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Distribution of Covid-19 cases: Geographical View of Karnataka State

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ABSTRACT: COVID-19 is now one of the most contagious diseases discovered recently and has spread across China in 2019 and has received global attention. In most COVID-19-infected individuals, respiratory symptoms should be mild to moderate and improve without the need for medical care. The risk of serious disease is higher for senior citizens and people with serious health problems, such as heart disease, diabetes, severe respiratory disease, and cancer. The World Health Organization (WHO) has formally declared the outbreak of COVID-19 to be a global pandemic. As on the current data we see a large number of people testing positive for covid-19 everyday. In Karnataka total, confirmed cases are 25,67,449, active cases 35,00,666, Recovered 21,89,064 and deceased cases 28,298 had been reported by the Ministry of Health and Government of Karnataka. The research aims to analyze the spatial distribution of COVID-19 and its trends with the help of GIS software. At this time, there are no precise antibiotics or treatment options for COVID-19. Besides, several ongoing clinical studies are assessing effective treatments. The best way to protect and sluggish transmission should be well advised about the current COVID-19 virus, the disease it triggers, and also how it continues to spread. Therefore, monitoring active ties using GIS spatial analysis is very important to control such as a COVID-19 virus spreading problem.

KEYWORDS: Covid-19, Karnataka, Distribution, Number of cases

I. INTRODUCTION

The novel coronavirus disease (COVID-19) has already affected over 6.9 million people, claiming more than 400 000 lives in over 200 nations all over the world. As of June 9, 2020, most of the cases were reported from Bangalore city with a spike of 42 new cases followed by 2 deaths. Some districts have successfully been able to flatten the pandemic curve, while other districts are finding it difficult to achieve the same. The novel coronavirus disease has also infiltrated into Karnataka; hit over 2567449 cases have been reported from the state. With a population of more than 6.41 crores people, Karnataka has become the new epicentre of COVID-19. Due to the remarkable population density, poor socioeconomic conditions, and health care resources, the World Health Organization (WHO) recently stated that the “future of the pandemic will depend on how state and country handle it. The paper presents a summary of the present scenario of COVID-19 in Karnataka with their effective response and major challenges that lie in the road ahead.

Karnataka, a state in the southern part of India, has a population of 64.41 million spread across 30 administrative units called districts. Karnataka state reported the first case of COVID-19 in an international traveller on March 8, 2020, in Bangalore. In the subsequent three months (March 8 to May 31, 2020) the number of COVID-19 cases steadily increased to 3404 in the state. The health authorities of the state initiated laboratory-based surveillance, traditional infection control, and public health strategies to contain the spread. These included tracing, testing, and tracking of contacts and isolating COVID-19 positive subjects. The state implemented several public health measures, including retrospective contact tracing, surveys for influenza-like illness, and strengthening the laboratory network under the Integrated Disease Surveillance Programme (IDSP). Also, the state had more than 17 task forces set up under the Karnataka State Disaster Management. Several innovative measures were taken to tackle COVID-19 in the initial months. For example, invoking powers under the Epidemic Diseases Control Act, the state started using information from available apps to notify people about their possible interaction with a COVID-19 positive person.

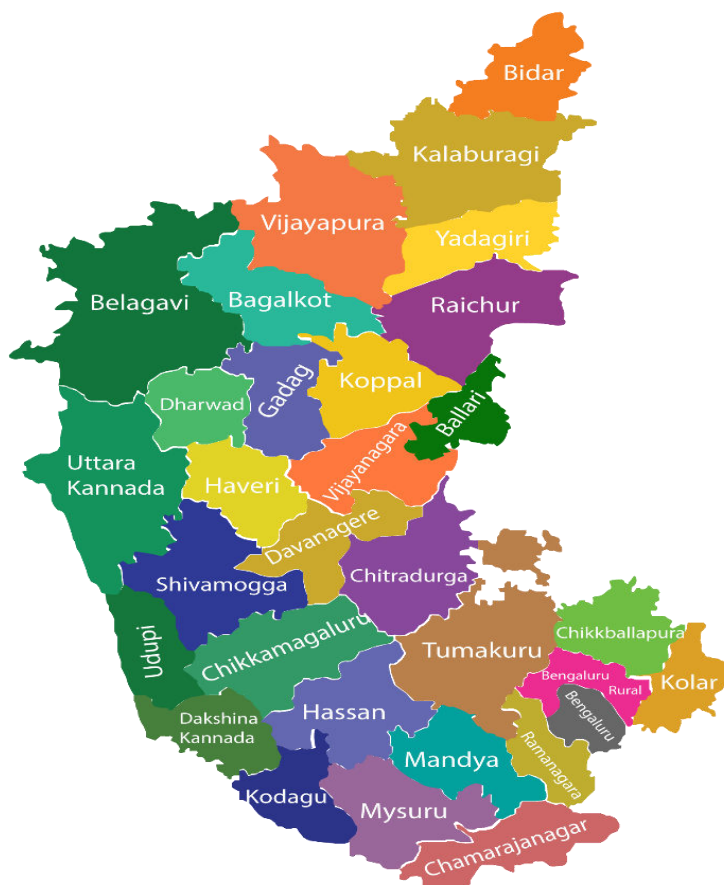


Fig-1: Map of Karnataka State

II. STUDY IMPLICATIONS

From the beginning of the pandemic, there has been considerable debate on the role of asymptomatic and symptomatic persons in spreading the SARS-CoV-2 infection. Initially, the World Health Organization (WHO) inferred that the role of asymptomatic persons in transmission was minimal. However, the WHO acknowledged later that there is a growing body of evidence that even asymptomatic persons can spread the disease. Previous reports suggest that nearly 4 % to 32% of the infections are spread through asymptomatic persons.

Determining the role of asymptomatic persons in viral transmission in low and middle-income countries (LMICs) is very important. The urban areas in all districts have high population density, poor personal hygiene, with ubiquitous crowding. In this report, we describe the epidemiology of SARS-CoV-2 infection in the southern state of Karnataka, India, during the lockdown phase with special emphasis on transmission dynamics of symptomatic and asymptomatic cases.

Distribution of Covid-19 cases in Karnataka:

The following table shows the district-wise distribution of covid 19 cases in Karnataka. As per the data analysis, we see the hike of cases in three districts i.e. Bengaluru Urban, Mysore, and Tumkur. The main question lies here is...

**Why District-wise consideration?**

Karnataka is a vast state with a geographic area of **1,91,791** square kilometres and a vast population of about 6.41 crores. Analyzing coronavirus infection data, considering the district-wise cases it is easy to sketch out the particular areas which come under the high infected zone. Different methodologies have been used to figure out the basic problems of infection in most of the districts. If we look into the data from the below table the findings suggest that the districts with the high movement of people were most affected. The people in this district were not liable to follow any guideline related to covid 19 and which internally turned into the most infectious zone

Table-1: District wise Distribution of Covid-19 cases in Karnataka

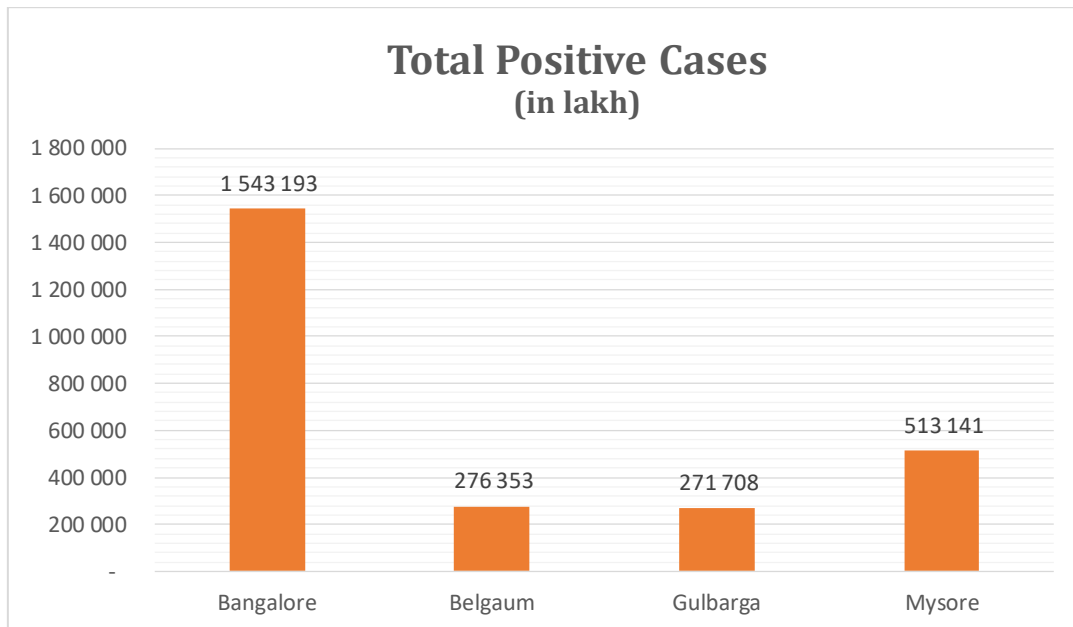
District-wise Distribution of COVID-19 in Karnataka					
Sl. No	District Name	Total Positives	Total Discharges	Total Active Cases	Total Covid Deaths
1	Bagalakote	32,964	30,457	2,226	281
2	Ballari	91,464	81,085	9,021	1,358
3	Belagavi	65,885	50,084	15,250	551
4	Bengaluru Rural	53,625	43,942	9,020	663
5	Bengaluru Urban	11,63,229	10,03,839	1,46,043	13,346
6	Bidar	23,838	23,111	346	377
7	Chamarajanagara	27,051	23,592	3,059	389
8	Chikkaballapura	38,039	33,768	3,966	304
9	Chikkamagaluru	37,758	31,798	5,703	257
10	Chitradurga	29,439	22,268	7,029	142
11	Dakshina Kannada	76,199	66,153	9,133	911
12	Davanagere	42,394	37,724	4,314	356
13	Dharwad	55,720	48,992	5,758	969
14	Gadag	23,566	20,786	2,530	250
15	Hassan	84,570	69,231	14,431	907
16	Haveri	19,716	17,663	1,613	440
17	Kalaburagi	60,074	57,521	1,785	768
18	Kodagu	25,000	22,522	2,255	223
19	Kolar	38,600	31,383	6,870	347
20	Koppal	31,664	27,594	3,649	421
21	Mandya	61,042	54,963	5,631	448
22	Mysuru	1,42,815	1,26,106	15,085	1,624
23	Raichur	38,051	33,207	4,573	271
24	Ramanagar	22,286	20,031	1,994	261
25	Shivamogga	52,216	44,697	6,712	807
26	Tumakur	1,03,365	90,505	11,958	902
27	Udupi	58,706	53,279	5,099	328
28	Uttara Kannada	45,260	39,779	4,906	575
29	Vijayapura	33,242	30,885	1,947	410
30	Yadagiri	26,617	24,592	1,824	201
	Total	26,04,395	22,61,557	3,13,730	29,087

Table-2: Distribution of covid 19 cases based on Administrative divisions of Karnataka

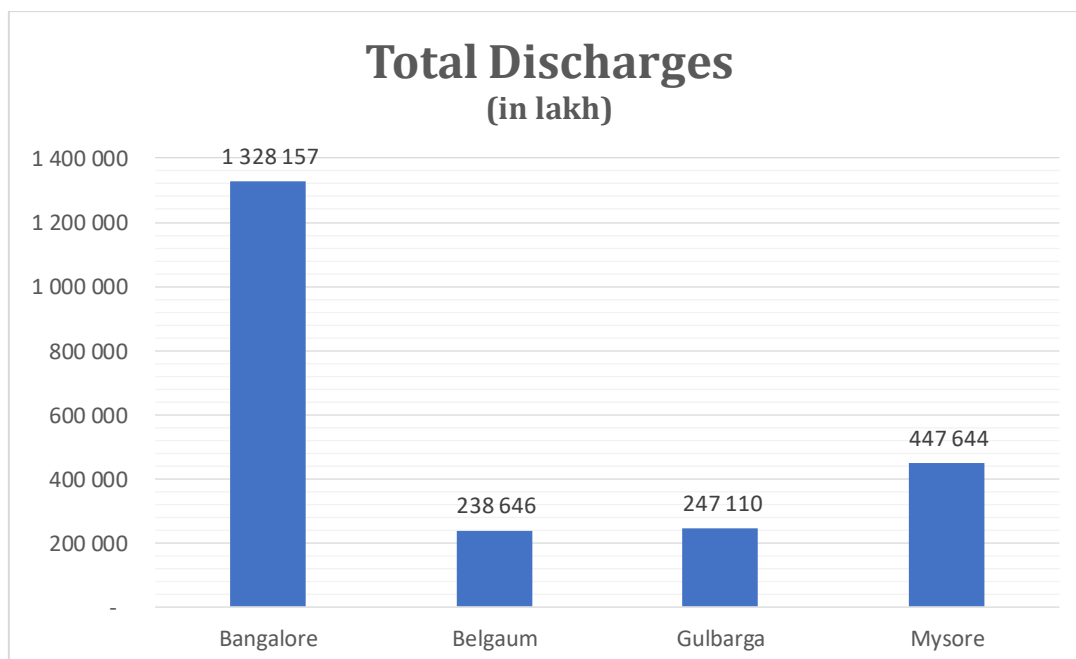
Administration Division	Sl. No	District Name	Total Positives	Total Discharges	Total Active Cases	Total Covid Deaths
Bangalore	1	Bengaluru Rural	53,625	43,942	9,020	663
	2	Bengaluru Urban	11,63,229	10,03,839	1,46,043	13,346
	3	Chikkaballapura	38,039	33,768	3,966	304
	4	Chitradurga	29,439	22,268	7,029	142
	5	Davanagere	42,394	37,724	4,314	356
	6	Kolar	38,600	31,383	6,870	347
	7	Ramanagara	22,286	20,031	1,994	261
	8	Shivamogga	52,216	44,697	6,712	807
	9	Tumakuru	1,03,365	90,505	11,958	902
	Total		15,43,193	13,28,157	1,97,906	17,128
Belgaum	10	Bagalakote	32,964	30,457	2,226	281
	11	Belagavi	65,885	50,084	15,250	551
	12	Vijayapura	33,242	30,885	1,947	410
	13	Dharwad	55,720	48,992	5,758	969
	14	Gadag	23,566	20,786	2,530	250
	15	Haveri	19,716	17,663	1,613	440
	16	Uttara Kannada	45,260	39,779	4,906	575
	Total		2,76,353	2,38,646	34,230	3,476
Gulbarga	17	Ballari	91,464	81,085	9,021	1,358
	18	Bidar	23,838	23,111	346	377
	19	Kalaburagi	60,074	57,521	1,785	768
	20	Koppal	31,664	27,594	3,649	421
	21	Raichur	38,051	33,207	4,573	271
	22	Yadagiri	26,617	24,592	1,824	201
	Total		2,71,708	2,47,110	21,198	3,396
Mysore	23	Chamarajanagara	27,051	23,592	3,059	389
	24	Chikkamagaluru	37,758	31,798	5,703	257
	25	Dakshina Kannada	76,199	66,153	9,133	911
	26	Hassana	84,570	69,231	14,431	907
	27	Kodagu	25,000	22,522	2,255	223
	28	Mandya	61,042	54,963	5,631	448
	29	Mysuru	1,42,815	1,26,106	15,085	1,624
	30	Udupi	58,706	53,279	5,099	328
	Total		5,13,141	4,47,644	60,396	5,087

As per the above table, the distribution study has been divided into four administrative divisions of Karnataka. The study provides complete information about total active cases, Total deaths, and Total positivity rate in each division. The divisions which were the source of employment for most of the people who were employed in IT sector, Private sector and public sector were mostly affected as there was a large number of migration of people in different places. Hence this led to a Pandemic zone with complete lockdown.

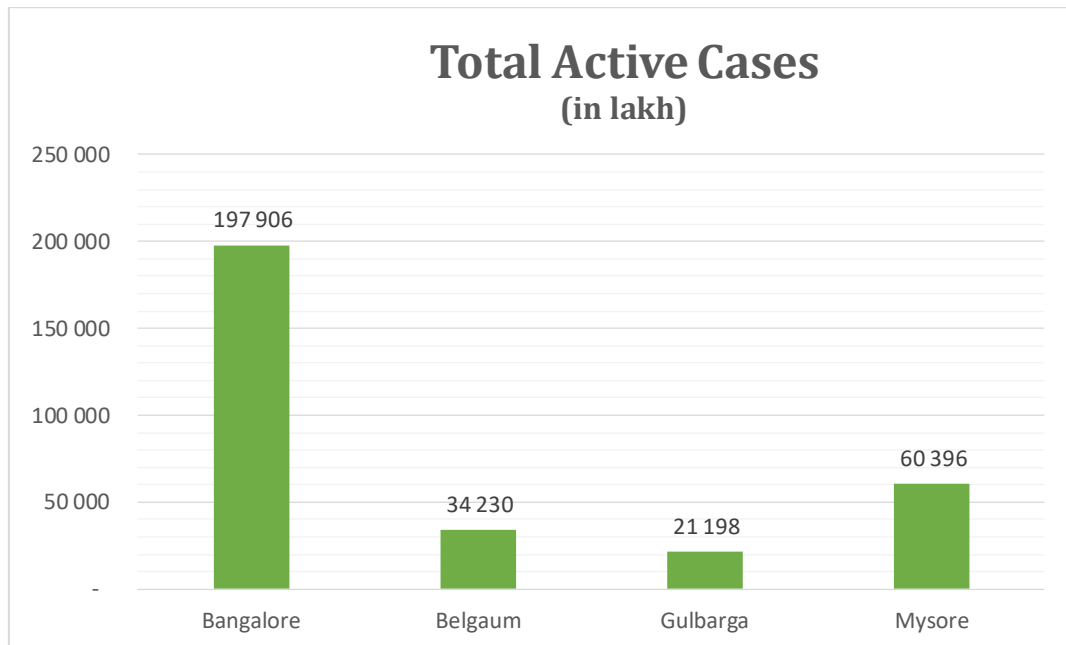
Graph 1.1 Total Number of Positive Cases (in Lakh)



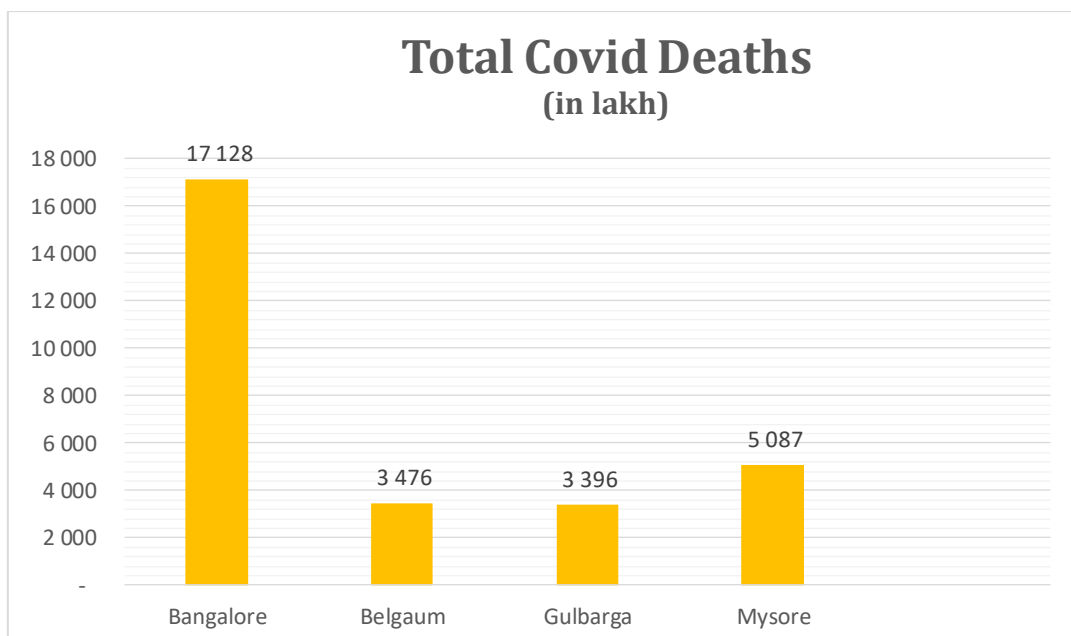
Graph 1.2 Total Number of Discharges (in Lakh)



Graph 1.3 Total Number of Active Cases (in Lakh)



Graph 1.4 Total Number of Deaths (in Lakh)





List of Preventive measures taken by Karnataka Government:

- ❖ Health screenings at airports and border crossings
- ❖ Introduction of quarantine policies: gradually for passengers coming from different countries
- ❖ Visa restrictions: gradually for different countries
- ❖ Limit public gatherings
- ❖ Border checks
- ❖ Border closure
- ❖ Limit public gatherings
- ❖ Travel restrictions
- ❖ Testing for the coronavirus disease
- ❖ Flight suspensions
- ❖ Cancellation of passenger train /bus services etc.
- ❖ Suspension of domestic airplane operations
- ❖ 21-day lockdown of the entire state with further extension if required
- ❖ Cancellation of Goods Transportation services
- ❖ Increase of quarantine/isolation facilities

Phases of Lockdown in Karnataka:

From March 25, 2020, the state was under complete lockdown until May 31, 2020, in four phases. The first phase of the lockdown was from March 25, 2020, to April 14, 2020. The second phase of lockdown was from April 15, 2020, to May 03, 2020, the third phase of lockdown from May 04–17, and the fourth phase from May 18–31, 2020. From the beginning of the third phase, the Government of India issued guidelines permitting inter-district and inter-state travel for stranded persons. Consequently, there was a huge surge of COVID-19 positive cases from May 4–31, by which time most of the residents of Karnataka ($n = 93,073$) from other states, especially from those with a high burden of COVID-19 cases, returned home. As of September 16, 2020, a total of 8,932,699 samples have been tested in the state, of which 851,212 tested positive (9.5%).

Reasons for a surge of covid 19 cases in Karnataka

1. Double mutant' variant:

The discovery of a new variant of Covid-19 in India and Karnataka state has caused widespread concern and has been blamed as one of the main factors driving the wave of cases. The variant is known as B.1.617 and has two unusual mutations: E484Q and L425R. This so-called “double mutant” variant is believed to be more transmissible than previous strains

2. Health system overwhelmed:

There are multiple reports of people being unable to find hospital beds, with desperate relatives pleading on social media for help to find care. There is also a severe shortage of medical supplies, especially oxygen. Just as was the wider health system, laboratories were unprepared for the steep rise in demand for testing that came with the surge and the demand for vaccines has increased three times compared to last year.

3. Lockdowns eased too quickly:

India was praised for its swift lockdowns last year but there has been criticism of the government for allowing restrictions to ease too quickly. Many states including Karnataka were very easy in the following lockdown with not following any guidelines of covid 19. Many political rallies were undertaken without proper

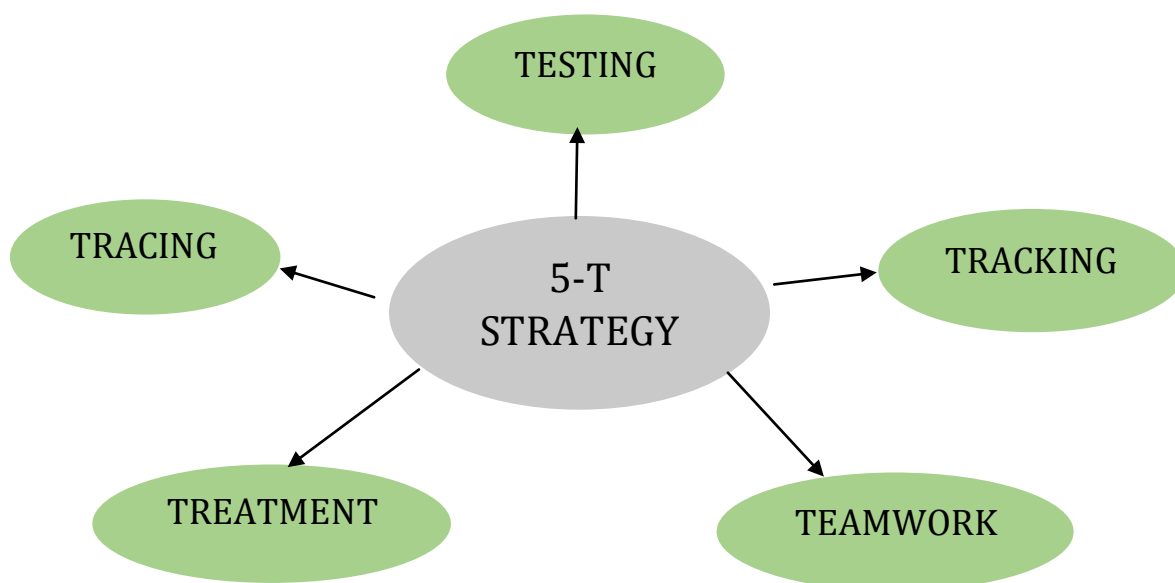
social distancing. Festivals were also allowed to go ahead, which has attracted as many as 25 million people since January, including about 4.6 million last week alone, with most people ignoring Covid-19 guidelines.

4. Vaccine rollout:

Massive vaccination programs in India, as well as Karnataka, were introduced but it has not been enough to stem the tide. More than 100m doses have been delivered but the country, as well as other states, have been hampered by a lack of supply.

5-T Strategy to prevent the spread of covid-19 in Karnataka.

The policy of trace, track, test, treat and technology (5T) was pioneered by Karnataka to fight the pandemic.



1. Tracing:

More than 10,000 well-trained field staff carry out specific responsibilities for contact tracing as per the detailed plan designed by the state which prescribes step-by-step actions to be performed by each designated person. The Contact Tracing mobile app and web application are being used to overcome the huge quantum of work, genuine forgetfulness of the positive persons, and attempts to hide facts due to various reasons.

Karnataka has conducted a physical and phone-based household survey. The survey was carried out during May 2020 and covered 15.3 million households out of a total of 16.8 million total households in Karnataka. Polling Booth Level Officers (BLO) were engaged to collect necessary information by using a Health Survey App as well as a Web Application.

2. Tracking:

All persons returning or traveling to Karnataka are required to register on the "Seva Sindhu" portal, which enables the state to follow them for the next few days when they are at home or in institutional quarantine. The 'Quarantine Watch App' is used to assist the field workers in enforcing the quarantine. The state government has also formed Mobile Squads for the enforcement of home quarantine through community participation. In case information about the violation of quarantine is received from a neighbour or some member of the public, that violator is moved to institutional quarantine.



3. Treatment

According to data from the Karnataka state COVID-19 war room, the state has 84,776 beds in its districts, of which 21,728 have been reserved for COVID-19. A total of 19,639 beds were available in Bengaluru Urban and Rural districts. And of these, 3,470 were reserved for COVID-19 in the two districts. More than 86% of the 21,728 beds were isolation beds — 6,695 with oxygen facilities, 2,105 ICU beds, and 1,000 with ventilators. With the number of COVID-19 cases in Karnataka going up, the hospital bed occupancy in Karnataka which was at less than 2% till May 8, had shot up to 13.1% by June 9.

The Karnataka Government issued an order to fix the rates for COVID-19 treatment in private hospitals. The rates range from ₹5,200 to ₹25,000 depending on the category and severity of the infection and can be availed by both Ayushman Bharat-Arogya Karnataka (AB-ArK) patients and other insurance/cash-paying patients. The State Government also directed 50% of beds in private hospitals having facilities to treat COVID-19 patients should be reserved for patients referred from public health authorities.

4. Technology

Karnataka was among the many states which decided to turn to technology to help government officials manage the number of tasks cropping up due to the COVID-19 pandemic. Through a team of in-house programmers, the state rolled out a series of mobile applications in the first three months of the pandemic in the country including a contact tracing application. Apart from the application for contact tracing, the state also introduced the 'Quarantine Watch', to keep a watch over and enforce quarantine of travelers who returned to Karnataka, 'Yatri Web App' to track international arrivals, and the 'Critical Patient Tracking System' to track all critical patients in the state.

Other applications were created like the 'Daily Mail and Air Passenger Arrival Tracking' to track arrivals of people coming into the state and the 'Health Watch App' which recorded data of the door-to-door survey done by health workers and identified vulnerable households. The data collected were transferred to other applications like the Aapthamithra and was used by the health department to follow up.

5. Testing

By June 2020, the state was conducting an average of 10,000 tests per day. The state contains 74 laboratories for testing compared to the total of 600 labs in the whole country.^[63] Due to the rising COVID cases, the Karnataka government said that it was planning to initially increase testing capacity to 15,000 and then to 25,000 samples a day. The Karnataka Government directed the conduction of random testing using the RT-PCR pooled sample technique, for slum dwellers, vendors/bill collectors, delivery boys of food chains and couriers, to ensure effective surveillance because of the recent increase in COVID-19 cases in the state.

III. CONCLUSION

The COVID-19 situation has evolved over the last few months since the first outbreak had occurred in Wuhan. A lot of information is available for the state to react effectively from these learnings both at the national as well as the international level. Neither data nor medical reasons suggest blanket lockdown. Hence, a blanket lockdown across the state would hurt the public in general and the marginalized & daily wage earners, in particular. It also adversely impacts the MSME sector and reviving it would prove difficult. However, lockdown, complete or partial, gives time for the Government and health establishments to prepare well for better action plans and resources for fighting the pandemic. It is, therefore, necessary to tread the line between lockdown and operations cautiously to ensure that there are no severe consequences of either decision on those at the highest risk.

Note: The following data is based on the current status of covid-19 cases in Karnataka state till today.

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