

SARS-CoV-2 seroprevalence among healthcare workers from a tertiary care center in Riyadh, Saudi Arabia

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ABSTRACT

Objectives: To calculate the seroprevalence of asymptomatic healthcare workers (HCWs) in our institution.

Methods: We conducted a cross-sectional study among asymptomatic HCWs in a large hospital during the peak of the pandemic (from July to August 2020 and followed them up until February 2021) in Riyadh, Saudi Arabia. We collected the data in a Microsoft Word document after collecting a single serum sample for detection of antibodies from each participant then we compared the results statically in Microsoft Excel tables.

Results: We enrolled 188 participants and measured their IgG antibodies from venous blood samples using CLIA. Six (3.2%) had positive antibodies despite being asymptomatic. Most of these were from non-COVID-19 working areas (4 out of 6), but all had an exposure with a positive COVID-19 patient at some point in the preceding 2 months.

Conclusions: Our results are consistent with similar local studies showing low seroprevalence among HCWs while most positive cases are from non-COVID-19 areas. Despite this low seroprevalence, HCWs are still considered a high-risk group; hence, there is a need to encourage strict implementation and adherence to infection control measures and vaccination among HCWs, especially when these measures are relaxed on the national level.

Keywords: COVID-19, seroprevalence, IgG antibodies, healthcare workers, Saudi Arabia

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Coronavirus disease (COVID-19), caused by Severe Acute Respiratory Syndrome-Coronavirus 2 (SARS-CoV2) is an unprecedented global health crisis leading to millions of mortality. This novel virus was first

detected in Wuhan, China, in December 2019, later on proclaimed COVID-19 as a pandemic on March 11th, 2020.¹ Healthcare workers (HCWs) in hospitals are particularly vulnerable because they have been on the front lines of COVID-19 management where they are in contact with visiting patients and their relatives who are potentially carriers of SARS-CoV-2 even if, they are not symptomatic.² Several studies have shown HCWs may carry the infection for weeks or months without showing any symptoms, posing risk to other patients, colleague, and families.³ It is essential to limit human to human transmission in order to reduce secondary infections among healthcare professionals and close contacts to prevent transmission amplification events.⁴ Detection of antibodies in asymptomatic state has been demonstrated in various small groups of the population around the world although, many questions are yet to be answered such as their ability to protect further infection and how long the protective antibodies last.⁵ In Saudi Arabia, numerous measures were taken in a widespread national program at the communities level and the healthcare sectors to restrict the spread of infection which results in lower prevalence rate of SARS-CoV-2 infection in our population as compared to many others.⁶ Despite the whole world's efforts to understand COVID-19, still, the knowledge about this novel virus and pathophysiology of the disease remains limited. Seroprevalence studies are critical for determining how the virus spreads and also assisting authorities in designing control measures and tracking COVID-19-related morbidity and mortality rates. The present study aimed to determine the seroprevalence of antibodies against SARS-CoV-2 infection among asymptomatic HCWs and followed them for 6 months in order to observe the development of any disease in asymptomatic HCWs population.

Methods. After acquiring an institutional board review approval, we conducted a cross-sectional study in which 188 asymptomatic HCWs were recruited between July and August 2020 then followed until February 2021 in one of the largest hospitals in Riyadh, Saudi Arabia. The HCWs were informed of the study via direct personal communication with their division/department heads. The participants included in this study were thoroughly questioned for any symptoms suggestive of an active COVID-19 infection or for a history of similar infection recently (defined as within the past 5 months which is considered the beginning of COVID-19 pandemic in Saudi Arabia). We included only those HCWs who were registered in the human resources database as a hospital worker, asymptomatic adult of ≥ 14 -years age, and agreed to give consent for

a blood draw; however, excluded all those who have any symptoms of an active SARS-CoV-2 infection and external workers. An electronic self-administered questionnaire using Microsoft word 2019 (Microsoft Corp, Redmond, WA, USA) was designed and modified based on previously published studies. The questionnaire was revised by Adult Infectious Diseases, Department of Medicine and Laboratory Medicine experts and adopted in English language. The questionnaire was distributed among HCWs with different professional levels involving physicians, nurses and administrative staff. The written informed consent forms were obtained from all the participants prior to the sample collection.

We have collected the basic demographic characteristics such as age and gender, previous medical history of COVID-19, current signs and symptoms, nature of work (namely, physician, nurse or admin), area of work and medical record number. A total of 3 mL venous blood was collected in plain vials from each subject at a designated collection point in clinical areas, blood samples were brought to the laboratory medicine department in an ice box, serum was isolated and stored at 80°C until the estimation of SARS-CoV-2 IgG antibodies. The IgG antibody against SARS-CoV-2 was measured using the IgG assay kit as per manufacturer's protocol (Abbott Laboratories, USA). This assay is based on chemiluminescent microparticle immunoassay techniques designed for qualitative detection of IgG antibodies against the SARS-CoV-2 nucleocapsid protein in serum or plasma. The presence or absence of IgG antibodies to SARS-CoV-2 in the sample is determined by comparing the chemiluminescent relative light unit (RLU) in the reaction to the calibrator RLU, which is calculated by the system as an index signal to cut-off (S/CO).

The estimated values greater than or equal to the cutoff 1.4 S/CO were considered as positive or reactive while lower than 1.4 S/CO units were non-reactive. The rapid diagnostic tests (RDTs) like enzyme-linked immunosorbent assay (ELISA), chemiluminescence immunoassay (CLIA) and neutralization assay have been approved for use in clinical and prevalence studies. The CLIA is considered as the automated version of ELISA, in which the chemiluminescence system is combined with immunochemical reactions. Those who tested

positive for antibodies, were followed prospectively for development of active COVID-19 for 6 months. The follow-ups were carried out by verbal communication through phone calls twice a month for development of any signs of infection and through verifications with their laboratories through hospital system for those who had to screen for COVID-19 by nasopharyngeal swabs for any reason during the follow-up period.

Statistical analysis. Collected data were translated to a Microsoft Excel sheet version 2010 (Microsoft Corp, Redmond, WA, USA), which was used to make tables. The statistical analysis was performed using SPSS for Windows, version 21.0 (SPSS Inc., Chicago, IL, USA). Data were sorted and grouped based on similarity and presented in percentage values. Descriptive statistics for all cases were presented in the form of frequency and percentages for categorical variables. Numeric variables were presented using a mean and standard deviation. Fisher's exact was used to check the significant difference between the groups. A p -value <0.05 was considered as significant.

Results. A total of 188 HCWs were included in this cross-sectional study from different areas of the hospital ranging from low to high-risk areas of COVID-19 exposure. The mean of age was 36.33 ± 7.7 years and male-to-female ratio was 1:1.7. The medical history of majority of participants were healthy apart from 11 (5.8%) who reported hypertension, 8 (4.2%) were diabetics, another 8 (4.2%) were asthmatics and only one participant had history of ischemic heart disease. Of the total HCWs, 56.9% worked directly with COVID-19 patients, while 37.7% worked in non-COVID-19 domains and 5.3% worked in administrative service. Our study demonstrates that 95.7% of HCWs had at least a single event of exposure to a confirmed COVID-19 patient at some point during their duty, yet have not reported symptoms in the preceding 2 months (Table 1). Half of the participants are nursing staff who predominantly work in COVID-19 areas. We found 6 (3.2%) out of 188 participants had positive IgG antibodies, 4 (66.7%) of them were females and 2 (33.3%) were males (Table 2). Interestingly, more than half of the positive cases were from non-COVID-19 working areas (4 non-COVID-19 areas, one COVID-19 areas, one administration). Statistically no significant difference of positive IgG antibodies was observed between genders ($p=0.613$), working areas ($p=0.057$) and nature of jobs ($p=0.653$). During the 6-month follow up period of this study, none of the participants were confirmed to have COVID-19 or develop any suggestive symptoms among the seropositive cases (Table 3).

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Discussion. Serological testing for HCWs has become standard, allowing for the determination of previous infection status and the avoidance of unnecessary HCWs quarantines.⁷ The correlation between seropositivity or antibody levels and protection against reinfection, as well as the life span of protective immunity in SARS-CoV-2 infection are critical for understanding pathophysiology and diagnosis of the disease.⁸

Our study showed higher seroprevalence of antibodies against SARS-CoV-2 as compared to

Alserahi et al who found 1.4% seroprevalence in the general population⁶ and 2.36% among HCWs in Saudi Arabia but lower seroprevalence than Alharbi et al. who reported 7.5% of HCWs in Saudi Arabia have reactive antibodies to SARS-CoV-2.⁹ There is a large variation in the seroprevalence rate of SARS-CoV-2 in HCWs worldwide including Saudi Arabia. In fact, a wide global variation in seroprevalence ranging from 0.37% to 22.1% was observed in a meta-analysis carried out in August 2020, where the authors contributed such variation to the economical, geographical and the type of serological assay used in the study.¹⁰

It has been suggested that the lower prevalence of antibodies cannot certify a true low prevalence of past infection.¹¹ Nevertheless, the risk of COVID-19 infection is still high among HCWs compared to the general population indicating that we are still a long way from achieving the 67% herd immunity level that is estimated to be required to protect the vulnerable population.¹² We observed that HCWs working in non-COVID-19 areas are having higher seroprevalence rate as compared to those in direct contact with COVID-19 patients and administrative staff. The possible reason could be the higher availability of PPE in COVID-19 units, adherence of HCWs to infection control measures, early implementation of RT-PCR screening programs, strict implementation of social distancing norms, effective contact tracing and quarantines.¹³ In our study, hypertension was shown to be more common among HCWs. Hypertension is the major cardiovascular risk factors that increases the chance of death.¹⁴ Hence, identification of populations with high

Table 1 - Demographic characteristics of the HCWs included in our study (N=88).

Demographic feature	n (%)
Age (years) (mean ± SD)	36.33±7.7
Gender	
Male	69 (36.7)
Female	119 (63.3)
Comorbidities	
DM	8 (4.2)
HTN	11 (5.8)
IHD	1 (0.5)
BA	8 (4.2)
Working area	
COVID-19 areas	107 (56.9)
Non-COVID-19 areas	71 (37.7)
Administration	10 (5.3)
Exposure to COVID-19 patient	180 (95.7)

DM: diabetes mellitus, HTN: hypertension, IHD: ischemic heart diseases, BA: bronchial asthma

Table 2 - Seropositive healthcare workers in the various groups (n=6).

Positive serology	n (%)
Male	2 (33.3)
Female	4 (66.6)
Nature of job	
Physician	2 (33.3)
Nurse	3 (50.0)
Administration	1 (16.7)
Working area	
COVID-19 areas	1 (16.7)
Non-COVID-19 areas	4 (66.6)
Administration	1 (16.7)
Exposure to COVID patient	6 (100)

Table 3 - Comparison between seropositive and seronegative healthcare workers under different group.

Characteristics	Seropositive (%)	Seronegative (%)	P-values
Gender			
Male	2 (33.33)	67 (36.81)	0.613
Female	4 (66.67)	115 (63.19)	
Working area of HCWs			
COVID-19 areas	1 (16.67)	106 (58.24)	0.0573
Non COVID-19 areas	4 (66.67)	67 (36.81)	
Administrative	1 (16.67)	9 (4.95)	
Nature of description			
Physician	2 (33.33)	66 (36.26)	0.653
Nurses	3 (50)	101(55.50)	
Administrative	1 (16.67)	15 (8.24)	

HCWs: healthcare workers

fatality in COVID-19, provides insight to deal with this pandemic by health services in Saudi Arabia.

As the time progressed along with the launching of COVID-19 vaccines, most of the infection control measures on the national level had relaxed. However, the persistence of social-distancing and mask-wearing in the community are still mandatory preventive measures.¹⁵ Our study has some limitations, such as a small sample size, lack of participants from the non-healthcare population, level of neutralizing antibodies among participants, antibody titers, and so forth.

In conclusion, the seroprevalence of SARS-CoV-2 antibodies in the present study is slightly higher than the seroprevalence in the general population in our region. Therefore, HCWs are still considered a high-risk group. Hence, strong strategies are needed to strengthen infection control measures such as encourage the regular asymptomatic HCWs surveillance, vaccination among them especially when these measures are relaxed on the national level, early implementation of RT-PCR screening programs, strict implementation of social distancing norms, effective contact tracing and quarantines, and so forth. Further studies with a larger sample size, multi-center studies, and estimation of other antibodies against SARS-CoV-2 are required to validate and strengthen the findings of the present study.

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