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Study of geographical distribution of number of cases of COVID-19 in different areas of Maharashtra

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ABSTRACT

Background: Geographical differences in number of COVID-19 cases and death are affected by population density, age, gender distribution and mitigation measures like social distancing etc. The aim of this study was to determine the geographical distribution of number of cases of covid-19 in different areas of Maharashtra. The investigator wants to know, which area, which age group and which gender has been affected the most by COVID-19 along with the effect of lockdown.

Methods: Area and population of all the COVID-19 affected area was collected and area wise number of cases till 31st May 2020 was considered. Association between number of COVID-19 cases and population of areas was calculated and gender-wise and age-wise case distribution was also calculated.

Results: Cases are more in urban areas mainly in corporation (Chi square=114441; p<0.0001). Age group 31-40 years' is most affected (11.5 per 100,000 population affected). Young adults as well males were affected most and even though population of children is quite big, they remained less affected (chi square=22117).

Conclusions: This COVID-19 is a disease of urban area primarily affecting corporation areas. High population density and overcrowding are mainly responsible for initial phase of this disease only in corporation area. Strict lockdown and other social measures decreased both transmission and mortality rate.

Keywords: COVID-19, Population distribution, Pandemic, Lockdown

INTRODUCTION

Clustering of cases of pneumonia of unknown cause was first detected in Wuhan, China and reported to the WHO Country Office on 31 December 2019. First case of novel coronavirus outside China was confirmed on 13 January 2020 in Thailand. The outbreak was declared a Public Health Emergency of International Concern on 30 January 2020. On 11 February 2020, WHO named the new coronavirus disease as COVID-19. The first case of the COVID-19 pandemic in India was reported on 30 January 2020. The patient was a student who returned from China. As of 31st May 2020, there were 182,143 cases in India

with total deaths 8,380 and case fatality rate of 2.84%. In this article has focus on Maharashtra State. The first confirmed case of coronavirus in Maharashtra was reported on 9 March 2020 in Pune. The patient and spouse returned from Dubai tested positive. Maharashtra's first death due to COVID-19 was reported on 17 March. The deceased person was a 64-year old man who died at the Kasturba Hospital in Mumbai. For controlling the pandemic, following major action were taken state-wide. Epidemic Act was imposed in five cities on 13th March 2020 which lead to closure of commercial and educational institutions. On 14th March there was announcement of ban on public gatherings and events. Closure of all

workplaces barring essential services was enforced on 20th March 2020. Imposition of Section 144 and lockdown declared on 22nd March 2020 followed by curfew and border seal-off in all districts.

As of 31st May 2020, there were 65,168 cases in Maharashtra with total deaths 2,197 and case fatality rate was 3.37%.

Geographic differences in numbers of COVID-19 cases and deaths, cumulative incidence, and pace of increasing numbers are probably affected by combination of jurisdiction specific epidemiological and population level factors, including the timing of COVID-19 introduction, population density, age and sex distribution, prevalence of comorbidities among population, the timing and extent of community mitigation measures, diagnostic testing capacity and public health reporting and management practices, availability of resources

Monitoring numbers of COVID-19 cases, deaths, and changes in incidence in administrative geographic boundaries is critical for understanding community risk and making decisions about community mitigation, including social distancing, compulsion of masks and strategic health care resource allocation. All population has been affected by this pandemic but in this initial phase many epidemiological aspects are not clear. The investigator wants to know which areas whether rural or urban and which age group is affected the most.

The aim of this study was to determine the geographical distribution of number of cases of covid-19 in different areas of Maharashtra. Objectives were to determine geographical distribution of cases with respect to corporations and non-corporation areas in Maharashtra, to measure association between age group and number of COVID-19 cases, gender-wise distribution of COVID-19 cases and association between population density with number of cases of COVID-19 in Maharashtra.

METHODS

Department of Community Medicine, of a private Medical College, Pune. It is 'A+' NAAC accredited college with 831 bedded NABH accredited multi-specialty hospital. The data pertain Maharashtra State which has estimated population of 123 million. There are 35 districts (Mumbai Municipal Corporation considered as one unit) and 27 municipal corporations in the state. Available data was analysed. Data available till 31st May has been analysed.

There was no sampling. All data regarding number of COVID-19 cases in different districts and municipal corporation on Maharashtra was obtained from government websites. Area and population of all affected districts and municipal corporations in Maharashtra was collected.

Data of all COVID-19 affected areas were taken into consideration till 31st May 2020. Data were collected from Government website- www. census 2011.com, www. mohfw. com, www. dmer. org/ new/, www.indiagrowing.com etc.

Variables used in the study were population, area, population density, age group, sex and number of cases of COVID-19.

Methodology

After obtaining permission from the Institutional Ethics Committee, number of COVID-19 cases in all the areas of Maharashtra have been searched till 31st May 2020. Area and population of all affected districts and municipal corporations in Maharashtra was collected. For this study the investigator has calculated the area and population corporations and non-corporation separately. Thus 61 units are considered for analysis of COVID-19 affected areas in Maharashtra. Population of 2020 for each 61 areas has been extracted from various websites. Estimation of expected number of cases without lockdown was based on observation of data from 9th March 2020 to 24th March 2020 and actual expected data starts from 25th March 2020. 31/05/2020 is the 84th Day after the first positive case in Maharashtra. So, without lockdown on 31/05/2020 there would have been 100706 positive cases as opposed to 67.655 cases with lockdown.

Data analysis

The collected data was entered in Microsoft Excel sheet. Area wise population density, number of cases per lakh population and chi square was calculated between number of cases and population of areas. Gender-wise and agewise case distribution was also calculated. Person correlation coefficient was calculated between population density and number of cases. Chi square was also applied between the population of different age groups and number of cases in that age group.

RESULTS

As on 31/05/2020, Maharashtra is the most affected state from COVID-19 with 65,168 cases, 2197 deaths with mortality of 3.37%. In Tables 1-3, cases per lakh population in Maharashtra are given.

Table 1: Areas with cases <1per lakh population.

District or area with cases <1 per lakh population	No of cases/lakh population
Amravati	0.53
Chandrapur	0.80
Nagpur	0.81
Nanded	0.76
Wardha	0.79
Washim	0.62

Among 61 affected areas of Maharashtra, there are only 6 districts having less than 1 case per lakh population. Rural Amravati is the least affected area from COVID-19.

Table 2: Areas with cases 1 to 10 per lakh population.

B1	no of
District or area with cases >1 per lakh population	cases/lakh
	population
Solapur	1.28
Aurangabad	1.54
Bid	1.66
Sangli-Miraj-Kupwad Municipal	1.88
Corporation	
Nandurbar	1.93
Ahmednagar	1.95
Dhule	2.02
Buldhana	2.10
Bhandara	2.26
Parbani	2.49
Chandrapur Municipal Coporation	2.56
Gadchiroli	2.79
Akola	2.95
Sindhudurg	3.63
Osmanabad	3.72
Nashik	4.00
Sangli	4.15
Latur Municipal Corporation	4.17
Gondiya	4.31
Yavatmal	4.38
Latur	4.57
Kolhapur Municipal Corporation	4.68
Parbani Municipal Corporation	4.74
Ahmednagar Municipal	
Corporation	5.19
Thane	5.19
Jalna	5.68
	2.20

Mumbai Municipal Corporation is the most affected area having 383.94 cases per lakh population. It is followed by Amravati Municipal Corporation (261.66/lakh population) and Navi Mumbai Municipal Corporation (175/lakh population). Cases are more in urban areas mainly in corporation (Chi square=114441; p<0.0001).

Age wise details were available for 62,035 individuals. Age group 31-40 years' is most affected (11.5 per 100,000 population affected) and >81 years are least affected. When compared with standardized population of Maharashtra (census 2011), COVID-19 has significantly affected young adults (chi square=22,117; p<0.0001) (Table 4).

The relationship between number of cases and population density is given in Figure 1. Population density has an intermediate relationship with number of cases of all areas. (Pearson correlation= 0.49 CI. 0.27-0.66).

Table 3: Areas with cases >10 per lakh population.

District or area with cases >1 per lakh	no of cases/lakh
population	population
Nashik Municipal Corporation	10.36
Jalgaon	11.18
Kolhapur	11.34
Hingoli	11.83
Nanded Municipal Corporation	12.47
Ratnagiri	14.35
Pune	14.56
Bhivandi-Nizampur Municipal Corporation	14.82
Satara	15.25
Nagpur Municipal Corporation	18.63
Palghar	22.16
Pimpri Chinchwad Municipal Corporation	22.50
Raigad	22.74
Dhule Municipal Corporation	25.38
Jalgaon Municipal Corporation	29.05
Vasai - virar Municipal Corporation	48.69
Ulhas Nagar Municipal Corporation	58.48
Mira Bhayandar Municipal Corporation	60.50
Solapur Municipal Corporation	80.11
Aurangabad Municipal Corporation	91.44
Kalyan-Dombiwali Municipal Corporation	95.70
Malegaon Municipal Corporation	104.33
Akola Municipal corporation	116.93
Pune Municipal Corporation	142.20
Thane Municipal Corporation	151.19
Panvel Municipal Corporation	158.74
Navi Mumbai Municipal Corporation	175.00
Amravati Municipal Corporation	261.66
Mumbai Municipal Corporation	383.94

Table 4: Age wise distribution of cases.

Age in years	Number of cases	Age adjusted attack rate
0-10	2188	2.0
11-20	4161	3.7
21-30	12627	11.3
31-40	12921	11.5
41-50	11153	10.0
51-60	10209	9.1
61-70	5749	5.1
71-80	2327	2.1
81+	700	0.6
Total	62035	55.4

Gender-wise details of only 62,217 individuals were available, out of which 38,778 were males and rest females. In Maharashtra males are more than females, and

COVID-19 has significantly affected males more than females. (chi square= 2,746: p<0.0001).

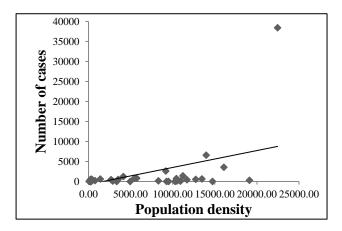


Figure 1: Distribution of cases per population density.

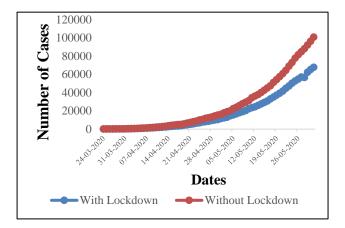


Figure 2: Date wise comparison of cases with and without lockdown.

DISCUSSION

The recent COVID-19 pandemic has caused serious problems in India. India acted fast by declaring a ban on International flights and enforcing a country-wide lockdown. This lockdown also gave time to the health care system and Government to deploy all possible resources to tackle the peak of this pandemic peaks in upcoming months. COVID-19 affected almost all the states but in a very different manner. Maharashtra is the most affected state. Mumbai Municipal Corporation occupies only 0.14% area of Maharashtra but it contributes to 59.04% of total cases. This COVID-19 is a disease of urban area primarily affecting corporation areas (chi square= 11444). High population density and overcrowding are mainly responsible for initial phase of this disease only in corporation area. The numbers of cases did not decrease as people did not follow the rules like not attending social gathering, keeping social distance and wearing masks in public places. If we take Median Incubation Period approximately as 5 days for COVID-19, even after 20 incubation period cycles, this is limited to mostly corporation areas. One of the main strategies of Maharashtra government adopted was to use drones which would monitor social distancing during the lockdown and followed cluster containment strategy: if three or more patients are diagnosed, all houses within 3 km are surveyed to detect further cases, contact racing and raise awareness. We can say this strategy worked out to some extent as without lockdown there might have been 100,000 cases on the 84th days itself. All major news sources like Times of India, Economic times, Hindustan India, India Today etc. with their published articles support the social measures taken in this pandemic which decreased both transmission and mortality rate. Lockdown is not the only way out, as it is short term solution.

This was the initial picture of the disease, COVID-19 was affecting only urban areas and mainly corporations, slowly when the lockdown was lifted, as predicted on the basis of our data, due to migration, transmission took place to rural areas and other states as well. A recent study also found increase in rate of transmission during unlock phase. And also people travelled during lockdown, they went back to their native places, so transmission occurred there too. Young adults as well males were affected most and even though population of children is quite big, they remained less affected (chi square= 22117). This observation is certainly due to higher out of home movements of young adults and males. Even corporations like Pune and Mumbai have a large working male population from Konkan area. Apart from population density, municipal corporations have higher trade and travel with other countries which were affected earlier.

Limitation

This study is solely based on secondary data. Population of 2011 was available in the latest Census. Estimates of population of 2020 were obtained from different websites.

CONCLUSION

This COVID-19 is a disease of urban area primarily affecting corporation areas. High population density and overcrowding are mainly responsible for initial phase of this disease only in corporation area. With this study we can conclude that strict lockdown and other social measures decreased both transmission and mortality rate. Many new strategies have to be taken in the near future to control this pandemic.

Rate of testing has to be improved, robust monitoring system, assured and prompt ambulance services, availability of beds as per need of the patient, equipped infrastructure, trained and increased number of healthcare workers with provision of PPE kits and proper mitigation of migrant population are important strategies. Availability of specific antiviral drug and development of vaccine against COVID-19 are the ultimate solution for controlling this pandemic and many companies are working for it. Many more studies and research have to be done for therapeutic management as well.

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Institutional Ethics Committee

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