

Epidemiological Characteristics and Prevention of COVID-19

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Abstract. At around March of 2020, the new coronavirus, now named severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), spread fast across the world. The symptoms of SARS-CoV-2, such as fever, cough, difficult breathing, and pneumonia were similar to the infection of influenza virus, which mislead the public at the beginning of the virus outbreak. In addition, social issues in aspects of economy, environment, and resource distribution should be considered as factors of what lead to the global pandemic as well. This article briefly introduced the pathology of COVID-19, summarized factors that lead to the global pandemic from three aspects: the complexity and variation of the virus, the validity of the vaccine, and the action and countermeasures of the public health system. Then, this article discussed the countermeasures aim from public health system and individual at this pandemic particularly, providing some ideas for pandemic of infection diseases in future.

Keywords: COVID-19 pathology; vaccine effectiveness; virus variants; public health system.

1. Introduction

In the December of 2019, the COVID-19 began its spreading without noticing. In the January next year, it suddenly erupted in city of Wuhan from China, leading the public to get to know about this virus. At around March of 2020, this virus already spread rapidly, and gradually became a serious global public health issue [1], which infected nearly 700 million people around the world and caused nearly 7 million deaths. Until now, there are still about 10,000 people die in worldwide because of infection this virus every week.

The symptoms of this virus infection, such as fever, cough, difficult breathing, and pneumonia were similar to the infection of influenza virus, which mislead the public at the beginning of the virus outbreak. Indeed, this virus is not the first coronavirus that has caused global pandemic in human history. According to research, the genetic sequence of this virus is 96% identical to the SARS-CoV virus which has caused the SARS epidemic in China in 2002-2003 [1]. In addition, this virus belongs to zoonotic virus, easily be transmitted between mammals such as bats and palm civets. After people had close contact with these animals, this kind of respiratory virus began its spreading between humans. The virus came out from an infected individual's nose or mouth and can be inhaled in the air by others. Also, the virus might stay on poorly sanitized surfaces, and people who touched the surfaces can also be infected after they touched their nose, eyes, and mouth.

Although the genetic sequence of this virus is high degree of homology with the SARS-CoV virus, the past therapeutic strategies for SARS-CoV were not as effective as expected when used to treat this kind of virus infection. The virus is not only attacking human's upper respiratory tract and lung, but also destroying the immune system [2]. What are the factors that eventually lead to a global fast and severe pandemic of this virus? Is it because of the flu-like symptoms that did not catch the researchers' attention? Or is it because the public were not alerted or told the consequences of infected by the virus? Moreover, social issues in aspects such as economy, environment, and resource distribution should be considered as factors of what lead to the global pandemic as well. Besides, what are the countermeasures that people utilized to prevent and mitigate the pandemic? What are the pros and cons of these measures? Here, this review briefly introduces the beginning and spreading of this novel respiratory virus, analysis the influential factors to what made it become a global pandemic and discusses the countermeasures aim at this pandemic particularly.

2. The Dabating in SARS-CoV-2

The infection with this respiratory virus can cause an excessive innate immune response and followed with weak adaptive immune responses. As it's highly identical to the SARS-CoV and very transformable, the origin of this novel virus became complicated and debatable. One of the common argues is that it is originated from mammal animals and transmit to human through close contact, while some argues that it was from a laboratory leak [3]. Instead of trying to see through the frost covering the beginning of this global pandemic, research such as study about the virus, how to prevent or treat infected ones is more concerned by the public. As people were still arguing about whether we should wear a mask or is the virus just another flu, it's quickly spreading inter different countries with poor control measures. This figure 1 below is a timeline of the emerges and spreading continually of this novel respiratory virus and its variants until September 2023. The virus spread faster before people understand its mechanisms and its different sequelae from other viruses [4].

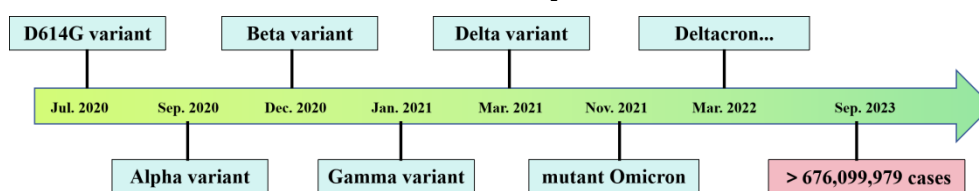


Fig. 1 The pandemic of SARS-CoV-2

3. The Padenmic Factors of SARS-CoV-2

This novel respiratory virus transmitting between human need combine with a cellular receptor, angiotensin-converting enzyme-2 (ACE2), then it can easily access into the target cells [4]. ACE2 is most found in the oral epithelial cells, especially on the tongue and salivary glands which made the infected individuals' saliva a high transmissible for the virus [4]. As the virus inter individual's nose, it will continue entering the respiratory system along the airway this infected person. First, the patient might experience asymptomatic stage, and there might be a minor immune response. At this point, even though the viral load of each individual is low, it is highly contagious [4]. Next, until the virus moved from nasal cavity into the lungs, most patient begin to have severe acute respiratory distress syndrome (SARS), and about 20% of the patients will experience worse symptoms [5]. Along with, the virus starts to reproduce viral nucleocapsids largely by binding with the patient's alveolar epithelial cells. Moreover, the damage to the patients is not only from this kind of respiratory virus, but also from the largely created inflammatory cells by the infected ones, leading to serious cytokines storm in short time [5].

As we can see at this point, the virus is an "unexpected invader" to human body's immune system. It is highly contagious even when the viral load of an infected individual is low, and it might cause the immune system to response severely [6]. On the other hand, the asymptomatic stage at the beginning of infection increased the risk of transmission because people might not aware that they are already infected.

Despite of the asymptomatic stage and the severe response of the body after infection, another important reason that this novel virus is difficult to control because this virus belongs to a family member of single-stranded RNA virus, characterized quickly and continuing evolving [6]. Even though there have been multiple vaccines such as Pfizer's mRNA vaccine (Comirnaty) and Moderna's vaccine (Spikevax) [7], it is hard for the vaccines to be completely valid and targeting on this genomic mutating virus. Moreover, the variants of the virus have different characteristics that is unpredictable and attacking the public health differently. Some affect the human body severely especially for people of old age, and some are less harmful to the human body, but infect people much easier and faster.

4. The Prevention of SARS-CoV-2

As the vaccines are not hundred percent effective due to the virus changing so much, people need support from the public health departments to bring this infectious disease under control. As previously mentioned, because of the high ratio of infection in this virus, it's essential to prevent the transmission of the virus through the strategies of disinfection and decrement social interaction. However, the actual action is not as simple as the ideal plan. For example, social distancing and self-isolation are very effective approaches to keep people away from infection but forced quarantine and limited public activities sometimes touched the red line of the ethical issues [8]. Following the instructions of the public health departments and under the regulation of the local government in controlling the virus, meaning that people had to sacrifice part of their individual's interests and freedom in order to contribute to the public benefit [8]. Not everyone in the public is willing to be restricted in their house for two or more weeks, and some occupations such as mailman and delivery are compulsively paused, and they are facing more issues like low or no income [9]. The problem of keeping providing people the basic living goods and pacify the public unpleasant while controlling the virus pushed a lot of pressure on the local governments. Also, the resource such as masks, medical aids, and human resource are limited, problems of distribution and shortage overwhelmed the public health system.

As individuals, what are some countermeasures that we can do to prevent the virus? First, reducing interaction with others in public, and stay inside. We can use the internet and the technologies to work and study remotely and avoid contact with others. Second, if going out is unavoidable, wearing a medical mask is the most effective way to protect our respiratory system from catching the virus [10]. Also, taking care of personal hygiene such as washing hands, avoiding touching the nose, mouth, and eyes without cleaning, and disinfect living area regularly can reduce the chance of infection. Last and not least, exercising will help our body to recover after infection. During times like this, watching news and focus on the instructions from the public health departments might help to ease nervous emotions, too. The pandemic of this serious disease did bring huge damage to the society and economy badly, and most of us were unprepared or had no experience of such kind of situation [11]. It is possible that there are potential unknown virus existing still and learning the lessons from COVID-19 are benefitted to reduce the loss. Living in an age with multiple channels of accessing information and highly developed social media, individuals will be also continuing learning and gaining the ability of separating valid information from the multivariant internet, think critically, and make ethical judgement.

5. Summary

As a global epidemic of severe respiratory tract-borne viruses, the epidemic of this kind of novel virus has had a significant impact on human health and life, caused immeasurable losses to the global economy. The reasons for the rapid spread of the new coronavirus include limited understanding of emerging infectious diseases, rapid virus mutation, high contagiousness, economic pressure, and social factors, et al. The government's introduction of some effective ways is capable to prevent the spread of SARS-CoV-2, such as strong prevention and control measures from government, improvement service of the public health system, and enhancement of education or training for personal protection. These measures to control COVID-19 will provide ideas and reference for pandemic of similar infectious diseases in the future.

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