

# Sources of spreading COVID-19 cases and afford made to control the infection in India

## Abstract

**Background:** To study the source of increasing of COVID-19 cases in India, and also evaluate the afford government made to disconnect the chain of infectious disease.

**Materials and methods:** COVID-19 data was obtained from website of Kaggle, which comprised details of individuals suffered with COVID-19 in India. Further, spot snap of COVID-19 situation as on 2<sup>nd</sup> July, 2020 was also taken to fill up the gap susceptibility. Moreover, analysis was carried out by univariate and bi-variate techniques in Microsoft Excel 2016 statistical software.

**Results:** In India, first five cases diagnosed with COVID were Indian, had international travel history and next 16 were Italian. These 21 cases were diagnosed in above mention states by 4th March, 2020, and when lockdown was declared, cases reached in 24 Indian states. The worst state with highest number of active cases about 160 per 100,000 population was in Delhi with Case Fatality Rate (44.6 per 1000 Cured and Deaths). Ladakh was second worst in highest number of active cases (147 per 100,000 population) followed by Maharashtra, Tamil Nadu and Goa. Case Fatality Rate was highest in Maharashtra (79.6 per 1000 Cured and Deaths) followed by Gujarat, Madhya Pradesh, West Bengal, Delhi etc. Delhi and Tamil Nadu was in worst situation in controlling of COVID-19 than the other state. The best state was Meghalaya with active cases 0.3 with alarming Case Fatality Rate 22.3 followed by Jharkhand.

**Conclusion:** Indian travelled from different countries and Indian government were responsible for spreading of COVID-19 throughout country. Delhi and Tamil Nadu was in worst situation in controlling of COVID-19 than the other state. The reason for wide variation in active cases of COVID-19 may be unrest in community due to labour movement. Hence, for COVID-19 containment, there is need necessary steps for providing better health facilities, awareness of positive and negative effect of COVID-19 and restricting the state-wise public movement until COVID-19 will not come under control.

**Keywords:** active case ratio, COVID-19, travelled history, India

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## Introduction

Unexpectedly, the novel corona virus disease 2019 started from Wuhan city of Hubei province, and it rapidly spread and covered to the entire nation till December 2019. Globally, the pandemic matures the numbers of cases, is rising at an alarming rate. On January 20, 2020 there were about 282 cases; it was only in four countries China, Japan, Republic of Korea and Thailand. Eleven days later, on January 30, 2020 there were almost 7818 Cases and 170 deaths in 19 countries including India, an increase almost 27% cases.<sup>1</sup> Surprisingly, China has revealed a total of 72,528 confirmed cases on February 17, 2020.<sup>2</sup> On April 6, 2020, the novel coronavirus 2019 (COVID-19) has spread across 210 nations and regions with 1.2 million confirmed cases and 67594 deaths. At last 2020, WHO declared public health emergency at the international level.<sup>3,4</sup>

Though, there has not been much focus on COVID-19 pandemic by international health agencies before declaration of COVID-19 as a pandemic, which was recognised by the WHO on 11 March 2020. Despite the difference in symptomatology and health difficulties from the disease presents greater health and mortality risks in persons at higher ages and in those with pre-existing medical situations. There

are points in hospitalizations, Intensive Care Unit (ICU) admissions and deaths in the worst affected countries. The health systems of these countries are being strained to the limit. The morbidity effect of the virus is attracting substantial attention, especially as the availability of intensive care units is being topped by the number of cases requiring critical care.<sup>5</sup>

In India, screening of traveller at airport migrant has been started with immediate effect, immediate Chinese visas have been cancelled, and who has found affected from COVID-19 have been quarantined.<sup>6</sup> The Ministry of Health and Family Welfare (MoHFW) of India had primarily warned to avoid traveling to China and quarantine of those returning from China.<sup>7</sup> In the nonappearance of licensed vaccine or effective therapeutics for COVID-19, other advises to hand cleanliness and quarantine a basic strategy to control and alleviation mediation towards the early detection and quarantine of cases to break the chain of transmission.

The SARS coronavirus (SARS-CoV)-2 pandemic is currently a big challenge for researchers, policy planner and government, and increasing cases are making a huge burden for clinicians and health-care workers. Many researchers published paper on novel corona

virus disease 2019 in reputed and non-reputed journal indicating results for India by sex and age. But no one study shown why and how disease are spreading? Moreover, a study published by Singh & Adhikari<sup>8</sup> trying to show age structure and impact of social distancing on the COVID-19 in India. Prasad et al.<sup>4</sup> shown trend of COVID-19 infectious disease. These authors missed to explain, why cases and deaths are continuously increasing? Even most of articles have estimated and projected the cases by using the different model, but no one study shown, how and from where case came first in India. Government of India had taken decision either at right time or late. What is current scenario of COVID-19? This study has taken all these things into account and trying to fulfil these gaps with some available data sources.

## Materials and methods

This study has used the COVID-19 data from the website of Kaggle<sup>9</sup> which provides platform for extracting the data on novel corona virus diseases 2019 to help the global community and health organizations for better decisions. It currently hosting a variety of tasks focused on better understanding about COVID-19 infectious disease.

The study included COVID-19 data on individuals responsible to bring COVID-19 in India with their nationality, detected city, detected state and travel history. Substantially, Indian who travelled from different country, and found positive with COVID-19 on before 26 April, 2020, were taken into account for highlighting the effect of government decision. Further, spot snap of COVID-19 situation as on 2<sup>nd</sup> July, 2020 has also been depicted to fill up the gap susceptibility.

Active Case has been computed as:

$$\text{Active Case} = \text{Confirmed Cases} - \text{Cured} - \text{Deaths}$$

Active Case Ratio (ACR) per week was computed as

$$\text{ACR} = \frac{\text{EAC}_{i+7}}{\text{EAC}_i}$$

Where,  $\text{EAC}_{i+7}$  - Active Cases at  $(i+7)^{\text{th}}$  day and

$\text{EAC}_i$  Active Cases at  $i^{\text{th}}$  day

Seven days Active Case Ratio, at place of one day has been computed to get magnifiable change and to minimising the misreporting.

Case Fatality Rate (CFR) was estimated as:

$$\text{CFR} = \frac{\text{Deaths}}{\text{Cured} + \text{Deaths}} \times 1,000$$

The data was analysed by univariate and bi-variate techniques in Microsoft Excel 2016 statistical software.

## Results

Table 1 reveals the individuals, who brought the COVID-19 infectious disease in India. COVID-19 was entered inside the country through the five Indian, who were detected positive with COVID-19 in different city of India. Among them, three were travelled from China, one was from Austria and Italy, and remain one was from Dubai. First case was female of age 20 year, travelled from Wuhan (China) to India, detected positive on 30<sup>th</sup> January, second and third travelled from Wuhan city of China, and detected positive with COVID-19 on 2 and 3<sup>rd</sup> February in Kerala state. These tree cases were recovered on 14 February, 2020. It was surprise that at a time 16 Italian detected positive on 4<sup>th</sup> March 2020. Out of these cases, 14 were detected in Gurugram (Haryana) and 2 were in Jaipur (Rajasthan). In other hand, directly or indirectly these 21 cases played a major role in spreading the COVID-19 infectious disease throughout country.

**Table 1** Distribution of individuals started to spread COVID-19 infection in India

Diagnosed date	Age	Gender	Detected city	Detected state	Nationality	Travel history
30/01/2020	20	F	Thrissur	Kerala	India	Travelled from Wuhan
2/2/2020		-	Alappuzha	Kerala	India	Travelled from Wuhan
3/2/2020		-	Kasaragod	Kerala	India	Travelled from Wuhan
2/3/2020	45	M	East Delhi (Mayur Vihar)	Delhi	India	Travelled from Austria, Italy
2/3/2020	24	M	Hyderabad	Telangana	India	Travelled from Dubai to Bangalore on 20th Feb, stayed there for 2 days and took a bus to Hyderabad
3/3/2020	69	M	Jaipur	Rajasthan	Italy	Travelled from Italy
4/3/2020	55	-	Gurugram	Haryana	Italy	Travelled from Italy
4/3/2020	55	-	Gurugram	Haryana	Italy	Travelled from Italy
4/3/2020	55	-	Gurugram	Haryana	Italy	Travelled from Italy
4/3/2020	55	-	Gurugram	Haryana	Italy	Travelled from Italy
4/3/2020	55	-	Gurugram	Haryana	Italy	Travelled from Italy
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4/3/2020	55	-	Gurugram	Haryana	Italy	Travelled from Italy
4/3/2020	55	-	Gurugram	Haryana	Italy	Travelled from Italy
4/3/2020	55	-	Gurugram	Haryana	Italy	Travelled from Italy

Table Continued...

Diagnosed date	Age	Gender	Detected city	Detected state	Nationality	Travel history
4/3/2020	55	-	Gurugram	Haryana	Italy	Travelled from Italy
4/3/2020	55	-	Gurugram	Haryana	Italy	Travelled from Italy
4/3/2020	55	-	Gurugram	Haryana	Italy	Travelled from Italy
4/3/2020	55	-	Gurugram	Haryana	Italy	Travelled from Italy
4/3/2020	55	-	Gurugram	Haryana	Italy	Travelled from Italy
4/3/2020	55	-	Gurugram	Haryana	Italy	Travelled from Italy
4/3/2020	70	F	Jaipur	Rajasthan	Italy	Travelled from Italy

Source: <https://www.kaggle.com/sudalairajkumar/covid19-in-india/data>

In India, lockdown was started from mid-night of March 24, 2020. Though, till 4th March, 2020, the cases were in only 5 states (Kerala, Delhi, Telangana, Rajasthan, Haryana) (Table 1). It was reached in 24 states namely Kerala, Delhi, Telangana, Rajasthan, Haryana, Uttar Pradesh, Ladakh, Tamil Nadu, Jammu and Kashmir, Karnataka, Maharashtra, Punjab, Andhra Pradesh, Uttarakhand, Odisha, Puducherry, West Bengal, Chandigarh, Chhattisgarh, Gujarat, Himachal Pradesh, Madhya Pradesh, Bihar, Manipur by March 24, 2020 (Kaggle, 2020), when government of India declared lockdown.

Table 2 revealed the travelled history of Indian, who were diagnosed with COVID-19, had international travel history from 48 different countries in between 30<sup>th</sup> January to 26 April, 2020. Out of total Indian travelled from abroad, 531 were diagnosed with COVID-19 on before 26<sup>th</sup> April, 2020. Among these positive COVID-19 cases, around 46 percent (244 persons) were travelled from Dubai, which was highest than the other countries followed by UK (around 9%), Saudi Arabia (around 6%), USA (around 5%), Iran (around 4%), London (around 4%), Italy (around 3%) and so on.

**Table 2** Indian diagnosed with COVID-19, travelled from different countries in between 30th January to 26 April, 2020

Travelled from	No. of Indian	%	Travelled from	No. of Indian	%
Wuhan	3	0.56	France	13	2.45
Portugal	1	0.19	Asansol	1	0.19
UK	46	8.66	Pollachi	1	0.19
Italy	18	3.39	Japan	3	0.56
Canada	3	0.56	Iran	21	3.95
Indonesia	3	0.56	Greece	1	0.19
Foreign Travel history	5	0.94	Malaysia	1	0.19
Island	2	0.38	Saudi Arabia	30	5.65
London	20	3.77	Mexico	1	0.19
US/USA	27	5.08	Finland	1	0.19
Brazil	3	0.56	Edenburg, South Africa	1	0.19
London	4	0.75	Istanbul, Turkey	1	0.19
Australia	3	0.56	Egypt	1	0.19
Dubai	244	45.95	Philippines	6	1.13
Ajman	1	0.19	Russia	1	0.19
Abhudhabi	8	1.51	Netherlands	3	0.56
Germany	10	1.88	New Zealand	2	0.38
Guyana	1	0.19	Scotland	2	0.38
Kenya	1	0.19	Singapore	2	0.38
Austria, Italy	1	0.19	Sweden	2	0.38
Congo	1	0.19	Switzerland	2	0.38
California via Singapore	1	0.19	Turkey	3	0.56
Spain	16	3.01	West Indies	1	0.19
Thailand	4	0.75	Total	531	100
Sri Lanka	5	0.94			

Table 3 reveals the distribution of detected COVID-19 infectious disease on before 26th April, 2020. Out of 18 Italian cases; 14 were diagnosed with COVID-19 in Haryana, two were in Rajasthan, and one each from Punjab and Kerala. Similarly, 15 Indonesian tourists were found with infectious diseases: ten were diagnosed in Telangana and 5 in Tamil Nadu. However, 7 tourists of United Kingdom were

diagnosed in Kerala state of India. In addition, Maharashtra situation was found to be critical i.e. burden of confirmed COVID-19 cases was found higher in Maharashtra (8068) followed by Gujarat, Delhi, Rajasthan, Madhya Pradesh, Tamil Nadu, Uttar Pradesh, and so on. Lowest number of cases was observed in the states of Arunachal Pradesh (1) and Mizoram (1).

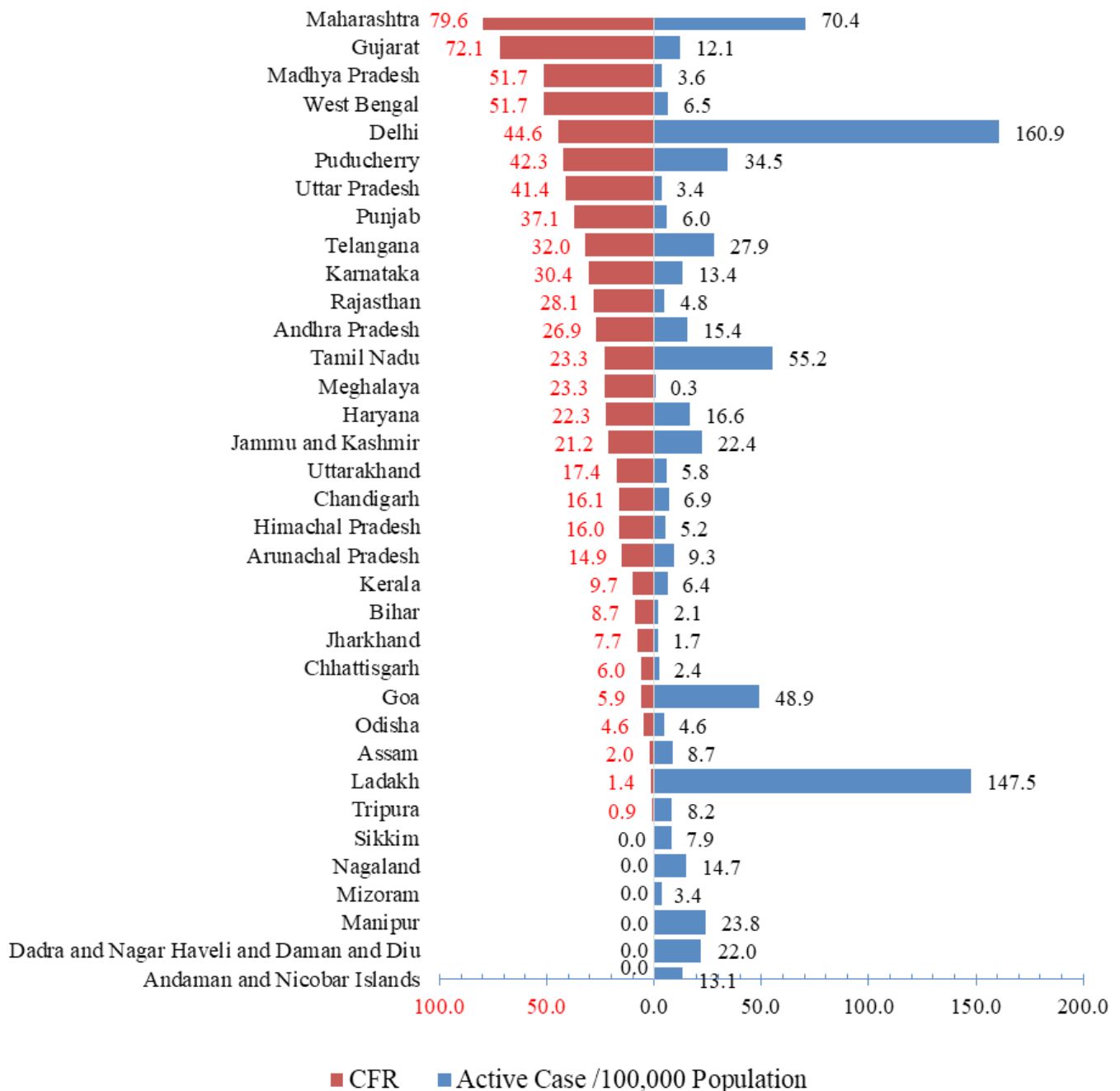
**Table 3** Distribution of detected COVID-19 infectious disease according to states/ UTs and nationality till 26th April, 2020

Detected state	Nationality												N
	MS	C	IN	ID	I	ML	MY	PH	TH	TB	UK	USA	
Andaman and Nicobar Islands	26	0	7	0	0	0	0	0	0	0	0	0	33
Andhra Pradesh	1084	0	13	0	0	0	0	0	0	0	0	0	1097
Arunachal Pradesh	0	0	1	0	0	0	0	0	0	0	0	0	1
Assam	34	0	2	0	0	0	0	0	0	0	0	0	36
Bihar	253	0	24	0	0	0	0	0	0	0	0	0	277
Chandigarh	28	0	8	0	0	0	0	0	0	0	0	0	36
Chhattisgarh	33	0	4	0	0	0	0	0	0	0	0	0	37
Delhi	2887	0	31	0	0	0	0	0	0	0	0	0	2918
Goa	4	0	3	0	0	0	0	0	0	0	0	0	7
Gujarat	1931	0	1369	0	0	0	0	0	0	0	0	0	3300
Haryana	163	0	119	0	14	0	0	0	0	0	0	0	296
Himachal Pradesh	37	0	2	0	0	0	0	0	0	1	0	0	40
Jammu and Kashmir	458	0	65	0	0	0	0	0	0	0	0	0	523
Jharkhand	80	0	1	0	0	1	0	0	0	0	0	0	82
Karnataka	219	0	284	0	0	0	0	0	0	0	0	0	503
Kerala	205	0	256	0	1	0	0	0	0	0	7	0	469
Ladakh	7	0	13	0	0	0	0	0	0	0	0	0	20
Madhya Pradesh	2061	0	29	0	0	0	0	0	0	0	0	0	2090
Maharashtra	7963	0	103	0	0	0	0	2	0	0	0	0	8068
Manipur	1	0	1	0	0	0	0	0	0	0	0	0	2
Meghalaya	12	0	0	0	0	0	0	0	0	0	0	0	12
Mizoram	0	0	1	0	0	0	0	0	0	0	0	0	1
Odisha	85	0	18	0	0	0	0	0	0	0	0	0	103
Puducherry	3	0	5	0	0	0	0	0	0	0	0	0	8
Punjab	217	0	104	0	1	0	0	0	0	0	0	0	322
Rajasthan	2142	0	41	0	2	0	0	0	0	0	0	0	2185
Tamil Nadu	1825	0	52	5	0	0	1	0	2	0	0	0	1885
Telangana	955	0	36	10	0	0	0	0	0	0	0	0	1001
Tripura	2	0	0	0	0	0	0	0	0	0	0	0	2
Uttar Pradesh	1827	1	45	0	0	0	0	0	0	0	0	0	1873
Uttarakhand	46	0	4	0	0	0	0	0	0	0	0	1	51
West Bengal	594	0	17	0	0	0	0	0	0	0	0	0	611
MS	2	0	0	0	0	0	0	0	0	0	0	0	2
N	25184	1	2658	15	18	1	1	2	2	1	7	1	27891

Missing, MS; Canada, C; India, IN; Indonesia, ID; Italy, I; Malaysia, ML; Myanmar, MY; Phillipines, PH; Thailand, TH; Tibet, TB; Total, N

Figure 1 reveals COVID-19 Active Cases and Case Fatality Rates by states of India as on July 02, 2020 indicating that the worst state with highest number of active cases around 160 per 100,000 population was Delhi with Case Fatality Rate (44.6 per 1000 Cured and Deaths). Ladakh was second worst in highest number of active cases (147 per 100,000 population) followed by Maharashtra, Tamil

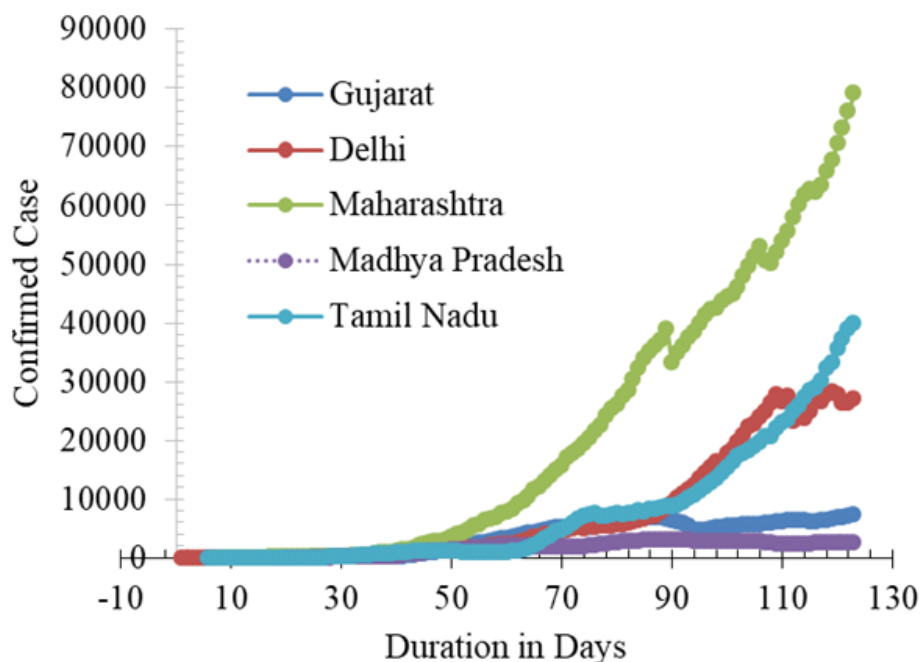
Nadu and Goa. Case Fatality Rate was highest in Maharashtra (79.6 per 1000 Cured and Deaths) followed by Gujarat, Madhya Pradesh, West Bengal, Delhi and so on. The best state was Meghalaya with active cases 0.3 with alarming Case Fatality Rate 22.3 followed by Jharkhand with respective Rates 1.7 and 7.7.



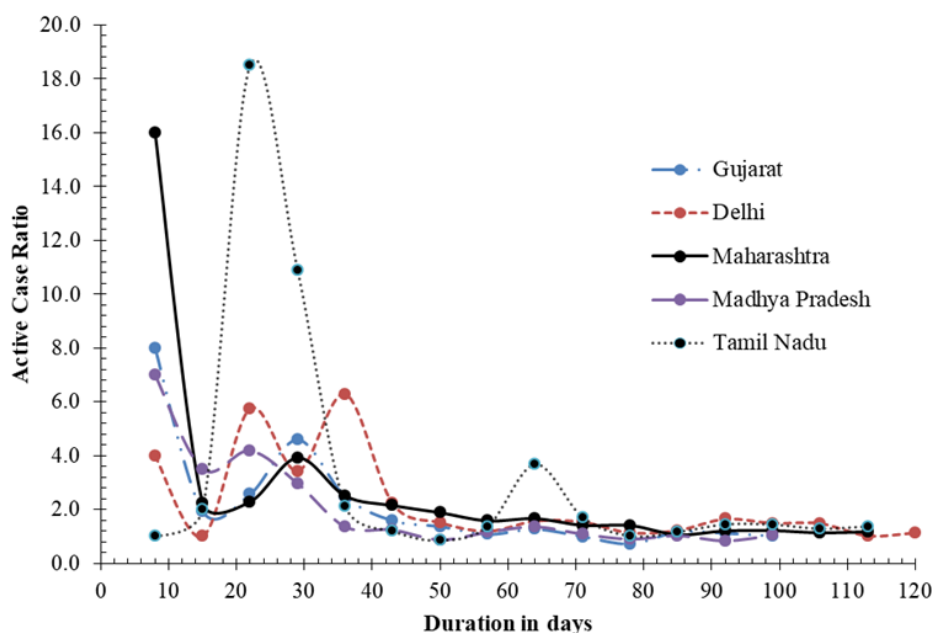
**Figure 1** COVID-19 Active Cases /100,000 population and Case Fatality Rate (CFR) by states of India as on 02 July, 2020.

Figure 2 & 3 depicts the situation and measures of COVID-19 cases among the states having highest number of COVID-19 cases in India, Maharashtra is at top most in number of COVID-19 cases, with high fluctuation in between 10 to 30 days, from the first days of case diagnosed. After 30 days, spread of cases declined, and was continued

up to 90<sup>th</sup> days. Thereafter, Active Cases were neither increased nor decreased in the state. Similar condition was seen in Delhi and Tamil Nadu, which have second and third greatest number of cases in the states. Figure 3 also depicts that Delhi and Tamil Nadu is in worst situation in controlling of COVID-19 than the other state.



**Figure 2** Confirmed Cases among States having highest number of COVID-19 Cases in India, 2nd March – 2nd July, 2020.



**Figure 3** Active Case Ratio among States having highest number of COVID-19 Cases in India, Case at beginning to - 29 June, 2020.

## Discussion

The novel corona virus disease 2019 caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has been spreading hastily across the world. Its outbreaks went along with mostly regular patterns of logarithmic increase of case counts, with a few notable exceptions. The case fatality rates differ substantially between countries.<sup>10,11</sup> The novel corona virus disease 2019 started from Wuhan city of Hubei province, covered to the entire nation by December 2019. On January 20, 2020, there were about 282 cases; it was in four countries such as China, Japan, Republic of Korea and Thailand. Eleven days later, on January 30, 2020, there were almost

7818 Cases and 170 deaths in 19 countries, including India, an increase nearly 27% cases.<sup>1</sup>

In India, COVID-19 takes place on 30<sup>th</sup> January 2020 by a woman of aged 20 year, who came from the Wuhan (China). After this, four more Indian were detected positive with COVID-19; two travelled from China (detected on 2nd and 3rd February, 2020), and one each from 'Austria & Italy' and Dubai detected on 2nd March, 2020. Surprisingly, 16 more cases were again detected positive; one was on 3rd March and remains 15 was on 4th March, 2020. Resultant a total case of COVID-19 became 21 by 4<sup>th</sup> March, 2020. These cases were diagnosed in five different states (Kerala, Delhi, Telangana, Rajasthan and Haryana) of India, when government of India was busy others



opposition party in Lok Sabha election. In addition, on 11 March 2020, COVID-19 was declared as a pandemic by the WHO, pointing to the over 118,000 cases of the coronavirus disease in over 110 countries and territories, and it continued risk of further global spread.<sup>12</sup>

In India, first lockdown was declared by Prime Minister on March 24, 2020, which was implemented from mid-night on same date for breaking the chain of novel corona virus disease 2019.<sup>13</sup> He told that this is the only way to save the country, which was right, but was too late. Because, till 4<sup>th</sup> March, 2020, the cases were in only 5 states such as Kerala, Delhi, Telangana, Rajasthan, Haryana, and reached in 24 states namely Kerala, Delhi, Telangana, Rajasthan, Haryana, Uttar Pradesh, Ladakh, Tamil Nadu, Jammu and Kashmir, Karnataka, Maharashtra, Punjab, Andhra Pradesh, Uttarakhand, Odisha, Puducherry, West Bengal, Chandigarh, Chhattisgarh, Gujarat, Himachal Pradesh, Madhya Pradesh, Bihar, Manipur by March 24, 2020,<sup>9</sup> resultant total number of cases and deaths continuously increased, and reached at community level.

The total 531 Indian were diagnosed with COVID-19, had travelled from abroad on before 26th April, 2020. Out of total COVID-19 diagnosed cases, around 46 percent (244) persons were travelled from Dubai, followed by UK (around 9%), Saudi Arabia (around 6%), USA (around 5%), Iran (around 4%), London (around 4%), Italy (around 3%) and so on. From this, it is clear that cases in majority, came from Dubai, and they are all Indian. On the other hand, out of 18 Italian cases, 14 were diagnosed with COVID-19 in Haryana, two were in Rajasthan, and one each from Punjab and Kerala. Similarly, 15 Indonesian tourists were found with infectious diseases: 10 were diagnosed in Telangana and 5 in Tamil Nadu. Seven tourists of United Kingdom were diagnosed with COVID-19 in Kerala state of India. It was surprised that no one foreigner tourist was diagnosed as COVID-19 in Maharashtra state till 26 April, 2020, but situation of Maharashtra was worst i.e. burden of COVID-19 cases was found higher in Maharashtra than the other states of India.

The worst state with highest number of active cases was Delhi followed by Ladakh Maharashtra, Tamil Nadu and Goa. Case Fatality Rate was found highest in Maharashtra (79.6 per 1000 Cured and Deaths) indicated that either cases reported to health system at severe condition or health management was not working properly. Delhi and Tamil Nadu was in worst situation in controlling of COVID-19 than the other state, may be due to movement of labour. The best state was Meghalaya followed by Jharkhand.

## Conclusion

In India, first cases were diagnosed with COVID-19 in 5 states, Haryana, Rajasthan, Punjab, Kerala, Telangana and Tamil Nadu and reached in 24 states before lockdown of India. Active Cases are highest in Delhi, followed by Ladakh, Maharashtra, Tamil Nadu Goa and so on. Indian, travelled from different countries and Indian government are responsible for spreading of COVID-19 throughout the country. Delhi and Tamil Nadu was in worst situation in controlling of COVID-19 than the other state. The reason for wide variation in active cases of COVID-19 may be unrest in community due to labour movement. Hence, for COVID-19 containment, there is need necessary steps for

providing better health facilities, awareness of positive and negative effect of COVID-19 and restricting the state-wise public movement until COVID-19 will not come under control.

## Ethical approval and consent to participate

Not applicable.

## Consent for publication

Not applicable.

## Availability of supporting data

This study was based on secondary data sources, available on <https://www.kaggle.com/sudalairajkumar/covid19-in-india>.

## Competing interests

The authors declare that they have no conflict of interest.

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