

Designing a Science-Based Strategy for the Next Pandemic

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ABSTRACT

Since its 2020 debut, the COVID-19 pandemic has impacted the lives of millions. Through the efforts of many researchers, scientists, and medical professionals strategies were developed to control the spread of the virus. Strategies developed included mask mandates, creating reliable testing, social distancing, and vaccination mandates. These strategies all proved to be successful in controlling the spread of the virus, but unfortunately, due to the unprecedented nature of the pandemic, they took time to be developed and were not as effective as they could have been. This resulted in dozens of problems across the world's economy and politics. To avoid this, in the event of a future pandemic, we should be prepared to quickly develop effective strategies to quickly control the spread of the virus and mitigate the impact of the pandemic. Pandemic prevention strategies include the following: universal contact tracing, quickly creating reliable diagnostic tests and vaccines, constant monitoring of zoonotic pathogens, sufficient funding, and following the pandemic plan already set in place.

Introduction

The COVID-19 pandemic has created an unprecedented global health crisis, impacting the lives of millions of people all around the world. In December 2019, many pneumonia-like cases of unknown causes were reported in Wuhan, China. Initial investigation by the World Health Organization determined that most of these cases were linked to the Huanan Seafood Market in Wuhan (WHO, 2020). In early 2020, the WHO discovered this new virus being transmitted from person to person and causing alarm in the global community. The emergence of the SARS-CoV-2 virus forced the scientific community to learn as much as possible about pandemic policy responses and rethink the way it tackles outbreaks.

Early COVID-19 Pandemic Policies

Masks

The first major step taken to curb the growth of the COVID-19 pandemic in the United States was to mandate the use of masks and facial coverings in public. Although there was never a federal mask mandate, many states initiated state-wide mandates. The CDC first recommended the use of face masks in April 2020. Mask-wearing, in addition to other prevention measures, helped reduce the spread of COVID-19. COVID-19 mainly spreads through respiratory droplets released from sneezing, coughing, or speaking. Wearing a facial covering can help block respiratory droplets from entering the body. There are three categories of masks, surgical, air-filtering respirators, and cloth masks, each with different levels of effectiveness. Surgical and air-filtering respirators provide the most protection because they were designed to filter out very small particles such as viruses. However, these masks were originally only recommended for healthcare workers because of the lack of supply. This left the general public with only cloth masks. Although cloth masks are not as effective as surgical masks, they still offer some protection against the virus.

Effectiveness of Masks

A study about mask effectiveness on influenza (somewhat similar in biology to COVID-19) found that 2.3% of healthcare workers wearing cloth masks were infected and only 0.7 percent of healthcare workers using medical masks were infected (Clase, 2020). Cloth masks still offer a large amount of protection against the virus, but less than surgical masks. An experiment by the University of California, San Francisco sprayed hundreds of small droplets ranging from 20 to 500 micrometers, and almost all of them were blocked when the mouth was covered by a damp washcloth (Bai, 2020). This further proves that cloth masks can mitigate the spread of viruses. It was also crucial for the public to understand that it is important for everyone to wear a face covering, not just those showing symptoms of COVID-19. People with COVID-19 can be asymptomatic and still spread the virus to others, therefore it was advised that everyone wear a face covering to reduce the spread of the virus. The state of Kansas was very split in its enforcement of mask mandates, with some counties requiring masks and others not. In 2020 in Kansas, the reported cases decreased by 6 percent among counties with mask mandates while cases increased by 100 percent in counties without mandates (Van Dyke et al., 2020). Mask mandates ended up being incredibly effective, not just in the United States, but all around the world.

Reliable Testing

One of the biggest priorities for scientists amidst the beginning of the pandemic was to develop a reliable test to determine if a person is infected with COVID-19. Thus far, the most reliable test is the polymerase chain reaction (PCR) test. This test detects the genetic material in the virus and helps to determine whether or not a patient has COVID-19. One of the nation's top priorities was to develop a reliable test because isolation is the key to preventing the spread of the virus. A positive test can allow the person to isolate themselves from others; it can also help medical professionals determine the proper care the patient should receive and identify what they are most likely infected with. Without a reliable test, no other advancements in COVID-19 protection and prevention would be possible. Fortunately, COVID-19 tests were developed quickly and were readily available a few months into the pandemic. Several different policies were made for COVID-19 testing around the world. Some countries only allow testing for specific groups, while others have it open to the public.

Effectiveness of Reliable Testing

Mass testing was one of the most important policies to combat the spread of COVID-19. It was created as a strategy to control the spread of COVID-19 in a large population, testing everyone, even asymptomatic people (Shen et al., 2021). Mass testing has the potential to be incredibly effective at preventing the spread of the virus under the correct circumstances. However, a lot of the time its effectiveness comes with several issues. Some of these include the challenge of providing enough testing kits in a short period of time, and the need to pay out of pocket can discourage socio-economically disadvantaged populations from participating. (Shen et al., 2021). Additionally, creating tests to test the majority of the population can be very cost ineffective (Du et al., 2022). However, in the areas where it was used, mass testing has been successful in reducing the number of COVID-19 cases. People carrying the virus were able to isolate themselves and those not carrying it were able to return to their normal lives. Mass testing was so effective because it was able to identify asymptomatic carriers of the virus and isolate them to avoid them spreading the virus.

Social Distancing

Social distancing was also a critical policy encouraged in response to COVID-19. Social distancing was intended to reduce virus transmission by keeping people apart from one another. Social distancing works because most respiratory droplets can travel about two meters in conditions with zero wind speed (Dbouk & Drikakis, 2020). Considering other

environmental factors such as wind speed, droplets can travel much farther than this. CDC's recommendation for social distancing is to stay six feet away from others. Therefore, it is important to use social distancing with other preventive strategies such as mask-wearing. But, social distancing accounts for more than just distancing yourself from others. It can also mean staying home when experiencing symptoms of COVID-19, seeking treatment, moving activities outdoors, or improving ventilation. Following all these recommendations makes social distancing an essential policy.

Effectiveness of Social Distancing

A study comparing how social distancing affected confirmed cases and deaths in 10 different countries shows it took up to four weeks from when strict social distancing measures were applied when the number of confirmed cases began to decrease (Thu et. al 2020). Although social distancing was vital to mitigating the spread of COVID-19, "social distancing policies led to a decrease in community mobility. This is a measurement of the movement trends of residents between various locations, such as home, work and retail shops" (Boldt 2020).

Vaccinations

The COVID-19 pandemic has changed vaccine policies worldwide. Unlike other similarly-situated countries, the United States did not mandate the COVID-19 vaccines for its citizens, but many companies and organizations did. The development of the COVID-19 vaccine has been a huge step in combatting the pandemic. This vaccine works by helping the body develop immunity to the virus.

Effectiveness of Vaccinations

A study about the impact of the COVID-19 vaccine on the pandemic found that, in the absence of vaccination, the daily incidence remained above one per 10,000 population for at least 288 days, while vaccination with 40% coverage reduced the outbreak peak and led to a daily incidence below one case within 203 – 222 days from the start of vaccination (Moghada et al., 2021). In addition, since the COVID-19 vaccine became available to the public in December 2020, the United States has seen a significant decrease in cases (Allen et al., 2023). The decrease in cases has been attributed to the vaccine policy, making it one of the most effective measures in combatting the pandemic.

COVID Policymaking and the Economy

The world's economy was greatly affected by the pandemic and the policies put in place. The nature of this pandemic caused the biggest global economic crisis in nearly 100 years (The World Bank, 2022).

China

China has been one of the hardest-hit countries due to its "zero COVID" policy resulting in a lack of mobility. Because people are forced to stay home, the "prolonged disruption of China's manufacturing industry would be a major shock to the global economy, as China exports up to one-third of the world's intermediate goods" (Herrero, 2022). China's economy being impacted has caused problems in nearly every other country as they rely on China for products. China is the world's leading exporter of goods (Statista Research Department, 2022), and the country's borders have been closed since 2020 due to the pandemic, limiting the goods transported out of the country.

United States

The United States economy has also been working to recover from the pandemic and the economic impact of the policies put in place. The US government has created The American Rescue Plan which “provides \$350 billion in emergency funding for eligible state, local, territorial, and Tribal governments to respond to the COVID-19 emergency and bring back jobs” (US Department of Treasury, 2021), hoping to help the country bounce back from the lost jobs and investments from the pandemic.

COVID Policymaking and the Social Order

Education

Schools and universities all around the world have been forced to close in order to lower transmission at crucial points during the COVID-19 pandemic. School closures threaten the education system and the lives of students, the “rapid increase of infected cases has created a sense of uncertainty and anxiety about what is going to happen...this stress may lead to unfavorable effects on the learning and psychological health of students” (Sahu, 2020). Because of the scale of the pandemic, the negative effects on the mental health of students were inevitable and drastically impacted students’ performance.

Demographic Risks

Elderly people are at a much higher risk of contracting COVID-19. Because of this, many elderly people are living in constant stress and fear of becoming infected. They are also likely to be less capable of supporting themselves when they are in isolation (United Nations, 2020). All of these factors change the lives of elderly people and make them more susceptible to having lower mental health than they would have otherwise.

Black and Hispanic adults have been hit hardest by the pandemic. The pandemic has increased racial disparities in nearly all aspects of life. Some of the most significant consequences of the pandemic include the loss of employment. In March 2022, “nearly a fifth of Black adults, and about one in four Hispanic adults reported living in a household that experienced a loss of employment income in the last four weeks (17.1% and 23.0%, respectively) compared to 10.2% of White adults” (Drake, 2022).

Political Support

Unlike other countries, politics played a huge role in the United States’ response to COVID-19. Many studies have shown that political views were directly related to vaccination rates and deaths from COVID-19 (Albrecht, 2022). As governors and mayors were in charge of initiating pandemic prevention policies, they varied by location. Studies from Yale School of Medicine found that deaths during the COVID-19 pandemic were 76% higher among Republicans than among Democrats (Goldsmith-Pinkham, 2022). Republican adults make up the majority of the non-vaccinated population in the United States. They represent 41% of adults and “now make up 60% of the adult unvaccinated population across the country (Palosky, 2021).

COVID Policymaking: Successes and Failures

Successful Policies in the Pacific

Different countries handled the pandemic in very different ways. Some policies worked better than others. For example, South Korea created very strict policies to reduce the spread of COVID-19. Some of these policies included adopting “active epidemiological investigations, strict isolation of affected patients, and extensive public lockdowns, which were helpful in controlling spread until the end of 2021” (Lim, 2022). These strategies helped keep COVID-19 cases stable and the country did not see a large spike until March 2022, over two years after the original emergence of the virus. Another country that handled the pandemic well was Australia. Amidst other policies, Travel restrictions and border control have been the focus (Nguyen et al., 2021). The travel restrictions focused on countries struggling the most with COVID-19 cases such as China, Iran, and Italy. These restrictions were put in place very early in the pandemic and were only lifted in July 2022. Australia reported a minimal, steady number of cases until a spike in 2022. Along with South Korea and Australia, Singapore also created measures to handle COVID-19 well. The policies that worked for them included “border control, mandatory 14-day quarantining for all returning residents, contact tracing and providing medical leave for mild cases allowing possible COVID-19 cases to self-isolate at home thus reducing community transmission” (Tan et. al., 2021). These strict policies resulted in a small, stable number of cases. Extensive, strict policies helped these countries combat the spread of COVID-19, but these systems cannot work with every country.

Ineffective Policies among the Powers

Although the United States implemented several pandemic prevention policies, it was one of the countries hit hardest by the pandemic. Along with the United States, other countries with the highest number of reported deaths include India, Brazil, and Russia (Worldometer, 2023). India struggled with having the resources needed to treat patients infected with COVID-19. As one of the most populous countries in the world, “High population density and poor socio-economic conditions in India further added to the struggle against the second wave...the available resources (oxygen, drugs, ventilators, etc.) got exhausted quickly and hospitals had no isolation wards left, thereby leading to a massive number of casualties” (Patel, 2022). The case was different in Brazil where “The federal government has all but refused to adopt evidence-based comprehensive public health guidelines, leaving Brazil’s dedicated medical staff to manage the sickest in intensive care units and improvise solutions when beds are unavailable” (Médecins Sans Frontières, 2021). Similar to the United States, politics played a role in the amount of cases and casualties reported in Brazil. Politics also play a role in the COVID-19 crisis in Russia where hesitancy to get vaccinated, even among frontline workers, medical staff and the elderly remain common (Stronski, 2021).

Learning from past mistakes, the United States and other countries that struggled throughout the pandemic can create plans for future pandemics by implementing policies that worked well.

Recommendations for Additional Future Pandemic Policies

All the previous policies implemented throughout the pandemic involving mask mandates, vaccination, and social distancing proved successful. Unfortunately, they were implemented later than necessary to make the difference they could have. In addition to previous policies, more appropriate points and other policies can be used to make a difference in future pandemics.

After living through a pandemic, it is essential to learn from past mistakes and effective strategies and implement policies to prevent future pandemics. Currently, the United States government has created an outline of its goals for the next pandemic. These goals include being able to quickly create vaccines, have therapeutics available,

have reliable diagnostic tests, detect viruses that pose a pandemic threat, regularly monitor these viruses, strengthen their public health system, be economically ready, and prepare the scientific community to respond rapidly to any threats (White House, 2021).

As the pandemic plan mentions, it is critical to begin to prepare before a pandemic. Above all sufficient funding should be given to the healthcare system and the scientific community. The United States gave billions of dollars of funding to develop tests and vaccines during the COVID-19 pandemic. The SARS-CoV-2 vaccine was developed and approved in a record time. The significant funding allowed for “advanced technology, swift study enrollment...[and], some of the fastest, high-quality vaccine research ever conducted” (Kuter et al., 2021). Vaccination and testing policies were some of the most effective public health measures used to combat the spread of COVID-19. Funding for scientific research was a key factor in the success of these policies.

Funding for healthcare facilities is also necessary to prepare for future pandemics. Through the COVID-19 pandemic, there was a shortage of healthcare devices that could have been avoided with sufficient, equitable funding (FDA, 2023). Shortages in healthcare devices can lead to delays in diagnosis, treatment, and an increase in preventable deaths. A lot of the devices that were in short supply during the pandemic were not COVID-19 related, leading to an increase in other complications.

The COVID-19 pandemic is the third recorded coronavirus outbreak (Feehan, 2021). We now have the technology and information needed to rapidly develop vaccines and reliable tests. In order to better prepare for future global health emergencies, we should have these ready to treat and diagnose any pandemic threat. During the COVID-19 pandemic, the virus spread rapidly in the time it took to develop tests and vaccines, and one of the greatest ways to decrease the spread of the virus is the combination of these methods.

In the event that these measures fail, it is also necessary to use the tests as developed and implement the idea of contact tracing to identify and isolate individuals with suspected cases of infection. A natural, observational study of COVID-19 in England by Thiemo Fetzer and Thomas Graeber found that “contact tracing may be an even more effective tool to fight infectious diseases than was previously thought” (Fetzer & Graeber, 2021). Oftentimes, amidst disease outbreaks, information about the contacts of infected people is lost or limited. During this experiment, it was seen that the areas where information was missing were hit harder by the virus.

Implementation of contact tracing is necessary to reduce the spread of infectious diseases. In the past, it has been an underused system; it is difficult to find all of the people who have been exposed to the virus and ensure they are isolated. To combat this, many countries and companies are developing contact-tracing apps and programs. In the United States, efforts have not been successful. The main reason for this is the lack of coordination between companies and security concerns. For future pandemics, if contract tracing programs are to be successful, they must be coordinated, universally accepted, and adhere to security measures (Wren, 2023). If these conditions are met, contact tracing apps will be an effective tool to reduce the spread of viruses.

Finally, monitoring zoonotic pathogens can be the key to stopping a pandemic from occurring before it happens. From the previous pandemic, scientists learned that the virus was thought to be zoonotic, coming from animals. Closely watching these pathogens can help scientists determine if the virus is zoonotic and may pose pandemic potential (Hodson, 2022). If this is the case, diagnostic tests, and vaccines can be created and the virus can be contained before it spreads to humans.

Conclusion

Almost seven million lives were lost to COVID-19, and even more lives changed indefinitely (WHO, 2023). Many of these deaths could have been easily prevented with a good plan in place. To ensure the next pandemic is prevented, it is essential to have a plan in place that is coordinated, universally accepted, and takes several precautionary measures to prevent the spread of disease.

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