Pravara Med Rev; December 2020, 12(04) , 45 - 50
DOI: 10.36848/PMR/2020/12100.50430

Original article

Seroprevalence of anti-SARS-CoV-2 antibodies in Mumbai: a population-based study

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ABSTRACT

Background

Measurement of severe acute respiratory syndrome coronavirus 2 (SARS-CoV 2) antibodies through serosurvey in a population is a method of estimation of the rate of infection and also to monitor the epidemic progression. It is also a useful tool to estimate herd immunity. we estimated the seroprevalence of anti-SARS-CoV-2 antibodies in the employees of IndusInd bank located in Mumbai suburbs Andheri and Prabhadevi.

Materials& Methods

The survey was conducted for twelve consecutive days in July 2020. The employees of IndusInd bank aging from 20 to 65 yrs were the participants. All enrolled participants were tested for COVIS antibodies by a kit manufactured by Cobas Roche.The seroprevalencewas determined by using a 2X2 contingency table and chi-square tests.

Results

Total 2077 employees were screened, outof which 527 reported seropositive giving prevalence of 25.37%, and only 49 employees reported prior symptoms.

Conclusion

The findings of our study suggest that process of developing immunity against COVID 19 is started in the Indian population however the rate of achieving the same is slow. It is essential to conduct more serosurveys in various parts of India to have more clarity. Such serosurveys repeated at regular intervals may be one of the preventive measures in respective areas

Keywords: COVID-19, Immunity, SARS-CoV-2Antibody, Prevalence, Surveillance

INTRODUCTION

The coronavirus disease (COVID-19) pandemic hasaffected the globe. It has been thethe greatest challenge world had ever faced since the Second World War. COVID-19 was declared a pandemic by the World Health Organization (WHO) on the 11th of March 2020.[1] In the years 2002 and 2003 the first SARS-pandemic (SARS-CoV-1) occurred, about 8000humans were infected and 9.6% died.[2] At the end of

2019, a new variant, the SARS-CoV-2, was detected in Wuhan/China for the first time. An infection by SARS-CoV-2 may induceCOVID-19, which in most cases proceeds without- or only slightflu-like symptoms, however, in some cases with severe SARS-like symptoms.[3]This pandemic has caused many deaths across the globe due to a lack of treatment modalities and vaccines.

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has flabbergasted the entire world with its range of disease manifestations, from asymptomatic infection to mild, moderate symptoms to critical illness leading to hospital admission and death. [4, ,5]

The current SARS-CoV-2 pandemic is a major burden to healthcare providers such as hospitals,doctors, paramedics, nursing homes, and rehabilitation facilities. All cadre of healthcare professional is in the grips of the risk of infection with SARS-CoV-2. Developing immunity to the virus might help to overcome fears and risks. 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. [5] Therefore, serological detection of specific antibodies against SARS-CoV-2 is a better tool to estimate the true number of infections. Many seroprevalence surveys are carried out in cities of India and also outside India but this requires periodical repetition to get a fair idea.

Detection of antibodies to SARS-CoV-2 in a person's blood likely indicates that they were infected at some point since the start of the pandemic. Thus, serologic assays can be used toprovide population-based estimates of infection that include people who had a mild or asymptomatic infection or who were never tested despite having symptoms. In the course of a SARS-CoV-2 infection, immunoglobulin G (IgG) antibodies may be detected after a median of 14 days (IQR 10–18 days) after the onset of symptoms. [6] This B-cell response and the production of IgG antibodies play an important role in the neutralization of SARS-CoV-2.[7]

We enrolled employees of a corporate bank named IndusInd from several branches located mainly in Andheri and Prabhadevi, for this survey. Our goal was to estimate the seroprevalence in the population of the employees- that is, to findthe proportion of the population with evidence of SARS CoV- 2 antibodies.

MATERIALS AND METHODS

The retrospective, observational study was designed and conducted at various branches of IndusInd bank. The study was accomplished according to the principles of good clinical practice of the MGM Institute of Health Sciences (MGMIHS).We enrolled in 2077 employees of IndusInd bank after obtaining written informed consent. The period of study was from 17th to 31st July. The study procedure included drawing blood and detecting the presence of SARS CoV-2 antibodies. We also introduced a questionnaire.

All data were collected in a strictly pseudonymous form according to the study protocol.The questionnaire included information about gender, age, symptoms, flu-like infectionsthis year, comorbidities. Also, we noted information like illness duration, presence of other symptoms like running nose, cough, headache, sore throat, body ache. Among comorbidities, we also recorded preexisting medical history like malignancy, Heart disease, Chronic liver disease, diabetes, hypertension. We also collected the history of RT PCR tests and its finding was done in past.

Venous blood samples were collected in a 3 ml gel vacutainer. Antibodies against SARS-CoV-2 in serum were analyzed using electrochemiluminescence by Roche. The ECLIA test kit is a semi-quantitative in vitro

assay for human antibodies against SARS-CoV-2 structural proteins in serum.

RESULTS

In total 2077 subjects were enrolled in the study. A completed questionnaire was obtained from all of them anda blood sample was drawn in all 2077 subjects. The study population comprised of 1735 men and 342 women in different age groups and professional groups resp(Table 1).

All 2077 sera specimens tested were from seven branches of IndusInd bank located in Andheri and Prabhadevibranches.The test for SARS-CoV-2 antibodies revealed that 527 subjects had antibodies against the virus resulting in a prevalence of 25.37%. It may be observed from Table 1 thatthe gender-wise seropositive status in the population, out of which 411 (19.8%) out were men and 116 (5.6%) were women.Table 2 depicts the age-wise division of the study population into three age groups which comprise 20-35 yrs, 36-50 yrs, 51-65 yrs resp.

Among the total subjects enrolled only 49 subjects (2.35%) reported to show the presence of one of the symptoms since 1st of January 2020. The most recent common symptoms were sore throat, coughing, rhinitis, loss of taste and smell, and body ache. Few subjects reported fever, diarrhea, breathlessness. This data is presented inTable 3. We have subjected this data to a 2x2 contingency table to find out the odds ratio, relative risk, and chi-square analysis. The odds ratio is 15.5% which is statistically significant, the relative risk ratio is 0.95 (0.93- 0.97, 95% CI) and the chi-square test yates value is 40.13 which is statistically significant.

Information was collected on nutritional supplements taken by the study subjects from January 2020 till the time of sample collection and observed that 39.5% of the study population was on nutritional supplements. Out of this 10% population was seropositive despite taking nutritional supplements. This data shows that 10% of the population did not benefit from nutritional supplements or viral exposure was much more than the ability of the immune system to handle. The 2x2 contingency table showed an odds ratio of 0.77, relative risk 0.82 (0.71 – 0.97, 95% CI), and the chi-square test yates value is 5.54 which is statistically significant (Table-4).

Table 1: Showing Sero status gender-wise in the study population

	Male	Female	Total
Sero Positive	411 (19.79%)	116 (5.58%)	527 (25.37%)
Sero Negative	1324 (63.75%)	226 (10.88%)	1550 (74.63%)

Table 2: Showing Age-wise serostatus in the study population

Age group, years	Positive	Negative
20-35 (n=680)	159 (20.38%)	521(76.62%)
20-35 (n=834)	244 (29.26%)	590(70.74%)
51-65(n=563)	128 (22.74%)	435 (77.26%)
Sex		
Female(n=342)	116 5.58%)	226(10.88%)
Male(n=1735)	411(19.79%)	1324(63.75%)

Table 3: Showing the status of Symptom wise distribution in the study population

	Sero positive	Sero Negative	Total
Symptoms	32 (1.54%)	17 (0.82%)	49
No symptoms	495 (23.83%)	1533 (73.80%)	2028
	527	1550	2077
Odds Raito	15.47*		
Relative risk ratio, 95% CI	0.95 (0.93- 0.97)		
Chi Sq. test	458.61*		

*p< 0.001

Table 4: Showing serostatus with nutritional supplements in the study population

	Sero positive	Sero Negative	Total
Nutritional Supplements	185 (8.91%)	636 (30.62%)	821
No Nutritional Supplements	342 (16.46%)	914 (44%)	1256
	527	1550	2077
Odds Raito	0.77		
Relative risk ratio	0.82 (0.71 – 0.97)		
Chi Sq. test	5.54*		

*p< 0.05

DISCUSSION

The study estimated seroprevalence of antibodies to SARS-CoV- 2 in the seven branches of IndusInd bank at Andheri and Prabhadevi, Suburb of Mumbai, with collection periods of 12 days period.

Seroprevalence estimates observed was 25.37% from 17th July to 31st July 2020. The finding of our study of these branches suggests that the infection rate of COVID-19 is much higher than the reported cases. This enrolled population in the study is likely to have a large number of od subjects without symptoms or with mild symptoms. This population also includedsymptomatic cases who avoided medical assistance or RT PCR test for COVID-19.

The finding of our sero-surveillance study revealeda higher percentage of seropositive is higher in men when compared with women. This difference was observed maybe because more number of men may be venturing out for the day to day work, job, and other related activities. These findings are contradictory with the finding of BMC's serosurvey, which showed a total seropositive percentage as 57 and out of which percentage of women with seropositive status was 59.3% (2297) in contrast to 53.2% (1937) in men.[8]

The results of several Indian Seroprevalence studies have been released, including those conducted in Delhi and Dharavi Slums of Mumbai. The seroprevalence of Studies has used rapid card tests and participant selection methods whereas we have used the ECLIA method for analysis of sero-antibodies.

Delhi recorded about 23% seroprevalence, indicatingthat 1.9 crore population has evidence of past exposure to Sars-Cov-2, in almost six months of period. The result of the seroprevalence study showed that a large number of infected people remained asymptomatic, during this period.[9]

The residents from five highly-affected areas in Pune were surveyed and the result of Seroprevalencewas 51.5 %. The sero-surveillance included 1,664 respondents (all above 18 years) from the city's 35 lakh residents. Sero survey was conducted by the Indian Institute of Science Education and Research (IISER) in collaboration with Pune Municipal Corporation (PMC); SavitribaiPhule Pune University (SPPU); Translational Health Science and Technology Institute (THSTI), Faridabad; Christian Medical College (CMC), Vellore and funded by Persistent Foundation.[10]

Dr.AurnabGhose, from the Indian Institute of Science Education and Research, Pune, India, said that 52.8 % of men and 50.1% of women were found to have seroprevalence of antibodies, as per the report. According to the findings, an extensive spread of the infection -ranging between 36.1% and 65.4%- in five areas of the city, has been found. Of the five sampled areas (wards), Lohiyanagar (Kasewadi) in BhavaniPeth accounted for the highest 65.4 percent of seropositivity. Navi Peth (Parvati) accounted for 56.7%; Yerawada 56.6%, Rasta Peth 45.7% while KasbaPeth (SomwarPeth) stood at 36.1%.[11]

Global Seroprevalence of COVID-19 antibodies is much lesser in comparison with India. Thus, it is evident from the data that India is achieving herd immunity at a reasonably good rate. COVID-19 Antibody Seroprevalence in

Santa Clara County, California was 1.5 % ARS-CoV-2 In the San Francisco Bay area was 1% (collected April 23-27) & 6.9% in New York City (collected March 23-April 1). [12]A weekly sero evaluation was done in a study population of Geneva which showed 10·8% seropositivity in the fifth week.[8]

We have compared the seroprevalence data from the various studies carried out in metro cities of India and outside India. It seems India is marching towards herd immunity slow and steady rate.However, at this point in the pandemic, there is not enough evidence about the effectiveness of antibody-mediated immunity as well as the life of antibody in the circulation antibodies that confer immunity. Very little is known about the relationship between antibody level (titer) and the resultant degree and persistence of any immunity that is conferred. Hence even if herd immunity is achieved, this cannot be considered asan immunity passport against COVID-19. Ultimate protection against COVID-19 will be a vaccine for all.

CONCLUSION

A multi-stage sample design serosurvey should be conducted nationwide. It will be a useful tool in the identification of areas affected by coronavirus infection. The data obtained from such a survey will be very important and crucial to plan preventive measures. Such kind of population-based survey will help identify the burden of the disease will contribute to the epidemiological data. The new treatment strategies can be devised and can be used in monitoring the disease trend.

Recommendations

To obtain an appropriate estimate of COVID antibodies more serosurvey should be conducted by the government across the country.

Limitations

Thelimitation of the study is these bank employees may not be a true representative of the general large population including their health status, nutritional status & socio-economic status. Exposure to disease and infection may also vary. Representativeness is subjected to vary by age and gender as well. Therefore the estimate of our seroprevalence may be confirmed by other studies by enrolling a more representative sample population.

ACKNOWLEDGMENT

The authors are thankful for the support by the authorities of IndusIndBank and their employees for the large attendance. The authors also express their gratitude towards the staff of MGM central laboratory or helping by organizing the study procedures.

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Date of Publication: 30 December 2020
Author Declaration: Source of support: Nil , Conflict of interest: Nil
Plagiarism Checked: Urkund Software
Ethics Committee Approval obtained for this study? Yes
Was informed consent obtained from the subjects involved in the study? Yes
For any images presented appropriate consent has been obtained from the subjects: NA

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DOI: DOI: 10.36848/PMR/2020/12100.50430