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Developing a Research-Based Strategy to Combat the Next Coronavirus Pandemic

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ABSTRACT

The purpose of this project is to evaluate the course of COVID-19 with hindsight and use collected data and original research published regarding the pandemic to devise a strategy that would better mitigate the next Coronavirus pandemic. This project targets these specific areas of the mitigation response to COVID-19: Mask Wearing, Social Distancing and Travel Restrictions, Lockdowns and School Shutdowns/Remote learning, Testing/Contact Tracing, and Vaccination Rollout. The analysis of the collected research and data leads to the conclusion that increased mask wearing (along with combatting masking misinformation), increased strictness of social distancing and travel, improvements in testing infrastructure and rollout, reconsideration of school closures, and increased global access to vaccination are among the many ways to better the response to a Coronavirus pandemic in order to reduce the associated social and economic impacts.

Introduction

The Coronavirus Disease 19 (COVID-19) pandemic was caused by the virus Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). It was discovered in December 2019 in Wuhan, China, and spread rapidly throughout the world (Basics of COVID-19, 2021) and declared as a pandemic on March 12th 2020 by the World Health Organization (Cucinotta & Vanelli, 2020). [RA1] Nations hurried to respond to the pandemic and attempted to mitigate its spread using many strategies, including shutting down schools, mandating masks and social distancing, enforcing lockdowns/stay-at-home orders, and pouring money into the development of a new vaccine (Lotfi et al., 2020). The pandemic caused great harm to the worldwide economies and people, as many of these strategies were not employed effectively. The recommendations made in this paper address ways that the COVID-19 response could have been improved in order to better prepare for future pandemics.

Recommendations

Mask Wearing

Government recommendations requiring or asking citizens to wear masks was one of the main steps of mitigation taken during the COVID-19 pandemic by various nations. Due to the widespread prevalence of these mandates, the effectiveness of mask wearing in slowing the spread of COVID-19 has been the subject of many studies. One such study assessed the various mask wearing responses of nations, specifically the change in COVID-19 related deaths after the institution of mask mandates. The study found that the per-capita mortality in nations without mask recommendations tended to increase week by week by a factor of 1.619. In contrast, nations with mask recommendations had mortality rate increases by a factor of 1.162 on average (Leffler et al., 2020). The same study also found that the mean duration of an outbreak before a governmental mask

recommendation was greater in countries with a higher COVID-19 mortality rate (6.69 weeks) than in those with a lower mortality rate (4.74 weeks), and that mask wearing was a main factor in this discrepancy. A study of the effectiveness of pandemic mitigation methods in New York and Italy between January and May 2020 indicated that face coverings reduced COVID-19-related deaths by over 66,000 in New York City and by 77,000 in Italy (R. Zhang et al., 2020). Furthermore, the study determined that social distancing alone without mask wearing was largely ineffective in preventing COVID-19 infection before the implementation of mask mandates in both New York and Italy. A study using machine learning to analyze the lifting of mask mandates at specific vaccination milestones found that lifting mask mandates 2-10 weeks after reaching a COVID-19 vaccine target is most cost effective and cost saving from "both the societal and third- party payer perspectives" (Bartsch et al., 2022).

The overall acceptance of mask wearing by populations (and the influence of popular individuals in promoting mask-wearing skepticism) has also been a factor in COVID-19 transmission. A study which reviewed the impact of the dialogue of political elites in the United States on mask wearing rates found that increased loyalty to the Republican presidential administration (which was described as having downplayed the use of masks) was significantly associated with lower rates of mask wearing (Shin et al., 2022).

These studies and articles support the conclusion that masks are a critical component of COVID-19 prevention even in the absence of social distancing. Importantly the institution of mask mandates prior to six weeks from the beginning of the outbreak is critical in reducing COVID-19 transmission, as shown by the fact that nations that waited over six weeks had higher COVID-19 mortality rates (Leffler et al., 2020). When a significant number of individuals have been vaccinated, the mandate can be lifted 2-10 weeks after the vaccination target has been achieved, depending on case trends and the current season. Additionally, the studies show that messaging from political elites that expressed skepticism to masking was harmful to mask wearing rates, and that reduction in said messaging could improve mask wearing rates and reduce illness.

Social Distancing/ Travel Restrictions

Social Distancing was another common method used to slow the spread of the pandemic. The effectiveness of social distancing was thus involved in many studies during the course of the pandemic. A study of the impact of social distancing mandates in preventing COVID-19-related deaths in Brazil found that social distancing results in a decline in cases 10 days after it is mandated(de Souza Melo et al., 2021). Another study of COVID-19 transmission in the Washington D.C area found that the percent of teleworking individuals (which was less than 19 percent) was inversely correlated with COVID-19 spread (Mahmoudi & Xiong, 2022). Further, the study determined that increased daily rates of COVID-19 infection are correlated with the number of daily trips per person with regard to any mode of travel and that higher rates of public transportation are positively linked with daily infection rates.

Enforcement of measures also plays a key role in preventing the spread of COVID-19. Various nations and local governments have enacted punishments such as jail time and fines greater than $1,000 and other enforcement mechanisms. Mahmoudi & Xiong also analyzed the differences in enforcement of COVID-19 between counties and cities in the Washington D.C area. It found that stricter enforcement of penalties for noncompliance for COVID-19-related restrictions can help decrease transmission of the virus and related deaths.

This data supports the conclusion that social distancing is a critical part of the pandemic response. Public transportation should be greatly limited due to the potential for close contact and COVID-19 spread. Teleworking and remote options that allow for better social distancing should be prioritized for those that are able. Noncompliance to social distancing and other restrictions should be strictly limited with potential fines and prison time.

Lockdowns and School Closures

Lockdowns were the main method employed by nations and municipalities in the prevention of COVID-19 [RA10] at the onset of the pandemic. It was hypothesized that this measure would best allow for the prevention of the spread of the pandemic without an effective vaccination program and/or substantial data on the spread of the disease. A study analyzed the length of lockdowns, its effect on COVID-19 spread, the economy, and various other factors. The study showed that there was initial evidence that COVID-19 transmission could be reduced by lockdowns. However, the authors also found that lockdowns affected human physiology in profound ways. For example, stress and depression were common physiological reactions experienced by many during the COVID-19 pandemic(Atalan, 2020). Additionally, the study indicates that lockdowns and other restrictions had a great economic impact on many nations due to the closure of workplaces and restriction of travel. An analysis considered the impact of lockdowns on 8 countries (United Kingdom, Spain, Netherlands, Italy, Germany, France, Belgium, and Austria). The study indicated that the time from lockdown had a "small but significant effect" on reducing the case count per million(Violato et al., 2021). It also concluded that the stringency of the lockdown produced the most important effect on infection and mortality rates. A review of the effect of easing lockdowns and restrictions on the Kingdom of Saudi Arabia (KSA). It estimated that if the lockdowns in KSA had continued beyond the time it ended (6/20/2020). The study concluded that the economic cost-per-life-saved index for an extended lockdown would be greater than 378,000 USD (Shimul et al., 2021), which is greater than the threshold employed by the KSA. School closures were also a major part of pandemic prevention efforts during the early stages of the pandemic, as it was hypothesized that schools would act as breeding grounds for COVID-19 viral transmission, endangering students and older relatives. The impact of school closures on COVID-19 transmission was analyzed in a study which concluded that children were substantially less affected by COVID-19 than adults (children ages 0-12 were 0.23 times less susceptible and young adults ages 12-23 were 0.28 times less susceptible) (Wu et al., 2022). Another article considered the negative impacts of school lockdowns on children in the Netherlands. It found that even with a more equitable remote learning program than many countries, and a short 8-week school shutdown, Dutch students lost about ½ year of education (Engzell et al., 2021). Another study showed that among 3 low-bias studies of school closings, 2 reported that there was little to no correlation between spread of COVID-19 and school closures (Walsh et al., 2021).

The studies demonstrate that although lockdowns are a critical part of pandemic prevention efforts, they come at extreme economic and physiological cost. Thus, lockdowns should be enacted immediately following the declaration of the pandemic with great stringency and enforcement. However, once a case threshold has been reached, the lockdown should be eased to avoid further economic and physiological harm. Other methods of COVID-19 prevention (mask wearing, social distancing) must remain longer to limit the spread of the disease post-lockdown.

Testing

Testing was one of the main goals of many nations as the pandemic raged, as access to effective and widely available testing was prioritized early in the pandemic. This has allowed for many to study the widespread benefits associated with large-scale COVID-19 screening policy. A study took advantage of the difference in French regions' responses to the pandemic before vaccine development to assess the impact of widespread testing on mortality rate. It found that a 1 percentage point increase in tests/hospitalization ratio leads to a statistically significant decrease in mortality rate (0.015 percentage point) (Terriau et al., 2021). Commenting on the importance of testing in preventing the spread of COVID-19, Dr. Eduardo Sanchez, the American Heart Association's chief medical officer for prevention and a former state health commissioner of Texas, stated that "Confirming that someone has had the disease and is now immune helps public health officials and others

understand the level of immunity in a population. A high percentage of people with immunity adds to 'herd immunity', which protects the larger community"(Sanchez, 2020). Another study found that individuals with no access to COVID-19 testing tended to engage in behavior that would facilitate transmission of COVID-19 more than those who had received a positive COVID-19 test result (p=0.016)(J. C. Zhang et al., 2022). This caused a 11.1 percent increase in "mean score risky behavior intentions".

The development and rollout of testing was one of the most widely scrutinized factors of the worldwide COVID-19 response. Another article analyzes the rollout of COVID-19 testing in the United States during the beginning of the pandemic. It highlights that the first confirmed COVID-19 patient in the United States was unable to procure testing early in the pandemic due to the CDC's (Center for Disease Control) refusal to test anyone without known links to an infected person (Cohen, 2020). The article highlights the ineffectiveness of the CDC's testing capacity, as the CDC only had one lab able to test for COVID-19 when the US case count had reached five. This limitation was partially caused by issues in early PCR tests, which reacted positively to DNA unrelated to SARS-CoV-2. Additionally, the article claims that declaration of a State of Emergency in the United States added the hurdle of requiring FDA emergency authorization for the use of any type of COVID-19 test, which potentially contributed to delay in testing rollout.

The reviewed studies and articles demonstrate that testing is a facet of the COVID-19 response that could be greatly improved in order to respond to the next pandemic. Widespread access to testing would result in the lessening of risky behavior that could contribute to COVID-19 transmission, reduction of bureaucratic barriers that may impede response, and improvement of existing testing infrastructure (including more testing labs and improvement in PCR testing).

Vaccine Rollout

Despite the many issues caused by nations' unpreparedness during the early stages of the pandemic, COVID-19 vaccine development and rollout was an outstanding success in many countries. In the United States, COVID-19 vaccines began to be distributed on December 14th, 2020 (less than a year after the start of the pandemic in March 2020), and reached 200 million Americans before 92 days had passed following the initial distribution (Carlsen et Al., 2022). However, some groups did not have an equal share in this vaccination success, as they were prevented from receiving (or chose not to receive) the COVID-19 vaccine at relatively high rates due to a variety of factors. One of these factors is education and misinformation. An analysis of the impact of misinformation and political partisanship in the United States on vaccination rate found that the mean amount of misinformation consumed related to vaccination in a state strongly correlated with decrease in vaccination rate per million (p=0.009) (Pierri et al., 2022). The analysis also found that strong political partisanship (10 percent increase in votes for the Republican Party) was negatively associated with vaccination rate. It clarifies that these factors account for nearly half the variance in vaccination rate by state. Additionally, many poorer nations were often left behind in vaccine distribution. A United Nations study of vaccination rates, found that by September 2021, just over three percent of people in lower-income nations had been vaccinated (compared to over 60 percent in higher income nations). The article concluded that if lower income nations had the same vaccination rate as higher income nations by September 2021, they would have been able to increase their GDP by 16.27 Billion USD in 2021 (United Nations, 2022).

The analyzed articles and studies demonstrate that although the development of COVID-19 vaccinations was an overall success, many inequities remain in the distribution and use of the vaccines. More effective combat of misinformation on social media platforms frequented by those in areas with greater political partisanship, and more equitable distribution of vaccines would greatly benefit vaccination progress in the next pandemic.

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Conclusion

The COVID-19 Pandemic was an unexpected occurrence that thoroughly tested the world's preparedness for combating infectious diseases. As a result, we (citizens of the world, collectively) were able to assess our responses and address gaps in preparedness that can facilitate improved responses to the next pandemic. I believe that improvements should be made in a potential future pandemic response in the areas of Mask Wearing, Social Distancing, Testing, Lockdowns, School Closure, and Vaccine Distribution, with the hope of better preparedness and less loss of life and social disruption than during the COVID-19 pandemic.