Visual Representation of COVID-19 Outbreak in India

Nitish Sinha[1], Suman Debnath[2], Rajat Kumar Das[3], Bishanka Brata Bhowmik[4]and Sangita Choudhury[5]

Department of Electronics & Communication Engineering[1, 2, 3, 4], Department of General Medicine[5]

Tripura University[1, 2, 3, 4], Tripura Medical College Dr. BRAM Teaching Hospital[5]

***E-mail:-** nitish.ns0176@gmail.com[1] , debnathsuman91@gmail.com[2] ,rajatkumardas332@gmail.com[3], bishankabhowmik@tripurauniv.in[4] ,drtumpa@gmail.com[5]*

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Abstract

This paper discusses the outbreak of COVID-19 in India since the first suspected case on 30th January 2020. The doubling rate, confirmed cases, recovered cases, active cases, and death per million people in India had been including in this paper. Some seriously affected states are also compared based on the current COVID-19 situation.

Keywords: - Data *Analysis, COVID-19, Doubling rate, SARSCov-2.*

INTRODUCTION

The history of Human Coronaviruses began in the 1960s. Since then, many different types of Coronaviruses had made their appearances from time to time, the latest being the 2019 Novel Coronavirus (2019-nCoV) or Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2).

The earliest alleged case of novel coronavirus disease (COVID-19) was found on 1st December 2019 in Wuhan, Hubei Province, China. A lot of the previous instances had a familiar exposure to the Huanan wholesale seafood market that also traded live animals [1].

The novel coronavirus infection has been named "COVID-19" by the World Health Organization (WHO) on 12th January 2020 [2]. It is declared to constitute a Public Health Emergency of International alarm by the WHO itself on 30th January [3].

Subsequently, on 11th March 2020, it was declared to be a Pandemic, which now has spread almost in the whole world. The Coronaviruses are enveloped non-segmented positive-sense RNA viruses belonging to the family Coronaviridae. This virus predominantly affects the respiratory systemresulting in viral pneumonia. The nCoV spreads via respiratory droplets when an infected person coughs, sneezes, or talks resulting in human to human transmission.

Unlike the seasonal Influenza, not only the infectivity, but the age-specific mortality rate is also quite higher (almost twenty times higher) than other seasonal viruses.

As a result, a considerable number of the world's population is getting infected with this nCoV very fast, creating overwhelming stress in the health sector. On 30th January 2020, the 1st case of this deadly virus was reported in India. Since then, the number of cases was increasing day by day and currently, India is having the most number of confirmed cases in Asia and also stood 3rd in the list of confirmed instances in the world after the USA and Brazil.

Almost every state and union territory of India is affected by the coronavirus except Lakshadweep. India has the lowest fatality rate in the world, which is 2.41%, and it is steadily declining.

On 22nd March, a voluntary curfew for 14 hours was observed all over the nation that was immediately followed by a compulsory lockdown covering all major states and COVID-19 affected hot spots.

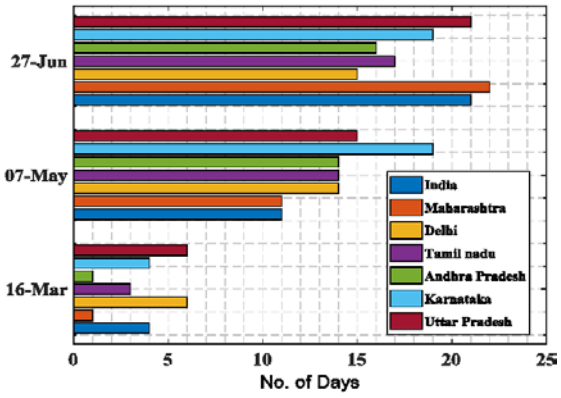

Fig. 1 Bar diagram of doubling rate

Further, starting from 24th March, India underwent a nationwide lockdown for 21 days. On

14th April, India elongated the state-wide lockdown till 3rd May, which was imitated by two-week augmentations starting 3rd and 17th May with substantial relaxations. From 1st June, the government began "unlocking" the country (except "containment zones") in three stages.

DOUBLING RATE

In fig. 1, a bar graph representation of the doubling rate in India along with seriously affected States viz. Maharashtra, Delhi, Tamil Nadu, Andhra Pradesh, Karnataka, and Uttar Pradesh have been shown. Here, three dates along the y-axis represent the doubling rate scenario before lockdown, during the lockdown, and after the lockdown or unlock phase in India.

Before lockdown, on 16th March, the doubling rate was 4, which means after 4 days from 16th March, the confirmed cases were doubled. During lockdown on 7th May, the doubling rate becomes 11 days, and the doubling rate after the lockdown phase on 27th June becomes

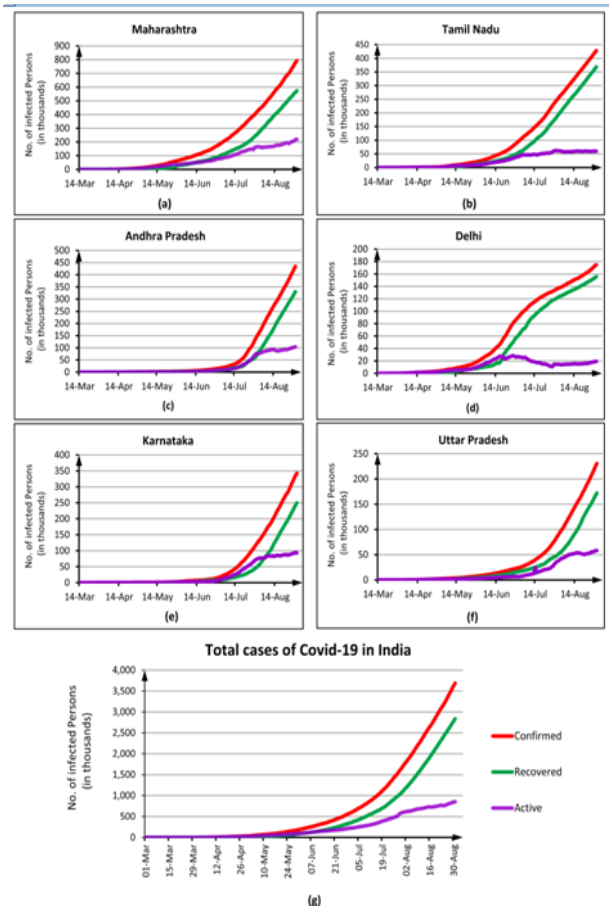

Fig. 2: COVID-19 scenario based on total confirmed, recovered andactivecases till 31st August 2020 of, (a) Maharashtra, (b) Tamil Nadu, (c) AndhraPradesh, (d) Delhi, (e) Karnataka, (f) Uttar Pradesh, (g) India.

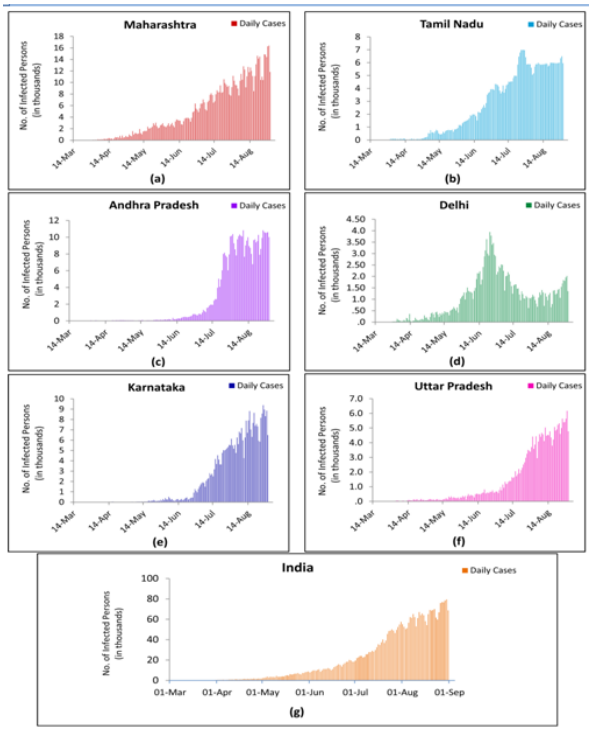

Fig. 3: Trend of daily cases due to COVID-19 till 31st August 2020 of, (a) Maharashtra, (b) Tamil Nadu, (c) Andhra Pradesh, (d) Delhi, (e) Karnataka, (f) Uttar Pradesh, (g) India.

Table I Comparison of the Six Major Affected States Due To Covid-19 in India

Sl. No.	*States*	*Population Density (Per Sq. km.)*	*Confirmed Cases*	*Recovered*	*Deceased*	*Confirmed Cases (per million)*	*Recovery Rate % (per 100 Infected person)*	*Fatality Rate % (per 100 Infected person)*
1	AP	320.4293	434771	330526	3969	8325.60	76.02	0.91
2	UP	933.8018	230414	172140	3486	1024.16	74.71	1.51
3	KA	343.0714	342423	249467	5702	5204.16	72.85	1.67
4	TN	582.0096	428041	368141	7322	5654.81	86.01	1.71
5	DL	13360.76	174748	155678	4444	8819.42	89.09	2.54
6	MH	396.9706	792541	573559	24583	6488.10	72.37	3.10

* AP(Andhra Pradesh), UP(Uttar Pradesh), KA(Karnataka), TN(Tamil Nadu), DL(Delhi), MH(Maharashtra)

MATHEMATICAL TREND OF ACTIVE CASES

In figure 4 shows the graphical presentation of active cases due to COVID-19 using mathematical modelling, till 31st August 2020 in India, along with six majorly affected States [6] [7]. Observing the active case data, the mathematical graphs are plotted for different R0 (Here R0 means Reproduction No.). Figure 4 graph shows R0 decreases for six majorly affected states and India. It means all over India Reproduction No. decreases. Here we used the SIR model curve for active cases. We extracted the value of R0 using the mathematical model by matching the SIR curve with the actual data. The reproduction rate for the whole of India was 6.7, but now it becomes 1.5. It shows that all over India, the rate of infection spread decreases.

DATA ANALYSIS

Data has been collected from various websites sources, which are available, publicly [8] [9] [10]

[11]. A statistical model has been adopted after doing a thorough study of the collected data till 31st August 2020 for better understanding the present scenario of COVID-19 in India.

Figure 2 and Table 1 shows the current scenario of the COVID-19 situation in India, along with six major affected States. After observing the graph and the table, we can draw inferences. We can keep that from the starting of May the number of cases had been increasing significantly. But around the mid of June, there is an exponential rising in the number of issues. Maharashtra is having the highest number of confirmed cases in India, with a recovery rate of 72.37 % and a high fatality rate of 3.10 %. The graph shows that the number of cases is increasing at an alarming rate and shows no slowing down.

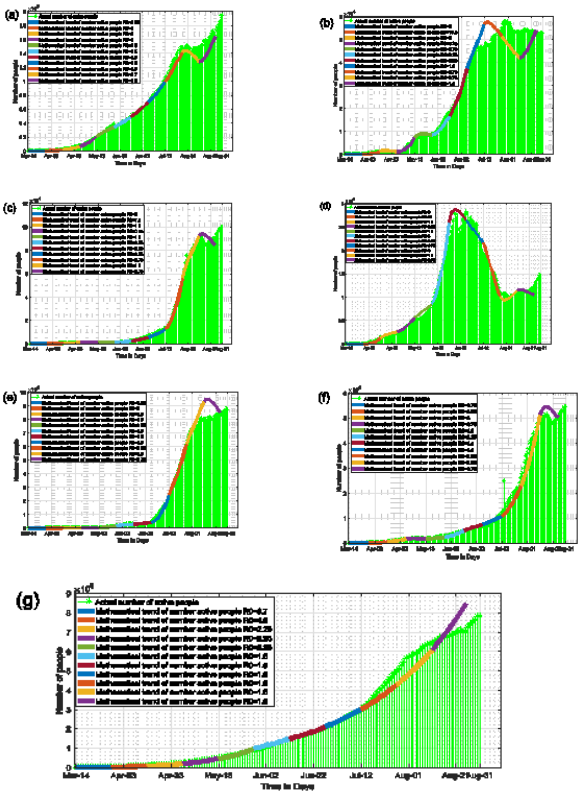

Fig. 4: Mathematical Trend of active cases due to COVID-19 till 31stAugust 2020 of, (a) Maharashtra, (b) Tamil Nadu, (c) Andhra Pradesh, (d) Delhi, (e)Karnataka, (f) Uttar Pradesh, (g) India.

While in the case of Tamil Nadu, the confirmed patients have been raised, the recovery rate has also been increased that results in lowering the active cases to a somewhat stable rate. A close observation reveals that there is a sudden increase in the number of cases in Andhra Pradesh and Karnataka during the first half of July. For Andhra Pradesh, the recovery and active issues are much equal, with a fatality rate of 0.91 %. In comparison, for Karnataka, the fatality rate has gone up to 1.67 %, and also, the active cases are much higher than the recovery cases that may seem to be the worst scenario right now.

Uttar Pradesh has also shown a gradual increase in the number of confirmed cases, and during the first half of July, it shows an upward rising too. Considering the density of the population, we may say that shortly the number of confirmed cases may increase. Compared to all states, a very densely populated region like Delhi is having the highest confirmed cases of 8819.42 per million with a fatality rate of 2.54 %. We can observe from figure 2(d) and ¬¬¬3(d) that the numbers of active cases had started to decline initially, while after mid-august, it's again increasing. So we say that Delhi might face a second wave of infection.

Figure 3 shows the graphical representation of daily cases in thousands. The graph of India shows that till 31st August 2020, the daily rate of infected persons has gone up near about 79 thousand in one day (on 30th August)[8]. Analyzing the major state graphs, we can say that Maharashtra has touched the highest cases of daily infected persons of around 16.4 thousand in one day (on 30th August)[8], followed by Andhra Pradesh, Tamil Nadu, and Karnataka. The Daily cases in Uttar Pradesh are much less than 6 thousand in one day (on 30th August)[8] per day, where Uttar Pradesh shows an upward rising.

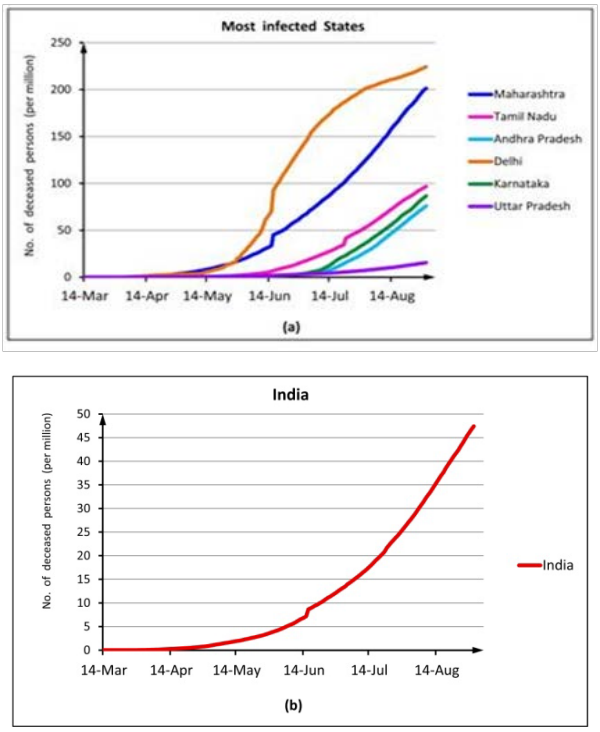

Fig. 5: Death rate spread of COVID-19, (a) Most infected states, (b) India

Figure 5 depicts the death rate per million. It is observed, from figure 5(b) that, India is having a death rate of slightly less than 50 persons per million of population. In figure 5(a), Delhi shows

the highest death rate of around 225 persons per million, followed by Maharashtra, where the death rate is nearly 200 persons per million. While in the case of Tamil Nadu, Andhra Pradesh, and Karnataka have a death rate ranges from 75 to 100 persons per million. Uttar Pradesh has the least among them all.

CONCLUSION

In this paper, we discussed various aspects of the COVID-19 scenario in India and as well as some of its majorly affected states. We have briefly analyzed the data from multiple sources and represent them graphically, and calculated the mathematical trend of active cases. Also, it is evident from the above graph that Delhi is now observing a new wave of infections, which was initially decreasing.

REFERENCES

1. T. Singhal, “A review of coronavirus disease-2019 (covid-19),” The Indian Journal of Pediatrics, pp. 1–6, 2020.
2. Y. Li, L.-W. Wang, Z.-H. Peng, and H.-B. Shen, “Basic reproduction number and predicted trends of coronavirus disease 2019 epidemic in the mainland of China,” Infectious diseases of poverty, vol. 9, no. 1, pp. 1–13, 2020.
3. M. N. K. Boulos and E. M. Geraghty, “Geographical tracking and map-ping of coronavirus disease covid-19/severe acute respiratory syndrome coronavirus 2 (sars-cov-2) epidemic and associated events around the world: how 21st century gis technologies are supporting the global fight against outbreaks and epidemics,” 2020.
4. Oliveiros, L. Caramelo, N. C. Ferreira, and F. Caramelo, “Role of temperature and humidity in the modulation of the doubling time ofcovid-19 cases,” medRxiv, 2020.
5. K. Muniz-Rodriguez, G. Chowell, C.-H. Cheung, D. Jia, P.-Y. Lai, Y. Lee, M. Liu, S. K. Ofori, K. M. Roosa, L. Simonsen et al., “Doubling time of the covid-19 epidemic by province, china,” Emerging infectious diseases, vol. 26, no. 8, p. 1912, 2020.
6. P. Ghosh, R. Ghosh, and B. Chakraborty, “Covid-19 in india: State-wise analysis and prediction,” medRxiv, 2020.
7. Gondauri, E. Mikautadze, and M. Batiashvili, “Research on covid-19 virus spreading statistics based on the examples of the cases from different countries. electron j gen med. 2020; 17 (4): em209,” 2020.
8. “https://www.covid19india.org/,” accessed on 02-09-2020at 4:30pm.
9. “https://www.mygov.in/covid-19,” accessed on 02-09-2020 at 3:24pm.
10. “https://www.mohfw.gov.in/,” accessed on 02-09-2020 at 7:43pm.
11. “https://www.india.gov.in/india-glance/states-india,” accessed on 02-09-2020 at 10:20am.