

Analytical Study of the Non-pharmaceutical Public Health Interventions to Control the Novel Coronavirus Disease 2019 (COVID-19)

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Abstract. The novel coronavirus disease (COVID-19) has been spread rapidly all over the world, imposing severe preventive measures in many countries. These non-pharmaceutical interventions, such as travel restrictions, public closures, full curfew, and lockdown of cities, ensure social distancing, and manage to slow down the spread of the disease. The global impacts of these strict measures on humans and economies require an analytical assessment of their effectiveness. In this study, we provide a time-series analysis of the COVID-19 response for selected countries, including China, Italy, Iran, UK, USA, Taiwan, Singapore, and Saudi Arabia. In addition, correlating public response towards governments announcements about COVID-19 daily reports and the applied measures can be an indicator of the effectiveness of these measures. We gathered and analyzed official announcements on social media in each country. We believe our results will provide insights into the epidemic control procedures and can assist the decision-makers in identifying the right time frame and scope to set or lift the different precautionary measures. The obtained analysis can contribute to improving country-based response to potential waves of COVID-19 and future disease outbreaks.

Keywords: Infectious diseases · Novel coronavirus · COVID-19 · Public health · Prevention measures · Social distancing interventions.

1 Introduction

On December 31, 2019, SARS-CoV-2, a novel coronavirus, has been identified to cause an acute respiratory disease (COVID-19) outbreak in Wuhan, China. Within a few weeks, the World Health Organization characterized COVID-19 as a pandemic, with various rates of transmission in more than 110 countries [10].

Under uncertainty and limited time to contain this rapidly spread disease, governments in many affected countries had to enforce several non-pharmaceutical interventions [1, 2]. The implemented control measures include quarantine, travel restrictions, school closure, public lockdown, suspension or cancellation of major events, and curfew. The extent and the timing of these measures vary from one country to another. These measures help to prevent direct interactions among individuals to minimize the number of new COVID-19 cases and potential failure of the health care systems in some of the affected countries. However, due to their large economic and social implications, it is important to assess their expected impact of controlling the epidemic.

The analysis presented in this study compares different strategies that selected countries have taken in response to COVID-19. These countries were selected based on the number of COVID-19 cases in the early stages of the pandemic [3, 7] and how the applied measures managed to slow down the disease [11, ?]. Besides China, where the novel coronavirus discovered and the first COVID-19 outbreak started, we include the USA, Italy, UK, Iran, Singapore, Taiwan, and South Korea. We also compared our results with the COVID-19 response in Saudi Arabia. For each country, we study the correlation between the size of the epidemic, applied measures, and people’s reactions towards COVID-19 official announcements and daily reports on social media.

Our study encompasses social distancing measures, travel restrictions, lockdown, isolation of confirmed COVID-19 cases and quarantine of suspected cases [13]. In addition to these non-pharmaceutical interventions we included widespread testing [14]. To analyze public reactions to country-based COVID-19 response in each country, we gathered data in one of the most well-known information sources during crises and public health emergencies, Twitter [12].

The obtained results in our study can provide insights into the epidemic control procedures and can assist the public health authorities, governments, and international organizations in identifying the right time frame and scope to set or lift the different precautionary measures. The findings can contribute to improving country-based response to potential waves of COVID-19 and future disease outbreaks.

2 Data and Methods

2.1 Country-based Response Data

Data was collected from publicly available international data sources on COVID-19 situation to create a profile for each selected country. Every profile includes daily numbers of COVID-19 confirmed cases, deaths, active, and recovery. For the COVID-19 daily updates, we collocated data in the early stage of the COVID-19 outbreak from January 23, 2020, until the end of April 2020. The timing of

the main decisions of enforcing prevention measures in the COVID-19 response timeline was obtained from official published reports, official webpages, and social media accounts of the different government entities for each country.

To be able to understand the effects of prevention measures applied in the selected countries on the growth of the pandemic, we first identified four major non-pharmaceutical interventions used by most of these countries. These measures were implemented to restrict the interactions and movements between individuals and limit the spread of the disease. Literature and media may refer to several different applied strategies as one of these four measures. Therefore, we have identified these measures as follows [8, 9, 13]:

1. Travel restriction: Travel restriction to and from infected countries starting with China was the first countermeasure applied in many countries to prevent importing COVID-19 cases among arriving travelers. Travel restrictions is implemented to limit the movements of individuals between communities, states, or countries. Travel-related precautionary measures also include screening at entry points and border closures.
2. Case-based measures: One of most effective measures against COVID-19 spreading includes isolation and quarantine of individuals to restrict their interactions with others. While isolation is used to separate confirmed COVID-19 cases, a voluntary or mandatory quarantine is applied to presumed exposed individuals (e.g. contacts of COVID-19 confirmed case) or suspected cases (e.g. individuals arriving from infected countries).
3. Lockdown: Lockdown is an emergency practice of preventing people from entering or leaving a specific geographical area. Under this definition we consider schools closure, suspension of mass gatherings, workplace closures, public closures including closing malls, sport facilities, parks, and faith-based communities.
4. Social distancing: Social distancing is a precautionary recommendation of maintaining a physical distance of six feet or more from others to avoid direct contact with people during an outbreak of close-contact infectious diseases.

In addition to these measures, widespread COVID-19 testing is included for each country. Widespread of COVID-19 testing is implemented via drive-through testing stations to identify confirmed COVID-19 cases and trace their contacts. Widespread testing strategy combined with contact tracing proven to be successful in flattening the COVID-19 curve in countries such as South Korea and Taiwan [4].

2.2 Twitter Data

We used Crimson Hexagon [6], a social media analytics tool, to collect public Twitter posts submitted by the official health ministry account for each country.

Twitter data was collected from September 1, 2019, before the discovery of the SARS-CoV-2 virus until 11, April 2020 after applying the prevention measures. We also collected the reaction to the posted tweets by each official account as a number of mentions and number of retweets. Table 1 lists the Twitter official accounts for the governmental entity in the selected countries. The variation in the number of posted tweets by each official account can be due to culture differences and the preferable communication channels to share information with the public during public emergencies and health concerns [5].

Table 1: Twitter accounts for governmental entities in the selected countries.

Twitter account	Twitter account description	Total number of tweets
@SaudiMOH	Ministry of Health in Saudi Arabia	2,065,335
@chinascio	State Council Information Office of China	830
@mohwpr	Ministry of Health and Welfare in South Korea	2,779
@MinisteroSalute	Ministry of Health in Italy	966
@HHSgov	U.S. Department of Health & Human Services	1,530
@Iran_GOV	Government of Islamic Republic of Iran	3,198
@sporeMOH	Ministry of Health in Singapore	356
@MOHW_Taiwan	Ministry of Health and Welfare in Taiwan	796
@DHSCgovuk	Department of Health and Social Care in UK	2,734

2.3 Methodology

To compare the COVID-19 situation among the selected 9 countries, we first conducted a statistical analysis of the disease activities all over the world. Then, we studied the COVID-19 trends in each country considered in this study.

3 Results

4 Conclusion

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