

# Designing a Science-based Strategy to Prepare for the Next Pandemic

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## ABSTRACT

For the last nearly two years, the world and its peoples have been on edge, dealing with a pandemic that killed millions of people and altered forever the lives of many others. The COVID-19 pandemic is a once in a generation event that provides an opportunity, despite its horrible impact, for us to be better prepared for future pandemics. The aim of this work is to investigate strategies that were used to combat COVID-19 and develop improved ones that will mitigate both the spread and mortality of similar episodes for the next generation. A review of public health guidance and primary literature suggests many currently used strategies were effective, but additional strategies and guidance are proposed here. These proposed strategies will improve not only preparedness but also the responses used to tackle and defeat the next COVID pandemic.

## Introduction

It has already been 2 years since the pandemic started in December 2019 and there have already been 211,141,305 cases in total and 4,422,418 deaths in total on August 20, 2021 (Worldmeter, 2021). Because of the long incubation time and high R0 value of a median of 5.7 (Ramirez, V., 2021) which means an infected person could transmit the coronavirus to 5-6 people, novel Coronavirus is difficult to be eliminated. Human beings may have to face a new trend of long-term coexistence with this virus and this kind of infectious disease. In the future, infectious disease outbreaks will occur regularly. If the next pandemic is inevitable, the only response that we can make is to prepare and mitigate the effect of the next possible pandemic. What we can do is to be more proactive in observing and predicting epidemic outbreaks so that the next pandemic can be identified more quickly, and early action could be taken to slow down their spread. Moreover, we need to seriously consider the possibility of long-term coexistence with the novel coronavirus, rather than allowing fear and severe pandemic response measures to affect our normal life and the normal functioning of the country's social and economic activities.

## Need for Long Term Responses

There is no doubt that many of the current emergency responses such as rapid construction of hospitals, widespread restriction of movement, and delaying the start of the school year, or having online courses are very effective. However, if we consider the fact that infectious disease outbreaks will occur regularly, those emergency responses would be unsustainable. Therefore, an approach for long-term response must be prepared so that we could deal with the next pandemic with the least cost for both society and the economy.

## Identifying Threats

To respond to the next pandemic, we need to know and understand its pathogenesis so we can make appropriate and accurate responses and ensure that no resources are wasted. Identifying the correct virus that could cause the next pandemic will likely

be impossible; however, our current knowledge indicates the next pandemic would possibly be caused by coronaviruses or viruses in the influenza family. Therefore, it is crucial to research a wide variety of zoonotic viruses to understand broad trends in their molecular functions.

## On Time Prevention and Response Measures

In general, if prevention and control response measures are enacted in time, it's possible for us to find out the source of infection and lock down the entire chain of transmission so further spreading of disease could be stopped through isolation. Due to various reasons such as asymptomatic individual and long incubation period, in the early stage of the outbreak of COVID-19, the disease detection, description, and early warning measures were far behind. For example, on January 30<sup>th</sup>, 2020, in a case of asymptomatic infection in Germany in which one patient transmitted the virus for five days before symptoms appeared (Rothe, 2020). As a result, before the large-scale prevention and control measures were implemented, especially before the lockdown of Wuhan, many patients had accumulated in Wuhan, and a considerable part of them had migrated to domestic and foreign countries. Because of this, the large patient base will continue to produce many new patients.

The next novel coronavirus is unlikely to have any vaccines in the short near term so isolation, the ancient method, remains to be the most reliable measure against Novel Coronavirus. Many countries with great success in controlling the spread of COVID-19 such as China with 767 cases weekly have followed this logic (WHO COVID-19 Explorer, 2021).

## Increasing Resilience of Health System

Limitations in the healthcare system have been revealed during the current pandemic. Take the USA as an example. There is a \$4.5 billion shortage (Maani & Galea, 2020) in funding required for the provision of minimum public health. Moreover, the funding in public health is mostly reactionary. There is an overall decrease in healthcare funding with a few supplementary funds to respond to specific infectious diseases. In 2018, the residential federal budget request was reduced to 17% of CDC funding and 25% (Maani & Galea, 2020) funding of global health programs. However, the supplemental fund does not allow stable construction of public health infrastructure and cannot address long-term problems in the health care system. Another example is India. The public health system in India is very underdeveloped. India has only 0.55 hospital beds for every 1,000 people (Singh et al., 2020). With lack of hospital bed, many people found positive could not take the appropriate treatment, some of them has had sequels and some has died. This is one of the reasons for their serious outbreak of pandemics.

Apart from death caused by COVID-19 directly, there was also much excess death that is caused by COVID-19 indirectly. There are various causes for the excess death due to changes socially and economically as a result of COVID-19. However, the most important cause of excess death is due to the slow response and lack of experience, and constrained medical resources in the health care system at the initial stage. The excess death accounts for 2.4 per 10,000 individuals in the USA in April 2020, 30% higher than the registered COVID death (Bureau, 2021). As the importance of the healthcare system is highlighted, improvements to healthcare systems must be made worldwide.

Developing countries with a constrained budget could be set up locally sustainable approaches. Unlike health care systems in a developed country, which are capable of handling increased patient burden, developing countries may need to rely on community health systems that facilitate trust and can administer care. As trusted speakers, these systems are crucial in early action by keeping the community healthy and informed on crucial practices such as social distancing, disinfection, and wearing masks. The community health approach is very effective. During the pandemic, an community health care system - the Partnership to Accelerate COVID-19 testing in Africa (PACT) program conducted 3.4 million COVID-19 tests by June 2020, a significant success given Africa's constrained health resources (Elsevier Ltd, 2020). Despite the advantages of the local sustainable approach, there should also be foreign aids that help Africa to fund their healthcare system as the local approach would be inefficient in large-scale infection.

A developed country such as the USA should consider increasing the percentage of the government budget on the public Health care system because it only accounts for 2-3% of total government health spending currently in the USA (Maani & Galea, 2020). There should also be additional funds, particularly designated to improve testing capacity.

## **Government Trust & Education**

The mistrust for governments and the misinformation during the pandemic has also led to many unnecessary COVID-19 cases and death. Moreover, this mistrust, which is also directed towards industry and academic scientific experts, has also brought negative consequences such as resistance to vaccination. This communication barrier must be eliminated so that everyday people can not only understand, even to a small extent, the science that drives public health guidance, but also the importance of adhering to such guidance. There were already procedures taken by the Health Resources and Services Administration (HRSA) in the USA by awarding \$121 million to improve communication in the local communities and eliminate the spread of misinformation about COVID-19.

## **Flexible Production Line**

A flexible production line that could switch into the production of medicines, masks, testing reagents, respirators, and other essential goods at any time would improve the ability of the government to respond to dynamic changes in the trajectory of the pandemic. The shortage of particularly masks, respirators, and testing reagents was identified as a critical deficit during the initial stage of the current pandemic.

As an example, China is the most populous country on Earth with a population of around 1.4 billion; however, the maximum production capacity of masks is 20 million masks per day in the initial stage. This means that there is a huge shortage of masks in China. Because of this, a flexible production line for masks is needed to respond to the next pandemic. During the pandemic, many textile-related enterprises and others in China were able to switch production methods to facilitate mask production. As an example, the SAIC-GM Wuling automobile has shifted and rebuilt its production line and produced 1.7 million masks per day (Mceachern, 2021). Due to this flexible production line, China can produce 450 million masks per day (Thomala, 2021).

## **Testing Reagent**

One of the keys to slow down the spread of COVID-19 is to have intensive testing with rigorous standards. Testing is the key for identification, isolation, and contact tracing for people with COVID-19 to stop the further spread of the virus. Testing in most European countries is still limited to symptomatic patients. Symptomatic testing is effective in mitigating influenza virus transmission, but a complication of COVID-19 is asymptomatic infections. If these patients cannot be screened early, they may become hidden spreaders.

On the other hand, Asian countries such as South Korea had more than 5,000 tests per million people at the initial spread of COVID-19 in March 2020, which has managed to control the spread of COVID 19 effectively. The key to having widely available testing is to produce a large number of tests as early as possible. For South Korea, the test reagent was developed and approved very early. On Feb. 7, 2020, the South Korean government approved the first test developed by a Korean company, Kogene Biotech. At the time, South Korea still had fewer than 20 confirmed cases. Three days later, the reagents developed by the company were being distributed to medical systems. (Martin & Yoon, 2020)

## Contact Tracing

Contact tracing is essential for identifying possible infections. As an example, in China, there is a QR code for every citizen that records that individual's route. When an infected individual is identified, those who have been in contact with him/her will be asked to take a test and isolate for 14 days.

Although the method of contact tracing is very effective, many Western countries haven't conducted this method due to the emphasis on democracy and freedom. While democracy and freedom are also important, an overemphasis on individual democracy and freedom during a pandemic comes at the expense of the lives of vulnerable populations. Therefore, individual self-discipline and the government's development of a contact tracing system (provided that privacy is guaranteed) are increasingly important.

## Drug

In the development of novel coronavirus drugs, the most ambitious target is a broad-spectrum antiviral drug. This is hard to do because viruses are distinct molecular entities, and it is necessary to find commonalities to develop broad-spectrum antiviral drugs. One shared trait of coronaviruses is their replication and infection mechanism. Targeting these processes is likely to produce a drug that is effective against multiple viruses in this family.

In an interview with CNBC in late April, Pfizer CEO Albert Bourla said his company's oral drug for COVID-19 entered clinical trials in March for patients with mild symptoms. If all goes well, as soon as the end of this year, COVID-19 positive patients will be able to take an oral medication to treat their symptoms at home. The oral coronavirus drug being tested is a protease inhibitor, which works by inhibiting an enzyme needed by the virus to replicate in human cells. Preclinical studies have shown that the drug shows potent antiviral activity. There is evidence that this drug has efficacy against multiple variants of the novel coronavirus.

## Global Collaboration

Even if some developed country achieves a high vaccination rate, global herd immunity won't be achieved if other developing countries are still struggling with vaccination. If herd immunity can't be achieved, vulnerable groups of society will be affected the worst. The next COVID pandemic can only be handled if there is global cooperation. Currently, the center for global development has advised a "challenge fund" that multiple countries will come together to finance advancement and development for the preparedness of the next pandemic. (Glassman, 2020)

## Conclusion

As infectious disease outbreaks will occur regularly in the future, we need to seriously consider the possibility of long-term coexistence with Novel Coronavirus. It is of the most important that all countries, regardless of socioeconomic status or national institutional and cultural differences, work together in the health sector during the pandemic without any interference. Next is a flexible production line that could rapidly produce testing reagents, masks, and a respirator that combines to mitigate the effect and spread of the next pandemic. Moreover, research on the possible virus is also crucial for identifying a virus that is associate with a high risk of zoonotic spillover from wild animals to humans so it could be prevented. There is also a need to increase the resilience of the health care system. Finally, government trust should be increased with the accompanying education of vaccines and pandemics.

Some may say that we are still in the pandemic, and it would be too early to prepare for the next pandemic. However, I believe now is just the correct timing for preparation for the next pandemic. The collective experiences generated during this

pandemic could be used to mitigate the next pandemic. The preparations for the next pandemic will require significant investment and reflection into what has been previously done, identifying the effective proposal, and abandoning those failures.

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