

COVID-19 ANALYSIS

Abstract

First reported in Wuhan, a city in China, Novel Coronavirus, SARS-CoV-2, or Covid-19 outbreak shook the world and even made World Health Organization (WHO) declare the pandemic as a Public Health Emergency of International Concerns (PHEIC).

Due to the growing magnitude of number of cases and its subsequent stress on the administration and health professionals, some prediction methods would be required to predict the number of cases in future. In this paper, we have used data-driven estimation to study the historic, present and predict the future trends with effect of preventive measures like social isolation and lockdown on the spread of COVID-19.

Purpose and Scope

This report covers the COVID-19 historic, present and future possible destruction and trends particularly in India. Suitable to take any major decisions by Government, or any public organization(s) to have a pre-knowledge for the future. The prediction of various parameters (number of positive cases, number of recovered cases, etc.) obtained by the proposed method is accurate within a certain range and will be a beneficial tool for administrators and health officials.

Terms and Definitions

Mortality Rate: Measure of number of deaths, scaled to size of population, per unit of time. In other words, number of deaths per 1000 people.

Number of Confirmed Cases: Total number of people tested positive for COVID-19 reported by a particular location (it can be a country or a state).

Number of Deaths: Total number of Deaths reported by a location due to COVID-19.

Number of Recoveries: Total number of people recovered from COVID-19.

Days since 1/22/2020: Total number of days after 22nd January 2020.

1. Introduction

After the 1918 Pandemic (H1N1 Virus), COVID-19 suddenly shook the world by China reporting its first case in the city of Wuhan, followed by a case reported in Thailand being the first to be outside the People's Republic of China (PRC). Since then, it had been an easy-way journey for an epidemic to convert into a pandemic.

At the onset of the pandemic, demand for medical products, including PPE, vaccines, Remdesivir, Oxygen Cylinders, etc. were suddenly outstripped supply. To tackle this in the future, we use data analysis.

By collecting, analyzing and learning the historic trends and patterns of the pandemic, we have a high chance to control the present situation and be prepared or even tackle the future distress. Right time for lockdown (state or country wise) and alerting the public to be prepared. Also give a sight of resources (including beds, PPE, etc.) to be used and have them ready in advance.

2. Implementation

(a) Data Source

Data used in this report is extracted from COVID-19 Data Repository by the Center for Systems Science and Engineering (CSSE) at John Hopkins University. Latest Data for Confirmed Cases, Deaths and Recoveries per country and state/province, is available which is gathered from official resources for individual nation.

Pandas being easy-to-use and open-source Data Manipulation library made it efficient to download and customize the data.

(b) Data Visualization and Analysis

Data visualization brings data to life making the useful insights within the numbers visible. A very powerful tool with which we can study present and future events.

Each and every graph/plot or any figure is exactly based on the real-life scenario(es). Matplotlib, a powerful and open-source Data Visualization library was used for this purpose.

Exploring and manipulating the pandemic data and analyzing its patterns, relations and connections, categorizing them and gaining insights from them.

The whole dataset was properly analyzed and many useful insights and trends were discovered.

(i) Current Situation: World

In the following heat-map (top 10 countries with highest COVID-19 cases), world nations are arranged from increasing to decreasing order of Number of Confirmed Cases, with USA at the top followed by India and Brazil.

Mortality rate in USA (0.016) is higher than that of India (0.013) which states that if a person in America is COVID-19 positive compared to an India, he/she is likely to suffer more. Hence it can be said that Indians have stronger and better immune system than Americans.

Oceania, mortality rates are highest. This can be a possibility of either weak immune system of the people, or a new mutation in the virus.

Number of confirmed cases in USA and India is significantly high, hence it might be said that these nations are densely populated which makes it easy for the virus to spread rapidly to a large number of population. Some reports have shown that the spreadage and mortality rate of a virus is inversely proportional. In other words, if a virus is quite deadly, the infection rate will probably be quite low and vice versa. And this same trend can be seen by coronavirus in these nations.

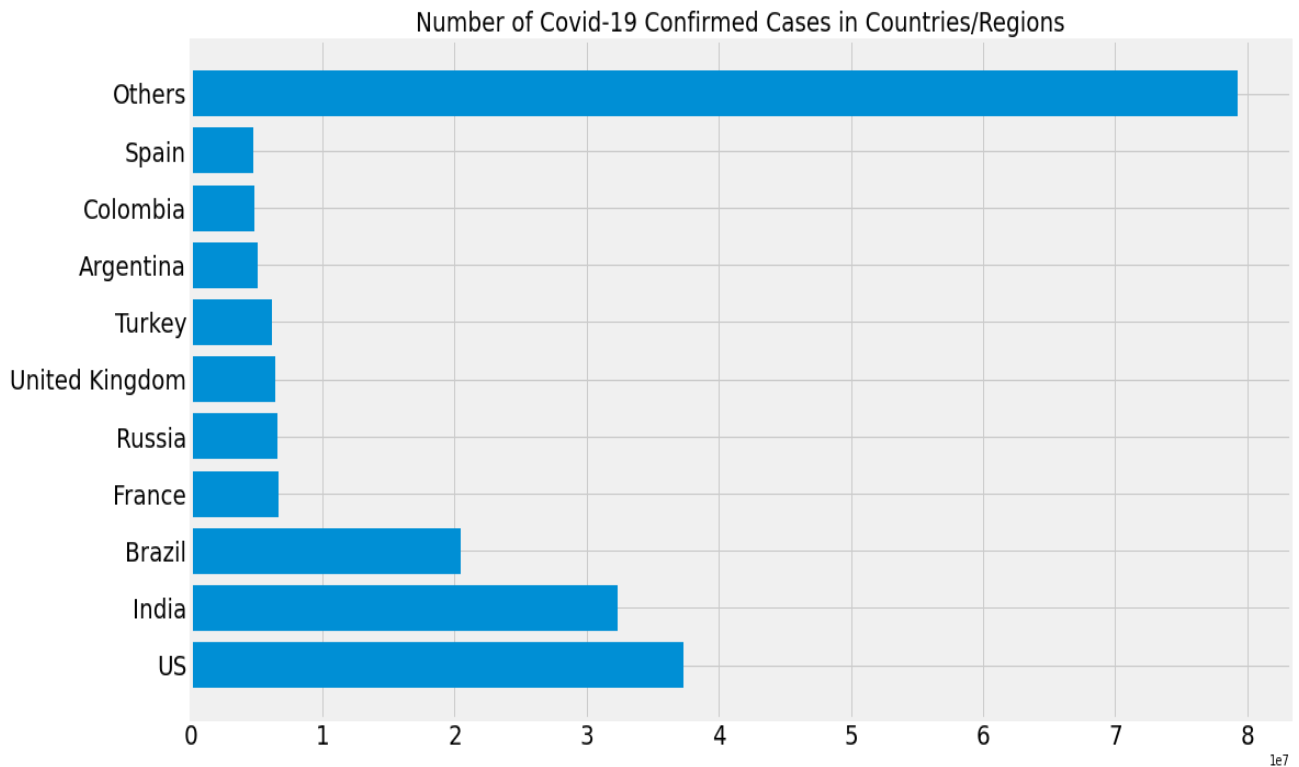
Moreover as number of cases are significantly high, affecting millions of people therefore, government should focus on strict guidelines like complete lockdown for public, promote masks and sanitizer usage, fund hospitals for free treatment, shelter for poor and increasing the rate of vaccination.

Biologically, more infection rate means more possible mutations in the virus. Either it can become more infectious, more deadly, or both! Therefore, it is mandatory to control its transmission. The new delta variant (first reported in Maharashtra, India) is a result of mutation which is more contagious and unvaccinated people are at risk!

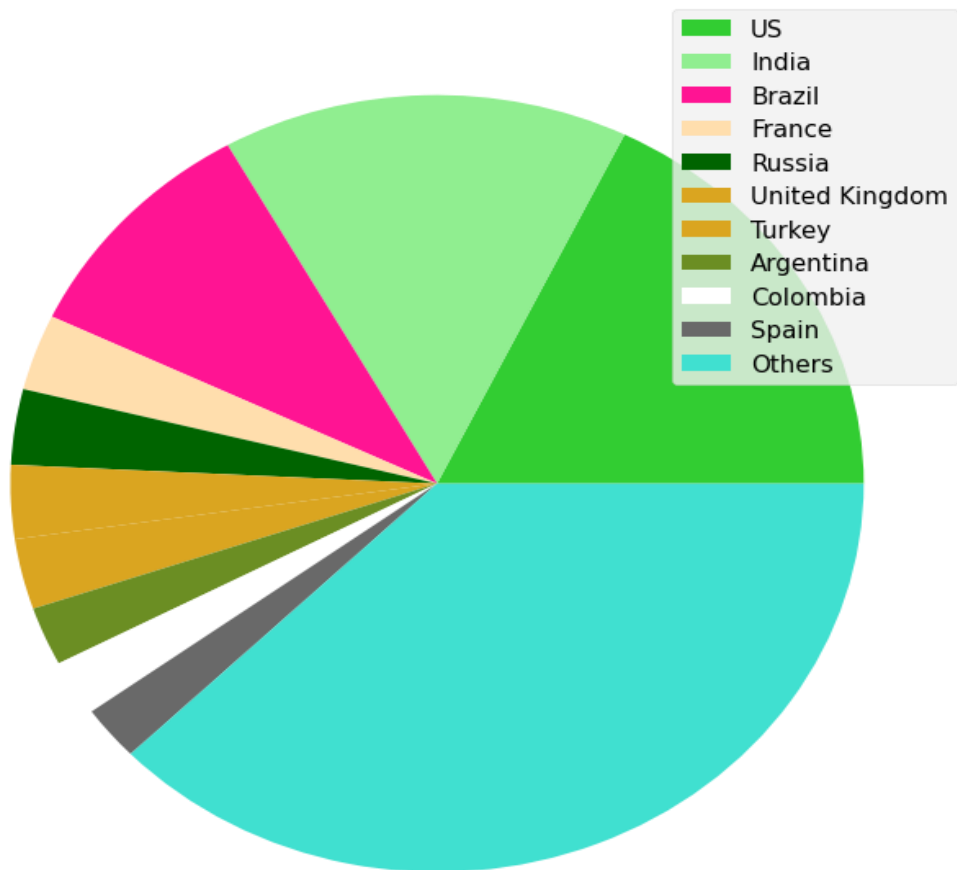
	Country Name	Number of Confirmed Cases	Number of Deaths	Number of Recoveries	Number of Active Cases	Mortality Rate
0	US	37294141	625166	0.000000	36668975.000000	0.016763
1	India	32358829	433589	0.000000	31925240.000000	0.013399
2	Brazil	20494212	572641	0.000000	19921571.000000	0.027942
3	France	6636833	113376	0.000000	6523457.000000	0.017083
4	Russia	6592705	170716	0.000000	6421989.000000	0.025895
5	United Kingdom	6422515	131691	0.000000	6290824.000000	0.020505
6	Turkey	6157742	53891	0.000000	6103851.000000	0.008752
7	Argentina	5116803	109841	0.000000	5006962.000000	0.021467
8	Colombia	4880516	123901	0.000000	4756615.000000	0.025387
9	Spain	4758003	83004	0.000000	4674999.000000	0.017445
10	Iran	4587683	100255	0.000000	4487428.000000	0.021853

Below is a graphical visual of number of confirmed cases per country. The Y axis have

name of countries and X axis denotes population in millions followed by a pie-chart of the same.



Covid-19 Confirmed Cases per Country



(ii) Current Situation: India

Particularly talking about India, first COVID-19 case was reported in Kerela in the early January of 2020.

In the heat-map below based on states and provinces of different nations, we can find that out of ten states globally, 4 belong to India. By Maharashtra leading, followed by Kerela, Karnataka and Tamil Nadu.

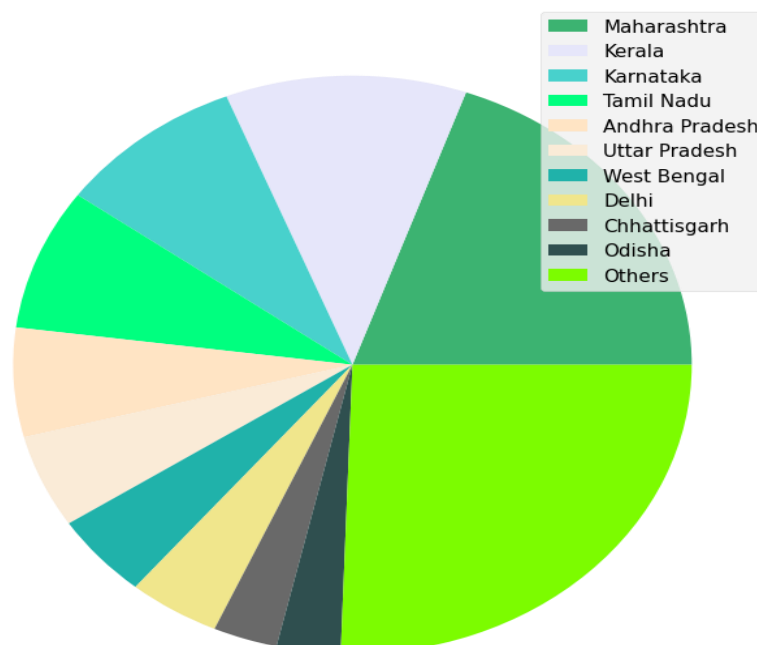
Particularly, the top 10 state of India occupy more than 75% of total COVID-19 cases throughout the country (illustrated in the pie chart below).

Andhra Pradesh, Chandigarh, Odisha, Lakshadweep, Ladakh, Sikkim and other East-Indian states are said to be least affected by COVID-19 and are comparatively safer than South-Indian states.

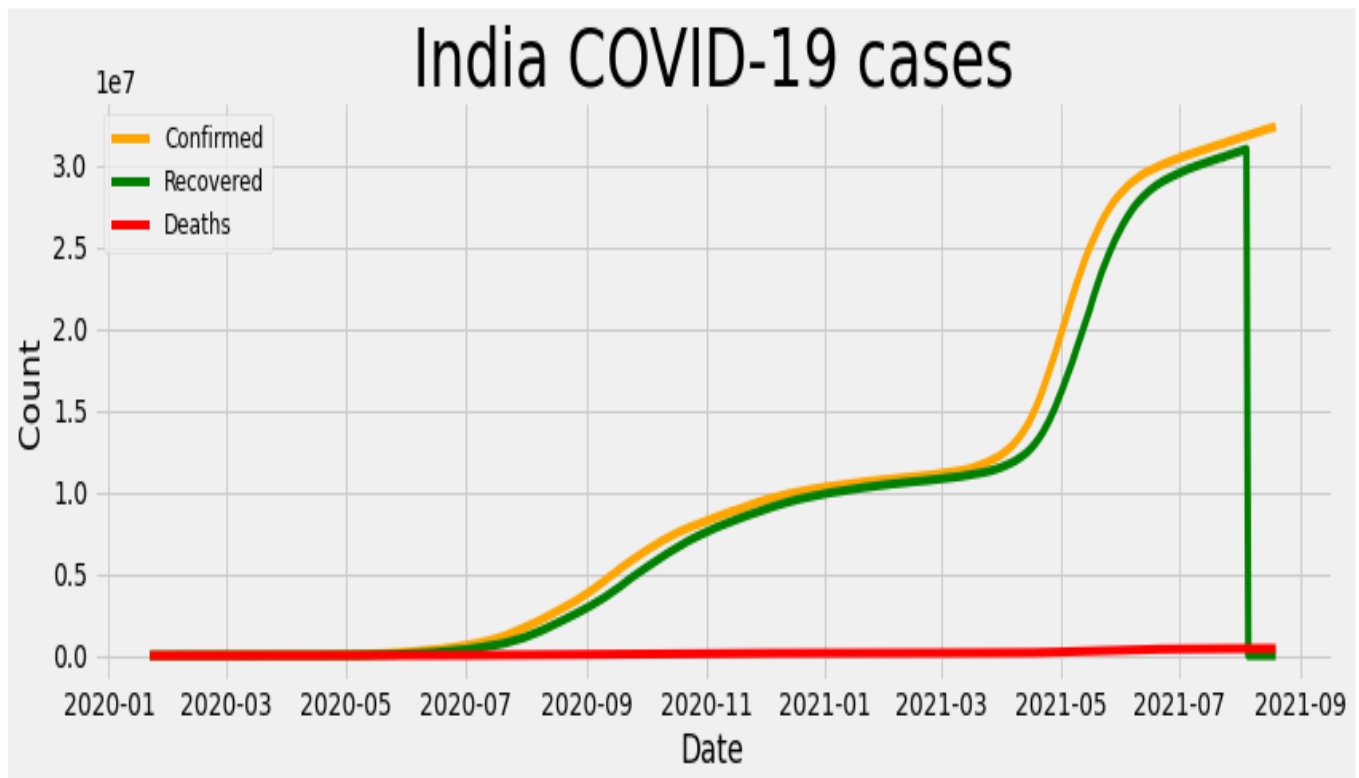
	Province/State Name	Country	Number of Confirmed Cases	Number of Deaths	Number of Recoveries	Mortality Rate
0	Maharashtra	India	6411570	135567	0.000000	0.021144
1	England	United Kingdom	5579087	115390	0.000000	0.020683
2	Sao Paulo	Brazil	4195466	143752	0.000000	0.034264
3	California	US	4188640	64920	0.000000	0.015499
4	Kerala	India	3766573	19246	0.000000	0.005110
5	Texas	US	3419098	54863	0.000000	0.016046
6	Karnataka	India	2934624	37088	0.000000	0.012638
7	Florida	US	2920749	40766	0.000000	0.013957
8	Tamil Nadu	India	2595935	34639	0.000000	0.013344
9	New York	US	2223052	53959	0.000000	0.024272
10	Minas Gerais	Brazil	2034478	52248	0.000000	0.025681

Maharashtra and Kerela are two densely populated states hence it can be a reason for high Number of Confirmed Cases. But mortality rate in these regions vary. Maharashtra has high mortality rate, 0.02 compared to that of Kerela being 0.005.

COVID-19 Confirmed Cases in India



Covid Disaster Over Time in India



First Wave:

During the 1st wave, the central government imposed a nationwide lockdown on March 25, 2020. The result revealed a well-controlled infection rate and the Indian Policy was appreciated internationally. The Epidemic Diseases Act, 1897 and Disaster Management Act, 2005 was invoked. All commercial and international flights were suspended, and many states banned public gatherings, closure of various non-essential businesses etc. On 16th March, union government ordered the closure of schools and colleges.

After 200 days, (around 1st August, 2020 till end of October, 2020), we can observe a spike in the number of cases. At this point Government implemented phase uplifting the lockdown in a series of “unlocks” which extended till November.

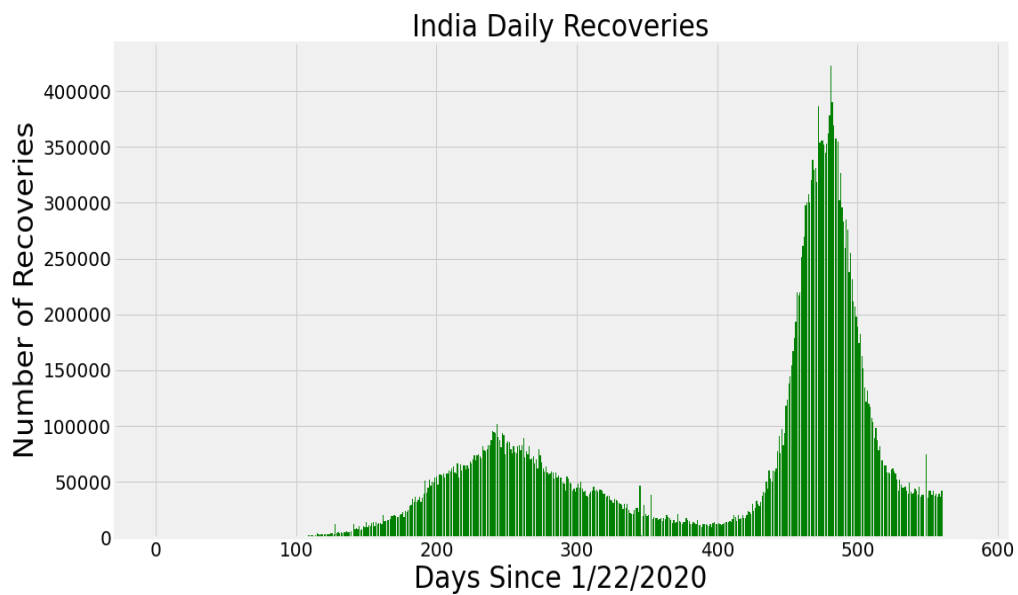
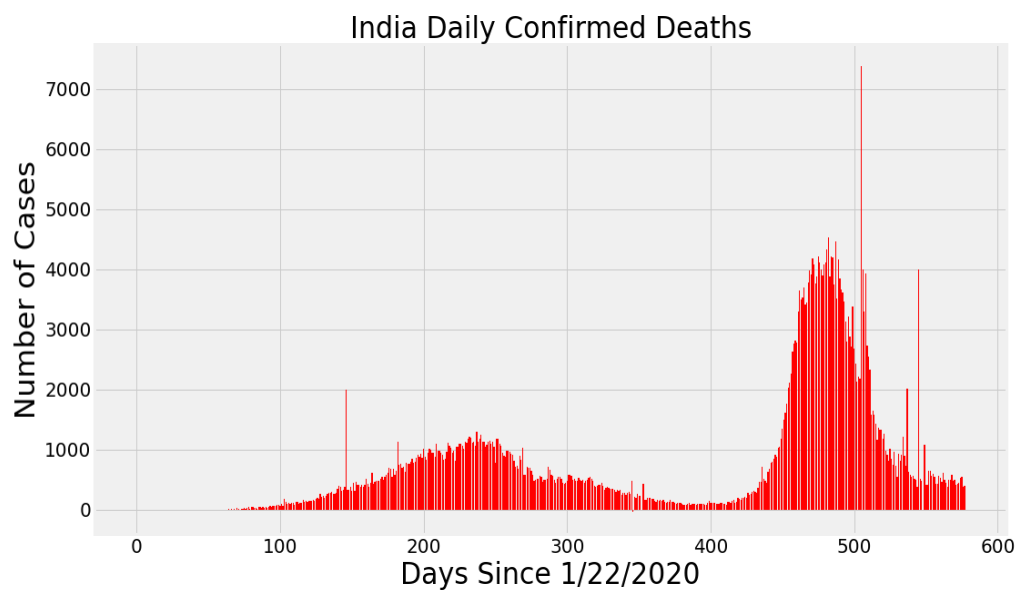
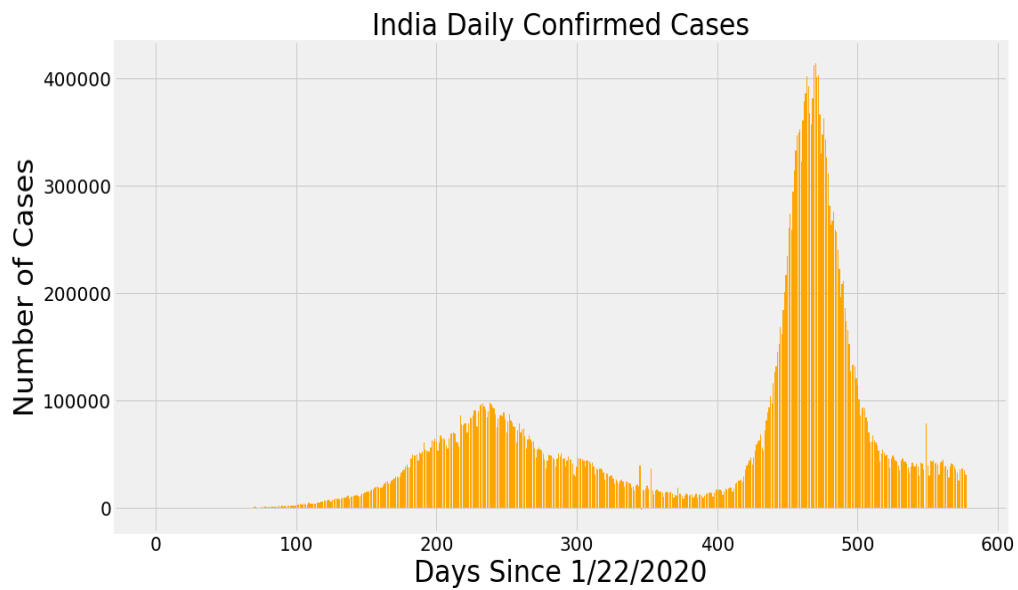
Second Wave:

Second wave in India was slightly different than the first one, with higher mortality being reported in all age groups except those below 20 years, and more people developing acute shortness of breath and requiring supplemental oxygen and mechanical ventilation. Second wave can be observed from 450 days till slightly more than 500 days (1st March, 2021 to mid-end June 2021). A more significant spike is seen in the graph. This was the period when 2 lakh cases per day were being reported and moreover a mutation in virus making the patient asymptomatic. We can see a sudden fall in line for recoveries because no recoveries were reported hence it fell to zero.

Economically, because of complete lockdown and social movement restriction, first wave was more severe compared to second wave. The second wave placed a major strain on the healthcare system, including shortage of liquid medical oxygen due to ignored warnings which

began in the first wave itself, logistic issues and lack of cryogenic tankers.

Every parameter is illustrated in the diagrams below:

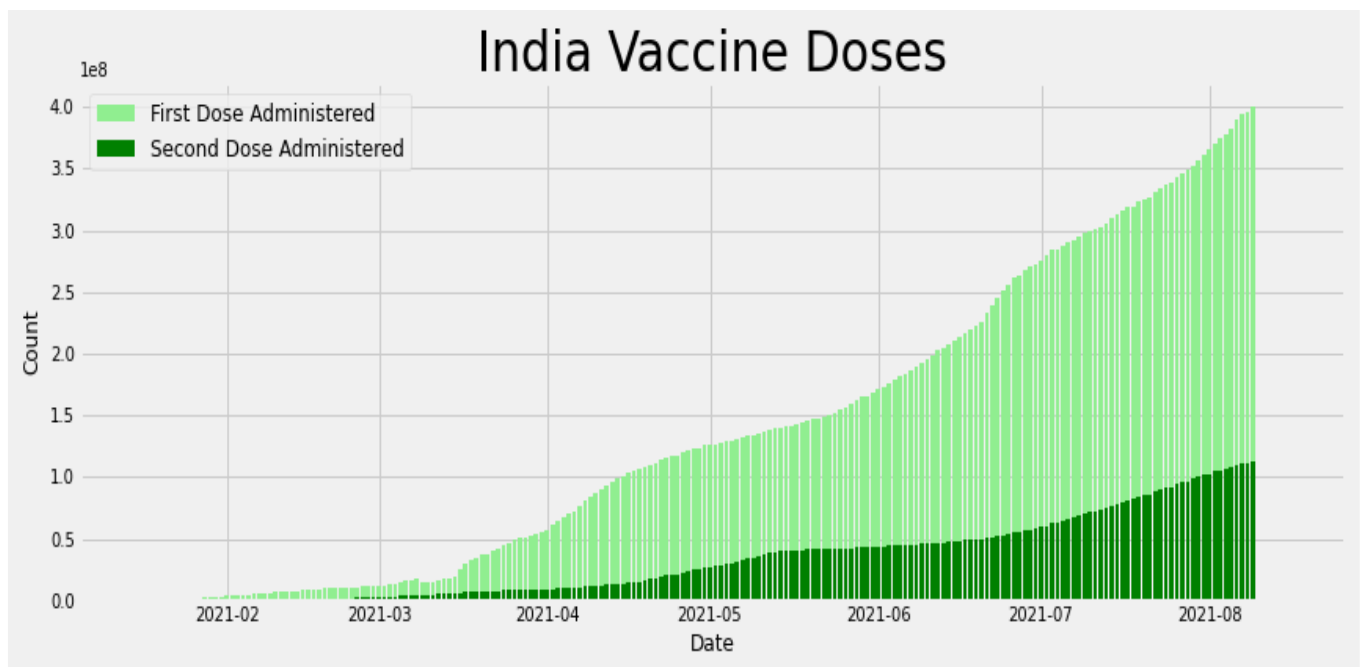


Vaccination Drives

India is ramping up its coronavirus vaccination drive as it races to stave off a third wave of infections. Since 16 January, 600 million doses of three approved vaccines – Covishield, Covaxin, and Sputnik V have been administered.

Some 469 million people have received the first dose and another 137 million or so have received both doses so far. 73,600 vaccination centers are now operational throughout the country.

The graph below illustrates the total number of people vaccinated as of 25th August 27, 2021.



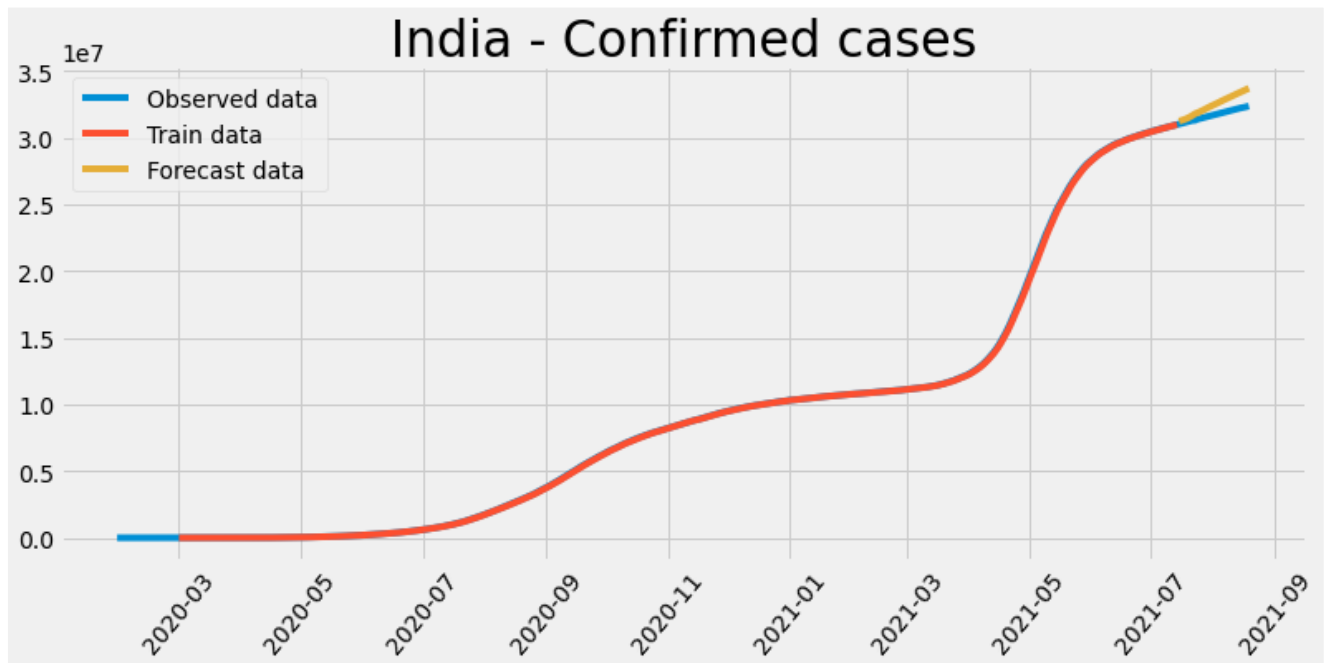
Prediction for future

Data for confirmed cases of COVID-19 was processed through heavily-trained machine learning based model for the prediction of Future. The graph for the result is attached below.

The data from 1st February till 11th August was fed into the model for its prediction and comparison with cases till 25th August.

According to the predictions of the model, the confirmed cases are meant to increase which might be an indication for the 3rd wave. Hence

it can be said that the unfamous third wave is about to hit the nation even with presence of vaccines. Although it may not be as worse as the previous first and second wave, due to presence of vaccines. Third wave is expected to hit India in the month of October-November or early 2022.



Conclusion

This study involved the examination of data from the COVID-19 epidemic in India. We've already seen two waves, and the third is expected to strike the country shortly. Vaccination rates are also rising significantly, breaking all-time highs. This study covers a wide range of topics, and six research objectives have been thoroughly addressed. They are concerned with providing the trends in the number of infected cases in India, forecasting the number of infected cases for the next few days, and assessing the options for lifting the lockdown in India. This study will be beneficial to the Government of India and its different states, Administrative Units of India, India's frontline health personnel, researchers, and scientists. This study would also be beneficial for other nations' administrative units to evaluate different issues connected to the control of COVID19 spread in their respective territories.