Original Article

Seroprevalence and Associated Factors of SARS CoV-2 Antibodies among employees of IMDC and its teaching hospital

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Abstract

Introduction: This study aims to determine the prevalence of anti-SARS-CoV-2 antibodies among the employees of Islamabad Medical and Dental College and its allied hospital Akbar Niazi Teaching Hospital.

Material and Methods: This descriptive cross-sectional study was conducted among the staff and faculty of Islamabad Medical and Dental College and its allied hospital, irrespective of their COVID-19 infection history. The study was approved by the institutional review board of Islamabad Medical and Dental College (Ref # 37/IMDC/IRB-2020). 294 employees volunteered for the study from 23rd July to 30th July 2020 through Elecsys® Anti-SARS-CoV-2 (Immunoassay for the qualitative detection of IgG antibodies against SARS-CoV-2 in humans serum and plasma). SPSS was used for data analysis and a p-value <0.05 was considered significant.

Results: Out of 284 volunteers, 87 (30.6%) were SARS-CoV-2 antibody positive, with the mean antibody level in seropositive individuals recorded as 24.44 ± 25.34. Among housekeeping and sanitary workers, 48.3% were seropositive while among lab technicians 37.1% were seropositive. After housekeeping and sanitary staff, the second most affected workers were lab technicians (37.1% were positive compared to 62.9% negative). Fever, loss of taste or smell, and breathing difficulty were the most significantly associated symptoms with COVID-19 antibody seroprevalence as suggested by p-value 0.003, 0.004, and 0.032 respectively. Out of the 13 PCR positive participants (in the preceding 3 months), 10 (76.9%) showed positive antibodies in their serum and 3 (23.1%) had not developed antibodies.

Conclusion: Seroprevalence of SARS-CoV-2 antibodies was estimated to be high among the healthcare staff, with the housekeeping and sanitary staff to be the most affected employees, probably due to the breach of personal protection. Fever, loss of taste or smell, and breathing difficulty were strongly associated with seropositivity of SARS-CoV-2 antibodies.

Keywords: SARS-CoV-2, antibody testing, COVID-19, healthcare workers.

Introduction

Since COVID-19 first emerged in Wuhan, China on December 12, 2019, it has played havoc and emerged as a massive pandemic. As of November 22, 2020, WHO has reported 57.8 million cases and 1.3 million deaths globally since this catastrophe hit the world. Pakistan along with Iran, Jordan, Morocco, Iraq, and Lebanon has reported the highest number of new cases in the Eastern Mediterranean Region.[1] Clinically, COVID-19 manifestations include fever, dry cough, and fatigue, severe pneumonia in almost half of the patients, and acute respiratory distress syndrome in one-third of the patients.[2]

Regarding diagnostic testing, two types of tests are being widely used across the globe. One type is molecular testing (Polymerase chain reaction) on a nasal or throat swab sample, which detects the presence or absence of genetic material (ribonucleic acid) of the virus. Another type of test detects the development of an immune response to the virus in the form of antibodies for example IgM, IgG, IgA produced by the body in response to infection. These antibody detection tests are not useful in the diagnosis and screening of early infection because the immune system requires time to counter the viral invasion, but they can have paramount importance in establishing the immune status of a population.[3] Serology testing for COVID-19 antibodies is helpful to determine whether people had been previously exposed to SARS-CoV-2. SARS-CoV-2 is a member of the β-coronavirus genus, with the sequence similarity being high (87.9% and 98.7%). 3 to 6 days after infection with SARS-CoV-2, the level of IgM antibodies increases and becomes detectable, but then the levels rapidly diminish thereafter. Approximately 8 days after the appearance of symptoms, IgG antibodies form in the blood, with progressively increasing levels over the course of infection and continue to rise for an extended period of time.[4] In the absence of a vaccine, the buildup of SARS-CoV-2 herd immunity through natural infection is theoretically possible.[5,6]

The objective of this research is to carry out the antibody test against covid-19 among the employees of ANTH, IMDC, and allied health care professionals at Islamabad Medical and Dental College and its allied hospital Akbar Niazi Teaching Hospital (ANTH). There's still a long way to go with both virus and antibody testing for COVID-19.

This current study will attempt to piece together the complex puzzle of antibody-mediated immunity, aiming to achieve safe, effective, and sustained protection against this devastating disease. It is pertinent to investigate the level of SARS-CoV-2 antibodies among healthcare staff who are the most exposed group in the community. It may help policymakers in making informed decisions in the light of evidence generated locally.

Materials and Methods

Study Design and Participants: It was a descriptive cross-sectional study conducted among the employees of Islamabad Medical and Dental College and its allied teaching hospital, Bhara Kahu, Islamabad. All members of the staff and faculty of Islamabad Medical and Dental College and allied hospital Akbar Niazi Teaching Hospital were encouraged to get tested for SARS-CoV-2 antibodies and 294 employees volunteered for the study. The healthcare workers included doctors, nurses, laboratory technicians, unit receptionists, housekeeping and sanitary workers, finance and administration staff. The study was approved by the Institutional Review Board of the institution. Informed consent was taken from all the participants explaining the objectives of the research and complete confidentiality and anonymity were ensured.

Data Collection Procedure and details of Antibody Testing: A structured questionnaire was used to collect information about age, department, history of any symptoms during the past 3 months, and history of nasal or throat swab for COVID-19 if done. SARS-CoV-2 antibody testing was done from 23rd July to 30th July 2020, through Elecsys® Anti-SARS-CoV-2 (Immunoassay for the qualitative detection of IgG antibodies against SARS-CoV-2 in human serum and plasma). The assay was performed on Cobas e 411 analyzers by Roche. Cutoff index of <1.0 was taken as non-reactive, while COI ≥ 1.0 was considered positive. The sensitivity of the kit ≥ 14 days post-PCR confirmation is 99.5%, while its specificity is 99.8% (as claimed by the manufacturers).

Data Analysis: Data was analyzed through SPSS v.26. Mean and standard deviation was calculated for continuous variables and frequencies and percentages for categorical variables. A Chi-square test was used to find the relationship between antibody positivity and other variables, with a p value <0.05 taken as significant.

Ethical Considerations: The study was approved by the institutional review board of Islamabad Medical and Dental College (Ref # 37/IMDC/IRB-2020). All

participants were informed about the objectives of the study and participated in the study with their consent.

Results

A total of 284 staff members were recruited. The mean age of the study participants was 30.8 ± 9.4 years. About 175 (61.6%) were males and 109 (38.4%) were females. Out of 284, 7 (2.5%) were from senior management, 52 (18.3%) were doctors, 31 (10.9%) unit receptionists, 93 (32.7%) were from the nursing department, 35 (12.3%) lab technicians, 29 (10.2%) housekeeping and sanitary workers, and 37 (13%) were from finance and admin department. Antibody testing was done from 23rd July to 30th July 2020 which showed that 197 (69.4%) were negative while 87 (30.6%) came out antibody positive. The mean antibody level in the sample was 7.54 ± 17.94 while the mean antibody level in seropositive individuals was 24.44 ± 25.35. During the COVID-19 pandemic, symptom analysis showed that 17 (6%) developed fever, 17 (6%) developed cough, 9 (3.2%) reported a loss of taste or smell, 3 (1.1%) reported diarrhea, while 5 (1.8%) had difficulty breathing. About 255 (89.8%) developed none of these symptoms, while 29 (10.2%) showed one or more of these symptoms. Participants were also inquired about the month in which they developed the symptoms which showed that all of them showed the symptoms during the three months preceding our study.

Table 1 depicts no significant difference between the various age and gender groups (p-value 0.642 and 0.792 respectively). On inquiring about the symptoms, 182 (71.4%) of the participants had no symptoms during the preceding 3 months and were antibody negative. While among those who had developed symptoms, 14 (58.3%) had also developed antibodies compared to 15 (51.7%) who were antibody negative at the time of the test (p-value 0.035). The mean antibody level in the participants with a history of symptoms was 11.98 ± 21.2 while it was 7.04 ± 17.51 among those who were asymptomatic.

Table 1 Cross-tabulation of antibody test results with age, gender, symptoms, and department of study participants

Variable	*Antibody level*		*p-value*
Age	**Positive**	**Negative**	
25 and below	32 (28.8%)	79 (71.2%)	
26-30	22 (37.3%)	37 (62.7%)	
31-35	14 (31.8%)	30 (68.2%)	0.642
36-40	10 (32.3%)	21 (67.7%)	
>40	9 (23.1%)	30 (76.9%)	
Gender			
Male	55 (31.4%)	120 (68.6%)	0.792
Female	32 (29.4%)	77 (70.6%)	
Any symptom in the preceding 3 months			
Yes	14 (48.3%)	15 (51.7%)	0.035*
No	73 (28.6%)	182 (71.4%)	
Department			
Senior Management/ Finance and Admin	13 (29.5%)	31 (70.5%)	0.095*
Doctors	9 (17.3%)	43 (82.7%)	
Unit Receptionists	9 (29%)	22 (71%)	
Nursing	29 (31.2%)	64 (68.8%)	
Lab Technicians	13 (37.1%)	22 (62.9%)	
Housekeeping and sanitary workers	14 (48.3%)	15 (51.7%)	

On analyzing the department of the study participants, housekeeping and sanitary staff were found to be maximally affected (48.3%) followed by lab technicians (37.1%). After housekeeping and sanitary staff, the second most affected workers were lab technicians (37.1% were positive compared to 62.9% negative). Out of the nursing staff, 29 (31.2%) had positive antibodies, while 64 (68.8%) had negative antibodies (p-value 0.095) as shown below in Figure 1.

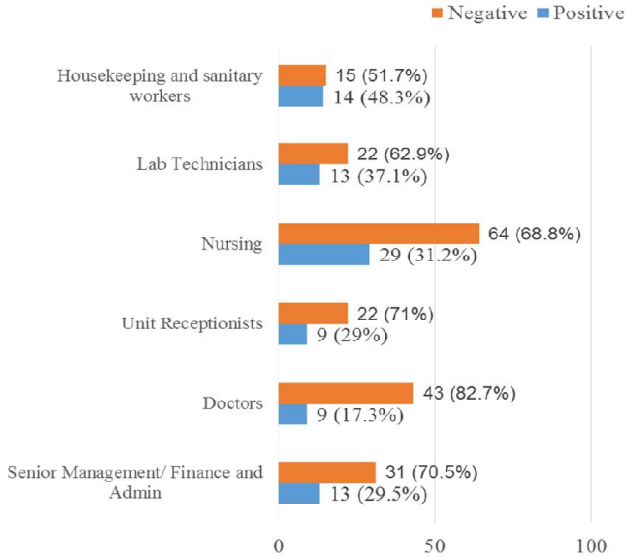

Figure 1: SAR-CoV-2 seroprevalence among employees of IMDC and its teaching hospital

Table 2 shows fever, loss of taste or smell, and breathing difficulty to be significantly associated with COVID-19 antibody seroprevalence as suggested by the p values 0.003, 0.004, and 0.032 respectively.

Table 2: Seroprevalence and symptoms of COVID-19 among employees

Symptoms	*Antibody level*		*p-value*
Fever	**Positive**	**Negative**	
Yes	11 (64.7%)	6 (35.3%)	
No	76 (28.5%)	191 (71.5%)	0.003*
Cough			
Yes	5 (29.4%)	12 (70.6%)	0.575
No	82 (30.7%)	185 (69.3%)	
Loss of taste or smell			
Yes	7 (77.8%)	2 (22.2%)	0.004*
No	80 (29.1%)	195 (70.9%)	
Diarrhea			
Yes	2 (66.6%)	1 (33.3 %)	
No	85 (30.2%)	196 (69.8%)	0.195
Breathing Difficulty			
Yes	4 (80%)	1 (20%)	0.032*
No	83 (29.7%)	196 (70.3%)	

*(*p-value < 0.05 depicts significant difference)*

54 study participants out of 284 also had their PCR test done in the 3 months preceding the study out of whom 13 (24.1%) were positive at the time of the test and 41 (75.9%) were negative. Out of the 13 PCR positive participants, 10 (76.9%) showed positive antibodies in their serum and 3 (23.1%) had not developed antibodies (among these 1 participants had been PCR positive only 10 days before the antibody test, while the other 2 were PCR positive 1.5-2 months before the antibody test). Out of the 41 participants who were PCR negative at the time of the PCR test, 12 (29.2%) got infected thereafter and developed antibodies. Among the 230 study participants who never had PCR test for COVID-19, 65 (28.2%) had positive antibodies for COVID-19.

Discussion

Our study provides valuable insight into the SARS CoV-2 antibody positivity rate among healthcare workers, seroconversion in PCR positive individuals, and strongly suggestive symptoms of COVID-19. Healthcare workers are the most exposed individuals in this pandemic and large numbers of asymptomatic healthcare workers could be a potential source of infection for others.

This study reveals the seroprevalence of SARS CoV-2 antibody to be 30.6% among healthcare workers in a tertiary care hospital with maximum prevalence among housekeeping and sanitary workers (48.3%) followed by lab technicians (37.1%). This is higher than studies conducted in hospital settings of other countries.[7,8] This may be due to a breach of personal protective measures and a lack of awareness in the communities they come from. The low prevalence of antibodies among doctors in our study reflects that strict use of precautionary measures has an impact on infectivity, despite being maximally exposed to the patients coming to the hospital. In another study done among healthcare workers in a tertiary care hospital in New York City, 9.8% of the healthcare workers tested positive for antibodies. However, no significant difference was observed in SARS-Cov 2 antibody rate across various age groups, gender, and job titles. Our study also shows similar results with insignificant p-values (0.642, 0.792, and 0.095 respectively).[9] Lower seroprevalence among healthcare workers has been reported in studies carried out in other parts of the world.[10,11,12]

In a study done in Sweden among healthcare workers, the most reported symptoms were headache, malaise, fever, loss of smell, cough, and loss of taste; while abdominal pain and dyspnea were reported less frequently. Symptoms with the strongest association to seroprevalence were anosmia, ageusia, and fever while the symptom of sore throat did not differ among seropositive and seronegative which is comparable to our results.[13] Another study that offered insight into the experience of healthcare workers of a critically affected COVID-19 referral hospital in Italy reported fever (69.5%), followed by weakness (44.5%), loss of taste (36%), and loss of smell (40%) to be the most common symptoms.[14] An observational cohort study was carried out in healthcare staff of the Capital Region of Denmark loss of taste or smell to be the most strongly associated symptom with seropositivity.[15] A study conducted among Swiss hospital workers reported a history of fever and myalgia to be the most differentiating symptom between seropositive and seronegative participants.[16] In our study, fever, loss of taste or smell, and breathing difficulty are strongly associated with seropositivity of SARS-Cov-2 antibodies.

A study assessing PCR positivity and humoral response in patients with COVID-19 in New York City reported that 37% of suspected SARS-Cov-2 infections seroconverted to the SARS-Cov 2 spike proteins after 4 weeks. In the same study, out of the 624 confirmed SARS-Cov 2 participants, all had seroconverted to the SARS-Cov 2 antibodies after 4 weeks except three.[17] In our study, out of the 13 participants who had been PCR positive, 3 (23.1%) had not developed antibodies. Among these three, 1 participant was probably negative for SARS-Cov 2 antibodies because her

antibody levels were checked 10 days after PCR positivity.

A limitation of this study was the small sample size. Voluntary participation might have instigated selection bias in our sample. Many of the healthcare workers refusing to participate might have had a characteristic associated with an increased risk of COVID infection (being too busy at COVID-19 wards, for instance). Limited data is available on the accuracy of serology tests, which may result in over or underestimation of COVID-19 infection.

Conclusion

Seroprevalence of SARS-CoV-2 antibodies was estimated to be high among the healthcare staff, with the housekeeping and sanitary staff to be the most affected employees, probably due to the breach of personal protection. Fever, loss of taste or smell, and breathing were strongly associated with seropositivity of SARS-CoV-2 antibodies.

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