International Journal of Community Medicine and Public Health
Mane P et al. Int J Community Med Public Health. 2021 Jul;8(7):3348-3351
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20212586

Original Research Article

Anti-SARS-CoV-2 IgG seroprevalence among non-vaccinated healthcare workers: a study from rural North India

Pratibha Mane, Jyoti Sangwan*, Kirti Lohan

Department of Microbiology, SHKM, GMC, Nuh, Nalhar, Haryana, India

Received: 26 May 2021
Accepted: 19 June 2021

***Correspondence:**
Jyoti Sangwan,
E-mail: jyolathwal@yahoo.co.in

ABSTRACT

Background: Coronavirus disease 2019 (COVID-19) is an infectious disease reported in China initially which spread around the world in no time affecting millions of people. It is caused by a new coronavirus (SARS-CoV-2 or 2019 n-CoV). The healthcare workers (HCW) are at increased risk of acquiring the disease as well as antibody response.
Methods: 457 health care workers (HCW) were recruited to give blood samples for anti-SARS CoV-2 IgG testing between September to October 2020.
Results: Of the 457 participants, IgG antibodies against SARS-CoV-2 were detected in 116 health care workers (25.4%). The anti-SARS-CoV-2 antibodies were detected maximally in HCWs involved in laboratory work. Around 4 % of health care workers were RT-PCR positive form whom IgG were detected in 15 individuals (71.4%) only.
Conclusions: The study concludes a higher prevalence among health care workers involved with patient's samples and laboratory.

Keywords: COVID-19, Health care worker, SARS-CoV-2, Seroprevalence

INTRODUCTION

Coronavirus disease 2019 (COVID-19) is novel viral disease caused by SARS-CoV-2. In December 2019, it was first reported in Wuhan, China.[1] Around the world, the disease has spread across 210 countries with a total of more than two million confirmed cases.[2,3] In India, the first case was detected on 30 January 2020 in Kerala in a student who returned from Wuhan city of China.[4,5] The route of transmission of SARS-CoV-2 appears to be primarily via aerosols. Recent studies have shown that in airborne particles SARS-CoV-2 remain infectious for more than 3 hours.[6] The infection caused by SARS-CoV-2 ranges from asymptomatic or subclinical cases with mild symptomatology to severe pneumonia, acute respiratory distress syndrome and death.[7]

This novel virus is supposed to be highly infectious in nature causing rapid spread in general population and in healthcare workers as well. The cases have been reported all over India in a short span of time. Initially the viral infection was limited in persons coming back from affected countries but eventually the infection has reached the rural parts of the country also.

COVID-19 infection in health care worker leads to mental stress, morbidity, mortality, disruption of patient care and increased risk of transmission to patient, co-worker and family members. Therefore, early diagnosis, isolation and treatment of HCWs to protect them from COVID-19 disease should be a priority. Real time reverse transcription polymerase chain reaction (RT-PCR) is the gold standard for diagnosis of COVID-19. Antibodies are developed in response to the infection.

IgM antibodies denote immediate response of the body, whereas IgG antibodies remain in the body for a longer duration of time in the body. IgG antibodies can be used to measure response of human body to the viral infection. Thus, it can be used to study the epidemiology of the

infection which can help the process of vaccine development and study its response.

As it is a newly emerging virus, the host response, antibody formation, its duration remaining in the body are not clear.[8] It is pertinent to note here that such serological studies are important for planning for ways to break the chain of virus transmission.[9]

As India is a populous country, the rate of spread of infection might be high with large number of subclinical cases emphasizing the .importance of seroprevalence studies further. Indian council of medical research have also recommended seroprevalence studies for epidemiological reasons only and not for diagnosis and treatment.

This study was planned in a medical college located in the most aspirational district of India. The medical college was declared as an exclusive COVID-19 hospital for corona patients in the very early period of pandemic. Thus, it was actively involved in the care of COVID-19 infected patients. This study was conducted to know the seroprevalence of IgG antibodies against COVID-19 among health care workers so as to understand the dynamics of immune response.

METHODS

This was a cross-sectional descriptive study conducted during the month of September to October 2020. All healthcare workers were informed about sero-survey and 457 consented to give blood samples.

History regarding any previous symptoms suggestive of COVID-19 and RT-PCR testing was obtained. Serum was separated and stored at -70˚C. Anti-SARS-CoV-2 IgG testing was performed by COVID-19 IgG ErbaLisa ELISA kit (Calbiotech, Inc USA) according to manufacture instructions. The kits were approved by Indian Council of Medical Research. Permission from Institutional Ethics Committee was obtained. Data was analysed using SPSS version 19.0.

RESULTS

Total 457 healthcare workers participated in the study. The division of HCW as per their exposure level is depicted in Figure 1. The mean age of study participants was 33.6 years. There were 286 male (62.5%) and 171 female (37.4%) participants.

Of the 457 participants, IgG antibodies against SARS-CoV-2 were detected in 116 HCW (25.4%) (Figure 2). 21 HCW (4.6%) gave history of positive RT-PCR test in preceding 6-8 weeks with mild to moderate symptoms without requiring hospitalization. Among these 21 previously RT-PCR positive individuals, IgG were detected in 15 individuals (71.4%) only. Of the remaining 436, no one gave history of symptoms or RT PCR positive status. Among these 111 (25.4%) developed IgG antibodies against SARS-CoV-2.

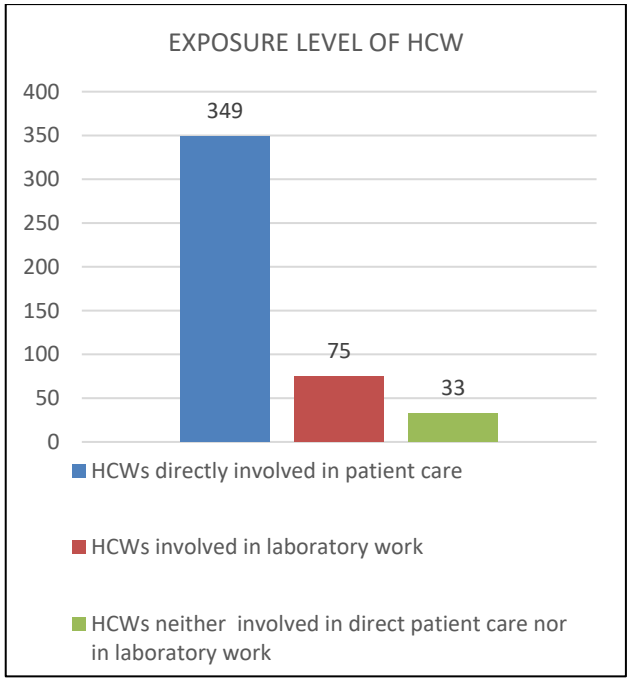

Figure 1: Exposure level of HCW.

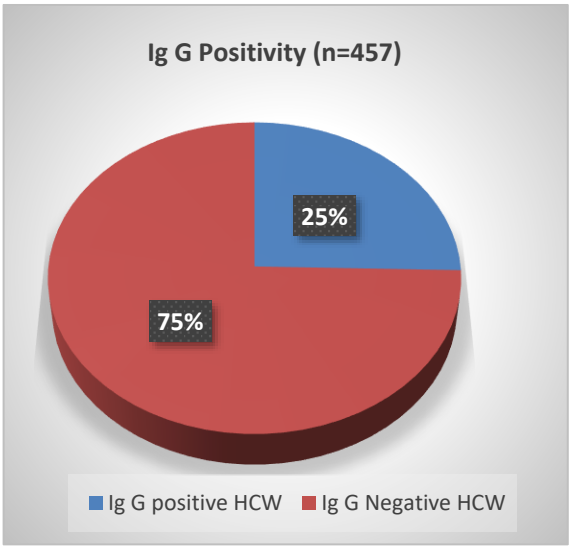

Figure 2: Prevalence of IgG positivity in HCW.

Among a total of 349 HCWs directly involved in patient care, 79 (22.6%) demonstrated presence of anti-SARS-CoV-2 antibodies. The anti-SARS-CoV-2 antibodies were detected in 30 out of 75 (40%) HCWs involved in laboratory work. Whereas only 7 of 33 (21.2%) HCWs not involved with direct patient care or samples were positive for anti-SARS-CoV-2 antibodies (Table 1).

When the positivity proportions were compared across the groups using Chi square test, the difference was found to be significant (p=0.006) (Table 1).

Table 1: Comparison of IgG positivity among HCW.

Parameters	HCWs directly involved in patient care	HCWs involved in laboratory work	HCWs neither involved in direct patient care nor in laboratory work	P value
Total	349	75	33	0.006 (Chi square test with df 2.0)
IgG positive	79	30	7	
IgG negative	270	45	26	
Proportion of IgG positive	0.226	0.4	0.212	

DISCUSSION

With COVID-19 pandemic involving around more than 200 countries from all the continents, everyone is hoping for development of herd immunity. In absence of vaccine, possibility of herd immunity is minuscule. Herd immunity is achieved when average number of persons infected by a case is less than one in absence of interventions. In flu pandemics, herd immunity is developed after two to three epidemic waves each interrupted by seasonality of influenza virus and more rarely by interventions like cross protection through immunity to previously encountered influenza viruses and vaccines when available. The SARS-CoV-2 virus is easily transmissible and would require around 60-70% of the population to be infected to acquire herd immunity.[10]

Herd immunity plays important role in viral infections and particularly in respiratory viruses e.g. influenza virus. As SARS-CoV-2 is a novel virus, nothing is clear about seroprevalence and herd immunity development. There are other factors also responsible for development of herd immunity such as cross reactivity with other viruses, rate of infection in a community. We didn't have any baseline data regarding the presence of antibodies in the community against this virus. We could find few studies describing the seroprevalence in HCW. There are reposts coming about seroprevalence in communities after surveys done by various Governments.

The study was done in September to October of 2020 after 10 months of finding first case in India in January 2020. There are studies showing there is gradual increase in antibody prevalence in general population as shown in Table 2. In Haryana, the prevalence increased from 8.1% (July) to 14.1% (October) in general population.[11] The overall prevalence in HCW in present study was 25.4%. This is more when compared with the general population in Haryana (Table 2). A study conducted by Singhal et al in June 2020 in Mumbai the prevalence was 4.3% in asymptomatic and 70% in mild symptomatic HCWs. In this study the prevalence was less than the general population (57.8% slum area and 17% non-slum) in Mumbai.[8] In a study conducted by Siddiqui et al in July 2020 at Delhi, the seroprevalence was 16.5% in HCW. In this study also, the prevalence was less in healthcare workers than general population (23.5%).[12] In another study done from Rajasthan by Dave et al in May 2020, prevalence of 16% was reported in healthcare workers.[13] This study was conducted in month of May 2020. The seroprevalence for the state of Rajasthan is not available for comparison. The present study reports a higher seroprevalence among HCWs contrary to other studies. Also, it is noted that the seroprevalence among general population in the region was reported around 17-18% during Phase I and II sero-surveys.[11]

Table 2: Phase I and phase II sero-survey of COVID-19 in general population.[11]

Cities	Phase I (%)	Phase II (%)
Delhi	22.8 (July)	29 (August)
Ahmadabad	17.68 (June)	23.24 (August)
Haryana	8 (August)	14.8 (October)

RT-PCR test was positive for 21 HCWs who reported mild to moderate symptoms without requiring hospitalization. Only 71% of these demonstrated the presence of IgG antibodies in them. This can be expected as the severity of symptoms directly correlates with development of antibodies as documented by Wellinghausen et al.[14]

Also the variation in antibody response can be due to the factors such as time of study, age of HCW, viral load, immune status of the person, exposure to the patients, severity of infection etc. There may be geographical variation also, as mutant strains of the virus have also been recorded in the literature. The seroprevalence studies published in Indian literature have been reported from Delhi, Mumbai, Udaipur, and Kolkata.[8,12,13,15] These studies were done in the very early period of pandemic and were done from large medical centers. The present study was done in a medical college located in most aspirational area of country and in the later period of pandemic.

When the data was further analyzed for HCW, the individuals involved with handling the samples and working in laboratory were the people developing antibodies. This could be explained with the fact that at some point of time during their work they do come in contact with tolerable dose of virus enough to mount some amount of antibody response. Also, it was noted that the prevalence was higher in ward and laboratory attendants and sweepers involved. The exact relationship cannot be hypothesized. Their educational status, inadequate training, higher exposure to viral load (patient's samples and excreta), inability to adherence to the standard protocols, callous attitude towards using PPE could be some of the factors responsible for the susceptibility of this group.

The seroprevalence in health care worker is reported to be higher in HCWs than in general population of Haryana. The fact that the magnitude of antibody response depends on severity of infection, measurable antibody response may not be produced in persons with asymptomatic infection or mild infection which leads to underestimation of infection rate.[14] False positive results are due to cross reactivity with other coronavirus.[16] The longevity of immune response is not known till date so that the protection against COVID-19 remains unanswered. Moreover, the cases of reinfection or relapse of COVID-19 have been reported.[17] Presence of antibodies in health care workers does not mean the immunity has been developed. Therefore, all infection control precautions need to be observed.

Limitations

The cross-sectional nature of study and hence no follow up was done. There was possibility of some false positive results which may be led to overestimation of the actual seroprevalence. Also, there is a possibility of asymptomatic individuals not giving correct history of symptoms due to recall bias.

CONCLUSION

This study concludes a higher prevalence among health care workers involved with patient's samples and laboratory. Presence of antibodies in health care workers should not be considered equivalent to development of immunity. All asymptomatic cases contribute to ongoing virus transmission; it is important to observe standard precautions to prevent the spread of COVID-19.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Zhao J, Yuan Q, Wang H, Liu W, Liao X, Su Y, et al. Antibody Responses to SARS-CoV-2 in Patients With Novel Coronavirus Disease 2019. Clin Infect Dis. 2020;71(16):2027-34.
2. Ioannidis JPA. Coronavirus disease 2019: The harms of exaggerated information and non-evidence-based measures. Eur J Clin Invest. 2020;50(4):13222.
3. Thienemann F, Pinto F, Grobbee DE, Boehm M, Bazargani N, Ge J, et al. World Heart Federation Briefing on Prevention: Coronavirus Disease 2019 (COVID-19) in Low-Income Countries. Glob Heart. 2020;15(1):31.
4. Unnithan PS. Kerala reports first confirmed coronavirus case in India, 2020. Available at: ndiatoday.in/india/story/keralareportsfirstconfirmed-novel-coronavirus-case-in-india. Accessed on 18 May 2021.
5. Bhatnagar T, Murhekar MV, Soneja M, Gupta N, Giri S, Wig N, et al. Lopinavir/ritonavir combination therapy amongst symptomatic coronavirus disease 2019 patients in India: Protocol for restricted public health emergency use. Indian J Med Res. 2020;151(2):184-9.
6. Riddell S, Goldie S, Hill A, Eagles D, Drew TW. The effect of temperature on persistence of SARS-CoV-2 on common surfaces. Virol J. 2020;17(1):145.
7. Moncunill G, Mayor A, Santano R, Jimenez A, Vidal M, Tortajada M, et al. SARS-CoV-2 Seroprevalence and Antibody Kinetics Among Health Care Workers in a Spanish Hospital After 3 Months of Follow-up. J Infect Dis. 2021;223(1):62-71.
8. Singhal T, Shah S, Naik R, Kazi A, Thakkar P. Prevalence of COVID-19 antibodies in healthcare workers at the peak of the pandemic in Mumbai, India: A preliminary study. Indian J Med Microbiol. 2020;38(3):461-3.
9. Shields A, Faustini SE, Perez TM, Jossi S, Aldera E, Allen JD, et al. SARS-CoV-2 seroprevalence and asymptomatic viral carriage in healthcare workers: a cross-sectional study. Thorax. 2020;75(12):1089-94.
10. Bulchandani VB, Shivam S, Moudgalya S, Sondhi SL. Digital herd immunity and COVID-19. Phys Biol. 2021.
11. Health Department Haryana. Seroprevalence of anti SARS- Cov-2 IgG antibodies in Haryana, India: A population based cross sectional study, 2020. Available at: http://nhmharyana.gov.in/WriteReadData/userfiles/file/CoronaVirus/Final%20report%20Sero%20Survey0409. Accessed on 18 May 2021.
12. Siddiqui S, Naushin S, Pradhan S, Misra A, Tyagi A, Looma M, et al. SARS-CoV-2 antibody seroprevalence and stability in a tertiary care hospital-setting. Medrxiv. 2020.
13. Bhadade R, Harde M, Souza R, Kasbe A, Deshpande C, Dave S, et al. Appraisal of Critically Ill COVID-19 Patients at a Dedicated COVID Hospital. J Assoc Physicians India. 2020;68(9):14-9.
14. Wellinghausen N, Plonne D, Voss M, Ivanova R, Frodl R, Deininger S. SARS-CoV-2-IgG response is different in COVID-19 outpatients and asymptomatic contact persons. J Clin Virol. 2020;130:104542.
15. Goenka M, Afzalpurkar S, Goenka U, Das SS, Mukherjee M, Jajodia S, et al. Seroprevalence of COVID-19 Amongst Health Care Workers in a Tertiary Care Hospital of a Metropolitan City from India. J Assoc Physicians India. 2020;68(11):14-9.
16. Peeling RW, Wedderburn CJ, Garcia PJ, Boeras D, Fongwen N, Nkengasong J, Sall A, et al. Serology testing in the COVID-19 pandemic response. Lancet Infect Dis. 2020;20(9):245-9.
17. Gousseff M, Penot P, Gallay L, Batisse D, Benech N, Bouiller K, et al. Clinical recurrences of COVID-19 symptoms after recovery: Viral relapse, reinfection or inflammatory rebound?. J Infect. 2020;81(5):816-846.

Cite this article as: Mane P, Sangwan J, Lohan K. Anti-SARS-CoV-2 IgG seroprevalence among non-vaccinated healthcare workers: a study from rural North India. Int J Community Med Public Health 2021;8:3348-51.