

A TIME-SERIES ANALYSIS: IMPACT OF COVID-19 ON INFLUENZA IN THE UNITED STATES OF AMERICA

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ABSTRACT

Respiratory viruses are among the leading causes of disease and death among people. Co-circulation of Influenza and SARS-CoV-2 can lead to diagnostic and management difficulties given the similarities in the clinical picture. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus causing COVID-19, has caused a disastrous pandemic with over 100 million cases and 2 million deaths globally so far. Viral infections such as Influenza and respiratory syncytial virus are among the prominent causes of death and diseases among people. COVID-19 and flu share some similar symptoms. The symptoms of flu tend to occur faster and can have more significant variations. But COVID-19 is more likely to lead to severe illness or death. Viral infections cause both COVID-19 and the flu. But COVID-19 is due to the SARS-CoV-2 virus, and flu is from Influenza A and B viruses. There is a lot that remains unknown about COVID-19. However, it is crucial to follow the guidance and recommendations provided by the CDC and local health authorities. A respiratory tract infection is an infection of the lungs, airways, sinuses, or throat. While respiratory infections occur year-round, there is a significant increase in these infections during the fall and winter months (cold and flu season). People tend to spend more time inside. During cold and flu season, it helps to know the common symptoms and how to avoid spreading illness to those around you. With the increasing cases of COVID-19 during the still ongoing pandemic, understanding the difference between common respiratory infections and your treatment options is even more critical. This research aims prediction of the Influenza trend in the U.S. before COVID-19 existed and relate if there are any changes in the prediction due to the impact of COVID-19.

Keywords: COVID-19, Influenza trend, Flu trends, Pandemic, Prediction, Forecasting, Time Series Analysis, Database, CDC, WHO.

1. INTRODUCTION

The presentation of patients with COVID-19 and Influenza requiring hospitalization differs considerably. Severe acute respiratory syndrome coronavirus 2 is likely to have a higher potential for respiratory pathogenicity, leading to more respiratory complications and higher mortality (Correction to Lancet Infect Dis 2019; Published Online April 20. [https://doi.org/10.1016/S1473-3099\(20\)30160-2](https://doi.org/10.1016/S1473-3099(20)30160-2), 2020b). Whereas in children, the rate of hospitalization for COVID-19 appears to be lower than for Influenza, the mortality is higher in the hospital. Influenza and COVID-19 are identical in pediatric patients, which makes diagnostic testing necessary for adequate diagnosis and management. Even though most cases of COVID-19 in children are asymptomatic or mild, the risk of death among hospitalized patients with comorbidities may be substantial, especially among infants. Influenza and COVID-19 are both contagious respiratory illnesses, but different viruses cause them. Coronavirus, which was found in 2019, is the reason for COVID-19, and Influenza viruses are the reason behind Influenza. Both the diseases have common symptoms. But through closer comparison, they can affect people differently (Sankar et al., 2020). The viruses that cause COVID-19 and Influenza spread in similar ways, and they can spread between people in close contact within 6 feet or 2

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meters. The viruses spread through respiratory droplets or aerosols released through talking, coughing, sneezing. These droplets, when released, can land in the mouth or nose of someone nearby or even can be inhaled. The other way this virus is spread is if the person touches a surface with one of the viruses on it and then touches their mouth, eyes, or nose (Similarities and Differences between Flu and COVID-19, 2021). The US population has shown conflicting intentions when evaluating their choice to get immunized once the COVID-19 vaccine is available. Reported percentages ranged from 58 % to 72% depending on the poll (Sankar, 2020).

The COVID-19 mitigation measures likely played a notable role in the marked decrease in Influenza, with little to no Influenza activity in both the northern and southern hemispheres. Despite this reduction in Influenza cases, there was still community spread of COVID-19, highlighting the contagiousness of SARS-CoV-2 compared to Influenza. The research provides descriptive evidence that the behavior-based COVID-19 mitigation measures are likely to be associated with a significant reduction in the transmission and impact of Influenza. Despite this reduction in Influenza, there was still community spread of COVID-19, highlighting that SARS-CoV-2 is markedly more contagious than Influenza.

The objective of this research is to describe the clinical characteristics and understanding the outcomes of COVID-19 vs. Influenza by checking the historical trends. The factors underneath also consist of the clinical features and epidemiologic characteristics of severe acute respiratory syndrome coronavirus 2 (SARS CoV-2) and Influenza in the United States of America, along with the prediction analysis of what would happen if COVID-19 would not exist. It was obvious that as COVID-19 cases arise people could not manage to get regular health checks and controls. This may lead to the misdiagnosis of the other diseases such as various cancers, dental issues, and even Influenza. So, it is important to understand the impact of COVID-19 among the other diseases and would alert and give recommendations for the future projections.

2. AIM OF STUDY

The aim is to study past historical development for Influenza and COVID-19 cases the by time series analysis. In the light of the historical analysis, it would be insightful to predict the Influenza trend in the U.S. before COVID-19 existed for upcoming couple of years and relate if there are any changes in the prediction due to the impact of COVID-19. Relatively, analyze how annual flu vaccination can stop the increase in Influenza cases.

3. METHODOLOGY

This medical research shows the impact of COVID-19 on Influenza. By the pandemic, COVID-19 hit the world in early 2020 and forced the world to shut down. The preventive measures taken to flatten the COVID-19 curve resulted in Influenza cases dropping as both are similar respiratory illnesses.

To compare the impact of COVID-19 on Influenza, the data is collected from multiple sources; the datasets relating to COVID-19 have been retrieved from Our World In Data with a wide range of data available, the data considered for the analysis range from January of 2020 to September of 2021 COVID-19 in the United States of America.

Data related to Influenza are collected from CDC, and the data contains Influenza cases in the United States from January of 2010 to September 2021. Forecast analysis was performed on Influenza data to predict 3 years trend starting 2020 to 2022 by considering monthly historical data starting January 2010 to Dec 2019.

Influenza vaccination data is collected from CDC, and the data contains the average % of the population aged 6years and older in the United States, covered by flu vaccination end of the season every year from 2010-2020.

The statistical and analytical software used for this research are Python, Tableau, Microsoft Excel, and Microsoft PowerPoint.

4. RESULTS

As shown below Figure 1 data contains weekly reported Influenza cases from January 2020 - September 2021. The Influenza trend was visualized by Tableau software. The below-mentioned graph represents an average monthly Influenza case reported in the United States using line graphs. The projection proved the seasonal hike in the Influenza trend every year did not sustain in 2020 – 2021 considering 2021 is still not completed during this research. The view is filtered month by month, which ranges from January 2010 to September 2021.

Number of Influenza New Cases in the U.S. 2010-2021

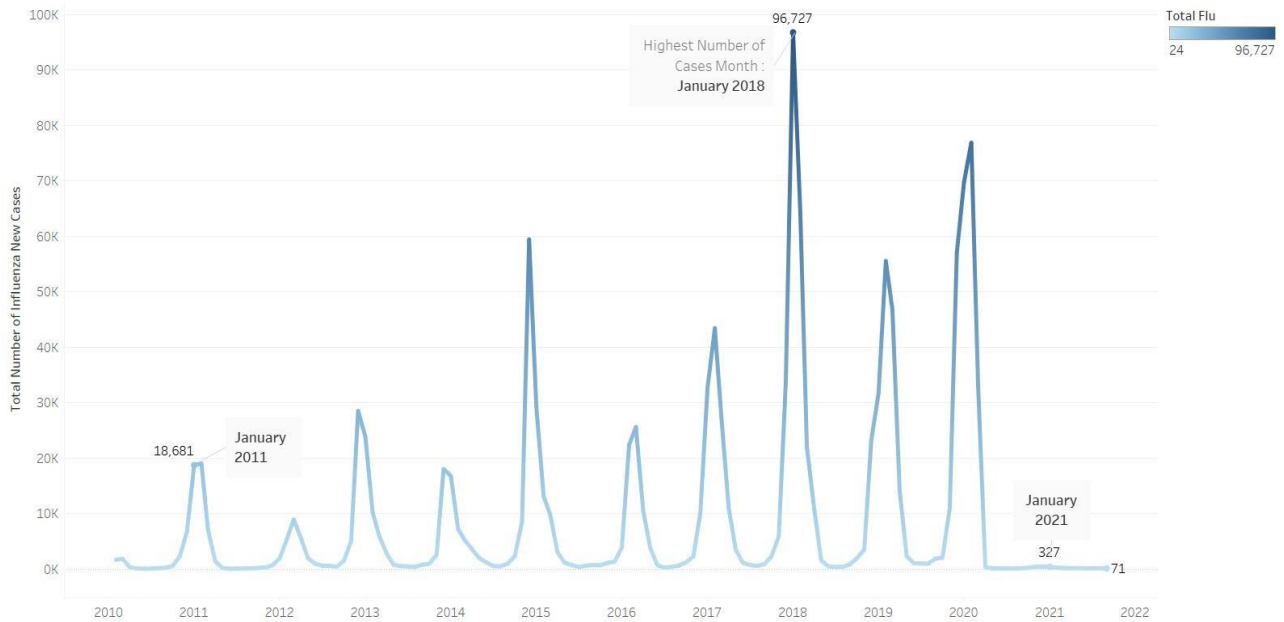


Figure 1: Number of Influenza new cases in the United States 2010-2021

The graph mentioned below as Figure 2 shows the monthly trend of COVID-19 new cases which data collected from Our World In Data (Ritchie, 2020b). The data had daily new COVID-19 cases in the United States from January 2020 to September 2021.

Tasks that were performed during this analysis are the elimination of irrelevant attributes, removal of null values, achieving data cleaning, data formatting by using python and performing time series analysis after cleaning the data using Tableau Software.

Monthly Covid-19 New Cases in the U.S. 2020-2021

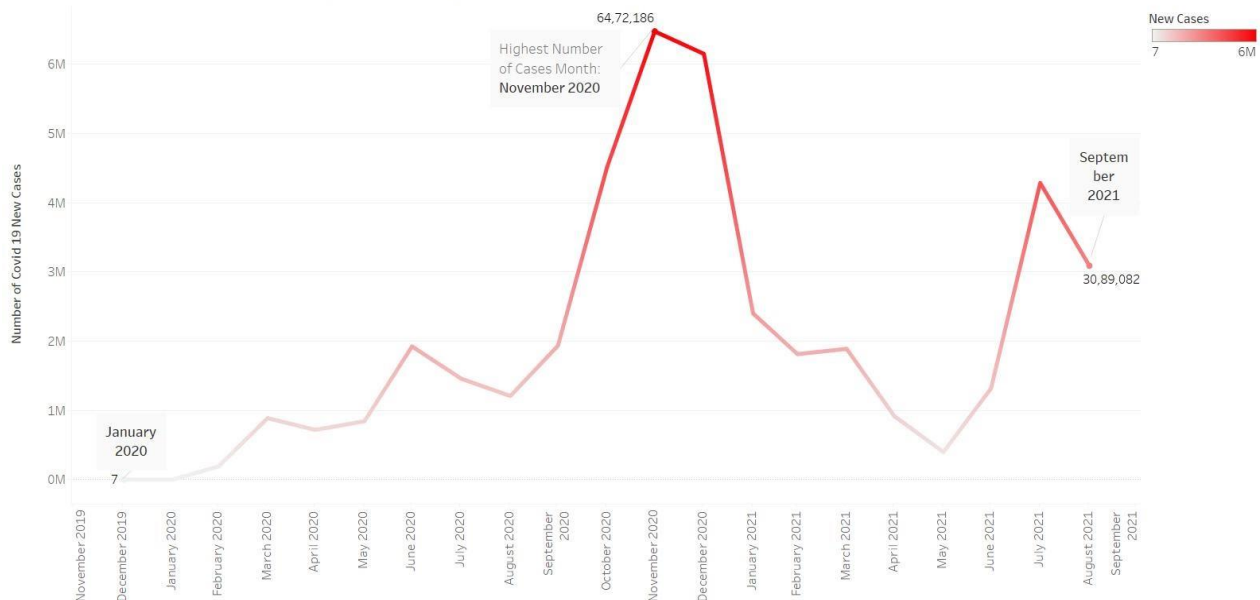


Figure 2: Monthly COVID-19 new cases in the United States 2020 - 2021

In order to analyse the effect of COVID-19 on Influenza, new cases of both diseases has been visualized by comparing both the data within the same time frame for 2020 and 2021. The results were eye-popping due to the changes in the Influenza trend as the COVID-19 movement hiked.

Influenza vs Covid-19 New Cases 2017-2021

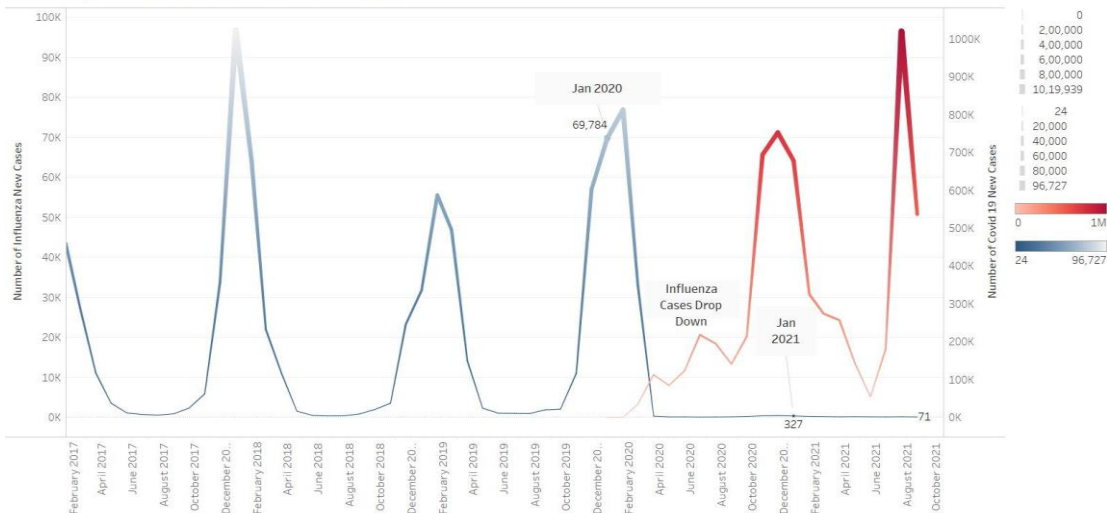


Figure 3: Influenza vs. COVID-19 new cases 2017 - 2021

The Influenza cases hit rock bottom due to COVID-19, as seen in the graph above in Figure 3. After performing the above step and analyzing it, there were multiple questions regarding Influenza. As a break in seasonal Influenza could be seen, predicting Influenza for the upcoming years was a monumental task. The tasks which were performed for the above research were started by importing the weekly reported Influenza data from Microsoft Excel. The next step included eliminating the irrelevant columns and converting required attributes into a pivot table for clear and better understanding. To produce the desired effect it has been performed forecasting analysis on the data using Microsoft Excel comparing the pre-COVID-19 and the post-COVID-19 to study if any differences are to be seen in the estimated number of Influenza cases. In severe cases, both the flu and COVID-19 cause pneumonia, respiratory failure, acute respiratory distress syndrome, sepsis, heart attack or stroke, multiple organ failure, severe inflammation, and even death (“Differential Diagnosis: Cold, Flu or COVID-19?” 2020). Although experts were concerned about possible twindemic last year, the 2020–2021 flu season was tranquil, with the number of cases lower than expected. There is a report which shows that in the United States, there were fewer confirmed cases of hospitalization due to flu than in any other year since the collection of such data began in 2005 (*Upcoming 2020–2021 Influenza Season*, 2021).

Estimated Number of Influenza Cases 2020-2022 Before Covid-19 Existence

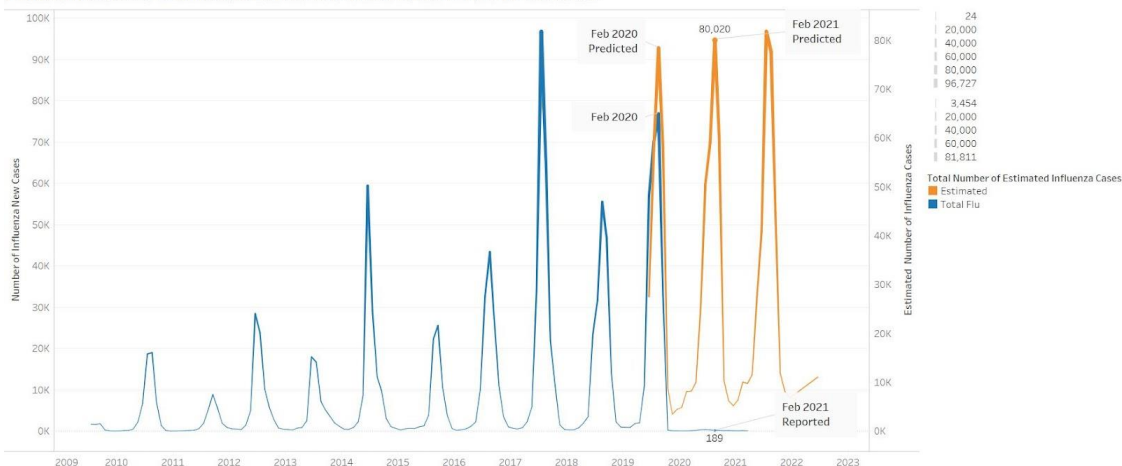


Figure 4: Forecasted number of Influenza cases 2020 - 2022 before COVID-19 existed

The predicted number of Influenza cases are shown at the above results (Figure 4) with a 95% Confidence Interval. The results were obtained by running the forecast function on Microsoft Excel, which considered predicting the number of Influenza cases from December 2019 with the historical data available. It was observed that the reported Influenza trend until May 2020 was in line with the prediction assumed, as shown in Figure 4. But soon, there was a break in a pattern which is due to

COVID-19. Hence, the prediction trend is aligned with the number of cases reported from June 2020 and later. With such a break in the pattern, the further prediction would be misleading.

According to scientists and health care experts, getting the flu makes people sick and builds immunity against the flu for a limited time. Since very few people got Influenza in 2020, it can be expected that there will be an increase in the number of Influenza cases in the upcoming years. This fact is supported by many other researchers worldwide (Benefits of Flu Vaccination During 2018–2019 Flu Season, 2020b).

Alternatively, humans can build immunity against a virus with a disease, provided vaccination, demonstrated in Figure 5 below. The Influenza vaccination rates in U.S.A. data was collected from CDC. Data consisting of the average percentage of people vaccinated every month from 2010-2021. The visualization was performed on Tableau .

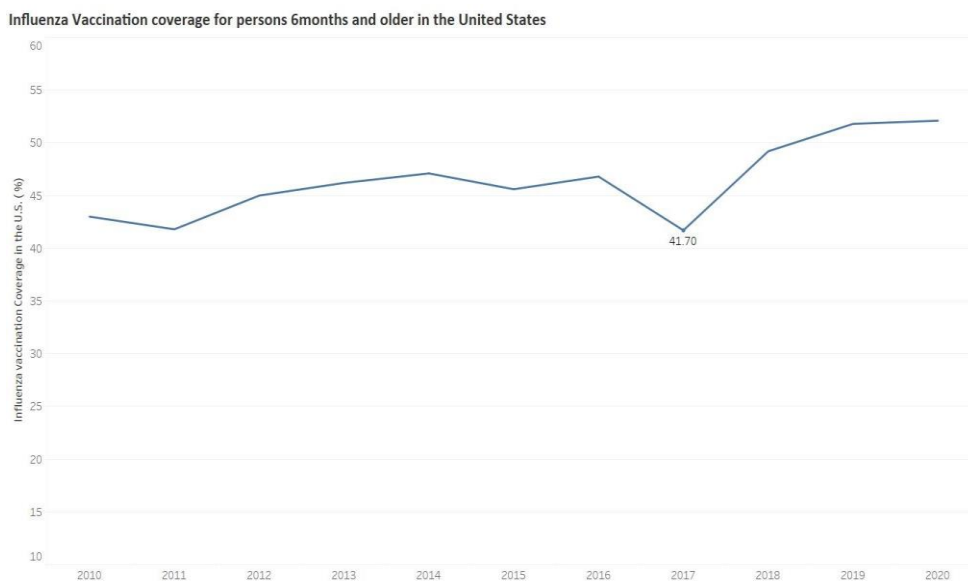


Figure 5: Flu vaccination rates in the United States 2009 – 2020

Figure 5 represents the average percentage of people covered by flu vaccination in the United States from 2010-2020. As we can observe, the percentage of people protected by flu vaccination in the United States was below average in 2017. The flu vaccination coverage dropped to 41.7%, which is 5%-6% lower compared to the previous year. In 2017, the average % of people in the United States vaccinated against Influenza dropped for various factors (Hill, 2018). That's why it was not perceived as an outlier for the research.

Number of Influenza New Cases in the U.S. 2010-2021

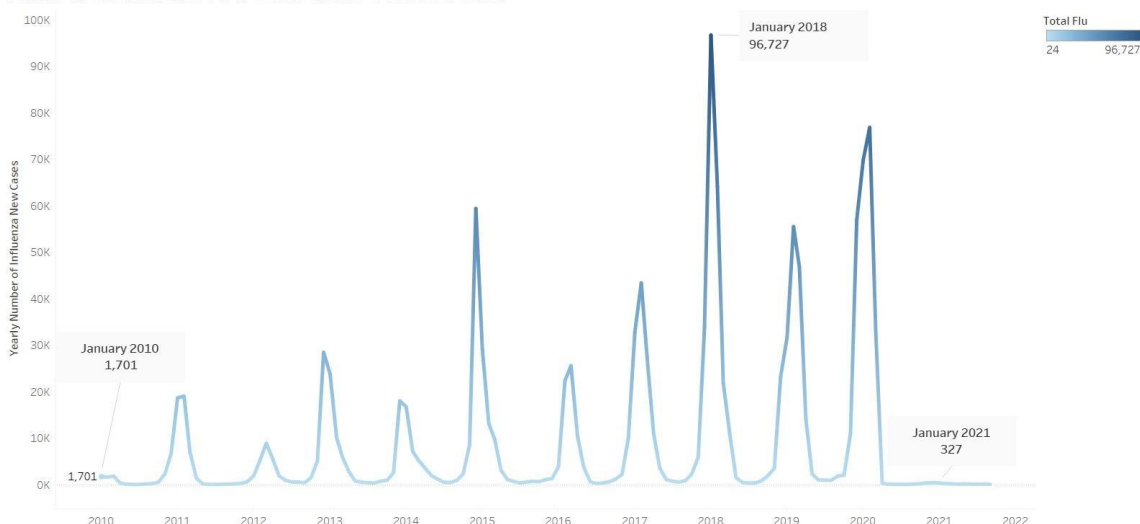


Figure 6: Influenza cases reported in the United States 2010 - 2019

The Figure 6 graph shows an increase in the number of Influenza cases, specifically in the year 2018, due to less number of vaccinations being done around the United States in 2017. The year 2018 has the highest number of cases among the ten years, as shown in Figure 6.

5. CONCLUSION

The hypothesis for this research shows that as the COVID-19 cases increased, Influenza cases drastically came down. The preventive measures were taken to flatten the COVID-19 curve, and it helped to drop the Influenza curve. According to health experts, exposure to flu viruses naturally boosts the immune system and reminds the immune system to keep up its defence. As this year there were very few Influenza cases, fewer people gained immunity against flu. Effectively, we could be expecting an increase in Influenza cases in the upcoming year.

The CDC recommends annual influenza vaccinations for everyone age six months or older. A survey of more than 1,000 U.S. adults commissioned by the National Foundation for Infectious Diseases found that while more than 60% of Americans agreed the flu shot was the best way to prevent flu deaths and hospitalizations, 44% said they were unsure about or not planning to get a flu vaccine this year (Flu Treatment, 2021). People are recommended to get a flu shot in September or October, but getting it any time during flu season will help (Flu Season, 2021). The shot takes effect in about two fewer weeks. The flu shot is effective for about a year. This means that people need a new shot for protection each flu season, even if the strains in the shot are the same. The flu is contagious from the day before symptoms begin, which means that people can transmit the flu virus to another person before they notice that they are unwell. An otherwise healthy person remains contagious until about a week after the appearance of symptoms. Others may continue to spread the flu after seven days. To limit the spread of the flu, doctors recommend annual flu shots, frequent hand washing, and cleaning frequently touched surfaces at home, school, and work.

In this research, the study shows that the 2020-2021 year Influenza data is not complete and hence if added those years to the prediction analysis, it would mislead the research. This pandemic has shown both the importance of initiatives in individual countries and the interdependence of the world and the necessity of global cooperation for pandemic control. The investment by a limited number of countries has led to the biomedical discoveries that have brought forward the tools to interrupt the spread of the pandemic. Yet, the lack of international structures for the implementation of these tools has brought into focus the disparities between advantaged and disadvantaged groups both within countries and between countries. This highlights the current inadequacies in healthcare delivery systems and access to new biomedical interventions. Global health leaders will need to be vigilant concerning the trajectory of SARS-CoV-2 shortly while assessing the strategies and approaches used in the pandemic to develop more effective structures and processes to ensure a more effective and equitable response for the future.

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Conflict of interests

The authors declare that there is no conflict of interest.

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