International Journal of Community Medicine and Public Health
Bhaskar A et al. Int J Community Med Public Health. 2022 Mar;9(3):1282-1287
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20220384

Original Research Article

COVID-19 infection and vaccination status among health care workers in a tertiary care setting in central Kerala

Anitha Bhaskar[1], Sobha Akshayakumar[2], Asha Joan Murali[2]*, Vipin Sam Alexander[3]

[1]Department of Community Medicine, Government Medical College, Thrissur, Kerala, India
[2]Department of Community Medicine, [3]Department of Microbiology, Government Medical College, Kottayam, Kerala, India

Received: 16 January 2022
Revised: 04 February 2022
Accepted: 05 February 2022

***Correspondence:**
Dr. Asha Joan Murali,
E-mail: ashajoan1611@gmail.com

ABSTRACT

Background: With the emergence of several new variants of the Severe acute respiratory syndrome- coronavirus disease-2 (SARS-CoV 2) virus, concerns regarding the effectiveness of vaccines arise and the threat of breakthrough infections increase. This study was conducted among health care workers who developed coronavirus disease 2019 (COVID-19) infection to assess their vaccination status and describe their morbidity profile.
Methods: A record based descriptive study was conducted among staff of Govt medical College, Kottayam, who became COVID-19 positive between March 2021 and September 2021, using a structured proforma. Data was coded and entered in Excel sheet and analysis was done using IBM Statistical package for social sciences (SPSS) version 20.
Results: A total of 444 health care workers at Govt College Kottayam tested positive for COVID-19 during the study period. 369 of the health care workers had taken at least one dose of COVID-19 vaccine, of which 273 (61.4%) were fully vaccinated. As on 31st August 2021, 4917 health care workers have been fully vaccinated, therefore the breakthrough infection rate in the present study was 5.6%. Of those with breakthrough infection 63% were females, 23.1% had history of comorbidities, and 88.6% were symptomatic. The mean interval between receipt of second dose of vaccine and diagnosis was 99 days (range between 16 and 24).
Conclusions: Breakthrough infection rate of 5.6% among health care workers presents a major public health challenge in ending the pandemic. Further studies including genomic variant analysis would be more helpful especially with in wake of new variants.

Keywords: COVID-19, Breakthrough infection, Health care workers

INTRODUCTION

Severe acute respiratory syndrome- coronavirus-2 (SARS-CoV2) virus has swamped the globe since its onset in December 2019.[1] The pandemic has not only affected millions of lives all over the world and taken a huge death toll but also toppled the world economy. Since a specific cure against the disease is yet to be realized, several efforts have been made for control and prevention of the disease including instating public health and social measures. Several vaccine candidates for the disease proved effective after clinal trials and were launched by most of the countries globally and achieving a maximum vaccine coverage was the prime strategy advocated for curbing the disease.

India too successfully launched the vaccination drive against COVID-19 in January 2021. Being the frontline warriors in the battle against the virus, health care workers were given the priority in our nation and

vaccination began with Covishield vaccine (AZD1222 (ChAdOx1) or Covaxin (BBV152).[2]

With the emergence of several new variants of the SARS-CoV 2 virus, concerns regarding the effectiveness of vaccines arise and the threat of breakthrough infections increase. The epidemiology of infections arising after vaccination of COVID-19 is a less explored turf, and it is crucial to address this gap. Hence this study was conducted to describe the vaccination status among Health care workers who developed COVID-19 infection at Government Medical College, Kottayam.

METHODS

Study design

The study design was descriptive study -record based.

Study setting

The study was conducted at Government Medical College, Kottayam.

Study period

The study was conducted from March 2021 to September 2021.

Study population

Health care workers of Government Medical College Kottayam who became COVID-19 positive between March 2021 and September 2021.

Inclusion criteria

Health care workers of Government Medical College Kottayam who became COVID-19 positive between March 2021 and September 2021.

Exclusion criteria

Patients with incomplete records.

Sample size and sampling technique

Census sampling, all the health care workers who meet the criteria, during the study period, were included in the study.

Operational definition of variables

Health care worker

All staff in the health care facility involved in the provision of care for a COVID 19 infected patient, including those who have been present in the same area as the patient, as well as those who may not have provided direct care to the patient, but who have had contact with the patient's body fluids, potentially contaminated items, or environmental surfaces. This included health care professionals, allied health workers, auxiliary health workers (e.g., cleaning and laundry personnel, X-ray physicians and technicians, clerks, phlebotomists, respiratory therapist, nutritionists, social workers, physical therapists, lab personnel, cleaners, admission/reception clerks, patient transporters, catering staff etc.).[3]

COVID-19 infection

For the study COVID-19 infection was operationally defined as SARS-CoV-2 virus detection by Rapid antigen test/RTPCR in the respiratory sample collection of a health care worker.

Breakthrough infection

For the study breakthrough infection was operationally defined as SARS-CoV-2 virus detection by Rapid antigen test/RTPCR in the respiratory sample collection of a health care worker who has received both the recommended doses of COVID-19 vaccination and completed 14 days of follow-up.

Fully vaccinated

A health care worker who has received both the recommended doses of COVID-19 vaccination and completed 14 days of follow-up.

Partially vaccinated

A health care worker who has received one dose of COVID-19 vaccination and completed 14 days of follow-up or a health care worker who has received the second dose COVID-19 vaccination but not completed 14 days of follow-up.

Unvaccinated

A health care worker who has received first dose of COVID-19 vaccination but not completed 14 days of follow-up or has not received any dose of COVID-19 vaccination yet.

Study tool

Semi-structured proforma was used for collection of data.

Study procedure

Data on health care workers who test positive for COVID-19 and data on COVID-19 vaccination among staff of Government Medical College Kottayam is routinely maintained by RPEID Cell, after obtaining their verbal consent, in the Department of Community Medicine, for the purpose of epidemiological analysis and

contact tracing. After obtaining IRB approval, information relevant for the study was retrieved from the records, using a structured proforma.

Data management and statistical analysis

Data was coded and entered in Excel sheet and analysis was done using IBM Statistical package for social sciences (SPSS) version 20. Qualitative variables were expressed as percentage and 95% confidence interval was calculated.

RESULTS

A total of 444 health care workers at Government College Kottayam tested positive for COVID-19 during the study period. Mean age of the health care workers was 31.98 years with SD 11.06 years (ranging between 18 and 62 years). Of those who tested positive 69.6% were females and 30.4% were males.

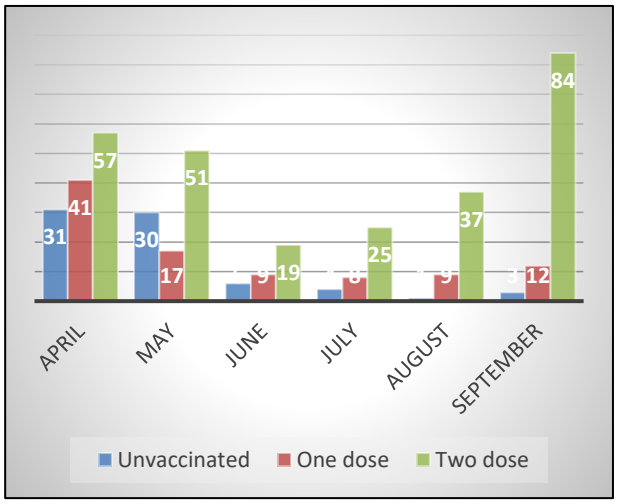

Figure 1: Month wise distribution of HCWs according to their vaccination status (n=444).

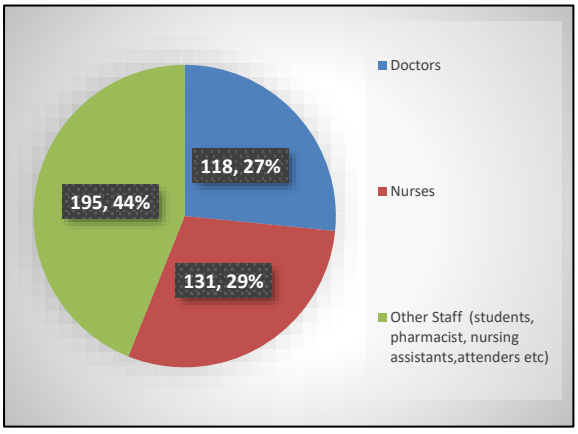

Figure 2: Category of staff (n=444).

64% of COVID-19 positive health care workers had done RTPCR and 35.8% had done Rapid antigen test. Distribution of health care workers according to the category of staff and month wise distribution according to vaccination status is shown in Figure 1 and 2.

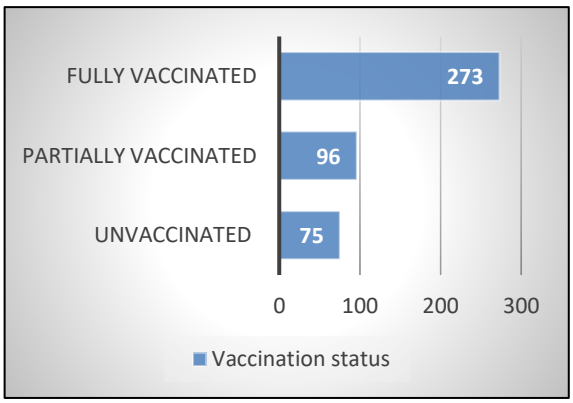

Figure 3: Vaccination status of COVID-19 positive HCWs.

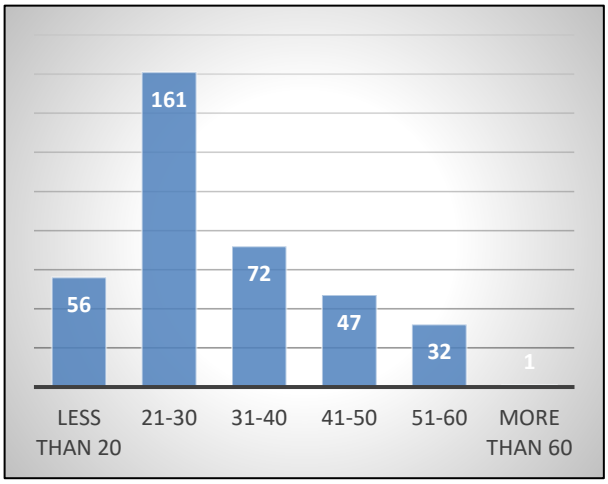

Figure 4: Age group distribution of vaccinated HCWs (n=369, taken at least one dose of vaccine) infected with COVID-19.

On assessing the history of vaccination, out of the 444 HCWs who were infected with COVID-19, 369 were vaccinated with at least one dose of COVID-19 vaccine. 21.6% were partially vaccinated, i.e., n=96 had received one dose of vaccine and completed 14 days of follow-up or had received the second dose, but not completed 14 days of follow-up and 61.4% were fully vaccinated i.e., n=273 had received both the recommended doses of COVID-19 vaccination (Covishield or Covaxin) and completed 14 days of follow-up (Figure 3). Age group distribution is shown in Figure 4. As on 31st August 2021, 4917 health care workers have been fully vaccinated, therefore the breakthrough infection rate in the present study was 5.6%.

Out of the 273 with breakthrough infection of COVID-19, 63% (n=172) were females and 37% (n=101) were males (Table 1). On exploring the category of staff with breakthrough infection 31.4% was constituted by

pharmacists, nursing assistants, security staff and students including medical and nursing students, and 31.2% were doctors, followed by 23.3% staff nurses (Table 1). 23.1% (n=63) of fully vaccinated had history of comorbidities, while only 13.5% (n=13) of those who were partially vaccinated had history of comorbidities. It was also seen that 88.6% of the fully vaccinated were symptomatic whereas only 81.2% of those who were partially vaccinated were symptomatic during the course of illness with COVID-19.

Table 1: Details of the vaccinated health care workers.

		Partially vaccinated (%)	Fully vaccinated (%)
Gender (n=369)	Male	19 (19.8)	101 (37)
	Female	77 (80.2)	172 (63)
	Total	96 (100)	273 (100)
Age group (n=369)	**Age group**	**Number**	**Percentage (%)**
	Less than 20	56	15.2
	21-30	161	43.6
	31-40	72	19.5
	41-50	47	12.7
	51-60	32	8.67
	More than 60	1	0.27
Category of staff (n=369)	Cleaning Staff	20	5.4
	Doctor	115	31.2
	Lab personnel	12	3.3
	Nursing assistant	13	3.5
	Others	116	31.4
	Staff Nurse	86	23.3
	Not mentioned	7	1.9
History of comorbidities (n=76)		**Partially vaccinated (%)**	**Fully vaccinated (%)**
		13.5	23.1
Type of comorbidity		**Frequency**	**Percentage (%) (n=76)**
Diabetes		18	23.6
Hypertension		19	25
Dyslipidaemia		9	11.8
CAD		2	2.6
COPD		2	2.6
Others*		31	40.7

* Hypothyroidism, Bronchial asthma etc.

On assessing the details of using personal protective equipment, among those with breakthrough infection of COVID-19, history of breach of PPE was reported by 4.6% (n=17). Wearing personal protective equipment appropriate for the health care setting during duty hours was reported by 80.4% health care workers. 46.8% reported using the same PPE for more than 6 hours of duty. 39% had history of working in a COVID setting two weeks prior to diagnosis.

The mean interval between receipt of second dose of vaccine and diagnosis was 99 days (range between 16 and 24).

None of the health care workers had a severe infection necessitating hospital admission or intensive care but had high viral loads as seen by the available data on cycle threshold value. Ct value was below 22 in 56% i.e., 64 among 114 RTPCR tested fully vaccinated health care workers.

DISCUSSION

In the present study of the 444 health care workers who were affected with COVID-19 during the study period 69.6% were females, the mean age was 31.98 years. Of these affected health care workers 61.4% were fully vaccinated. This is much lower compared to the state average, where 91% of the health care workers have completed second dose.[4]

The present study revealed that the breakthrough infection rate was 5.6% among health care workers, i.e., of the fully vaccinated 4917 health care workers 273 developed COVID-19. Breakthrough infection rates of COVID-19 among health care workers in other Indian studies range between 2-14.5% and in global studies rates as low as 0.35% and 0.74% have been reported.[5-8,10] This varying range of rate of breakthrough infection maybe because the factors associated with breakthrough infection like the type of vaccine used, the circulating virus variant, the immune status and comorbidity status of

the vaccinated etc differs in different populations. Emerging evidence shows that the risk of severe breakthrough infection increases in the months following vaccination.[11] As the reported cases are increasing throughout the world, it important to know who are at higher risk for severe breakthrough infection.

In the present study, both among partially vaccinated and fully vaccinated, females were of higher proportion of infected, similar to Lange et al and Bergwerk et al.[9,12] Most of the health care workers with breakthrough infection were aged between 21 and 30 years and 31.4% were pharmacists or security staff, students etc. This age, sex and category of staff distributions reflect the trend of fully vaccinated staff of the institution.

23.1% of those with breakthrough infections had associated co-morbities, in the present study. Majority of literature noes that although any fully vaccinated person can experience a breakthrough infection, people with comorbidities and people with weakened immune systems caused by certain medical conditions or treatments (including organ transplants, HIV and some cancers and chemotherapy) are more likely to have breakthrough infections.[13,14] Contrastingly Butt et al reported that presence of comorbidities was not associated with severe disease or death among persons with breakthrough infection.[15]

Literature accounts that vaccinated people with breakthrough infections, are less likely to develop symptoms, more likely to recover from their illness quickly, and much less likely to require hospitalization compared with unvaccinated people.[16] CDC reported that 73% rate of those with breakthrough infections were symptomatic, whereas another report on breakthrough infection surveillance in US has shown that 88% of their infected were symptomatic.[14,17] In the current study, 88.6% were symptomatic and none required hospitalization.

In the present study, wearing personal protective equipment appropriate for the health care setting during duty hours was reported only by 80.4% health care workers and 46.8% reported using the same PPE for more than 6 hours of duty. Up to 4.6% also reported a breach in PPE during duty hours. This could have contributed to the high proportion of break through infection among health care workers in this institution.

In the current study, asymptomatic breakthrough infections might have been missed, as COVID-19 testing was done only by symptomatic health care workers or by those who had a history of contact with a positive case.

CONCLUSION

Breakthrough infection rate of 5.6% among health care workers presents a major public health challenge in ending the pandemic. Further studies including genomic variant analysis would be more helpful especially with in wake of new variants.

ACKNOWLEDGEMENTS

Faculty, Residents and Interns in the department of Community Medicine.

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

REFERENCES

1. 20200121-sitrep-1-2019-ncov.pdf. Available at: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200121-sitrep-1-2019-ncov.pdf?sfvrsn=20a99c10_4. Accessed on 5 February 2022.
2. COVIDVaccinationBooklet14SEP.pdf. Available at: https://www.mohfw.gov.in/pdf/COVIDVaccinationBooklet14SEP.pdf. Accessed on 5 February 2022.
3. Protocol for assessment of potential risk factors for 2019-novel coronavirus (COVID-19) infection among health care workers in a health care setting. Available at: https://www.who.int/publications-detail-redirect/protocol-for-assessment-of-potential-risk-factors-for-2019-novel-coronavirus-(2019-ncov)-infection-among-health-care-workers-in-a-health-care-setting. Accessed on 5 February 2022.
4. GoK Dashboard | Official Kerala COVID-19 Statistics. Available at: https://dashboard.kerala.gov.in/covid/vaccination.php. Accessed on 5 February 2022.
5. Ezgi H, Caryn H, Yuhki S, Nathalie EB, Marissa B, Erin GC, et al. Vaccine Breakthrough Infections with SARS-CoV-2 Variants. N Engl J Med. 2021;385(2):e7.
6. Victor PJ, Mathews KP, Paul H, Mammen JJ, Murugesan M. Protective Effect of COVID-19 Vaccine Among Health Care Workers During the Second Wave of the Pandemic in India. Mayo Clin Proc. 2021;96(9):2493-4.
7. Tyagi K, Ghosh A, Nair D, Dutta K, Bhandari P, Ansari I. Breakthrough COVID19 infections after vaccinations in healthcare and other workers in a chronic care medical facility in New Delhi, India. Diabetes Metab Syndr. 2021;15(3):1007-8.
8. Masthi R, Hebbar G. COVID-19 vaccination and breakthrough infections among healthcare workers: an online survey. Int J Community Med Public Health. 2021;8(11):5435-40.
9. Lange B, Gerigk M, Tenenbaum T. Breakthrough Infections in BNT162b2-Vaccinated Health Care Workers. N Engl J Med. 2021;385(12):1145-6.
10. Alishaq M, Nafady-Hego H, Jeremijenko A, Ajmi JAA, Elgendy M, Vinoy S, et al. Risk factors for breakthrough SARS-CoV-2 infection in vaccinated

healthcare workers. PLOS ONE. 2021;16(10):e0258820.
11. Maclean P, Mentzer AJ, Lambe T, Knight J. Why do breakthrough COVID-19 infections occur in the vaccinated? QJM Int J Med. 2021;hcab307.
12. Bergwerk M, Gonen T, Lustig Y, Amit S, Lipsitch M, Cohen C, et al. Covid-19 Breakthrough Infections in Vaccinated Health Care Workers. N Engl J Med. 2021;385(16):1474-84.
13. Breakthrough Infections: Coronavirus After Vaccination. Available at: https://www hopkinsmedicine.org/health/conditions-and-diseases/coronavirus/breakthrough-infections-coronavirus-after-vaccination. Accessed on 5 February 2022.
14. CDCMMWR. COVID-19 Vaccine Breakthrough Infections Reported to CDC — United States, January 1–April 30, 2021. MMWR Morb Mortal Wkly Rep. 2021;70. Available at: https://www.cdc.gov/mmwr/volumes/70/wr/mm7021e3.htm. Accessed on 5 February 2022.
15. Butt AA, Nafady-Hego H, Chemaitelly H, Abou-Samra A-B, Khal AA, Coyle PV, et al. Outcomes Among Patients with Breakthrough SARS-CoV-2 Infection After Vaccination. Int J Infect Dis. 2021;110:353-8.
16. Klompas M. Understanding Breakthrough Infections Following mRNA SARS-CoV-2 Vaccination. JAMA. 2021;326(20):2018-20.
17. SARS-CoV-2 Vaccine Breakthrough Surveillance and Case Information Resource. 2021;11.

Cite this article as: Bhaskar A, Akshayakumar S, Murali AJ, Alexander VS. COVID-19 infection and vaccination status among health care workers in a tertiary care setting in central Kerala. Int J Community Med Public Health 2022;9:1282-7.