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Transmission Pathway in India to COVID-19 during Lockdown Period - An Observational Study



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ABSTRACT

COVID-19 commonly known as Corona disease is an infectious disease declared by World Health Organization (WHO) as a health emergency and pandemic. This is an observational study on the transmission, mortality and recovery rates from COVID-19 in India and the factors influencing the transmission and outcome. Observational study, the data was collected on day to day basis from 24th March to 14th April 2020 from Ministry of Health website and other reliable sources that are internet. The data was analyzed to find the maximum and minimum affected states from COVID-19 during the lockdown period and Percentage of change of incidence to analyze the effects of Lockdown and other preventive measures taken by the administration. The conclusions drawn from this study are that states who had increased rate of transmission were Maharashtra, Delhi, Tamil Nadu, Rajasthan, Madhya Pradesh whereas least transmission rate in Mizoram, Meghalaya, Arunachal Pradesh, Manipur, Tripura, Goa, Puducherry, Andaman & Nicobar Islands, Ladakh. Kerala has low transmission rate due to effective lockdown, community outreach, rigorous contact tracing and mass quarantine. The overall mortality in India is 3.3 % nearly 20 times less than the global rate because of diet rich in immune boosters like herbs and spices and doing indoor home based exercises to boost their immunity.



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INTRODUCTION

COVID-19 commonly known as Corona disease is an infectious disease that causes respiratory illnesses. The COVID-19 is China originated Virus in December-2019. It belongs to the Coronaviridae family in the Nidovirales order. The subgroups of coronaviruses family are alpha, beta, gamma and delta coronavirus. The SARS-CoV, H5N1 influenza, H1N1 2009 are some of the important infectious respiratory illnesses caused by these viruses. The disease was first started in the Wuhan city of Hubei Province in China. The World Health Organization (WHO) has declared the COVID-19 as a health emergency and pandemic. COVID-19 is the defining global health crisis of 21st century and is the great challenge that the whole world is facing after world war-II. All the countries globally are racing to slow down the spread of this virus by taking necessary precautionary measures.¹

In the December 2019, Wuhan, an emerging business hub in the province of Hubei, China experienced an outbreak of a novel coronavirus. This virus is reported to be the member of beta group of coronaviruses. The International Committee On Taxonomy of Viruses (ICTV) named the virus as SARS-CoV-2 and the disease as COVID-19.^{2,3,4}

In this review, we have tried to analyze the trend of transmission of COVID-19 having some of the collection of day to day data from India and trend from globe.

COMPARITIVE ANALYSIS OF EMERGENCE AND SPREAD OF COVID-19 IN INDIA.

Indian commonly known as a subcontinent has a large population and diversified temperature zones⁵. The population density of India is 464 per Sq. KM.⁵It is really a herculean task to control the transmission of an infectious disease like COVID-19 in India which is a densely populated nation. The first case of COVID-19 in India was reported on 30th Jan 2020. The origin of Infection in India is believed to be from China. As on 17th April 2020, the Ministry of Health and family welfare have confirmed the occurrence of 12,759 cases. ⁶ The experts believe that the number of infections in India could be much higher as India's testing rates is lower amongst the world.⁷

As a preventive measure, the government of India on 22nd March 2020, decided to completely lock down 82 districts in 22 states and Union Territories of the Country where confirmed cases were reported.⁸ On 24th of March 2020, the government of India announced a complete

nationwide lockdown for 21 days.⁹ By the second week of lockdown, the rate of transmission had doubling slowed down to six day which was earlier rated to every 3 days.¹⁰

METHODOLOGY

We have collected data every day from 24th March 2020 to 14th April 2020 in terms of number of confirmed cases (Disease Transmission), number of Death trolls and Number of recovered cases among various states and Union territories of India from Ministry of Health and Family welfare website.¹¹

We recorded the state wise, monthly average temperatures for the months of February, March & April 2020 from the website Timeanddate.com¹²

Data of various preventive measures was collected from the Government of India, State as well as Union Territories in controlling the spread of pandemic.

ANALYSIS

This is an observational study to find out the rate of transmission of COVID-19 and various factors affecting the rate of transmission, number of Deaths and recoveries in India.

After collecting the data from various sources, the data was critically analyzed graphically on first week (31st March 2020), second week (07th April 2020) and Third week (14th April 2020) of the Lockdown period to identify the Maximally affected 5 states in terms of high number of confirmed cases (disease transmission), death trolls and recovered cases. The data of 5 states was analyzed for this purpose.

The percentage of increase among the states was calculated by using the formula:

$$\% \text{ of increase} = \frac{[(\text{New value} - \text{Original value}) / \text{Original value}] \times 100}{100}$$

We have critically analyzed various factors that would have lead to high disease transmission in the maximally affected 5 states and least transmission of 5 states along with the death trolls and recoveries. Analysis regarding the impact of temperature of various states and U.T's and various preventive measures was also done.

RESULTS AND DISCUSSION

A critical analyses of the collected data revealed that the Maximum affected states in terms of confirmed cases as on third week (14th April 2020) were Maharashtra (2686), Delhi (1561), Tamil Nadu (1204), Rajasthan (969), & Madhya Pradesh (713).(figure 1&7) The least affected states & U.T's in terms of Confirmed cases were Meghalaya, Arunachal Pradesh & Mizoram (01), Tripura & Manipur (02), Puducherry (U.T) & Goa (07), Andaman & Nicobar Islands (U.T) (11) Ladakh (U.T)(17).(Table-1) (Figure 2)

The maximum affected states in terms of rate of progression in disease transmission by Percent of increase are Andhra Pradesh (2000%), Odisha (1900%), Tamil Nadu (1697.01%), Delhi (1509.2%), Madhya Pradesh (1417%). The least affected 5 states in terms of rate of progression by percent of increase are Mizoram (0%), Andaman & Nicobar islands (U.T) (10%), Ladakh (U.T) (30.76%), Goa (40%), Chandigarh (U.T)(60%).

The maximum affected states having highest number of deaths as on 14-April, 2020 are Maharashtra (178), Madhya Pradesh (50), Delhi (30) Gujarat (28), Telangana(17) (Figure 3) and the least affected states having death trolls are Himachal Pradesh, Bihar, Odissa, Assam(01), Jharkhand (02), Kerala, Rajasthan, Haryana (03), Jammu & Kashmir (04), Uttar Pradesh (05).(Figure 4)

The maximum affected states in terms of death trolls by percent of increase are Maharashtra (1680%), Delhi (1400%), Madhya Pradesh (1150 %), Tamil Nadu (1100 %), Gujarat (366.66%). The Least affected 5 death troll states by percent of increase are Kerala (50%), Jammu & Kashmir (100%), Telangana (112.5%), West Bengal (133.33%) Karnataka (233.33%).

The maximum affected states having highest number of recoveries as on 14-April, 2020 are Maharashtra (259), Kerala(211), Rajasthan (147), Telangana(100), Tamil Nadu (81).(Figure 5) The least 5 recovery related states are Puducherry (UT) and Manipur(01), Goa (05), Chandigarh(UT)(07), Uttarakhand (09), Ladakh (UT)(10). (Figure 6)

Maximum affected states in terms of recovery by percent of increase are Rajasthan (4800%), Jammu & Kashmir (2900%), Tamil Nadu (1925%), Andhra Pradesh(1500%) Punjab(1300%).The least affected 5 states by Percent of increase among recovered cases are Haryana (100%), Uttar Pradesh(194.11%), Ladakh (UT)(233.33%), Uttarakhand (350%), Delhi(400%).

There were more cases recorded after a religious congregation in Delhi. (Table-2)

This observational study was conducted for a period of 3 weeks from 24th march to 14th April 2020 during the Lockdown period in India. From the above study, the maximum mortality rate is faced by Maharashtra (178), Madhya Pradesh (50), Delhi (30), Gujarat (28), Telangana (17) and the minimum mortality rate was recorded from the states of Himachal Pradesh, Bihar, Odissa, Arunachal Pradesh (01), Jharkhand (02). The overall mortality rate in India is 3.3% (31-03-2020) and 3.3 % (14-04-2020) indicating no rise in mortality rate. The overall mortality in India is 3.3 % nearly 20 times less than the global rate²⁴. The low mortality rate could be attributed to the dietary, social and cultural habits of Indians. The spices like Curcumin (Turmeric), a spice often used in Indian foods is well known for its anti-inflammatory effects. It is also a potent immunomodulatory agent that can modulate the activation of T-cells, B-cells, Macrophages, Neutrophils, Natural killer cells, and dendritic cells. It is also evident that curcumin at low doses can also enhance antibody responses.²⁵ Other Indian spices like cloves, cinnamon, chillies, ginger, ajowan, curry leaves also have antibiotic and immune boosting properties.²⁶

The other factors that had lead to the low incidence of COVID-19 in India when compared to other emerging countries is mainly because of Large-scale screening of international passengers at Airport, early lockdown and restriction of foreign travelers entering into India. In our observation, we found that the numbers of cases are high in the state of Maharashtra followed by Delhi, Tamil Nadu, Rajasthan and Madhya Pradesh. The first case of the COVID-19 in Maharashtra was confirmed on 9th March 2020. As on to 14th April, Maharashtra had 23% of the total cases in India.¹⁴ The cities of Mumbai and Pune of Maharashtra had the highest number of Confirmed cases. These are densely populated cities. In Mumbai, the Asia's largest Slum area Dharavi¹⁵ is present where the population density is 277,136/Sq.Km¹⁶. It is really a difficult task for administration to educate and maintain social distancing in this type of congested areas. The highest numbers of cases were reported due to increased testing facilities from 3 till mid March to 27 testing labs by to 5th April 2020. ¹⁷ The

state authorities have reported that there were 352 new confirmed cases on to 13th April 2020, out of which 50 cases were associated with a religious congregation in Delhi.¹⁸

After Maharashtra, Delhi had been reported the highest number of Confirmed cases. The first case was reported on to 2th March 2020. The highest numbers of cases in Delhi were mainly because Delhi had thousands of migrant workers from many states. There were also cases attributed to the religious congregation in Delhi. Though there was a nationwide complete lockdown, the number of confirmed cases increased every week.

The first confirmed case in Tamil Nadu was reported on to 7th March. Among the reported cases, 1113 (84%) of cases were from religious congregation. The most of the confirmed cases were linked to the history of Foreign Travel.¹⁹ and in contact with Foreign Nationals. The government officials had reported that 80 out of 124 confirmed cases in Tamil Nadu were from one cluster as they are in direct or indirect contact with Two Thailand Nationals who were tested positive on 21 March 2020.²⁰ The Tamil Nadu government had increased testing lab facilities from 4 to 27 by mid April.²¹

The first case in Rajasthan was reported on 2nd March 2020. The cases in Rajasthan had been reported due to direct or indirect contact with foreign tourists as Rajasthan is a tourism spot of India.²²

The cases in Madhya Pradesh had increased as it homes the Biggest Industrial Hub, Indore where there will be float of foreign travelers and migrant workers. The lockdown and social distancing were not followed strictly in the state of Madhya Pradesh because most of the confirmed cases are from close family contacts with the positive cases.²³

Kerala has flattened its curve for transmission of new cases. Kerala has porous borders, a large number of migrant workers and huge expatriate population, NRI's who keep travelling back and forth to the state of Kerala. When the Pandemic occurred in India, Kerala was the maximum affected state with 370 confirmed cases and 3 deaths and over 100,000 people remained in isolation. Kerala had taken Hercules task in controlling the transmission. The state was alert and vigilant and had imposed a lockdown one day before the complete National Lockdown. It made rigorous contact tracing using detailed route maps of people coming in from abroad. Health workers also supported the needy. The counselors appointed for COVID-19 made more than 340,000 telephonic calls to personnel working in affected areas to counsel. The government had made aggressive rapid testing in more than 12 labs

statewide. Experts believe that the control of COVID-19 in Kerala happened mainly because of an effective administration which helped in community outreach, rigorous contact tracing and mass quarantine.²⁶

CONCLUSION

The conclusions are drawn from this study are that states who had increased rate of transmission were Maharashtra, Delhi, Tamil Nadu, Rajasthan, Madhya Pradesh during 24th March to 14th April 2020. The states with least transmission rate are Mizoram, Meghalaya, Arunachal Pradesh, Manipur, Tripura, Goa, Puducherry, Andaman & Nicobar Islands, Ladakh. The Rate of transmission in Kerala has lowered from 24th March 2020 to 14th April 2020 due to effective lockdown, community outreach, rigorous contact tracing and mass quarantine. The overall mortality in India is 3.3 % nearly 20 times less than the global rate because of diet rich in immune boosters like herbs and spices and doing indoor home based exercises to boost their immunity.

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Conflicts of Interest: The authors declare no conflicts of Interest.

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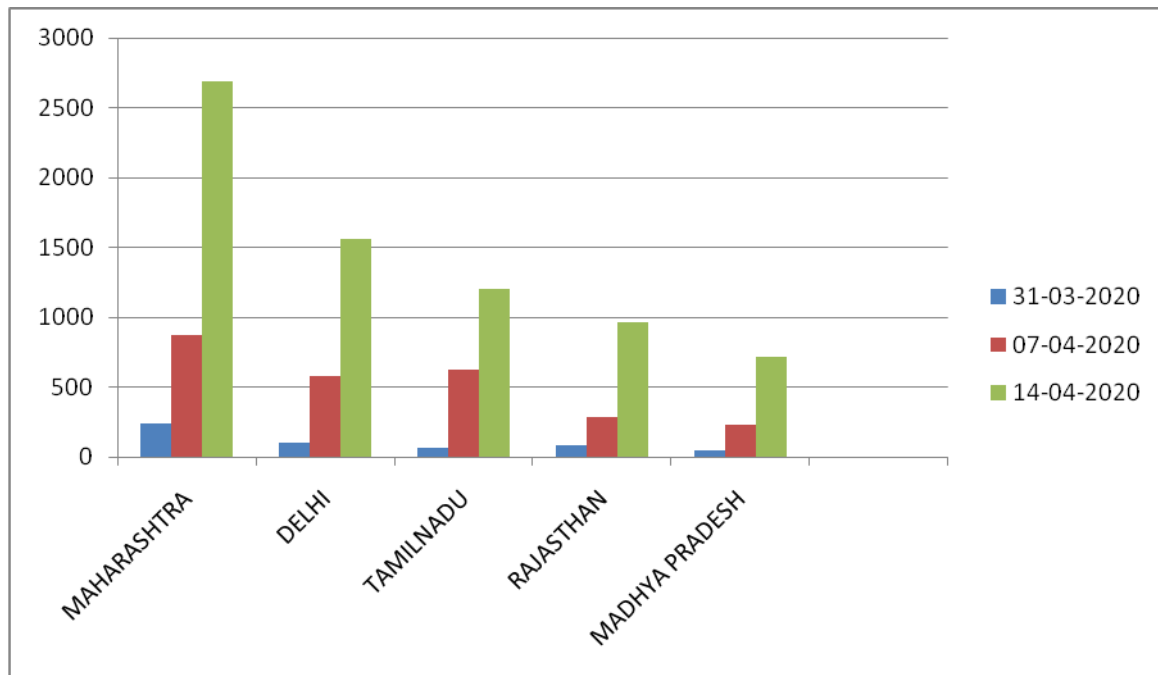


Figure No. 1: Maximally affected states in terms of Confirmed cases (rate of transmission) during 1st, 2nd & 3rd week of lock down period in India

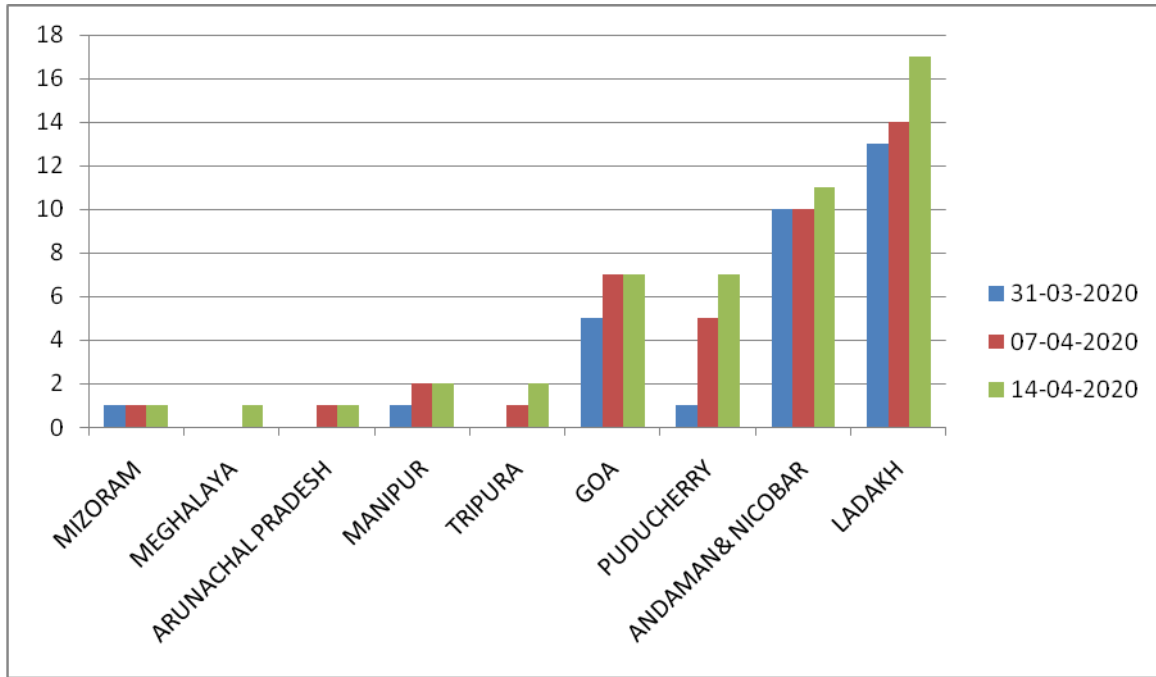


Figure No. 2: Least affected states in terms of confirmed cases in 1st, 2nd & 3rd week during Lockdown period in India

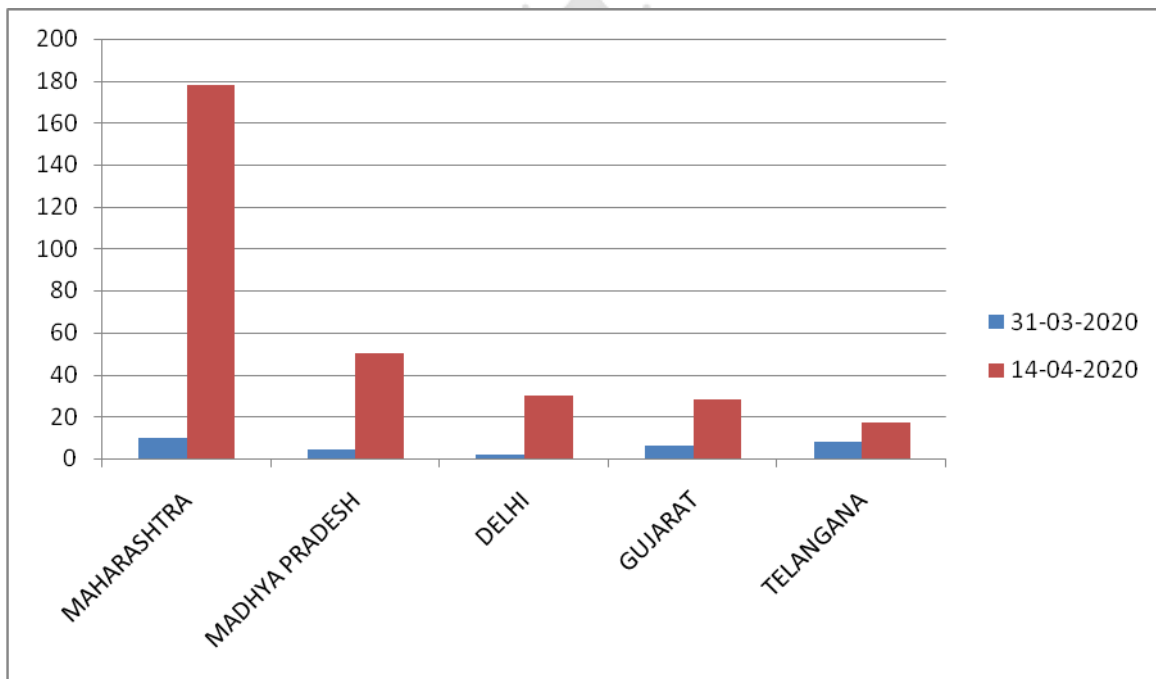


Figure No. 3: maximally affected states in terms of Death Toll rate in 1st & 3rd week during Lockdown period in India

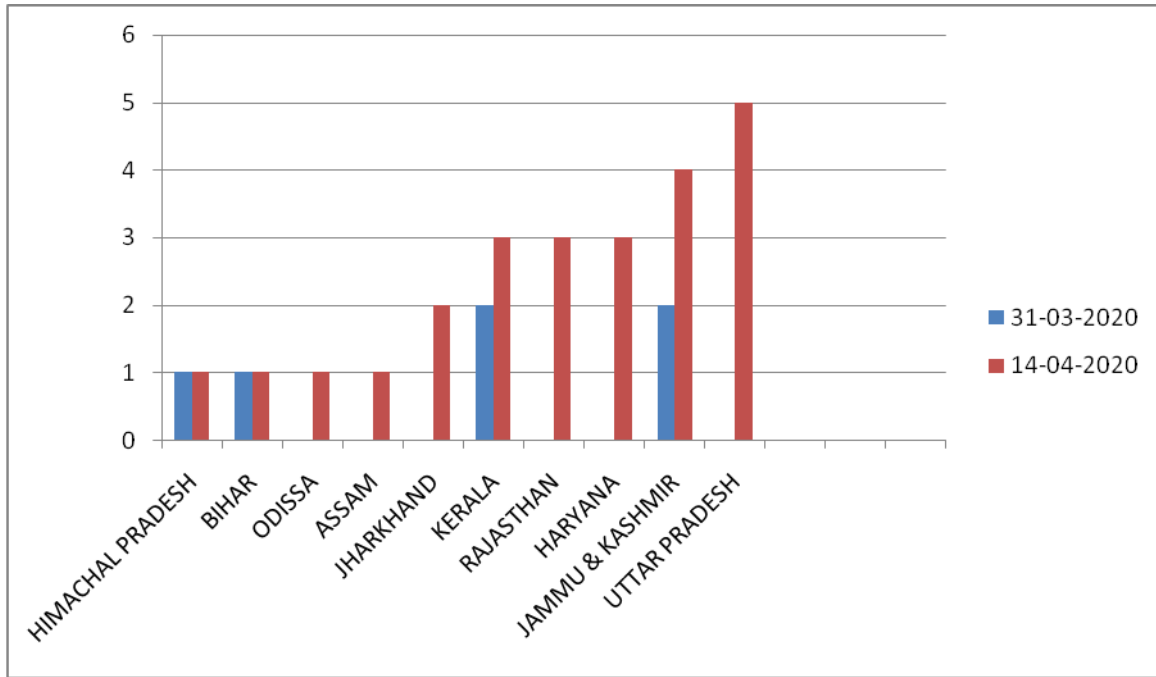


Figure No. 4: Least affected states in terms of Death Toll rate during 1st & 3rd week of Lockdown Period in India.

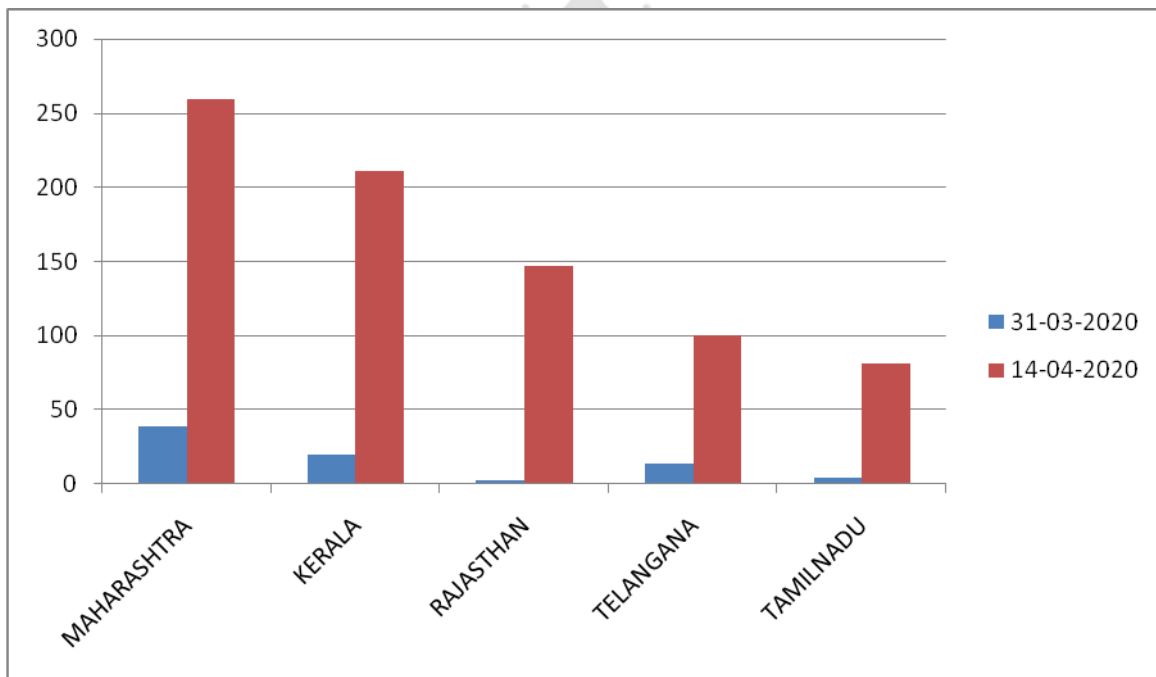


Figure No. 5: maximally affected states in terms of recovered cases during 1st & 3rd week during lockdown period in India.

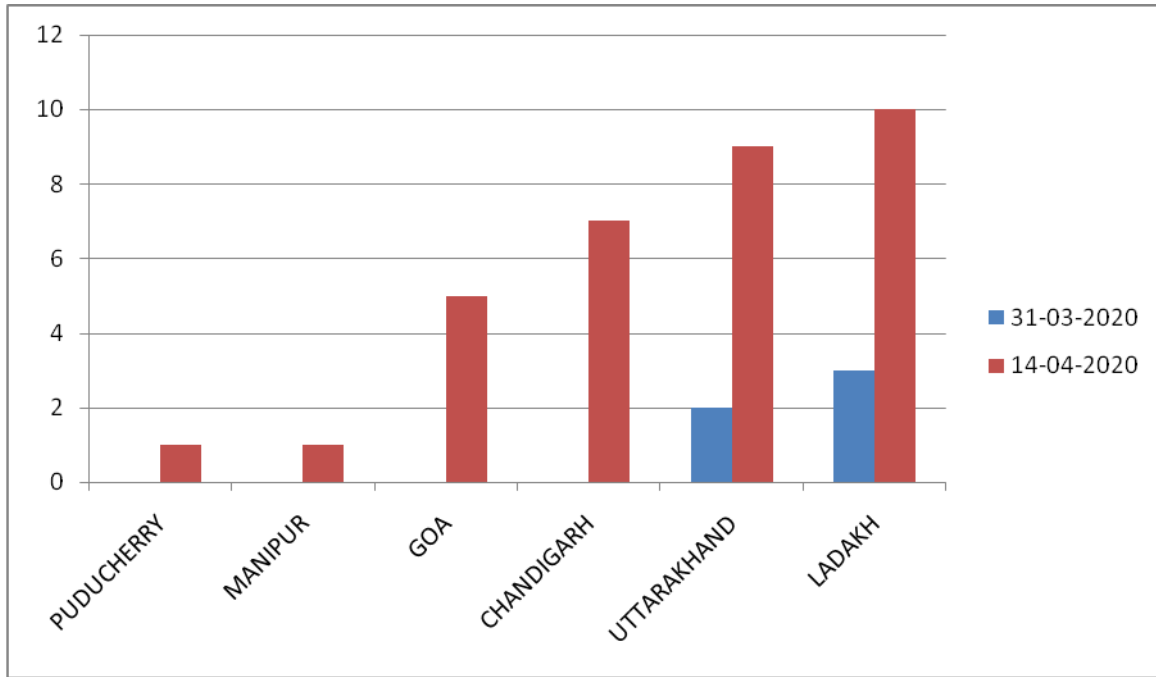


Figure No. 6: Least affected states in terms of recovered cases during 1st & 3rd week of lock down period in India

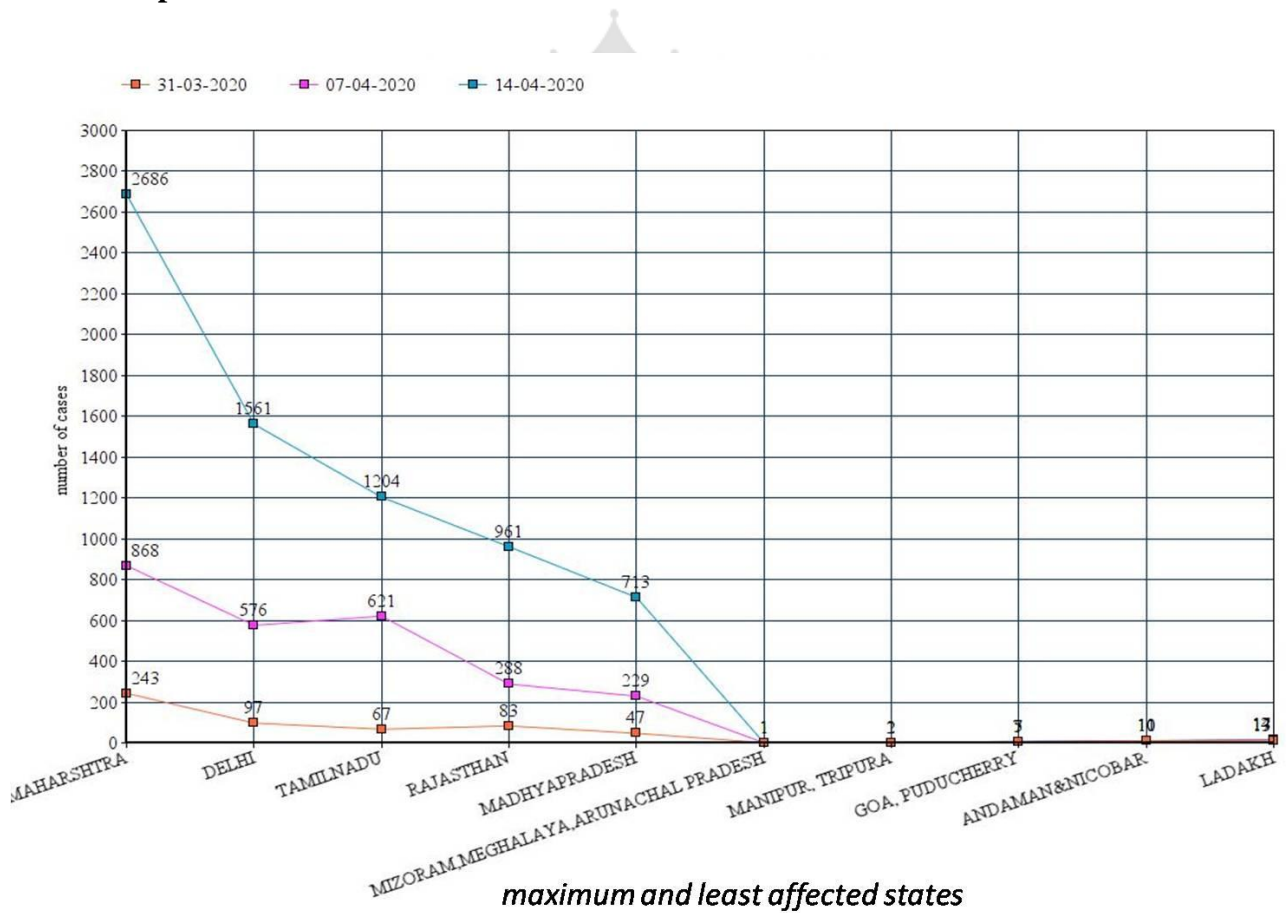


Figure No. 7: Progression of COVID-19 with effect from 24-03-2020 to 14-04-2020.

Table No. 1: Number of COVID-19 confirmed cases in different states during the Lockdown period from 24-03-2020 till 14-03-2020.

Sr. No.	State	Covid-19 Confirmed Cases		
		First Week	Second Week	Third Week
1.	Maharashtra	243	868	2686
2.	NCR of Delhi	97	576	1561
3.	Tamil Nadu	67	621	1204
4.	Rajasthan	83	288	969
5.	Madhya Pradesh	47	229	713
6.	Uttar Pradesh	101	305	660
7.	Gujarat	73	165	650
8.	Telangana	77	365	624
9.	Andhra Pradesh	23	266	483
10.	Kerala	234	327	387
11.	Jammu& Kashmir	49	116	278
12.	Karnataka	91	175	260
13.	West Bengal	22	91	213
14.	Haryana	36	90	199
15.	Punjab	41	91	176
16.	Bihar	16	32	66
17.	Odisha	3	0	60
18.	Uttarakhand	7	31	37
19.	Himachal Pradesh	3	13	33
20.	Chhattisgarh	8	10	33
21.	Assam	0	26	32
22.	Jharkhand	0	4	27
23.	Chandigarh	13	18	21
24.	Ladakh	13	14	17
25.	Andaman& Nicobar Islands	10	10	11
26.	Puducherry	1	5	7
27.	Goa	5	7	7
28.	Tripura	0	1	2
29.	Manipur	1	2	2
30.	Aruchal Pradesh	0	1	1
31.	Meghalaya	0	0	1
32.	Mizoram	1	1	1
33.	Nagaland	0	0	0
34.	Sikkim	0	0	0
35.	Dadra&Nagerhaveli	0	0	0
36.	Daman&Diu	0	0	0
37.	Lakshadweep	0	0	0

Table No. 2: Number of confirmed cases of COVID-19 from religious congregation at Delhi as on 02-04-2020 Source: Live Hindustan.com

STATE	NUMBER OF CASES
TAMILNADU	173
RAJASTHAN	11
ANDAMAN & NICOBAR	09
DELHI	47
TELANGANA	33
ANDHRA PRADESH	67
ASSAM	16
JAMMU & KASHMIR	22
PUDUCHERRY	02
UTTAR PRADESH	54

