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Original article

Detection of SARS-CoV-2 antibody level and associated factors among healthcare workers of a tertiary care hospital

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Abstract

Background: Healthcare workers (HCWs) at the front lines, provided care to Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) infected patients around the world. In a pandemic, serological testing is a pressing need to estimate the antibodies against SARS-CoV-2 in high-risk communities. The main objective of this study was to detect the level of SARS-CoV-2 antibodies among HCWs of a tertiary care hospital and find out the role of age, sex, occupation, working zone, and co- morbidity with the antibody level. ***Methodology:*** This cross-sectional study was conducted at the Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM) General Hospital. A total of 125 HCWs of BIRDEM were enrolled, all participants filled out a questionnaire, blood samples were obtained for SARS-CoV-2 Immunoglobulin G (IgG) II Quant assay, a Chemiluminescence Microparticle Immunoassay (CMIA). ***Results:*** Among the study participants, 63.2% were female. Among the HCWs, 50 (40%) were involved working at COVID and 75 (60%) from non-COVID zone of hospital. Among 125 HCWs, 124 (99.2%) HCWs were found seropositive for SARS-CoV-2 anti- Receptor Binding Domain (RBD) IgG. HCWs in direct patient contact (Doctors, nurses, cleaners) had higher antibody levels than those with indirect patient contact (Lab personnel). Among the occupational groups, nurses had significantly higher (P value <0.05*) anti-RBD IgG levels, than doctors, cleaners, and lab personnel. The highest clinical exposure were of nurses may be a cause of increased SARS-CoV-2 infection and robust antibody production. No significant association was found (p>0.05) in anti-RBD IgG concentration among COVID and non-COVID zone workers. SARS-CoV-2 anti-RBD IgG concentration of female participants was significantly higher (p<0.05*) than male participants. Among female participants, the physiological concentration of estrogens may stimulate a humoral response to viral infections and vaccination. SARS-CoV-2 anti-RBD IgG concentration of co-morbid HCWs was not significant compared to the non-co-morbid group. Antibody levels of diabetic and hypertensive HCWs were not statistically significant (p>0.05). ***Conclusion:*** The present study revealed a higher prevalence of SARS-CoV-2 anti-RBD IgG antibodies among HCWs. Nurses had significantly higher antibody levels than doctors, cleaners, and lab personnel. A significant association was found between sex and antibody level. Whereas age, working zone (COVID, non-COVID), and co-morbidity did not affect the antibody level.

Keywords: SARS-CoV-2, COVID-19, Healthcare workers, SARS-CoV-2 anti-RBD, CMIA.

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INTRODUCTION

SARS-CoV-2 is the virus that causes the highly infectious illness- Coronavirus disease 2019 (COVID-19). In March 2020, the World Health Organization (WHO) declared it a world wide pandemic.[1] The initial cases of COVID-19 were first reported in Wuhan, China in December 2019.[2] In March 2020, it was declared a global pandemic by the World Health Organization (WHO).[1] Bangladesh confirmed the detection of its first three novel COVID-19 positive cases on March 8, 2020.[3]

Since COVID-19 remains a serious concern, front-line HCWs are one of the highest-risk occupational groups for COVID-19 infection, as they have contact with both COVID-19 patients and other healthcare professionals.[4] 10–20% of all COVID-19 diagnoses may be attributable to front-line HCWs. Frequent exposure to the virus is expected to cause HCWs to have a larger viral load and worse clinical outcomes than the general population. However, there are discrepancies in the information that is currently accessible. The risk of infection is variable in each HCW category.[4]

To evaluate the amount of exposure among HCWs, to identify high-risk groups among HCWs, and to explain the transmission of COVID-19 among HCWs, it is necessary to ascertain the prevalence of SARS-CoV-2 antibodies among HCWs.[5,6,7] To identify the risk variables connected, the seroprevalence of SARS-CoV-2 antibodies was assessed in a random sample of HCWs working in a large tertiary care hospital. In comparison to the general population, persons who work in health or social care settings are predicted to have a 6-fold higher prevalence by the Office for National Statistics (ONS) of the United Kingdom. Increased infection rates have been reported.[6]

During COVID-19 pandemic, increased infection rates, morbidity, and death among healthcare personnel were reported. Studies are crucial to ascertain the seroprevalence of anti-SARS-CoV-2 antibodies in different clusters of healthcare staff. The outcome of SARS-CoV-2 infection in individuals is heterogeneous and dependent on multiple variables, mainly co-morbidities, obesity, age, sex, etc.[8]

Meta-analyses of antibody prevalence from several countries demonstrate that the presence of IgG antibodies among HCWs varied between 7%.[7,9] Risk factors influencing antibody production are yet unknown other than patient interaction. It is unclear if personal or professional traits, such as a job involving frequent or direct patient contact, raise the risk of COVID-19 infection.[9,10]

A Serological survey is a potentially powerful tool to understand the epidemiology of infection, both before and after the vaccination rollout. It is important to identify the populations of interest and the sampling method to provide a representative sample of those populations, and the selection of the most appropriate laboratory assays.[11]Some serosurveys have already been done in different countries at different time points in the pandemic on different population groups (e.g. general population, healthcare workers, contacts) and using different types of laboratory assays. Xinhua Chen and colleagues in the Lancet Global Health, have synthesized data from published serological studies-based on the use of information from 82 high-quality research, they assessed that the general population's total seroprevalence is 80% (95% CI 68%-92%). The seroprevalence was higher among close contacts of COVID-19 cases and healthcare workers than in low-risk healthcare workers and the general population.[12]

It is important to determine and characterize the immune responses to SARS-CoV-2 infection to understand how well the response protects people against future SARS-CoV-2 infection and how long this protection lasts.[13] Among HCWs, vaccination is important to minimize SARS-CoV-2 infection and mortality, although non-HCWs bear similar levels of COVID-19 risk compared to HCWs.[14]

HCWs remain a priority group for vaccination for multiple reasons, including their continuous potential exposures in the workplace and the risk of transmitting the virus from infected HCP to a large number of at-risk patients.[15] The antibody concentration and affinity are generated according to the viral load and immune response from the host. It is important to know how long these antibody titers can be maintained

in individuals who received the vaccine after a prior infection and those with a second dose and no prior infection.[16] SARS-CoV-2 antibody positivity was higher than the general population among healthcare assistants, which supports patient-related transmission of SARS-CoV-2 to HCWs as these HCWs are involved in most near-patient work. In this systematic review, seroprevalence was higher among HCWs working in COVID-19 units. HCWs in contact with patients with COVID-19 represent a high-risk group for SARS-CoV-2 infection.[17] Females were associated with higher seroprevalence,[18] whereas, there was significantly higher ($p<0.001$) seropositivity of male health-care workers (5.45%) than females (3.66%).[19]

To detect and differentiate anti-SARS-CoV-2-specific antibodies from antibodies of widely circulating CoVs by a sensitive and specific immunoassay is crucial for SARS-CoV-2 serosurvey.

SARS-CoV-2 antibody responses are characterized through the detection of IgG, IgA, and/or IgM. Since IgM coincides with IgG antibodies during early infection, it persists for a short duration and shows cross-reactivity and heterogenic result.[20] We have therefore used the antibody tests targeting the spike protein, S1 antigen. S1 is more specific than S2 or nucleocapsid (N) protein.[21] The assay- we used in this study was Abbott SARS-CoV-2 IgG II Quant Assay, which is a Chemiluminescence Microparticle Immunoassay (CMIA), that targets the Receptor Binding Domain (RBD) of S1 spike protein. The assay has specificity and sensitivity of 99.6% (95% confidence interval [CI], 99.20–99.80) and 100.0% (95% CI 95.72–100.00), respectively.[22]

So, this study was conducted to estimate the seroreactivity rates prevalent in HCWs of a tertiary care hospital in Dhaka city. The study attempted to detect quantitative SARS-CoV-2 anti-RBD IgG antibody concentration by quantitative serological assay, to compare antibody concentration among different groups of healthcare workers as well as to monitor its association with different factors.

Methodology:

Study design: This cross-sectional hospital-based analytical study on HCWs was conducted in BIRDEM General Hospital, Dhaka from November '21 to February 2022. BIRDEM is one of the largest tertiary care hospitals in Dhaka involved in the management of general patients as well as COVID-19 patients, having a dedicated emergency department (ED), intensive care unit (ICU), cabins and admission wards, allocated for COVID-19 patients.

Study participants: Participation in the study was voluntary. HCWs were invited by the internal announcement to participate in the study. Interested participants were asked to contact the study team for an appointment. 125 HCWs were enrolled in the study as study participants. A purposive sampling method was applied to ensure that recruited study samples were representative of the HCW involved in the provision of healthcare for patients directly (doctors, nurses, cleaners) and indirectly (lab personnel). Among 125 study participants, there were 32 doctors, 30 nurses, 33 lab personnel, and 30 cleaners. Above participants were selected regardless of their age, sex, co-morbidity history and working zone (COVID, non-COVID working zone). The majority of the participants were vaccinated.

Categories of Participants

As exposure of HCWs to COVID-19 differs based on their specialty and place of work.

Categorization of working zone[23]

COVID zone: COVID-19 zone of the emergency department, COVID-19 transit ward-admitting patients awaiting laboratory confirmation of COVID-19 infection, COVID-19 general wards, and COVID-19 intermediate and intensive care units- all these zones of tertiary care hospital were considered as COVID zone. Non-COVID zone: The zone of tertiary care hospitals other than the COVID zone.

Data Collection procedure: Structured questionnaire and checklist were the tools of data collection. Data contained some parameters e.g. age, sex, history of co-morbidities, working zone, and previous COVID-19 infection. All participants were asked to complete a questionnaire.

Sample collection: In the designated sample collection room of the Microbiology Department of BIRDEM, a phlebotomist collected 3 ml of whole blood sample aseptically by venipuncture from each study participant and kept it in red topped Serum Separator Tube (SST).

Serum preparation: Serum preparation was done in the Microbiology laboratory of BIRDEM. As per the tube manufacturer's processing instructions, the whole blood samples contained in the tube were allowed to clot by leaving them undisturbed for 15-30 minutes at room temperature for gravity separation. Then for the removal of the clot, the samples were centrifuged at 4000 RPM for 10 minutes in a centrifuge machine at room temperature.

Preservation: The supernatant serum was aliquoted in a microcentrifuge tube and kept frozen immediately at -20°C until laboratory analysis.[24]

Laboratory Test: SARS-CoV-2 anti-RBD IgG Testing: SARS-CoV-2 IgG II Quant assay was performed in the Immunology laboratory of BIRDEM General Hospital. Before this Chemiluminescent Microparticle Immunoassay (CMIA) technique, all serum samples were held at room temperature and centrifuged briefly. SARS-CoV-2 IgG II Quant assay is a fully automated two-step immunoassay to determine the presence of specific IgG antibodies, to the automated two-step immunoassay to determine the presence of specific IgG antibodies, to the spike receptor binding domain (RBD) of SARS-CoV-2 human serum using CMIA technology with flexible assay

protocols, referred to as chemiflex. This assay is a fully automated two-step immunoassay on ARCHITECT i2000SR (Abbott Laboratories, Abbott Park, IL, US) and was done according to the manufacturer's instructions. The IgG antibody concentrations in human serum are expressed as-relative light units (RLU) and grade the results, indicating a direct relationship with the amount of IgG antibodies to SARS-CoV-2 in the sample and the RLUs detected by the ARCHITECT i2000SR system optics. As the assay detection range is from 21.0 – 40000.0 AU/mL, by the manufacturer protocol (reference number 06S61; Abbott Laboratories). SARS-CoV-2 S1 IgG <50 AU/mL ll was reported as negative. Test result ≥ 50 AU/mL is considered positive.[25]

Ethical consideration: The research proposal was approved by the ethical review board of BIRDEM Academy with reference no. BIRDEM/IRB/2021/285. For participation in the study, informed written consent was taken from all participants after informing them of the purpose, procedure, risk, privacy, etc. issues related to the study.

Data Analysis and Interpretation: Categorical variables were expressed as counts, and percentages and compared using the Chi-Square test. Continuous variables were described as the mean, standard deviation, standard error, median and interquartile ranges (IQR) value. An Independent t-test was applied to compare two continuous variables. ANOVA test was done to compare three or more continuous variables. Statistical analyses were performed using SPSS version 23.0. A two-sided P-value < 0.05 was considered statistically significant.

RESULT

SARS-CoV-2 anti-RBD IgG antibody response was observed among 125 healthcare workers of BIRDEM General Hospital, a tertiary care hospital in Dhaka City.

Table 1: Age, sex, co-morbidity, working zone distribution of healthcare workers

Trait	Total N(%)
Age (in years)	
21-30	32(25.6)
31-40	27(21.6)
41-50	33(26.4)
51-60	30(24.0)
>60	3(2.4)
Gender	
Male	46(36.8)
Female	79(63.2)
Patient contact	
Direct	92(73.6)
Indirect	33(26.4)
Working zone	
COVID	50(40.0)
Non-COVID	75(60.0)
Occupation	
Doctor	32(25.6)
Nurse	30(24.0)
Cleaner	33(26.4)
Lab personnel	30(24.0)
Presence of co-morbidity	
Yes	55(44.0)
No	70(56.0)
Name of co-morbidity	
Hypertension (HTN)	29(23.2)
Diabetes Mellitus (DM)	17(13.6)
Bronchial Asthma (BA)	6(4.8)
Cardiovascular disease	3(2.4)
Hypothyroidism	5(4.0)

Table 1 shows the age, sex, working zone, and co-morbidity distribution of healthcare workers. Age range 21 years to above 60 years, the highest 26.4% of HCWs were within 41-50 years and the lowest 2.4% of participants were above 60 years. The mean age (±SD) of HCWs was 40.92 (±11.5) years. 63.2% of the study population were female. The nurse and laboratory personnel group had more female participants, doctors, and the cleaner group had an almost equal sex ratio. 60% of HCWs were from the non-COVID zone and 40% from the COVID zone. 48% of participants had co-morbidities. Hypertension (HTN) and Diabetes Mellitus (DM) were the predominant co-morbidities among 23.2% and 13.6% of participants respectively.

Table 2: Range of antibody levels among the study participants (N=125)

Antibody level in the range (AU/mL)	Frequency n	Serostatus	Total N
40-49	1	Seronegative	1
50-5000	83	Seropositive	124
5001-10000	10		
10001-20000	17		
20001-30000	6		
30001-40000	9		

Table 2 shows the frequency of different antibody levels among 125 study participants. Antibody levels were divided

into 6 ranges starting from 40 up to 40000 AU/mL. Only 1 participant had an antibody level below 50 AU/mL, considered as seronegative, and the rest 124 participants had an antibody level more than 50, considered as seropositive. Out of these 124 HCWs, a maximum of 83 HCWs had the lowest antibody range from 50-5000 AU/mL. Only 15 HCWs had the highest antibody level from 20001-40000 AU/mL.

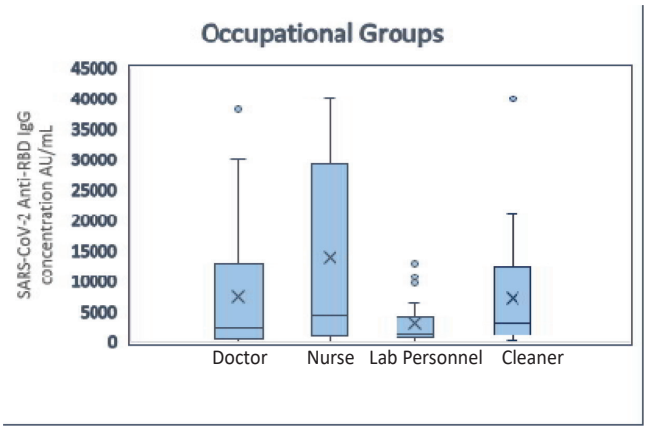
Table 3: Mean SARS-CoV-2 anti-RBD IgG antibody concentration according to age, sex, co-morbidity, occupation and working zone

Trait	SARS-CoV-2 anti-RBD IgG (AU/mL) Mean± SE	*P value*
Age (in years) 21-30 31-40 41-50 51-60 Above 60 years	 9602.4 ± 2371.5 6231.8 ± 1653.0 6263.9 ± 1728.6 9001.0 ± 2270.8 10387 ± 4268.5	*P value=0.6*
Sex Male Female	 5797.2±122.1 7779.9±1493.9	***P value=0.012****
Occupation Doctor Nurse Lab personnel Cleaner	 7563.1±1759.8 13911.4±2996.6 3214.4±640.4 7266.7±1656.4	*Nurse vs Doctor, Lab personnel, Cleaner* ***#P=0.002****
Working zone Covid Non-Covid	 10108.3 ±1939.3 8855.9±1682.5	*P value= 0.6*
Co-morbidity Present Absent	 8011.3± 1196.8 7754.5± 1355.3	*P value= 0.9*
Name of co-morbidity DM Non-DM HTN	 8011.3± 266.9 7754.5±1729.4 7011.6±1500.5	*P value=0.2*

P value was determined by independent t-test. # P value was measured by one-way ANOVA test. ***P value <0.05**** was considered significant.

Table 3 shows the mean SARS-CoV-2 anti-RBD IgG concentration according to age, sex, co-morbidity, occupation and working zone. The mean ± SE value of anti-RBD IgG concentration did not correspond with increasing or decreasing age (p>0.05). The mean ± SE value of anti-RBD IgG of females was 9779.9 ±1493.9AU/mL, significantly higher (p=0.012*) than the value of males 5797.21± 122.1 AU/mL. The antibody concentration in diabetic HCWs, 8011.3± 1100.8 AU/mL was not significantly higher than non-diabetic HCWs 7754.5±1729.4 AU/mL. The mean value of Hypertensive HCWs was 7011.6 ± 1500.5 AU/mL, which was not significantly higher than other co-morbid groups. The SARS-CoV-2 mean anti-RBD IgG concentration of COVID zone workers was not significantly higher (p>0.05) than non-COVID zone workers. Nurses had significantly higher (#P-value<0.05*) antibody concentrations than doctors, lab personnel and cleaners.

Fig 1: Box and Whisker plot shows SARS-CoV-2 anti-RBD IgG antibody concentration among different occupational groups



Group A(Doctor): Median- 2629; IQR-526-13669; Range: 68-30000…….. AU/mL
Group B (Nurse): Median-4447; IQR-1100-32308; Range:110- 40,000… AU/mL
Group C (lab personnel):Median-1596; IQR- 749-4225.5; Range: 48-6527……AU/mL
Group D (cleaner): Median: 3202.5; IQR- 1250.5-12555.8; Range: 269- 21278….. AU/mL

Box and Whisker plot of Fig 1 shows SARS-CoV-2 anti-RBD IgG concentration among different occupational groups. Median antibody level was highest in the nurse group, followed by cleaners, and doctors, and lowest in the lab personnel group. The interquartile range (IQR) of the nurse group was highest at 1100-32308.5 AU/mL, indicating the highest level of dispersion of antibody concentrations of the participants of this group. The lowest IQR was presented by lab personnel group 759-4225.5 AU/mL.

DISCUSSION

This cross-sectional survey was done to estimate the seroprevalence of SARS-CoV-2 anti-RBD IgG among 125 HCWs of BIRDEM and to find out the role of some factors affecting the antibody level. The Mean ± SD of the age of the participants was 40.92±11.5 years. Out of 125 HCWs, 124 (99.2%) had SARS-CoV-2 anti-RBD IgG antibody level of more than 50 AU/mL (cut-off value of manufacturer), were considered seropositive and 1 participant had antibody level 48AU/mL, considered seronegative. The only seronegative HCW was a 25 years old female laboratory personnel, who had no vaccination history against SARS-CoV-2.

In this study, the prevalence of SARS-CoV-2 antibody was 99.2%. This seroprevalence rate was higher than many studies of different countries on HCWs. Seropositivity was 45% in London, UK,[26] 24.4% in Birmingham (UK),[27] in Santa Clara County, United States 1.5 %,[28] in China, 4.2%, Italy, 9%, and USA, 17.8%.[29]After the vaccination rollout started worldwide, some studies showed higher seropositivity 60.10%,[30] 99.4%.[31] The cause of the discrepancy between this study and others could be multifactorial. First of all, during the study period, vaccination against SARS-CoV-2 had already been started in Bangladesh and the maximum number of healthcare workers in Bangladesh, as well as our study participants (90%), were vaccinated at that period time.The variation of participants' eligibility criteria among the studies may also be contributed to the discrepancy. This present study focused on all categories of HCWs regardless of age, sex, occupation, working zone. The mean ± SE value of anti-RBD IgG concentration of female participants was 9779.9±1493.9 AU/mL, significantly ($p<0.05$*) higher than male participants' 5797.2±122.1 AU/mL. Like this study, females were associated with higher seroprevalence.[18] Whereas, significantly higher ($p<0•001$) seropositivity was found in male healthcare workers (5•45%) than in females (3.66%).[6] Variable results were found in a majority of the studies, including no association between gender and seroprevalence rates. While there was a significant association between male gender with higher seroprevalence.[6,32] Higher COVID-19 prevalence among males was described as male-based employment in essential jobs, engaging them in risky behaviors, including smoking.[33] In this study, the previous SARS-CoV-2 infection rate was higher in females. In particular, sex hormones differentially modulate immune responses. In females, the physiological concentration of estrogens stimulates a humoral response to viral infections by inducing higher levels of antibodies and activating antibody-producing cells. Females show a better response to vaccination also.[34] Testosterone and Androgen are combinedly responsible for the immunosuppressive effects, in producing fewer antibodies in males.[35]

In this study, the mean ± SE value of SARS-CoV-2 anti-RBD IgG concentration varied in different age groups. The youngest age group had mean anti-RBD IgG level of 9602.4±2371.5 AU/mL, 60 HCWs within 31-50 yrs 6200±1700 AU/mL, 30 HCWs within 51-60 yrs, 9001±2270.8 AU/mL and 3 HCWs above 60 years age had the highest level of anti-RBD IgG 10387± 4268.5 AU/mL. Statistically, no association was found between age with anti-RBD IgG level. Whereas among healthcare workers, a trend for decreasing seroprevalence with seniority of age was demonstrated.[17] The cause of the highest range in the younger group in our study is probably due to the maximum exposure of young aged healthcare workers in contact with patients for longer duration and frequent exposure, junior staff being more likely to share breakrooms and office space, maximum HCWs perform duties from the hostel.[8] But some conflicting results showed significantly increased seroprevalence among HCWs over 65 years of age.[36] In a systematic review, COVID-19 incidence rates at a global level were higher in older HCWs, especially in the 50–59 years age group.[37] Like our study, many serosurveys among HCWs have not shown any association between age and SARS-CoV-2, HCWs younger than 30 years, had a slightly increased risk of seropositivity. Younger HCPs may be more likely to have children in school or daycare and have contact with other younger persons who may have fewer symptoms of infection.[38]

A large study in Denmark showed a higher positivity rate of frontline HCP than a group of blood donors and HCP with more hospital exposure to COVID-19 patients had a higher risk.[6]

Another similar study, a large study of more than 40000 HCP in New York found no association between work location or direct patient care and seropositivity.[39] This study showed the mean of SARS-CoV-2 anti-RBD IgG antibody concentration of HCWs of COVID working zone 10108.3 AU/mL, not significantly higher than non-COVID zone workers 8855.9 AU/mL ($p>0.05$) (Table-4). A similar non-significant finding between COVID and non-COVID zone area health staff was found.[40] This finding was in contrast with a study showing significantly higher seropositivity among HCWs working in COVID-19 units.[41] A study showed a higher seroprevalence of HCWs in COVID-19 wards than in other non-COVID wards ($p<0.001$).[6]

Our study unmasked that clinical care of COVID-19 unscreened patients was associated with a similar prevalence of SARS-CoV-2 antibodies as in COVID-19 facilities uncovering a relevant source for nosocomial SARS-CoV-2 transmission. In addition, healthy HCWs may also be another relevant source for SARS-CoV-2 transmission. So, HCWs of a non-COVID zone are at equal risk as HCWs of a COVID zone. If segregation of these 2 areas is not done properly in a tertiary care hospital, the chance of risk of infection in non-COVID zone HCWs will be even more than COVID zone workers. Sero-surveys in hospitals may be helpful to design strategies that control the SARS-CoV-2 epidemic.

In this study, 48% of HCWs had co-morbidities, having Mean (± SE) anti-RBD IgG 8011.3 (±1496.8) AU/mL, which was not significantly higher than the level of non-co-morbid HCWs, ($p> 0.05$). Among the co-morbid groups, 23.2% had HTN, 13.6% had Diabetes Mellitus (DM), 4.8%, Cardiovascular disease, and 4.0% had Bronchial Asthma. The mean SARS-CoV-2 anti-RBD IgG concentration of diabetic HCWs was 8011.3±266.9 AU/mL was not significantly higher ($p> 0.05$) than non-diabetic HCWs 7754.5±1729.4 AU/mL. The hypertensive participants had 7011.6±1500.5 AU/mL of anti-RBD IgG, which was not significantly associated with the value of- the co-morbid groups. Association of co-morbidity with SARS-CoV-2 antibody level was not found in our study.

Out of a total of 125 healthcare workers, 49(39.2%) had a known history of documented past COVID-19 infection. The Laboratory personnel group had the highest percentage of SARS-CoV-2 infection. Another interesting finding was the lowest rate of infection among the cleaner group (76.8%). These two findings are generally in contrast with different studies, in the low-risk group, lab personnel are less infected, cleaners, who usually belong to low socio-economic conditions, have less knowledge of hygiene and social distance as well as living in gatherings, are more vulnerable to infection. The highest mean value of anti-RBD IgG was found in nurses who suffered from known infection. Previous data suggested that nurses are the most common healthcare professionals infected with SARS-CoV-2.[15] But this likely reflects workforce demographic characteristics given that nursing is the most common healthcare role.[10]

Limitations of our study include its single-centered setting, purposive sampling, and smaller sample size. Longitudinally serial sample collection and detection of antibody level was not possible due to a shortage of time and constrain of budget.

Conclusion: In our study, we found an association between sex with SARS-CoV-2 antibody level. Females were more likely to be infected and had higher antibody levels. However no association was found with age, occupation, working zone (COVID, non-COVID), co-morbidity with SARS-CoV-2 infection risk as well as SARS-CoV-2 antibody level.

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Conflict of interest

The authors thereby declare no conflict of interest exists.

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