COVID-19 and Vaccines: delving into the global pandemic

A guide to unravel the pandemic

BY Alessandro Hammond & Paige DeFiori

Questions We Had:

- We are seeking to identify the correlation between the socioeconomic status of each country, the rate of infection, and the rate of vaccination.
- What relationship exists between an individual's country of residence and their ability to receive the vaccine?
- What factors are considered when determining which countries will receive the vaccine? What social inequities are resulting from the distribution of the COVID-19 vaccine?

Introduction

-Economic Impact of COVID-19

-Social Impact of COVID-19

-Figures

-Conclusion

Why Does COVID-19 Matter?

- *Health care*
- *Economic*
- *Social*

Economic Impact of COVID

- The coronavirus pandemic has significantly disrupted both the national and global economy.
- As the country was forced into lockdown, many small companies were forced to shut down temporarily, preventing them from achieving their earnings goals for multiple months. As many small businesses operate on slim profit margins, they typically do not have ample emergency savings available for unforeseen situations such as the current pandemic, causing many of them to close permanently.
- According to Brookings Scholars, the lockdown and subsequent closures of these small businesses has created an additional crisis for many workers across the country, particularly for minorities, lower-wage earners, and those with fewer educational qualifications (Stevenson, 2020)
- Countries who rely on travel have been completely devastated from COVID
- According to a recent advisory released by the United Nations Department of Economic and Social Affairs, the global economy could shrink by almost one percent this year-0.9 percent-due to the COVID-19 pandemic, and world production could contract more if enforced limits on economic operations spread to the third quarter of the year and if fiscal responses struggle to sustain income and consumer spending.

Social Impact of COVID

- From the mass cancellation of athletic events to daily social distances regulations, COVID-19 has deeply impacted our daily social life.
- Travel restrictions have increased throughout the pandemic, meaning that many individuals have not been able to visit their loved ones in different states and countries.
- Similarly, many religious events have been postponed or cancelled, making it difficult for practitioners to pray and worship in a time when faith and hope is a rare commodity.
- In addition, due to this decreased social activity and forced separation from key, cumulative shared stress has increased to create a deep sense of population-wise trauma.
- For many communities that already carry generational trauma, such as Black Lives Matter movement and protests, this pandemic has amplified their pain by isolating them. Even if an individual is not suffering from personal pain, they may be interacting with others who are experiencing social distress, which can create a second-hand impact.

COVID-19 Vaccine

- Vaccines force out bodies to create antibodies for future protection against a disease.
- Although there is not currently a widely available COVID-19 vaccine in the United States, previous efforts concentrate on artificially developing antibodies that target coronavirus's namesake spike protein, which will consequently prevent the virus from entering the host (Wall, 2020).
- mRNA-1273 is the vaccine which is used for COVID and it is a spike protein.
- Pfizer has achieved a vaccine that is 90% effective in phase three clinical trials, and is currently being distributed to medical professionals and at-risk populations in the United States (Caddy, 2020).

Suprising Fact about COVID-19

A 2020 Gallup poll reveals that "11% of U.S. adults believe vaccines [in general] are more dangerous than the diseases they prevent, while 10% think vaccines cause autism," despite experts repeatedly debunking these false allegations (Galvin, 2020).

If this is how the US thinks, how would the rest of the globe view this issue?

Herd Immunity

US WORLD REPORT

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Data on COVID-19 (coronavirus) by *Our World in Data*

Our complete COVID-19 dataset is a collection of the COVID-19 data maintained by *Our World in Data*. It is updated daily and includes data on confirmed cases, deaths, hospitalizations, testing, and vaccinations as well as other variables of potential interest.

Download our complete COVID-19 dataset : CSV | XLSX | JSON

We will continue to publish up-to-date data on confirmed cases, deaths, hospitalizations, testing, and vaccinations, throughout the duration of the COVID-19 pandemic.

The data you find here and our data sources

- **Confirmed cases and deaths:** our data comes from the COVID-19 Data Repository by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU). We discuss how and when JHU collects and publishes this data here. The cases & deaths dataset is updated daily. *Note: the number of cases or deaths reported by any institution—including JHU, the WHO, the ECDC and others—on a given day does not necessarily represent the actual number on that date. This is because of the long reporting chain that exists between a new case/death and its inclusion in statistics.* ***This also means that negative values in cases and deaths can sometimes appear when a country corrects historical data, because it had previously overestimated the number of cases/deaths. Alternatively, large changes can sometimes (although rarely) be made to a country's entire time series if JHU decides (and has access to the necessary data) to correct values retrospectively.***
- **Hospitalizations and intensive care unit (ICU) admissions:** our data comes from the European Centre for Disease Prevention and Control (ECDC) for a select number of European countries; the government of the United Kingdom; the COVID Tracking Project for the United States; the COVID-19 Tracker for Canada. Unfortunately, we are unable to provide data on hospitalizations for other countries: there is currently no global, aggregated database on COVID-19 hospitalization, and our team at *Our World in Data* does not have the capacity to build such a dataset.
- **Testing for COVID-19:** this data is collected by the *Our World in Data* team from official reports; you can find further details in our post on COVID-19 testing, including our checklist of questions to understand testing data, information on geographical and temporal coverage, and detailed country-by-country source information. The testing dataset is updated around twice a week.
- **Vaccinations against COVID-19:** this data is collected by the *Our World in Data* team from official reports.
- **Other variables:** this data is collected from a variety of sources (United Nations, World Bank, Global Burden of Disease, Blavatnik School of Government, etc.). More information is available in our codebook.

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The COVID statistics analyzed and used for the visualizations below is form Our World in Data dataset, which is updated automatically daily. It is a meta data collection from global sources like: Johns Hopkins University, the UK government, the European Centre for Disease Prevention and Control, UN, World Bank and many more official reports.

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Manag

Data Trimming:

```
: covidDaily.info()
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 63779 entries, 0 to 63778
Data columns (total 59 columns):
 #   Column                                Non-Null Count  Dtype
---  ------                                --------------  -----
 0   iso_code                              63417 non-null  object
 1   continent                             63039 non-null  object
 2   location                              63779 non-null  object
 3   date                                  63779 non-null  object
 4   total_cases                           63172 non-null  float64
 5   new_cases                             63164 non-null  float64
 6   new_cases_smoothed                    62205 non-null  float64
 7   total_deaths                          54535 non-null  float64
 8   new_deaths                            54533 non-null  float64
 9   new_deaths_smoothed                   62205 non-null  float64
 10  total_cases_per_million               62810 non-null  float64
 11  new_cases_per_million                 62802 non-null  float64
 12  new_cases_smoothed_per_million        61848 non-null  float64
 13  total_deaths_per_million              54186 non-null  float64
 14  new_deaths_per_million                54184 non-null  float64
 15  new_deaths_smoothed_per_million       61848 non-null  float64
 16  reproduction_rate                     51295 non-null  float64
 17  icu_patients                          7012 non-null   float64
 18  icu_patients_per_million              7012 non-null   float64
 19  hosp_patients                         8324 non-null   float64
 20  hosp_patients_per_million             8324 non-null   float64
 21  weekly_icu_admissions                 693 non-null    float64
 22  weekly_icu_admissions_per_million     693 non-null    float64
 23  weekly_hosp_admissions                1061 non-null   float64
 24  weekly_hosp_admissions_per_million    1061 non-null   float64
 25  new_tests                             30363 non-null  float64
 26  total_tests                           30148 non-null  float64
 27  total_tests_per_thousand              30148 non-null  float64
 28  new_tests_per_thousand                30363 non-null  float64
 29  new_tests_smoothed                    34187 non-null  float64
 30  new_tests_smoothed_per_thousand       34187 non-null  float64
 31  positive_rate                         32371 non-null  float64
 32  tests_per_case                        31847 non-null  float64
 33  tests_units                           35421 non-null  object
 34  total_vaccinations                    1270 non-null   float64
 35  people_vaccinated                     981 non-null    float64
 36  people_fully_vaccinated               503 non-null    float64
 37  new_vaccinations                      1049 non-null   float64
 38  new_vaccinations_smoothed             1789 non-null   float64
 39  total_vaccinations_per_hundred        1270 non-null   float64
 40  people_vaccinated_per_hundred         981 non-null    float64
 41  people_fully_vaccinated_per_hundred   503 non-null    float64
 42  new_vaccinations_smoothed_per_million 1789 non-null   float64
 43  stringency_index                      57387 non-null  float64
```

	ISO	Continent	Country	Date	Total Cases	Total Cases per Million	Total Deaths	Total Deaths per Million	Total Vaccines	Total Vaccines per Hundred	Stringency Index	Population	GDP per Capita
60685	USA	North America	United States	2021-02-02	26435557.0	79865.092	446885.0	1350.095	32780860.0	9.80	NaN	331002647.0	54225.446
60684	USA	North America	United States	2021-02-01	26321120.0	79519.364	443355.0	1339.430	32222402.0	9.63	71.76	331002647.0	54225.446
60683	USA	North America	United States	2021-01-31	26186781.0	79113.509	441324.0	1333.294	31123299.0	9.31	71.76	331002647.0	54225.446
60682	USA	North America	United States	2021-01-30	26074885.0	78775.458	439530.0	1327.875	29577902.0	8.84	71.76	331002647.0	54225.446
60681	USA	North America	United States	2021-01-29	25932794.0	78346.183	436799.0	1319.624	27884661.0	8.34	71.76	331002647.0	54225.446

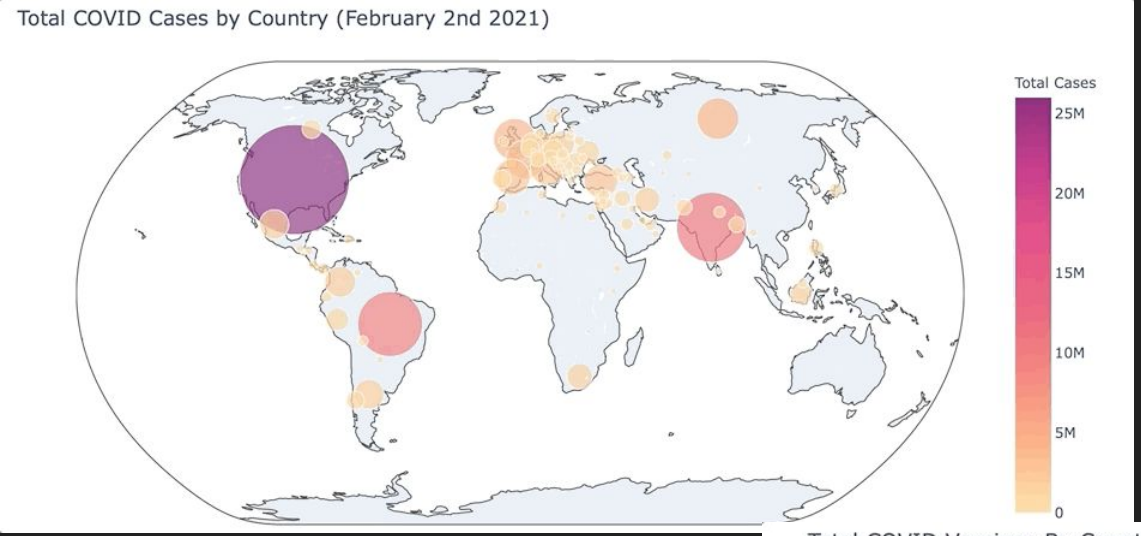
```
In [15]: # this indexes through the country column, adding the values in the desired columns with .agg:
         new_covid = new_covid.groupby(new_covid['Country']).agg({'Total Cases': 'max', 'Total Vaccines': 'max',
                                                                  'Total Deaths': 'max','Country': 'max','ISO': 'max'})

         new_covid.head(200)
```

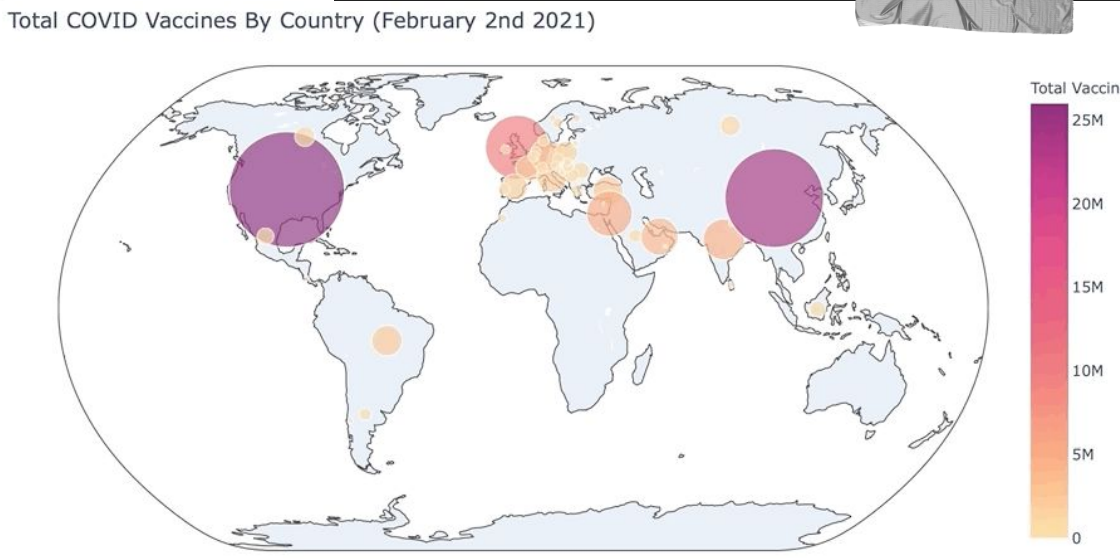
Out[15]:

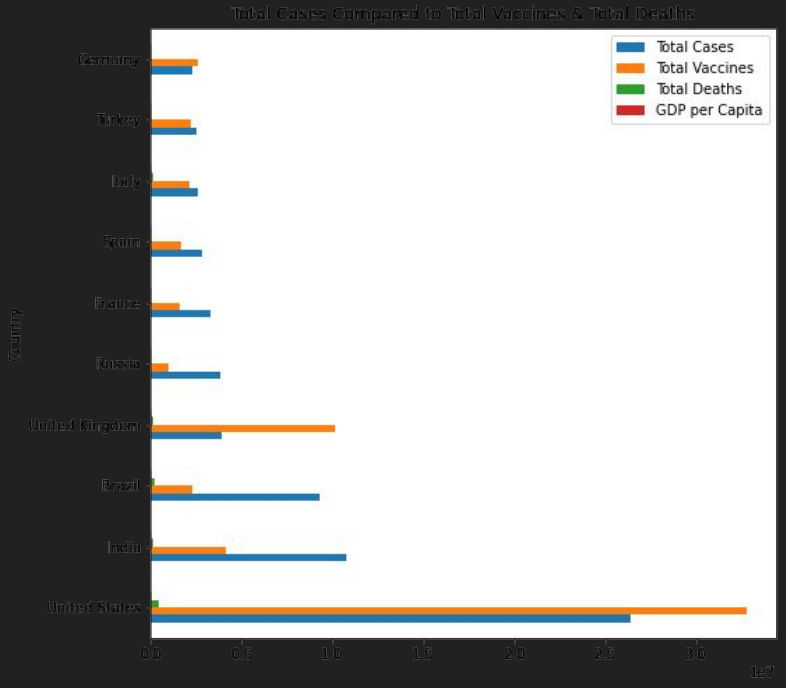
Country	Total Cases	Total Vaccines	Total Deaths	Country	ISO
Afghanistan	55121.0	0.0	2405.0	Afghanistan	AFG
Albania	79934.0	0.0	1398.0	Albania	ALB
Algeria	107841.0	30.0	2898.0	Algeria	DZA
Andorra	10017.0	1036.0	102.0	Andorra	AND
Angola	19900.0	0.0	468.0	Angola	AGO
Antigua and Barbuda	249.0	0.0	7.0	Antigua and Barbuda	ATG
Argentina	1943548.0	375851.0	48426.0	Argentina	ARG
Armenia	167231.0	0.0	3089.0	Armenia	ARM
Australia	28829.0	0.0	909.0	Australia	AUS
Austria	416763.0	208988.0	7847.0	Austria	AUT

As you can see, even though the head is 200, it stops at the number of countries there are as I took the max value (which is the most recent).
Now `new_covid` dataframe is 3 variables I want on COVID, most up to date but not BY DAY. Which helps with plotting total values, rather than interactive ones to change over time. Notably, I had to, what appears to, duplicate the country name. However, this is needed as the **bolded** country is an unplottable column. Firther, I need the ISO to properly plot on world maps!



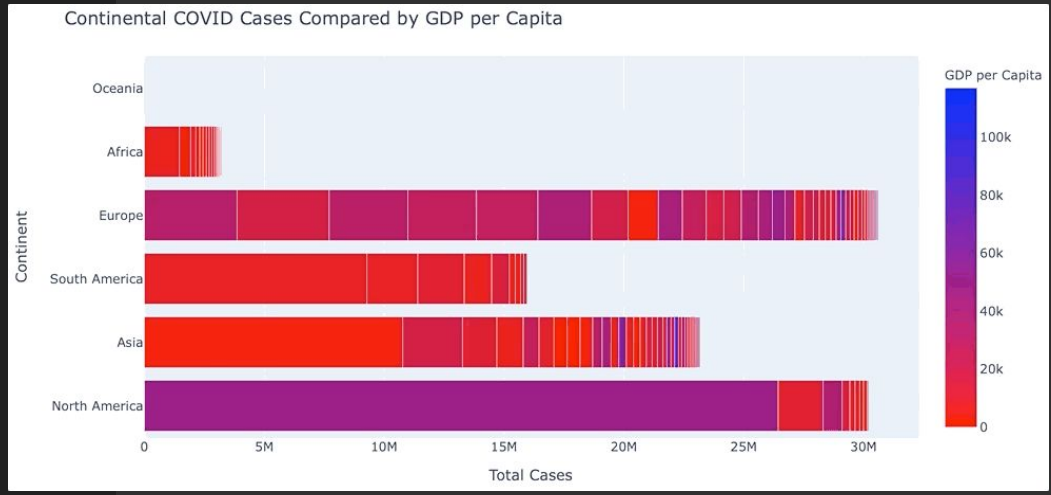
Cases VS Vaccines



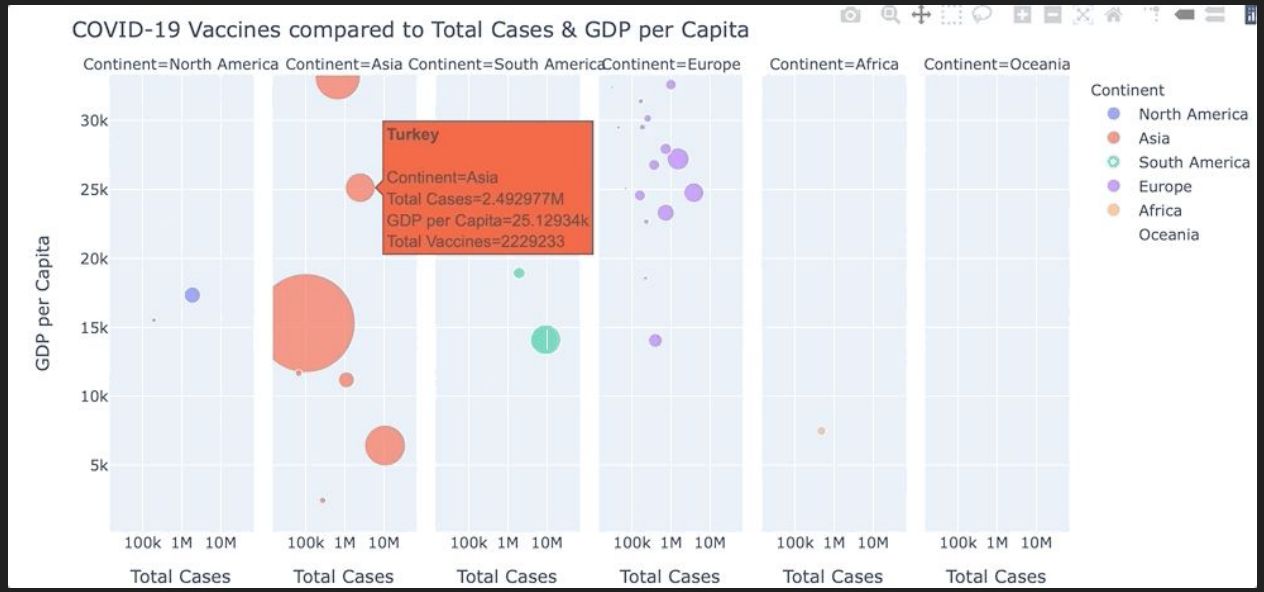


First Chart VS Improved upon:

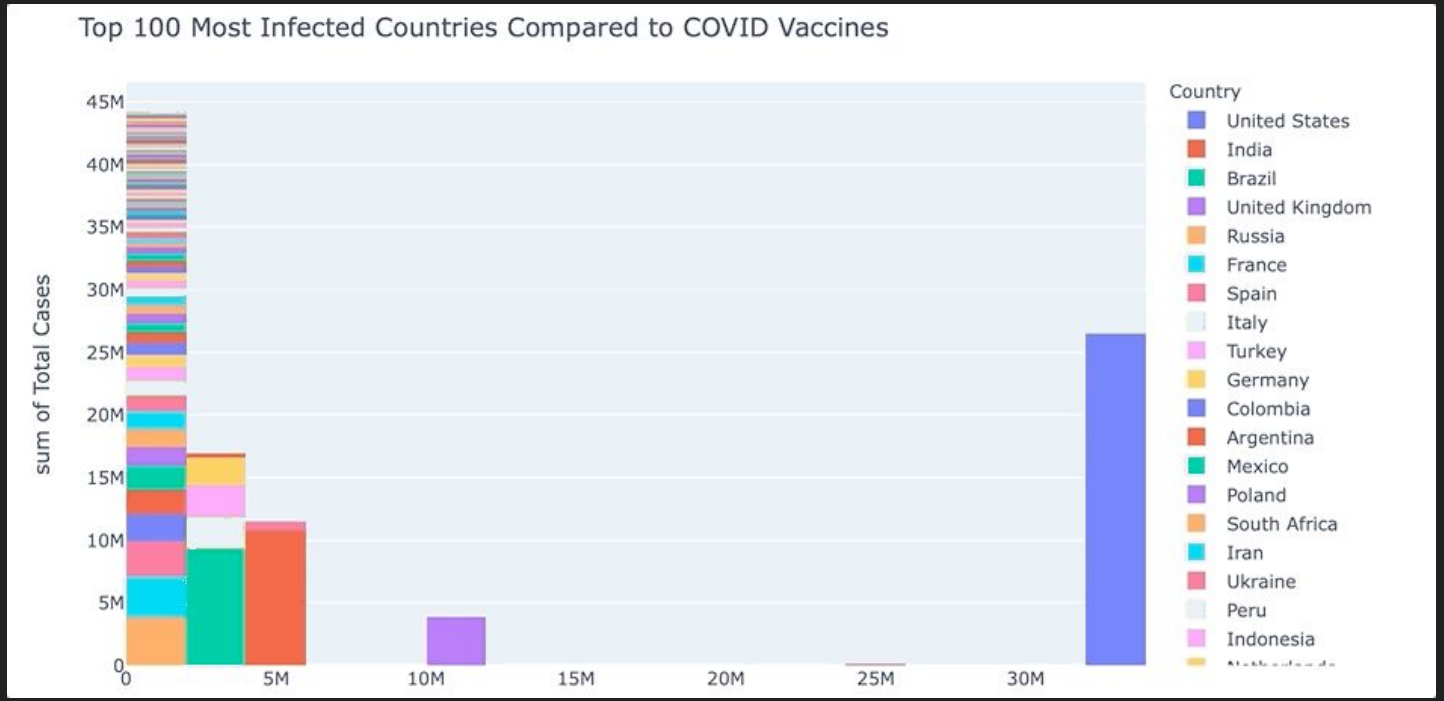
Total cases compared to GDP per capita



GDP & Vaccines



Top 100 Most Infected Nations and their Vaccines:



US and Spain are the countries most affected by COVID-19 totaling 40% of all total COVID cases.

THAT'S MORE THAN 33 Million cases!

Source: travel.trade.gov

Our Findings

There is no direct correlation between socioeconomic status and COVID-19 cases.

Ability to receive vaccine depends on condition of health and location.

We found that there is a possible underreporting of cases in African countries.

Report

COVID-19: delving into the deadly Pandemic

Introduction

In addition to infecting and killing millions of people across the globe, COVID-19 has affected the lives of many individuals worldwide. All aspects of humanity have been impacted by COVID-19, including the economy and social sphere. As a result, vaccines are essential to not only healing the health and wellness of the human population, but for easing the collective trauma caused by the pandemic. Our research question pertains to the current COVID-19 pandemic and its spread throughout the globe. Specifically, we are seeking to identify the correlation between the socioeconomic status of each country, the rate of infection, and the rate of vaccination. What relationship exists between an individual's country of residence and their ability to receive the vaccine? What factors are considered when determining which countries will receive the vaccine? What social inequities are resulting from the distribution of the COVID-19 vaccine?

When COVID-19 first began to spread in the US in February 2020, most assumed that, like SARS in 2003 or Ebola in 2014, the Coronavirus would only last about two weeks before we were able to stamp out the disease. However, a year later, we are still seeing the devastating effects and widespread impact of the disease, and it remains unclear when, if ever, we will be rid of it. Some experts, like Dr. Anthony Fauci, have suggested that we will all have to adjust to a new normal in which mask-wearing and social distancing are expected in public spaces more often. Each of us in this group has witnessed the trauma of COVID-19 firsthand as friends and family have been diagnosed with the virus. Never before have we seen a virus so severely impact our economy, health, government, and more, and we will likely see the consequences from the developments of this past year for the rest of our lives. While the medical community is largely focused on finding and deploying therapies and vaccines, other members of the scientific community must seek to analyze the social and political impact of the Coronavirus to mitigate and prepare for future progression of the disease or other potential diseases from novel pathogens.

Vaccines Today

As we continue to cope with the COVID-19 pandemic, the importance of vaccines has become increasingly more apparent. Scientists have made significant efforts to combat, cure, and prevent the virus, with at least six different vaccine trials running concurrently around the globe. Although there is not currently a widely available COVID-19 vaccine in the United States, previous efforts concentrate on artificially developing antibodies that target coronavirus's namesake spike protein, which will consequently prevent the virus from entering the host (Wall, 2020). Additionally, scientists have successfully retooled existing vaccines to effectively combat COVID-19, such as the BCG vaccine that is typically used to treat tuberculosis. Utilizing this

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technique, Pfizer has achieved a vaccine that is 90% effective in phase three clinical trials, and is currently being distributed to medical professionals and at-risk populations in the United States (Caddy, 2020).

Nevertheless, many individuals today express concerns against these new vaccinations, particularly in response to statements from leading government officials. President Trump, for example, had vocally expressed concerns about the safety of the approved coronavirus vaccinations, promoting several baseless claims linking vaccines to childhood autism (Schwartz, 2017). In addition, as government initiatives such as Project Warp Speed have pushed for the approval and distribution of the coronavirus vaccine, many constituents fear that they have not been appropriately tested, citing concerns about illness and potential infertility (Shapiro, 2020). Similarly, a 2020 Gallup poll reveals that "11% of U.S. adults believe vaccines [in general] are more dangerous than the diseases they prevent, while 10% think vaccines cause autism," despite experts repeatedly debunking these false allegations (Galvin, 2020).

Consequently, experts fear that, even when a COVID-19 vaccine is made more widely available to the average citizen, the lack of public acceptance will curtail the nation's chances of developing *herd immunity*. To combat this, medical experts and policy makers have collaborated on public education and awareness initiatives that resonate with the average American, such as informative commercials and websites about the importance of taking the vaccine. By focusing on increasing transparency from pharmaceutical companies and utilizing clear, concise language, medical professionals can better connect with citizens, producing greater confidence in vaccinations for both COVID-19 and future pandemics.

Economic Impact of COVID-19

In addition to severely impacting the world's health and wellness, the coronavirus pandemic has significantly disrupted both the national and global economy. As the country was forced into lockdown, many small companies were forced to shut down temporarily, preventing them from achieving their earnings goals for multiple months. As many small businesses operate on slim profit margins, they typically do not have ample emergency savings available for unforeseen situations such as the current pandemic, causing many of them to close permanently. As small businesses constitute a majority of U.S. companies and employ about half of all unionized workers, these closures created tremendous ripple effects throughout the blue collar community as they were forced to lay off their employees (Bartik, Bertrand, Cullen, et al. 2020; Small Business Administration 2012).

According to Brookings Scholars, the lockdown and subsequent closures of these small businesses has created an additional crisis for many workers across the country, particularly for minorities, lower-wage earners, and those with fewer educational qualifications (Stevenson, 2020). As a result, these employees are unable to support themselves, and are forced to rely on government programs such as unemployment and stimulus checks, which eventually run out and leave these individuals stranded. Lower income homes, homes of minorities, and children have

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experience the most economic impact from COVID, especially since they would not be able to pay for the medical bills associated with the disorder (Monte 2020). For example, since these families are statistically more likely to live in multi-generational homes with high-risk elderly relatives, they may not even be able to go to work if their job resumes without risking exposure. Consequently, they are exposed to the both greatest health risks and greatest financial risks, resulting in major economic consequences.

Social Impact of COVID-19

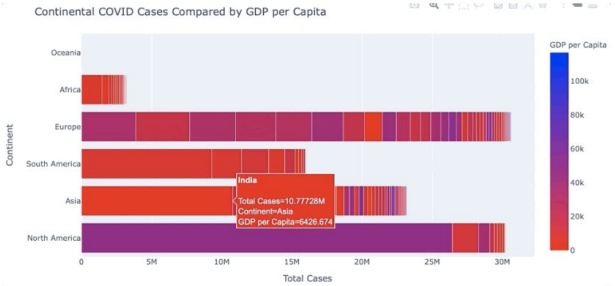
From the mass cancellation of athletic events to daily social distances regulations, COVID-19 has deeply impacted our daily social life. Travel restrictions have increased throughout the pandemic, meaning that many individuals have not been able to visit their loved ones in different states and countries. Similarly, many religious events have been postponed or cancelled, making it difficult for practitioners to pray and worship in a time when faith and hope is a rare commodity. On top of all this, each attempted foray back into "normal life" causes increased exposure to COVID-19, which can cause additional illness, suffering, and death to individuals and their family members. As a result, the average person is coping with a tremendous amount of individual stress, which can cause even further agony throughout the pandemic.

In addition, due to this decreased social activity and forced separation from key, cumulative shared stress has increased to create a deep sense of population-wise trauma. For many communities that already carry generational trauma, such as African-Americans who are additionally coping with the Black Lives Matter movement and protests, this pandemic has amplified their pain by isolating them. Even if an individual is not suffering from personal pain, they may be interacting with others who are experiencing social distress, which can create a second-hand impact. Consequently, this stress has become its own nationwide endemic, creating serious anxiety for the population at large that will follow Americans for generations.

Conclusion

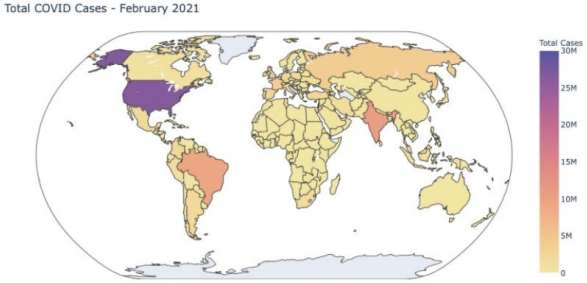
Robust vaccination programs have saved billions of lives since the eradication of smallpox in the 1980s, and are poised to deliver astonishing results against the COVID-19 pandemic. Although many today remain skeptical, history has shown the efficacy and safety of vaccines in combating the spread of disease, which is essential to healing our community's health, finances, and social wellbeing. With continued primary prevention efforts such as campaigns, vaccines and community awareness programs, more Americans will have the knowledge basis to make informed decisions about vaccinations and to demand that leadership pay attention to scientific advancement - which will ultimately be necessary in order to triumph over the coronavirus crisis. From our graphs we have been able to determine there is no inherent relationship between socioeconomic status and COVID-19 cases or vaccines. Rather, vaccines are dispersed randomly and more focused on the severity of someone who has experienced symptoms of COVID-19.

Data Explanation



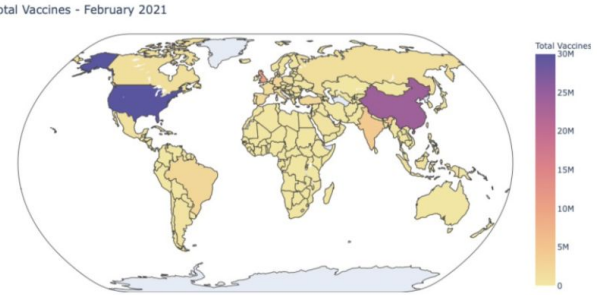
Description: The following graph is showing COVID cases against GDP per capita. GDP is a measure of the robustness of the economy, and we are looking to see how GDP per capita compares to the number of cases in total in a given country. The countries are divided into bars that represent continents or regions of Earth. There are several key things to notice. First, among high economic output countries, there is an outlier in North America, which has a very high GDP per capita but has an unusually large amount of COVID cases, almost as many cases in its 320 million population as the entirety of Europe with 740 million people and considerably more cases than Asia with its 4.4 billion people. This outlier is the United States, which has experienced an unusually lackluster - especially for a developed nation - federal government response to the pandemic. Second, the number of cases in the high economic output countries is generally larger than in the low economic output countries. This trend can especially be seen by looking at European countries in comparison with African and South American countries. For instance, Africa has very few cases and it is also very poor. At the same time, there are some very wealthy European nations with very few cases as well. The preponderance of these data points would generally lead us to believe that the rate of infection is not related to a country's cases. Thus, there does not appear to be a correlation between GDP per capita and a country's COVID cases. However, there are some confounding factors to consider. It is likely there is a great deal of underreporting of cases, particularly in Africa. It is also possible that because many African nations are so disconnected from the global economy, there is not a lot of movement between these African countries and countries with high incidence of COVID. Furthermore, in Africa, there are large segments of rural population among which there is less ability for the virus to spread. One of the reasons that the US is so disproportionately affected is the lack of concerted effort by the Federal government under former President Trump to enforce things like mask wearing and social distancing. Conversely, the European countries who did enact mandates experienced a generally better overall caseload.

Data Explanation



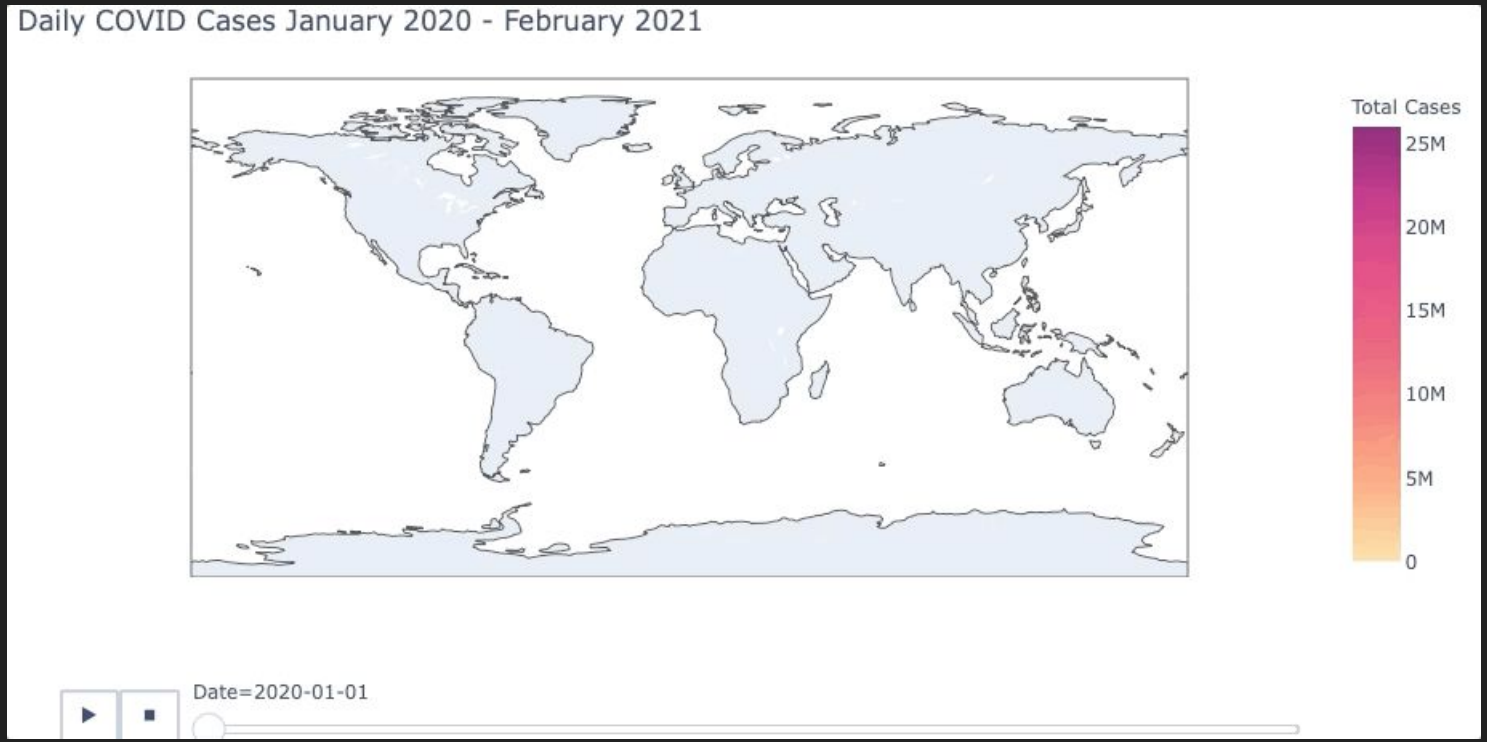
Description: The following graph is showing worldwide total COVID cases. It is apparent that the United States has the most COVID cases totaling over 30 million. It is notable that China is no longer the most disportionately affected country in the Asian region: it is now India. According to news reports, China has taken efforts to contain the virus which less authoritarian countries have not taken. The case of China in comparison with, say, South Korea shows the large role that culture and government play in the containment strategy of the virus. South Koreans generally don't have a problem if the government needs to track their location in order to conduct contact tracing, an important preventative measure against the virus. In South Korea, everyone downloaded an app and the government was quickly able to track down and help quarantine anyone who may have been infected early on. In the US, a significant proportion of Americans do not trust the government and so there is no way they would give consent for a government agency to do that, unless it was a threat that they believed in. For the US to not be as disproportionately affected, we must be able to recognize the threat. The extent to which the United States participates in COVID tracing would only be possible if Americans saw it as a threat. After 9/11, Americans consented to wiretapping to thwart future terrorist plots. But there has been a great deal of misinformation put out about the coronavirus so that there is a large part of the American population that doesn't believe it is real, or believes it is intended to allow the government to intrude further into our lives. Other significant data points from the graph include India. We can see that India, which is a democracy, overcrowded, and poor, has been very transparent to communicate its many cases but has been unable to effectively stop the spread. China's government, once they found out Wuhan was the hub of the virus, enacted an immediate and stringently enforced quarantine. In the South American region, we can see that Brazil has the most cases; this may be because Brazilian President Jair Bolsonoro has not been taking the virus as seriously and has spread misinformation about it.

Data Explanation



Description: The following graph is showing the total vaccines distributed as of February 2021. The most important highlight is that the United States has the most number of vaccinations completed. In the Asian region, China has been the most successful especially considering the dearth of cases to begin with. China was, in fact, one of the first to develop a vaccine to combat COVID and to begin administering it, despite not going through safety trials that most countries went through. Russian is another country to highlight as it was the first nation on earth to develop and approve a vaccine. However, Russia did not complete Phase 3 testing before they started vaccinating the population. Britain was the first country in the West to begin a large scale vaccination program, and that is reflected in how many successful vaccinations it has accomplished. One of the reasons that the US has so many vaccinations is because we have a great deal of vaccines available. This is both because we approved two types of vaccines and the Trump administration secured 100 million doses early on, through a federal government program called Operation Warp Speed, that guaranteed payment to pharmaceuticals even before the vaccines were proven to work. After the US bought all of these doses, they distributed the vaccine with the highest efficacy approval. We can see very few African countries have been able to get the vaccine because of their poverty. South American countries, African countries, and most Asian countries are fluctuating within the 0-5 million vaccinations. According to Dr. Amesh Adalja, a physician at Johns Hopkins, the reason the United States has the most COVID cases is largely because of sheer amount of social interactions, population, and lack of action from the US citizens and government. Conversely, as we refer back to the chart and compare this to countries like Australia where there are very minimal cases, they don't have very many vaccines.

COVID Progression:



Questions or Comments??

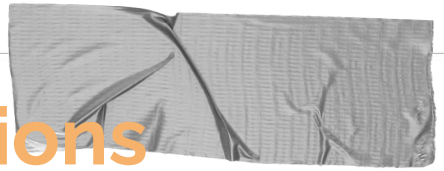
CODE TO MAKE THE MAP ANIMATED:

Now is the fun part: making the map and making it animated! This link is where I got the information on plotly express and the functions that work in the `px.choropleth()` figure:

In [23]:
```
# making an animated map via plotly express with a .csv file

list_countries = covidDaily['Country'].unique().tolist()

fig = px.choropleth(data_frame = covidDaily,
                    # ISO is necessary in plotly in order to depict the map properly
                    locations = "ISO",
                    color = "Total Cases",
                    # figure out how this works so the scale is consistent?
                    range_color=[1,26000000],
                    hover_name = "Country",
                    # continuous scale as data is changing
                    color_continuous_scale = 'sunsetdark',
                    animation_frame = "Date")
fig.update_layout(
    title_text='Daily COVID Cases January 2020 - February 2021')
fig.show()
```



Citations

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Any questions!