

Report on

Analysing some critical issues related to dynamics of the COVID 19 epidemic in Maharashtra – an evidence based, public health perspective

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Prepared by

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Valuable inputs have been taken from mentioned experts, the views and positions outlined in this report are responsibility of the Maharashtra Public Health Analysis Group.

Background

As we know, the recently emerged COVID 19 pandemic has developed in rapid and unprecedented manner across the globe and in India, presenting us all with a complex humanitarian crisis. While there is much that we still do not know about this disease, a number of useful analytical papers and articles have been written from different angles concerning the COVID 19 epidemic in India. This includes various official bulletins and guidelines, scientific interventions, as well as regular updates and position papers by civil society networks like Jan Swasthya Abhiyan, addressing various dimensions of the epidemic along with relevant recommendations from a public health and civil society standpoint.

Keeping this background in view, as a voluntary group of public health professionals dealing with Maharashtra (several of us are associated with Jan Swasthya Abhiyan), we have felt the need to ensure better understanding of dynamics of the epidemic in context of this major state - which has been the worst affected in India in terms of numbers of cases and deaths, continuing to climb on a daily basis. Such understanding seems necessary to ensure much more effective control of the epidemic, while dealing with its diverse, serious health and social impacts. We recognise the many dimensions of this complex problem which has clinical, public health, epidemiological, social, political and human rights ramifications – all of which need to be understood and addressed urgently and effectively from a people-centred viewpoint. Within this wider backdrop, we have taken here a more modest focus to analyse the available data and information related to COVID 19 in Maharashtra, to highlight certain critical public health issues. This is towards trying to inform the wider epidemic control efforts in the state, which are being undertaken by the state government.

We are motivated by deep concern about the scale, rapidity and significant mortality which characterises spread of the COVID 19 epidemic in Maharashtra, and based on comparisons with certain other states we apprehend that more effective public health strategies are urgently required to deal with this epidemic in timely manner.

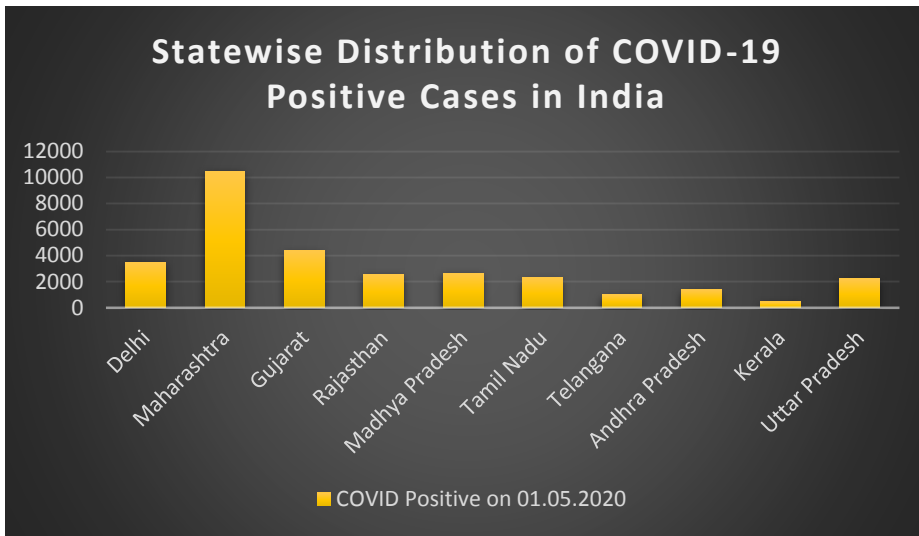
This document is based on our rapid analysis of COVID 19 data (most data is updated until end April 2020) concerning Maharashtra which is available in the public domain. We have also referred to data at national level and concerning other states, especially Kerala which has been taken for comparison in certain respects. The analyses presented here are not exhaustive, and inevitably suffer from certain limitations imposed by availability and quality of data. However, we do feel that certain initial observations can be made which could improve the conceptual basis for control of the COVID 19 epidemic in Maharashtra. While this document has focussed on certain aspects of the epidemic, we hope to follow this by further analyses of other important aspects (such as health system preparedness) which could not be comprehensively covered here.

A. Some key features of the COVID 19 epidemic in Maharashtra

1. Time trajectory and geographical distribution of cases

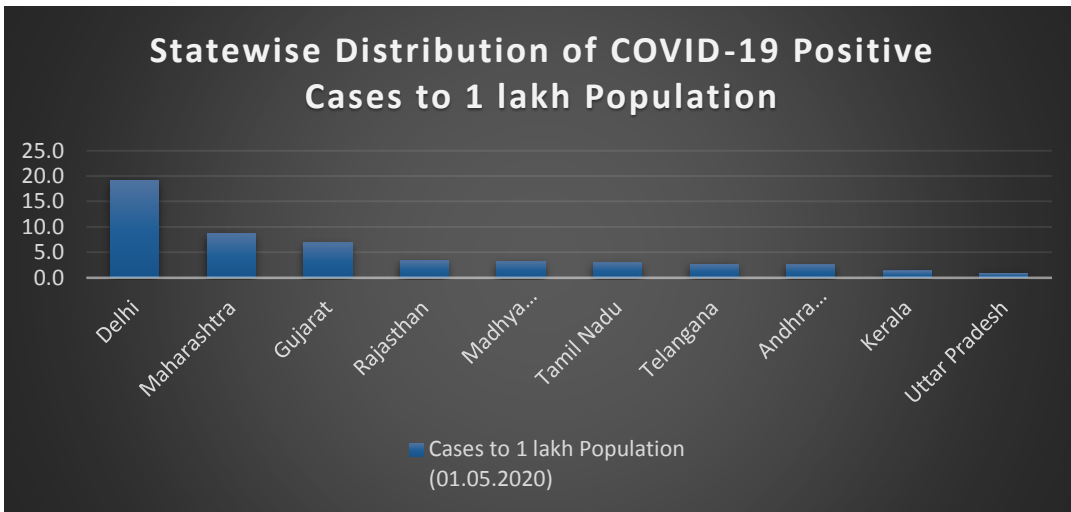
Maharashtra has experienced the largest number of COVID 19 cases and deaths among Indian states, consistently since end-March this year. The number of cases and deaths has risen dramatically since early April, with rising trend in number of new cases (indicating acceleration of spread) being observed daily since 5th April.

Fig. 1 State wise Distribution of COVID-19 Positive Cases in India (1st May 2020)



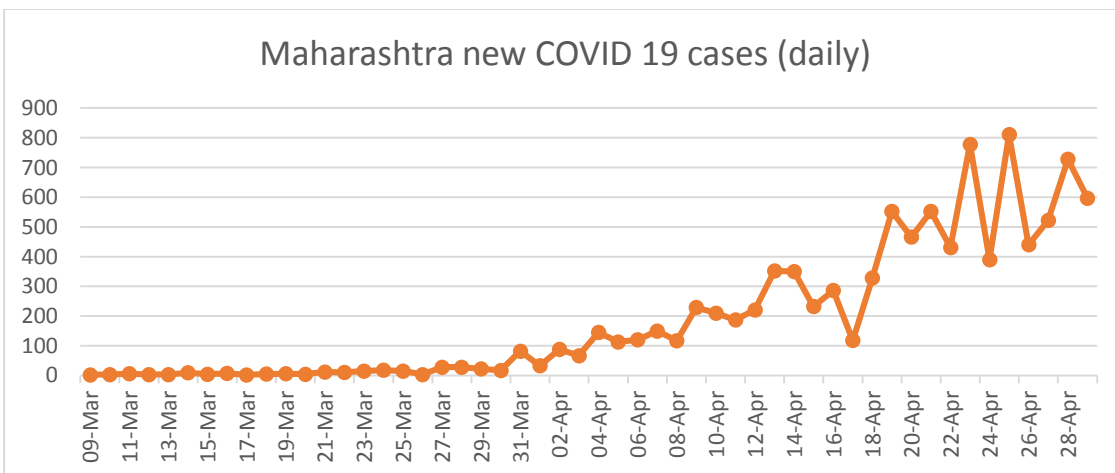
Source- Medical Education and Drugs Department (MEDD), daily report published by WHO, MOHFW and Public Health Department.

Fig. 2 State wise Distribution of COVID-19 Positive Cases to 1 lakh Population (1st May 2020)



Source- Medical Education and Drugs Department (MEDD), daily report published by WHO, MOHFW and Public Health Department.

Fig. 3 Date wise new COVID 19 cases in Maharashtra



Source: Press Bulletins, Directorate General of Information and Public Relations (DGIPR), Maharashtra (<https://twitter.com/MahaDGIPR>)

What was earlier an arithmetic progression, seems to have metamorphosed into something more like a geometric progression, with fluctuations which might be related to uneven updating of data from various areas.

The rapidity of spread of COVID 19 in Maharashtra is reflected in low doubling times (meaning more rapid growth) compared to most other Indian states.

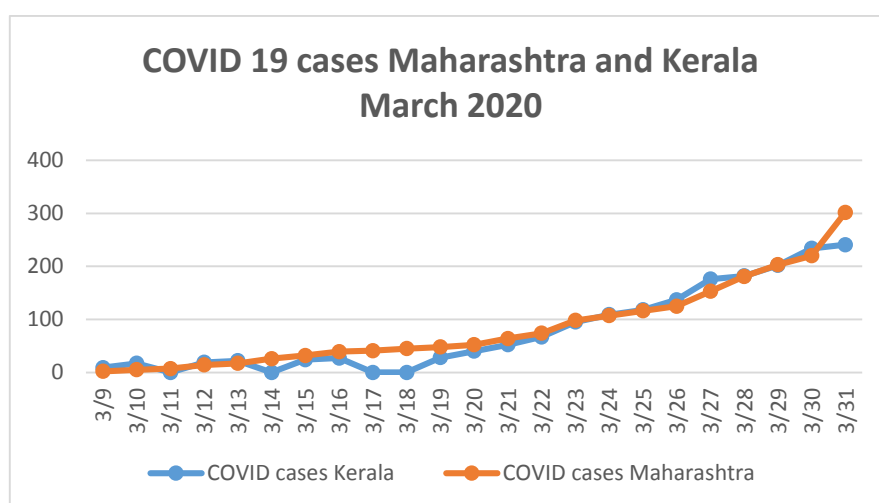
Table 1 COVID 19 case doubling time in selected Indian states

State	COVID 19 doubling time on 25 April (seven day rolling average)
Kerala	35.8
Telangana	24.0
Tamil Nadu	17.1
Madhya Pradesh	14.8
India (average)	9.4
Maharashtra	6.6
Gujarat	6.0

Source: RESPONSE - MH Daily Dashboard (Internal), 26 April 2020, Maharashtra Government presentation

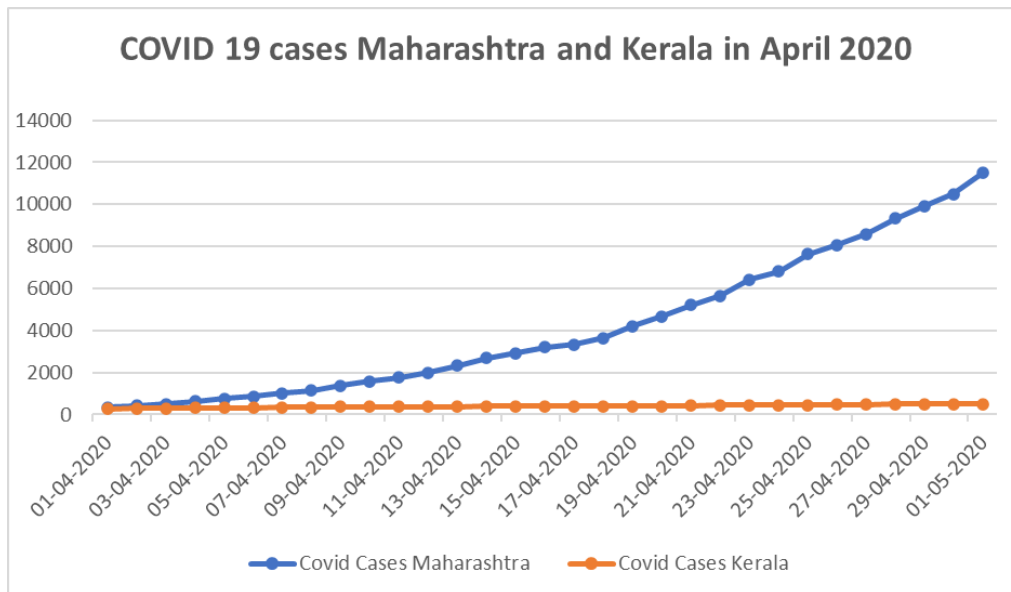
Further, the trajectory of the COVID epidemic so far in Maharashtra and Kerala is a study in contrast. From 9 March to 31 March, Maharashtra and Kerala had comparable number of cases - despite Maharashtra having a population over three times higher than Kerala. In this sense the much smaller state of Kerala started off with a worse epidemic situation than Maharashtra in March, with major clusters like Kasargod. However, **from early April onwards the curves diverge drastically**, with Kerala seeming to have largely contained spread of cases (indicated by declining number of new cases on daily basis), while number of new cases have rapidly increased in Maharashtra.

Fig 4a COVID 19 cases Maharashtra and Kerala in March 2020



Source- Maharashtra data source-Press Bulletins, Directorate General of Information and Public Relations (DGIPR), Maharashtra (<https://twitter.com/MahaDGIPR>), Kerala Data Source : Government of Kerala Dashboard (<https://dashboard.kerala.gov.in/index.php>)

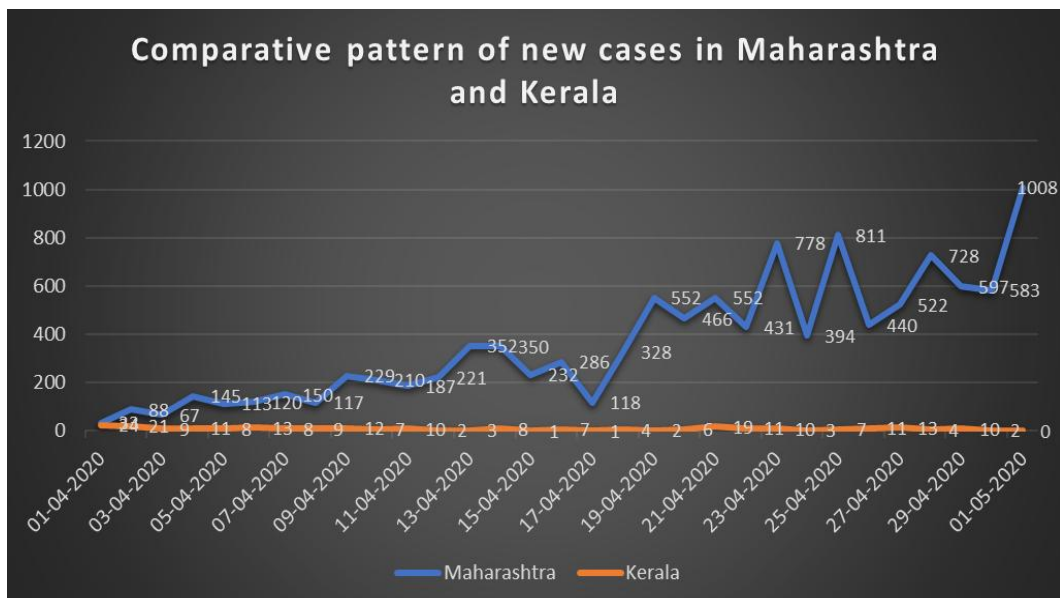
Fig 4b COVID 19 cases Maharashtra and Kerala from 1st April to 1st Mayth 2020



Source- Maharashtra data source-Press Bulletins, Directorate General of Information and Public Relations (DGIPR), Maharashtra (<https://twitter.com/MahaDGIPR>), Kerala Data Source: Government of Kerala Dashboard (<https://dashboard.kerala.gov.in/index.php>)

The contrast in numbers of deaths is even more dramatic; COVID 19 deaths in Maharashtra on 3rd May 2020 were 521, while in Kerala the number of deaths stood at just 4.

Fig 5 Comparative pattern of new cases in Maharashtra and Kerala

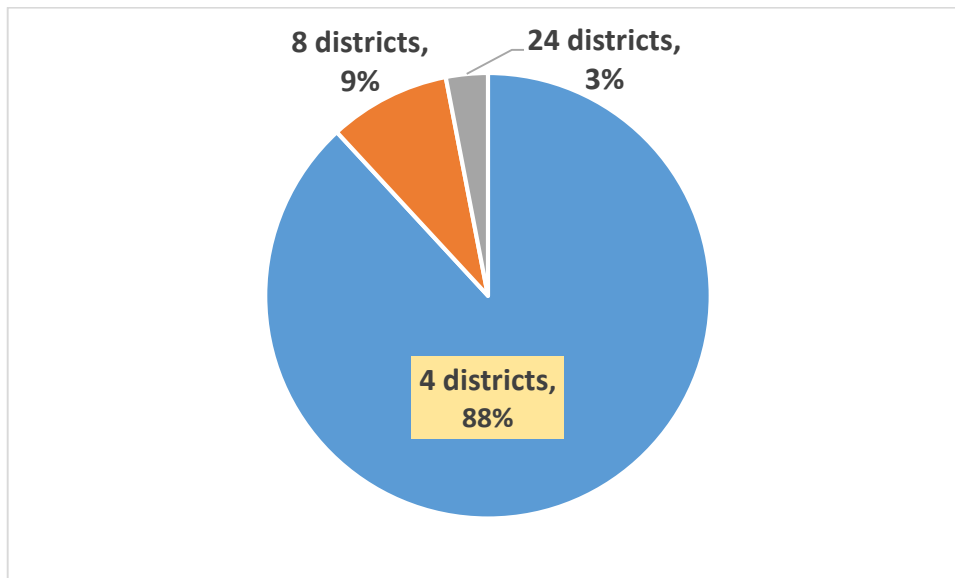


Source- Maharashtra data source-Press Bulletins, Directorate General of Information and Public Relations (DGIPR), Maharashtra (<https://twitter.com/MahaDGIPR>), Kerala Data Source- Government of Kerala Dashboard (<https://dashboard.kerala.gov.in/index.php>)

In our understanding, despite similar initial patterns of spread in March, the divergence in the fate of the COVID 19 epidemic in these two Indian states from early April onwards – the number of cases exploding in Maharashtra, while being largely contained in Kerala - most probably reflects differences in strategies for control of the epidemic. We will revisit this critical issue below.

Further, Maharashtra presents geographically a highly differentiated picture, with **88% of cases concentrated in just four districts with large urban areas** (Mumbai including suburban areas, Pune and Thane), while some other districts (like Nagpur, Nashik, Palghar, Aurangabad) have recently growing numbers, while majority of districts have either small clusters or isolated cases. Certain districts in Vidarbha, Marathwada and North Maharashtra had no detected cases until recently.

Fig 6 Distribution of COVID 19 cases in Maharashtra on 30th April 2020



Source: COVID-19 Monitoring Dashboard by Public Health Department , Government of Maharashtra, accessed from <https://experience.arcgis.com/experience/8167a61f882a4af4b9098e947dfd589f/> on 2nd May 2020

This clearly establishes the **urban cluster-based nature of spread of the epidemic** in Maharashtra, with major hotspots rapidly growing in Mumbai, Pune and Thane during the last fortnight. The large and sharply rising number of cases concentrated in specific localities of major urban centres is one indication of **community-based transmission** emerging in these areas, an issue which we will return to below.

Nevertheless, there are **no grounds for complacency related to the situation in other parts of the state**, since following initial importation of cases into these districts, **spread and increase in numbers of cases is being seen in several more urban areas**. There appears to be need for much more effective strategies **to prevent emergence of many more hotspots across the state** – which would lead to a completely overwhelming crisis in the state.

Table 2 COVID 19 cases in some districts/cities of Maharashtra

Date	COVID 19 cases				
	Aurangabad (Corp)	Nagpur (Corp)	Solapur (Corp)	Yavatmal	Malegaon
15 March	1	4	0	2	0
22 March	1	4	0	4	0
29 March	1	14	0	4	0
5 Apr	7	17	0	4	0
12 Apr	16	27	1	4	15
19 Apr	30	67	15	14	78

26 Apr	50	107	47	48	*
1 May	159	133	101	79	201

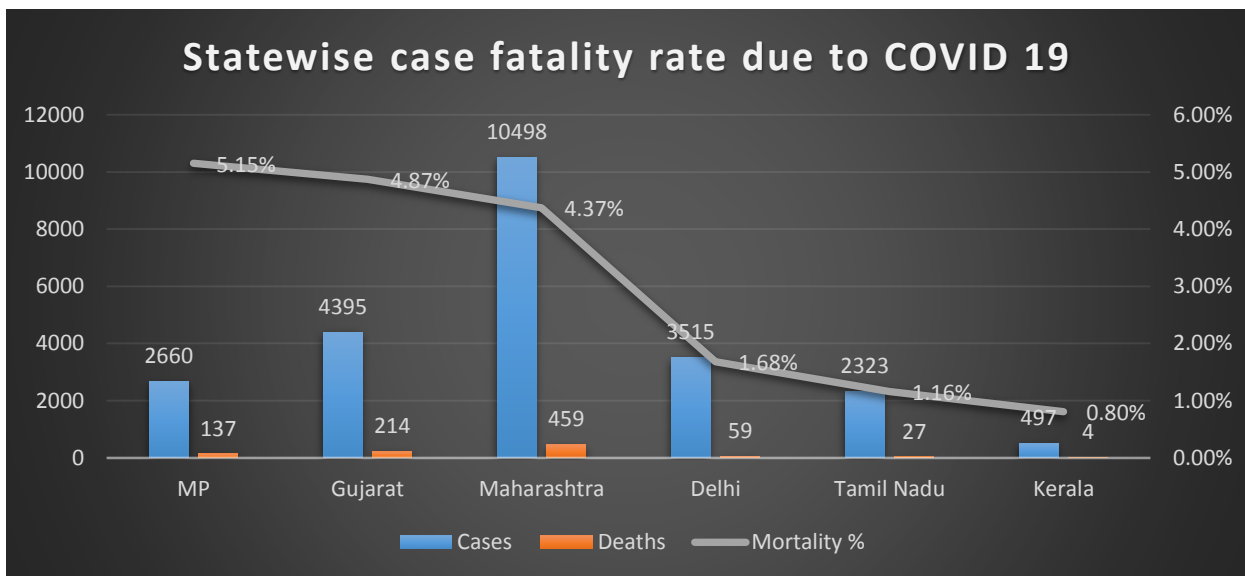
* Disaggregated data not available. Source: Press Bulletins, Directorate General of Information and Public Relations (DGIPR), Maharashtra (<https://twitter.com/MahaDGIPR>)

We can see that *in Aurangabad corporation area the number of cases increased ten-fold* between 12 April to 1 May, in the same period *in Malegaon the rise was over 13 fold*.

2. High case fatality rates, with wide variation across different areas

Another worrisome feature of the COVID 19 epidemic in Maharashtra is *high case fatality rates among known cases*. Compared to other Indian states which have experienced large number of cases from the COVID 19 epidemic, along with MP and Gujarat, *Maharashtra has higher case fatality rates (i.e. larger proportion of deaths occurring among those detected as COVID 19 positive)*.

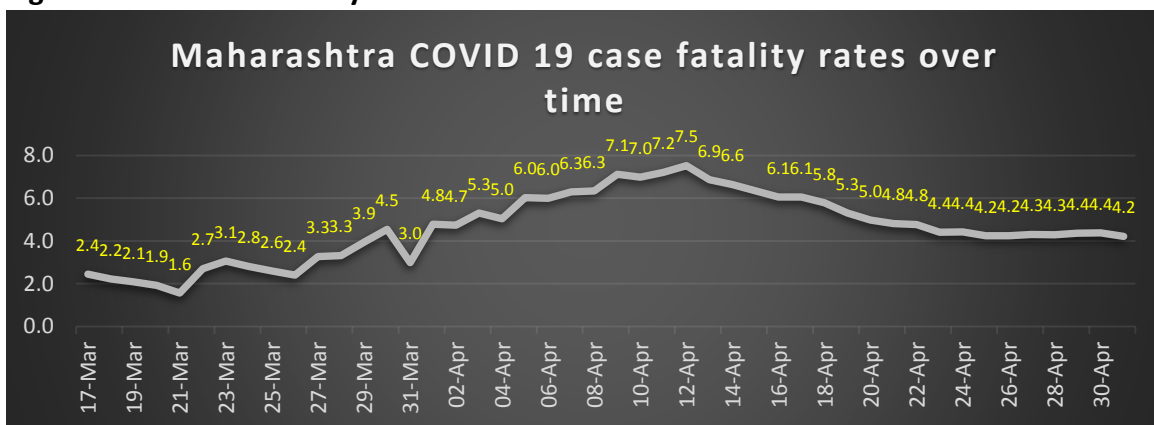
Fig. 7 State wise case fatality rate due to COVID 19 (1st May 2020)



Source- Medical Education and Drugs Department (MEDD), daily report published by WHO, MOHFW and Public Health Department.

We see that COVID 19 case fatality rates in Maharashtra appeared to be rising over time in first half of April, followed by decline and relative stabilisation in second half of April.

Fig. 8 Trend of case fatality rate in Maharashtra



Source- Medical Education and Drugs Department (MEDDD), daily report published by WHO, MOHFW and Public Health Department.

Although we are not in a position to ascribe any single reason for the comparatively high case fatality rates in Maharashtra, this is undoubtedly a matter of concern. **High case fatality rates (which were rising in first half of April, though subsequently these have declined) combined with large and growing number of cases, might simply translate into rising numbers of deaths in the near future.**

Another striking observation which requires further analysis is **huge variation in these fatality rates**, when observed across major COVID 19 clusters in different urban areas of the state.

Table 3 Case fatality rates due to COVID 19 in selected Municipal corporation (MC) areas of Maharashtra (24 April 2020)

	Cases	Deaths	Case Fatality Rate
Nagpur MC	132	1	0.76
Thane MC	373	4	1.07
Navi Mumbai MC	162	3	1.85
Kalyan MC	158	3	1.90
Vasai Virar MC	128	3	2.34
Mumbai MC	6644	270	4.06
Aurangabad MC	103	7	6.80
Malegaon MC	171	12	7.02
Pune MC	1062	79	7.44
State average	9915	432	4.36

Source: Public Health Department, Maharashtra COVID-19 Related Updates Media Bulletins

There is **over nine-fold variation between the case fatality rates seen in Nagpur and Malegaon**, although their number of COVID 19 cases is similar. Comparing the two largest epidemic aggregations with large numbers – Mumbai and Pune – case fatality rates are almost twice higher in Pune. Some factors which might be responsible for these high and varying case fatality rates could include:

- a. Lower levels of COVID 19 testing in Maharashtra compared to other states (we will discuss this below). If overall scale of testing is lower, then only the more symptomatic and clinically apparent cases may get tested, and among this denominator of more severe cases the likelihood of deaths would be higher. Hence mortality rates would appear higher.
- b. COVID 19 cases are being detected and treated at a later stage, so that by the time they reach appropriate hospitals, their condition has deteriorated and hence probability of death is higher. An analysis of the first 50 COVID-19 deaths in Mumbai reveals that around half of them died within few hours or a day of hospitalisation. In half of these cases that led to

deaths, the COVID 19 test result came positive just an hour before death or after death, which indicates delayed testing¹.

- c. Quality of clinical care and observance of protocols is inadequate or uneven, leading to higher mortality.

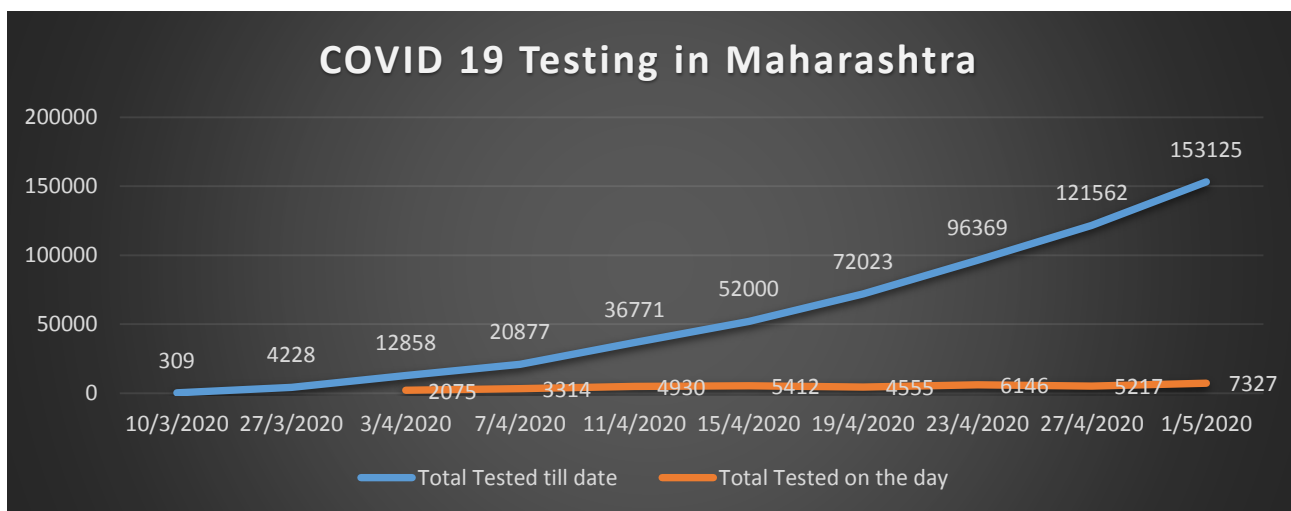
Urgent investigation is required to understand the reason for these high case fatality rates – however to address the first two possible factors, **wider scale of testing for COVID 19 among contacts, suspects and persons even with mild symptoms** should definitely part of the larger set of solutions.

3. Status of COVID 19 testing and asymptomatic cases

It is clear that adequate levels of testing linked with related tracing, isolation and treatment activities are critical for control of COVID 19. This is the experience emerging from countries like South Korea, where despite major rise in number of COVID 19 cases in early March, based on very widespread tracing of contacts, their testing and timely isolation of contacts, the epidemic was effectively brought under control by end of March.

Levels of COVID 19 testing in Maharashtra have definitely increased since early April, however the number of tests in Maharashtra per lakh population remain lower than states like Delhi and Tamil Nadu.

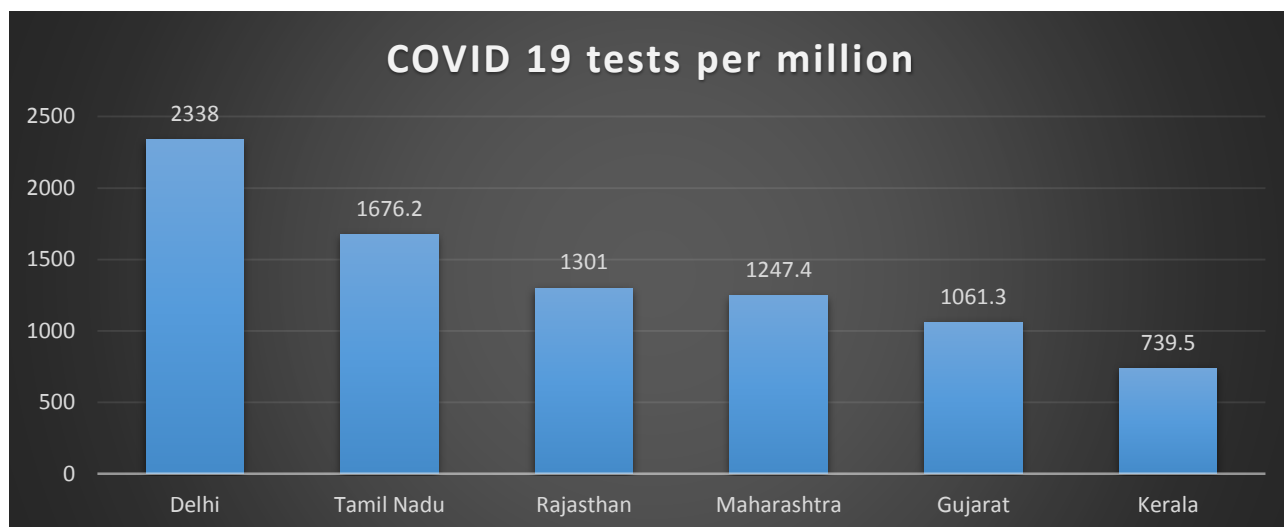
Fig. 9 Number of COVID tests in Maharashtra



Source- Medical Education and Drugs Department (MEDD), daily report published by WHO, MOHFW and Public Health Department.

¹ In half of Mumbai's deaths, delays in testing and admission to hospitals; experts to audit, Indian Express, 17th April, 2020 accessed from <https://indianexpress.com/article/coronavirus/mumbai-coronavirus-covid-19-test-deaths-6363066/>

Fig. 10 State wise COVID tests per million population (1 May 2020)



It may be kept in mind that levels of COVID 19 testing in India are much lower compared to many other countries which are tackling the COVID 19 epidemic at various stages. In this context, current levels of testing in Maharashtra might overall be lower than the scale required for effective containment.

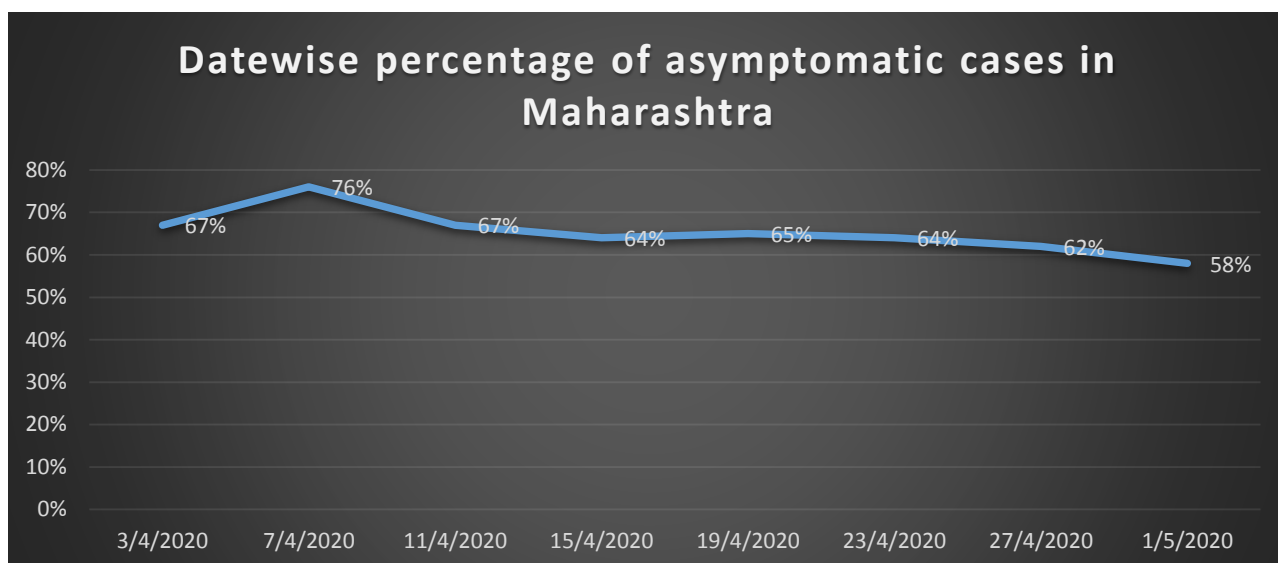
Table 4 Country wise COVID 19 tests per lakh population

Country	COVID 19 tests / lakh population
Germany	2079
Italy	2402
South Korea	1089
United States	1267
Singapore	1047
Iran	440
Nepal	119
Thailand	51
Pakistan	52
India	34

Source: www.en.wikipedia.org/wiki/COVID-19_testing

After we examine the profile of persons who have tested COVID positive in Maharashtra, it appears that around 60% of positive persons were asymptomatic at the time of testing. This is notable since out of the five categories of persons to be tested for COVID 19 as per ICMR revised criteria, four categories would have symptoms at time of testing. Only the fifth category - asymptomatic direct and high-risk contacts of a confirmed case – would not have symptoms. Further study is required concerning such asymptomatic positive persons, to understand the role of asymptomatic carriers in spreading the infection.

Fig 11 Date wise percentage of asymptomatic cases in Maharashtra

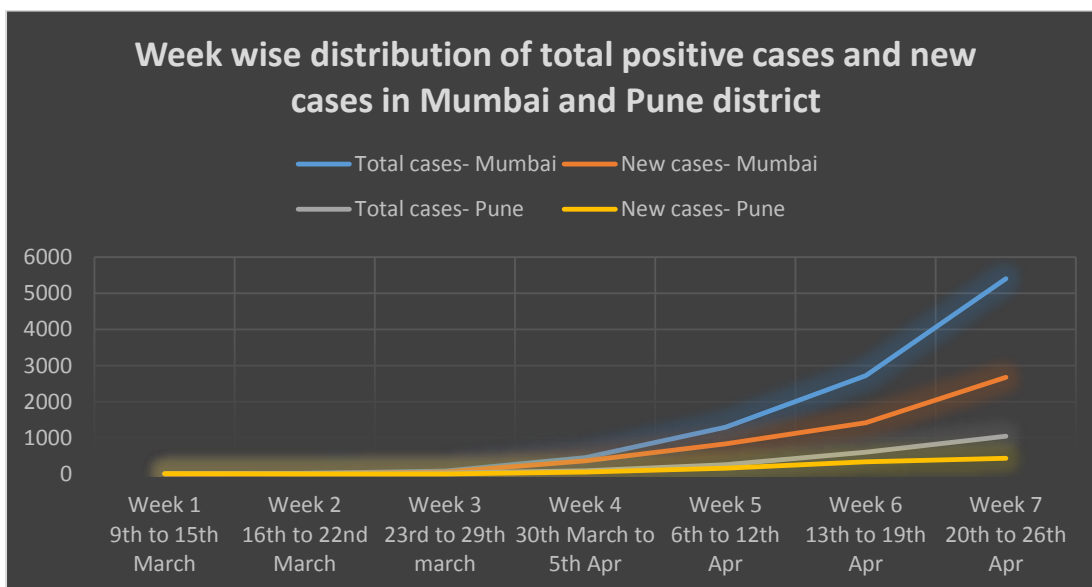


Source- Medical Education and Drugs Department (MEDDD), daily report published by WHO, MOHFW and Public Health Department.

4. Community transmission in major urban clusters

The feature of this epidemic in Maharashtra which has attracted most popular attention is probably the large and increasing number of cases in the two largest urban centres of the state – Mumbai and its suburbs, and Pune.

Fig 12 Week wise distribution of total positive cases and new cases in Mumbai and Pune



Source- Press Bulletins, Directorate General of Information and Public Relations (DGIPR), Maharashtra (<https://twitter.com/MahaDGIPR>)

We need to understand what is the exact nature of this spread, and how it has evolved over time. If we examine the figures for ward wise cases in Mumbai in April, two features are obvious. Firstly, that rapid growth of the epidemic has been concentrated in specific wards of the city (such as G

South, D, E, G North), with other areas having much fewer cases, indicating cluster focused spread. Further, the rise in numbers of cases has been very sharp in the areas with clusters – for example *in G South ward the number of cases increased over four-fold in a week* (from 4 to 11 April), and then again more than doubled in the next fortnight (from 11 to 25 April). *In E ward, cases increased over four fold in the fortnight from 11 to 25 April*. In some of these wards, there is weekly doubling or higher increase of cases in this entire period. This *very rapid multiplication in number of cases leading to major increase in short period* supports the assertion that moving beyond immediate contacts of recent travellers, *generalised community based transmission is underway in these urban clusters*.

Table 5 Mumbai City- COVID 19 cases over time and per million in selected wards as on 25th April 2020

Ward\Date	Population (Census 2011)	COVID 19 cases				Cases per million as per 25th April
		04-Apr	11-Apr	17-Apr	25-Apr	
GS	377749	58	246	389	600	1,588.36
E	393286	19	111	194	466	1,184.89
D	346866	31	94	141	285	821.64
A	185014	7	12	49	127	686.43
FN	529034	5	39	79	359	678.60
GN	599039	4	48	142	349	582.60
N	622853	14	25	42	109	175.00
RS	691229	11	27	47	94	135.99
PN	941366	18	43	73	120	127.47
RC	562162	4	21	22	56	99.62
T	341463	10	9	13	32	93.71
RN	431368	4	13	17	29	67.23
All wards	12442373	330	1182	2120	4870	391.40

Source: Daily updates by BMC (<https://twitter.com/mybmc>); <https://portal.mcgm.gov.in/irj/go/km/docs/documents/MCGM%20Department%20List/Public%20Health%20Department/Docs/Census%20FAQ%20%26%20Answer.pdf>

Pune city which has emerged as a second epicentre for the epidemic in Maharashtra presents similar features of cluster based spread, though with smaller numbers. In Dhole Patil road, Bhavani Peth and Kasba – Vishrambaug wada wards, cases have been doubling or more weekly in the period from 8 to 22 April. On the other hand, areas like Kothrud and Aundh have few cases and minimal rise over time.

Table 6 Pune City- distribution of cases over time and per million in selected wards as on 29th April 2020

Ward	Population - 2017	08-Apr	15-Apr	22-Apr	29-Apr	Cases per million as per 29th April
Dhole Patil	1,55,160	16	48	110	203	1,308.33
Bhavani Peth	2,11,910	40	96	171	266	1,255.25
Shivajinagar-Ghole road	1,69,891	6	27	77	190	1,118.36

Kasba- Vishrambaug wada	2,14,275	17	45	111	157	732.70
Warje- Karvenagar	2,48,451	1	9	9	9	36.22
Aundh- Baner	1,69,432	3	3	2	4	23.61
Kothrud- Bawdhan	2,36,606	1	1	1	2	8.45
All wards (mapped)	33,71,626	142	386	768	1335	395.95

Source- Daily updates by Smart City Pune (<https://twitter.com/SmartPune>);Pune Municipal Corporation- census data accessed from <https://pmc.gov.in/sites/default/files/miscellaneous/WARD-OFFICE-POPULATION-DATA.pdf>

Regarding the contact background of COVID 19 cases in Maharashtra we have some information, though sketchy, about which has been made available in MEDD reports until 7 April. This analysis, although based on availability of data for a limited period, shows certain interesting trends. On 27 March half of the cases (67) had been found among recent travellers from outside the state, and another nearly one-third (42) were among contacts of these travellers. For the remaining either the details of contact history were awaited, or were inconclusive.

In short, in late March over 80% of the COVID 19 cases in Maharashtra were confined to recent travellers and their contacts. This picture rapidly changed in the next ten days, with the traveller cases and their positive contacts levelling off. However, in these ten days the 'awaited' and 'inconclusive' cases (presumably most of these being neither travellers nor their contacts) have skyrocketed to become 81% of all cases (MEDD reports have stopped giving this breakup of cases after 7th April) – evidence of likely community based transmission.

Table 7 Contact details of COVID 19 positive cases in Maharashtra

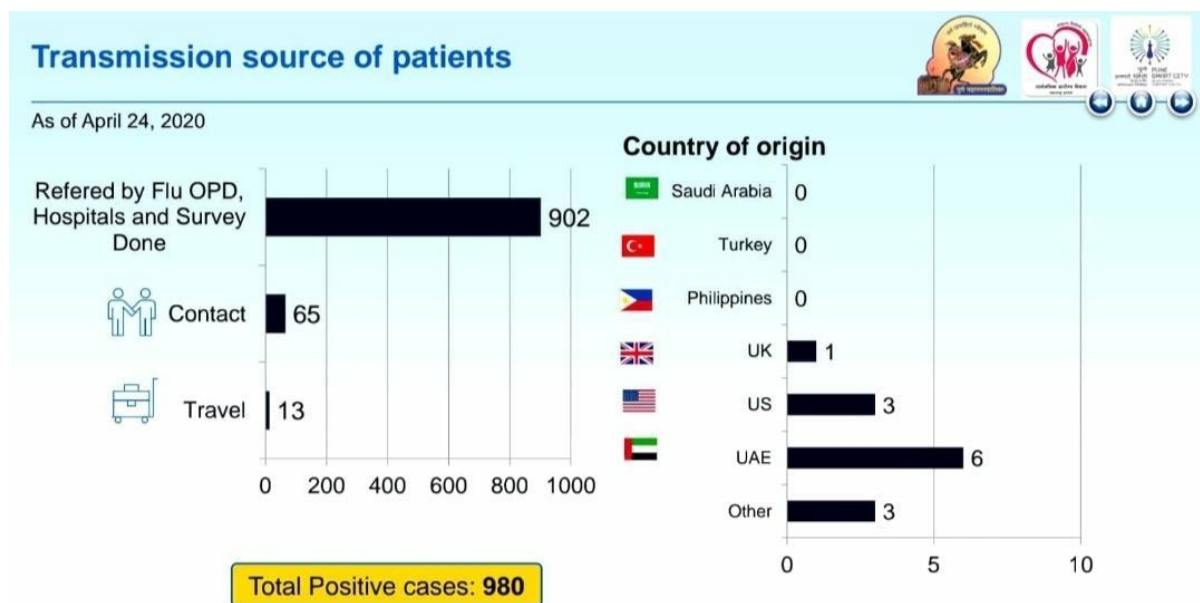
	Traveller	Contact	Awaited / inconclusive
27-Mar	67 (50%)	42 (31%)	25 (19%)
31-Mar	82 (38%)	57 (26%)	77 (36%)
03-Apr	82 (24%)	60 (18%)	193 (58%)
05-Apr	84 (17%)	60 (12%)	346 (71%)
07-Apr	84 (11%)	60 (8%)	604 (81%)

Source- Medical Education and Drugs Department (MEDD), daily report published by WHO, MOHFW and Public Health Department.

In just around ten days among COVID 19 cases in Maharashtra, the ratio between travellers and their contacts vs. those who presumably do not have such known contact history has become exactly reversed. This is another piece of evidence which substantiates the assertion that in Maharashtra transmission of COVID 19 infection among persons who are neither recent travellers nor their known contacts has accelerated in specific areas since early April, in other words that community based transmission has emerged.

The contact profile of COVID 19 cases in Pune depicted in the following graphic released by Pune Municipal Corporation supports the same assertion, with 87% of cases being detected outside the circle of travellers and known contacts -

Figure 13 – Transmission source of COVID 19 patients in Pune



Source: <https://twitter.com/SmartPune> accessed on 26th April 2020

The likelihood of community transmission is further supported by recently declared results of the study² done by ICMR on COVID 19 among persons with Severe Acute Respiratory Illnesses (SARI). During this study, 5911 patients having SARI admitted at 41 sentinel sites across the country were tested for COVID 19. Of these nationally 104 (1.8%) tested positive for COVID 19, and among these **39% did not report any history of international travel or contact with a known case.**

It is worth noting that in this study, **among all major states with significant numbers of COVID 19 cases, Maharashtra had the highest prevalence of COVID 19 positivity at 3.8%.** Although the article based on this study does not provide state wise details of contact background for cases, there is no reason to assume that the national trend of nearly 40% COVID 19 cases lacking history of international travel or contact with known cases, would be any different for Maharashtra.

The reason why we need to closely examine the likelihood of community based transmission of COVID 19 in certain parts of Maharashtra is because the strategies required to deal with this kind of transmission in specific areas would be qualitatively different, compared to those required in other areas.

To conclude, we can make an overall assessment that:

- Growth of COVID 19 cases in certain major urban areas (Mumbai, Pune, Thane) was initially gradual in March, but has sharply accelerated since early April, which appears linked with emergence of significant community transmission. **An important opportunity to control the epidemic at early stage in these cities has been missed** (unlike Kerala which controlled its

² Nivedita Gupta, Ira Praharaj, Tarun Bhatnagar et al and ICMR COVID Team#(2020), Severe acute respiratory illness surveillance for coronavirus disease 2019, India, 2020, Indian Journal of medical research, DOI: 10.4103/ijmr.IJMR_1035_20

initial large clusters much more effectively by intensive testing and case identification, contact tracing, and home quarantine starting in March.)

- **COVID 19 cases have been growing quite rapidly in certain other districts** (mostly in specific urban areas within these districts) – like Nagpur, Nashik, Palghar and Aurangabad. These are emerging new major hotspots which deserve high attention, localised community transmission is likely to be underway here, but it may still be possible to control this with intensive strategies.
- In majority of districts (presently 24) number of COVID 19 cases is still small (less than 40), **here intensive strategies are still very much feasible, which should be implemented urgently** before these develop into new hotspots.

Overall, the **COVID 19 epidemic in Maharashtra, reflected in trends of cases and deaths so far, seems to be developing despite the lockdown since 25 March and other restrictive measures being taken**. It seems that the emphasis on restrictive measures, which may have some impact but are definitely not sufficient for comprehensive epidemic control, needs to be shifted towards focus on intensive, community based control measures which are much more effective.

B. Maharashtra COVID 19 epidemic dynamics – what more we need to know urgently

This report is based on information presently available in the public domain, since we do not have access to possible studies or advanced analysis which might have been conducted by Maharashtra Health department or any official scientific body, related to dynamics of the COVID 19 epidemic in Maharashtra. Hence there is possibility that some of the analysis being suggested by us has been done but is not publicly available. In that case, it should be made public and readily accessible at the earliest.

While obviously a wide range of areas need to be researched related to this novel epidemic, here we will focus on a few types of action-oriented knowledge which could directly contribute to more effective control of the COVID 19 epidemic in Maharashtra.

1. **In-depth understanding of COVID 19 transmission dynamics – WHO has recommended conduction of ‘First Few Cases’ (FFX) studies** in every country where COVID 19 has appeared, offering a protocol for the same. Such a rapid study would be relevant for a large state like Maharashtra dealing with COVID 19 epidemic. Such study (which can be done either prospectively or retrospectively) would focus on the first few persons who imported the infection in a particular geographical area (most likely international travellers), while intensively studying all their contacts, as well as a similar exercise for initial secondary cases and their contacts. This would include clinical assessment and testing for COVID 19, through detection of the virus (RT-PCR) as well as reliable serological studies. Such a focussed study would give us a precise understanding of the dynamics of COVID 19 transmission in our setting – is it primarily by close and indoor contacts, such as household members? Or has it also spread through short-term and open air contacts? We would also get an idea of the spectrum of clinical manifestations, we could calculate the Secondary attack rate, Secondary infection rate and R0 (basic reproductive number) – all of which would help tremendously in understanding the detailed dynamics of the epidemic in our setting, while informing its effective control. In context of Maharashtra, this could be done retrospectively by a detailed

study of first few cases and their contacts in specific clusters (such as in Mumbai and Pune). Such an exercise would also help in mapping of transmission chains, revealing the social and spatial patterns by which spread is taking place in our specific context.

- 2. Documenting current contact tracing and home quarantine practices.** As detailed in the next section, it may be seen that one of the core elements of Kerala's effective COVID 19 control strategy was the high number of contacts traced for each case – on average around 100 contacts were traced for each lab confirmed case, and practically all of these contacts were put into home quarantine. Hence all those at high risk of developing the illness were quarantined, and were then prevented from infecting others except perhaps some household members.

Hence in context of Maharashtra, we need an analysis for some set of positive cases regarding the numbers of contacts which have been traced, and out of these how many have been effectively home quarantined. This information should be correlated with levels spread of clusters of infection in various areas. We are likely to find that areas with lower levels of contact tracing and isolation have subsequently higher numbers of fresh cases arising in the community – because relevant contacts were missed, who then spread the infection further. Such analysis is important to assess the current level of adequacy of contact tracing and isolation – which is an extremely critical component of the entire containment strategy.

- 3. Studying hospital based outbreaks and clusters of cases among healthcare workers**

A striking feature of the epidemic in Maharashtra – specifically Mumbai – has been emergence of certain hospitals as major hotspots for spread of the infection. Wockhardt hospital in Mumbai is a prime example, where due to a combination of poor isolation practices for patients, and grossly inadequate protection for nurses and healthcare staff, until now 82 hospital staff members have been found to be COVID 19 positive. Similar threat remains for healthcare staff working in many other hospitals across the state. Given this background, a rapid study needs to be carried out in few such cases to understand the patterns of transmission in hospital settings, including what forms of protection of staff were adequate or inadequate, to prevent any more such clusters from emerging in the state as larger numbers of hospitals - both public and private – are now treating COVID 19 patients in growing numbers.

- 4. Need to understand cause of high case fatality rates, and the clinical spectrum including asymptomatic infections**

As noted above, the proportion of deaths by COVID 19 to current cases of COVID 19 is higher in Maharashtra compared to most other states. The reasons for such high case fatality rates can be diverse - including levels of testing and case detection, age profile of patients, prevalence of co-morbidities, stage at which hospitalisation care and intensive treatment was started, and nature of clinical care. This area needs to be urgently investigated to analyse the contribution of various factors, which would enable us to reduce negative influencing factors where relevant and controllable.

At the other end of the clinical spectrum are asymptomatic infections, which present a different kind of challenge. As mentioned above, around two-thirds of COVID positive persons in the state have been labelled as 'asymptomatic'. This finding needs to be further

investigated and confirmed (perhaps many of these persons had minor symptoms which were not reported at time of testing). Also and there is need to follow up and ascertain the subsequent status of persons who had earlier been tested positive and at that time were asymptomatic. We need to know how many have later become clinically symptomatic (within 14 days), and how many have remained asymptomatic even after 14 days (the maximum incubation period). This is important for at least two reasons. Firstly, the state is presently relying on symptom based active surveillance on large scale to identify COVID 19 suspects. If significant number of infected persons remain asymptomatic, then the value of such surveillance becomes less, while need for testing of all contacts of known cases (irrespective of symptoms) becomes highlighted. Secondly, if asymptomatic positive persons can effectively transmit the infection to others, and there are large numbers of such persons, then widespread testing even among the general population becomes more important, to pick up such asymptomatic persons and quarantine them to prevent further transmission.

Further, ***there is need for consolidated information to be made available in public domain on district / city wise status of Health system preparedness*** such as numbers of COVID treatment facilities at various levels, beds, ventilators etc. Currently, scattered information is available regarding quarantine facilities, fever clinics and COVID dedicated facilities. This is of course not an exhaustive list of required analysis, but indicates some key areas where additional knowledge is urgently required which can contribute towards improved control of the COVID 19 epidemic in Maharashtra.

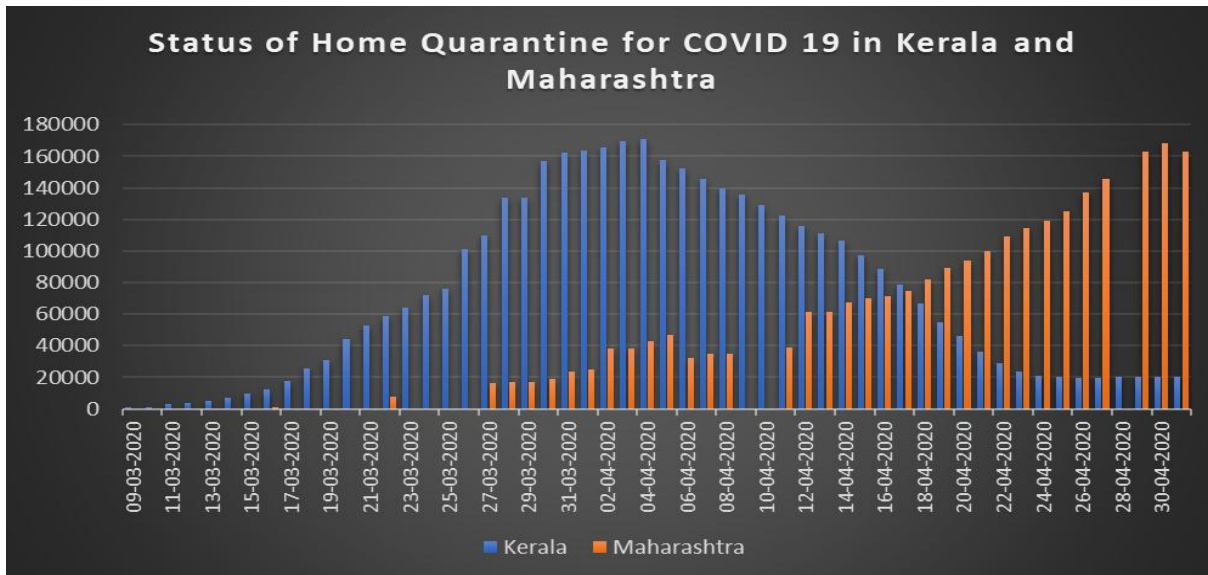
C. Learning lessons from Kerala for improved control of COVID 19 in Maharashtra

Kerala's largely effective initiatives to control the COVID 19 crisis until now provide some key learnings for other states to emulate³. The strategy involves a combination of initiatives, some important ones are given below:

- a. The state government ***instituted aggressive mitigation measures early*** which included screening of passengers returning from abroad, quarantining suspected cases, tracing and isolation of contacts, testing of suspected cases and treatment of positive cases.
- b. ***Kerala introduced strict quarantine protocols much earlier*** than the rest of the country. By March 10, the state was screening all international passengers irrespective of the origin of departure.
- c. Kerala has a ***much higher rate of contacts traced per case***, 100 on average per lab confirmed case. As of 14 April 2020, 107075 people, of whom 106511 were in home quarantine and 564 were quarantined in hospitals (DHS, Kerala). This was much higher compared to Maharashtra which had 68256 in home quarantine despite a much higher case load (MEDD, Maharashtra).

³ For details see www.policycorps.org/post/hammering-the-curve-lessons-from-an-indian-state

Figure 14: Comparison of status of home quarantine in Kerala and Maharashtra



Source- Maharashtra data source-Press Bulletins, Directorate General of Information and Public Relations (DGIPR), Maharashtra (<https://twitter.com/MahaDGIPR>), Kerala Data Source- Government of Kerala Dashboard (<https://dashboard.kerala.gov.in/index.php>)

The ‘wave’ of home quarantine in Kerala began to decline from early April onwards as the number of new cases reduced. Positively, the numbers under home quarantine in Maharashtra have now climbed from mid-April onwards, even though these were slow to rise initially during March and first half of April.

- D. Kerala also **aggressively tested the suspected cases and so far, has one of the best testing figures in the country**. The state has done 510 tests per million and the figures have been consistently high ever since the state started the containment efforts (DHS, Kerala). There was a significant increase in the testing capacity from one designated lab for COVID 19 testing to twelve as of 9th April.
- E. The state also **ramped up the existing public health infrastructure**, by designating one dedicated COVID 19 hospital in each district. The government expedited the filling up of human resource vacancies to meet the expected increase in demand. It recruited 276 doctors in a day from the existing rank list of the state public service commission. Most of the mitigation efforts were streamlined at the local level by mobilising the grassroots level health workers.
- F. **Risk communication is key in controlling any epidemic** and the state government effectively utilises the local media to make people aware of the gravity of the situation. The Chief Minister’s daily press briefings have been very popular among the populace because of its nuanced explanation of the measures taken by the government, and transparency in relaying data.
- G. Kerala government empowered the Panchayat bodies, leading to a bottom up approach in managing the crisis. The government **enlisted large number of volunteers to do contract tracing and surveillance. The state’s vast network of women led self-help groups have played a major role** in supplementing the government activities by running community kitchens and relief centres for the poor as well as migrant workers. The state government

also ensured that large number of people placed in home quarantine are well supported physically and mentally, and that containment measures are not enforced with coercion or through punitive measures, rather ensuring active community participation.

One notable impact of these intensive measures has been that the **COVID 19 cases in Kerala have until now been mostly confined to recent travellers and their known contacts**. As of 15 April, there were a total of 386 COVID 19 cases in Kerala and data was available for 322. Out of these, the number of imported cases (recent travellers) was 208 while cases among their known contacts were 98. The Delhi cohort of cases constituted 12 cases, 3 cases were among health workers, and for one case the contact background was unknown.

These figures demonstrate how the epidemic in Kerala until now has been effectively contained to travellers and their contacts, with contained further spread and minimal community transmission – definitely an achievement considering that Kerala was the first state in India to receive COVID cases, and keeping in mind its large number of returning travellers.

H. Recommendations

We start by acknowledging the wide range of energetic efforts which are being carried out by Maharashtra State health department to control the COVID 19 epidemic, which must be viewed also in context of existing constraints at various levels. We offer comments here in a spirit of public health engagement with ongoing official efforts.

The National COVID 19 containment strategy has correctly laid down a differential approach for various zones, now taking this as the foundation certain adaptation and intensification appears necessary in context of Maharashtra.

As widely discussed and accepted, the main objective of COVID 19 control strategy is ***'flattening the curve' to delay and reduce the peak of cases during the course of the epidemic***, which would enable the health system to better deal with expected large number of cases, including proportion of serious cases. Hence the set of suggestions given here envisage intensification of certain key components, while also taking care of complementary social considerations related to restrictive measures like lockdown, by highlighting the need for a graded and responsive lockdown reversal strategy. ***Hence the primary objective of these proposals is to widen the discourse, and initiate dialogue by public health professionals with the government***, while proposing value additions to the ongoing control strategy. The idea is that through such discussion we could develop ***more intensive and knowledge driven control operations across the state, while minimising generalised restrictive measures which lead to major social distress.***

A key consideration while proposing this upgradation is that the ***social cost – benefit ratio related to continuing generalised restrictive strategies*** (universal hard lockdown) needs to be examined. This may become negative in situations having only few cases in an entire district. Hence ***the need for a differential approach, which could also guide development of appropriate lockdown reversal strategies*** which balance public health and socio-economic considerations in the current situation.

Ten-point proposal to upgrade COVID 19 control in Maharashtra

1. Ensuring two tracks of action, appropriately dealing with areas having different levels of transmission

If we sum up the COVID 19 situation in Maharashtra, we are now seeing rapid spread of cases and increasing deaths in existing hotspots – Mumbai, Pune and Thane, having considerable community transmission. Several new hotspots are also appearing with rapid increase in number of cases, indicating early community transmission. There is a genuine threat that these new areas could become multiple outbreaks, parallel to the existing major hotspots.

We can categorise districts of Maharashtra into four categories, based on current nature of COVID 19 transmission (this classification is at macro-level and overlaps with the national division into three types of zones, while adding one category):

Categorisation of Maharashtra districts based on number of COVID 19 cases on 30 April 2020 (likely to change with time)
Category A (over 300 cases)
Significant community transmission - 4 districts
Mumbai City
Mumbai- Suburban
Pune
Thane (including suburban areas)
Category B (40 to 200 cases)
Localised community transmission in certain areas - 8 districts
Nashik (including Malegaon)
Nagpur
Palghar (including Vasai, Virar and other suburban areas)
Solapur
Yavatmal
Raigad (including part of Navi Mumbai)
Aurangabad
Ahmednagar
Category C (10 to 40 cases) Clusters of cases - 11 districts
Satara
Akola
Jalgaon
Sangli
Buldhana
Dhule
Hingoli
Latur
Amaravati
Nandurbar
Kolhapur
Category D (less than 10 cases) - Isolated or no cases - 13 districts
Osmanabad
Ratnagiri
Beed
Gondia
Jalna

Sindhudurg
Washim
Bhandara
Chandrapur
Gadchiroli
Nanded
Parbhani
Wardha

This categorisation is not a substitute for more granular identification of specific clusters of COVID 19 inside cities or within districts – which require focussed containment measures. Such more granular analysis is extremely important, however we do not have access to such data, which is already being used by Health authorities for designing appropriate detailed interventions. Our limited purpose here is to highlight the extremely differentiated nature of epidemic spread, which demands refocussing of strategies as described below.

Overall, moving beyond primary focus on fire-fighting related to the existing hotspots along with continued and generalised restrictions in all other areas, ***we are suggesting a two-track strategy to contain the epidemic across Maharashtra, also keeping in view the need for a graded lockdown reversal strategy, which is becoming socially necessary now.***

Track 1 (For Mumbai, Pune and Thane cities, high transmission areas in Category B districts) - In these areas where community transmission now seems to be underway, the intensive approach of case detection, widespread contact tracing and home quarantine remain relevant, but might be less effective for definitive containment of epidemic spread. Here existing approaches including certain level of restrictions on population movement might be necessary for longer period of time, however these must be accompanied by ***extensive testing, identification of maximum cases in the community at early stage, preferential testing of high risk sub-groups***, followed by their isolation and home quarantine of their contacts, and ***providing effective treatment at early stage*** by ramping up hospitals and ensuring good quality clinical care, thus minimising deaths due to COVID 19.

Two of the measures recommended below – ***expanded testing for COVID 19***, including community based testing in some areas, and carefully ***analysing case fatality rates in various cities / areas as a step towards reducing mortality*** – are especially relevant for Track 1 areas, and will be discussed further below.

Track 2 (For majority of Maharashtra – all lower transmission areas in category B districts, and entire category C and D districts – which would together cover around three-fourths of Maharashtra’s population). ***These areas should not be given lower importance due to preoccupation with fire-fighting in track 1 areas.*** The future of the COVID epidemic in Maharashtra will be decided in these areas, and it is here that we have a much better chance of preventing community transmission to check the epidemic, as was done in Kerala.

In parallel to major efforts being devoted to Track 1 areas, dedicated public health officials, expert inputs and organised efforts from state to district and local levels need to be also focussed on Track 2 districts and areas. In these areas where large scale community transmission is not yet underway, ***critical components of the intensive Kerala strategy need top priority:***

- wider testing to detect maximum cases, followed by isolation and early treatment
- meticulous contact tracing of all known cases (may involve 20 to 50 contacts per case)
- stringent home quarantine of all these contacts
- provision of support to home quarantined persons
- testing of all such contacts and suspects, leading to identification and management of any further cases

While these measures are already mentioned in the National containment strategy, probably they have not received sufficiently high priority in implementation as an integrated package until now; where meticulously implemented as in Islampur town of Sangli district, the results are striking.

The experience of Islampur town in Sangli district of Maharashtra, which was able to control the spread of COVID 19 despite a large spurt of initial cases, demonstrates the importance of intensive, community based strategies. Based on four members of a family returning from abroad who were positive, 26 cases were detected by March 23. Following this, all contacts were traced, symptomatic contacts were put in isolation, while the asymptomatic contacts were put in institutional quarantine. A one-km radius containment zone was created with sealing of entry and exit points, and home delivery of essential items was ensured. This has led to effective containment, with recovery of the earlier cases and practically no further cases in the area.

In our opinion ***such an intensive approach could effectively contain the epidemic or at least slow down its spread significantly in Track 2 areas***, we still have a good chance to attempt this. Two or three weeks from now, even that chance may have been lost. **Maharashtra has missed the first bus in COVID 19 epidemic control, let us not miss the second bus, for this may be the last one.**

2. Upscaling intensive strategies in track 2 districts and areas

We would agree that ***lockdown accompanied by social distancing and symptom based surveillance might be slowing down transmission to some extent, but is not sufficient to effectively contain the epidemic.*** Lockdown and restriction of social interaction in itself might hopefully slow down the rapidity of spread for some time, but will not be able to contain transmission even in the short term. Rather the lockdown provides ‘breathing space’ for some limited time, to implement intensive outreach based strategies which are necessary for effective control. As the economic and social costs of the lockdown mount, the viability of blanket social restrictions beyond certain point will naturally be increasingly questioned. And if lockdown remains the main strategy without adequate, complementary implementation of other intensive strategies during this period, then transmission will continue at some level even during the lockdown, and ***in the immediate post-lockdown situation we are likely to witness a much larger, second wave of cases*** which would be far more generalised in nature.

The South Korean approach to COVID 19 control was based on much more emphasis on active, free and massive screening (including drive-through tests), early detection of cases by such massive testing and rapid case finding, active contact tracing, followed by early isolation and quarantine of contacts in large numbers to stop further spread of the infection. It is relevant that South Korea did not resort to lockdowns or major restrictions to movement at any stage. In this context, ***the strategy followed in Kerala seems closer to the South Korean model***, or at least it heavily draws upon this approach, with its emphasis on wider testing and active contact tracing, along with quarantining of larger numbers of people. On the other hand, the manner in which the MOHFW strategy is presently

being implemented in Maharashtra seems to rely more on major restrictions on movement to and from entire areas (sealing 'red zones'), along with house to house surveys to detect symptomatic persons, with less emphasis on meticulous contact tracing, widespread testing of all contacts and suspects, linked with larger scale of home quarantine. ***The different approaches to control the COVID 19 epidemic which were adopted in Kerala vs. Maharashtra in March are showing very contrasting results in April, which speak strongly in favour of the Kerala strategy.***

However, once large scale community transmission is underway, while intensive testing, tracing and quarantine remain important, these will be less effective in containing overall spread of cases. These strategies were implemented at a relatively early stage of transmission in South Korea as well as Kerala, when identification of maximum number of contacts of initial cases was feasible. Keeping this context in mind, we see that major clusters with community transmission in Maharashtra are so far mostly limited to 12 out of 36 districts (categories A and B). Even in B category districts, many of the blocks do not have large clusters of cases. Though we missed the first bus for COVID control in March (followed by the first wave of hotspots in Mumbai, Pune, Thane), we may still have a fighting chance to contain this epidemic in many other areas of the state (especially category C and D districts), before it engulfs much larger sections of the population.

3. Implementing comprehensive COVID 19 testing to support the intensive strategy

Wider scale of testing for COVID 19 is integral to identification of maximum number of existing cases, which becomes the basis for further steps in the intensive strategy. In this context it is positive that COVID 19 testing has been considerably expanded in Maharashtra in the recent period. However, there are some worrisome trends related to restricting criteria for testing in Mumbai, which need to be revised. Currently the ICMR criteria for COVID 19 testing should be comprehensively followed as the main approach, with additional ***community based testing on sample basis in high transmission areas*** also being considered. This is especially relevant keeping in view the likely role of asymptomatic infected persons in propagating transmission. ***There is also need for pre-emptive testing among symptomatic elderly persons and those with significant co-morbidities on a priority basis, to detect and treat early and thus majorly reduce deaths in Track 1 areas.***

In order to ***expand testing while covering additional categories of people, ramping up COVID 19 RT-PCR testing facilities*** is required across the state which may include engagement of public labs outside the health department (in educational institutions etc.) and regulated insourcing of services of qualified private labs. ICMR has recently suggested ***pooling of samples for testing which can significantly bring down the costs and time required for COVID 19 testing – this must be seriously considered in Maharashtra.*** The rapid antibody test has proven to be unreliable, so as of now we will need to continue conduction of RT-PCR as the mainstay of COVID 19 diagnostic testing. However serological tests for surveillance purpose should continue to be explored, based on availability of more reliable antibody tests.

4. In-depth analysis of available data and rapid studies related to COVID 19, to drive a more evidence based approach to epidemic control

The COVID 19 pandemic is a new and evolving entity, and there are many aspects which are not sufficiently understood, although these are critical for more effective control. While we do not have the luxury of doing elaborate studies, we can conduct quick analysis of key forms of data and rapid studies, which would greatly improve our ability to control the epidemic in Maharashtra.

We have already outlined above key areas where we need better understanding of the COVID 19 epidemic through further analysis (**section B**). This includes answering questions of direct practical relevance such as –

- **What is the current population based prevalence of COVID 19 infection** (including all forms including asymptomatic persons) in the general population in high focus areas? As of now we only know the proportion of who are COVID 19 positive among those tested (who are a highly selected sample due to testing criteria). This is not sufficient to understand the status of infection in the community, which is very important to predict the further trajectory of the epidemic and to design control strategies.
- **What is the correlation between population density and rapidity of spread of COVID 19** in our settings? We have seen how significant community transmission is now underway in urban clusters like localities Mumbai and Pune, which are densely populated. The feasibility of social distancing in such situations needs to be carefully evaluated, and complementary approaches might be emphasised.
- **What is the scale of asymptomatic cases in the population** and what is their likely importance in promoting spread of infection?
- In areas of community based transmission, **is the spread primarily by close contacts, such as household members? Is there a special role of indoor areas**, including air conditioned spaces, in facilitating transmission? On other hand, what proportion of cases have apparently acquired the infection through short-term and open air contacts? (this has major implications for recommendations related to social distancing in coming period).
- **What is the numerical distribution of cases across the clinical spectrum** – asymptomatic, mild, moderate, severe and critical cases?
- What is the case- hospitalisation rate, and what is the fatality rate among hospitalised cases? What are the key features of cases which have died? (see next point below).

At this point of time, **what is possible and highly desirable is conducting rapid micro studies in a few high prevalence epidemic sites** in terms of occurrence, pattern of symptoms shown, contact history, proportion of hospitalization, case fatality and so on. We could use the WHO FFX protocol, adapted as a rapid retrospective study in a few urban containment zones of Mumbai and Pune. **Efforts should be made to capture population level understanding of the transmission of COVID in at least few pockets.** These studies could be entrusted to various health research institutes and groups with oversight by Public health department.

We can also analyse existing data and carry out **comparative and ongoing analysis of recent case doubling times in various areas**, including major hotspots and lower transmission areas, including **positive outliers like Islampur in Sangli district**, since there is major variation in doubling times across the state. We need to understand the factors which may have been responsible for better containment in certain clusters, which might provide lessons for control in other areas.

5. **Analysis of COVID 19 deaths to refine treatment and reduce Case Fatality Rate (CFR)**

As mentioned above, there is currently huge variation in CFR due to COVID 19 across cities in Maharashtra, with these rates being around nine times higher in certain urban areas compared to other ones. It is very likely that very differing levels of COVID 19 testing in these various cities are primarily responsible for these huge apparent variations (although standardisation of testing criteria is expected).

However, this needs to be investigated through comparative analysis of levels of testing in each of these areas. Further, ***detailed analysis should be conducted concerning all 500+ persons who have died so far in Maharashtra associated with COVID 19 infection***, analysing these *according to age, sex, pre-existing co-morbidity, time between detection and hospital admission, time between hospital admission and initiating intensive care, time between onset of intensive care and death, clinical practices adopted, and hospital wise disaggregation, along with comparison across major urban clusters*, and comparing case fatality rates in various major hospitals treating COVID 19 cases, while adjusting for other factors.

During such analysis, *certain areas and certain hospitals are likely to have lower case fatality rates even after adjusting for other factors*, and these need to be especially analysed to understand possible reasons for lower fatality which may have implications for case management across the state. Teams of public health professionals along with relevant clinicians could be entrusted with carrying out such analysis to inform public health officials.

6. **Forming a State Public health advisory group**

We recommend formation of a State Public health advisory group to actively assist COVID 19 control in Maharashtra, including individuals from multi-dimensional public health backgrounds who can regularly analyse state, national and international developments, draw upon scientific updates, oversee rapid analysis of updated data, and advise the Health department regarding refinements and modifications in public health strategies to tackle the epidemic. This group could provide analysis and information to State health authorities and decision makers on daily basis. Kerala government formed such an advisory group at an early stage, which has been providing regular inputs to state health officials. Many of the analyses and studies suggested in this report could be facilitated by such an advisory group.

7. **Upgrading Health system preparedness to deal with the COVID 19 epidemic situation**

This is a very important and detailed area which requires separate analysis, which we hope to contribute towards soon in a separate document; only a few broad points will be noted here. Strengthening public hospitals to deal with expected serious COVID 19 cases requiring ICUs, ventilators etc. is already high on the State government's agenda. Along with upgrading and earmarking public hospitals as 'COVID hospitals' to deal with serious cases, more basic COVID Care Centres need to be developed across the state, housed in Rural hospitals and well-staffed PHCs, to deal with large number of persons having minor to moderate forms of the illness. As we know, besides severe cases requiring hospitalisation, 15 to 20 times the number of hospitalised cases would be mild and moderate cases requiring non-hospitalisation care (see estimates below).

Table 8: Expected peak numbers of COVID 19 cases in Maharashtra (in lakhs)

Scenarios	Peak hospitalisations	Peak symptomatic Non-hospitalised infections	Peak total infections
Hard lockdown	1.81	30.70	131.8
Hard lockdown and continued social distancing / isolating cases	1.31	22.32	94.2

Source: CDDEP⁴

Keeping such relatively optimistic scenarios in view, let us see the approximate existing number of hospitals, ICU beds and ventilators in Maharashtra, which would be available to deal with more serious COVID 19 cases.

Table 9: Healthcare resources in Maharashtra (estimates) in public and private sector

	Public	Private	Total
Hospitals	711	2492	3203
ICU beds	2572	9015	11,587
Ventilators	1286	4507	5793

Source: CDDEP⁵

WHO has estimated based on the Chinese experience that 15–20% of COVID-19 cases require hospitalization, with around 5% requiring intensive care. National health profile 2018 states that ***Maharashtra has 51,446 public hospital beds, which is less than 40% of the peak expected hospitalisations (1.31 lakhs) required for COVID 19 management in the best case scenario.*** If we estimate that around 6550 patients (5%) out of these would require ICU support, then again ***the public health system with 2572 ICU beds would be able to manage less than half of these critical COVID 19 cases.*** And obviously, all public hospital beds cannot be devoted exclusively to COVID 19 treatment, since all existing forms of illness would continue along with accidents, emergencies, routine deliveries etc. which would continue to occupy significant number of beds. So there is presently a huge shortfall in the public health system; while physical infrastructure can be augmented somewhat in the short term, a greater challenge would be to obtain the required staff such as specialist doctors, ICU and general nurses, lab technicians and other skilled support staff at short notice (see below also). Hence large scale insourcing / taking over of private healthcare facilities would also be required specially to deal with the peak of the epidemic; this concern is dealt with in the next action point.

Linked with expanding physical resources, there is need for giving top priority to addressing health manpower issues at various levels, to ensure adequate healthcare staff for treating patients, as well as community health activities related to COVID 19. Although long pending vacant posts in the health department at various levels are now supposed to

⁴ Center for Disease Dynamics, Economics and Policy: Covid-19 India: State-level Estimates of Hospitalization Needs

⁵ Center for Disease Dynamics, Economics and Policy: COVID-19 in India - State-wise estimates of current hospital beds, intensive care unit (ICU) beds and ventilators

be finally being filled, a more sustainable Health Humanpower policy is required for the state to ensure adequate numbers of skilled staff at all levels. Another major concern which has been already raised in various forms is the ***need for provision of adequate PPE to health staff involved in dealing with suspected and confirmed COVID 19 patients***. Here adoption of a graded PPE policy (required protection depending on level of likely exposure) and harnessing the considerable industrial capacity of Maharashtra to rapidly ramp up production of protective gear is an urgent requirement.

Further it must be ensured that routine and ongoing health services are not compromised due to temporary diversion of healthcare resources towards epidemic control. There are numerous reports from Mumbai and other places, which indicate that due to conversion of existing public hospitals (which were already insufficient for the population) into COVID hospitals, patients with non-COVID serious conditions such as cancer or chronic renal disease are facing difficulties in accessing required public health care. Wherever certain public hospitals are converted into COVID hospitals, parallel arrangements must be made to ensure that all patients with other health problems continue to receive required care, through other public health facilities or insourced private facilities, which are accessible.

8. **Developing comprehensive policy guidelines for regulated engagement of the large private healthcare sector, for COVID 19 related activities**

As noted already, in Maharashtra given the high level of privatisation of healthcare, especially during the epidemic surge if all patients are to be adequately treated then perhaps around half of the COVID 19 cases might need to be treated by insourced and regulated private facilities. In this context, two recent initiatives by the State government are quite significant. Firstly, the Mahatma Jyotiba Phule Jan Arogya Yojana (MJPJAY) insurance scheme for free hospitalisation care has now been extended to all citizens. Secondly, the government has invoked the Disaster Management Act and Epidemic Act, capping the fees of COVID-19 treatment in all private hospitals across the state.

Building on these positive measures taken in the epidemic situation, there is need for a ***comprehensive policy dealing with role of the Private healthcare sector for management of COVID 19 cases in the state***, dealing with continuation of routine healthcare, surveillance, testing, and treatment of COVID 19. This should include the ***option of government temporarily taking over private hospitals for COVID care where required***, along with obligations of private providers related to providing regular information and assisting surveillance. Such a policy may be discussed with medical associations, and could also be widely disseminated through their networks. This policy should also include comprehensive protocols for COVID 19 management and protective measures at various levels to be rigorously monitored (no more Wockhardt hospital - type scenarios to be allowed), mechanisms for solving any constraints faced by private providers while providing care in the lockdown situation, and ensuring free COVID 19 testing by private labs based on rational testing criteria, and with a fair and timely reimbursement mechanism.

9. **Developing a responsive lockdown reversal strategy document for Maharashtra**

A wide range of public health opinion^{6,7,8} is telling us that lockdown is only a short term and relatively ineffective instrument for slowing down COVID 19 transmission. Each of the mentioned public health expert groups have opined that blanket restrictions at best give opportunity to implement much more effective tools of widespread testing, isolation of cases, wide tracing of contacts and quarantine, which need to be the main strategy for epidemic control.

As noted above, given the large number of social and economic constraints produced by a generalised lockdown, which especially impact large sections engaged in the unorganised sectors of the economy in urban and rural areas, there is urgent need to lay down an overall lockdown reversal strategy for Maharashtra. This could cover several areas such as the following:

- Overall Health objectives and non-Health related objectives to be achieved during lockdown reversal process
- Management of existing hotspots (track 1 areas) as well as lower transmission (track 2) areas in a manner which would contain further transmission and minimise severe health impacts of the epidemic
- Criteria for relaxing the lockdown in any district / city, with options for differential phasing out of restrictions, depending on nature of COVID 19 transmission and other considerations
- Ensuring agricultural inputs, farming activities, and procurement of agricultural produce
- Guaranteeing food security especially for large population in the unorganised sector
- Dealing with special needs of various vulnerable groups including migrant workers, homeless people etc.
- Measures for livelihood and economic revival in the post lockdown period
- Dealing with public transport issues in the period of social distancing
- Range of health system reform measures to be pursued in the post-lockdown situation, while ensuring capacity to deal with any resurgence or second wave outbreaks.

Given the highly multi-disciplinary nature of the lockdown reversal process and post lockdown socio-economic strategies, there is need to engage diverse experts and stakeholders in this process through online consultation. The well drafted '*COVID lockdown reversal strategy*' developed by a multi-disciplinary committee in Kerala could be a useful reference point for drafting such a strategy for Maharashtra, which is now urgently required.

⁶ <http://www.ijmr.org.in/downloadpdf.asp?id=281608;type=2>

⁷ www.hindustantimes.com/india-news/testing-quarantine-more-effective-than-lockdown-to-check-covid-19-suggests-epidemiological-model/story-SIOXB8SzEHugmI0D3bOXoN.html

⁸ www.iphaonline.org/wp-content/uploads/2020/04/Joint-Statement-of-IPHA_IAPSM-for-COVID-19-containment-plan_April-11_6-pm_Final-1.pdf

10. Need to catalyse widespread public awareness and participation for COVID 19 control

The intensive strategy mentioned above can become possible only with much more active social engagement – this is one of the lessons of the Kerala experience. We also need to keep in view that in absence of any vaccine or definitive treatment to eliminate the infection, along with testing and supportive care, ***a major plank of COVID 19 control is various forms of modification in social behaviour*** - including isolation of cases, home or institutional quarantine of suspects / contacts, social distancing, and modification of public movement and interaction. While administrative orders obviously have a role, these kind of changes can be ensured only when combined with high level of social awareness and informed, voluntary participation. This requires Panchayat representatives, community volunteers, women’s self-help groups and civil society organisations in each area to be informed and actively involved on highest priority. ***This can be initiated in appropriate manner even in conditions of lockdown and social distancing*** including use of digital and online communication, and could be appropriately expanded when restrictions on movement are reduced in the lockdown reversal and post lockdown process.

Under supervision from Health and other officials, *with due personal protection and precautions*, community health workers (ASHAs, Anganwadi workers) can carry out expanded contact tracing and overseeing home quarantine, and other social actors can help shoulder tasks of supporting people in home quarantine (without any direct contact), whose houses may need to be visited daily to supply food and medicines etc. There is also need to maintain wider social support to encourage all such quarantined persons to remain strictly at home, while eliminating any stigma to them from the community, and preparing food locally to be supplied to such houses as required. All this can be organised while maintaining social distancing and other due precautions.

Catalysing public participation also requires more proactive and effective public communication by the government, moving beyond restrictive messages (‘stay at home’) and general reassurance (‘no need to worry’), but also positive messages (‘how you can help’ – by countering unscientific beliefs, encouraging people to observe home quarantine and supporting them if possible, not stigmatising anyone due to infection or contact etc.). If the Chief Minister and Health Minister can daily address the general public across the state through the electronic media with updated information and explanations, this will give people an accurate picture of the evolving situation, and will get people fully on board for measures like home quarantine and contact tracing without any stigmatisation, while countering various negative social media influences and misconceptions. In addition, while objectives for control and core lines of action obviously must be decided at state level, ***regarding means for achieving public participation and compliance, there should be space for decentralised initiative in various districts***, encouraging District officials and Panchayat bodies to actively innovate for public awareness and organised behaviour, within contours of the overall strategy (the colour coded pass system implemented in Chandrapur is one such example).

There should be no hesitation in ***engaging the wide and diverse range of civil society networks*** which are active across every district of Maharashtra, to support epidemic related measures in organised form, through ***setting up a systematic State-civil society interface in each district and at state level***. This could help to coordinate social efforts for mass awareness, mobilise volunteers, facilitate health, food security and other services for vulnerable and excluded groups

in the epidemic situation, run community kitchens, and provide community based feedback to officials to address various gaps.

Given the constraints imposed during the lockdown scenario, and wide penetration of mobile phones including smart phones even in most rural areas, ***use must be made of non-intrusive IT tools to ensure two-way communication which is essential in the present situation***. This might include WhatsApp posters, SMS, voice messages, short videos etc. for awareness generation, as well as helplines and Apps for rapid response systems, simple online surveys, telephonic feedback mechanisms, and online consultations using mobile phones – helping to ensure outreach to needy and vulnerable populations, and redressal of gaps and grievances in rapid manner.

This document by the Maharashtra public health analysis group has attempted to rapidly analyse the current state of the COVID 19 epidemic in Maharashtra, and is focussed on deepening our collective understanding of dynamics of the epidemic, while proposing a set of strategies for upgraded control. We feel that this approach is broadly in line with the National containment strategy proposed by MOHFW. However, it does highlight certain critical areas requiring major upscaling, and suggests value additions along with adapting the broad national approach to the current realities of Maharashtra, emphasising community based strategies while asking for review of generalised restrictive measures.

We are deeply aware of many wider issues related to the lockdown and impacts of the epidemic, which we are unable to address here - such as need for ensuring food security to wide sections working in the unorganised and informal sector, urgently providing food and other forms of support to groups of stranded migrant workers, and preventing various types of health, social and human rights violations, as well as communal and other forms of stigmatisation, which are unfortunately appearing in this situation. Many of these issues are being dealt with by various civil society networks and groups, and hopefully such collectives may come up with related documentation and recommendations regarding these important issues in context of Maharashtra in the near future.

Finally, we hope that moving beyond what seems to be a primarily administrative and state-centric approach for dealing with this unprecedented and multi-dimensional health and social crisis, the Government of Maharashtra will take a more inclusive attitude to partner with the people of the state for tackling this epidemic. This is especially important because there are all indications that unfolding across various stages, the epidemic may significantly affect health and lives of people in the state over at least next three to six months. Greater responsiveness by the state machinery, ensuring that commitment for epidemic control is strongly shared by state and society through dialogue processes, and appropriate forms of social involvement based on systematic and well designed, regular mass communication - these seem essential for all of us to collectively counter this challenge of such magnitude and complexity. Developing such a new 'social compact' during and beyond the epidemic is the call of the hour which Maharashtra, historically a heartland of social reform and innovation in India, must no longer ignore.