BEMM457 Topics in Business Analytics Final Assignment	
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Introduction:

UK Health Security Agency (2020) stated that, World Health Organization (WHO) was start getting reports of cumulative pneumonia cases and the reason of these cases were not clear. WHO received these reports from province of China Wuhan on 31 December 2019. From the first reports it has been almost 2 years and our lives changed dramatically. Majority of students could not take their education, a lot of people have started working from home, governments temporarily shut down the factories and most crucial one is losing someone very close to us became normal. In order to understand how come we have found ourselves in this situation and having deeper understanding, scientific analyses have crucial role. Increasing the knowledge and know-how very important for the showing high resistance against possible diseases that can cause pandemic in the future. Achieving these goals need too many well detailed analyses and scientific studies. In this report, I will briefly analyse whole pandemic timeline. This analyse will be mainly based on datasets that I collected from WHO. In this report, I will touch the ethical issues of the data, my analyses and study cases separately, in order to preserve clear structure. When I was planning for this report, I had questions such as which factors made the pandemic worse, which countries need help, to what extent vaccines have a positive impact on death numbers, is there any correlation between GDP per capita and having strong fight against Covid-19, which political strategies, actions or behaviours caused drawbacks for struggling with corona virus. I will demonstrate the answers of these kind of questions by supporting with graphs. This report firstly will examine the validation and content of datasets. In the second part, there will be analyses about the performances of the countries and regions between the first day and 29 November 2021. In the third part, there will be analyses about impact of some actions or strategies of governments on fighting against Covid-19, such as Boris Johnson's herd immunity strategy for struggling against Covid-19. In the last section before conclusion, there will be analyses to show updated situation of the pandemic.

Ethical Base of Study:

I am writing this report by obeying to the core principles of The UK Government Data Ethics Framework (2020), which are:

- **Transparency**
- **Accountability**
- **Fairness**

Further of the report, for every section I will explain how I manipulated the data and going to give reasons of it.

Datasets and Preparation for Analyses:

For this study I have used two datasets. Both of the datasets from World Health Organization. I took my data for this study from WHO because it is an official and global institution founded by United Nations and its delegations in 1948 (WHO, 2021). WHO's main duty is that helping territories where have diseases. Every year World Health Assembly meets at Geneva to determine global perspective plans and budgets with the member states. Today, WHO has 194 member states, which it means institution have integrated with the governments and it caused auto-audit structure. However, it does not mean that governments cannot manipulate workflow. Throughout the pandemic almost all the countries have sent corona case numbers, death numbers to WHO.

I have taken GDP per capita numbers of the countries from the World Bank. World Bank has same institution structure and history such as WHO. They also have related with United Nations and their goal as international institution is to help countries who face with financial problems in their economies and supporting innovative projects in the world.

First dataset:

This dataset has got 165.189 rows and 9 columns. It has the data from 237 countries. Dataset have all countries' data for 697 days. Name of the columns and definition of them are shown in below. I have painted orange the columns that I have used, the green parameter is the parameter that I have created. Name of the columns and their definitions are in the rest of the paragraph. **Date reported**, the day of the countries send data. **Countries**, names of the countries, territories, and areas. **Country code**, countries' codes according to ISO Alpha-2. **WHO region**, WHO regional offices: "WHO Member States are grouped into six WHO regions -- Regional Office for Africa (AFRO), Regional Office for the Americas (AMRO), Regional Office for South-East Asia (SEARO), Regional Office for Europe (EURO), Regional Office for the Eastern Mediterranean (EMRO), and Regional Office for the Western Pacific (WPRO)". **New cases,** daily new cases for the countries. Calculated by subtracting cumulative case number with the same parameter of day before. - **Cumulative cases**, number of cumulative positive Covid-19 cases from the countries. **New deaths**, daily death numbers. Calculated with same method of new cases. - **Cumulative deaths,** cumulative death numbers from the countries (WHO, 2021). - **Health System Power Index (HSPI)**, Daily New cases / New deaths.

I did not use country code column for this study. In addition to these columns, I have added new column, which is Health System Power Index. Calculation of Health System Power Index (HSPI) is number of new cases divided to the number of new deaths. The logic behind it, I was trying to put scores to the countries in daily base about their health system. The ratio of new cases and new deaths shows to what extent hospitals deal with the positive cases. In analyse part we will go deeper

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about this index. There were some uncertainties about the data such as some daily new cases and daily death numbers were negative. I have converted them to positive values, it might mistype mistake, which is very possible in the hard days like these. WHO indicates that in its website, some part of the corresponded data to the days can belong previous days. It means that, some Health Departments of the countries can send the numbers of the day before. Because of there is not significant time difference, in my analysis I have assumed them as they belong corresponded date in the dataset. Other ethical issue about this dataset, in order to hide political failures, sometimes governments can send reports that have less case numbers for a period of time. In mini-study case section I will demonstrate this issue by numbers and graphs. In my opinion, these kinds of issues are not obstacle to use this dataset. The reason is that there are not more valid sources worldwide and even they can diminish the numbers, we can estimate the approximate true numbers by checking timeline.

Second dataset:

  This dataset has got data about vaccination from WHO. It consists of 228 rows and 13 columns. Dataset gives updated number and ratio of the vaccination for the countries. Name of the columns and definition of them are in the rest of the paragraph. **Country**, name of the countries, regions, and areas. **ISO3,** codes of countries according to ISO Alpha-3. **Who Region,** same regions with the first dataset. **Data source,** source of the data, which it might be state officials or from Our World in Data platform. **Date updated**; the day of the data updated. **Total vaccinations,** total vaccine doses used in locations. **Persons vaccinated 1plus dose,** number of people who got shot one dose of vaccine or two. **Total vaccinations per100**, total vaccine doses used in locations in a percentage base on population. **Persons vaccinated 1plus dose per100,** percentage of people who got one or two doses of vaccine based on population. **Persons fully vaccinated per100,** percentage of the people who got two doses of vaccines -except people who got one dose of Moderna also in this column- based on population. **Vaccines used,** names of the company who invented it and manufacturer company. **First vaccine date,** the day of vaccination started. **Number vaccines types used, "**Number of vaccine types used per country, territory, area". (WHO, 2021)

This dataset was very helpful to interpretation of impact of vaccines on death numbers, when I integrated it with the first dataset. I did not use columns, which are ISO3, data source, date updated, total vaccinations, persons vaccinated 1plus dose, total vaccinations per100, vaccines used, and number vaccine types used. In ethical perspective, I have not seen many unusual data except data from warzones such as Yemen. There is one more ethical issue that I have seen but it was not about

the dataset, which I will interpret it in the last section of analysis. The reason of I did not use the total vaccinations number was not fair comparison, when we consider scale of the countries.

Performance of Countries and Regions throughout Pandemic:

In this section I will focus performance of the countries and regions day by day. For many countries frequency of the deaths might be low right now and their situation can be good. However, the goal of the analyses of this section what was the power of resistance against Covid-19 when the numbers went up peak. Before vaccines invented, one of the crucial elements of fighting with the virus was the power of health systems of the countries beside the restrictions that cause diminished the pace of spread of virus. As I mentioned in data section, Health System Power Index ratio of daily cases and deaths. When this index gets higher, we can extract the result that the reaction of health system to the virus is that much powerful. Lastly, I deleted the rows, which it means days, that have zero daily deaths and cases, in order to maintain HSPI usable. If I did not delete those rows, HSPI would be infinitive or NaN.

1. Question: Is there any correlation between fighting level with the pandemic and GDP per capita?

I took the first 20 country that have highest average health system power index (HSPI) for the whole pandemic. In my first attempt most of the first 20 countries were small island countries. Thus, I applied filter to dataset and sort the countries that higher than 50.000 cumulative cases until 29 November 2021. The reason of this approach, I want to find the pattern from the countries that have diverse economy like most of the countries. My findings are shown below.

GDP per capita - Health System Power Index Linear Reggression

$y = 0.0009x + 207.88$

$R^2 = 0.0584$
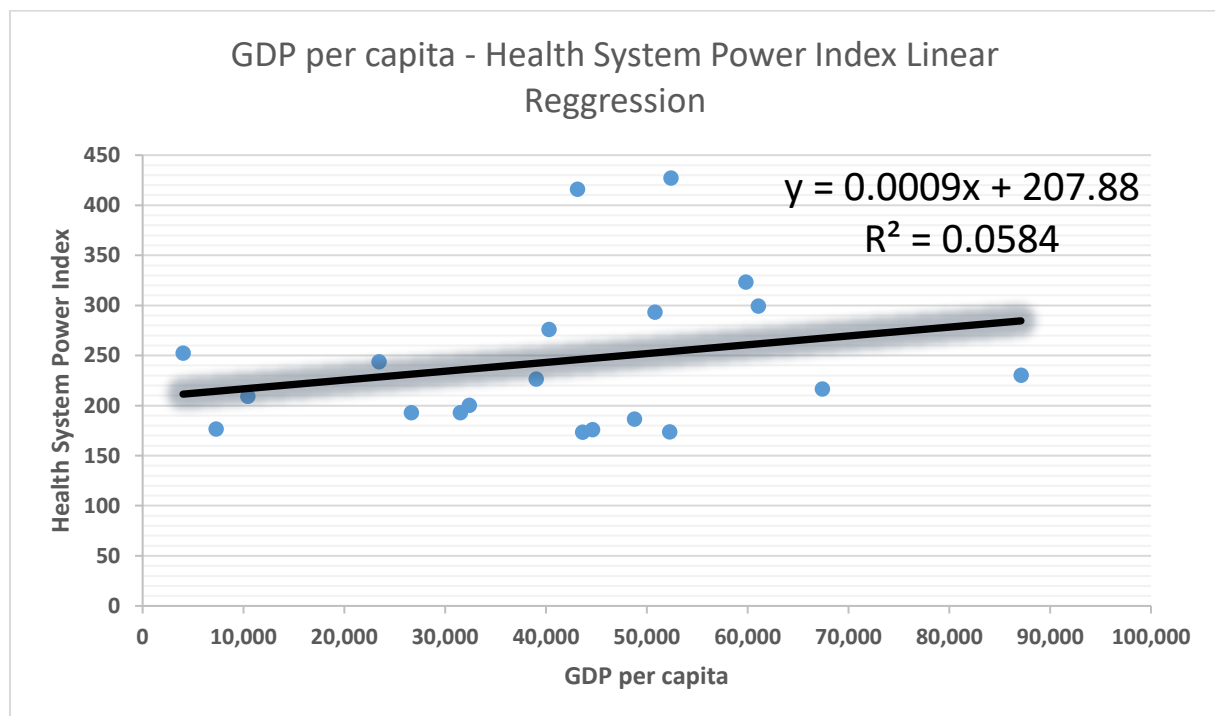
As we can see from the graph, R square is 0.0584, which it means that size of HSPI cannot explained by GDP per capita. There is no correlation between these two variables. The reason is power of health systems have developed in years, and it gets shape by the culture. There might be low demands in normal times in countries that have high GDP per capita, so their system would be adjusted to meet low demands to increase efficiency. Other probability is that, having good health system is not required to have a high GDP per capita, in order to maintain powerful health system states can make investments throughout time and create very powerful health system.

2. Question: Which first 10 countries did start vaccination earliest and what was the impact of the vaccination on daily death numbers in 6 months?
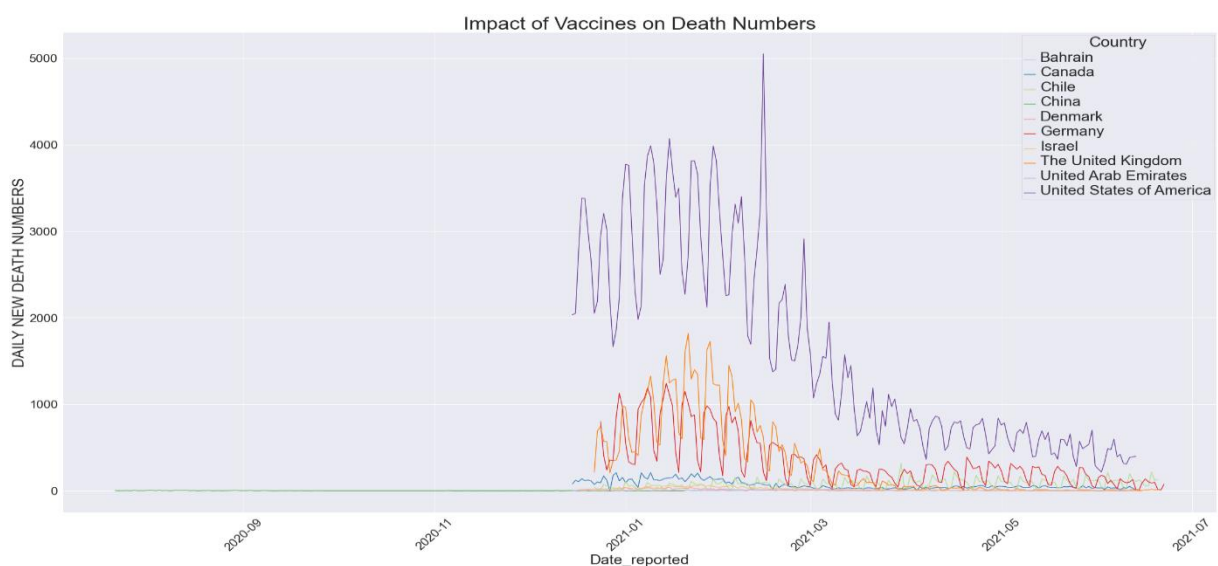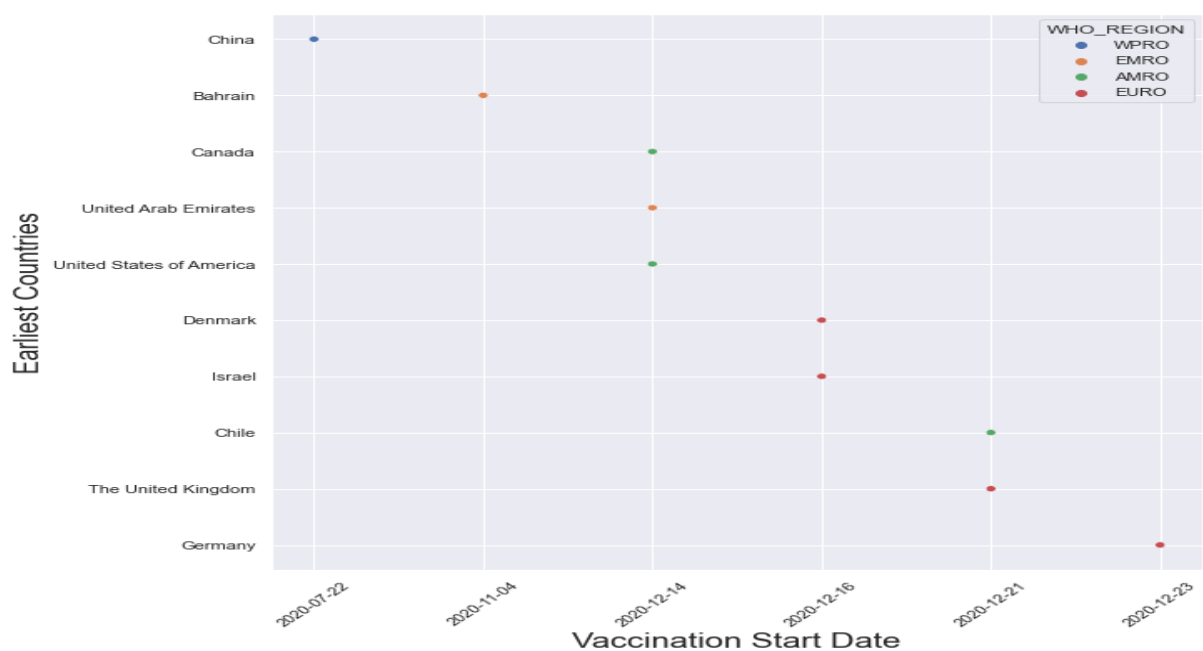
From the graph we can clearly see that vaccines have significant positive impact on death numbers. Only clear difference between countries is China, which line stays in zero constantly. This picture raises some questions related to ethical issues. There are two possibilities on China reports; the first one is that government of China hide their death numbers in order to preserve their power image in international field, second possibility is that because of their culture, Chinese citizens very easy going with restrictions from the government and obey them unconditionally, so they could prevent the spread of virus. For the Germany, United Kingdom and USA we can clearly see that vaccines caused decreased daily death numbers when the numbers were very high in daily base.

3. Question: What is the distribution of daily death numbers for the first 5 countries that have highest cumulative death numbers?
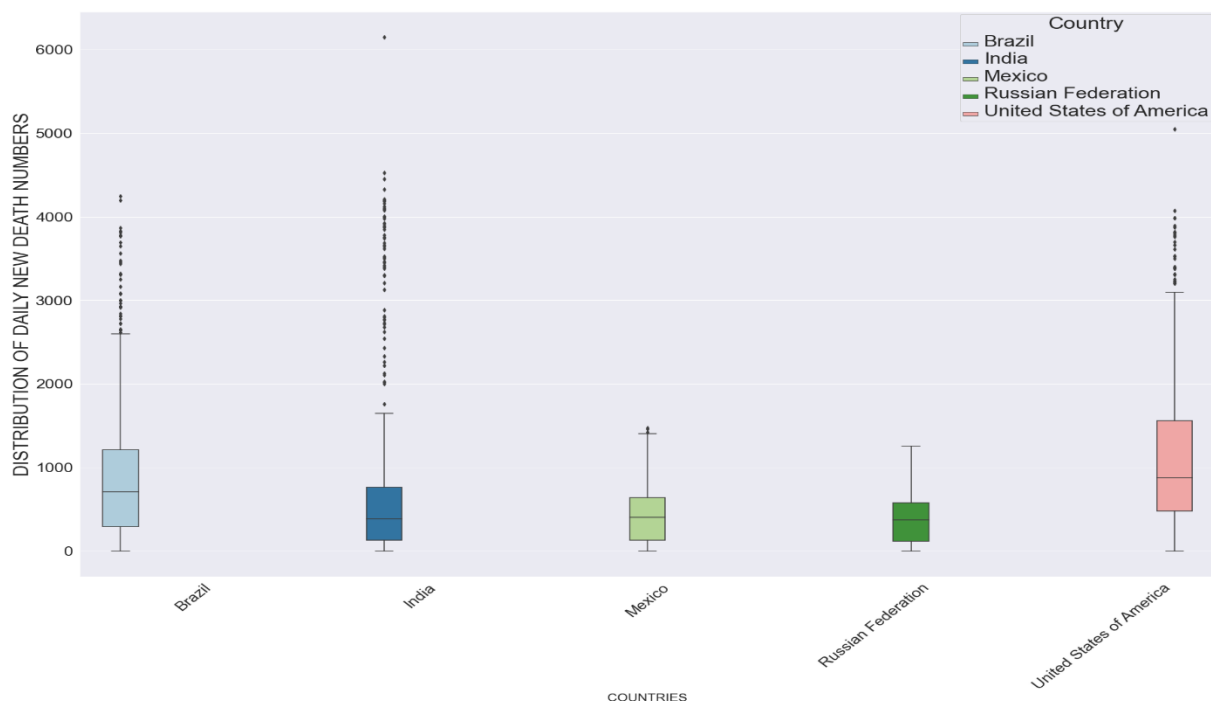
From this graph we can see that median of the USA death distribution is highest. These countries lost thousands of people for many days, which it shows that their health system failed with the fight of corona, or they had enough power of health system, but their government followed wrong health policies during the pandemic. In the next section I will demonstrate the impacts of some wrong health policies to emphasise how much important it is.

4. Question: What is the rank of regions that have been most successful in fighting against Covid-19 based on HSPI throughout the pandemic?

AVERAGE HEALTH SYSTEM POWER INDEX THROUGHOUT THE PANDEMIC
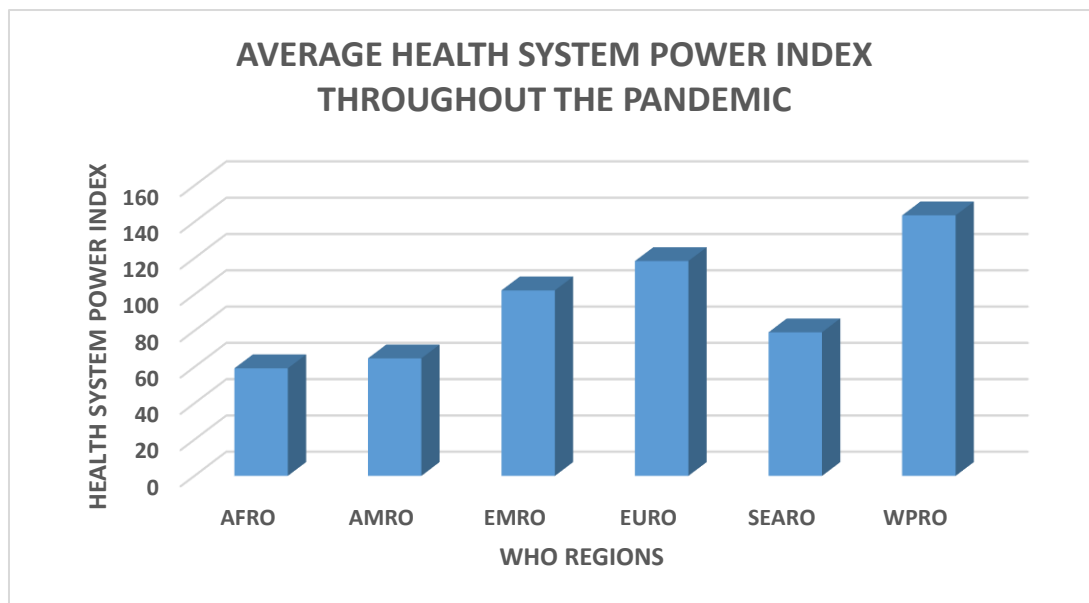
Ranking: 1) Western Pacific 2) Europe 3) Eastern Mediterranean 4) South-East Asia 5) Americas 6) Africa.

This ranking shows that specially Africa and Americas regions need to make or find investments in their health system to at least be ready for future threats.

Focused Analyses: In this section I will show you same cases to show impact of some decision from governments and cases that have ethical issues.

First Case: On 13 March 2020, when first deaths observed in the UK, government declared that as a government they going to apply herd immunity strategy for fighting against corona virus (Burdeau, 2020). Even government declared first lockdown after days, by pressure from the public, on 23 March 2020 (Sample, 2021), because of this speech, perception in some part of people in UK for Covid-19 was a heavier normal flu. When world face with a pandemic, last thing that a country need is lack of seriousness. Achieving herd immunity in a short way means that no mask and no social distance. Considering that there was not clear knowledge about Covid-19, it was very odd decision by the government. Majority of the developed countries that have enough economic power to apply lockdown directly chose this approach. The reason why choosing lockdown was safe choice, scientist did not know how to properly cure people who got corona virus. Moreover, virus could have mutation by spreading and could cause more deaths. In addition to that, there was not enough knowledge about Covid-19 to make an estimate herd immunity will be happening. In ethical perspective, government of UK have failed accountability from 3 core principles of ethics that they have created by making analyses that leads far way wrong directions.

In order to observe impact of this declaration, I chose Germany to get utilize the differences of daily death numbers between two countries. Both countries are economically developed, and they announced first lockdowns day after day. After the first cases observed in Germany, Chancellor Merkel made a speech on 18 March 2020, which was part of her speech:

"It is serious. So, please take it seriously. Since German reunification — no, since World War II — our country has never faced a challenge that has so urgently required us to pull together in solidarity with each other."

Four days after this speech on 22 March 2020, government of Germany announced **partially** lockdown (Bosen & Thurau, 2021).
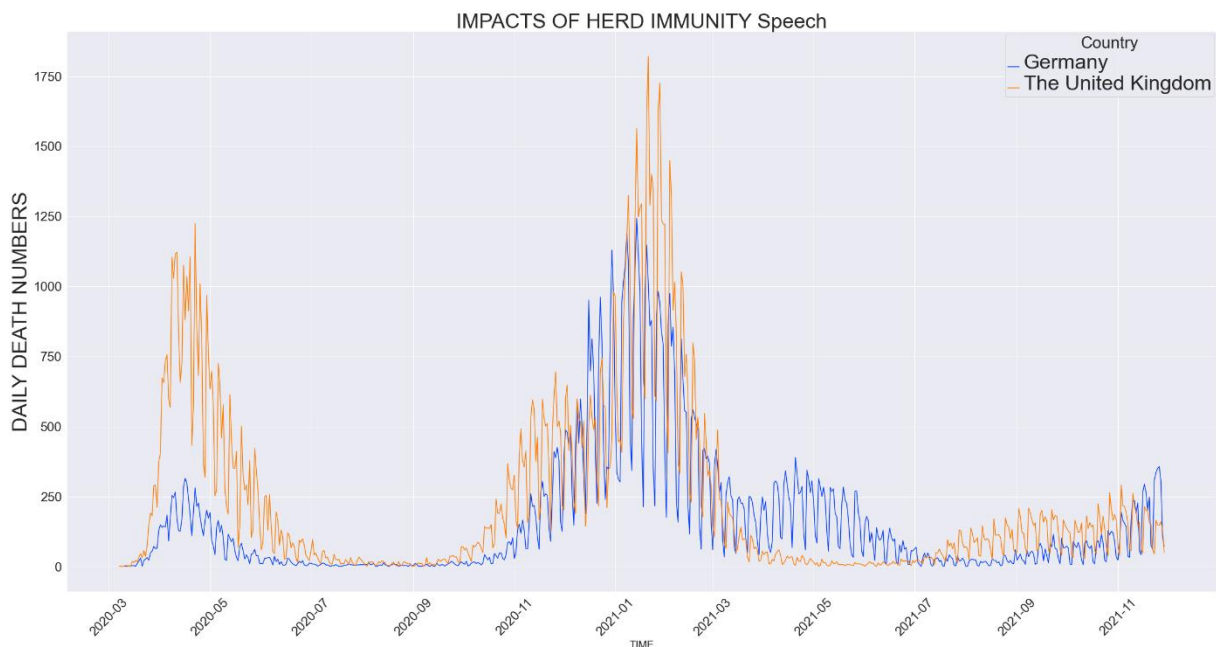
From the graph, if we look at the first wave, we can see significant differences on daily death numbers between two countries. It does not mean that the only factor is the approaches of both countries' governments for these differences in daily basis. However, when we look second wave differences are not similar with the first wave. When we consider UK went national lockdown and Germany announced partially lockdown in the first place, it would be fair to say that impact of herd immunity speech was very devastating move by the UK government for fighting against pandemic.

Second Case: When I was briefly checking vaccination dataset, I saw the Gibraltar has the ratio of persons vaccinated one or more dose 121%, and ratio of fully vaccinated persons 118 %. This ratio is number of people who got the vaccines divided into the population of the country. It means that, people who have the money and are not the citizenship of Gibraltar, have travelled to the Gibraltar

and had gotten vaccinations. In a time like pandemic, equality of the people should be provided by the governments and companies who manufacturing vaccines. This issue has two side ethical violation for fairness principle, both companies and countries. There are many countries in the line for the vaccination for people who need it. If countries in this case Gibraltar, ordered more vaccines then its need, Gibraltar violating rights of countries who have not gotten all vaccines that they need for their citizens. These kinds of violations of ethical values can be a concrete reason of worldwide chaos in times like pandemic.

Third Case: Minister of Health of Turkey Fahrettin Koca on 30 September 2020 stated that as a government, they did not involve the whole people who get corona positive from tests on daily new case numbers since 29 July 2020. Turkish government just count the number of people who have Covid-19 symptoms, which it means patients. Fahrettin Koca also stated that, number of daily cases, which consist of just number of patients, have most of the real daily case numbers. For the 10th of September 2020, he gave the number of patients which it was 1512 (Daventry, 2020). However, when I checked from first dataset that day, Turkey reported to WHO 8403 daily new cases. We can clearly see that number of the patients that Fahrettin Koca have given, are not majority of the whole daily case numbers.

|	Date_reported	Country_code	Country	WHO_region	New_cases	Cumulative_cases	New_deaths	Cumulative_deaths
152197	2020-09-10	TR	Turkey	EURO	8403	581063	55	6837

After this confession, government of Turkey did not publish daily case numbers to its people until 25th of November 2020 (Erkoyun & Kucukgocmen, 2020). When government decided to publish whole daily case numbers that involves asymptomatic cases too, government's daily case numbers that they have sent had significant increase. We can see the trend of daily cases from the graph shown below.
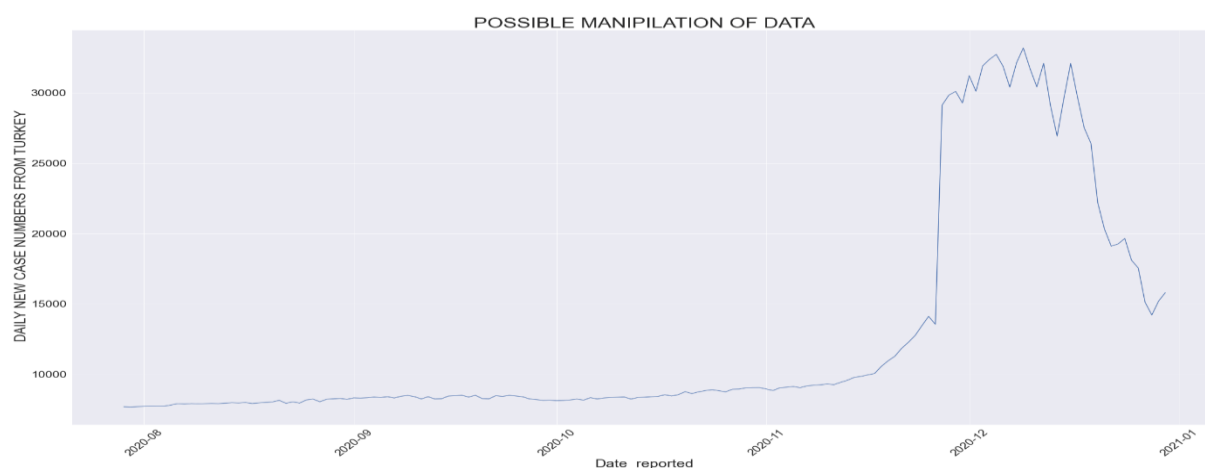
We can clearly see that, when government did not publish the whole daily positive case numbers, government was sending daily numbers, that were not changing too much to the WHO. After they publish the whole case numbers, we can see the dramatical increase in the graph. In this case, government violates the transparency and accountability of the 3 core ethical principles. In addition to that, these violations can easily cause bad impact on fighting against Covid-19.

Updated Situation of the Countries and Regions:

First Question: Which countries are behind in the vaccination race?
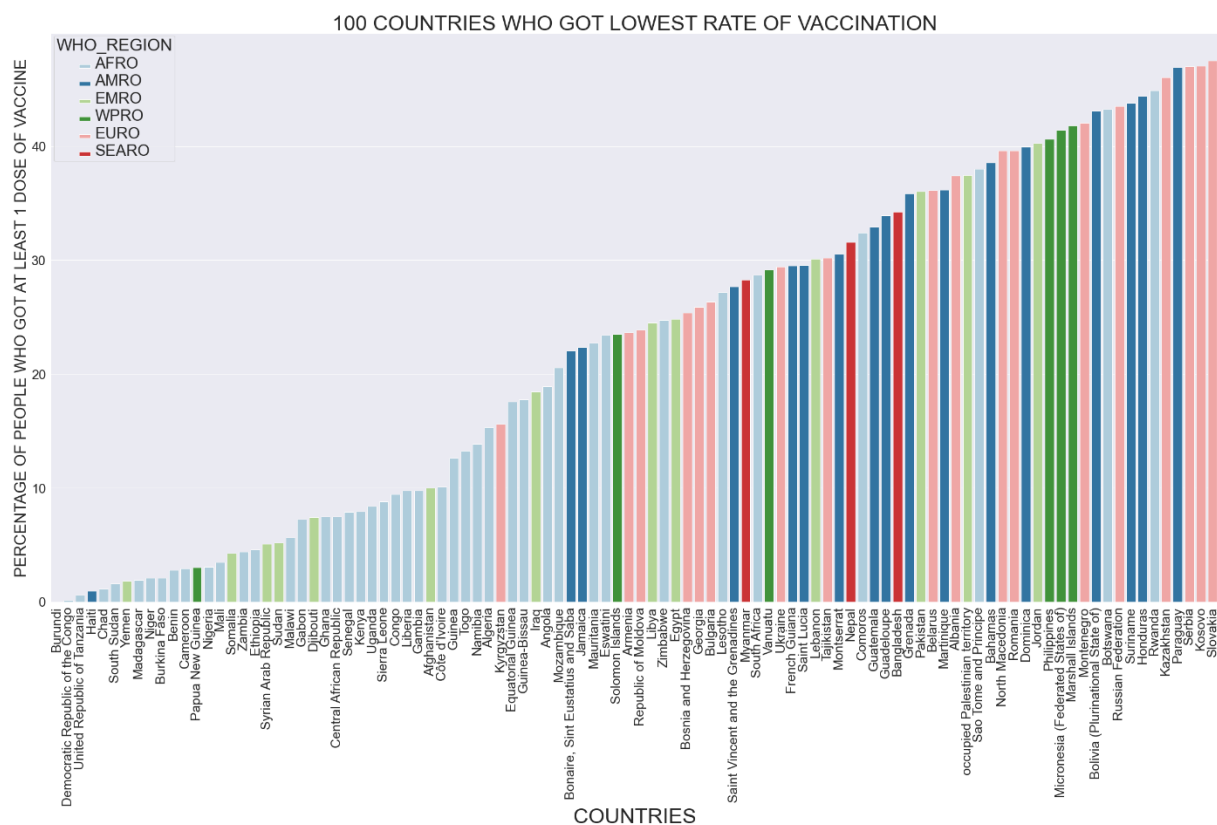
Countries and international health institutions such as WHO should focus to help countries that shown above in the graph. Help budgets should be directed to these countries and these operations should start from the countries that in the worst situations. It can be easily seen that, African countries in very bad conditions against Covid-19.
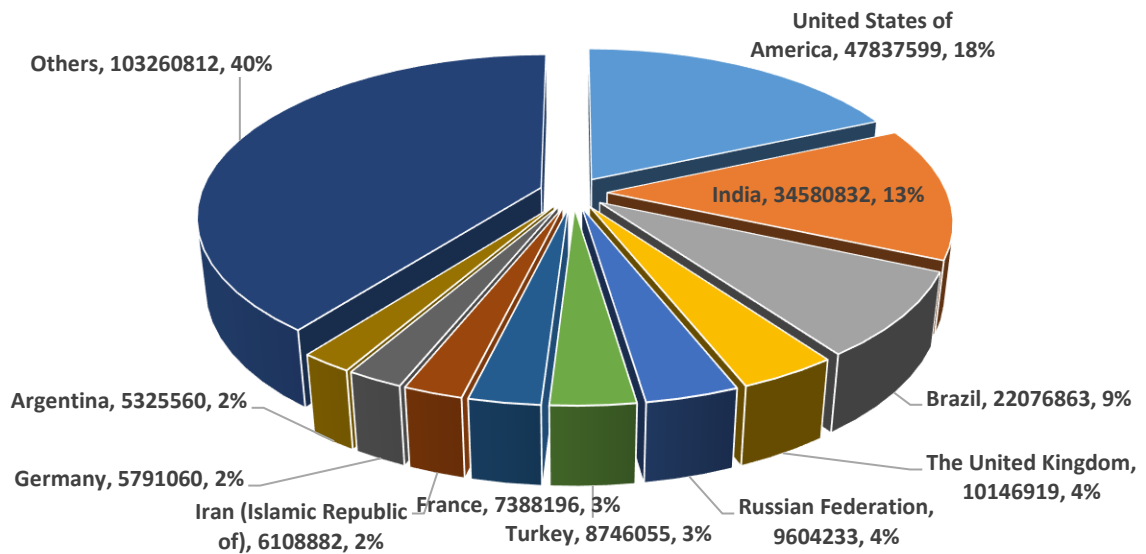
Second Question: Which first 10 countries are in the for highest average death numbers for last 20 days?
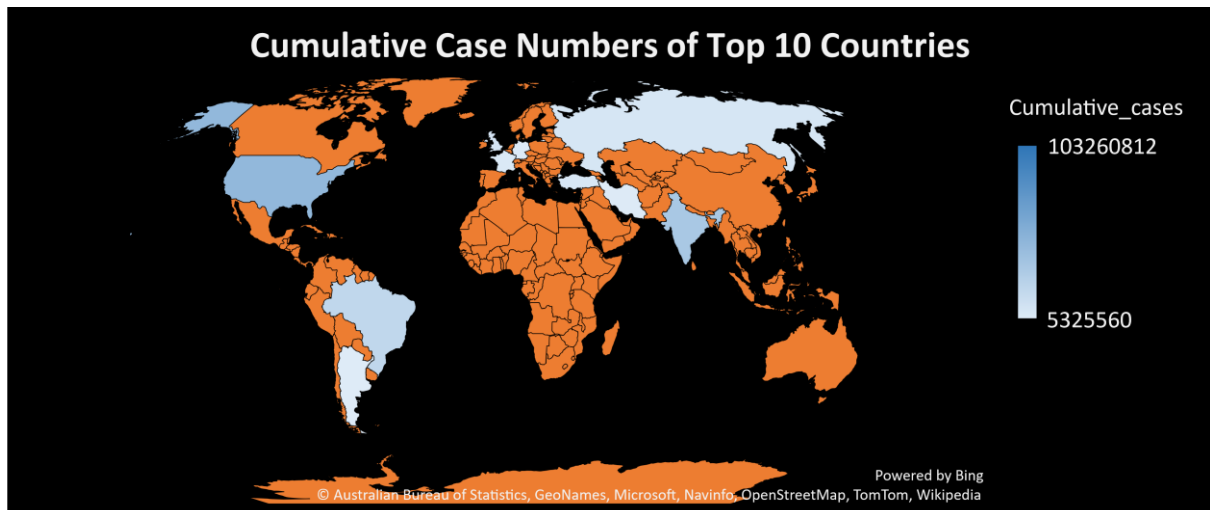
Chart Title
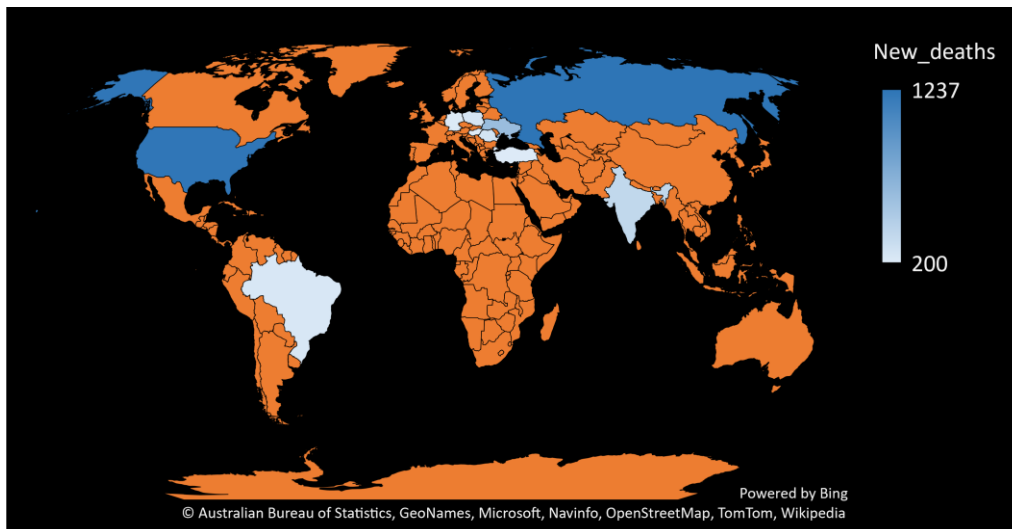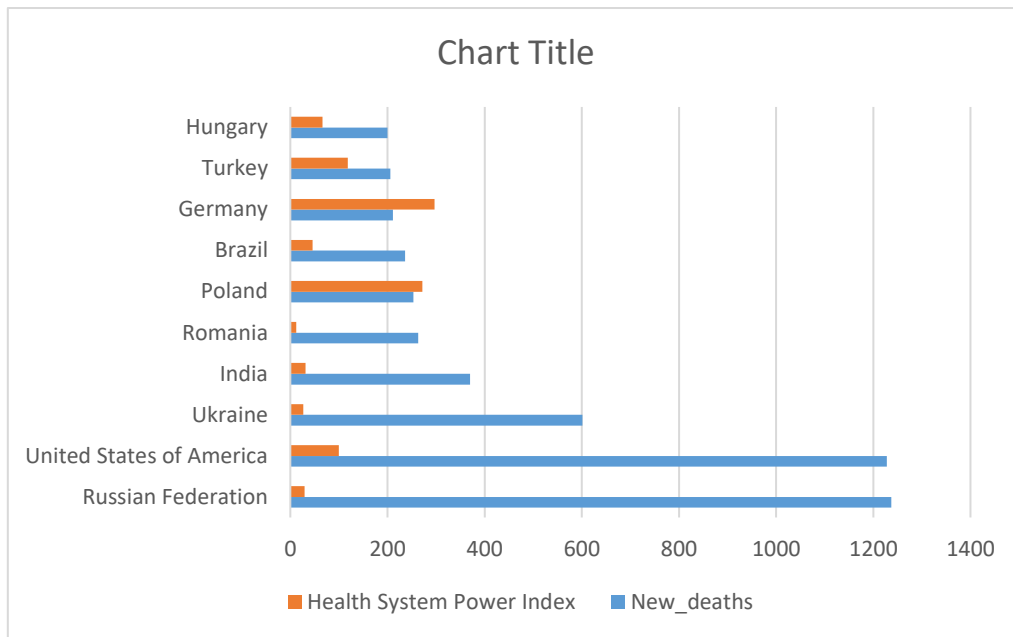
Countries that have low HSPI should get vaccinations. Increasing HSPI is long term improvement. In order to increase HSPI, some of the factors are educating better and more doctors, making investments for more hospitals and infrastructure.

Third Question: Which first 10 countries have the highest cumulative positive case numbers?
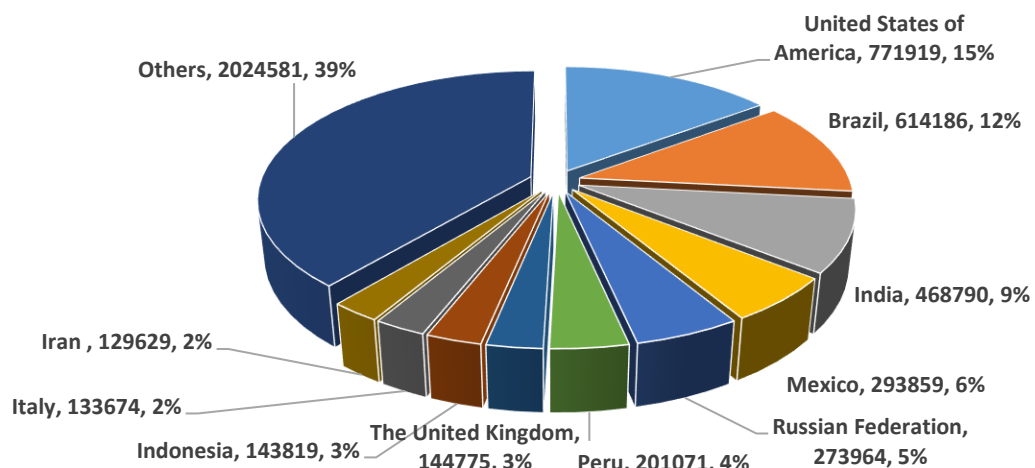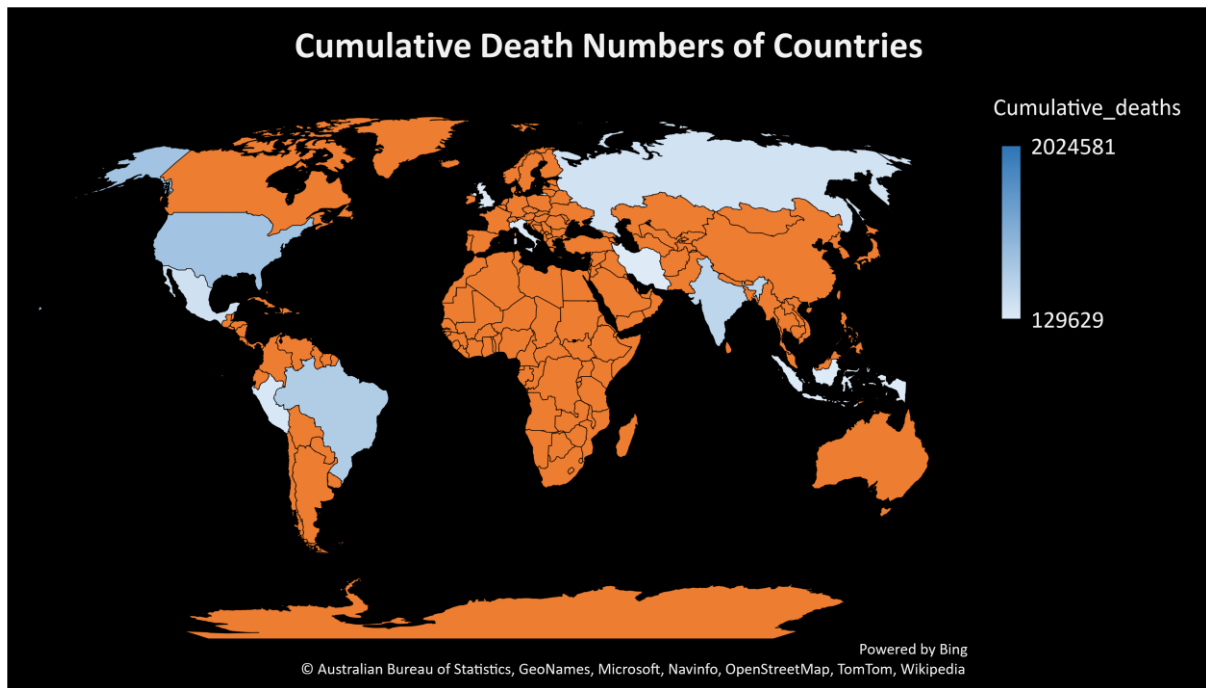
Rates of Cumulative Case Numbers of Top 10 Countries

Others, 103260812, 40%

United States of America, 47837599, 18%

India, 34580832, 13%

Brazil, 22076863, 9%

The United Kingdom, 10146919, 4%

Russian Federation, 9604233, 4%

Turkey, 8746055, 3%

France, 7388196, 3%

Iran (Islamic Republic of), 6108882, 2%

Germany, 5791060, 2%

Argentina, 5325560, 2%

Cumulative Case Numbers of Top 10 Countries

Cumulative_cases

103260812

5325560

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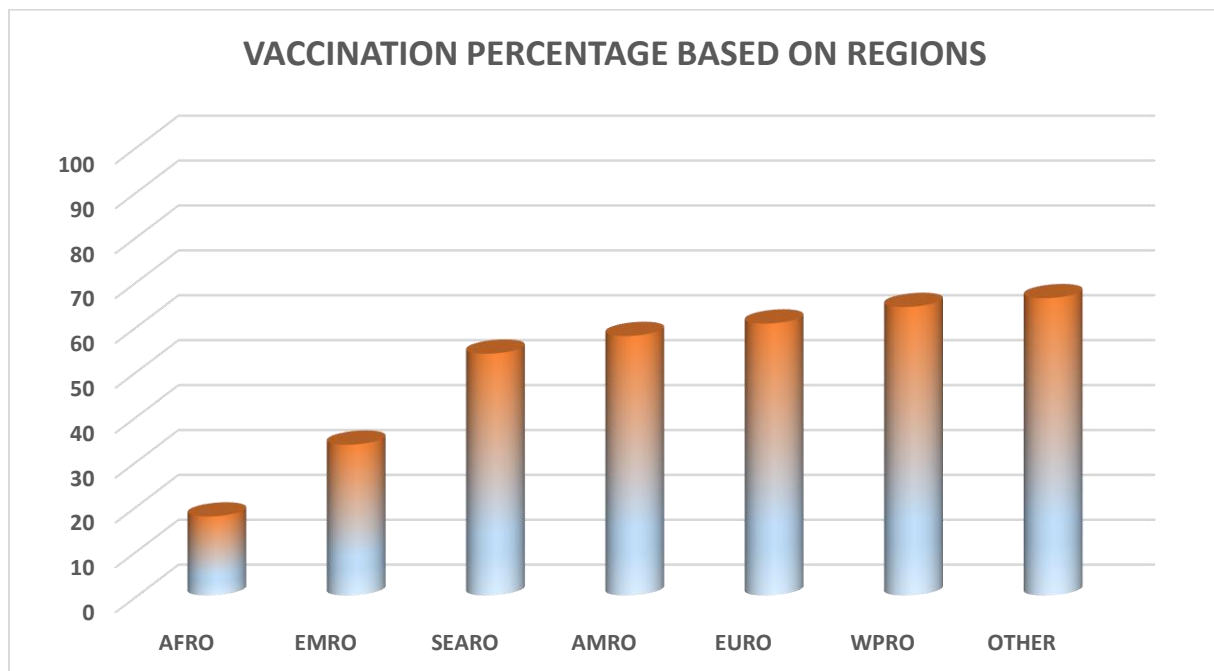**Fourth Question: Which first 10 countries have the highest cumulative death numbers?**

Rates of Cumulative Death Numbers of Countries

Others, 2024581, 39%

United States of America, 771919, 15%

Brazil, 614186, 12%

India, 468790, 9%

Mexico, 293859, 6%

Russian Federation, 273964, 5%

Peru, 201071, 4%

The United Kingdom, 144775, 3%

Indonesia, 143819, 3%

Italy, 133674, 2%

Iran , 129629, 2%

Cumulative Death Numbers of Countries

Cumulative_deaths
2024581
129629

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Fifth Question: What is the current rank of the vaccination rates based on regions?

VACCINATION PERCENTAGE BASED ON REGIONS

When I was taking this data from the dataset, I used **Persons vaccinated 1plus dose per100** parameter. The idea behind it, I wanted to determine areas that needs vaccination. According to graph all regions need more vaccinations. However, percentage of vaccination on Africa is very small. Ongoing operations could be more focused on Africa. In addition to that, when countries meet their number of vaccinations, they should put Africa in the first place for the health of the people in the region. Moreover, EMRO region have some warzones. First 3 hot spots are Syria, Afghanistan, and

Yemen. It is impossible to receive healthy data from these countries. Thus, these countries also need help immediately. Authorities should get attention to these datasets to plan their future operations.
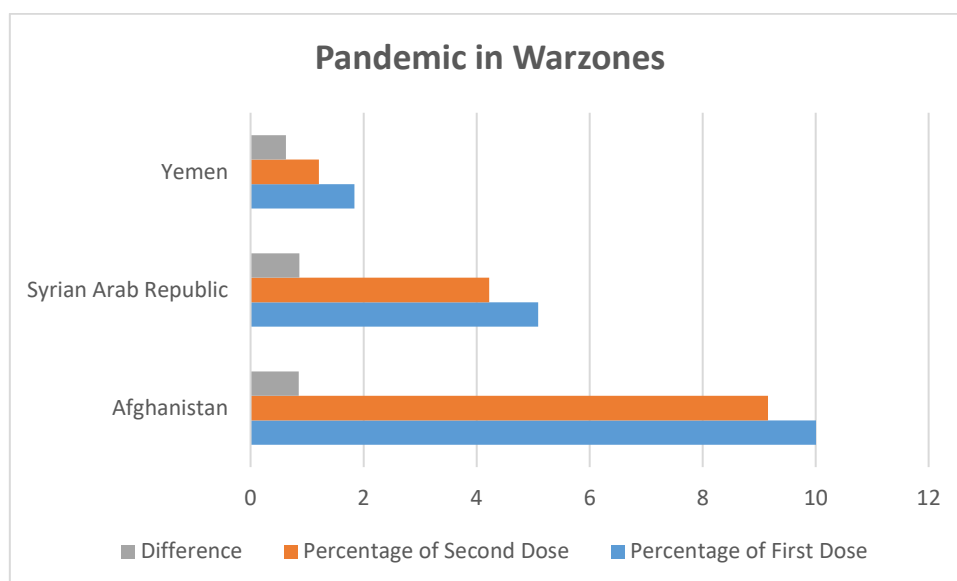
Vaccination on warzones are hard operations. However, when we look at the graph, general vaccination percentages are very low. However, difference between first shot and second shot percentages very low, which it means that only one part of the society gets the vaccines. In these areas vaccines are very hard to find medicines. It should not be coincidence that same people find second vaccines. I would like to remind you that one dose of vaccine also has positive effect against corona even it is less. Even that much of positive effect of vaccines could save some of the lives that in risk groups.

Conclusion:

  In conclusion, there are many factors come into play when the matter is fighting against pandemic. In this report I have considered the factors such as management, cultural, vaccines, war, economic and power of health systems. Despite of some uncertainties, for the validation of study, choosing my data from institutions like WHO and World Bank (for GDP per capita) was very important. In the second section, impact of the vaccinations in 6 months was very impressive. Health System Power Index made my perspective wider. Thus, I could apply deeper analyses. Government's managerial skills have crucial impacts. Obeying ethical values when processing and sharing data clearly is so important to maintain accountability. Because in times like pandemic, societies need solidarity. We can clearly see Africa need help of international institutions. It should be too hard to live in pandemic for the regions that have poverty problem. Finally, countries that have wars in their lands, there have to be truce at some point, and vaccinations should be increase among old people and other risk groups that cannot defend themselves.

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