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. Currently the only way to be tested for COVID-19 is through licensed health care providers, although FDA EUAs have been issued for at-home, over-the-counter-assays and should become available to the consumer in the near future. See In Vitro Diagnostics EUAs for FDA-authorized tests. 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 2020a). 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), Semi-quantitative, Serum or Plasma
- COVID-19 Antibody (IgG), Serum, Plasma, or Whole Blood
- 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

Overview

At the end of 2019, a novel coronavirus was identified as the cause of several cases of pneumonia in Wuhan City, Huber 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 100 million infections have been confirmed globally in over 200 countries and territories with over 3 million deaths (WHO situation rept 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 (COVID-19). The virus is thought to spread mainly by larger respiratory droplets (and less commonly, small aerosol droplets) produced when an infected person exhales (eg, breathes, speaks, coughs, sneezes, or sings). The droplets can land in the mouths, noses and eyes of nearby people, or possibly be inhaled into the lungs. Touching a contaminated surface and transferring to eyes, nose or mouth is also thought to be a mode of transmission although not as efficient as by respiratory droplets. 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 2020c).

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 authorization. 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).

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), Considerations for COVID-19 Diagnostics (Molecular or Antigen) Testing 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 2020e).

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 2020b)

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: Interim Guidelines for Collecting, Handling, and Testing Clinical Specimens for COVID-19

See: Information for Laboratories

See: Frequently Asked Questions about Coronavirus (COVID-19) for Laboratories

See: For Healthcare Professionals

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

**References**


Clarifi COVID-19 Test Kit [product information] [EUA]. Syracuse, NY: Quadrant Biosciences Inc; September 2020.


