

Current and Future Trends for COVID-19: A Case Study of Vadodara, India

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Abstract

Background: COVID-19 has been a pandemic and global disaster since the beginning of 2020. However, there is a lack of city/locale based studies on status and trends of COVID-19 in India.

Aim: The study aims to report the tests, total cases, cases per age group, zone wise confirmed cases and the status of hospitalization / home quarantining for COVID-19 for the smart city of Vadodara.

Methods: A retrospective secondary data analysis conducted on all the COVID-19 cases reported from 3rd April to 15th September 2020 for the city of Vadodara. Data were accessed through the Website of Vadodara Municipal Corporation and analyzed on cumulative number of tests, positive cases, deaths and patients' recovery for comparison of Vadodara with the State, National and International statistics.

Results: COVID-19 was found to be more prevalent among males. The age group of 51-60 years had the highest number of cases. The number of deaths was highest in the age group of 61-70 years. Nonetheless, case fatality rate was highest in the age group of 71-80 years. Vadodara also has shown a steady decrease in test positivity rate and fared better in terms of recovery rate as compared to Gujarat, India and the world. However, 15 day moving average of positive cases and deaths indicated that there will be an increase of the cases in near future.

Conclusion: Vadodara showed positive trends in managing the COVID-19 pandemic. Vadodara administration had managed to reduce the case fatality rate as compared to Gujarat, India and rest of the world.

Key Words: COVID-19, Virus, Pandemic, Smart City, Vadodara

Introduction

The current Corona virus disease 2019 (COVID-19) pandemic has led to more than 29,727,390 cases and 939,289 deaths globally as of September 15, 2020.^[1]

Although most infections are self-limited, about 15% of infected adults develop pneumonia that requires treatment with supplemental oxygen and an additional 5% progress to critical illness with hypoxemic respiratory failure, acute respiratory distress syndrome, and multi-organ failure that necessitates ventilator support, often for several weeks. ^[2-4] At least half of patients with COVID-19 requiring invasive mechanical ventilation have died in hospital, ^[4,5] and the associated burden on health-care systems, especially intensive care units, has been overwhelming in several affected countries.

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Till date there is no proven treatment and availability of vaccine for COVID-19 hence clinicians and public health experts are focusing on preventive measures till vaccine and effective anti-viral drugs are available for everyone.

On 15th September 2020, India ranked 2nd in the list of countries having most cumulative cases with 4,938,293 active cases and 3rd in cumulative deaths (82,066).^[6] The situation poses a grave challenge for India because of high population density.^[7] There are several variables that are central, such as age, comorbidity, amount of virus exposure, etc., which may assess the seriousness of the infection and the rate of infection recovery.^[8] The higher rate of disease transmission further increases the risk especially for urban population. Hence, India went into a lockdown state for 68 days from 25th March to 1st June 2020 and since then India has begun its unlocking phase.^[9] Few studies have shown that the testing rate has increased drastically after the 68 days of lockdown in India. The last day of lockdown had 2,708 tests per million population, which had increased to 16,947 tests per million by first week of August.^[10]

COVID-19 is probably one of the most dreadful words in the lexicon of Gujarat, especially in Vadodara where people equate it with death because of its upward curve towards case fatality rate during initial phase of the epidemic. The panic affected behaviour not only from closing the schools but also people become xenophobic.

Few studies have been conducted on the effectiveness of the lockdown and unlock phases^[10, 11] as well as on the current mortality statistics and trends in India^[12] and state wise also.^[13] Kapasa N et al, and Mahato S et al, have analysed the impact of the lockdown on education and pollution across states and cities.^[14, 15] But very few studies have looked at city/district wise statistics and trends, especially after the start of the unlock phase. City/town based studies have also not been conducted on future prediction on the spread of the disease. This study thus will aim to look at the statistics of a smart city Vadodara of Gujarat State in terms of tests, cases, and cases per age group, zonation of confirmed cases within the city and the status of hospitalization / home quarantining in the city. The trends were studied independently for the smart city of Vadodara and results

were compared with the status of the Gujarat as well as with the Indian data.

Methods

Study Area:

Vadodara is the third largest city in the state of Gujarat and located 140 kilo meter South of the State capital Gandhinagar. It is well connected by air, rail, and road. Vadodara city is a metropole with 2.1 million population governed by Municipal Corporation. Vadodara Municipal Corporation (VMC) reported first diagnosed COVID-19 case on 18th March 2020; a businessman who had a travel history to Spain, Dubai, and Mumbai.^[16] VMC area reported first COVID-19 death on 2nd April 2020. The deceased has history of travel to Sri Lanka from where he had most likely contracted the COVID-19 infection.^[17]

Study Design:

A retrospective secondary data analysis conducted on all the COVID-19 cases reported in from 3rd April to 15th September 2020 for the smart city of Vadodara.

Data Sources:

The secondary data obtained from the public domain sources like Vadodara Municipal Corporation website,^[18] the Gujarat State Government COVID-19 dashboard^[19] the Government of India COVID-19 dashboard,^[20, 21] and Worldometer global corona virus database.^[22] The information collected for the study includes daily updates as well as cumulative statistics. The information collected for Vadodara includes number of tests carried out on suspected patients for diagnosis of COVID-19, demographic profile of the cases, total number of positive tests, number of patients recovered, number of active cases, and number of deaths in Vadodara city. This analysis considered the data available on the website from April 03, 2020 till September 15, 2020 i.e. of 166 days. For comparison of Vadodara with the State, National and International statistics, data has been taken on cumulative number of tests, positive cases, deaths, active cases and patients' recovery.

Ethical Clearance: The study has utilized existing (secondary) data available in the public domain, and therefore, no direct interaction was made with any

human beings. The data do not have any identifying information (anonymous in analysis).

Statistical Analysis: Data were processed in Microsoft Excel and analysed through Excel 2013 and SPSS (20.0). Data for age, sex, location, tests, confirmed cases and mortality were analyzed and percentages for categorical variables were calculated. The 15-day moving average was also calculated and predictions were made on the trends of number of tests, number of cases and number of deaths for smart city of Vadodara.

Results

Of 122,104 individual were tested for COVID-19 during the study period, 9,918 were positive. There were 6,506 (66%) male and 3,412 (34%) female cases.

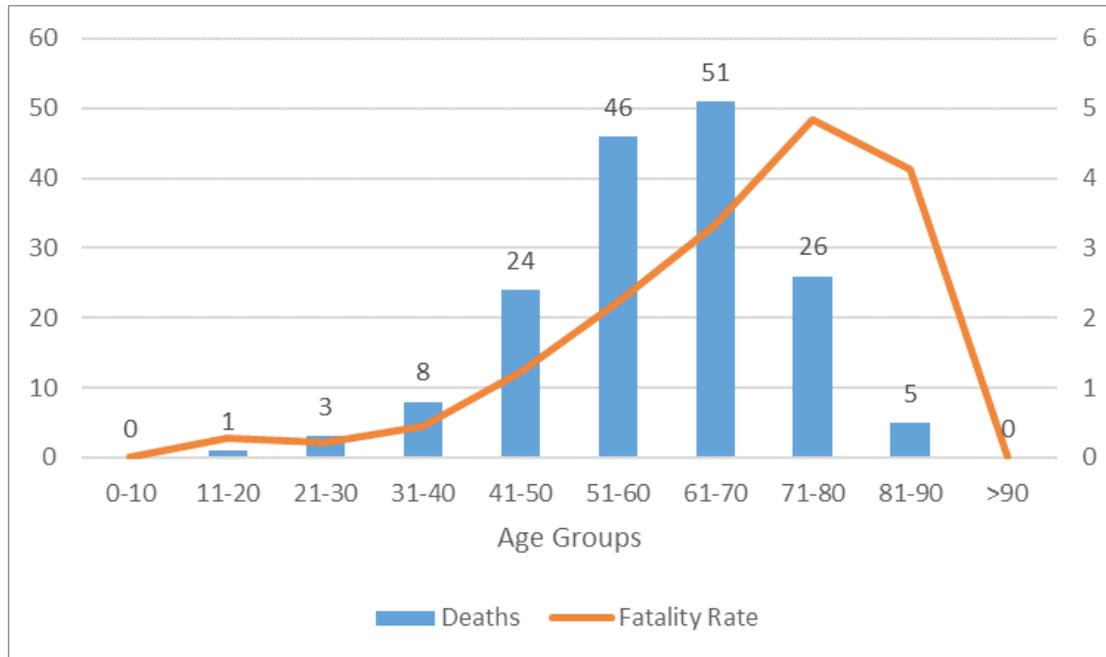


Figure 1: Age Distribution of Deaths due to COVID-19 in Vadodara, India

Figure 1 depicts the age and case fatality rate wise distribution of the COVID-19 in Vadodara. A total of 164 deaths have occurred during the study period of 166 days. While the number of deaths is highest between the age group of 61-70 years, but the case fatality rate (CFR) is highest in the age group of 71-80 years.

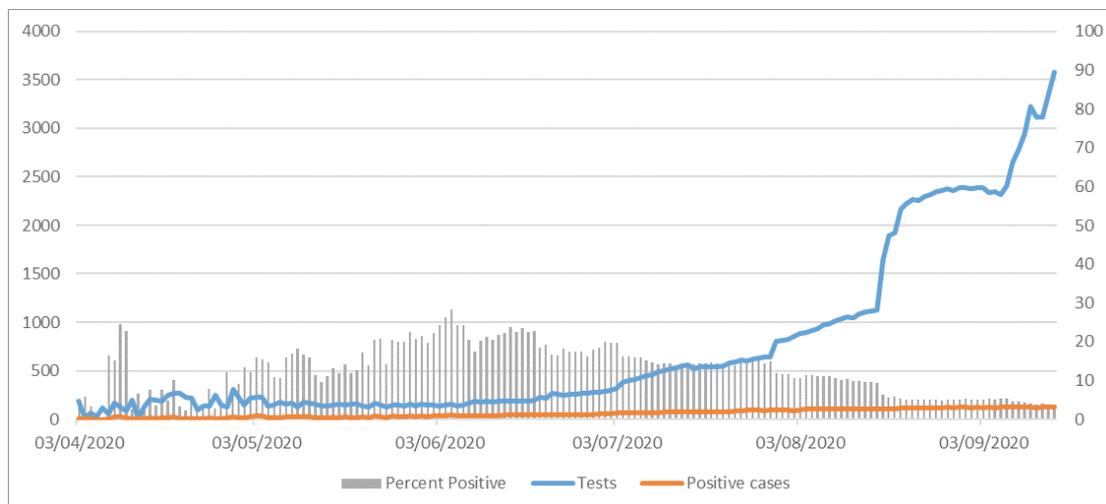


Figure 2: No. of tests, no. of test positive and positive cases % per day

The tests carried out and number of positive samples for COVID-19 have been increasing over the period but the percentage of positive cases per day were in decreasing trend. There was a gradual increase in percentage of positive cases against test carried out per day till first week of June 2020. Twenty-eight per cent of the laboratory samples tested positive for COVID-19 on 5th June 2020, then there is a gradual decline in percentage of positive samples which is around 3.5% as of 15th September 2020 (Figure 2).

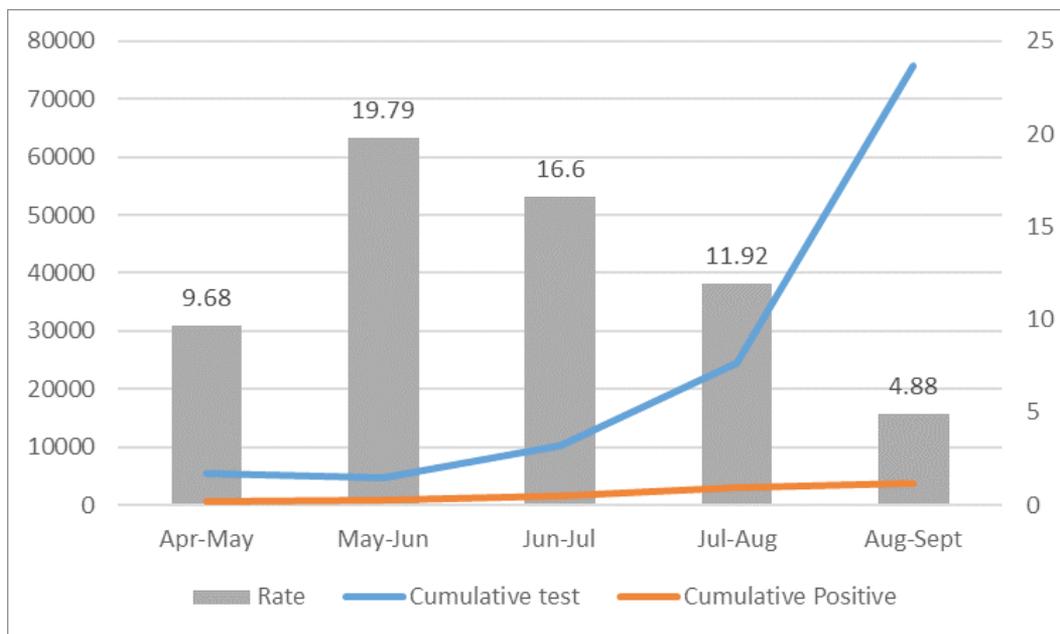


Figure 3: Monthly Tests and Positivity Trends

Figure 3 shows the cumulative tests and rate of positivity. The trends show a spike in the month of May-June but there has been a steady drop since then with the current positivity rate at 4.88% in the month of August-September.

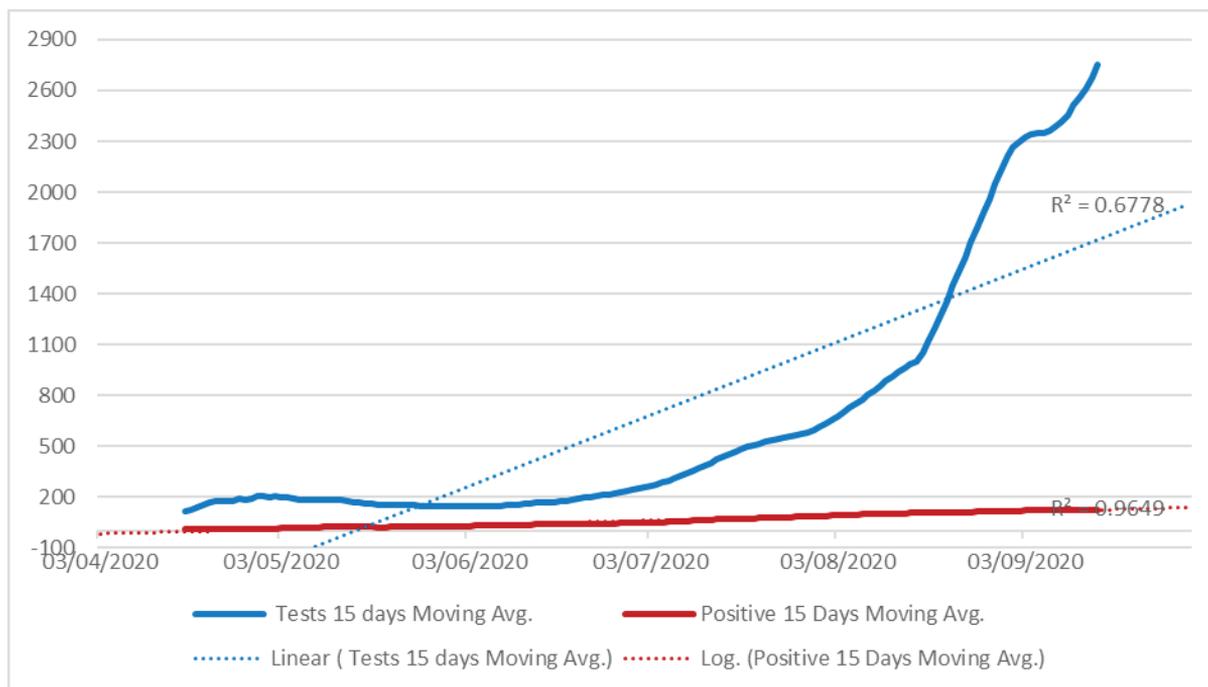


Figure 4: Fifteen (15) Days moving average of positive cases and deaths by COVID-19 (Linear scale)

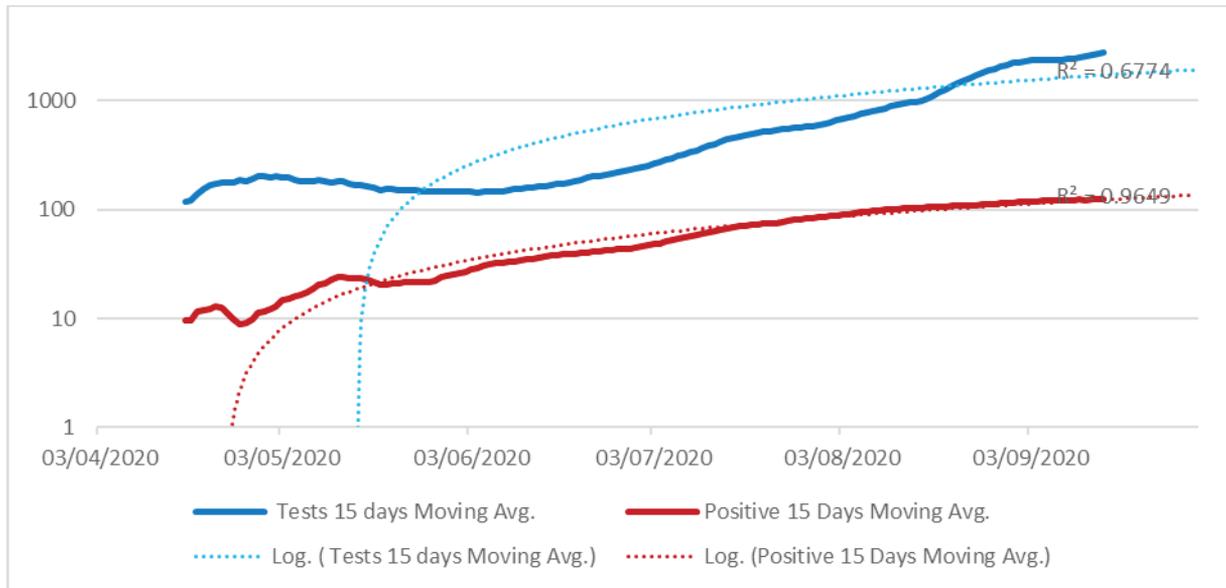


Figure 5: Fifteen (15) Days moving average of positive cases and deaths by COVID-19 (Logarithmic scale)

Figure - 4 and 5 depicts that the fifteen days moving average of positive cases is showing upward trend in the forecast best fit trend line. The occurrence of deaths in COVID-19 patients is also slightly above the forecast best fit trend line.

Table: Distribution of the COVID-19 cases, CFR and recovery rate (15th September 2020), Vadodara, India

Variable	Number of Cases	Percentage
Age (yrs) Group wise distribution*		
0 – 10	138	1.39
11 – 20	350	3.53
21 – 30	1423	14.35
31 – 40	1792	18.07
41 – 50	1953	19.69
51 – 60	2065	20.82
61 – 70	1529	15.42
71 – 80	538	5.42
81 – 90	121	1.22
> 90	9	0.09
VMC Zone wise distribution*		
East	1,613	16.26
West	1,602	16.15
North	2,352	23.71
South	1,935	19.50
Rural	2380	24.00
Outside (VMC limit)	36	0.36

Hospital wise cases*		
GMERS Gotri Medical College Hospital	245	17.68
SSGH (Sir Sayajirao General Hospital)	320	23.10
Private Hospitals	245	17.68
Home Isolation	474	34.22
COVID-19 Care Centre (CCC)	101	7.29
Total Tests Conducted**		
Vadodara	122,104	100.00
Gujarat	3,436,069	100.00
India	59,429,115	100.00
Test Positive (Test Positivity Rate)**		
Vadodara	9,918	8.12
Gujarat	116,345	3.38
India	5,020,359	8.44
Case Fatality Rate (CFR)**		
Vadodara	164	1.65
Gujarat	3,244	2.78
India	82,066	1.62
World	939,289	3.15
Recovery Rate		
Vadodara	8,369	84.38
Gujarat	96,582	83.00
India	3,942,360	78.52
World	2,15,46,861	72.46

*Till 15th September 2020

**On 15th September 2020

Table shows that almost 88% of the COVID-19 cases were in between ages of 21 to 70 years. However, highest number of COVID-19 cases was in the age group of 51-60 years. It also shows that the Rural zone has higher number of cases (24%) followed by the North zone, while West zone has lowest percentage of cases on 15th September 2020. On the day of 15th September 2020 only 34.22% of the patients were in home isolation, 17.68% patients were treated for COVID-19 in private hospitals while 40.78% were treated in Government Hospitals. The COVID-19 Care Centre in Vadodara is handling only 7.29% cases. COVID-19 Test positivity rate for Vadodara is lesser than India but higher than

Gujarat State. The CFR for Vadodara is almost aligned with the national level but it is significantly lower than the Gujarat state as well as for the whole world level. The recovery rate for Vadodara is higher than Gujarat, India as well as for the world (Table).

Discussion

The pandemic of COVID-19 posed a serious threat to the population. Currently it is a cause of great concerns of various health organizations and Governments and given the sleepless nights to health and other administration officials. The handling of COVID-19 outbreak has been a critical issue ever since its inception. To the best of our knowledge, this kind of report is the first from smart city of Vadodara, so we are unable to compare the results of this study with other Indian

studies. Vadodara was chosen as the study area because of the readily available data in the public domain. More so VMC has shown many positive adjectives in handling of the COVID-19 epidemic.

The difference in sex distribution of COVID-19 is significant in Vadodara with the male population having almost double the number of cases than the female population is consistent with State and National level data. This could be possibly explained that because of work / job and movement in the community due to social obligations made the male population more vulnerable to contract the infection than the females. The age distribution shows that the working population has been more affected due to their exposure to the infection. However, the CFR is higher for the age group of 71-80. This finding concurs with the earlier COVID-19 study that higher age and co-morbidities results in more deaths among COVID-19 victims.^[23] The zonal distribution have shown a need for better attention towards the North, South and Rural zones as these have the higher percentages of cases.

The results have shown an increase in the number of tests since April 3rd and an increase in number of daily cases, however, daily test positivity rate has decreased after a huge spike in June 2020. The results have also shown that Vadodara has around 1.65 per cent CFR which is significantly lower than Gujarat, signifying that Vadodara has outperformed the State. This may be due to the innovative measures like COVID-19 management protocols and the untiring efforts of VMC officials. The overall test positivity rate of below 5 percent and a fatality rate of less than 1 percent show that a city, state or country has a grip over the pandemic. However, the test positivity rate is still near the national level which is around 8 per cent but much higher than Gujarat (3.38%). Vadodara has a better recovery rate as compared to the state of Gujarat, India and the World. The current recovery rate is almost 12% more than the international average as on the 15th of September 2020. The continuous streak of very high levels of recoveries is the testimony of the effective clinical management and treatment protocols active in Vadodara. Hence, it is clearly evident that VMC is doing fairly well in terms of handling COVID-19 epidemic. However, cases may rise in near future as per analysis of 15 day moving average of positive cases and deaths.

Limitations:

Some limitations of the study need to be acknowledged.

- The main limitation of the study is that it couldn't include the daily tests and daily results of Gujarat and India from 3rd April 2020 because of the unavailability of the data in the public domain. The availability of daily data for Gujarat and India could have helped in a better comparative analysis for Vadodara.

- This analysis used cumulative data which limited the findings.

Hence, there will be limitation to generalization of observation and results.

Conclusion

The study analyzed COVID-19 situation for the smart city of Vadodara using data on daily tests and cases and compared the data of Vadodara with the state of Gujarat, India and the world. The study has shown that Vadodara has done a good job in containing the spread of the COVID-19 pandemic. As of 15th September 2020, the number of cases in Vadodara stands at 9,918 and the total number of tests stands at 122,104. There is a decrease in percentage of positive cases from around 28 per cent to 3.5 per cent. In terms of mortality and recovery, Vadodara has performed better than the average of Gujarat, India and the rest of the world. The recovery rate is higher as compared to State, National and International, however, the CFR is higher than the Gujarat and the world but almost similar to the India level.

Finding of the study also shows that there will be increase in cases in near future though percentage of test positive and the case fatality rate are in declining trend. The increase in cases would increase the burden on the VMC administration, health infrastructure and resources. Authorities need to reassess the availability of beds, intensive care facility, oxygen supply, medicines particularly required to treat COVID-19, medical and nursing staff in view of increase in the cases.

Recommendations:

The findings from this study may lead to further studies in Vadodara in understanding and dealing the

COVID-19 pandemic at local level. The findings can further lead to nationwide adoption of the measures and help in flattening the COVID-19 curve.

Conflict of Interest: The authors declare that they have no conflict of interests.

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