239)		22–49 years (n=330)		>49 years (n=798)	
	N	EV (%)	N	EV (%)	N	EV (%)	N	EV (%)	N	EV (%)
Bacteria										
Bordetella pertussis	9	0.5	5	0.8	2	0.8	0	0.0	2	0.3
Chlamydophila pneumoniae	6	0.3	1	0.2	3	1.3	2	0.6	0	0.0
Mycoplasma pneumoniae	24	1.2	4	0.6	6	2.5	11	3.3	3	0.4

The number and percentage of co-infection cases, as determined by the QIAstat-Dx Respiratory Panel, calculated by age group are presented in Table 28.

Table 28. Expected value (co-infections as determined by the QIAstat-Dx Respiratory Panel for all targets excluding SARS-CoV-2) summary by age group

Co-infection	Number (expected value) overall (n=191)	<6 years (n=151)	6–21 years (n=12)	22–49 years (n=14)	>49 years (n=14)
AdV + HRV/EV + CoV NL63	2 (1.05%)	2	0	0	0
AdV + HRV/EV	12 (6.28%)	9	2	1	0
AdV + RSV	11 (5.82%)	11	0	0	0
AdV + *M. pneumoniae*	2 (1.05%)	1	1	0	0
AdV + CoV HKU1	3 (1.57%)	3	0	0	0
CoV HKU1+ AdV+ RSV	1 (0.52%)	1	0	0	0
CoV HKU1 + HMPV	3 (1.57%)	3	0	0	0
CoV HKU1 + PIV 3 + HRV/EV	1 (0.52%)	1	0	0	0
CoV HKU1 + PIV 4	1 (0.52%)	1	0	0	0
CoV HKU1 + RSV	8 (4.28%)	5	1	1	1

Table 28. Expected value (co-infections as determined by the QIAstat-Dx Respiratory Panel for all targets excluding SARS-CoV-2) summary by age group (continued)

Co-infection	Number (expected value) overall (n=191)	<6 years (n=151)	6–21 years (n=12)	22–49 years (n=14)	>49 years (n=14)
CoV HKU1 + HRV/EV + RSV	1 (0.52%)	1	0	0	0
CoV HKU1 + HRV/EV	4 (2.09%)	2	0	0	2
CoV NL63 + AdV+ RSV	1 (0.52%)	1	0	0	0
CoV NL63 + AdV	1 (0.52%)	1	0	0	0
CoV NL63 + *B. pertussis*	2 (1.05%)	1	1	0	0
CoV NL63 + PIV 1	1 (0.52%)	0	0	1	0
CoV NL63 + RSV	2 (1.05%)	2	0	0	0
CoV NL63 + HRV/EV	2 (1.05%)	2	0	0	0
CoV OC43 + AdV	2 (1.05%)	2	0	0	0
CoV OC43 + HMPV	2 (1.05%)	2	0	0	0
CoV OC43 + PIV 3 + HRV/EV	1 (0.52%)	1	0	0	0
CoV OC43 + RSV	4 (2.09%)	3	1	0	0
CoV OC43 + HRV/EV + RSV	2 (1.05%)	2	0	0	0
CoV OC43 + HRV/EV	2 (1.05%)	1	1	0	0
CoV 229E + RSV	1 (0.52%)	1	0	0	0
HMPV + AdV	2 (1.05%)	1	0	1	0
HMPV + RSV	2 (1.05%)	1	0	0	1
HMPV + HRV/EV + AdV + CoV 229E	1 (0.52%)	1	0	0	0
Influenza A (no subtype) + RSV + AdV	1 (0.52%)	1	0	0	0
Influenza A (no subtype) + RSV	1 (0.52%)	1	0	0	0

Table 28. Expected value (co-infections as determined by the QIAstat-Dx Respiratory Panel for all targets excluding SARS-CoV-2) summary by age group (continued)

Co-infection	Number (expected value) overall (n=191)	<6 years (n=151)	6–21 years (n=12)	22–49 years (n=14)	>49 years (n=14)
Influenza A H1N1 pdm09 + CoV NL63	1 (0.52%)	0	0	1	0
Influenza A H1N1 pdm09 + CoV OC43 + AdV	1 (0.52%)	1	0	0	0
Influenza A H1N1 pdm09 + HRV/EV	2 (1.05%)	1	1	0	0
Influenza A H1N1 pdm09 + HRV/EV + *B. pertussis*	1 (0.52%)	1	0	0	0
Influenza A H1N1 pdm09 + RSV	1 (0.52%)	1	0	0	0
Influenza A H3 + AdV	2 (1.05%)	0	0	1	1
Influenza A H3 + CoV NL63 + PIV 1	1 (0.52%)	1	0	0	0
Influenza A H3 + CoV NL63 + *B. pertussis*	1 (0.52%)	1	0	0	0
Influenza A H3 + CoV NL63	1 (0.52%)	0	0	0	1
Influenza A H3 + CoV OC43 + AdV + RSV	1 (0.52%)	1	0	0	0
Influenza A H3 + HRV/EV	4 (2.09%)	2	0	1	1
Influenza A H3 + PIV 1	2 (1.05%)	2	0	0	0
Influenza A H3 + PIV 3	2 (1.05%)	1	0	0	1
Influenza A H3 + RSV	1 (0.52%)	0	0	1	0
Influenza A H3 + CoV 229E	1 (0.52%)	0	1	0	0
Influenza B + CoV HKU1	3 (1.57%)	1	0	0	2
Influenza B + CoV NL63	1 (0.52%)	0	1	0	0

Table 28. Expected value (co-infections as determined by the QIAstat-Dx Respiratory Panel for all targets excluding SARS-CoV-2) summary by age group (continued)

Co-infection	Number (expected value) overall (n=191)	<6 years (n=151)	6–21 years (n=12)	22–49 years (n=14)	>49 years (n=14)
Influenza B + HRV/EV	7 (3.67%)	4	1	1	1
M. pneumoniae + CoV HKU1	1 (0.52%)	0	1	0	0
M. pneumoniae + HRV/EV	1 (0.52%)	0	0	1	0
PIV 1 + AdV	1 (0.52%)	1	0	0	0
PIV 1 + RSV	1 (0.52%)	1	0	0	0
PIV 1 + HRV/EV	2 (1.05%)	2	0	0	0
PIV 1 + HRV/EV + *M. pneumoniae*	1 (0.52%)	1	0	0	0
PIV 3 + AdV	3 (1.57%)	3	0	0	0
PIV 3 + AdV + HRV/EV	3 (1.57%)	3	0	0	0
PIV 3 + HMPV	2 (1.05%)	2	0	0	0
PIV 3 + RSV	2 (1.05%)	2	0	0	0
PIV 3 + HRV/EV	14 (7.33%)	14	0	0	0
PIV 4 + RSV	1 (0.52%)	1	0	0	0
PIV 4 + HRV/EV	2 (1.05%)	2	0	0	0
RSV + HMPV + HRV/EV + AdV	1 (0.52%)	1	0	0	0
RSV + HMPV + HRV/EV	2 (1.05%)	1	0	0	1
RSV + HRV/EV	29 (15.18%)	26	0	2	1
HRV/EV + RSV + AdV	2 (1.05%)	2	0	0	0

12.2.6. Clinical performance of QIAstat-Dx Respiratory Panel Plus SARS-CoV-2 assay

The clinical performance of the SARS-CoV-2 assay in the QIAstat-Dx Respiratory Panel Plus was established through a multi-center prospective (i.e., all comers) clinical study conducted at

five (5) geographically diverse study sites in the US. Nasopharyngeal swab (NPS) specimens in UTM were prospectively collected from individuals with signs and symptoms of respiratory infection, between February and May 2023, and February 21–26, 2024.

The clinical performance of the SARS-CoV-2 assay in the QIAstat-Dx Respiratory Panel Plus was established by comparing results to an FDA-cleared molecular respiratory panel that includes SARS-CoV-2 and was cleared under 21 CFR 866.3981. A total of 616 prospective NPS specimens were enrolled and tested in this clinical study. One specimen was excluded due to failure to meet the inclusion criteria. Overall, 615 evaluable specimens were included in the analysis.

Table 29a–Table 29d provides the summary of demographic information for the 615 subjects that participated in the study.

Table 29a. Demographic summary for the SARS-CoV-2 prospective study (sex)

	Total	
Sex	**N**	**Percentage (%)**
Female	391	63.58
Male	224	36.42
All	**615**	**100.00**

Table 29b. Demographic summary for the SARS-CoV-2 prospective study (age group)

	Total	
Age group	**N**	**Percentage (%)**
<5	23	3.74
5–9	23	3.74
10–13	4	0.65
14–18	31	5.04
19–29	208	33.82

Table 29b. Demographic summary for the SARS-CoV-2 prospective study (age group) (continued)

	Total	
Age group	**N**	**Percentage (%)**
30–49	206	33.50
50–69	102	16.59
70–85	18	2.93
All	**615**	**100.0**

Table 29c. Demographic summary for the SARS-CoV-2 study (race)

Race	Total	
	N	**Percentage (%)**
American Indian or Alaskan Native	2	0.33
American Indian or Alaskan Native, Other	1	0.16
Asian	19	3.09
Asian, White	3	0.49
Black or African American	56	9.11
Black or African American, Native Hawaiian or Other Pacific Islander, White	1	0.16
Black or African American, White	1	0.16
Native Hawaiian or Other Pacific Islander	1	0.16
Native Hawaiian or Other Pacific Islander, White	1	0.16
Not Reported	85	13.82
Other	51	8.29
White	391	63.58

Table 29c. Demographic summary for the SARS-CoV-2 study (race) (continued)

Race	Total	
	N	Percentage (%)
White, Other	3	0.49
All	**615**	**100.00**

Table 29d. Demographic summary for the SARS-CoV-2 study (SARS-CoV-2 vaccination status)

SARS-CoV-2 Vaccination Status	Total	
	N	Percentage (%)
Not vaccinated	132	21.46
Prefer not to say/No information	69	11.22
Vaccinated	414	67.32
All	**615**	**100.00**

The overall performance of the QIAstat-Dx Respiratory Panel Plus SARS-CoV-2 assay only is shown in Table 30.

Table 30. QIAstat-Dx Respiratory Panel Plus prospective clinical performance summary for SARS-CoV-2 target only

		Positive percent agreement			Negative percent agreement		
Target	Sample Type	TP/(TP+FN)	%	95% CI (%)	TN/(TN+FP)	%	95% CI (%)
SARS-CoV-2	Fresh	61 / 63*	96.8	89.0–99.6	551 / 552†	99.8	99.0–100.0

TP-True Positive, FP-False Positive, TN-True Negative, FN-False Negative

*The 2 samples with false negative SARS-CoV-2 results by the QIAstat-Dx Respiratory Panel Plus were both positive by 2 FDA-EUA molecular SARS-CoV-2 assays.

† The single sample with a false positive SARS-CoV-2 result by the QIAstat-Dx Respiratory Panel Plus was positive by 2 FDA-EUA molecular SARS-CoV-2 assays. The PPA for SARS-CoV-2 is 96.8% with a 2-sided 95% CI of 89.0–99.6%. The NPA for SARS-CoV-2 is 99.8% with a 2-sided 95% CI of 99.0–100%.

12.2.7. Co-infection summary for SARS-CoV-2

The QIAstat-Dx Respiratory Panel Plus detected 2 SARS-CoV-2 positive specimens with distinctive multiple organism detection. The distinct co-infection combinations are presented in Table 31.

Both results were true positive based on the comparator result.

Table 31. Listing of SARS-CoV-2 positive specimens with co-infections based on the QIAstat-Dx Respiratory Panel Plus results from prospective studies

Number of positive pathogens detected	Pathogens detected	
2	Rhinovirus/Enterovirus	SARS-CoV-2
2	Human Metapneumovirus A+B	SARS-CoV-2

During the QIAstat-Dx Respiratory Panel Plus clinical evaluation a total of 615 prospective clinical specimens were tested. Of these, 98.9% (608/615) yielded valid results on the first attempt (i.e., first loaded cartridge). Of the remaining 7, 5 had invalid results and 2 had positive with warning results. Testing was repeated for the subjects with invalid or positive with warning results and in all cases a valid result was obtained on re-testing.

12.2.8. Expected values

The number and percentage of positive SARS-CoV-2 cases, as determined by the QIAstat-Dx Respiratory Panel Plus, calculated by age group are presented in Table 32 and Table 33.

Table 32. Summary of Expected values of SARS-CoV-2 by site based on the QIAstat-Dx Respiratory Panel Plus result excluding cartridge failures and positive with warning results

	Overall (n=615)		Site 1 (n=183)		Site 2 (n=33)		Site 3 (n=179)		Site 4 (n=170)		Site 5 (n=50)	
Pathogen	N Positive	% Positive	N Positive	% Positive	N Positive	% Positive	N Positive	% Positive	N Positive	% Positive	N Positive	% Positive
SARS-CoV-2	62	10.8	17	9.3	0	0.0	25	14.0	18	10.6	2	4

Table 33. Summary of expected values of SARS-CoV-2 by age groups based on the QIAstat-Dx Respiratory Panel Plus result

	Overall (n=615)		2-21 yrs. (n=108)		22-49 yrs. (n=387)		>49 yrs. (n=120)	
Analyte	**N Positive**	**% Positive**	**N Positive**	**% Positive**	**N Positive**	**% Positive**	**N Positive**	**% Positive**
SARS-CoV-2	62	10.1	2	1.8	36	9.3	24	20.0

13. References

1. Centers for Disease Control and Prevention (CDC). National Center for Immunization and Respiratory Diseases (NCIRD). Division of Viral Diseases (DVD) web site. Accessed June 2023.
2. Flu.gov web site. About Flu. **www.cdc.gov/flu/about/index.html**. Accessed June 2023.
3. World Health Organization. Influenza (seasonal). **www.who.int/en/news-room/fact-sheets/detail/influenza-(seasonal)**. Accessed June 2023.
4. Centers of Disease Control and Prevention (CDC). Common Human Coronaviruses. **www.cdc.gov/coronavirus/general-information.html**. Accessed June 2023.
5. Centers for Disease Control and Prevention (CDC). Diseases & Conditions: Coronavirus (COVID-19). **www.cdc.gov/coronavirus/2019-ncov/index.html**. Accessed June 2023.
6. Centers for Disease Control and Prevention (CDC). Diseases & Conditions: Human Parainfluenza Viruses (HPIVs). **www.cdc.gov/parainfluenza/index.html**. Accessed June 2023.
7. Centers for Disease Control and Prevention (CDC). Diseases & Conditions: Respiratory Syncytial Virus Infection (RSV). **www.cdc.gov/rsv/**. Accessed June 2023.
8. Centers of Disease Control and Prevention. Human Metapneumovirus (HMPV) Clinical Features. **www.cdc.gov/surveillance/nrevss/hmpv/clinical.html**. Accessed June 2023.
9. Centers for Disease Control and Prevention (CDC). Diseases & Conditions: Adenoviruses. **www.cdc.gov/adenovirus/index.html**. Accessed November 2022.
10. Centers for Disease Control and Prevention (CDC). Emerging Infectious Diseases. **wwwnc.cdc.gov/eid/article/12/5/05-1523_article**
11. Centers for Disease Control and Prevention (CDC). Diseases & Conditions: Non-polio Enterovirus. **www.cdc.gov/non-polio-enterovirus/**. Accessed June 2023.
12. Centers for Disease Control and Prevention (CDC). Diseases & Conditions: Mycoplasma pneumoniae Infection. **www.cdc.gov/pneumonia/atypical/mycoplasma/index.html**. Accessed June 2023.
13. Centers for Disease Control and Prevention (CDC). Chlamydia pneumoniae Infection. **www.cdc.gov/pneumonia/atypical/cpneumoniae/index.html**. Accessed June 2023.
14. Centers for Disease Control and Prevention (CDC). Legionella (Legionnaires' Disease and Pontiac Fever). **www.cdc.gov/legionella/index.html**. Accessed June 2023.

15. Centers for Disease Control and Prevention (CDC). Diseases & Conditions: Pertussis (Whooping Cough). **www.cdc.gov/pertussis/**. Accessed June 2023.
16. Schreckenberger, P.C. and McAdam, A.J. (2015) Point-counterpoint: large multiplex PCR panels should be first-line tests for detection of respiratory and intestinal pathogens. J Clin Microbiol 53(10), 3110–3115.
17. Sachdeva, S., Davis R.W., and Saha, A.K. (2021) Microfluidic Point-of-Care Testing: Commercial Landscape and Future Directions. Front. Bioeng. Biotechnol 8: 602669. doi: 10.3389/fbioe.2020.602659
18. Clinical and Laboratory Standards Institute (CLSI) Protection of Laboratory Workers from Occupationally Acquired Infections; Approved Guideline (M29).
19. Van der Zee, A., Schellekens, J.F.P., Mooi, F.R. (2015) Laboratory diagnosis of pertussis. Clin Microbiol Rev. doi:10.1128/CMR.00031-15.
20. Roorda, L., Buitenwerf, J., Ossewaarde, J.M., van der Zee, A. (2011) A real-time PCR assay with improved specificity for detection and discrimination of all clinically relevant Bordetella species by the presence and distribution of three Insertion Sequence elements. BMC Research Notes 4:11. doi: 10.1186/1756-0500-4-11.
21. BLAST: Basic Local Alignment Search Tool. blast.ncbi.nlm.nih.gov/Blast.cgi. Accessed June 2023.

14. Troubleshooting Guide

In case of damaged cartridge, please refer to the Safety Information section. For technical assistance and more information, please see our Technical Support Center at **www.qiagen.com/Support** (for contact information, visit **www.qiagen.com**). For issues that may occur with the QIAstat-Dx Analyzer 2.0, please refer to the corresponding User Manuals, which are also available at **www.qiagen.com**.

15. Symbols

The following symbols appear in the instructions for use or on the packaging and labeling:

Symbol	Symbol definition
	Contains reagents sufficient for <N> reactions
	Use by
	In vitro diagnostic medical device
	Catalog number
	Lot number
	Material number (i.e., component labeling)
	Global Trade Item Number
	Contains
	Component
	Number
Rn	R is for revision of the Instructions for Use and n is the revision number

Symbol	Symbol definition
	Temperature limitation
	Manufacturer
	Consult instructions for use
	Keep away from sunlight
	Do not reuse
	Caution
	Serial number
	Do not use if package is damaged
	Flammable, risk of fire

Symbol	Symbol definition
	Corrosive, risk of chemical burn
	Health Hazard, risk of sensitization, carcinogenicity
	Risk of harm

16. Contact Information

For technical assistance and more information, please see our Technical Support Center at **support.qiagen.com**.

17. Appendices

17.1. Appendix A: Installing the Assay Definition File

The Assay Definition File of the QIAstat-Dx Respiratory Panel Plus must be installed on the QIAstat-Dx Analyzer 2.0 prior to testing with QIAstat-Dx Respiratory Panel Plus Cartridges.

Note: Whenever a new version of the QIAstat-Dx Respiratory Panel Plus assay is released, the new QIAstat-Dx Respiratory Panel Plus Assay Definition File must be installed prior to testing.

Note: Assay Definition Files are available at **www.qiagen.com**. The Assay Definition File (**.asy**) must be saved onto a USB drive prior to installation on the QIAstat-Dx Analyzer 2.0. This USB drive must be formatted with a FAT32 file system.

To import new assays from the USB to the QIAstat-Dx Analyzer 2.0, proceed with the following steps:

1. Insert the USB stick containing the Assay Definition File into one of the USB ports on the QIAstat-Dx Analyzer 2.0.
2. Press **Options** and then select **Assay Management**.
   The Assay Management screen appears in the Content area of the display (Figure 25).

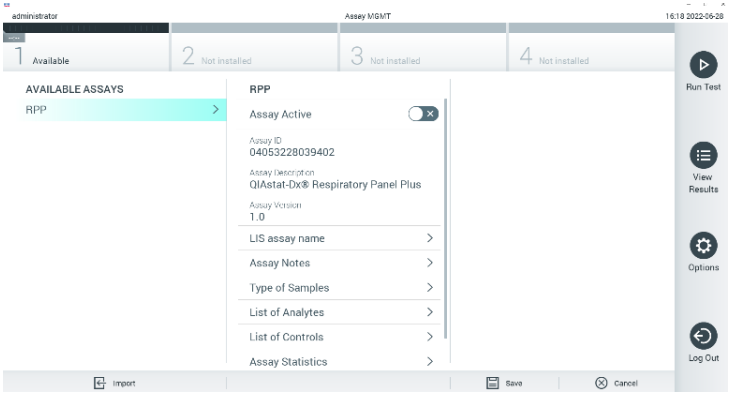


Figure 25. Assay Management screen.

3. Press the **Import** icon in the bottom left of the screen.
4. Select the file corresponding to the assay to be imported from the USB drive.
   A dialog box will appear to confirm the upload of the file.
5. A dialog may appear to override the current version by a new one. Press **Yes** to override.
6. The assay becomes active by selecting **Assay Active** (Figure 26).

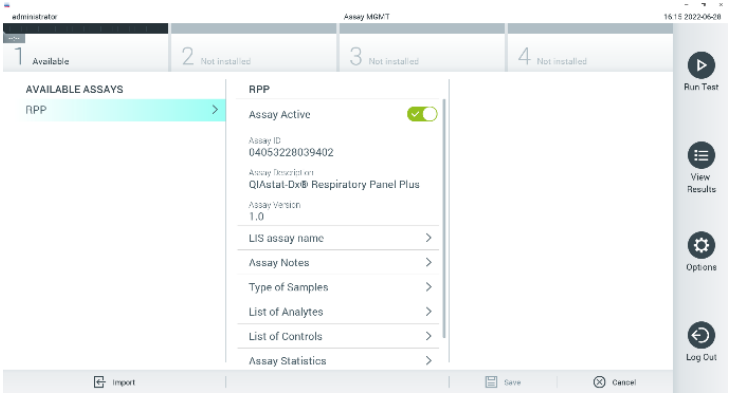


Figure 26. Activating the assay.

17.2. Appendix B: Glossary

Amplification curve: Graphical representation of the multiplex real-time RT-PCR amplification data.

Analytical Module (AM): The main QIAstat-Dx Analyzer 2.0 hardware module, in charge of executing tests on QIAstat-Dx Respiratory Panel Plus Cartridges. It is controlled by the Operational Module PRO. Several Analytical Modules can be connected to one Operational Module PRO.

QIAstat-Dx Analyzer 2.0: The QIAstat-Dx Analyzer 2.0 consists of an Operational Module PRO and Analytical Module. The Operational Module PRO includes elements that provide connectivity to the Analytical Module and enables user interaction with the QIAstat-Dx Analyzer 2.0. The Analytical Module contains the hardware and software for sample testing and analysis.

QIAstat-Dx Respiratory Panel Plus Cartridge: A self-contained disposable plastic device with all pre-loaded reagents required for the complete execution of fully automated molecular assays for the detection of respiratory pathogens.

IFU: Instructions For Use.

Main port: In the QIAstat-Dx Respiratory Panel Plus Cartridge, inlet for transport medium liquid samples.

Nucleic acids: Biopolymers, or small biomolecules composed of nucleotides, which are monomers made of 3 components: a 5-carbon sugar, a phosphate group, and a nitrogenous base.

Operational Module PRO (OM PRO): The dedicated QIAstat-Dx Analyzer 2.0 hardware that provides the user interface for 1–4 Analytical Modules (AM).

PCR: Polymerase Chain Reaction.

RT: Reverse Transcription.

Swab port: In the QIAstat-Dx Respiratory Panel Plus Cartridge, inlet for dry . The swab port is not used for the QIAstat-Dx Respiratory Panel Plus.

User: A person who operates the QIAstat-Dx Analyzer 2.0 / QIAstat-Dx Respiratory Panel Plus Cartridge in the intended way.

18. Ordering Information

Product	Contents	Cat. no.
QIAstat-Dx Respiratory Panel Plus	For 6 tests: 6 individually packaged QIAstat-Dx Respiratory Panel Plus Cartridges and 6 individually packaged transfer pipettes	691224
Related Products		
QIAstat-Dx Analyzer 2.0	1 QIAstat-Dx Analytical Module, 1 QIAstat-Dx Operational Module PRO, and related hardware and software to run molecular diagnostic QIAstat-Dx assay cartridges	9002828

For up-to-date licensing information and product-specific disclaimers, see the respective QIAGEN kit Instructions for Use or User Manual. QIAGEN kit Instructions for Use and User Manuals are available at **www.qiagen.com** or can be requested from QIAGEN Technical Services or your local distributor.

19. Document Revision History

Revision	Description
Rev. 01, July 2026	Initial release

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