



## COVID-19 Epidemiology and Natural History

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Last updated: May 13, 2020

### Origins

The first cases of pneumonia, now identified as caused by a novel coronavirus—the SARS-CoV-2 virus—were reported in December 2020 in Wuhan, Hubei province, Republic of China. The outbreak has been associated with patients who worked at or lived near a live animal and produce market, the Hunan Wholesale Seafood Market. The origin is suspected as animal-to-human viral transmission. [Researchers](#) examining two sub-lineages of the SARS-CoV-2 genome theorize the virus originated in [bats](#) then passed through an intermediary animal (some scientists have suggested the [pangolin](#), one of the most trafficked mammals), infecting humans by binding to our [ACE2 receptors](#), found in heart and lung cells.

The highly contagious SARS-CoV-2 virus causes the illness named COVID-19. Human-to-human transmission was rapidly documented. It has also been shown to spillover in wild and domesticated [feline species](#). Transmission occurs when a person coughs, sneezes, or speaks, causing tiny droplets from the nose or mouth to travel outward. Individuals can become infected when droplets are inhaled, ingested, or transferred to the face, mouth, or eyes via unwashed hands contaminated by coughs or sneezes, or via touching surfaces where respiratory droplets have landed. The virus has been reported as traveling via tiny, liquid droplets (20-50 micrometers [ $\mu\text{m}$ ]), such as walking through a mist, as well as carried far distances with airflow ([>2m, or more than 6 feet](#)). Further studies are needed to understand transmission in confined spaces, but there have been suggestions that [air conditioning](#) could direct airflow and play a role, which has implications when planning to re-open office spaces, restaurants, and other businesses.

There has been [some evidence](#) of viral ribonucleic acid (RNA) in feces, yet fecal-oral transmission has not been substantiated. [Sexual transmission](#) that does not include saliva or mucus has not been found; there's no evidence that it transmits through vaginal fluid or semen. There are few studies on transmission during pregnancy, amniotic fluid, or breastmilk; pregnant people and newborns alike are at risk of getting COVID-19. [Guidance](#)

recommends not to breastfeed while sick, and to take precautions to wash hands and disinfect breast pumps before breastfeeding.

The SARS-CoV-2 virus initially spread rapidly in the Hubei province, with outbreaks subsequently reported in most regions in the Republic of China. This quickly prompted strict public health policies of containment and quarantine in most cities to prevent further transmission. [The first case reported outside the Republic of China](#) was in Thailand on January 13, 2020; this event marks a second phase in the epidemic. Additional outbreaks were detected in early February 2020, on the Diamond Princess cruise ship, and in early March 2020, on the Grand Princess cruise ship, indicating how quickly the virus can travel in confined spaces. The third phase of the epidemic saw a rapid increase in cluster cases around the world. COVID-19 cases were reported by the end of January/early February in South Korea, Northern Italy, and Iran, given the travel hubs and potential “super-spreading events,” such as large gatherings, religious congregations, and carnival festivities. By March 11, 2020, [the WHO](#) called the COVID-19 viral disease a pandemic; cases have been reported in 210 countries, nearly everywhere in the world.

The first known cases in the U.S. were documented in early 2020, and [the first related death](#) has been reported as February 6, 2020. Data collection varies by state, but trends of more severe cases and hospitalizations are linked to social determinants of health. Since the onset of the U.S. epidemic, COVID-19 has disproportionately affected [immigrants](#) and communities of color, many of whom have a [higher prevalence of underlying chronic conditions and comorbidities](#) that raise the risk of infection. Lower incomes, higher representation in frontline service work, higher exposure to air pollution, and other racial and [socioeconomic inequalities and injustices](#) have been found as contributing factors in the higher rates of hospitalizations and deaths among immigrants and communities of color. This is notably reflected in data emerging in [New York City](#), [New York State](#), and in [disproportionately black U.S counties](#).

## Symptoms

Common symptoms of COVID-19 are fever, dry cough, tiredness, shortness of breath, nausea, or diarrhea. The [Centers for Disease Control and Prevention \(CDC\)](#) expanded the list of symptoms from fever, cough and shortness of breath to also include:

- chills
- repeated shaking with chills
- muscle pain
- headache
- sore throat
- loss of taste or smell.

## Natural History

Anyone is at risk of catching COVID-19, and people who are without symptoms or with mild symptoms can transmit the virus. An [estimated 25%](#) or more people are [asymptomatic](#). Symptoms are usually mild and start slowly. About [80% of people](#) recover from COVID-19 without requiring hospitalization or intensive treatment. However, 1 in 5 people who have COVID-19 become seriously ill and have trouble breathing. People who are older (over age 55) and people with comorbidities, such as high blood pressure, cardiovascular disease, other heart and lung conditions, diabetes, cancer, or with compromised immune systems, such as living with untreated HIV, chronic HCV, and TB, may be at greater risk of developing a more severe illness. [In the U.S.](#), these chronic conditions and comorbidities disproportionately impact people of color and low-income communities. Children and adolescents (younger than age 19) are more rarely affected and generally have mild cases of COVID-19, representing [around 2% of total cases](#). There are concerns that young children may be vulnerable to a rare [multi-system inflammatory manifestation](#) of the disease, which is not yet fully characterized.

People with mild symptoms are recommended to self-isolate in a safe space, if possible, to avoid public places, rest, and treat the infection like a seasonal flu. People who experience a fever, persistent cough, and difficulty breathing are recommended to consult their doctors via telemedicine, if that is an option. People who experience more severe symptoms, including shortness of breath, chest pains, or signs of a stroke, are recommended by the CDC to seek emergency care in hospital.

Patients in different populations are presenting different symptoms at different points of care. Some researchers have theorized that the virus is causing the immune system to overreact in similar ways as HIV, in what has been termed as a “cytokine storm.” COVID-19 can also target and injure the [brain, central nervous system, eyes, nose, lungs, heart, blood vessels, livers, kidneys, intestines](#). [One New York State study](#) showed up to 70% of 5,700 patients who were sick enough to seek hospital care did not have a fever. [One proposal](#) for the respiratory problems could be “silent hypoxia”, or the collapse of air sacs in the lungs. [Emerging evidence](#) has also demonstrated that blood clotting can occur, in which hundreds of small clots in the lungs can separate and travel to the brain or heart, causing a stroke or heart attack.

[People can be asymptomatic and still shed the virus](#) for up to 12 days. Viral shedding is a slow process. In mild to moderate cases, the time from onset of symptoms to recovery has been shown to be around [22 days](#). In more severe cases, symptoms such as difficulty breathing took about [one week](#) to develop. The proportion of people with severe cases who need to enter intensive care treatment (ICU) vary in available studies. [In Nanchang, Republic of China](#), about 23 (77%) of 30 people with severe cases required ICU treatment.

Severity of cases has also been attributed to higher viral loads of the virus, with the average viral load as much as [60 times higher](#) than mild cases. Critical cases—for example, people who require intubation/invasive ventilators to assist with breathing—are [estimated](#) at [3%](#).

The projection of the virus in one country is not “one-size fits all”, and it looks differently in different contexts. Mortality rates vary according to many variables: population, demographics, quality, equity, and access to care, underlying health conditions, social determinants of health, mobility, housing stability, ventilation, et cetera. Mortality at the global level has been [estimated as 1-2%](#) of total cases.

For real-time, updated epidemiological data, visit the Epidemiology/Tracking section of our [Resources](#) page.