



# A Mini-review of the 2019 Novel Coronavirus, SARS-CoV-2

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## Abstract

A novel coronavirus has recently emerged in December 2019 out of Wuhan City, Hubei Province, China. The virus can cause disease, termed coronavirus virus disease 2019, or COVID-19. Its presentation is similar to severe acute respiratory syndrome, known as SARS, because of the disease manifesting as mild-to-severe respiratory symptoms. Animals sold out of a seafood market in Wuhan are thought to have transmitted the virus. Since its discovery, it has infected more than 78,000 people and spread to at least 30 other countries. The majority of cases are in China, but cases are increasing in multiple countries throughout the world, including the United States. The virus shares many similar physical and pathogenic features as the virus that causes SARS and has thus been named SARS-CoV-2. Close contact can cause transmission of the virus. Initial symptoms in 2-14 days of viral contact are similar to influenza, including fever, cough, myalgias, and dyspnea. Those with severe illness are generally older or those with medical comorbidities. There are currently no cures or vaccines against the virus.

In comparison to seasonal influenza, which is currently more prevalent than SARS-CoV-2, SARS-CoV-2 is considered more infectious and carries a higher mortality rate. There is still much to learn about the virus, as it is expected to continue spreading. Global efforts are being made via public health emergencies to identify those infected and quarantine them early on to prevent further spread.

**Abbreviations:** SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus 2; COVID-19: Coronavirus Disease 2019; CoV: Coronavirus; SARS-CoV: Severe Acute Respiratory Syndrome Coronavirus; MERS-CoV: Middle Eastern Respiratory Syndrome Coronavirus; ACE2: Angiotensin-Converting Enzyme 2; RBD: Receptor Binding Domain; RBM: Receptor Binding Motif; RT-PCR: Reverse-transcription Polymerase Chain Reaction

## Introduction

The 2019 novel coronavirus, previously known as 2019-nCoV, now named SARS-CoV-2 by the International Committee on Taxonomy of Viruses, is a newly emerging virus affecting the respiratory tract. The disease the virus causes, which was named by the World Health Organization, is coronavirus disease 2019, better known as COVID-19. It has quickly spread internationally, affecting more than 78,000 people and claiming over 2,400 lives since its discovery in December 2019. It continues to be a global health concern, with multiple countries declaring public health emergencies, including the United States [1,2].

Coronavirus (CoV) is an enveloped pathogen that contains a single-stranded positive-sense RNA that is 27-32 kb in length [3]. CoV is the largest known RNA virus [4]. It had gained notoriety in the medical and scientific communities within the last 20 years

due to the outbreaks of severe acute respiratory syndrome CoV (SARS-CoV) in 2003 and Middle Eastern respiratory syndrome CoV (MERS-CoV) in 2012. SARS-CoV infected 8098 patients with a 10% mortality rate. MERS-CoV infected 2,254 patients with a 35% mortality rate [4]. The mortality rate of SARS-CoV-2 is currently estimated to be about 2% [5]. Before these outbreaks, the majority of infections by CoV were found in birds and mammals [6].

There are four genera in the sub-family of Coronaviridae, and each genus has a preference to infect a specific type of host. Before the new outbreak, six CoVs cause infections in humans, the most serious, including SARS-CoV and MERS-CoV, and four others that cause mild upper and lower respiratory symptoms. Betacoronaviruses, including SARS-CoV, MERS-CoV, and now SARS-CoV-2, infect mammals, while deltacoronaviruses infect birds. Bats are believed to be the main reservoirs for beta-coronaviruses; other

mammals, such as palm civets for SARS-CoV and dromedary camels for MERS-CoV, serve as an intermediate host. The crossing of the animal to humans, which has been documented in all three CoV outbreaks, makes CoV a zoonotic virus. [3,4,6].

SARS-CoV-2's physical structure and pathogenic behavior share similarities with SARS-CoV. CoVs utilize a protein called a spike (S) protein to bind to target cells and a cellular protease to prime the S protein. "The overall sequence similarities between [SARS-CoV-2] spike and SARS-CoV spike... are around 76%-78% for the whole protein, around 73%-76% for the RBD [receptor binding domain], and 50%-53% for the RBM [receptor binding motif]" [7]. The target cellular receptor for the S protein of SARS-CoV-2 was confirmed to be the same as SARS-CoV, angiotensin-converting enzyme 2 (ACE2). The cellular protease, TMPRSS2, was also the same [8] [7,9]. In spite of many similarities between SARS-CoV-2 and SARS-CoV, SARS-CoV-2 is more closely related to two other coronaviruses found in bats, bat-SL-CoVZC45, and bat-SL-CoVZXC21 [8], which suggests that bats are the reservoir for this virus [10].

SARS-CoV-2 was first discovered in Wuhan City, Hubei Province, China, during December 2019 after several patients developed viral pneumonia that appeared similar to SARS. The identified patients had similar exposure to the Huanan Seafood Wholesale Market in Wuhan, which sells live animals, including birds and other mammals. These mammals are postulated to have served as an intermediate host, similar to SARS-CoV and MERS-CoV, and transmitted the virus to humans, although the species of animal is still unknown. [11]. The virus has since spread to at least twenty-four countries [12].

The rapid spreading of disease has lead healthcare professionals and scientists to believe that the virus can be transmitted from person-to-person via close contact [10,13]. There is concern that the virus can be transmitted asymptotically, prior to symptom onset [14]. The virus had been detected in respiratory secretions and stool, with respiratory secretions thought to be the primary means of transmission [15]. The incubation period from exposure to onset of symptoms ranges from 2 to 14 days [16]. An RT-PCR laboratory test kit testing upper and lower respiratory specimens are the method of detection [17]. In a small case series of 18 patients, radiographic findings on chest computed tomography scan included ground-glass opacities with or without consolidation, opacities with a rounded appearance, and a crazy paving pattern. The distribution is typically bilateral involving multiple lobes of the lungs. Cavitory lung lesions, pleural effusions, lymphadenopathy, and pulmonary nodules were not found [18]. In a large case series published by JAMA, of 138 confirmed cases of COVID-19 in a Wuhan, China hospital, the most common symptoms included fever (98.6%), fatigue (69.6%), dry cough (59.4%), myalgia (34.8%), and dyspnea (31.2%). The median age of those infected patients was 56 years old. Twenty-six percent of patients were admitted to the intensive

care unit (ICU). The median age of those admitted to the ICU was generally older, 66 years, with the majority having other medical comorbidities. Of those infected, six died (4.3%). At this time, there is no antibiotic or antiviral shown to improve the outcome of COVID-19 [10]. There is no vaccine to protect patients against SARS-CoV-2 [19]. International organizations recommended supportive therapies for the complications of COVID-19, including acute respiratory distress syndrome, septic shock, and prevention of other in-hospital adverse outcomes.

Questions often arise regarding prevention, mortality, and degree of contagiousness between the influenza virus and SARS-CoV-2. Currently, the best way to prevent influenza and its complications is by vaccination, whereas there is no vaccine for SARS-CoV-2. The best way to prevent the spread of COVID-19 is to stay home if one feels sick, wash hands frequently, avoid touching one's own face, avoiding traveling to countries with endemic spread of the virus, and avoiding contact with those known to have the virus. According to the CDC, there has been an estimated 26 million cases of the flu and 14,000 related deaths, a 0.05% mortality rate, in the United States this season [20]. Globally, there are more than 78,000 cases of COVID-19 and over 2,400 related deaths, a mortality rate of about 2% [5]. Comparatively speaking to countries like China and Italy, the United States' spread is not yet as extensive [21]. Although the United States' outbreak is not yet as high, serious precaution must still be made, as COVID-19 has a mortality rate 40 times that of influenza. To compare the degree of contagiousness of each virus, the R0 of seasonal influenza is 1.3 [22] and the R0 of SARS-CoV-2 is 2.2 [10] [23]. This means that SARS-CoV-2 is nearly twice as contagious as Influenza. It is expected that the number of cases of COVID-19 will continue to trend upwards in the coming months. Early identification of patients with flu-like symptoms with recent travel to countries endemic with the virus or exposure to others infected with the virus is critical for detection, treatment of illness, and prevention of spread. There is no cure for COVID-19, only supportive therapy for presenting symptoms. There is understandable concern regarding the mortality rate and how easily contagious COVID-19 is when compared to influenza. Efforts must continue to be made to reduce spread. Much research is still needed regarding the origins of SARS-CoV-2.

## Conclusion

Its mode of transmission, treatments, and an effective vaccine.

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