

# COVID-19: Comprehensive Review of Transmission, Clinical Features, Diagnosis, Treatment, and Prevention Strategies

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**Abstract.** The emergence of Coronavirus Disease 2019 (COVID-19) has been a considerable challenge to global health. This study surveys the origins, morphology, structure, and genome of coronaviruses, with a particular emphasis on SARS-CoV-2. The epidemiology of the virus is debated, emphasizing its transmission conventions, risk factors, and global case dispersal. Clinical manifestations range from mild symptoms to severe intricacies, such as critical respiratory distress syndrome and multi-organ dysfunction. The analysis outlines the mechanisms of viral entrance and duplication in cells of the host, highlighting the role of the ACE2 receptor. Screening strategies, such as polymerase chain reaction (PCR) and clinical evaluation, are studied. Current treatment options remain limited, with supportive care being the primary approach. Besides, preventive measures, including quarantine, personal protective equipment, and hygiene practices, are highlighted as key approaches to mitigate virus spread. The study contributes to the clarification of COVID19 by summarizing its characteristics, diagnostic strategies, treatment plans, and prevention procedures.

**Keywords.** COVID19, SARSCoV-2, Transmission, Diagnosis and Treatment, Prevention Strategies.

## 1. Introduction

Virology has its sources dating back to 1892, with the isolation of the foremost avian infectious bronchitis virus, corona virus fulfilled by Frad Baeudette in 1937 [1]. This was followed by the identification of SARSCoV within 2002 and the Middle East Respiratory Syndrome corona virus (MERSCoV) within 2012. As of March 25, 2020 [2,3], there have been roughly 21,000 deaths among more than 470000 patients, with around 82000 noted in China and an accumulative totality overextending 380000 verified cases across 194 governments. This article provides a summary of index case records within Africa, highlights distinctions among SARS\_CoV\_2 and different corona viruses, and outlines the preventative approaches employed. The epidemic of COVID-19 indicates a significant global health crisis and poses an enormous challenge worldwide. It's an enclosed RNA virus which is specifically prevalent within animal as well as human beings. It's classified within the Niadovirales group, which involves families such as Coronaviridae, Arteriviridae, and Roniviridae [4,5]. For the time being, there have been 15,033,861 instances of Coronavirus illness (COVID19), which has resulted in 618,061 deaths around the globe. due of the lockdown that was imposed due of the coronavirus, numerous activities throughout the world have been halted, a number of firms have restricted their operations, and an increasing number of individuals anticipate that they will lose their employment [6].

## 2. Morphology of Coronaviruses

Inoculation of the vero cells was performed using SARS-CoV-2 that had been identified from nasopharyngeal and oropharyngeal material. Using a combination of 2% paraformaldehyde and 2.5% glutaraldehyde, inoculation cells were primed with the SARS-CoV-2 virus, and then transmission electron microscopy was carried out. Infected cells were examined three days after infection in order to investigate the structure of the SARS-CoV-2 virus. The coronavirus-specific morphology of SARS-CoV-2 was discovered through the use of electron microscopy. When examined under a wide range of intracellular organelles, virus particle sizes ranging from 70 to 90 nm were detected, with vesicles being the most prominent example [7]. As a result of the significant sequence similarity between the two viruses, it is hypothesized that the structure of SARS-CoV-2 is identical to that of SARS-CoV [8]. A lipid bilayer that is produced from the host membrane encapsulates the helical nucleocapsid that contains viral RNA as stated in figure 1 [9]. The surface viral protein spike, membrane, and envelope of the coronavirus are all encased in this lipid bilayer. The structure of the spike [10] and the protease of SARS-CoV-2 [11] has been understood, which opens the door for the creation of a more recent category of medicines that may be used to treat COVID-19.

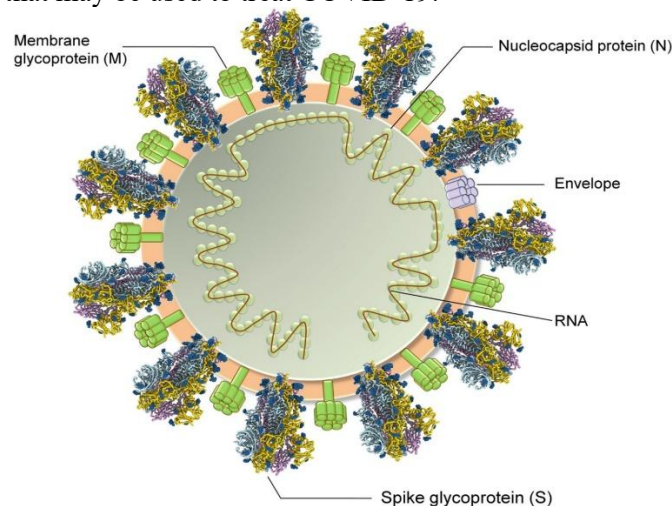
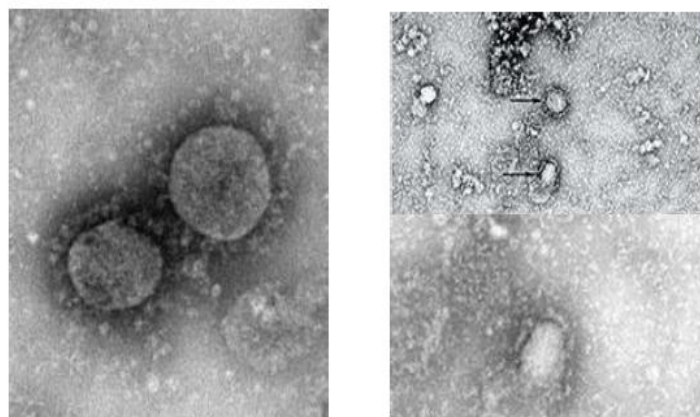


Figure 1. The structure of the SARSCoV\_2 virus.

## 3. Coronaviruses Genome and Structure

Coronaviruses are single strand RNA virus. Several primary protein components are involved in the COVID-19 genome: the protein Spike (S), the Membrane (M) protein, the Envelope (E) protein, and the Nucleocapsid (N) protein [14]. Despite more widespread is the dissemination of SARS-COV-2 across communities [15,16]. The coronavirus known as SARSCoV-2 is a wrapped virus that fluctuates in diameter from around 60 to 140 nanometers and is broadly spherical or somewhat pleomorphic by appearance [17]. The taxonomic information of 2019-nCoV, a coronavirus, is displayed in Figure 2. This information pertains to an atmospheric sampling and a healthcare individuals sample from Wuhan, which is located in Hubei Province, China. A description and narration of the history of the virus detection may be found in the next section. SARSCoV is a category of Corona viruses as stated in China within 2003, MERSCoV in Saudi Arabia since 2012 as well as SARSCoV-2 or COVID-19 also in China since 2019. COVID19 as well as SARS-CoV appear to have very similar clinical features, with just a small difference between the two.



(A) Isolation source: environmental samples. (B) Isolation source: clinical patients.

Figure 2. Taxonomy information of 2019-nCoV, \_ coronavirus <http://nmdc.cn/nCov/en>.

**5. Epidemiology of Coronaviruses**

It is possible for people of any age to get the sickness. Large droplets that are produced as a result of coughing and sneezing by those who are experiencing symptoms are responsible for the transmission of the disease for this reason. There are several situations in which the infection can occur in persons who are asymptomatic and prior to the onset of symptoms. As of March 2020, the World Health Organization (WHO) reported that there are about 87,317 cases of COVID-19 around the globe, and the number of fatalities that have been verified is 2,977 [18,19,20].

The fact that just 3.42 percent of people who have the sickness have passed away as a result of the virus suggests that the symptoms of the condition are very moderate. While this is proceeding on, it has been located that China has a notable number of deaths and incidents. It is a fact that Asia, and China in special, has been the zone where 92% of the entire number of instances have been recorded [21]. The confirmed instances are clinically identified and laboratory-approved, which is an critical point to highlight. Similarly, the number of cases and fatalities differs beyond of Asia due to the continuing nature of the disease, residents density, the degree of testing and recording, and the timing of goes to decrease the disease [22].

As stated on the third of March, 2020, the World Health Organization has documented 87317 cases within the world. As an outcome of these verified cases, 2977 individuals, or 3.42%, have passed away as a development of the virus. China has been the reporting zone for the most prevalence of patients and fatalities. China has been recognized as the zone of 79968 cases, which accounts for 92% of the whole number of infected patients. In a similar vein, all of the fatalities that have been documented have occurred in China, with a total of 2,873 deaths [23]. It is essential to keep in mind that verified cases are those that have been clinically identified and confirmed by laboratory testing. Outside of China, there have been a total of 7,169 cases reported in 59 different countries. It is anticipated that the number of cases and the nations that are affected by the pandemic will vary due to the continual nature of the epidemic. Table 1 states the Epidemiology of COVID-19 Transmission, Impact, and Risk Factors.

Table: Epidemiology of COVID-19 Transmission, Impact, and Risk Factors.

Aspect	Details	Key Insights
Transmission	Spreads via respiratory droplets.	social distancing are essential.
Global Impact	87,317 cases, 2,977 deaths (3.42% mortality) as of March 2020.	High infection rates required urgent health interventions.
High-Risk Groups	Underlying conditions are more vulnerable.	Extra protective measures are necessary for these groups.
Spread & Factors	Affected 194 countries.	Strong healthcare systems.

## 6. Clinical features of Coronaviruses

It is possible for this condition to manifest itself in a variety of clinical manifestations, ranging from a state of asymptomaticness to acute respiratory distress syndrome, septic shock, and malfunction of several organs. In an ideal world, this condition would be classified according to its severity, making it possible to distinguish between mild, moderate, severe, and critical [24]. The clinical manifestations of COVID-19 span a broad spectrum, ranging from individuals who are asymptomatic to those who are experiencing septic shock and dysfunction in many organs [23]. In order to categorize COVID-19, the severity of the presentation is taken into consideration [23].

### 6.1. Mild Disease

It is possible for those who have the very modest illness to exhibit symptoms of a viral contamination of the respiratory system. In addition to a dry cough, a little temperature, a sinus infection, a sore throat, lethargy, muscular discomfort, and headache, clearly noticeable symptoms include [25]. A further distinguishing feature of this condition is the absence of severe symptoms, such as dyspnea. Eighty-one percent of COVID-19 cases are classified as having a light severity [23]. In addition to this, radiograph characteristics are not present in scenarios like these [26].

### 6.2. Moderate Disease

The respiratory symptoms that these individuals present with include breath shortness, coughing, and tachypna [23]. There are no symptoms or even indications of a major illness to be found at this time [24].

### 6.3. Severe Disease

Patients who are suffering from severe illness typically come with critical respiratory distress syndrome, pneumonia, septic shock, or sepsis [23]. The screening is done with clinical examination, and intricacies may be prevented by the utilization of the analysis of radiographics. With the assistance of radiographic investigation, the diagnosis at this stage is medical, and it is possible to exclude health concerns from consideration. Furthermore, it is important to note that five percent of those who have the sickness might have a dangerous condition that manifests itself with symptoms of respiratory issues, multiple organ dysfunction, RNAemia, and cardiac problems [27].

## 7. Entry and Replication of Coronavirus in Host Cells

The attachment of glycoprotein spikes with a cell receptor along with the activation of S protein via cell-surface proteases, which constitute vital prerequisites for the entrance of coronaviruses into their host cells. Internalization of SARSCoV2 is accomplished via the ACE2 receptor usage, and S protein priming is accomplished via utilization of TMPRSS2 serine proteases [28]. As is the case with SARSCoV, It could be feasible to see the extrapulmonary spreading of SARSCoV-2 as a result of the widespread activity of the ACE-2 receptor within connective tissue. There is evidence that the spike protein of SARS-CoV-2 is visible to have a ten to twenty times stronger affinity than the protein of spike within SARSCoV, according to research [29]. Due to the result of the spike protein attaching to the receptor of the ACE-2, The protein spike goes through a series of morphological modifications, which, in the end, lead to the attachment in which the viral envelop protein into the membrane of the cell that is the host whenever the viral infection has succeeded in infecting a cell through the endosomal route 30 and 31. Following this phase is the expulsion of RNA from the virus through the cytoplasm within the host, whereby it is subsequently exposed to translation and creates replicase polyproteins that are pp1a and pp1b. Taking this into consideration, virus-encoded proteinases have been accountable for the disintegration of such polyproteins into protein fragments. A mechanism known as ribosomal frameshifting takes place while the interpretation is being done of the coronavirus. This leads to the production of genome RNA species as well as many copies of sub genomic RNA species via the process of discontinuity transcribing. Besides, species of the RNA encode for viral proteins that are crucial to the replication of the virus. An interaction between viral

RNA and protein takes place in the endoplasmic reticulum (ER) and the Golgi complex, which is where virion assembly takes place. Vesicles are responsible for the eventual release of these virions upon their departure from the cells as stated in figure 3 [32].

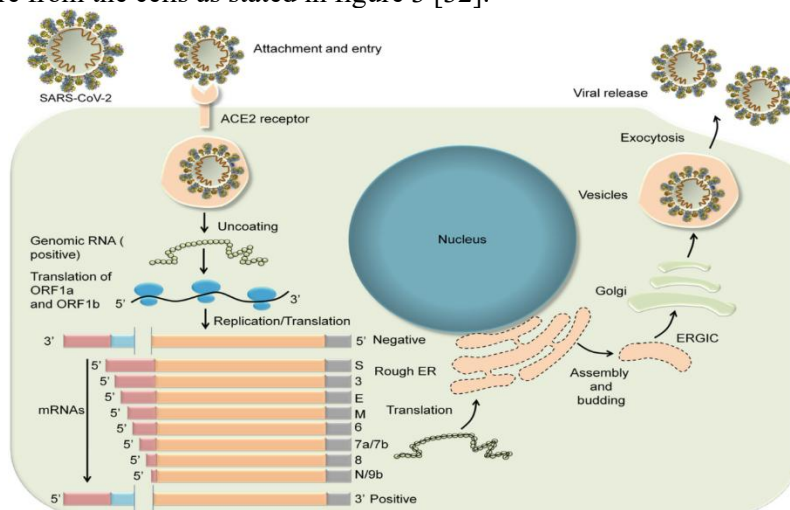


Figure 3. Entry and replication of SARS-CoV-2 in host cells.

## 8. Diagnosis Coronaviruses

Examining the case Utilizable screening and diagnostic methods are required for all of the following: efforts to block the propagation of the COVID-19; steps to implement seclusion as well as confinement; and clinical management of cases in an appropriate manner. While SARSCoV-2 is scattering, it is possible that other respiratory illnesses are more prevalent in the population where it is being observed. A guideline on the surveillance of COVID19 cases was stated by the WHO within January 31, 2020 [33]. respiratory disorders carried associated with coronaviruses have been found to account for between 5 and 10 percent with critical respiratory illnesses, with no symptoms of this virus accounting for over 2% of the entire population [34].

Disease Control Center and Prevention in the USA have devised criteria that can be used to an individual who is the subject of an inquiry. The ideal case is for quick control and management activities to be started in the event that an case is the subject of an inquiry [5]. In the meanwhile, clinical regards are taken into account in order to specify whether or not examining is mandated. Within fourteen days after the onset of symptoms, this needs close engagement with a infected case who has been screened with the infection. Besides, it may entail a history of travel to an infected spot within 14 days of the onset of signs [35].

The Centers for Disease Control and Prevention (CDC) in the United States has set criteria for individuals under investigation (PUI) [4]. There is an primary implementation of preventative and infection control measures in the event that a person is chosen to be a PUI. In order to decide whether or not testing is necessary, epidemiological markers are analyzed. Among these are intimate touch with a patient whose signs have been verified by a laboratory with fourteen days of the beginning of signs or a record of travel to an infection region within fourteen days of the onset of symptoms [4]. According to the WHO, it is suggested to gather sample taken from the lower and upper respiratory parcels. Sputum that has been expectorated, bronchalveolar lavage, or endotracheial aspirat are all techniques that can be utilized to do this [4]. After that, the PCR is utilized to determine whether or not these samples contain viral RNA. On the off chance that an approving examination result is obtained, it is strongly suggested that the examination be repeated for the purpose of re-verification. If the test comes out negative, but there is a strong clinical suspicion, then more testing is necessary. Table 2 shows the diagnostic methods and criteria for COVID-19 detection.

Table 2: Diagnostic Methods and Criteria for COVID-19 Detection.

Aspect	Details	Purpose
Diagnostic Methods	Quick testing for screening.	Ensures control and proper clinical management.
Prevalence of Respiratory Illnesses	cause 5-10% of acute respiratory illnesses; >2% are healthy.	global standardization of diagnostic protocols.
CDC Criteria (PUI)	Testing required if symptoms occur within 14 days of close contact.	Highlights the widespread nature.
Clinical Considerations	Testing is based on symptom onset.	Defines the process for individuals under investigation (PUI).
Sample Collection	both upper and lower respiratory tracts.	Helps determine necessity of testing.
Testing Method	PCR used to detect viral RNA.	Ensures accuracy of viral detection.

### 9. Treatments

In the present instance, there has been is no specific antiviral medication that is accessible for COVID-19 [36], which is comparable to the condition with SARSCoV as well as MERSCoV. Some COVID-19 patients experienced fast progression to ARDS as well as septic-shock, that has been eventually resulted in the demise of an extensive amount of organs [37,38].

While addressing patients that have been reported of being carriers COVID-19 when they are being medicated, the first priority is to ensure that they are adequately isolated for the purpose to avoid the virus from transmitting to all individuals who come into touch with it, customers, and healthcare professionals [39]. It is recommended that the mild condition be treated at home by maintaining good diet, remaining hydrated, and monitoring fever and cough [40]. It is also recommended that those who are experiencing symptoms of COVID-19 refrain from using antibiotics and antivirals, particularly oseltamivir, on a regular basis [41]. It may be deduced from this that there is no specific therapy available for this condition.

### 10. Prevention

There is no doubt that COVID-19 is a severe illness that is of concern on a global scale. According to some estimations, In comparison to SARS, it exhibits a higher level of reproduction [42], This was earlier claimed that a greater number of persons have had the disease or passed away from it than SARS [43].

The avoidance of this disease is of the utmost importance because there is no specific cure for it. In the first place, it is recommended that instances of the minor disease that are believed to be present in the home be isolated [44]. Again, it is advised that the virus be destroyed at home by ensuring that there is adequate ventilation and adequate sunshine [8]. It is therefore true to declare that the prevention of COVID-19 entails the utilization of personal protection items, particularly skirts, protection for the eyes, protective gloves, and medical masks [45]. Isolation, sufficient ventilation, and good hand hygiene are all important components of the COVID19 prevention.

### 11. Conclusions

The global epidemic associated with COVID19 has been having an impact on the economy, cultures, and health worldwide. SARS-CoV-2 transmits quickly and causes severe sickness in sensitive people as an RNA virus. Despite advances in understanding its morphology, genome, transmission, and clinical features, regulating its spread and impact remains difficult. Despite diagnostic breakthroughs, therapeutic choices are mostly supportive, with no universally effective antiviral medicine. Vaccination has reduced disease severity and death, but ongoing observation and study are needed to battle new variations. Social distance, PPE, and cleanliness remain essential for transmission prevention. More effective therapies and prevention require ongoing scientific study and worldwide collaboration. Medical advances, public health measures, and community participation can reduce COVID-19's long-term impact and improve pandemic preparation.

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