How are vaccination drives going + the inequalities underneath

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In the last two years, Covid 19 pandemic has been the cause of significant health concern over the entire globe. In such conditions, predicting trends in Covid 19 cases and analyzing patterns in spread have become tasks of utmost importance. Combining this information with the data on vaccinations around a particular country and the manufacturers of each vaccine gives us important insights into the areas that are more severely affected, the vaccines that have proved to be more effective, and show us potential next steps.

Covid-19 data is currently one of the most dynamically maintained and researched topics right now, and as such, there are various sources available to choose the data. We chose the Covid-19 data collected daily from Our World in Data GitHub repository for covid-19, which has been processed and narrowed down to two major files made available on Kaggle. The two files are country_vaccination.csv, which contains data about the number of vaccinations carried around countrywise, and country_vaccinations_by_manufacturers.csv, which has important data about the manufacturers of a particular vaccine. The detailed description of both the files, as taken from the official Kaggle info page, is as follows:

The data (country vaccinations) contains the following information:

- Country
- Country ISO Code
- Date - date for the data entry
- Total number of vaccinations - this is the absolute number of total immunizations in the country;
- Total number of people vaccinated - a person, depending on the immunization scheme, will receive one or more (typically 2) vaccines; at a certain moment;
- Total number of people fully vaccinated - this is the number of people that received the entire set of immunization according to the immunization scheme (typically 2);
- Daily vaccinations (raw) - for a certain data entry, the number of vaccination for that date/country;

- Daily vaccinations - for a certain data entry, the number of vaccination for that date/country;
- Total vaccinations per hundred - ratio (in percent) between vaccination number and total population up to the date in the country;
- Total number of people vaccinated per hundred - ratio (in percent) between population immunized and total population up to the date in the country;
- Total number of people fully vaccinated per hundred - ratio (in percent) between population fully immunized and total population up to the date in the country;
- Number of vaccinations per day
- Daily vaccinations per million - ratio (in ppm) between vaccination number and total population for the current date in the country;
- Vaccines used in the country - total number of vaccines used in the country (up to date);
- Source name - source of the information;
- Source website - website of the source of information;

The second (country vaccinations by manufacturer), contains the following columns:

- Location - country;
- Date - date;
- Vaccine - vaccine type;
- Total number of vaccinations - total number of vaccinations / current time and vaccine type.

Through our analysis of the data, we aim to answer questions like the following:
- Which are the top 20 countries in order of the number of total vaccinations carried out?
- How does the vaccination trend in India compare to that in other important countries like Russia and China?
- Which company has sold the most number of vaccines across all countries?
- For a particular country, what fraction of people who got the first dose of the vaccine administered were able to receive the second dose as well?

Let us start with the first question. We first use a bar graph to compare the total vaccinations that have been carried out in different countries. We create the graph for the top 20 countries:

Top 20 countries according to the total population vaccinated
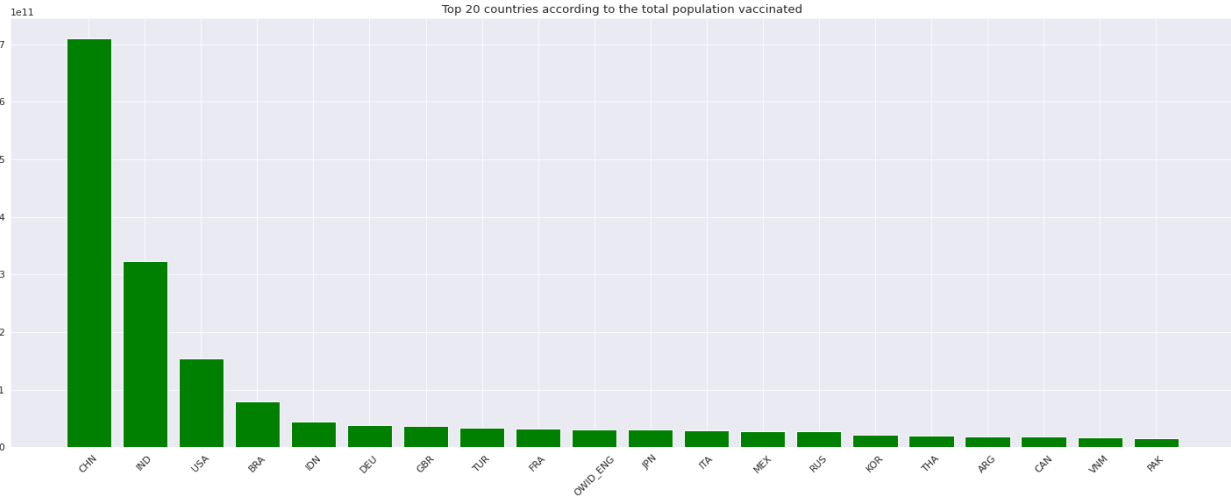
China surpasses the other countries by far in terms of the total vaccinations carried out, expected because China has the highest world population. India is the next country with the highest number of vaccines, although it is significantly lesser than China. This could be a combination of factors like the lesser population compared to China and some rural areas not receiving the vaccines in proportion to other parts of the country. The USA and Brazil are the next ones in the trend.

Since the total number of vaccines administered depends mainly on the country's population, it might not be an accurate indicator of the scale of the vaccine drive in the country. A better comparison would be the number of people vaccinated per 100 people in a particular country, and we show this trend with the help of a bar graph as well:

Top 20 countries according to the population vaccinated per hundred on an average
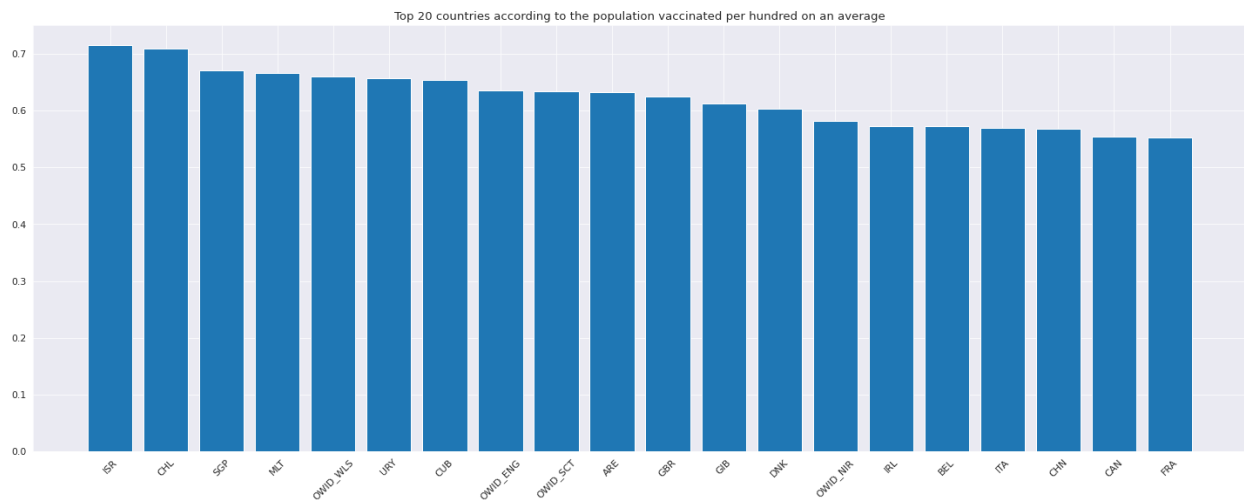
The above graph shows a very different trend compared to the previous one. Notice how countries with a high population like China and India are way behind in the list of an average number of people vaccinated per hundred. Israel leads the list, with Chile and Singapore following.

Let us now move to a trend of vaccinations over the days for different countries. We start with India, and the following plot shows the number of vaccinations carried out in India across the dates, compared with the number of vaccinations in China and Russia over the same period:

Per day vaccinations population trends in CHINA
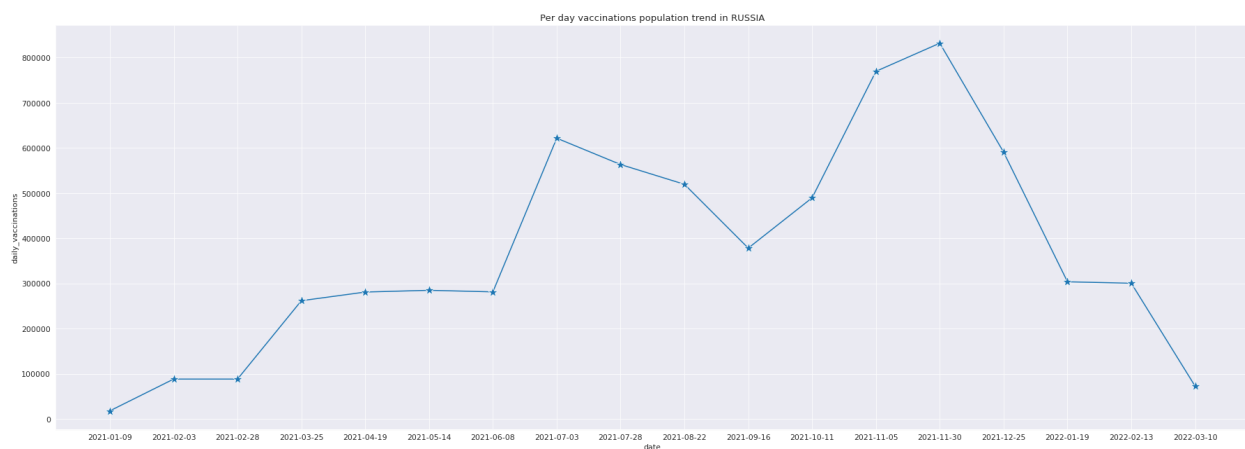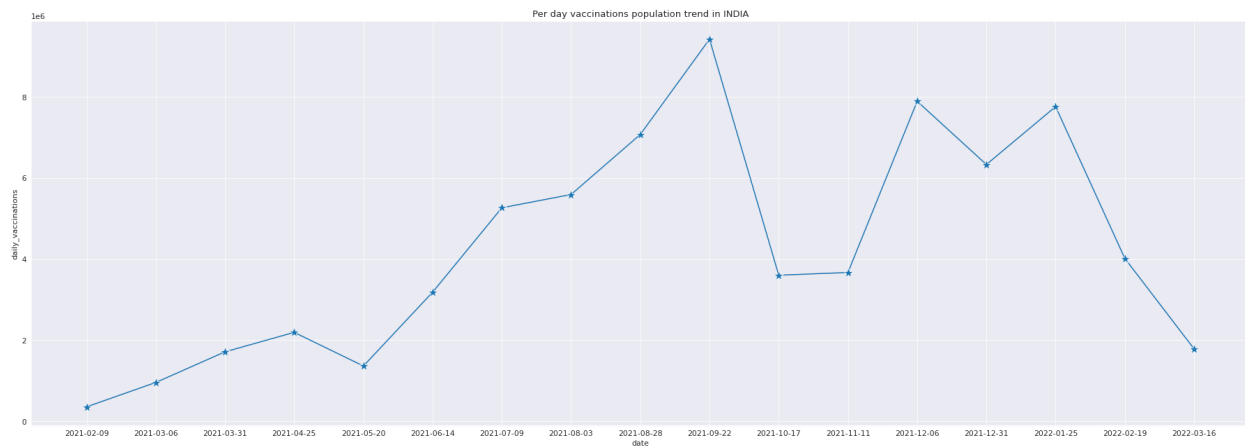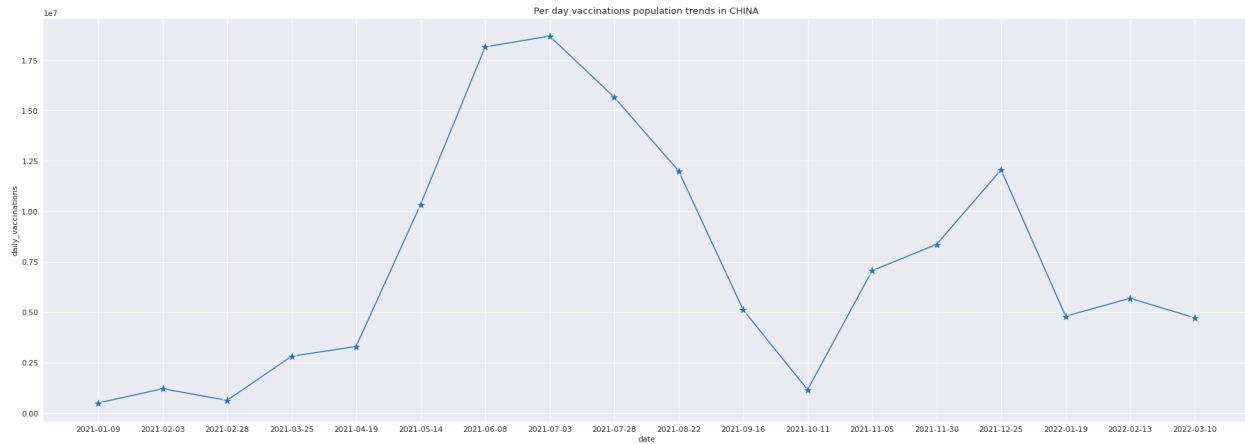
We see that the plots for all the three countries are very irregular, and this may depend on a number of factors like the dates around which the cases hit a peak in a particular country(corresponding to a wave); the peak of vaccination drive in that country and so on.

Now, we move on to a more vaccine- manufacturers based approach towards our data analysis. We aim to find trends in which company has been the most successful in terms of vaccines sold in a particular country and all over the world. We start with a simple pie chart demonstrating the success of different vaccines all over the world(in terms of sale):
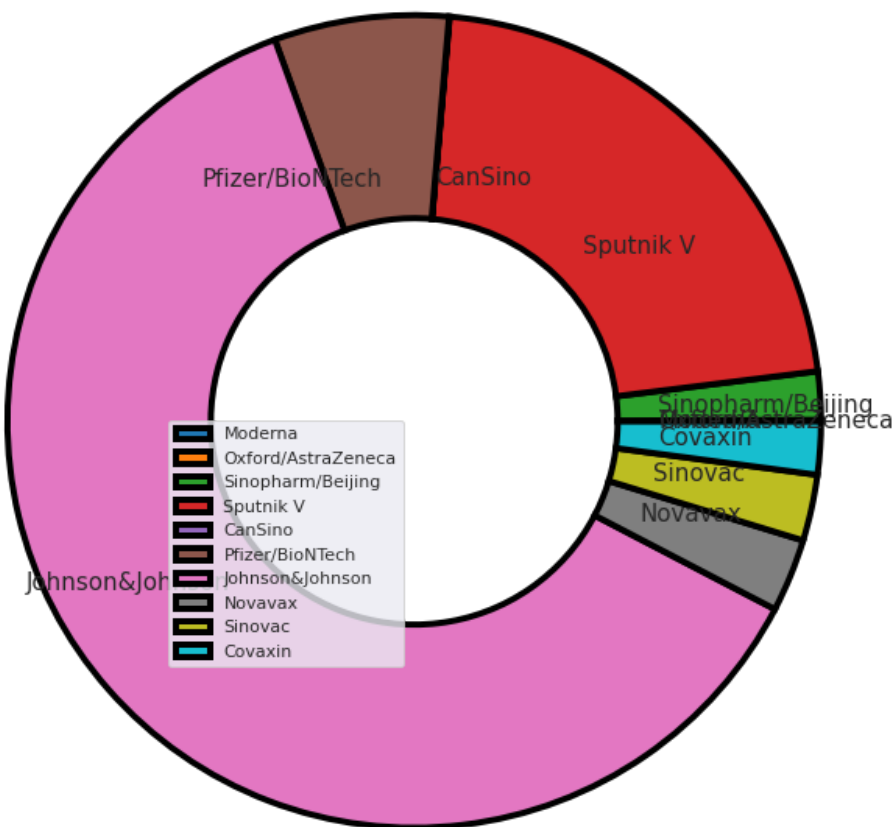
Next, let us take a look at a more country-wise approach towards distribution of different vaccines. We aim to analyze the popularity of different vaccines in different countries and form a consensus of the distribution.
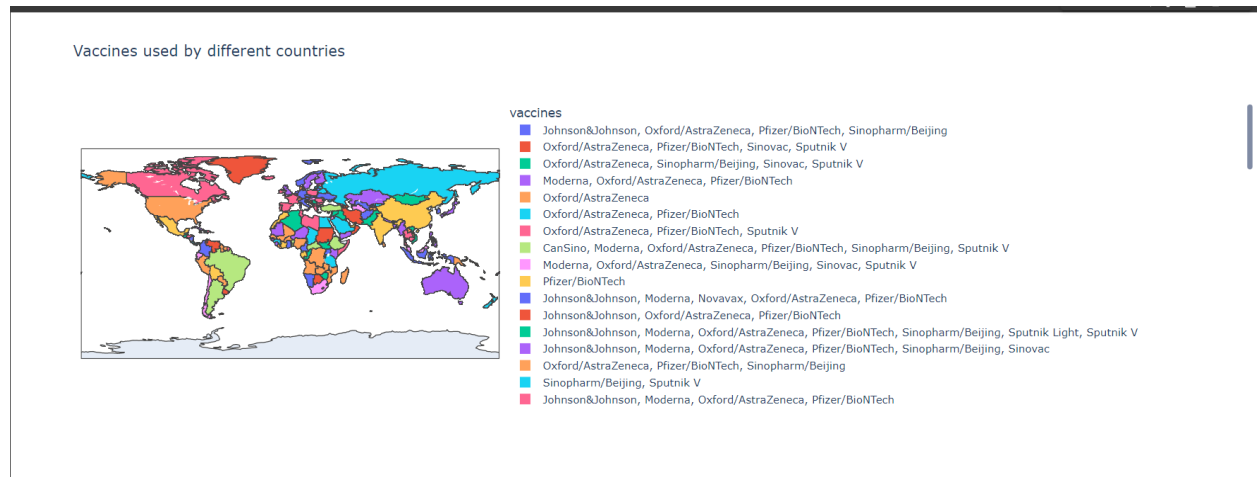
The above choropleth represents the spatial variations of the vaccines used by the different countries worldwide. Different colors denote different vaccines that have been used in a particular country, in accordance with the legend specified. We have also added a hover feature which allows one to observe the country name when interacting with the graph. For better visualization, we have also plotted the 3d version of it.
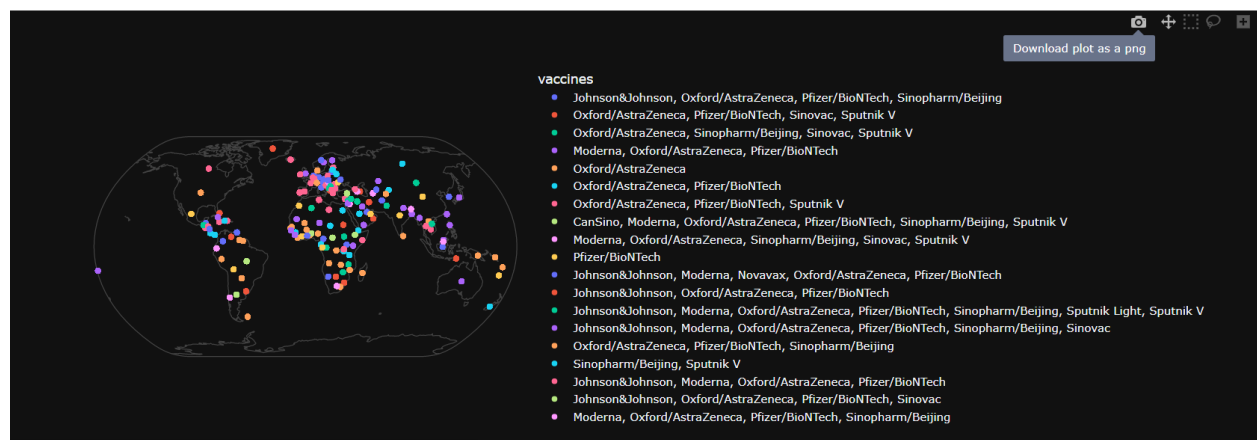
As a final analysis, we study the different sources of providing the vaccines in different countries. These consist of the government, the ministry of health, WHO, private organizations and so on. The choropleth below plots the source_name of the vaccines for different countries denoted by different colors.

Sources of vaccines for different countries
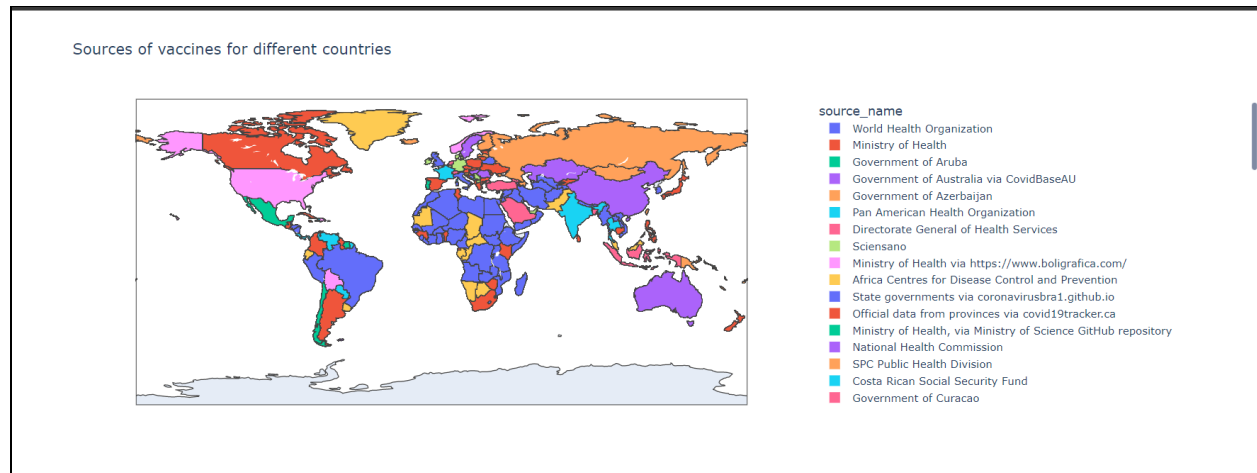
As a concluding analysis, we visualize the trend of the total number of people vaccinated all around the globe over the period of time we have the data for. The 3d plot below shows the distribution of the number of people getting vaccinated over the days for all countries. The country name and the number of people vaccinated till a particular date can be displayed when hovered over that country.