

# The Impact of COVID-19 on Different Human Systems and Related Research Progress

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**Abstract.** The coronavirus, also known as SARS-COVID-19 was a global pandemic that created an enormous impact on the world. Some of which include the economy, isolation for long periods of time, and most importantly the health of the people. The COVID-19 has created long term effects on the central nervous system (CNS), respiratory system, and digestive system. The virus's major target is the respiratory system, with symptoms similar to a sinus infection, which causes serious respiratory disorders including pneumonia, ARDS, and sepsis, which can cause considerable damage to the body. Central nervous system damage may result in delirium, the three types of this are hyperactive, hypoactive, and mixed. In addition, some patients mainly present with digestive symptoms such as diarrhea, loss of appetite and so on. Currently, there are many ways to intervene and prevent the disease. This is achievable through following COVID-19 safety measures, so the disease won't further spread. While there are still many challenges and shortages when it comes to COVID-19. Some of which include shortages with a weak healthcare system, research difficulties, healthcare equities, and vaccines. This paper mainly discusses the relationship between COVID-19 and different systemic diseases, and provides new ideas for finding effective prevention with different systems in the future.

**Keywords:** COVID-19; central nervous system (CNS); respiratory system; digestive system.

## 1. Introduction

The coronavirus, also known as SARS-COVID-19, was initially discovered in Wuhan, China in December of 2019, and the World Health Organization (WHO) declared it to be a pandemic in March of 2020. The WHO states that there are 6,981,263 deaths and 772,166,517 confirmed cases globally [1]. The COVID-19 pandemic presents many effects and challenges to the world of work, food system, and public health due to the large amount of death from the disease. Numerous schools were shut down in an effort to decrease the virus's spread. Around half of the world's students were affected by the pandemic a year ago. Businesses lost over 255 million jobs in 2020 as a result of closures. Although economies from every country have been impacted, lower and middle income countries are experiencing the harshest consequences due to their vulnerability to the economic shocks and reliance on a limited number of sectors, such as commodities and tourism. This has resulted in millions of people falling below the poverty line. Compared to wealthy nations, which had the resources to intervene promptly and protect their populations and businesses, lower and middle income countries have been unstable to take similar measures [2]. This is all a result of the impacts that COVID-19 has on the health of individuals.

This article aims to summarize the clinical manifestations of different systems of COVID-19, the associated possible pathogenesis, and the management and prevention of related symptoms.

## 2. Different Systems

### 2.1. Respiratory System

The respiratory system is the primary target of the virus, particularly the lungs, when it reaches a critical stage. This becomes even more dangerous as the virus exhibits symptoms resembling those of a sinus infection. According to the website of Johns Hopkins Medical, the virus's symptoms can lead to several severe respiratory diseases, including pneumonia, Acute Respiratory Distress

Syndrome (ARDS), and the sepsis can all cause significant damage to the body that can persist longer than the initial disease [3]. Recognizing the signs and symptoms of each is crucial in order to promptly inform a doctor if the person starts experiencing them. COVID-19 -related pneumonia cases are particularly severe, with a higher likelihood of long-lasting effects. Even after the pneumonia subsides, individuals may continue to experience respiratory difficulties for months, which can often be mistaken for symptoms of a sinus infection. ARDS is a possible outcome of a severe instance of pneumonia and is classified as a type of lung failure characterized by difficulty in breathing. Individuals who experience the advancement of this condition to such an extent may suffer from permanent damage to the lungs. Sepsis does not refer to a lung infection specifically, but it can be triggered by one. Similar to ARDS, sepsis can cause enduring damage to various organs, including the lungs. According to the American Lung Association, bronchitis can also occur as a significant aftermath of COVID-19. Bronchitis primarily targets the bronchi, which serve as air passages within the lungs. The association further highlights that COVID-19 may lead to various relatively less severe respiratory issues, including nasal congestion, migraines, coughing, irritated throat, high body temperature, and exhaustion.

About 5% of infected people are severe patients, and it is easy to cause cytokine storm, respiratory the failure, the shock, multiple organ system failure and other serious diseases, with a mortality rate of more than 30%, and has potential long-term effects on the lungs. Survivors may also leave chronic pulmonary sequelae -- pulmonary fibrosis. Resulting in reduced mobility and the possible need for long-term supplemental oxygen [4].

## 2.2. Digestive System

COVID-19 also has certain effects on the digestive system. Further clinical reports from different countries and regions indicate that SARSCoV-2 can be detected in feces or anal swabs of patients with novel coronavirus, suggesting that the digestive tract may be one of the target organs invaded by the novel coronavirus. Post-COVID, or long COVID syndrome, encompasses more than just exhaustion and dyspnea [5]. There have been reports of symptoms like headaches, brain fog, and ringing in the ears, and doctors are seeing more patients with gastrointestinal issues lately. The most typical symptoms are explained by Greg Vanichkachorn, M.D., director of the COVID Activity Rehabilitation Program at Mayo Clinic. According to Dr. Vanichkachorn, a doctor in the Mayo Clinic's Division of Public Health, Infectious Diseases, patients in the rehabilitation program are reporting a range of digestive issues, from mild nausea and decreased appetite to the severe constipation and the food intolerance, and physical reactions to certain foods. According to the research, patients with the long COVID were suffering from conditions known as disorders of the gut brain interaction [6]. Heartburn, difficulty swallowing, irritable bowel syndrome, constipation, diarrhea, bloating, and incontinence are all symptoms of this condition.

## 2.3. Central Nervous System

There is growing evidence that COVID-19 can cause neurological symptoms and complications. Both the autonomic and central nervous system can be impacted by COVID-19. Altered mental status or delirium is the most common manifestation of severe COVID-19, with an incidence of 66.0% to 75.5% and coma occurring in 10%. There are certain patients who either experience delirium at the beginning of their illness or develop it while in the hospital. COVID-19 can induce significant strokes or seizures, although these are rare [7]. A major alteration in mental capacity is delirium. It causes one to think erratically and become unaware of their surroundings. The disorder typically manifests itself quickly, perhaps in a matter of hours or days. It is common to identify one or several causes of delirium. A severe or protracted disease or an imbalance in the body, like insufficient salt, could be contributing factors. Additional potential causes of the disease include specific medications, infections, surgical procedures, and alcohol or drug use or withdrawal. Sometimes, dementia symptoms can be mistaken for delirium symptoms. To identify the disease, medical professionals may consult with a family member or caregiver. Usually starting over a few hours or days, delirium

symptoms manifest themselves. Usually, a medical issue is present when they happen. Daytime onset and remission of symptoms is common. Moments without any symptoms could occur. Since it's darker and less familiar during the night, symptoms are typically worse. Additionally, in unfamiliar environments like hospitals, they frequently get worse. Some of the primary symptoms of delirium include reduced awareness of surroundings resulting in difficulty maintaining focus or shifting subjects, giving up on answering questions in favor of becoming stuck on an idea, easily becoming sidetracked, remaining quiet, not moving much, and not reacting much to the environment. Poor thinking skills appearing as an inability to recall recent events due to poor memory, unaware of their location or identity, speaking or remembering words is difficult, speaking incoherently or rambling, speech comprehension issues, difficulty writing or reading. Behavior and emotional changes such as fear, anxiety, or mistrust toward others, depression, an abrupt outburst of rage or temper, an exuberant feeling, absence of feeling and interest, rapid shifts in emotional state, changes in personality, et al. [8].

Three categories of delirium have been recognized by experts [8].

- Hyperactive delirium. Perhaps the most obvious kind to identify is this one. Such individuals could pace the room and exhibit restlessness. They might also see things that aren't there, have fast mood swings, or feel nervous. This kind of person frequently rejects assistance.

- Hypoactive delirium. Individuals of this type could be less active or inactive. They are usually sleepy or lethargic. It may appear as though they are dazed. They don't communicate with people or their families.

- Mixed delirium. Both forms of delirium are present as symptoms. The person may go from being agitated to being lethargic very quickly.

### 3. Intervention and Prevention

There are a variety of steps to take to protect individual, family, and the community from serious COVID-19 infections. First of all, it is very important to stay up to date with COVID-19 vaccines. Vaccinations against COVID-19 assist the body in building defenses against the virus that causes COVID-19, reduces the risk of contracting the virus, becoming seriously ill, needing hospitalization, and even dying from the disease, even though vaccinated individuals can still contract the virus occasionally. Everyone should maintain current COVID-19 vaccination records, according to the CDC, especially those with compromised immune systems. If symptoms of COVID-19 appear, it is very important to get tested so that the disease doesn't spread to others. Viral tests are recommended to use to find out if there are any COVID-19 in the body system. Remember to get tested for COVID-19 right away if COVID-19 symptoms appear. Get tested five full days after being exposed to COVID-19 if symptom-free. Run the risk of receiving an unreliable test result if the test is not taken at the appropriate time. A PCR test can be obtained at a testing facility or medical facility. Compared to antigen tests, PCR tests have a higher chance of finding the virus. Rapid antigen tests are available at testing locations or for use at home, and they yield results fast. To be certain that a person does not have COVID-19, the FDA advises having two negative antigen tests (if the person has symptoms) or three negative antigen tests (if the person does not), carried out two days (48 hours) apart. Testing may help make educated decisions about health and risks of spreading COVID-19 to others, especially those who are more vulnerable to a severe illness, even if symptoms don't get exhibited or have not recently been exposed to the virus. In spite of the lack of symptoms, it is still possible to infect others with COVID-19. Get tested if symptoms appear, then remain at home until the test comes back.

Staying away from those who may have COVID-19 suspicion or confirmation is crucial to preventing the disease. According to these recommendations, wearing a high-quality mask when indoors with other people for a certain amount of time and staying home and away from others for at least five days—possibly longer are important. There are situations that might not be feasible to avoid those who are with COVID-19, or people that might want to assist in their care. Use as many

preventive technique possible in those circumstances. Prevention methods such as wearing masks and increasing distance between others are also highly recommended. A selection of masks is offered. A greater degree of protection is offered by some masks than by others. In order to protect everyone, respirators (like the N95 model) fit tightly over the face. Compared to masks, respirators (like N95) offer more protection. The most crucial thing to consider when donning a mask or respirator (like the N95), is that it should fit snugly over the mouth and nose, be comfortable, and offer adequate protection. Meanwhile, virus particles can be present in tiny particles that people breathe in. The likelihood of being exposed to the COVID-19 virus increases with proximity to a larger population [9,10].

## **4. Challenges and Shortages**

There are many challenges and shortages when it comes to prevent and control COVID-19 [11].

### **4.1. Weak and Unbalanced Healthcare Systems**

The most worrisome problem is the inadequate infrastructure, which is unable to handle COVID-19. The current pandemic crippled the health systems, putting primary and essential healthcare needs at risk. Individuals in need of intensive care due to morbidities faced challenges in meeting the rising demand. Healthcare providers face a significant scarcity of personal protective equipment (PPE), which is compounded by panic buying and hoarding of PPE. PPE is not widely available, which may eventually make it more difficult to stop the pandemic's rapid spread.

### **4.2. Epidemiological Research's Difficulties during the COVID-19 Pandemic**

Because most researchers work from home to minimize face-to-face interaction, there has been a rise in observational and descriptive research in a few fields and interventional studies as a result of social constraints. Especially for the listing of some new drugs, due to the implementation of home isolation measures, whether it is fewer patients than the original plan, or the loss of patients who have been enrolled, the final reaction in the clinical research report is a data problem - data integrity and compliance, and the data recorded remotely may not all be recognized by the drug regulatory authorities. The most immediate remedy would be to add more subjects, which would lengthen the program and lead to a significant delay in bringing new drugs to market.

### **4.3. Healthcare Equity**

There exist disparities in health between various demographic groups both internationally and domestically. As a result, there were unjust and disastrous deaths among vulnerable populations, including refugees, ethnic minorities, and people from lower socioeconomic backgrounds. The disease load is adversely increased by health disparities during pandemics that are exacerbated by a variety of risk factors and morbidities. Some have referred to this as a pandemic that is coinciding with the poorer communities. The pandemic was able to discriminate against disadvantaged people due to preexisting priorities and decisions in social and political organizations as well as global financial forces that cut across cultural boundaries.

Quarantine facilities and intensive care beds are insufficient in low- and middle-income countries. The most critically ill coronavirus patients are kept alive by ventilators, although they are not cheap. The medical community is fighting the coronavirus threat on the front lines, but there are not enough doctors in many developing nations. Health professionals are too busy to handle every illness case.

## **5. Vaccination**

### **5.1. Challenges in Developing a COVID-19 Vaccine**

The usual timeframe for developing vaccines was shortened due to the pressing need to develop COVID 19 vaccines under strict deadlines. The duration of clinical research, which typically takes

several years, is being shortened to a few months for efficacy, safety, and dosage trials, which jeopardizes the assurance of safety. The need to develop a COVID-19 vaccine quickly may be related to a higher failure rate and a higher risk of producing a vaccine that is both safe and effective. In addition, social and physical isolation from research subjects as well as the closure of research facilities impede research. Clinical trials for vaccines must go through several stages in order to guarantee their safety, efficacy, immunogenicity, dose ranges, and side effects. Because the virus is a "moving target" with variable rates of transmission within and between countries, vaccine developers invest significant resources in recruiting a sufficient number of subjects for phase II and III clinical trials [12].

## **5.2. Acceptability of vaccines**

"Delay in acceptance or refusal of vaccination despite availability of vaccination services" is the definition of vaccine hesitancy. Three factors influence vaccine acceptability: ease of use, complacency, and confidence. Trust in the efficacy and safety of vaccines, in the way vaccines are delivered within the healthcare system, and in politicians are all examples of confidence. In order to boost vaccine acceptance, healthcare professionals, legislators, and community leaders must address the concerns the majority of people have about vaccine safety. Complacency breeds more mistrust toward vaccines and is linked to a low perceived risk of the disease that can be prevented by vaccination. Convenience also refers to the vaccines' physical availability, accessibility, and cost.

## **5.3. The Effectiveness of Vaccines**

Certain vaccinations provide months or years of robust immunity, while others call for a booster shot. Adjuvants are used in protein-based vaccines to maximize effectiveness while reducing antigen quantity and expense. Pfizer and Moderna are two companies that use encapsulated lipid nanoparticles in their COVID-19 vaccines. Perhaps a brief immunity would be sufficient to break the chain of transmission. The majority of COVID-19 vaccinations require booster shots against the same strain of the virus because they lose their effectiveness over time. In addition, a lot of COVID-19 strain mutations have been found. To guard against these mutations, the vaccinations must be remanufactured. A booster vaccination is advised by experts due to evidence from animal studies [12].

## **5.4. Vaccinations being Marked with the Nation of Origin**

Researchers are looking for vaccines and treatments that work, regardless of where the virus came from. Every now and then, scientists are working feverishly to develop a vaccine and treatment. During a pandemic, drug development, production, and distribution should proceed regardless of a person's race, religion, or political affiliation.

## **6. Conclusion**

In conclusion, COVID-19 has had a wide range of harmful effects on human bodies such as the central nervous system, respiratory system, and digestive system. Emerging data points to possible long-term effects, sometimes known as "long COVID," in addition to the immediate respiratory difficulties. This highlights the significance of ongoing study and healthcare monitoring. The virus has brought attention to the susceptibility of specific groups and the significance of public health initiatives in halting its spread. It emphasizes the vital need for immunization, preventative measures, and continued study to better understand and reduce the long-term impact of COVID-19 on the health. Although the clinical manifestations and intervention and prevention of different systems are described in this paper, the actual situation is more complicated and needs further study. Nevertheless, during COVID-19 and post-infection recovery, greater attention should be paid to potential associations between different systems, and patients with atypical manifestations need to be carefully identified and screened. This is of great significance for epidemic prevention and control, comprehensive treatment and improvement of prognosis.

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