

TECHNICAL REPORT

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Epidemiological and Serological Surveillance of COVID-19 in Pune City

Organizations involved: Pune Municipal Corporation (PMC); Savitribai Phule Pune University (SPPU); Indian Institute of Science Education and Research (IISER) Pune; Christian Medical College (CMC), Vellore; Translational Health Science and Technology Institute (THSTI), Faridabad.

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Rationale: Global data suggests that a significant proportion of SARS-CoV-2 infections are asymptomatic and remain undetected unless populations are actively screened. Understanding the extent of infection in the population permits better understanding of the severity of COVID-19 and transmission dynamics. Serological testing for antibodies against SARS-CoV-2 in a representative sample population can estimate the cumulative incidence of infection in the population. This study was undertaken to initiate generation of unbiased data important for gaining insights into the spread of the pandemic in Pune city and estimated the **seroprevalence of antibodies against SARS-CoV-2** in five high-incidence prabhags (subwards).

STUDY METHODOLOGY

Study period: Samples collected between 20th July - 5th August, 2020.

Study settings: the PMC administrative prabhags were divided into 3 strata; high-incidence strata (incidence >0.20%), medium-incidence (between 0.10% to 0.19%) and low-incidence (<0.10%) based on the cumulative incidence of confirmed COVID-19 cases by 01 June 2020 (based on granular data provided by PMC). 5 prabhags were randomly chosen from the high-incidence strata. The selected prabhags were **Yerwada, Lohyanagar-Kasewadi, Rastapeth-Ravivarpeth, Kasbapeth - Somwarpeth, Navipeth-Parvati.**

Sample size calculation: Assuming 5% seroprevalence, the study needed to recruit 1520 individuals to obtain a 95% Confidence Interval of +/- 1% after incorporating a design effect of 2.5 for the clustered sampling design. The study recruited 1664 individuals in the 5 selected prabhags.

Sampling strategy: An independent team of geospatial experts randomly selected 63 of 235 polygons with roughly equal area covering the selected prabhags. The survey team started at the centre of the grid and collected samples from every fifth house. Every fifth home was sequentially selected in multi-occupancy tenement buildings. The study included all types of dwellings; hutments, tenements, apartments, bungalows falling within the selected grid. One adult individual was selected from each household using a matrix to ensure appropriate age/gender balance.

Consenting adults (≥ 18 years) from residential areas who self-reported no known acute illness at the time of collection were included in the study. No sampling was done in active containment zones.

Sample collection: The study team visited selected households and briefed the occupants about the survey objectives and procedures. Blood was collected after obtaining written consent.

SARS-CoV-2 antibody detection: IgG antibodies against the receptor-binding domain (RBD) of the viral spike protein was detected using the highly specific (100%) and sensitive (84.7%) THSTI-RBD-ELISA assay. This assay has been extensively characterised and compared with other commercially available tests for SARS-CoV-2 IgG (doi: [10.1101/2020.08.12.20173856](https://doi.org/10.1101/2020.08.12.20173856)).

Table 1: Prabhag population, collection period and samples analysed from selected prabhags

	Prabhag 6 Yerwada	Prabhag 16 Kasbapeth-Somwarpeth	Prabhag 17 Rastapeth-Raviwarpeth	Prabhag 19 Lohiya Nagar-Kasewadi	Prabhag 29 Navipeth-Parvati	Total Number
Population	84948	70596	70153	70846	70441	3,66,984
Collection period	20 Jul – 24 Jul	31 Jul – 3 Aug	29 Jul – 31 Jul	25 Jul – 28 Jul	4 Aug – 5 Aug	-
Number of samples tested*	367	352	335	312	298	1664

(* Final numbers after excluding samples for not meeting study design or technical errors)

KEY RESULTS

Note: Preliminary results presented in this report are not adjusted for the IgG detection test sensitivity or population parameters. 95% Confidence Intervals (CI) have been calculated without correction for sample structure and cluster design.

- This study estimates 51.5% (CI: 49.1-53.9%) seroprevalence in the five prabhags sampled.** The prevalence ranged from 36.1% (CI: 31.1-41.1%) in Kasbapeth-Somwarpeth to 65.4% (CI: 60.1-70.7%) in Lohiya Nagar-Kasewadi. See **Table 2**.

Table 2: SARS-CoV-2 IgG antibody seroprevalence in five high-incidence prabhags

	Number	Prevalence of Seropositivity (%)	95% CI
Prabhag 6 Yerwada	367	56.6	51.5-61.7
Prabhag 16 Kasbapeth-Somwarpeth	352	36.1	31.1-41.1
Prabhag 17 Rastapeth-Raviwarpeth	335	45.7	40.4-51.0
Prabhag 19 Lohiya Nagar-Kasewadi	312	65.4	60.1-70.9
Prabhag 29 Navipeth-Parvati	298	56.7	51.1-62.3
Overall Average	1664	51.5	49.1-53.9

2. **No difference in seropositivity was found between men and women ($p=0.13$). See Table 3.**

Table 3: Gender-wise estimate of seropositivity

	Number	Prevalence of seropositivity (%)	95% CI
Men	861	52.8	49.5-56.1
Women	803	50.1	46.6-53.6

3. **Prevalence was lower in the older 66+ years population but was similar across age groups below 66 ($p=0.009$). See Table 4.**

Table 4: Estimate of seropositivity across age groups

	Number	Prevalence of seropositivity (%)	95% CI
18-30 yrs	395	52.5	47.6-57.4
31-50 yrs	680	52.1	48.4-55.9
51-65 yrs	418	54.8	50.0-59.6
66 yrs and above	171	39.8	32.6-47.1

4. **Hutments (62.0%; CI: 58.1-65.9%) and Tenements (56.2%; CI: 52.0-60.4)** have higher seroprevalence, although a significant proportion of the **Apartment/Bungalow** dwelling population were also seropositive. As seen in Tables 5 and 6, the seropositivity is significantly higher in hutment and tenement dwellers as compared to those in apartments and independent bungalows ($p<0.001$) and also differ with the size of the residence ($p<0.001$).

Table 5: Estimate of seropositivity by type of residence

	Number	Prevalence of seropositivity (%)	95% CI
Hutment	600	62.0	58.1-65.9
Tenement	536	56.2	52.0-60.4
Apartment	446	33.2	28.8-37.6
Bungalow	82	43.9	33.2-54.6

Table 6: Estimate of seropositivity by size of residence

	Number	Prevalence of seropositivity (%)	95% CI
<150 sq ft	287	59.6	53.5-65.2
151-300 sq ft	608	58.6	54.6-62.5
301-500 sq ft	456	48.5	43.9-53.1
> 501 sq ft	313	34.6	29.3-39.8

5. Participants from dwellings with **shared toilets** have higher seroprevalence ($p < 0.001$), although a significant proportion of people living in residences with **independent toilets** were also seropositive. See Table 7.

Table 7: Estimate of seropositivity by nature of usage of toilets

	Number	Prevalence of seropositivity (%)	95% CI
Shared toilet	619	62.3	58.4-66.1
Independent toilet	1045	45.3	42.3-48.3

CONCLUSIONS

- A substantive proportion of populations in the five prabhags sampled in this study have been previously infected by SARS Cov-2.
- This indicates there has been extensive spread of infection in these prabhags.

CAVEATS

Our tests estimate the presence of IgG antibodies against SARS-CoV-2 in the population and suggest past infection. The presence of these antibodies does not necessarily indicate that the individual is resistant to subsequent infection. Neither is the high seroprevalence necessarily an indicator of population-level immune protection.

INVESTIGATORS

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