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Short communication

Duration of anti-SARS-CoV-2 antibodies much shorter in India

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ABSTRACT

Seroprevalence survey, for antibodies to SARS-CoV-2, of healthcare workers (HCW) working in three Government run hospitals in Mumbai was carried out in June 2020. Among the 801 HCWs tested, seroprevalence was 11.1%. Males (13.5% vs. 8.9% in females) and ancillary workers (18.5% vs 6.9% in doctors and nurses) were more likely to be seropositive. Sixty-two (7.74%) had been previously diagnosed with RT PCR test for SARS-CoV-2. Of these, 44 (71%) were seronegative. Upto 28 days after a positive PCR test, 90% of subjects were found to be seropositive. This reduced to less than half (38.5%) between 29 and 42 days. None of 28 infected HCWs who had the RT-PCR more than 50 days ago tested positive for antibodies. It seems likely that cellular immunity plays a larger role in defence against the illness.

Humoral immune response to SARS-CoV-2 infection have been reported to be variable, but short-lived [1–4]. We carried out a seroprevalence survey of healthcare workers (HCW) working in three Government run hospitals in Mumbai. Pan immunoglobulin Elecsys Anti-SARS-CoV-2 Assay (Roche Diagnostics, Rotkreuz, Switzerland) using recombinant protein representing the nucleocapsid (N) antigen in double antigen sandwich assay format was done after informed consent. This test has a specificity of 99.8% and 100% sensitivity for patients, fourteen days post-PCR confirmation. The result is given as a cut off index (CoI), and is then interpreted either as reactive/positive (CoI $\geq$ 1.0) or non-reactive/negative (CoI < 1.0) [5]. We did not test for the antibodies against S antigen. A pretested, validated questionnaire in local language was used to collect data on demographic details and symptoms.

The study was approved by Institutional Ethics Committee of the JJ group and Grant Medical College, Mumbai, India.

Among the 801 HCWs who got tested, seroprevalence was 11.1%. Males (13.5% vs. 8.9% in females) and ancillary workers (18.5% vs 6.9% in doctors and nurses) were more likely to be seropositive (Table 1).

There was significantly higher seroprevalence in those previously diagnosed with COVID-19 with a positive PCR test compared to those who had not been tested by RT-PCR; 29% (CI 19.2–41.4) compared to 9.6% (CI 7.7–12). Sixty-two (7.74%) had been previously diagnosed with RT PCR test for SARS-CoV-2. Of these, 44 (71%) were seronegative. Individuals who were symptomatic in the last 30 days with any of the symptoms associated with COVID-19 had a significantly higher seropositive rate; 16.8% (CI 11.8–23.2) compared to 9.6% (CI 7.6–12.2). Sub-analysis of the various symptoms indicates that only loss of smell or taste and presence of non-specific febrile illness in the last 30 days were significant variables associated with higher seroprevalence. None of the other symptoms associated with COVID-19 were statistically significant (Table 2).

Subjects who had visited a fever clinic in the last 30 days had a significantly higher seroprevalence; 20.5% (CI 14.4–28.2) compared to 9.3% (CI 7.3–11.7). Individuals with a family member living in the same house diagnosed with COVID-19 had a significantly higher seroprevalence; 18.9% (CI 11.5–29.4) compared to 10.3% (CI 8.3–12.8). Having a COVID-19 patient living within 50 m of the individual's residence was not a significant factor for increased seroprevalence (see Table 3).

Duration between positive RT-PCR test and serological testing ranged from 15 to 49 days for 34 (54.8%), and >50 days in 28 subjects. Upto 28 days after a positive PCR test, 90% of subjects were found to be seropositive. This reduced to less than half over next two weeks (38.5%) between 29 and 42 days. This further reduced to less than 15% for subjects who were tested between 43 and 49 days of their positive RT-PCR. None of the 28 infected HCWs who had had the RT-PCR more than 50 days ago tested positive for the antibodies. Of the people who had never been RT PCR positive, 9.6% had antibodies (Table 4). The mean antibody levels of people who had never been tested for RT PCR were 26.77 CoI (28.47 CoI in those with RT PCR test positive).

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Table 1
Seroprevalence as per different demographic and comorbidity characteristics.

Group	All	Sero (−)	Sero (+)	% (+)	95% CI	p value Odds ratio
All	801	712	89	11.1	9.1–13.5	
Occupation						
Ancillary workers	292	238	54	18.5	14.5–23.3	Odds = 0.227
Doctors	201	187	14	7.0	4.2–11.4	OR = 2.65
Nurses	308	287	21	6.8	4.5–10.2	OR = 2.71
Gender						
Male	386	334	52	13.5	10.4–17.3	p = 0.04 OR = 1.51
Female	415	378	37	8.9	6.5–12.1	
Age group						
20–40 years	413	372	41	9.9	7.4–13.2	p = 0.54 OR = 0.803
40–60 years	380	333	47	12.4	9.4–16.1	
>=60 years	8	7	1	12.5	2.2–47.1	
Comorbidities						
None	682	604	78	11.4	9.3–14.1	0.49
Single	103	94	9	8.7	4.5–16.0	0.62
Multiple	16	14	2	12.5	2.2–37.3	
Cancer	5	4	1	20.0	2.0–64.0	0.94
Immunosuppression	11	9	2	18.2	4.0–48.9	0.45
Asthma	35	32	3	8.6	2.2–23.1	0.67
Cardiac problems	48	44	4	8.3	2.8–20.1	0.56
Diabetes mellitus	38	35	3	7.9	2.0–21.5	0.56

Table 2
Seroprevalence and associated factors.

Group	All	Sero (−)	Sero (+)	+ve (%)	95% CI	p value
PCR positive individuals						
COVID PCR (+)	62	44	18	29.0	19.2–41.4	0.000003
COVID PCR (−)	739	668	71	9.6	7.7–12.0	OR = 3.02
Symptomatic in last month	167	139	28	16.8	11.8–23.2	0.0001
Asymptomatic in last month	634	573	61	9.6	7.6–12.2	OR = 2.655
Symptoms associated with seropositivity						
Loss of taste/smell	10	4	6	60.0	31.2–83.3	0.0003
No loss of taste/smell	791	708	83	10.5	8.5–12.8	OR = 2.71
Acute Febrile Illness	28	15	13	46.4	29.5–64.2	0.000002
No acute Febrile Illness	773	697	76	9.8	7.9–12.1	OR = 1.51
Any Acute Respiratory Illness	97	83	14	14.4	8.7–22.9	0.26
No acute Respiratory Illness	704	629	75	10.7	8.6–13.2	
Acute Respiratory Illness – SARI	16	13	3	18.8	5.8–43.8	0.59
Acute Respiratory Illness – ILI	81	70	11	13.6	7.6–22.9	
Non-specific illness	90	78	12	13.3	7.6–22.0	0.47
No Non-specific illness	711	634	77	10.8	8.7–13.3	
Acute Gastric/enteric illness	8	7	1	12.5	0.1–49.2	0.83
No acute gastric/enteric illness	793	705	88	11.1	9.1–13.5	
Eye Redness	12	11	1	8.3	0.0–37.5	0.84
No Eye Redness	789	701	88	11.2	9.1–13.6	
Skin rash	9	8	1	11.1	0.0–45.7	0.91
No skin rash	792	88	704	88.9	86.5–90.9	

Table 3
Seroprevalence based on exposure.

Group	All	Sero (−)	Sero (+)	(+) %	95% CI	p value Odds ratio
Risk/exposure characteristics						
Visited Fever clinic	132	105	27	20.5	14.4–28.2	0.0002 OR = 2.52
Not visited fever clinic	669	607	62	9.3	7.3–11.7	
Household person positive	74	60	14	18.9	11.5–29.4	0.02 OR = 2.03
No household person positive	727	652	75	10.3	8.3–12.8	
Neighbourhood person positive	397	348	49	12.3	9.4–16.0	0.27
No Neighbourhood person positive	404	364	40	9.9	7.3–13.2	

Our findings are in agreement with the view that humoral response is launched rapidly and peaks at about 3–4 weeks with an exponential decline thereafter [1–4]. This however is in contrast to the findings of Gudbjartsson et al in Iceland where more than 90% of persons with previously positive RT PCR tests had neutralizing antibodies after 4 months [4]. Nearly 9.6% of HCWs have been asymptomatic and never tested with RT PCR but had anti SARS-CoV-2 antibodies indicating asymptomatic infections. Antibody levels in such asymptomatics are similar to levels seen in symptomatics which is contrary to findings by Long et al. [2]. Suscepti-

Table 4
Weekwise anti SARS-CoV-2 antibody levels in Healthcare workers in Mumbai, India.

Days after (+)ve RT-PCR Test	No. Of persons	Positives[#]	Antibody levels mean (std dev) COI	Outliers[*] n (values)
15–21	5	3	1.01 (1.61)	1 (14.26)
22–28	11	9	31.7 (31.3)	1 (0.08)
29–35	7	2	0.93 (1.81)	1 (73)
36–42	6	1	0.1 (0.1)	1 (12.91)
43–49	6	1	0.1 (0.03)	1 (28.93)
50–56	9	0	0.07 (0.01)	0
>56	18	0	0.08 (0.01)	2 (0.92, 0.12)

[#] COI > 1 is considered positive.
[*] Outliers have not been included in the calculation of mean and std. dev.

bility of subjects to re-infection after antibody response has subsided is a matter of investigation, but has shown to be unlikely in rhesus experimental models [6]. Since the reported rates of re-infection are quite low, it is possible that cellular immunity or antibodies to the S antigen may play a greater role in defence against COVID 19.

Key findings

(1) Humoral antibody response to SARS-CoV-2 is much shorter in Indian population as compared to previously reported.
(2) Cellular immunity or other antibodies may play a larger role in providing protection against the disease.
(3) These facts need to be kept in mind before planning vaccine studies.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1] Wang X, Guo X, Xin Q, Pan Y, Hu Y, Li J, et al. Neutralizing antibodies responses to SARS-CoV-2 in COVID-19 inpatients and convalescent patients. Clin Infect Dis 2020;721.
[2] Long Q-X, Tang X-J, Shi Q-L, Li Q, Deng H-J, Yuan J, et al. Clinical and immunological assessment of asymptomatic SARS-CoV-2 infections. Nat Med 2020;26(8):1200–4.
[3] Suthar MS, Zimmerman M, Kauffman R, Linderman SL, Hudson WH, Vanderheiden A, et al. Rapid generation of neutralizing antibody responses in COVID-19 patients. Cell Rep Med 2020;1(3).
[4] Gudbjartsson DF, Norddahl GL, Melsted P, Gunnarsdottir K, Holm, et al. Humoral Immune Response to SARS-CoV-2 in Iceland. N Engl J Med 2020 available at www.nejm.org/doi/10.1056/NEJMoa2026116 [accessed on 5 September 2020].
[5] Kontou PI, Braliou GG, Dimou NL, Nikolopoulos G, Bagos PG. Antibody tests in detecting SARS-CoV-2 infection: a meta-analysis. Diagnostics (Basel). 2020;10(5):319.
[6] Bao, L., et al. Reinfection could not occur in SARS-CoV-2 infected rhesus macaques. Preprint at bioRxiv; 2020 https://doi.org/10.1101/2020.03.13.990226.