



Government of Karnataka

Department of Health and Family Welfare Services

**PRESS RELEASE**

(19-08-2021)

**Estimating the burden of COVID-19 in Karnataka: Results of the second round of survey**

On the Technical Advisory Committee's (TAC) recommendation, the Department of Health and Family Welfare Services (DHFWS) conducted the second round of the sero survey across Karnataka during 25 January – 18 February 2021. The goal was to estimate the proportion of people who had COVID-19 infection before the survey and those with active SARS-CoV-2 infection at the time of the survey.

**Methods:** The participants included all adults aged 18 years and above. We excluded those who were already diagnosed with SARS-CoV-2 infection, those unwilling to provide a sample for the test, those who had received vaccination for COVID-19, those who already participated in Round 1 of the serosurvey, and those who did not agree to provide informed consent. While each district other than Bengaluru Urban was a unit for the survey, we subdivided Bengaluru Urban into nine units: eight zones of BBMP (East, West, South, Bommanahalli, Dasarahalli, Mahadevapura, RR Nagara, and Yelahanka) and the rest of Bengaluru Urban district. This subdivision led to a total of 38 units across Karnataka. We selected 290 health facilities based on geographical representation, feasibility, and ease of recruitment. The health facilities were the same as in Round 1.<sup>(1)</sup>

We covered three population groups. (i) The low-risk group comprised pregnant women presenting for a regular check-up at the ANC clinic and attenders of patients coming to the outpatient department in the healthcare facilities. (ii) The moderate-risk group comprised people with high contact in the community, e.g., bus conductors, vendors at the vegetable markets, healthcare workers, pourakarmikas/waste-collectors, and individuals in congregate settings such as markets, malls, retail stores, bus stops, railway stations, and hotel staff. (iii) The high-risk group comprised the elderly and persons with comorbid conditions.

For a margin of error of 0.05 and a 95% confidence level, taking design effect to be 3, assuming 32.3% prevalence, which is 5% more than the total burden estimated in the September 2020 serosurvey Round 1,<sup>(1)</sup> the minimum required sample size is 1050 per unit<sup>(2)</sup> or 39,900 across all the 38 units. The 1050 samples per unit were divided equally (350 each) among the three risk groups and were further divided equally among the risk subgroups.

We collected the meta-data of all participants through a specific web-based application designed for the study. We linked them to the samples using the ICMR Specimen Referral Forms for COVID-19. We collected the nasopharyngeal/oropharyngeal swabs (NPS/OPS) from consenting participants. We used the current protocols recommended by ICMR for sample collection, cold-chain transport, and laboratory analysis. We conducted RT-PCR and IgG antibodies tests among all participants.

The RT-PCR testing was done through the current ICMR-approved testing network. For IgG antibody testing, we collected 4 ml of venous blood from each consenting participant. The sample was centrifuged, and

the serum was transported to the laboratory while maintaining a cold chain. SARS-CoV-2-specific IgG antibodies were detected using an ELISA-based commercial test kit (Zydus-Cadila).<sup>(3)</sup>

To measure the level of antibody waning, we conducted a separate nested longitudinal study. We identified 4579 RAT/RT-PCR or IgG positive participants from Round 1 (all the positives from the matched line list in Round 1) for recruitment towards the longitudinal study. We excluded those that were vaccinated, and those that did not provide informed consent. We measured antibody waning on the same ELISA-based test kit (Zydus-Cadila<sup>(3)</sup>) used in Rounds 1–2 serosurveys. We collected the serum samples for the longitudinal study during 02 April – 11 May 2021 from 648 participants.

**Results:** We first report the findings from Round 2 of the serial cross-sectional sentinel survey conducted during **25 January –18 February 2021**.

- Of the 41,228 people surveyed in the different risk categories, we present the results for 41,071 individuals whose RT-PCR or IgG antibody test results were available.
- **Assuming the laboratory-calibrated 92.2% sensitivity and 97.7% specificity for the ELISA-kit, the overall weighted adjusted seroprevalence of IgG in Round 2 was 15.6% (95% CI: 14.9 – 16.3), as of 18 February 2021, which is the end date for Round 2 [Table 1].**
- **The active infection was estimated to be 0% (95% CI: 0.0 – 0.3) during the Round 2 period.** This estimate is based on the numbers that tested positive on the RT-PCR test after considering the IgG outcomes and the serial sensitivities and specificities of all the tests.
- Tables 2 and 3 provide information on the estimated IgG positivity across districts and Bengaluru Urban Conglomerate units.
- Comparative results across categories and subcategories are as follows [Table 1].
  - Across age groups, the odds risk for the 30-39, 40-49, 50-59, and 60+ age-groups, over the reference 18-29 age-group, were 1.36, 1.74, 1.67, and 1.73 respectively. See Table 1 for confidence intervals.
  - The odds risk for males was 1.22.
  - The odds risk for the urban population was 0.89 over the rural population.
  - The vulnerable population in the high-risk category continued to have a higher odds risk of 1.6 over the low-risk category.

**The estimated IgG positivity at the end of Round 2 (15.6%) is noticeably lower than the estimated total infection of 27.7% (95% CI: 26.1–29.3) at the end of Round 1.**<sup>(1)</sup> The estimation of IgG positivity at the end of Round 2 is based on the lab-verified sensitivity of 92.2% for test-samples with calibrated IgG levels. However, the seroprevalence estimates are based on test outcomes on samples collected from participants with variable IgG levels that also wane with time.<sup>(4)-(5)</sup> It may be noted in this context that the **Round 2 serosurvey began 131 days after Round 1 serosurvey and around 98 days after Karnataka's active cases had peaked in early October 2020.** A significant fraction of the population that had the infection before the end of Round 1 may have had waned IgG levels, below the ELISA kit's detection threshold, at the time of Round 2.

For the nested longitudinal study, out of the 648 samples, 370 ELISA outcomes were valid, i.e., had valid control outcomes. Of these, 144 tested positive, and 226 tested negative. Thus, only 38.9% of

the first-round positive participants were above the detection threshold of the ELISA test kit.

The longitudinal study indicated that the ELISA kit's sensitivity on the population infected during Round 1 was 38.9% as of 22 April 2021 (the mid-point of the sample collection period for the longitudinal study). **Assuming this measured 38.9% sensitivity, following the same statistical analysis for estimating the weighted adjusted state-level seroprevalence, the total number infected in Karnataka as of 18 February 2021 is at most 35.8% (95% CI: 34.0–37.7).**

Given the total burden of 27.7% (95% CI: 26.1–29.3), measured at the end of Round 1,<sup>(1)</sup> we conclude that Karnataka's COVID-19 burden was between 26.1–37.7% (at 90% confidence) as of 18 February 2021.

Males continued to be at higher risk than females (odds ratio 1.22), the vulnerable population in the high-risk category continued to be at higher risk than the low-risk category (odds ratio 1.6), those in the higher age groups continued to be at higher risk than the 18-29 age group (see Table 1). However, data suggests that rural areas were more at risk than urban areas (odds ratio 0.89 < 1), a reversal from Round 1. Together with the observations on antibody waning, the higher risk for rural areas suggests that the infection continued to be active in the rural areas after it had subsided in the urban areas during October 2020 – February 2021.

#### **Organizations involved:**

1. Department of Health Family Welfare Services, Government of Karnataka.
2. Indian Institute of Public Health, Public Health Foundation of India, Bengaluru
3. Indian Institute of Science, Bengaluru
4. Indian Statistical Institute, Bengaluru.
5. Department of Community Medicine, BMCRI, Bengaluru.
6. Department of Community Medicine, MS Ramaiah Medical College, Bengaluru.
7. National Institute of Mental Health and Neurosciences, Bengaluru.
8. UNICEF
9. Sri Jayadeva Institute of Cardiovascular Sciences and Research, Bengaluru
10. World Health Organisation
11. National Institute of Virology, Bangalore Unit, Bengaluru
12. Vijayanagar Institute of Medical Sciences, Bellari
13. VRDL Hassan Institute of Medical Sciences, Hassan
14. Shimoga Institute of Medical Sciences, Shivamogga
15. Mysore Medical College and Research Institute, Mysuru
16. Gulbarga Institute of Medical Sciences, Kalburgi
17. Karnataka Institute of Medical Sciences, Hubli, Dharawad
18. Institute of Nephro Urology, Bengaluru
19. All ICMR approved RT-PCR testing laboratories involved in RT-PCR testing of survey samples. (Government Medical College labs, District H&FW labs and Private labs)

**Acknowledgments:** We thank the Additional Chief Secretary – DHFWS, GoK, Commissioner – DHFWS, MD – NHM, PD-KSAPS, Director – DHFWS, PD-IDSP & DD-SSU, Microbiologist-SSU & IDSP, and the State Surveillance Unit for their support. We thank the DSOs, the DAPCU officers, the AMOs & Medical officers, the District Microbiologist, and the District Epidemiologist and all

other district level staff for coordinating and implementing the survey, for guiding the health facility and laboratory staff in sample collection, and for coordinating sample transportation to mapped RT-PCR and antibody testing labs. We thank the Lab Nodal Officers and staff of ICMR labs for IgG antibody testing and RT-PCR testing. We thank Mr. Ramesh, IT Cell Admin, E-Health Division and his team for providing a web platform for metadata collection. Our heartfelt gratitude goes to all the lab technicians, counsellors – ICTC & NCD, staff nurses, and health workers for filling data in the survey app, collecting samples, and sending them to the mapped laboratories. We thank all the study participants for providing their consent to be a part of this survey.

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**Table-1 seroprevalence\* of IgG antibodies against SARS-CoV2 and Acute infection in Karnataka state serosurvey Round 2.**

Category		Type	Samples <sup>y</sup>	%-IgG against SARS-CoV2 <sup>@</sup>	%-Active Infection of COVID-19 <sup>@</sup>	%-Prevalence of COVID-19 <sup>@</sup>	Odds Ratio
State	Karnataka	Crude	41071	6002/40030	187/39779	6161/41071	-
		Adjusted	41228	15.5	0	15.5	
		Weighted Adjusted	41228	15.6 (14.9--16.3)	0 (0--0.3)	15.6 (14.8--16.4)	
Demography	Sex	Male	19165	15.4 (14.4--16.4)	0 (0--0.5)	15.4 (14.3--16.5)	1.22 (1.03--1.45)
		Female	22046	13 (12.1--13.9)	0 (0--0.4)	13 (12--13.9)	1
		Other	17	36.7 (0--80.6)	0 (0--15.7)	36.7 (0--82.5)	3.88 (0--34.57)
	Age	18 - 29	15841	10.8 (9.8--11.7)	0 (0--0.5)	10.8 (9.7--11.9)	1
		30 - 39	7856	14.1 (12.5--15.6)	0 (0--0.7)	14.1 (12.4--15.7)	1.36 (1.05--1.73)
		40 - 49	5745	17.4 (15.5--19.4)	0 (0--0.8)	17.4 (15.3--19.5)	1.74 (1.34--2.26)
		50 - 59	3967	16.8 (14.5--19.2)	0 (0--1)	16.8 (14.3--19.3)	1.67 (1.24--2.23)
		60 and above	7818	17.3 (15.6--18.9)	0 (0--0.7)	17.3 (15.5--19.1)	1.73 (1.36--2.2)
	Region	Rural	4074	15.4 (13.2--17.6)	0 (0--1)	15.4 (13--17.8)	1
		Urban	37154	14 (13.3--14.7)	0 (0--0.3)	14 (13.2--14.8)	0.89 (0.7--1.16)
Risk Category		High-risk <sup>#</sup>	13865	16.8 (15.6--18)	0 (0--0.5)	16.8 (15.5--18.1)	1.6 (1.3--1.99)

		<b>Moderate-risk</b>	13714	14.3 (13.2--15.5)	0 (0--0.5)	14.3 (13.1--15.6)	1.32 (1.06--1.66)
		<b>Low-risk</b>	13649	11.2 (10.1--12.3)	0 (0--0.5)	11.2 (10--12.4)	1
<b>Risk Sub-category</b>	<b>High-risk</b>	<b>Elderly</b>	6740	17.3 (15.5--19.1)	0 (0--0.8)	17.3 (15.4--19.2)	2.14 (3.02--1.55)
		<b>Persons with comorbidities</b>	7125	16.3 (14.6--18)	0 (0--0.8)	16.3 (14.5--18.2)	1.99 (2.83--1.45)
	<b>Moderate-risk</b>	<b>Bus conductors/Auto drivers</b>	2694	16.5 (13.7--19.3)	0 (0--1.2)	16.5 (13.5--19.5)	2.02 (3.08--1.33)
		<b>Pourakarmikas / wastecollectors</b>	2665	14.8 (12.1--17.5)	0 (0--1.2)	14.8 (11.8--17.7)	1.78 (2.73--1.14)
		<b>Healthcare workers</b>	2701	15 (12.3--17.7)	0 (0--1.2)	15 (12.1--17.9)	1.81 (2.77--1.17)
		<b>Vendors at vegetablemarkets</b>	2715	13.3 (10.8--15.9)	0 (0--1.2)	13.3 (10.5--16.2)	1.57 (2.45--1)
		<b>Congregate settings<sup>s</sup></b>	2939	12.3 (9.9--14.7)	0 (0--1.2)	12.3 (9.6--14.9)	1.44 (2.22--0.91)
	<b>Low-risk</b>	<b>Outpatient department</b>	6876	13.5 (11.9--15.1)	0 (0--0.8)	13.5 (11.7--15.3)	1.6 (2.29--1.13)
		<b>Pregnant women</b>	6773	8.9 (7.5--10.3)	0 (0--0.8)	8.9 (7.3--10.5)	1
<b>Pre-existing medical conditions</b>	<b>More than one</b>	1067	19.1 (14.5--23.8)	0 (0--2)	19.1 (14.2--24.1)	1.46 (0.97--2.11)	
	<b>One</b>	4808	15.1 (13.1--17.1)	0 (0--0.9)	15.1 (12.9--17.3)	1.1 (0.87--1.39)	
	<b>None</b>	35353	13.9 (13.1--14.6)	0 (0--0.3)	13.9 (13.1--14.6)	1	
<b>Symptoms</b>	<b>More than one</b>	1037	15.3 (10.9--19.6)	0 (0--2)	15.3 (10.5--20)	1.07 (0.65--1.59)	
	<b>One</b>	6026	12.6 (10.9--14.3)	0 (0--0.8)	12.6 (10.7--14.5)	0.86 (0.67--1.08)	

	<b>None</b>	34165	14.4 (13.6--15.1)	0 (0--0.3)	14.4 (13.6--15.2)	1
y Includes only samples that have been mapped to participants.						
® All estimates are adjusted for sensitivities and specificities of the RT-PCR and antibody testing kits and procedures; the assumed values are RT-PCR sensitivity 0.95, specificity 0.97, IgG ELISA kitsensitivity 0.921, specificity 0.977; Weighted estimates for Karnataka estimate the prevalence in each unit and then weights according to population						
§ Markets, Malls, Retail stores, Bus stops, Railway stations, waste collectors; #Some individuals recruited in the moderate and low-risk categories, but with high risk-features, were moved to high-risk.						

**Table-2 Seroprevalence\* of IgG antibodies against SARS-CoV2 and Acute infection in districts of Karnataka state (N=41228)**

Unit	Samples	%-IgG against SARS-CoV2®	%-ActiveInfection of COVID-19®	%-Prevalence of COVID-19®
Karnataka	41228	15.6 (14.9--16.3)	0 (0--0.3)	15.6 (14.8--16.4)
Mysuru	1104	33.6 (28.2--39)	0 (0--1.9)	33.6 (28--39.3)
Mandya	1159	31.9 (26.9--37)	0 (0--1.8)	31.9 (26.6--37.3)
Kodagu	1063	27.1 (22.1--32.1)	0 (0--1.9)	27.1 (21.8--32.4)
Chamarajanagar	1161	22.6 (17.6--27.6)	0 (0--1.9)	22.6 (17.3--27.9)
Kolar	1050	20.8 (16.1--25.4)	0 (0--1.9)	20.8 (15.8--25.8)
Bengaluru Rural	1084	20.3 (15.7--24.8)	0 (0--2)	20.3 (15.4--25.1)
Dakshina Kannada	1074	19.8 (15.4--24.3)	0 (0--1.9)	19.8 (15.1--24.6)
Belgaum	1110	19.4 (14.9--23.9)	0 (0--1.9)	19.4 (14.5--24.2)
Bengaluru Urban Conglomerate	9730	18.7 (17.1--20.2)	0 (0--0.7)	18.7 (17--20.4)
Udupi	1076	17.9 (13.7--22.1)	0 (0--1.9)	17.9 (13.4--22.5)
Chitradurga	1060	16.6 (12.3--21)	0 (0--1.9)	16.6 (11.9--21.3)
Davanagere	1054	16.2 (11.9--20.4)	0 (0--2)	16.2 (11.6--20.8)
Bagalkot	1051	15.7 (11.5--19.9)	0 (0--1.9)	15.7 (11.1--20.3)
Ramanagar	1057	14.5 (10.5--18.6)	0 (0--1.9)	14.5 (10.1--19)
Chikkaballapur	1062	13.7 (9.7--17.7)	0 (0--1.9)	13.7 (9.3--18.1)
Gadag	1137	13.1 (9.4--16.9)	0 (0--1.9)	13.1 (9--17.3)
Vijayapura	1058	12.9 (9--16.8)	0 (0--1.9)	12.9 (8.6--17.3)
Shivamogga	1062	12.8 (8.9--16.6)	0 (0--1.9)	12.8 (8.5--17)
Chikmagalur	1050	12.6 (8.8--16.4)	0 (0--1.9)	12.6 (8.4--16.8)
Ballari	1056	12.3 (8.5--16)	0 (0--1.9)	12.3 (8.1--16.5)
Tumakuru	1051	10.7 (7.1--14.4)	0 (0--2)	10.7 (6.6--14.9)
Raichur	1247	10.5 (7.1--13.9)	0 (0--1.8)	10.5 (6.7--14.3)



Uttara Kannada	1080	10.3 (6.7--13.8)	0 (0--1.9)	10.3 (6.3--14.3)
Koppal	1063	9 (5.6--12.4)	0 (0--1.9)	9 (5.2--12.8)
Hassan	1051	7.6 (4.6--10.6)	0 (0--2)	7.6 (4--11.2)
Kalaburagi	1087	6.3 (3.3--9.2)	0 (0--1.9)	6.3 (2.8--9.8)
Dharwad	1101	5.8 (3--8.5)	0 (0--1.9)	5.8 (2.4--9.1)
Yadgir	1061	5.5 (2.7--8.4)	0 (0--1.9)	5.5 (2.1--9)
Bidar	1168	4.5 (1.9--7.1)	0 (0--1.9)	4.5 (1.3--7.7)
Haveri	1061	3.7 (1.2--6.1)	0 (0--1.9)	3.7 (0.5--6.8)
y Includes only samples that have been mapped to individuals.				
® Adjusted for sensitivities and specificities of RT-PCR and antibody testing kits and procedures.				

**Table-3 Seroprevalence\* of IgG antibodies against SARS-CoV2 and acute infection in Bengaluru Urban Conglomerate (N = 9730)**

<b>BBMP Zone</b>	<b>Samples<sup>y</sup></b>	<b>%-IgG against SARS-CoV2<sup>@</sup></b>	<b>%-Active Infection of COVID-19<sup>@</sup></b>	<b>%-Prevalence of COVID-19<sup>@</sup></b>
BBMP Dasarahalli	1088	24.3 (19.6--29)	0 (0--1.9)	24.3 (19.3--29.3)
BBMP West	1063	23.8 (18.8--28.7)	0 (0--1.9)	23.8 (18.5--29)
BBMP Yelahanka	1112	22.6 (18.1--27)	0 (0--2)	22.6 (17.8--27.4)
BBMP Bommanahalli	1070	19.8 (15.5--24.1)	0 (0--1.9)	19.8 (15.2--24.4)
<b>Bengaluru Urban Conglomerate</b>	<b>9730</b>	<b>18.7 (17.1--20.2)</b>	<b>0 (0--0.7)</b>	<b>18.7 (17--20.4)</b>
BBMP South	1118	18.6 (14.5--22.8)	0 (0--1.9)	18.6 (14.1--23.2)
Bengaluru Urban	1089	18.4 (14.8--22)	0 (0--1.8)	18.4 (14.4--22.4)
BBMP East	1085	17.6 (13.5--21.7)	0 (0--1.9)	17.6 (13.1--22.1)
BBMP Mahadevpura	1049	16.6 (12.5--20.6)	0 (0--2)	16.6 (12.1--21.1)
BBMP RR Nagar	1056	13.8 (10.2--17.3)	0 (0--1.9)	13.8 (9.7--17.8)
<sup>y</sup> Includes only samples that have been mapped to individuals.				
<sup>@</sup> Adjusted for sensitivities and specificities of RT-PCR and antibody testing kits and procedures.				