

# COVID-19, PCR, Saliva (Lab Tests and Diagnostic Procedures)

## Comment

The FDA has noted that unauthorized **fraudulent** COVID-19 test kits are being sold online. The FDA advises consumers and health professionals to be cautious of websites and stores selling products that claim to prevent, diagnose, treat, or cure COVID-19 ([FDA Fraudulent 2020](#)). Consumers and health care professionals can help by reporting suspected fraud to the [FDA's Health Fraud Program](#) or the [Office of Criminal Investigations](#).

## Related Information

- [COVID-19 Antibody \(IgG\), Quantitative, Serum or Plasma](#)
- [COVID-19 Antibody \(IgG\), Semi-quantitative, Serum or Plasma](#)
- [COVID-19 Antibody \(IgG\), Serum, Plasma, or Whole Blood](#)
- [COVID-19 Antibody Total, Oral Fluid](#)
- [COVID-19 Antibody Total, Serum, Plasma, or Whole Blood](#)
- [COVID-19 Antibody, IgG/IgM Rapid Test, Serum, Plasma, or Whole Blood](#)
- [COVID-19 Antigen, Upper Respiratory Specimen](#)
- [COVID-19 Neutralization Antibody, Serum or Plasma](#)
- [COVID-19, PCR, Respiratory Specimen](#)
- [Influenza and SARS-CoV-2 Antigen, Upper Respiratory Specimen](#)
- [Influenza SARS-CoV-2 Multiplex Assay, PCR, CDC](#)
- [Respiratory Panel, PCR, Nasopharyngeal](#)

## Overview

At the end of 2019, a novel coronavirus was identified as the cause of several cases of pneumonia in Wuhan City, Hubei Province, China. Initially linked to a large seafood and animal market suggesting animal-to-human spread, person-to-person transmission was quickly confirmed (Li Q 2020). The virus spread rapidly worldwide and in January 2020, the World Health Organization (WHO) declared the outbreak a "public health emergency of international concern." On March 11, 2020, the WHO publicly characterized COVID-19 as a pandemic. Currently, more than 200 million infections have been confirmed globally in over 200 countries and territories with over 4 million deaths ([WHO situation report 2021](#)).

The novel virus has been named **severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)** and the disease it causes has been named **coronavirus disease 2019, or COVID-19**. The virus spreads by contact with respiratory fluids (droplets or aerosol) produced when an infected person exhales (eg, breathes, speaks, coughs, sneezes, or sings). These droplet/aerosol particles can be

- inhaled directly into lungs

- directly deposited on exposed mucous membranes (eyes, mouth, nose)
- transferred to mucous membranes by hands contaminated with virus-containing respiratory fluids or by indirectly touching surfaces with virus on them ([CDC SARS-CoV-2 Transmission 2021](#))

COVID-19 symptoms typically appear within 2 to 14 days (median of 5 days) of exposure and include **fever, chills, fatigue, cough, shortness of breath, myalgia, recent loss of taste or smell, vomiting or diarrhea, and/or sore throat**. Sickness ranges from a mild respiratory illness to severe disease including respiratory failure, septic shock, or other organ failure. Most fatalities have occurred in patients with underlying comorbidities, with overall global fatalities around 2 to 3 percent ([WHO situation rept 2021](#)). The CDC currently estimates that about 30% of COVID-19 infections are asymptomatic, and 50% of transmission occurs prior to symptom onset ([CDC Pandemic Planning 2021](#)).

Although molecular nucleic acid polymerase chain reaction testing on respiratory specimens has become the current gold standard method for diagnosis of SARS-CoV-2 infection (see [COVID-19, PCR, Respiratory Specimen](#)), there has been a need for a more robust specimen that is easier to collect. In early May 2020, the FDA issued an Emergency Use Authorization (EUA) to Rutgers Clinical Genomics Laboratory for TaqPath SARS-CoV-2-Assay, a real time Reverse Transcription-Polymerase Chain Reaction (rRT-PCR) assay for the detection of SARS-CoV-2 nucleic acid in NP, OP, NMT, NS, BAL, and **self-collected saliva** specimens (EUA was reissued to Infinity BiologiX in November 2020). Since the initial EUA for saliva, several other saliva tests have received FDA emergency use authorizations. Saliva specimens can be collected at home or in a health care setting when determined to be appropriate by a health care provider. Such testing is becoming more prevalent as self collection reduces the need for personal protection equipment and the process is less invasive than other methods. Although considered to be not as sensitive as nasopharyngeal (NP) specimens, comparative studies agree saliva is an acceptable alternative specimen to NP for the diagnosis of SARS-CoV-2 infection in symptomatic patients (Butler-Laporte 2020; Wong 2020; [IDSA \[Hanson 2020\]](#)) . Recent studies indicate saliva is also a valuable specimen in mass screening of asymptomatic individuals (ie, surveillance testing of a community) (Yokota 2020; Rao 2021). See [FDA EUA](#) for further information on available COVID-19 saliva testing.

In April 2021, the FDA issued EUAs for serial screening (testing an individual multiple times on a routine basis) with saliva specimens. The qualitative nucleic acid tests, developed by the University of Illinois (covidSHIELD) and Yale School of Public Health (SalivaDirect), can be used for individuals with or without symptoms. This can provide better testing solutions for schools, workplaces, and communities when establishing SARS-CoV-2 screening protocols (UIL 2021; Yale 2021).

In May 2021, the FDA issued an EUA for qualitative detection of SARS-CoV-2 nucleic acid in pooled saliva samples. Up to 12 individually collected saliva specimens can be pooled for testing (Quadrant Biosciences Inc 2021).

### **Use/Indications**

Aid in the diagnosis of coronavirus disease (COVID-19); detect current infection.

### **Special Instructions**

With the rapid spread and newly acquired knowledge of COVID-19 along with the increased availability of tests, the CDC and IDSA testing recommendations are continuously changing, see

[Overview of Testing for SARS-CoV-2 \(COVID-19\)](#) and

[Infectious Diseases Society of America Guidelines on the Diagnosis of COVID-19](#) (IDSA [Hanson 2020]).

**Note:** Testing for other respiratory pathogens by the provider should be done as part of the initial work-up (as indicated) and should not delay specimen shipping to CDC or qualified laboratory.

**Test Includes**

Qualitative detection of nucleic acid from SARS-CoV-2

**Turnaround Time**

24-72 hours from receipt of specimen in testing laboratory

**Patient Preparation**

Patient should not eat, drink, chew gum, brush teeth, use mouthwash, or smoke for at least 30 minutes prior to saliva collection.

**Specimen**

Saliva

**Container(s)**

- Collection device provided in kit
- Sterile, leakproof, plastic container
- Swab collection system provided in kit

**Volume / Minimum Volume**

1-5 mL; collection system dependent

**Collection**

Patient collected either in the presence of health care provider or at-home collection. The optimum collection method has not been determined; manufacturer instructions must be followed. Package and ship specimen on the same day as collected.

**Stability**

Room temperature: 3 to 14 days (manufacturer dependent). Follow manufacturer instructions if longer storage is required.

**Methodology**

Real time Reverse Transcriptase-Polymerase Chain Reaction (rRT-PCR)

**Normal Values/Findings**

Not detected

**Note:** If a negative result is obtained from a patient with a high index of suspicion, the Infectious Disease Society of America (IDSA) recommends repeat testing within 24-48 hours, if possible using another specimen type, preferably lower respiratory tract ([IDSA \[Hanson 2020\]](#)).

All positives must be reported to local/state health departments.

### **Interpretative Information**

- A positive result indicates the presence SARS-CoV-2 RNA; results must be correlated with patient history and clinical symptoms. Positive results do not rule out infection with other pathogens (bacteria or coinfection with other viruses).
- A Not Detected test result means that SARS-CoV-2 RNA was not present in the specimen above the limit of detection, thus a negative result does not rule out the possibility of COVID-19 and should not be used as the sole basis for patient management decisions. Negative results for SARS-CoV-2 RNA from saliva should be confirmed by testing of an alternative specimen type if clinically indicated (FDA Rutgers 2020).

### **Limitations**

Factors that can lead to a false-negative result include:

- Poor specimen quality; small amount of patient specimen
- Dilution of viscous specimen can cause loss of sensitivity
- Specimen collected very early or very late in the infection process
- Inadequate processing, storage, or shipping of specimen
- Technical reasons inherent in the test (eg, virus mutation, PCR inhibition) (FDA novel coronavirus EUA 2020)

False positive results can occur due to technical error, specimen contamination, or reagent contamination

### **Laboratory/Diagnostic Pearls**

- The relative sensitivity of saliva specimens compared with nasopharyngeal specimens has been found to be approximately 85% (Williams 2020; Pasomsub 2020).
- Although the nasopharyngeal swab specimen is used as a "gold" standard to compare other specimen types, it should be noted that NP swab is an imperfect standard due to variability in collection techniques which can lead to sampling error.
- Severe Acute Respiratory Syndrome (SARS) was identified in 2003 and Middle East Respiratory Syndrome (MERS) was identified in 2012. As these syndromes are also caused by viruses in the coronavirus family, researchers are incorporating information learned from these previous infections to aid in understanding SARS-CoV-2.

- Studies indicate SARS-CoV-2 may persist on surfaces for a few hours up to several days dependent on conditions (eg, type of surface, temperature or humidity of the environment). Warmer temperatures and exposure to sunlight reduces viral survival time ([CDC EPA 2020d](#)).
- High SARS-CoV-2 viral loads (more in nose than throat) can be detected soon after symptom onset (within first week) and can also be found in the asymptomatic patient (Zhou 2020). Viral shedding may continue for days after symptom relief and recovery (Lan 2020). Median range of viral shedding among hospitalized patients has been documented as 12 to 20 days (Zhou 2020; Young 2020).
- Current data indicate that low levels of SARS-CoV-2 may persist for up to 3 months in the respiratory tracts of persons recovered from COVID-19 infection, although it has not been found to be replication competent. If tested within 3 months of initial infection, the individuals may continue to have a positive test result, however; there is no evidence that they are contagious (CDC Duration of Isolation 2020a).

### **Additional Information**

For more information, interim guidance has been issued by the United States [CDC](#) and the [World Health Organization](#).

See: [Guidance for Healthcare Workers about COVID-19 \(SARS-CoV-2\) Testing](#)

See: [Interim Guidelines for Collecting, Handling, and Testing Clinical Specimens for COVID-19](#)

See: [Information for Laboratories](#)

See: [Interim Laboratory Biosafety Guidelines for Handling and Processing Specimens Associated with Coronavirus Disease 2019 \(COVID-19\)](#)

See: FDA [Emergency Use Authorizations](#)

### **Index Terms**

2019 Novel Coronavirus; 2019-nCoV; COVID-19 PCR; COVID-19 Saliva Test; COVID-19, Qualitative, PCR; Covid19; nCoV, 2019; Novel Coronavirus, 2019; Qualitative COVID-19; SARS-CoV-2, Saliva, PCR; Severe Acute Respiratory Syndrome Coronavirus 2; Wuhan

### **Applies to**

Pandemic; Pneumonia of Unknown Etiology

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