SARS-CoV-2 Pandemic Tracking: Understanding Different Mitigation Strategies

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Abstract

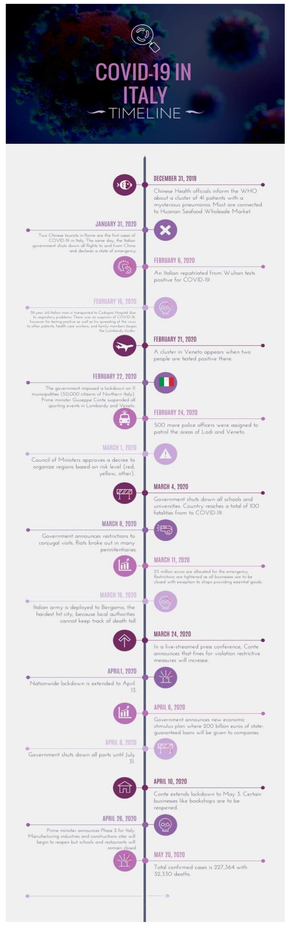
Near the end of 2019, a new severe respiratory disease was found in Wuhan, China, and was later identified as the novel human Coronavirus infectious disease, 2019 (COVID-19). It is a highly infectious disease caused by a newly discovered coronavirus, SARS-CoV-2 (Severe Acute Respiratory Syndrome-Coronavirus-2). The virus has spread past China, to the rest of the world with countries such as Italy, United States, Spain, France, and the United Kingdom having the highest number of confirmed infections. There are nearly four million individuals infected and at least 262,376 deaths due to the illness globally to date. In comparison to the most recent pandemic, the 2009 swine flu (H1N1) which took place from January 2009 to August 2010, the SARS-CoV-2 pandemic is unique in its speed and severity. According to the CDC, there were an estimated 60.8 million cases and 12,469 deaths in the United States over the year and a half course of the H1N1 pandemic. As of May 6th 2020, there have been 1,237,633 confirmed infections and 72,271 confirmed deaths in the United States as a result of COVID-19 in only four months even with significant mitigation strategies in place. After assaying the epidemiological data collected from countries at both the national and regional level, a link between legislative action and infection rates seems to be present. By looking at the data and taking into account some of the many factors that can influence the daily number of infections, including the economy and tourism of an area, we were able to evaluate the relative successes of different governments' actions in limiting the spread of SARS-CoV-2 as well as which countries were the hardest hit by this pandemic.

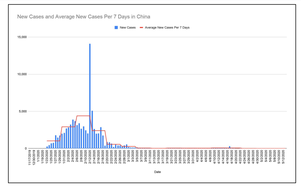
Introduction

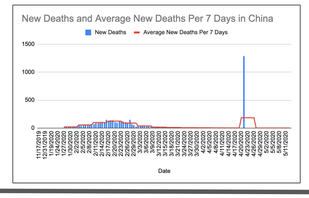
The COVID-19 pandemic in both Italy and China acts as a microcosm for the rest of the world in which our evaluation of the success or backlash received from certain government reforms can be taken as guidelines for how other nations should respond to a global crisis. For instance, when the prime minister of Italy allowed for the reopening of certain businesses across to the country, we can determine whether that led to more people being in close proximity with each other and therefore caused a spike in cases or if the opposite occurred. Whether the former or the latter occurred can be applied to other countries and how they should approach making reforms and governing their people during a pandemic. After compiling a timeline of notable reforms that the government passed, it becomes necessary to inquire whether they were effective in mitigating infection rates. China was the first country to see localized COVID-19 outbreak turn into a worldwide pandemic. Just like Italy, we are able to look at China's legislative actions and timelines in relation to the rate of new cases; this would answer the question of how China was able to mitigate the spread of the virus rather quickly while other nations are currently struggling to contain the amount of new cases in their country.

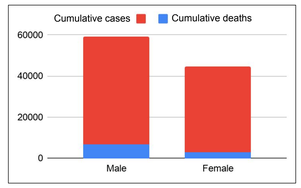
Main goals:
-Track confirmed SARS-CoV-2 cases in eight countries who were experiencing large numbers of confirmed infections.
-Understand and compare differential strategies for mitigating the spread of SARS-CoV-2 in China and Italy.
-To evaluate the effects of government legislation on infection rates in both countries

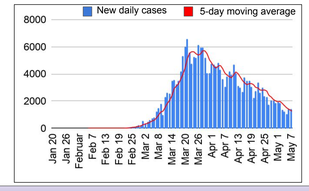
SARS-CoV-2 in Italy and China

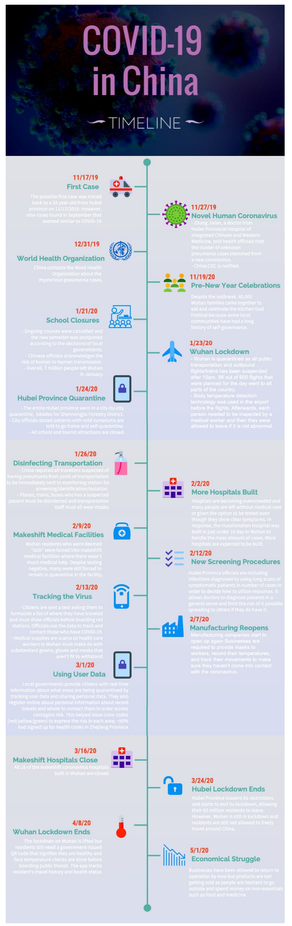




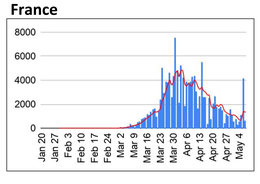


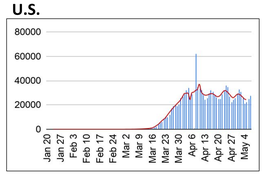


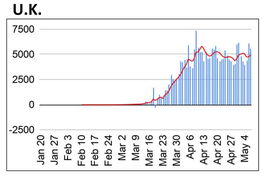


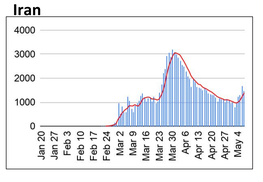


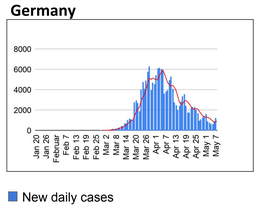
SARS-CoV-2 tracking of other large outbreaks

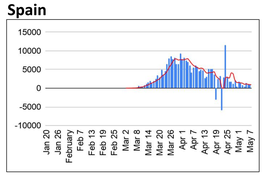












New daily cases
5-day moving average

Results

- Some but not all countries show signs of flattening the curve. Countries like the U.S. and the U.K. are seeing cases plateau but not diminish.
- There were incongruous spikes and drops in the amount of cases seen in both China and Spain's data. This may be due to new testing procedures, what qualifies as as a confirmed case, and the amount of SARS-CoV-2 tests given out.
- There were 1771 new cases the day the lockdown was imposed on Hubei Province, China, and 3089 new cases the day a total lockdown was imposed in Italy. This could be a factor on how long the outbreaks persisted in each country, how China was able to mitigate the outbreak in less time than Italy.
- The relative effectiveness of the respective mitigation strategies in China and Italy can be determined by looking at the daily case count on the day that a lockdown was imposed and tracking how long it took for the case count to return to that same number.
- As seen on the daily cases in China, it approximately took one month for the Wuhan outbreak to be controlled.
  - China was able to track citizens who are or could possibly infected by having everyone put their personal information and current location into the app. Multiple checkpoints were present and only people who weren't infected and haven't been in the presence of the virus were allowed outside, stunting the spread through public interactions.
- Countries such as those in the European Union have very strict privacy laws where they can access user data, but everything is anonymous with no specific information tied to an individual. This has made it hard to track the spread of the virus because the information given is general and they have to convince users to use any application.
- Italy has not shown any correlation between economic status and infection rates. However, a more eco touristic-heavy region naturally attracts more tourists, and more people in a confined location means infection rates will spike. Also, we must take into consideration how long it has been since a region has had its first infected patient.

Discussion

- In Italy, there does not seem to be a correlation between economic status and infection rates, as the poorer regions seem to have both high and low infection rates across different areas.
- Certain government action had an effect on the populace because some saw the measures as unjust and extreme. For example, riots in penitentiaries across Italy
- During and after lockdowns on certain cities and countries, certain applications were used to track the spread of the virus but its effectiveness was based on their privacy laws and to what extent could personal data be stored and used. A steep decline in the data that coincides with government legislation indicates that the more enforced and specific among the population these changes are on an individual's personal data, the more effective the application is in slowing the growth of cases.
- As seen on the timeline, China's app which was enforced on Alipay and WeChat, two apps that have the most users and posted in public via QR codes, only allowed people who were confirmed healthy on the app were allowed outside. For reference, 90% of Zhejiang Province's 50 million population signed up when it was first introduced late February.

Materials and Methods

- SARS-CoV-2 infection data was sourced from Worldometers Coronavirus tracker and plots of infections over time were generated using Microsoft Excel and Google spreadsheets. Moving averages were calculated by taking infections from the previous 7 days (indicated date -6) and dividing by the cumulative infections from days -7-(-14).
- Timelines were generated using the Venngage and Visme website and references for information collected is cited in the References section (China: google spreadsheet. Italy: Wikipedia).

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