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SEROPREVALENCE OF COVID-19 IN AURANGABAD DISTRICT

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Abstract:

Background: Seroprevalence of Covid 19 data will be necessary for public health authorities to estimate exposure rates in the general population. Maharashtra is the state with highest number of Covid 19 infections. In terms of Covid deaths, it would rank tenth in the world. Aurangabad is one of the worst hit districts in Maharashtra state, with Covid cases in excess of 35,000.With this rationale a district wide serosurvey was conducted in Aurangabad district of Maharashtra, India.

Objective: To estimate the sero- prevalence of COVID-19 in Aurangabad district and also study the determinants of seropositivity of COVID-19.

Materials and Methods: A community based cross sectional study was carried out in the households of Aurangabad Municipal Corporation (AMC) area, peri urban, council and rural areas of Aurangabad district from 10th August 2020 to 19th August 2020 by 20 field teams**.** Data was collected using Google forms and 3-5 ml of venous blood was collected and transported to Viral Research and Diagnostic Laboratory at Government Medical College, Aurangabad as per ICMR guidelines. Antibody testing was done using COVID-19 IgG ELISA technique on the same day.

Results: Estimated sero-prevalence of Covid 19 in Aurangabad district was found to be 5.8%. Sero-positivity was more in corporation area, slum dwellers and Muslim population. More than 93% of the sero positive people had no history of contact with confirmed Covid case. This indicates community transmission. Since the study is representative of the entire district, it can be said that there is little if any, role of lockdown as public health measure.

Keywords: *Covid 19, sero-prevalence, Aurangabad*

INTRODUCTION:

On 30 Jan 2020, The Director-General declared the novel coronavirus outbreak a public health emergency of international concern (PHEIC), WHO's highest level of alarm. [(1)] WHO announced COVID-19 outbreak as a pandemic on 11 March 2020.[(2)] Currently worldwide we have 33034598 Confirmed cases, 996342 Confirmed deaths, spread over 235 Countries, areas or territories with cases .[(3)]

Serology, or antibody testing checks a sample of a person's blood to look for antibodies against SARS-CoV-2, the virus that causes COVID-19. Antibodies usually become detectable in the blood 1-3 weeks after someone is infected. Some people may take longer than 3 weeks to develop antibodies, and some people may not develop antibodies. It is currently unknown how long antibodies are detectable after infection. A positive result from this test may mean that a person was previously infected with the virus. The percentage of individuals in a population who have antibodies to an infectious agent is called seroprevalence.

A seroprevalence survey uses antibody tests to estimate the percentage of people in a population who have antibodies against SARS-CoV-2. [(4)] Little is currently known about COVID-19 virus antibody kinetics. Asymptomatic infected persons may clear the virus more quickly than do symptomatic patients and antibody titres in the former are likely to be lower, if they seroconvert at all, than in infected patients exhibiting symptoms.[(5)]

Due to the high proportion of asymptomatic or mild infections (approximately 80%), data restricted to laboratory-confirmed cases do not capture the true extent of the spread or burden of the virus, or its infection-fatality ratio. Therefore, serological detection of specific antibodies against SARS-CoV-2 can better estimate the true number of infections.[(6)]Seroprevalence studies from cohorts representing the general population have become available from COVID-19 hotspots such as China, the USA, Switzerland, and Spain.[(7-11)]

We are still in the midst of an unprecedented global health crisis hence sero-prevalence data will be necessary for public health authorities to estimate exposure rates in the general population. Globally, Maharashtra is the province with highest number of infections. In terms of deaths, it would rank tenth in the world.[(12)] Aurangabad is one of the worst hit districts in Maharashtra state, with cases in excess of 35,000.[(13)]With this rationale a district wide sero survey was conducted in Aurangabad district of Maharashtra , India.

STUDY OBJECTIVES:

The primary objective of the sero-Survey was to provide essential data on estimate the sero- prevalence of COVID-19 in Aurangabad district and also study the determinants of seropositivity of COVID-19.

METHODOLOGY:

A community based cross sectional study was carried out in the households of Aurangabad Municipal Corporation (AMC) area, peri urban, council and rural areas of Aurangabad district. Sample size was calculated taking into consideration the antigen/RTPCR positivity rate of 20% using statistical formula $N= z^2pq/e^2$, where N= Sample size, Z^2= Std. Normal deviate=3.84, p=20, q= 100-p, e- absolute precision. Absolute precision was taken as 1.2 for municipal corporation area, 2.5 for peri urban area and 3 for council and rural areas. Sample of 4267, 938, 683 and 683 adults was to be taken from Municipal Corporation, peri-urban, council, and rural areas respectively. The total sample size of 6571 individuals above 18 years of age, who had been residents of Aurangabad district for more than 6 months, excluding non-consenting and migrant population, was selected. Study population was taken from 115 wards of Aurangabad Municipal Corporation, Rural and council study population from Aurangabad, Phulambri, Sillod, Soegaon, Khultabad, Kannad, Vaijapur, Gangapur, and Paithan blocks. Study population from peri-urban areas was selected from Bajaj Nagar and Waluj. The samples were taken proportionate to the population and population of slums and non-slum

area too was given appropriate weightage. Data collection was conducted from 10th August 2020 to 19th August 2020 by 20 field teams. Each team consisted of 2 doctors, 1 trained phlebotomist, 1 assistant and 1 health worker from local health post. After visiting the selected area, main square was identified. Lane was selected randomly by spinning the bottle. After randomly selecting first household, required number of households from that area, were selected by using left hand rule. After the first household every tenth household was selected. In case of refusal, the immediate next household was selected. One adult from each household fulfilling the inclusion criteria was interviewed by using Google form. From the first household oldest male, from second household oldest female, from third household youngest male and from fourth youngest female was interviewed and same sequence was continued further. The study team briefed the selected household about the survey objectives and process involved with the help of participant information sheet. After obtaining consent, information on basic demographic details, exposure history to laboratory confirmed.COVID-19cases, symptoms suggestive of COVID-19, and clinical history was recorded. All data was entered in Google form on mobile phones by the survey teams.3-5 ml of venous blood was collected and transported to VRDL at Government Medical College, Aurangabad as per ICMR guidelines. Antibody testing was done using COVID-19 IgG ELISA technique on the same day.

RESULTS:

The coverage of sample was 100% in corporation area and peri urban area and more than 97% in council and rural areas. Estimated sero-prevalence of Covid 19 in Aurangabad district was found to be 5.8%.

Table 1 shows the seroprevalence of the Aurangabad Municipal Corporation Area, Peri Urban, Rural and Council areas of Aurangabad district. It was 11.81% in Aurangabad Municipal Corporation area, 7.12% in peri urban area, 4.82% in council areas and 2.54% in rural areas. Seroprevalence was more in slum areas as compared to non-slum areas. Chi- square test was applied to study the correlation between slum and non-slum areas with sero- positivity which was found to be statistically significant with, $\chi 2=17.529$; 'p' value=0.000 . The Odds Ratio was calculated for relationship between locality and seropositivity and it revealed that the people living in slums had a 1.44 (CI-1.21 to 1.72) times higher chance of developing seropositivity, than all others and the p-value was <0.0001, which indicated that this association is significant.

Table 1: Sero-Prevalence Of Sars-Cov-2 In Aurangabad District

	LOCALITY	TOTAL SAMPLES	TOTAL SEROPOSITIVE	CI 95%
Area under Aurangabad Municipal Corporation	**SLUM**	1422 (32.86)	207 (14.56)	12.72-16.39
	NON-SLUM	2905 (67.14)	304 (10.46)	9.35-11.58
	TOTAL	**4327 (100)**	**511 (11.81)**	**10.85-12.77**
Peri-urban areas	**SLUM**	253 (25.73)	17 (6.72)	3.6-9.8
	NON-SLUM	730 (74.26)	53 (7.26)	5.4-9.1
	TOTAL	**983(100)**	**70 (7.12)**	**5.5-8.7**
Council areas	**SLUM**	169*(26.83)	10(5.92)	2.40-9.50
	NON-SLUM	461*(73.17)	17(3.69)	2.00-5.40
	TOTAL	**630(100)**	**32(4.82)**	**3.20-6.40**
Rural areas	**RURAL**	**669 (100)**	**17 (2.54)**	**1.30-3.70**

*Data extracted from 630 samples since incomplete data obtained from 34 samples.
(Figures in parenthesis are percentage)

Table 2 shows the age, sex wise seroprevalence in slum and non-slums areas in Aurangabad Municipal Corporation and peri urban areas. In the area under Aurangabad Municipal Corporation, highest sero-prevalence (100.00%) was seen in the age group of 71-80 years in slum areas and 12.10% in 18- 20 years age group in non-slum area. Lowest prevalence of 10.53% is seen in 18-20 years age group in slum areas and 3.03% in 71-80 years age group in non-slum areas. Sero-prevalence among males from both slum and non-slum areas was 12.73% and that of females was 10.51%. Overall sero-prevalence in slum areas was 14.56% and non-slum areas were 10.46%.

In the peri urban areas, highest seroprevalence of 11.11% was seen in the age group of 41-50 years in slum areas and 13.04% in 51-60 years age group in non-slum areas. Lowest prevalence of 4.30% is seen in 21-30 years age group in slum areas and 4.29% in 31-40 years age group in non-slum areas. Overall sero-prevalence among both males and females was similar.

Table 2: Age And Sex-Wise Distribution Of Seroprevalence In Aurangabad Municipal Corporation And Peri Urban Areas

AREA		POSITIVE			NEGATIVE		TOTAL SAMPLES	SERO PREVALENCE (%)
		AGE	MALE	FEMALE	MALE	FEMALE		
AURANGABAD MUNICIPAL CORPORATION	SLUM	18-20	7	5	65	37	114	10.53
		21-30	40	32	229	178	479	15.03
		31-40	33	16	168	148	365	13.42
		41-50	25	21	111	107	264	17.42
		51-60	9	8	71	44	132	12.88
		61-70	6	3	35	21	65	13.85
		71-80	0	2	0	0	2	100.00
		>80	0	0	1	0	1	0.00
		TOTAL	**120(8.44)**	**87(6.12)**	**680(47.82)**	**535(37.62)**	**1422(100)**	
	NON SLUM	18-20	12	3	77	32	124	12.10
		21-30	47	22	342	243	654	10.55
		31-40	54	33	398	318	803	10.83
		41-50	44	24	346	257	671	10.13
		51-60	28	12	196	130	366	10.93
		61-70	15	8	112	72	207	11.11
		71-80	1	1	39	25	66	3.03
		>80	0	0	9	5	14	0.00
		TOTAL	**201(6.92)**	**103(3.54)**	**1519(52.29)**	**1082(37.25)**	**2905(100)**	
PERI URBAN	SLUM	18-20	1	0	10	4	15	6.67
		21-30	3	1	53	36	93	4.30
		31-40	3	3	26	48	80	7.50
		41-50	2	3	26	14	45	11.11
		51-60	1	0	8	6	15	6.67
		61-70	0	0	3	1	4	0.00
		71-80	0	0	1	0	1	0.00
		>80	0	0	0	0	0	0.00
		TOTAL	**10(3.95)**	**7(2.77)**	**127(50.19)**	**109(43.08)**	**253(100)**	
	NON SLUM	18-20	2	2	31	12	47	8.51
		21-30	9	9	97	91	206	8.74
		31-40	1	9	94	129	233	4.29
		41-50	5	7	87	48	147	8.16
		51-60	8	1	38	22	69	13.04
		61-70	0	0	16	6	22	0.00
		71-80	0	0	4	2	6	0.00
		>80	0	0	0	0	0	0.00
		TOTAL	**25(3.42)**	**28(3.83)**	**367(50.27)**	**310(42.46)**	**730(100)**	

(Figures in parenthesis are row percentage)

Table 3 shows age and sex wise distribution of seroprevalence in council and rural area. In council area, highest seroprevalence of 9.62% was seen in the age group of 31-40 years in slum areas and 7.03% in 31-40 years age group in non-slum areas. Lowest prevalence of 4.35% is seen in 41-50 years age group in slum areas and 1.96% in 21-30 years age group in non-slum areas.

In rural area, highest seroprevalence of 25% was seen in the age group of >80 years and lowest prevalence of 0.63% is seen in 21-30 years age group.

Table 3: Age And Sex-Wise Distribution Of Seroprevalence In Council And Rural Areas

AREA			POSITIVE		NEGATIVE		TOTAL SAMPLES	SERO PREVALENCE (%)
		AGE	MALE	FEMALE	MALE	FEMALE		
*COUNCIL	SLUM	18-20	0	0	9	4	13	0.00
		21-30	1	1	20	18	40	5.00
		31-40	2	3	25	22	52	9.62
		41-50	0	1	9	13	23	4.35
		51-60	0	2	13	9	24	8.33
		61-70	0	0	6	5	11	0.00
		71-80	0	0	1	4	5	0.00
		>80	0	0	1	0	1	0.00
		TOTAL	**3(1.77)**	**7(4.14)**	**84 (49.70)**	**75(44.37)**	**169(100)**	
	NON SLUM	18-20	0	1	12	7	20	5.00
		21-30	1	1	41	59	102	1.96
		31-40	7	2	64	55	128	7.03
		41-50	1	2	50	42	95	3.16
		51-60	1	1	35	19	56	3.57
		61-70	0	0	28	19	47	0.00
		71-80	0	0	5	5	10	0.00
		>80	0	0	2	1	3	0.00
		TOTAL	**10(2.16)**	**7 (1.51)**	**237(51.40)**	**207 (44.90)**	**461(100)**	
RURAL	RURAL	18-20	1	1	12	20	34	5.88
		21-30	0	1	88	69	158	0.63
		31-40	2	1	100	80	183	1.64
		41-50	3	3	67	38	111	5.41
		51-60	1	1	48	49	99	2.02
		61-70	1	1	35	34	71	2.82
		71-80	0	0	6	3	9	0.00
		>80	1	0	2	1	4	25.00
		TOTAL	**9 (1.34)**	**8(1.19)**	**358(53.51)**	**294 (43.94)**	**669(100)**	

*Data extracted from 630 samples since incomplete data obtained from 34 samples.
(Figures in parenthesis are row percentage)

It was found that higher sero positivity was found in different age groups in different areas. No pattern could be established. There was no significant difference in sero positivity among men and women.

Table 4 shows sero-prevalence of SARS-CoV-2 in different religions and occupations in Aurangabad Municipal Corporation, peri-urban, council and rural areas of Aurangabad district. Sero positivity was highest among Muslims as compared to other religions in all areas. Highest sero-prevalence in Aurangabad Municipal Corporation area of 24.96% was seen in Muslims, followed by Hindu- 8.96%, Buddhists- 15.27 %, and 8.69% in other religions. In peri urban areas, highest seroprevalence of 10.52% was seen in Muslims, followed by Hindu- 7.34%, Buddhists- 6.66%, and 3.33% in other religions . In council area, seroprevalence of 13.15% was seen Muslims, 3.90% was seen in Hindus. Samples from other religions tested seronegative. In rural areas highest sero-prevalence of 4.76% was seen in Muslims, followed by Hindus having sero-prevalence of 2.43%. The Odds Ratio was calculated for relationship between religion and seropositivity and it revealed that the Muslims had a 3.50 (CI-2.90 to 4.24) times higher chance of developing seropositivity, than all others, p-value < 0.0001, which indicated that this association was significant.

Highest sero-prevalence of 15.96% was present in semi-skilled workers in Aurangabad municipal corporation (AMC) areas. Highest seroprevalence of 12.65% was seen in unskilled workers in peri urban areas. In council areas, highest seroprevalence of 9.80% was present in professionals, and in rural areas, highest sero-prevalence of 5.26% was seen in skilled workers. Sero positivity was found more in different occupations in different areas. No pattern could be established.

Table 4: Sero-prevalence of SARS-CoV-2 in different religions

*Religion	Sero Positive				Sero Negative				Total
	AMC	Peri Urban	Council	Rural	AMC	Peri Urban	Council	Rural	
Hindu	305	62	22	14	3098	782	544	561	5388
Muslim	171	2	10	2	514	17	66	40	822
Buddhist	33	4	0	0	183	56	21	32	329
Others	2	2	0	1	21	58	1	19	104
Total	**511**	**70**	**32**	**17**	**3816**	**913**	**632**	**652**	**6643**
Occupation									
Unemployed	172	40	14	11	1344	444	295	296	2616
Unskilled	58	10	1	0	490	69	41	114	783
Semiskilled	122	14	2	0	642	211	55	68	1114
Skilled	51	3	3	2	411	99	71	36	676
Clerical	32	0	2	3	279	38	54	83	491
Semi Professional	42	3	0	0	369	31	41	20	506
Professional	34	0	5	1	281	21	46	35	423
Total	**511**	**70**	**27**	**17**	**3816**	**913**	**603**	**652**	**6609**

*Data extracted from 630 samples in council area since incomplete data obtained from 34 samples.

Fig 1 shows seroprevalence in relation to confirmed contact with COVID-19 positive patients. Of the total seropositive cases, 490 (81.94%) were found to have no history of contact with COVID-19 positive patient, 39 (6.52%) had history of contact with confirmed case of COVID-19 and 69 (11.54%) were unaware of any contact history. Majority of the seropositive people had no history of contact with confirmed Covid case. This indicates community transmission.

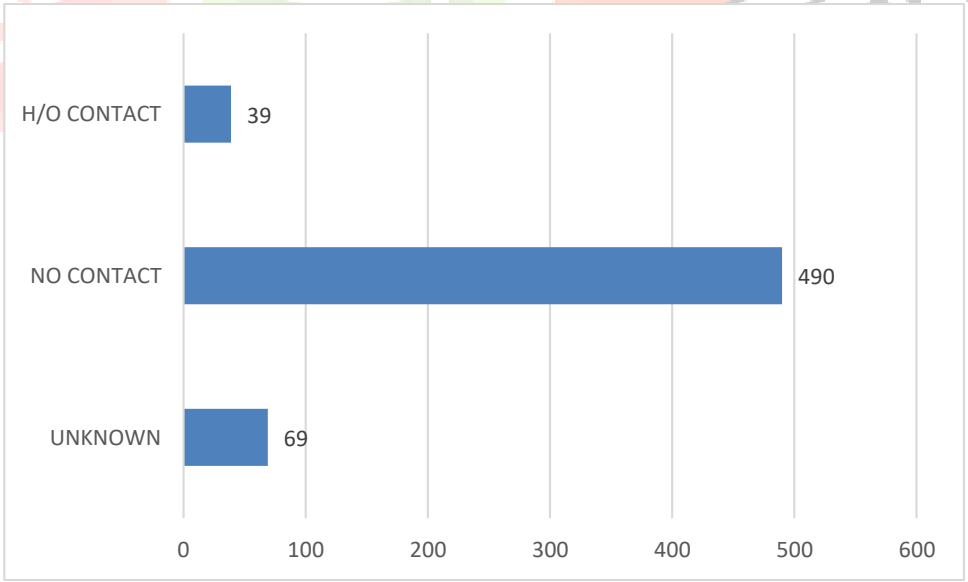

Fig 1: Sero-prevalence in cases with history of contact with COVID-19 patients

Among the total samples tested for sero-positivity, 4327 samples collected from Aurangabad Municipal Corporation (AMC) area, 596 had been tested for SARS-CoV-2 antigen. Of this 56 had come positive and 540 were negative. Among the Antigen positive cases, 39.28% were seropositive and 60.71% were seronegative for SARS-CoV-2. 16.66% of the total samples tested negative for SARS-CoV-2 antigen were seropositive, and 83.33% were seronegative. In peri urban areas, 123 out of 983 samples had been tested for SARS-CoV-2 antigen, of which 8 were positive and 115 were negative. Among the Antigen positive cases, 25% were sero-positive and 75% were sero-negative for SARS-CoV-2. From that of Antigen negative cases, 10.43% were sero-positive and 89.56% were sero-negative for SARS-CoV-2. Out of the total sample population from council area, 76 individuals had done the

antigen test prior. Out of these only 3 tested positive for SARS-CoV-2 antigen, of which 1 was seropositive and 2 were seronegative. Out of the 32 seropositive individuals, only 2 had done a swab test, of which one had tested positive for antigen, while other had tested negative for antigen. Out of the total sample population from rural area, 26 individuals had done the antigen test prior. Out of these only 1 tested positive for SARS-CoV-2 antigen, but was seronegative. Out of the 17 seropositive individuals, only 1 had done a swab test, and had tested negative for SARS-CoV-2 antigen. These finding leads us to believe that antigen positivity is no guarantee for developing antibody for Covid and antigen negativity does not rule out development of antibody.

DISCUSSION:

Drive-through testing in the USA[14], school-based testing in France[15], testing in retirement homes in Sweden[16], representative community screening in Germany[17], volunteer screening in Italy[18] and community-wide screening using various strategies in the USA [19,20,21,22,23], represent the various strategies for undertaking community-based testing. Positivity rates in population-based community screening ranged from 0.5 per cent in San Miguel County [21], to 14 per cent in Gangelt, Germany [17], and New York, USA [23] The first national sero-prevalence survey, by Indian Council of Medical Research (ICMR) conducted over May and June this year reported a seroprevalence of 0.73% [24]. This is possibly the first study where a sample population representative of entire district is studied. Estimated sero-prevalence of Covid 19 in Aurangabad district was found to be 5.8%. It was 11.81% in Aurangabad Municipal Corporation area, 7.12% in peri urban area, 4.82% in council areas and 2.54% in rural areas. In Delhi, by early July, 23% of those surveyed had developed IgG antibodies. In Mumbai, by around the same time, 57% of those surveyed in slums and 16% in non-slum areas had developed these antibodies.[25] Sero prevalence was more in slum areas as compared to non-slum areas in present study as well. We found that slum dwellers were 1.44 times more likely to develop sero-positivity as compared to non-slum dwellers. Higher prevalence in slums could possibly be due to high population density, and shared common facilities like water points and toilets. The 'Epidemiological and Serological Surveillance of Covid-19 in Pune' conducted in 5 high-incidence *Prabhags* also corroborates that the seroprevalence was higher in those who live in tenement or hutment dwellings, and among those who share toilets [26]. In the present study, Odds Ratio was calculated for relationship between religion and seropositivity and it revealed that the Muslims had a 3.50 times higher chance of developing sero-positivity, than all others with a p-value < 0.0001, which indicated that this association was statistically significant. A similar study conducted recently in Malegaon also revealed that seropositivity was more among Muslims, and the association of religion with seropositivity was statistically highly significant [27]. More than 93% of the sero positive people had no history of contact with confirmed Covid case. This indicates community transmission. High prevalence of seropositivity in other studies from Mumbai [25], Pune [26], Delhi [28] , and Ahmedabad [29] also suggest that there is extensive spread of infection, and most of the infections are asymptomatic and go undetected. High virus circulation despite the implementation of strict lockdown measures in the country could infer that there is little if any, role of lockdown as public health measure.

CONCLUSION:

The estimated sero-prevalence of Covid 19 in Aurangabad district was found to be 5.8%. It was highest (11.81%) in Aurangabad Municipal Corporation area, and lowest in (2.54%) in rural areas. Seropositivity was higher among slum dwellers, and Muslim population. More than 93% of the sero positive people had no history of contact with confirmed Covid case. This indicates community transmission. Moreover it was seen that antigen positivity does not guarantee seroconversion, and antigen negativity does not rule out seropositivity. The high prevalence of sero-positivity despite the strict implementation of lockdown would lead us to believe that there is little if any, role of lockdown as public health measure in the control of this pandemic now. It is necessary to strictly implement the practice of wearing masks, washing hands with soap and water and physical distancing. Little is known about the protective titres of the antibodies and the duration for which they stay in blood. High seropositivity in certain areas must not generate a false sense of security in the common people.

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CONFLICT OF INTEREST*:* None declared

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