

A Review article of COVID-19 (Corona Virus Disease 2019) Introduction, Diagnosis, Treatment

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Abstract

Corona virus Disease 2019 (COVID-19) has become a major health problem causing severe acute respiratory illness in humans. It has spread rapidly around the globe since its first identification in Wuhan, China, in December 2019. The causative virus is called severe acute respiratory syndrome corona virus 2 (SARS-CoV-2), and the World Health Organization (WHO) named the new epidemic disease Coronavirus Disease (COVID-19). The incidence of COVID-19 continues to increase with more than three million confirmed cases and over 244,000 deaths worldwide. There is currently no specific treatment or vaccine against COVID-19. Therefore, in the absence of pharmaceutical interventions, the implementation of precautions and hygienic measures will be essential to control and to minimize human transmission of the virus. In this review, we highlight the epidemiology, transmission, symptoms, and treatment of this disease, as well as future strategies to manage the spread of this fatal coronavirus.

Introduction to COVID-19

The World Health Organization (WHO) has declared the coronavirus disease 2019 (COVID-19) a pandemic. A global coordinated effort is needed to stop the further spread of the virus. A pandemic is defined as “occurring over a wide geographic area and affecting an exceptionally high proportion of the population.” The last pandemic reported in the world was the H1N1 flu pandemic in 2009. On 31 December 2019, a cluster of cases of pneumonia of unknown cause, in the city of Wuhan, Hubei province in China, was reported to the World Health Organization. In January 2020, a previously unknown new virus was identified, subsequently named the 2019 novel coronavirus, and samples obtained from cases and analysis of the virus’ genetics indicated that this was the cause of the outbreak. This novel coronavirus was named Corona virus Disease 2019 (COVID-19) by WHO in February 2020. The virus is referred to as SARS-CoV-2 and the associated disease is COVID-19. (World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19 – 11 March 2020) (Merriam Webster Dictionary. Pandemic)

Emergency Use Listing Procedure (EUL) open for IVDs

On 30 January 2020, the Director-General declared that the outbreak of COVID-19 caused by SARS-CoV2 constitutes a Public Health Emergency of International Concern

(PHEIC) and on 11 March 2020 it was characterized as a pandemic. In vitro diagnostics (IVDs) of assured quality, safety and performance are a critical component of an overall strategy to control the pandemic.

The WHO Emergency Use Listing procedure was developed to expedite the availability of IVDs needed in public health emergency situations. It is intended to assist procurement agencies and Member States with their decisions regarding the suitability for use of a specific IVD, based on a minimum set of available quality, safety, and performance data. The procedure is currently open to candidate IVDs to detect SARS-CoV-2 (previously called 2019-nCoV).

Priority categorization of applications for prequalification and Emergency Use Listing (EUL) assessment of IVDs

Applications are currently prioritized as follows:

High priority:

- EUL applications for SARS-CoV-2 antigen detection tests
- EUL applications for SARS-CoV-2 nucleic acid detection tests intended to be used at a point of care.

Medium priority:

- prequalification applications
- EUL applications for SARS-CoV-2 nucleic acid detection tests.
All other submissions/requests are currently assigned a lower priority. Change notifications are prioritized on a case-by-case basis.

Please also note that due to the current peak in applications under assessment that the Prequalification Unit is only accepting EUL pre-submission call requests and new expressions of interest in EUL assessment for the above high- and medium-priority applications.

IVDs eligible for EUL submission

Currently, the following IVDs are eligible for EUL submission:

- assays for the detection of SARS-CoV-2 nucleic acid (multiplex assays, detecting more than one viral target)
- rapid diagnostic tests for the detection of SARS-CoV-2 antigens; other platforms to detect SARS-CoV-2 antigen will be considered on a case-by-case basis.

Instructions for manufacturers, detailing the technical documentation to be submitted, can be found below.

WHO procedure

WHO will review all documentation submitted in order to assess available evidence in support of the product's safety, quality and performance.

Currently, several performance evaluations of SARS-CoV-2 IVDs are being carried out by regulatory authorities, reference laboratories and other stakeholders in various regions.

Manufacturers are strongly encouraged to participate in initiatives which generate evidence that can be used to support their EUL submission. However, participation in external evaluations does not replace the EUL submission, nor is participation in such studies mandatory for submission for WHO EUL.

What are the symptoms of COVID-19?

According to the Centers for Disease Control and Prevention (CDC), the median incubation period for SARS-CoV-2 is 4 to 5 days Trusted Source. However, it can range anywhere from 2 to 14 days Trusted Source.

Not everyone with a SARS-CoV-2 infection will feel unwell. It's possible to have the virus and not develop symptoms. When symptoms are present, they're typically mild and develop slowly.

The most common symptoms are:

- a gradually worsening fever
- a gradually worsening cough
- fatigue
- shortness of breath

Some people with COVID-19 may sometimes experience additional symptoms, such as:

- runny or stuffy nose
- sore throat
- headache
- muscle aches and pains
- diarrhea, vomiting, and other gastrointestinal symptoms
- chills
- repeated shaking to go along with the chills
- loss of taste or loss of smell
- discoloration of the fingers and toes
- pink eye

Impact of respiratory symptoms

Some observations suggest that respiratory symptoms may worsen in the second week of illness. This appears to occur after around 8 days Trusted Source.

According to the World Health Organization (WHO), about 1 in 5 people Trusted Source with COVID-19 become seriously ill.

These individuals can develop severe pneumonia or respiratory failure. They may require oxygen or mechanical ventilation.

Emergency symptoms

Symptoms that should prompt an immediate visit to the emergency room (ER) include:

- difficulty breathing
- persistent chest pain or pressure in the chest
- confusion
- difficulty waking up or staying awake
- cyanosis, which causes blue lips or a blue face

Diagnosis (Paper-based test , PCR)

Paper Test for Quick Diagnosis of COVID-19

Researchers at the University of Illinois have developed a paper-based electrochemical diagnostic test for COVID-19 that can provide a result in just five minutes. The inexpensive test relies on the conductive properties of graphene and gold, and contains gold nanoparticles covered in sensitive nucleic acid probes that can bind to RNA from the SARS-CoV-2 virus. The presence of viral RNA changes the electrical readout from the sensor, indicating a positive result. While news of effective vaccines is very welcome during the ongoing COVID-19 pandemic, achieving widespread immunity will take a while, and measures such as social distance and mask wearing will be with us for some time to come. A key measure in tracking and controlling COVID-19 transmission is comprehensive testing, but many countries have struggled with this and the current gold-standard PCR tests are time and labor intensive. Researchers are rapidly redeploying other testing methods to aid in the pandemic response, and this latest test uses a paper-based electrochemical method to achieve viral detection in as little as five minutes. “Currently, we are experiencing a once-in-a-century life-changing event,” said Maha Alafeef, a researcher involved in the study, in a press release. “We are responding to this global need from a holistic approach by developing multidisciplinary tools for early detection and diagnosis and treatment for SARS-CoV-2.” The new test consists of filter paper covered in a layer of conductive graphene. “The discovery of graphene opened up a new era of sensor development due to its

properties,” added Alafeef. “Graphene exhibits unique mechanical and electrochemical properties that make it ideal for the development of sensitive electrochemical sensors.” The sensor also contains gold nanoparticles coated with sensitive oligonucleotide probes specific for two regions of a gene present in SARS-CoV-2. If viral RNA is present in a sample, it will bind to the probes, changing the electrical properties of the sensor and resulting in an increase in the output signal. So far, the researchers have tested the device with samples spiked with the virus, and found that the sensor could rapidly detect it and also provide an indication of viral load, suggesting that it could indicate disease progress. It’s not clear what the manufacturing costs of this kind of test would be, considering it relies on graphene, which is not trivial to mass produce.

PCR testing

PCR tests are used to directly screen for the presence of viral RNA, which will be detectable in the body before antibodies form or symptoms of the disease are present. This means the tests can tell whether or not someone has the virus very early on in their illness. During Covid-19 PCR testing, substances known as reverse transcriptase or DNA polymerase are added to a nasopharyngeal sample in a lab. These substances work to make numerous copies of any viral RNA that may be present. This is so that enough copies of the RNA are present to signal a positive result, as specifically designed primers and probes attach themselves to sequences of the genetic code of the virus to signal that a pathogen has been found. “PCR gives us a good indication of who is infected,” says University of Sussex senior lecturer in microbiology Dr Edward Wright. “They can be isolated and get in contact with people they’ve been in touch with so they can be quarantined too, just in case. That’s the true advantage of the current major diagnostic tests; you can break that transmission chain and get a clearer picture of what’s happening.” By scaling PCR testing to screen vast swathes of nasopharyngeal swab samples from within a population, public health officials can get a clearer picture of the spread of a disease like Covid-19. However, PCR still has its caveats. These types of Covid-19 test need to be sent away to a laboratory for analysis, meaning it can take days for people to find out their results. False negatives can occur up to 30% of the time with different PCR tests, meaning they’re more useful for confirming the presence of an infection than giving a patient the all-clear. They can also provide false positive results, as they’re so sensitive they can potentially signal a positive result upon detecting dead, deactivated virus still present in the body of someone who has recovered from Covid-19.

VACCINE

A **COVID-19 vaccine** is a vaccine intended to provide acquired immunity against severe acute respiratory syndrome corona virus 2 (SARS-CoV-2), the virus that causes corona virus disease 2019 (COVID-19). The COVID-19 vaccines are widely celebrated for their role in reducing the spread, severity, and death caused by COVID-19. Prior to the COVID-19 pandemic, an established body of knowledge existed about the structure and function of corona viruses causing diseases like severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS). This knowledge accelerated the development of various vaccine technologies during early 2020. On 10 January 2020, the SARS-CoV-2 genetic sequencedata was shared through GISAID, and by 19 March, the global pharmaceutical

industry announced a major commitment to address COVID-19.

In Phase III trials, several COVID-19 vaccines have demonstrated efficacy as high as 95% in preventing symptomatic COVID-19 infections. As of June 2021, 18 vaccines are authorized by at least one national regulatory authority for public use: two RNA vaccines (Pfizer–BioNTech and Moderna), nine conventional inactivated vaccines (BBIBP-CorV, Chinese Academy of Medical Sciences, CoronaVac, Covaxin, CoviVac, COVIran Barakat, Minhai-Kangtai, QazVac, and WIBP-CorV), five viral vector vaccines (Sputnik Light, Sputnik V, Oxford–AstraZeneca, Convidecia, and Johnson & Johnson), and two protein subunit vaccines (EpiVacCorona and RBD-Dimer). In total, as of March 2021, 308 vaccine candidates are in various stages of development, with 73 in clinical research, including 24 in Phase I trials, 33 in Phase I–II trials, and 16 in Phase III development. Many countries have implemented phased distribution plans that prioritize those at highest risk of complications, such as the elderly, and those at high risk of exposure and transmission, such as healthcare workers. Single dose interim use is under consideration to extend vaccination to as many people as possible until vaccine availability improves.

As of 20 June 2021, 2.66 billion doses of COVID-19 vaccine have been administered worldwide based on official reports from national health agencies. AstraZeneca anticipates producing 3 billion doses in 2021, Pfizer–BioNTech 1.3 billion doses, and Sputnik V, Sinopharm, Sinovac, and Johnson & Johnson 1 billion doses each. Moderna targets producing 600 million doses and Convidecia 500 million doses in 2021. By December 2020, more than 10 billion vaccine doses had been preordered by countries with about half of the doses purchased by [high-income countries](#) comprising 14% of the world's population.

Treatment

Currently, only one medication has been approved to treat COVID-19. No cure is available for COVID-19. Antibiotics are not effective against viral infections such as COVID-19. Researchers are testing a variety of possible treatments.

The FDA has approved the antiviral drug remdesivir (Veklury) to treat COVID-19 in hospitalized adults and children who are age 12 and older in the hospital. The FDA has granted an emergency use authorization for the rheumatoid arthritis drug baricitinib (Olumiant) to treat COVID-19 in some cases. Baricitinib is a pill that seems to work against COVID-19 by reducing inflammation and having antiviral activity. The FDA states baricitinib may be used in combination with remdesivir in people who are hospitalized with COVID-19 who are on mechanical ventilators or need supplemental oxygen.

Several monoclonal antibody medications are available. These include a combination of bamlanivimab and etesevimab, a combination of two antibodies called casirivimab and imdevimab, and sotrovimab. These drugs are used to treat mild to moderate COVID-19 in people who have a higher risk of developing serious illness due to COVID-19.

Treatment consists of a single intravenous infusion given in an outpatient setting. To be most effective, these medications need to be given soon after COVID-19 symptoms start and prior to hospitalization.

The U.S. National Institutes of Health has recommended the corticosteroid dexamethasone for people hospitalized with severe COVID-19 who are on supplemental oxygen or need mechanical ventilation. Other corticosteroids, such as prednisone, methylprednisolone or hydrocortisone, may be used if dexamethasone isn't available.

The FDA has also granted emergency use authorization for convalescent plasma therapy with high antibody levels to treat COVID-19. Convalescent plasma is blood donated by people who've recovered from COVID-19. Convalescent plasma with high antibodies may be used to treat some hospitalized people ill with COVID-19 who are either early in their illness or who have weakened immune systems.

Many people with COVID-19 may have mild illness and can be treated with supportive care. Supportive care is aimed at relieving symptoms and may include:

- Pain relievers (ibuprofen or acetaminophen)
- Cough syrup or medication
- Rest
- Fluid intake

There is no evidence that ibuprofen or other nonsteroidal anti-inflammatory drugs (NSAIDs) need to be avoided.

Important Ways to Slow the Spread

- Get a [COVID-19 vaccine](#) as soon as you can. [Find a vaccine.](#)
- Wear [a mask that covers your nose and mouth](#) to help protect yourself and others.
- [Stay 6 feet apart from others](#) who don't live with you.
- Avoid crowds and poorly ventilated indoor spaces.
- [Wash your hands often](#) with soap and water. Use hand sanitizer if soap and water aren't available.

Wear a mask

- Everyone 2 years and older should wear masks in public.
- Masks should be worn in addition to staying at least 6 feet apart, especially around people who don't live with you.
- If someone in your household is infected, people in the household should take precautions including wearing masks to avoid spread to others.
- Wash your hands or use hand sanitizer before putting on your mask.
- Wear your mask over your nose and mouth and secure it under your chin.
- Fit the mask snugly against the sides of your face, slipping the loops over your ears or tying the strings behind your head.
- If you have to continually adjust your mask, it doesn't fit properly, and you might need to find a different mask type or brand.
- Make sure you can breathe easily.

Masks are required on planes, buses, trains, and other forms of public transportation traveling into, within, or out of the United States and in U.S. transportation hubs such as airports and

stations. Travelers are not required to wear a mask in outdoor areas of a conveyance (like on a ferry or the top deck of a bus). CDC recommends that travelers who are not fully vaccinated continue to wear a mask and maintain physical distance when traveling.

people arrows light icon Stay

6 feet away from others

- **Inside your home:** Avoid close contact with people who are sick.
 - If possible, maintain 6 feet between the person who is sick and other household members.
- **Outside your home:** Put 6 feet of distance between yourself and people who don't live in your household.
 - Remember that some people without symptoms may be able to spread virus.
 - Stay at least 6 feet (about 2 arm lengths) from other people.
 - Keeping distance from others is especially important for people who are at higher risk of getting very sick.

band aid icon

Get Vaccinated

- Authorized COVID-19 vaccines can help protect you from COVID-19.
- You should get a COVID-19 vaccine when it is available to you.
- Once you are fully vaccinated, you may be able to start doing some things that you had stopped doing because of the pandemic.

users slash icon

Avoid crowds and poorly ventilated spaces

- Being in crowds like in restaurants, bars, fitness centers, or movie theaters puts you at higher risk for COVID-19.
- Avoid indoor spaces that do not offer fresh air from the outdoors as much as possible.
- If indoors, bring in fresh air by opening windows and doors, if possible.

hands wash light icon

Wash your hands often

- Wash your hands often with soap and water for at least 20 seconds especially after you have been in a public place, or after blowing your nose, coughing, or sneezing.
- It's especially important to wash:
 - Before eating or preparing food
 - Before touching your face
 - After using the restroom
 - After leaving a public place
 - After blowing your nose, coughing, or sneezing
 - After handling your mask
 - After changing a diaper
 - After caring for someone sick
 - After touching animals or pets
- If soap and water are not readily available, **use a hand sanitizer that contains at least**

60% alcohol. Cover all surfaces of your hands and rub them together until they feel dry.

- **Avoid touching your eyes, nose, and mouth** with unwashed hands.
box tissue light icon

Cover coughs and sneezes

- If you are wearing a mask:** You can cough or sneeze into your mask. Put on a new, clean mask as soon as possible and wash your hands.
- If you are not wearing a mask:**
 - Always cover your mouth and nose with a tissue when you cough or sneeze, or use the inside of your elbow and do not spit.
 - Throw used tissues in the trash.
- Immediately **wash your hands** with soap and water for at least 20 seconds. If soap and water are not readily available, clean your hands with a hand sanitizer that contains at least 60% alcohol.

spray bottle icon Clean
and disinfect

- Clean high touch surfaces daily. This includes tables, doorknobs, light switches, countertops, handles, desks, phones, keyboards, toilets, faucets, and sinks.
- If someone is sick or has tested positive for COVID-19, disinfect frequently touched surfaces.** Use a household disinfectant product from [EPA's List N: Disinfectants for Coronavirus \(COVID-19\)](#) external icon according to manufacturer's labeled directions.
 - **If surfaces are dirty, clean them** using detergent or soap and water prior to disinfection.

head side medical light icon

Monitor your health daily

- Be alert for symptoms.** Watch for fever, cough, shortness of breath, or [other symptoms of COVID-19](#).
 - Especially important if you are [running essential errands](#), going into the office or workplace, and in settings where it may be difficult to keep [a physical distance of 6 feet](#).
- Take your temperature** if symptoms develop.
 - Don't take your temperature within 30 minutes of exercising or after taking medications that could lower your temperature, like acetaminophen.
- Follow [CDC guidance](#) if symptoms develop.

Conclusion

There are hundreds of coronaviruses, most of which circulate in animals. Only seven of these viruses infect humans and four of them cause symptoms of the common cold. But, three times in the last 20 years, a coronavirus has jumped from animals to humans to cause severe disease.

SARS, a beta coronavirus emerged in 2002 and was controlled mainly by aggressive public

health measures. There have been no new cases since 2004. MERS emerged in 2012, still exists in camels, and can infect people who have close contact with them.

COVID-19, a new and sometimes deadly respiratory illness that is believed to have originated in a live animal market in China, has spread rapidly throughout that country and the world.

The new coronavirus was first detected in Wuhan, China in December 2019. Tens of thousands of people were infected in China, with the virus spreading easily from person-to-person in many parts of that country.

The novel coronavirus infections were at first associated with travel from Wuhan, but the virus has now established itself in 177 countries and territories around the world in a rapidly expanding pandemic. Health officials in the United States and around the world are working to contain the spread of the virus through public health measures such as social distancing, contact tracing, testing, quarantines and travel restrictions. Scientists are working to find medications to treat the disease and to develop a vaccine.

The World Health Organization declared the novel coronavirus outbreak “a public health emergency of international concern” on January 30. On March 11, 2020 after sustained spread of the disease outside of China, the World Health Organization declared the COVID-19 epidemic a pandemic. Public health measures like ones implemented in China and now around the world, will hopefully blunt the spread of the virus while treatments and a vaccine are developed to stop it.

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