

**SARS-CoV2 Serological Survey in Mumbai by NITI-BMC-TIFR:
Preliminary Report of Round-2**

Technical Details

Organizations involved: NITI-Aayog, Municipal Corporation of Greater Mumbai (MCGM) and the Tata Institute of Fundamental Research (TIFR), and partner organizations viz. Kasturba Molecular Diagnostic Laboratory, Translational Health Science and Technology Institute (THSTI), A.T.E. Chandra Foundation and IDFC Institute.

Rationale of the study: As a large cross-sectional survey in India, this study aimed to estimate prevalence in the population based on random sampling methodology and to be conducted at two time points to infer epidemic trajectory. The study was designed to capture exposure to SARS-CoV2 infection in slum and non-slum areas, and from (a) age & gender stratified samples from the general population and b) Health care workers, in areas selected based on reported cases. Participants were recruited following informed voluntary consent. Anti-SARS-CoV2 IgG was detected using Chemiluminescence assay (CLIA) by Abbott, whose specificity (100%) and sensitivity (93%) has been independently validated by Public Health England (PHE)¹.

Findings from the second round: General Population

Study period: 14 days in the second half of August 2020.

Areas selected: Three wards (R-North, M-West and F-North) in Mumbai were chosen based on the following criteria: (a) City and Suburban areas (b) East, West and North areas and (c) As representative of localities with low to high prevalence based on reported cases as on June 2nd 2020.

Sampling design: Sampling from households (in slums) or buildings (in non-slums), which were separated by at least 3 households/buildings ensured geographically separate and a systematic method for non-overlapping area coverage. In high-rises with more than 5 apartments, N/5 households were selected from separate floors (one household for every 5 apartments in a building). No more than one sample were collected per household/family and as per the age/gender stratification viz. Females and Males belonging to age brackets (a) 12-24 years (b) 25-39 years (c) 40-60 years and (d) >60 years.

**SARS-CoV2 Serological Survey in Mumbai by NITI-BMC-TIFR:
Preliminary Report of Round-2**

Samples	NS	S	Total
Dahisar RN	579	1,264	1,842
Matunga FN	813	1,212	2,025
Chembur MW	748	1,224	1,972
Sum	2,140	3,699	5,839

Sample sizes were calculated based on statistical considerations, which took into account results from our first round and population sizes in each of these wards as below (for slums and non-slums separately)². No sampling was done in active

containment zones (i.e. during the study period).

Number of participants recruited and samples analyzed are as below:

	Target	Recruited	Percentage recruited	Samples Analysed*
<i>FN Slum</i>	1212	1205	99	1122
<i>FN Non-Slum</i>	813	850	105	828
<i>MW Slum</i>	1224	670	55	666
<i>MW Non-Slum</i>	748	752	101	727
<i>RN Slum</i>	1264	1268	100	1236
<i>RN Non-Slum</i>	579	639	110	621
<i>Total</i>	5840	5384	92	5200

Strengths of the study:

- Large sample sizes to estimate prevalence with better accuracy (total 5200 from 3-wards)
- Random sampling methodology to capture prevalence in population without bias.
- The kit used in this study has been independently validated by PHE for 100% specificity and 93% sensitivity. The PHE study also suggests that the kit does not cross-react with other seasonal corona-viruses, which have been tested.
- Age and gender wise stratification to provide insights into sero-prevalence.

**SARS-CoV2 Serological Survey in Mumbai by NITI-BMC-TIFR:
Preliminary Report of Round-2**

- Assess impact of risk factors on prevalence (analysis ongoing)
- Determination of presence of viral neutralizing antibodies (studies ongoing) from both rounds of the serosurvey.

Potential caveats of the study:

- As with any sero-surveillance our study also captures only people who have circulating antibodies and those who were infected in the recent past. Although a caveat, this in fact puts the prevalence at a conservative lower number.
- The study has possibly missed migrant population in these wards, which may have left the city during the lockdown.

**Key findings of the study from general population
in slum and non-slum areas of Mumbai**

Sampling included people who may have been symptomatic and recovered or asymptomatic, without distinction and excluded those who were in institutionalized quarantine facilities (i.e. during the study period). No sampling was done in active containment zones (i.e. during the study period).

The systematically conducted study estimates around 44.9% prevalence in slums and 17.5% prevalence in non-slums, on an average, in the three wards that were studied tables in annexure below. These numbers have not been corrected for 93% sensitivity of the CLIA test used, which puts the numbers at a lower conservative estimate.

Non-slums						
Ward	Positives	Total	Pos rate	Prevalence (age adjusted)	Lower CI	Upper CI
F North	165	828	19.9%	19.6%	16.9%	22.3%
MW	130	727	17.9%	18.1%	15.3%	20.9%
R North	77	621	12.4%	12.5%	9.9%	15.1%
Grand Total	372	2176	17.1%	17.5%	15.9%	19.1%

Slums						
Ward	Positives	Total	Pos rate	Prevalence (age adjusted)	Lower CI	Upper CI
F North	500	1122	44.6%	44.2%	41.3%	47.1%
MW	326	666	48.9%	48.4%	44.6%	52.1%
R North	542	1236	43.9%	43.6%	40.8%	46.4%
Grand Total	1368	3024	45.2%	44.9%	43.2%	46.7%

**SARS-CoV2 Serological Survey in Mumbai by NITI-BMC-TIFR:
Preliminary Report of Round-2**

Slum					
Age bracket	Positives	Total	Pos. rate	Lower CI	Upper CI
12 to 24	260	637	40.8%	37.0%	44.6%
25 to 40	466	1099	42.4%	39.5%	45.3%
41 to 60	533	1060	50.3%	47.3%	53.3%
Above 60	109	226	48.2%	41.7%	54.7%
Grand Total	1368	3022	45.3%	43.5%	47.0%
Non slum					
Age bracket	Positives	Total	Pos. rate	Lower CI	Upper CI
12 to 24	43	233	18.5%	13.5%	23.4%
25 to 40	104	628	16.6%	13.7%	19.5%
41 to 60	179	964	18.6%	16.1%	21.0%
Above 60	46	349	13.2%	9.6%	16.7%
Grand Total	372	2174	17.1%	15.5%	18.7%

Slum					
Gender	Positives	Total	Pos. rate	Lower CI	Upper CI
Female	649	1405	46.2%	43.6%	48.8%
Male	719	1619	44.4%	42.0%	46.8%
Grand Total	1368	3024	45.2%	43.5%	47.0%
Non slum					
Gender	Positives	Total	Pos. rate	Lower CI	Upper CI
Female	127	721	17.6%	14.8%	20.4%
Male	243	1452	16.7%	14.8%	18.7%
Grand Total	370	2173	17.0%	15.4%	18.6%

Interpretations

- There is a notable decrease in the sero-positivity in the slum populations and a marginal increase in the non-slums.
- The reduction in sero-positivity in slums could be due to a decrease in antibody^{3,4} titers in a significant proportion of the population who were possibly infected very early in the pandemic, unlike in the non-slums. The sero-positivity in non-slums may also be a lower biased estimate of the positivity rate due to decline in the antibody levels.
- Sero-positivity from the first two rounds, keeping in mind that the estimates in the second round are likely lower biased due to decline in antibodies, taken together with declining no. of reported cases from slum areas in these wards, indicate that there could be a reduction in the spread of infection in slum areas.

**SARS-CoV2 Serological Survey in Mumbai by NITI-BMC-TIFR:
Preliminary Report of Round-2**

- Marginal increase in Sero-positivity of non-slum areas, again keeping in mind that second round estimates are likely lower biased due to decline in antibodies, correlates with increase in reported cases in August from non-slum areas.
- Survey information on travel history of participants does not indicate returning migrants to have significantly affected the findings of the study.
- About 1-2% of the samples belonged to people who had participated in both the rounds
- Emerging scientific evidence hints at decay of antibody levels in recovered patients over a period of time. The impact of this on immunity, if any, is still unknown.
- These results provide will be valuable to learn more about assessing infection spread in populations and emergence of herd immunity.

We are checking if prevalence estimates would change based on RBD antibodies that will be tested on a subset of samples and decay of antibody. We are in the process of assaying for the presence of neutralizing antibodies and risk factors on SARS-CoV2 infection.

Prevalence in Health Care Workers

	Positives	Total	Positive fraction	Lower CI	Upper CI
Health post staff (ANM+MPW+CHV)	68	217	31.3%	25.2%	37.5%
Dispensary staff (Dr+LT+Dresser+Pharmacist)	26	122	21.3%	14.0%	28.6%
Health office and other staff	91	321	28.3%	23.4%	33.3%
Program staff	14	68	20.6%	11.0%	30.2%
Total	199	728	27.3%	24.1%	30.6%

- Seroprevalence observed among the Health care workers working in slum areas was lower than Seroprevalence in the slum populations could be due to Corona appropriate behavior which includes use of Masks and hand hygiene.

**SARS-CoV2 Serological Survey in Mumbai by NITI-BMC-TIFR:
Preliminary Report of Round-2**

Investigators involved in the study

PI: Dr. Ullas Kolthur-Seetharam (TIFR)

Co-PIs: Dr. Daksha Shah (BMC) and Dr. Jayanthi Shastri (Kasturba Molecular Diagnostic Laboratory);

Co-investigators: Dr. Sandeep Juneja (TIFR), Dr. Gagandeep Kang (THSTI), Dr. Anup Malani (IDFC), Dr. Manoj Mohanan (IDFC), Ms. Gayatri Nair Lobo (ATECF), Dr. Gajanan Velhal (HOD, Community Medicine, KEM) and Dr. Mangla Gomare (EHO-BMC)

Acknowledgements

- Project management team headed by Ms. Sofia Imad and field managers and volunteers
- CDSA monitoring team Dr. Rajesh Jain, Ms. Vimaljeet Kaur and Mr. Gourav Khurana
- MOH teams headed by Dr. Nilesh Palve (FN), Dr. Bhupendra Patil (MW) and Dr. Avinash Vydande (RN).
- Ms. Rhea Dabriwala (IDFC) for logistic support
- NGO partners
- All MLAs/Corporators/Councilors from these wards
- Logistic support from Thyrocare and LivHealth

Reference:

1. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/890566/Evaluation_of_Abbott_SARS_CoV_2_IgG_PHE.pdf
2. <http://arxiv.org/abs/2006.03375>
3. Rapid Decay of Anti-SARS-CoV-2 Antibodies in Persons with Mild Covid-19. The New England Journal of Medicine DOI: 10.1056/NEJMc2025179
4. Clinical and immunological assessment of asymptomatic SARS-CoV-2 infections. Nature Medicine | VOL 26 | August 2020 | 1200–1204

**SARS-CoV2 Serological Survey in Mumbai by NITI-BMC-TIFR:
Preliminary Report of Round-2**