

Analysis of Vaccination effect on COVID-19 cases

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ABSTRACT: *Data analysis plays an important role to collect and analyze discrete data and conclude some results from that data. In this research paper, we are taking data for the number of covid cases found and vaccination is done. Our main aim is to check the effect of vaccination done on covid cases found that we are checking from the correlation coefficient. The range of the correlation coefficient is from -1 to +1. If we are getting a correlation coefficient 0 then it means no relation and if negative, then trades are opposite meaning one is increasing and the other is decreasing or vice versa and if positive then trades are similar. If we get a correlation coefficient negative for any country, then it means there is a positive effect of vaccination in that country as this correlation coefficient moves towards -1, we get strong relation. If we the correlation coefficient as positive for any country, then it means there is no effect of vaccination on several cases found so it means in that country percentage of people getting vaccinated is low they must increase vaccination doses.*

INTRODUCTION

The name covid 19 comes from corona virus disease that began to spread in 2019. The outbreak of this virus was first seen in Wuhan City, Hubei Province, China. It was initially reported to World Health Organization (WHO) on 31st December 2019. On 30th, January 2020 World Health Organization declared the covid 19 outbreak as a global health emergency later on 11th March 2020, the WHO declared it was the first time this thing was happening after the H1N1 outbreak in 2009 millions of people are dying because of this, thus making it the deadliest pandemic in the history. To overcome covid-19 most important thing is vaccination nearly in all country's vaccination has started in December, January, or in February. Each country has its vaccine, and each vaccine has different effects main significance of a vaccine is to build

immunity against diseases. In this paper, we analyse the number of cases found, and the number of vaccinations done per month from 1st Jan 2020 to 30 April 2021 for 9 countries: the USA, India, Brazil, France, Turkey, UK, Italy Spain, and Germany. Also, we are checking how vaccination affects the number of cases found by co-relation analysis.

Literature Review:

Alternative graphical displays for the monitoring of epidemic outbreak with application to COVID-19 mortality, Thomas Perneger, Antoine Kevorkian, Angele Gayet-Ageron

In this research paper two graphs are proposed. In first graph the logarithmic of daily increase in events (new cases or deaths) (i.e."N") is plotted against the logarithm of the cumulative count of events (total cases or deaths) (i.e."C") because of this graph both the rate of progression of the pandemic and its size are jointly readable. This plot allows easy detection of exponential sub exponential, sub-exponential, and linear growth. In second graph the logarithm of the relative rate of growth of the epidemic over time i.e., $\log(N(t)/C(t))$ is plotted against time (t). This plot displays a key parameter of epidemic outbreaks and helps to identify deviations from a pattern of linear decrease that characterizes exponential epidemic decay. These two methods are applied to daily death counts attribute to COVID-19 in selected countries.

Reduction in COVID-19 patients' morbidity and mortality weekly report, Ehud Rinott, Ilan Youngster and Yair E. Lewis

In this research paper they have collected the data of number of people vaccinated who are above the age of 60 in Israel and they found that about 84% of people have completed vaccination till Feb 2021. By February 9, 2021, a total of 3,606,858 persons had received the first vaccine dose, and

among those, 2,223,176 (62%) had received the second dose. Two-dose COVID-19 vaccination coverage among persons aged ≥ 70 years, 60–69 years, 50–59 years, and < 50 years was 84.3%, 69.0%, 50.2%, and 9.9%, respectively. The main motive of the report is to check the decline in the % of COVID-19 cases in Israel. The method used to get this outcome is the ratio method. They concluded that there was 67% decline in COVID-19 patients. These findings provide preliminary evidence of the effectiveness of vaccines in preventing severe cases of COVID-19 at the national level in Israel.

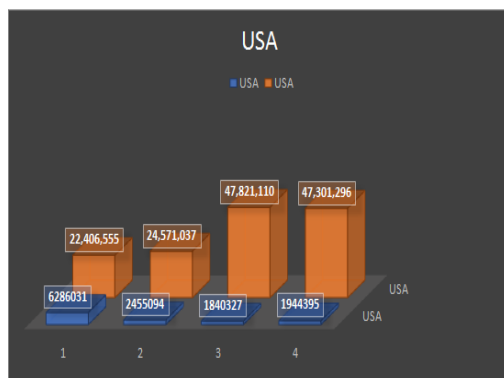
Data based analysis, Modeling and Forecasting of the COVID-19 outbreak, Cleo Anastassopoulou, Iuciarusso, Athanasios Tsakris, Constantinos Siettos

In this research paper graphs were sketched as per covid cases and case recovery ratios using SIRD model. SIRD model was used to present the data of susceptible, infected, recovered, and dead people. From this model it was noted that the case recovery ratio is 0.15%. From 11th Jan to 10th Feb in China the basic reproduction number is one of the key values that predict whether the infectious disease will spread into population or die out.

DATA VISUALISATION

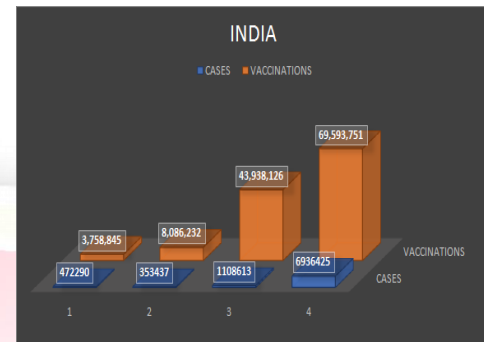
Here we are taking data for number of cases found per month & number cases found per month & number of people vaccinated (at least one dose) per month for USA, India, Brazil, France, Turkey, UK, Spain & Germany from 1st of Jan 2021 to 30th of Apr 2021 & representing this data country wise this graph are useful for comparing number of cases & vaccination done.**Note series 1, 2, 3, 4 indicates months Jan, Feb, Mar, and Apr.**

USA



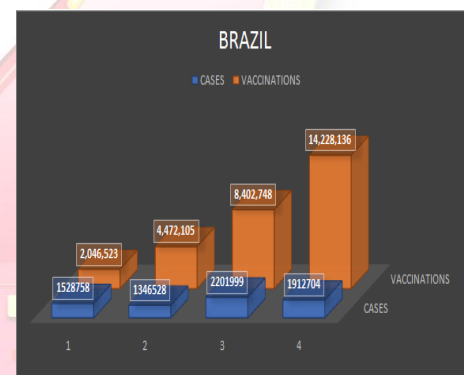
By the above graph we can see that there is sudden decrease in number of cases in USA in Jan 2021, Feb 2021 to Apr 2021. Maximum vaccinations are done in March.

India



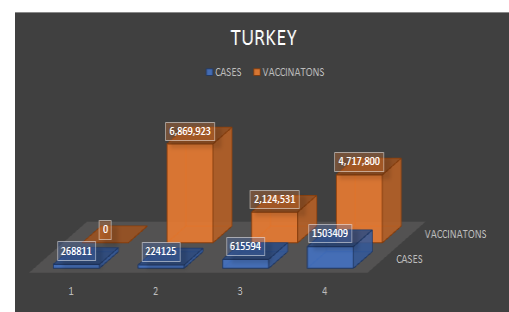
In India there is very large increase in number of cases found in April 2021. From Jan 2021 to April 2021 maximum number of cases is found in April 2021 and minimum number of cases is found in Feb 2021. Maximum vaccination is done in April 2021.

Brazil



In Brazil from Jan 2021 to April 2021 maximum number of cases is found in March 2021 and minimum number of cases is found in Jan 2021 and minimum number of cases is found in Feb 2021. Maximum vaccination is done in April 2021.

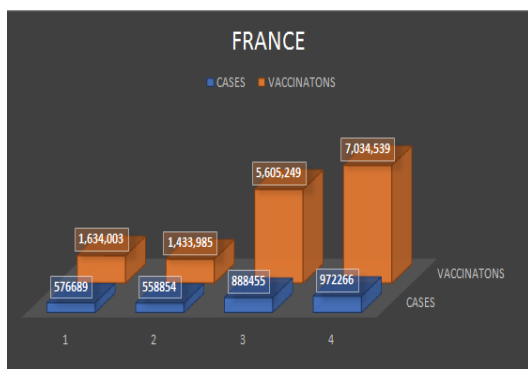
Turkey



In

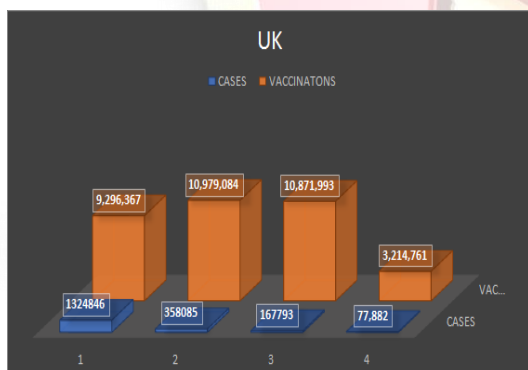
Turkey from Jan 2021 to April 2021 maximum number of cases is found in Jan 2021 and minimum number of cases is found in March 2021. Maximum vaccination is done in Feb 2021.

France



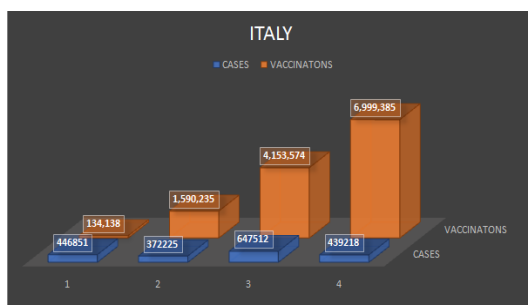
In France from Jan 2021 to Apr 2021 maximum number of cases is found in Apr 2021 and minimum number of cases is found in Apr 2021. Maximum vaccination is done in Apr 2021

UK



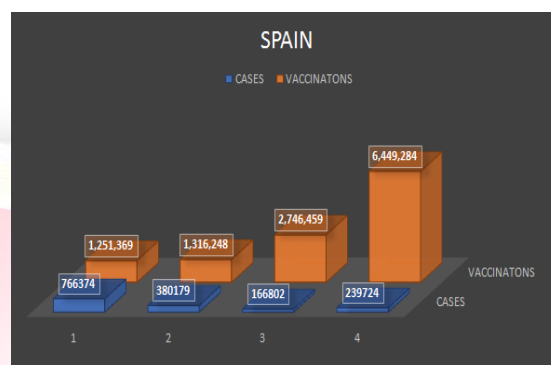
In UK from Jan 2021 to Apr 2021 maximum number of cases is found in Jan 2021 & minimum number of cases is found in Apr 2021. Maximum vaccination is done in Feb 2021.

Italy



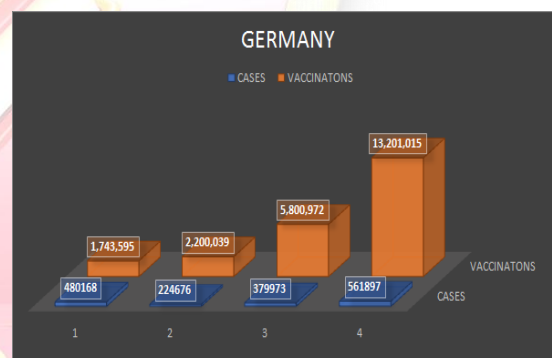
In Italy from Jan 2021 to Apr 2021 maximum number of cases is found in Mar 2021 and minimum number of cases is found in Feb 2021. Maximum vaccination is done in Apr 2021.

Spain



In Spain from Jan 2021 to Apr 2021 maximum number of cases is found in Jan 2021 and minimum number of cases is found in Mar 2021. Maximum vaccination is done in Apr 2021.

Germany



In Germany from Jan 2021 to Apr 2021 maximum number of cases is found in Apr 2021 and minimum number of cases is found in Feb 2021. Maximum vaccination is done in Apr 2021.

CORRELATION ANALYSIS

We are finding two correlation coefficients. The first correlation coefficient indicates the relation between the number of cases found per month and vaccination given at least one dose and the second dose correlation coefficient indicates the relation between the number of cases found per month and fully vaccinated both correlation coefficients for each selected country are shown below.

COUNTRY	1ST CORRELATION COEFFICIENT	2ND CORRELATION COEFFICIENT
USA	-0.7205	-0.8063
INDIA	0.871	0.957
BRAZIL	0.6419	0.3884
FRANCE	0.9989	0.7228
TURKEY	0.1848	0.2647
UK	0.2565	0.6027
ITALY	0.2603	0.3075
SPAIN	-0.5647	-0.8745
GERMANY	0.6533	0.6016

CONCLUSION

1) USA

For USA both correlation coefficients are negative, and both are close to -1 which means there is strong relation between taken variables and that negative sign indicates opposite relation means if one is increasing then other is decreasing and vice versa and by data we have seen that number of cases are decreases as vaccination increases so we can conclude that there is positive effect of vaccination in USA.

2) INDIA

For India both correlations are positive and very close to 1 which means if one strong relation between given variables and both have same trades means if one is increasing then other is also increasing and vice versa and by data we observed that cases also increase with increase in vaccination this is due to insufficient vaccination. In India approximately 9.007% of people get at least one dose and 1.97% of people are fully vaccinated from 1st Jan 2021 to 30th Apr 2021 which is very less. Hence, we can conclude that there is no effect of vaccination on increasing cases yet due to insufficient vaccination there is sudden increase in number of cases found in April 2021.

3) BRAZIL

For Brazil both correlation coefficients are positive which indicates there is no effect of vaccination. In Brazil very less % are vaccinated. Approximately 13.63% of people got at least one dose and 6.33% are fully vaccinated.

4) FRANCE

For France both correlation coefficient are positive and by looking at data we can conclude that still case are

increasing after vaccination started. Is no effect on increasing?

5) TURKEY

For Turkey both correlation coefficient are positive and there is no effect on increasing number of cases after vaccination started.

6) UK

For UK r_1 is positive and r_2 is negative, r_1 is positive because of both variables taken have same trades. We are finding first correlation coefficient by doing correlation analysis between number of cases found and vaccination done at least one dose that is why first correlation coefficient is positive but still there is decrease in number of cases found which means there is positive effect of vaccination in UK. In UK approximately 50.38% of people get at least one dose and 21.93% of people are fully vaccinated which means sufficient vaccination is done.

7) ITALY

For Italy both correlation coefficient are positive and count also increased for March 2021.

8) SPAIN

For Spain correlation coefficients are negative number of cases are consistently decreasing as vaccination increasing which means there is positive effect of vaccination in Spain.

9) GERMANY

For Germany both correlation coefficient are positive and not that much effect of vaccination. There is increase in number of vaccination there is increase in number of cases in April 2021.

From the list of taken countries

In USA there is maximum decrease in number of cases after vaccination started. In India least vaccination is done as per the percentage of population this is because of large population of India. From the list of taken countries first vaccination is started in USA and in Turkey vaccination started at last which is in Feb 2021. From the list of taken countries only USA, UK, and Spain have positive effect of vaccination. Only these countries there are decrease in number of cases found.

References:

- (1) Thomas Perneger , Antoine Kevorkian , Angele Gayet-Ageron alternative ; graphical display for monitoring of epidemic outbreak with application to covid-19.
- (2) Ehud Rinott ,Illan youngster and yair E.lewis ; reduction in covid-19 patients morbidity and mortality weekly report.
- (3) Cleo Anastassopoulou ,luciaRusso , Athanasios Tsakris , ConstantinosSiettos ; Data based analysis , modelling and forecasting of the covid-19 outbreak.

