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Designing a Science-Based Strategy to Prepare for the Next Pandemic

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ABSTRACT

The emergence of SARS-CoV-2 led to a severe pandemic across the world. However, the globe did not response to the pandemic properly and preparedly, causing the impact of the pandemic to be more adverse than it should be. Many lessons can be learned from the experience of tackling the current pandemic and used to help prepare for the next pandemic, which is inevitable. In finding out the most suitable preparation strategy, research was conducted on the epidemiology of the coronavirus, current therapeutic options for treatment of COVID-19, and current anti-epidemic strategies and policies. It was determined that efficient tactics to prepare for and combat next virus outbreak include developing anti-viral drugs, improving healthcare infrastructure, and educating the general public. If these measures can be implemented, preparedness for the next pandemic will be significantly improved, leading to significantly reduced severity of the pandemic.

Introduction

1.1 The Overview of Covid-19

The outbreak of COVID-19 marked the onset of the current global pandemic. COVID-19 is caused by the virus called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which is a single-stranded RNA virus. To date, 210 million cases of infections and 4.41 million deaths have been reported (Worldometer).

The common symptoms of COVID-19 include fever, cough, fatigue, body ache or headache, loss of taste or smell, sore throat, runny nose, nausea, and diarrhea. Some more severe symptoms are difficulty breathing, pain and pressure in the chest, and loss of speech and movement (CDC). However, a number of SARS-CoV-2 infections are asymptomatic, but these people with no COVID symptoms are able to transmit the disease to other people, posing a significant challenge on the control of the spread of the disease.

These characteristics of coronavirus infections and COVID-19 indicate that this virus is an immensely dangerous pathogen.

1.2 The Mode of Transmission

The SARS-CoV-2 virus spreads from person to person mainly through respiratory droplets or contact transmissions. The primary source of infection is people infected by the virus. People from all different age groups and races are susceptible to the virus. However, older people and people with the immune disorder are particularly at a higher risk of getting infected (Jin et al., 2020). In addition, in rooms with inadequate ventilation, the virus is highly infectious (Triggle et al., 2021).

Contact with infected patients significantly increases the risk. Therefore, people who have been in contact with infected patients belong to the high-risk population. For example, healthcare workers and family members of infected patients are prone to getting coronavirus infections due to their exposure to the virus (Jin et al., 2020).

As mentioned above, people who are infected with the virus but show no symptoms also facilitate the spread of the virus because asymptomatic infections usually have the same infectivity as regular infections that exhibit symptoms (Gao et al., 2021). As these people are asymptomatic, they tend to be unaware of infections and can enter public places and directly contact many uninfected people.

Strategies to Prepare for the Next Pandemic

2.1 Developing New Drugs

Currently, no drugs are particularly effective against the SARS-CoV-2 virus, but some anti-viral drugs are being re-purposed to treat COVID-19. Most available anti-viral drugs are broad-spectrum, and in treating COVID-19, all these drugs face problems and have drawbacks. Following are some examples of current drug used to treat the virus infections.

Chloroquine and hydroxychloroquine were initially thought to be useful. However, several clinical trials conducted in different countries suggested that the efficacy of these drugs is limited and that they are associated with certain potential risks, including prolonged hospitalization and death (Triggle et al., 2021).

Remdesivir is another promising anti-viral drug used against coronavirus. Even though WHO indicated that remdesivir is not effective, multiple studies suggested that the drug indeed has certain therapeutic benefits (Triggle et al., 2021). Many countries have approved the use of remdesivir (Triggle et al., 2021).

Dexamethasone, an immunosuppressant, also is an effective therapeutic in that it suppresses the hyperinflammatory response triggered by the virus (Triggle et al., 2021).

Accordingly, one thing to consider when preparing for the next pandemic would be developing effective anti-viral drugs against SARS.

The shortage of useful drugs in part contributed to the pandemic now. If an abundance of anti-viral drugs against SARS viruses are available, we would be much better prepared (Dolgin, 2021). These drugs can potentially treat COVID-19 with very high efficiency, reducing overall hospitalization rate and mortality rate. In this way, we can save up limited healthcare facilities and resources for people in desperate need and avoid the shortage of healthcare resources we have when the pandemic first hit. The development of these drugs and relevant research requires funding and cooperation between different countries and enterprises (Dolgin, 2021). Investment in pharmaceutical companies or research facilities that aim to develop anti-viral drugs is hugely beneficial, while cooperation between companies or countries fosters the sharing of helpful information and data that propel the development of anti-viral drugs. Supporting the development of useful drugs also includes the training of research scientists in this area. This approach will spur more job opportunities, which are vital for people during the pandemic period, and ensure that there is a pipeline of human assets that are able to contribute to the development of pharmaceuticals in the future.

When these steps are implemented and there is a stockpile of available drugs against the virus, it will be much easier for people and governments to tackle the next pandemic in terms of pharmaceutical resources.

2.2 Improving Healthcare Infrastructures

Another thing that can help better prepare for the next pandemic is healthcare infrastructure. Healthcare infrastructure plays an essential role in combating the pandemic. These infrastructures are needed to deliver necessary healthcare services for the public. In fact, one of the reasons that COVID-19 is less severe in Africa is that the continent has a robust community health system that once helped African countries fight Ebola and other infectious diseases (Soy, 2020). These healthcare infrastructures, albeit less advanced, performed well in isolating the infected, tracking contacts, and delivering important information. Shockingly, the healthcare infrastructure in North America was relatively inadequate when the pandemic hit. For instance, in the United States, the funding for public healthcare infrastructure

has been decreasing in recent years. In addition, other compounding issues such as the conflict between public and private healthcare facilities and the lack of political will further weakened surveillance capacity, coordination, and adaptability of the healthcare infrastructure (Maani & Galea, 2020). These problems led to the rapid spread of the virus among the public. Canada was also in a similar situation. As many infected people needed to be hospitalized, hospitals across the country faced tremendous pressure: deficiency of rooms for all patients, the problem of understaffing, and the lack of resources (Sayers et al., 2021). If all healthcare infrastructures had received sufficient funding, staff, and medical resources, the virus would be much less likely to spread rapidly and cause an extremely severe pandemic.

Therefore, sufficient healthcare infrastructure is the key to combating the COVID-19 pandemic (Frieden et al., 2021). In the future, we should seek to build more healthcare facilities and strengthen the supply of medical resources and the training of medical staff. Additionally, the cooperation between public healthcare systems and private healthcare systems needs to be practiced so that patients in both systems can receive sufficient treatments with high standards and enjoy the proper allocation of healthcare resources. These measures can not only alleviate the pressure from dealing with an exceedingly large group of infected people but also prevent the rapid spread of the virus when the next pandemic hits.

Adequate healthcare infrastructures also entail high surveillance (i.e., contacting tracing) capacity that allows healthcare officials to track infected people and their close contacts. To maintain the high efficacy of our surveillance system, we need to increase our investment on contact tracing technologies and design better approaches. Once put into effect, the surveillance system will be capable of effectively limiting the chain of transmission and reduce the overall infected cases (CDC, 2020). The system can also provide important data that help officials to make predictions on the number of infections and the progression of the pandemic and design proper anti-epidemic strategies and policies.

Rapid COVID-19 testing and diagnosis is another important aspect of improving healthcare infrastructure. Current methods such as the RT-PCR viral gene detection, antibody detection, and viral antigen detection require a significant amount of time to yield accurate results, but during this time period, infected people who has undergone the test and is waiting for the result may still spread the virus to other healthy, uninfected people (Yüce et al., 2021). If a rapid testing method is put into place and we have adequate resources to test all people, we can acquire useful results quickly and immediately quarantine people tested positive. In this way, we can further reduce the possibility of letting the virus spread widely.

2.3 Education

Public support is also a critical factor when it comes to combating the pandemic. If government officials issue policies and recommendations but people do not follow, the anti-epidemic efforts will be significantly hindered.

Lockdown is an effective measure of controlling the spread of COVID-19. However, a lot of people are against lockdown for certain reasons, and these people are frequently exposed to the pathogen transmitting it to their friends and families. Many people have also become anti-maskers who refuse to wear a mask in public places. They either do not believe that the pandemic is true or think the mask is harmful and ineffective. This population is dangerous because they can get COVID-19 easily and transmit it to other healthy, uninfected people.

Similarly, the group of people that are against COVID-19 vaccines poses a demanding challenge to public health (Hotez, 2021). While the majority of people are vaccinated and safe, anti-vaxxers can contract the disease and spread it to vulnerable people who cannot get vaccinated for a variety of medical reasons (Kandola, 2020). Thus, it's imperative that we reduce the number of anti-maskers and anti-vaxxers.

Educating people on scientific reasons behind policies in the pandemic is an efficient way of overcoming the influence of anti-vaccine and anti-mask misinformation campaigns. Here are some potential ways to educate the hesitant population. First, public health officials should persuade people who are unsure of what they should trust to believe in the anti-epidemic plans and policies. Second, when spreading scientific information, we should keep it

depoliticized (Kathleen, 2021). Since many people do not trust the public health authority for political reasons, depoliticizing science whenever possible will make the information more reliable and trustworthy. Last but not least, we can rely on people who believe in science to influence the small communities around them (Kathleen, 2021). As these people are acquainted with the local social circle, their words will appear more dependable to others.

The educated population adheres to important policies, helping public health officials implement concrete, effective actions against the pandemic. Before the next pandemic, if more people believe in science and anti-epidemic strategies, the next pandemic will be addressed more quickly.

Conclusion

Our preparedness for the current pandemic is inadequate, yet it is inevitable that there will be another pandemic. Therefore, our preparation for the next pandemic must be improved to minimize the adverse impact of the pandemic. To prepare for the next pandemic, we should develop new anti-viral drugs, improve healthcare infrastructure to provide sufficient healthcare services and accommodate infected populations, and increase education on the general public to enhance the efficiency of anti-epidemic measures and policies. While these preparations take immense funding, research, cooperation, and public support, they can help us be better prepared for the next pandemic, mitigating the spread of the virus and mortality caused by the viral infection.

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