ORIGINAL ARTICLE

COVID-19 Vaccination status among Health care workers diagnosed with COVID-19 in a tertiary care institute of Uttarakhand: A Cross-sectional Study

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Article Cycle

Abstract

Background: Vaccines are considered as the one of the main pillars in halting and ending the presently on-going coronavirus disease (COVID-19 disease) pandemic which has spread globally since it was first detected in Wuhan, China in December 2019. In the absence of specific therapy, infection prevention practices and mass vaccination remains the mainstay in controlling the disease. **Objectives**: Objective of the study was to assess COVID-19 vaccination status, socio-demographic and clinical profile among healthcare workers diagnosed with COVID-19. **Methodology**: A cross-sectional survey from 1st March 2021 to 30th June 2021 among healthcare workers who were diagnosed with COVID-19 in a tertiary care institute of Uttarakhand, India was conducted, and universal sampling was used. Institutional Ethics Committee approved this study. **Results**: Total 662 healthcare workers were diagnosed with COVID-19. 429 (64.8%) of these COVID-19 diagnosed healthcare workers had received either single (129,30%) or both dose (300,70%) of COVID-19 vaccine while remaining 233 (35.2%) belonged to non-vaccinated group. History of exposure to COVID-19 positive patients was higher in vaccinated (66.4%) than in non-vaccinated group (55%) (p = 0.004). Hospitalisation was found to be higher among non-vaccinated (5.6%) than vaccinated group (2.3%) (p = 0.029). **Conclusions**: This study concludes that being vaccinated against COVID-19 disease provides protection against severe infection and reduces the need for hospitalization.

Keywords

Introduction

Vaccines are considered as the one of the main pillar in halting and ending the presently on-going coronavirus disease (COVID-19 disease) pandemic which has spread globally since it was first detected in Wuhan, China in December 2019.(1)India reported its first case of COVID-19 disease on 30th January 2020.(2) World Health Organisation declared coronavirus disease as pandemic on 11th March 2020.(3)The pandemic has caused over 254 million cases and 5.1 million deaths globally till date.(4) In the absence of specific therapy targeting the cure of the disease, infection prevention practices and mass vaccination remains the mainstay in controlling the disease.(5)

Since the start of the pandemic, research for development of vaccines for prevention against COVID-19 disease have been undergoing in many countries worldwide including

India. The Government of India granted emergency use authorization forAZD1222-ChAdOx1-S (Covishield) (6) and BBV152 (Covaxin).(7) The AZD1222-ChAdOx1-S/n-CoV-19 (Covishield), is a recombinant vaccine against COVID-19 infection which is replication deficient chimpanzee adenoviral vector vaccine which expresses the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) spike glycoprotein.(8) BBV152 (Covaxin) is a whole-virion inactivated SARSCoV-2 vaccine adjuvanted with Algel-IMDG to induce T helper-1 cell (Th1) responses.(7)

A small group of individuals despite being completely vaccinated against COVID-19 will get infected with the same as no vaccine provides 100% protection against the disease along with other factors such as emergence of newer virulent strains which develop mechanism to escape antibody response developed as a result of vaccine. (9)

The need of this study arises from the fact that there were limited studies which were conducted across the country to assess the impact of COVID-19 vaccination among healthcare workers who got COVID-19 post vaccination for different clinical parameters such as need of oxygen therapy, intensive care etc.

Aims & Objectives

1. To assess COVID-19 vaccination status, socio-demographic & clinical profile among healthcare workers diagnosed with COVID-19 in tertiary care institute of Uttarakhand.
2. Other outcomes of interest included proportion of COVID-19 diagnosed healthcare workers against type of COVID-19 vaccine administered, proportion of COVID-19 diagnosed healthcare workers against both or one dose of COVID-19 and those who were not vaccinated.

Material & Methods

Study Design and Setting: The present study was a cross-sectional observational study which was conducted for a duration of 6 months including 2 months for data analysis. Data collection period in our study was from 1st March 2021 to 30th June 2021 which was followed by 2 months of data analysis. Universal sampling was done in which all healthcare workers who were diagnosed with COVID-19 in between 1st March 2021 and 30th June 2021 were included in the study after taking informed consent.

Data Collection and Ethics: Institute has maintained detailed data regarding COVID-19 infections of all HCWs. We received line listing of all HCWs who were diagnosed with COVID-19 infection in our health care facility. Using the list, we obtained mobile numbers for all HCWs and thereafter, telephonic interviews with affected individuals were conducted using a predefined semi-structured interview schedule which contained questions regarding socio-demographic profile, clinical profile, and COVID-19 vaccination status for each HCW. The study was approved by institutional ethics committee.

Statistical Analysis: The data collected was entered in Microsoft Excel and was analyzed using Statistical Package for the Social Sciences (SPSS for Windows, Version 23.0, IBM Corporation, Armonk, New York, United States). Results were expressed in frequency and proportions for categorical variables, mean and standard deviation for continuous variables.

Proportion of Covid-19 diagnosed HCWs vaccinated, not vaccinated against COVID-19 vaccine, proportion of Covid-19 diagnosed HCWs vaccinated against both, or one dose of COVID-19 was calculated. Socio-demographic, clinical profile and clinical outcome among these sub-groups were compared.

The significance of the difference between proportions was assessed using the chi-square test or Fisher Exact's Test. A p-value <0.05 was considered statistically significant.

Ethical Clearance: AIIMS/IEC/21/402 dated 16/07/2021

Results

Total 662 healthcare workers were diagnosed with COVID-19 in a tertiary care institute of Uttarakhand with COVID-19 from 1st March 2021 to 30th June 2021. 429 (64.8%) of these COVID-19 diagnosed healthcare workers had received either single (129,30%) or both dose (300,70%) of COVID-19 vaccine while remaining 233 (35.2%) belonged to non-vaccinated group of healthcare workers. Out of total 662 COVID-19 diagnosed HCWs, 199 (30.1%) were doctors, 241 (36.4%) were from nursing staff and rest 222 (33.5%) were paramedics. Around two-third (407) were males and rest were females (255). Symptomatic among study participants were 593 (89.6%) while 413 (62.4%) had history of exposure to COVID-19 positive patient. Only 23 (3.5%) out of 662 participants required hospitalization and only 5 (0.7%) and 3 (0.4%) had requirement of oxygen and ICU care respectively.

Table 1 shows distribution of socio-demographic, clinical profile and clinical outcome among vaccinated and non-vaccinated healthcare workers. The median (interquartile range) age was 28 years (31-25) for vaccinated group of healthcare workers and 27 years (31-24) for non-vaccinated group.

It also shows that being symptomatic for COVID-19 had no statistically significant difference among vaccinated and non-vaccinated healthcare workers. However, history of exposure to COVID-19 positive patients was higher in vaccinated healthcare workers (66.4%) than in non-vaccinated healthcare workers (55%) and the difference was found to be statistically significant (**p = 0.004**). Another factor considered was hospitalisation and it was found to be higher among non-vaccinated healthcare workers (5.6%) than vaccinated healthcare workers (2.3%) and difference was found to be statistically significant (**p = 0.029**). Other factors such as requirement of oxygen therapy and ICU care, the statistically significant

difference among vaccinated and non-vaccinated healthcare workers was not found.

Table 2 shows distribution of socio-demographic, clinical profile, and clinical outcome among vaccinated healthcare workers those who had received either single dose of vaccine or both dose of vaccine.

Out of 429 vaccinated healthcare workers, 423 (98.6%) had received AZD1222-ChAdOx1-S/n-CoV-19 (Covishield) while rest 6 (1.4%) received BBV152 (Covaxin). However, there was no statistically significant difference found between those who received one dose or both dose of the vaccine. Proportion of healthcare workers who received one dose of vaccine who had to undergo hospitalization was higher (5.6%) than those who received both dose of vaccines (1%) and the difference was statistically significant (**Fisher's = 0.009**). Other factors such as being symptomatic for COVID-19 disease, history of exposure to COVID-19 positive, requirement of oxygen therapy and ICU care had no statistically significant variation among both groups.

Discussion

COVID-19 pandemic is a major public health crisis of 21st Century which affected all nations throughout the world. Being at forefront for combating this pandemic, healthcare workers were at increased risk of getting infected with COVID-19. Therefore, we conducted this study to analyse and compare relevant characteristics among healthcare workers who were vaccinated for COVID-19 to those who were not vaccinated.

In our study, we found that two-third of healthcare workers who got infected with COVID-19 were vaccinated while rest of them were not vaccinated. Out of those who were vaccinated, nearly 7 out of every 10 healthcare workers who had received both doses of vaccine contracted COVID-19 infection. These findings provide evidence that in real-world settings a significant proportion of vaccinated individuals who belong to high-risk group for contracting COVID-19 infection remain vulnerable for same although with reduced severity of disease in most cases.

Vaccine seroconversion through robust anti-spike antibody response is likely to be induced after single dose of AZD1222-ChAdOx1-S/n-CoV-19 (Covishield) compared to BBV152 (Covaxin) in which two doses are generally needed to stimulate adequate antibody levels.(10)However, there was no statistically significant difference based on type of vaccine received and number of doses received among healthcare workers.

A study conducted by Nivedita et al had reported that 87.4% (592 out of 677) had received both doses of COVID-19 vaccine while rest of the patients (12.6%) had received only one dose of COVID-19 vaccine.(11)One of the studies conducted in a tertiary care institute in India reported 57 (17.5%) COVID-19 infections among healthcare workers who were vaccinated with either single or both doses of

any of the vaccine, Covishield and Covaxin.(12)This is much lower than what we found in our study. This could be due to difference in the study design and study population utilized in the study.

One of the major reason for having higher incidence of COVID-19 infections among vaccinated healthcare workers could be the period of observation of this study which coincided with massive second wave of COVID-19 epidemic in Uttarakhand in which nearly half of totalCOVID-19 positive cases were reported in May 2021 only.(13)However, diminished neutralizing antibody activity and inadequate protectiveness against the delta variant of the SARS-CoV-2 has been observed in most of the currently available COVID-19 vaccines globally especially prior to complete vaccination with both vaccinedoses.(14,15)

In our study, we found that hospitalisation was significantly higher among non-vaccinated healthcare workers than vaccinated healthcare workers. This suggests that vaccination does not prevent infection and development of disease, but it reduces severity of disease, hospitalization, and mortality. It appears that the current COVID-19 vaccines are disease modifying in nature wherein mild or less severe infections are expected to occur in vaccinated individuals. Therefore, enhancing the vaccination drive and immunizing the populations quickly would be the most important strategy to prevent further deadly waves of the COVID-19 and therefore, will help to reduce the burden on the health care system. It will also help in prevention of disruption of routine healthcare services that are greatly hampered at the time of COVID-19 wave.

In our study, we observed that history of exposure to COVID-19 positive patients was significantly higher in vaccinated healthcare workers than in non-vaccinated healthcare workers. This might be result of false perception regarding being immune to COVID-19 disease as a result of being vaccinated and thus not following COVID appropriate behaviours regularly in daily life. This implies that following COVID appropriate behaviour is also equally important as getting vaccinated to stay protected against the disease.

This study also highlights that chances of getting hospitalized was significantly higher among those who received only one dose than those who received two doses of vaccine. This finding suggests that being fully vaccinated is more protective in nature than partially vaccinated. However, in these two groups, other factors such as having symptomatic COVID-19 disease, history of prior exposure to COVID-19 positive patients, requirement of oxygen therapy and ICU care had no significant difference. This might be result of very small subset in both the group who actually required O2 therapy or ICU care.

Other factors such as being symptomatic for COVID-19 disease, history of exposure to COVID-19 positive,

requirement of oxygen therapy and ICU care had no statistically significant variation among both groups.

Conclusion

The present study shows that being vaccinated against COVID-19 disease provides protection against severe infection and reduces the need for hospitalization. To ensure that morbidity and mortality associated with COVID-19 should decrease, it is important to vaccinate eligible population as soon as possible.

Recommendation

One of the recommendations that can be made from this study is that there should be a system in place so as to ascertain COVID-19 infection post-vaccination among healthcare workers so as to mitigate the public health risk posed by such infections as they may lead to frequent disruptions in health services as well can act as potential spreader for the patients catered by them. As newer strains of COVID-19 virus keep coming, such post-vaccination surveillance data will help in modifying existing COVID-19 vaccines or for development of new vaccines. Since COVID-19 still has no radical treatment available, therefore, efficacy and effectiveness of vaccination programme should be evaluated in different populations as an ongoing process as development of immune response or antibodies differs from person to person.

Limitation of the study

One of the limitations of this study was that we were reliant on self-reported symptoms and thus subjecting him/herself for testing as there was no regular screening program for same. Secondly, asymptomatic individuals might not get tested themselves as much as compared to symptomatic, therefore, might result in overestimation of vaccine effectiveness than in reality. Another limitation of this study was that telephonic interviews were conducted which are not as efficient as personal interviews.

Relevance of the study

The study provides evidence for effectiveness of COVID-19 vaccines in preventing severe form of disease as compared to severity of disease in non-vaccinated individuals.

Authors Contribution

MS: Conception and design, definition of intellectual content, literature search, data collection and analysis, manuscript preparation, editing, review and guarantor. RK, PS: Conception and design, manuscript preparation, editing and review. PA, VS: Conception and design, manuscript editing and review. YB: Conception and design, data analysis, manuscript editing and review GS: Literature search, data collection, manuscript editing and review.

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Tables

TABLE 1 COMPARISON BETWEEN VACCINATED AND NON VACCINATED HEALTHCARE WORKERS (HCWS)

Characteristics	Vaccinated HCW	Non vaccinated HCW	P-value
	(N=429) n (%)	(N=233) n (%)	
Age (Years)			0.004
Median (Interquartile range)	28 (31-25)	27 (31-24)	
Gender			10.36*, 0.001**
Male	283 (66%)	124 (53.2%)	
Female	146 (34%)	109 (46.8%)	
Profile			7.41*,0.024**
Doctor	119 (27.7%)	80 (34.3%)	
Nursing	172 (40.1%)	69 (29.6%)	
Paramedical	138 (32.2%)	84 (36.1%)	
Symptomatic			0.074
Yes	391 (91.1%)	202 (86.7%)	
No	38 (8.9%)	31 (13.3%)	
Exposure with COVID positive			8.50*, 0.004**
Yes	285 (66.4%)	128 (55%)	
No	144 (33.6%)	105 (45%)	
Hospitalization			4.75*, 0.029**
Yes	10 (2.3%)	13 (5.6%)	
No	419 (97.7%)	220 (94.4%)	
Requirement of O2 therapy			0.351 (Fisher's)
Yes	2 (0.5%)	3 (1.3%)	
No	427 (99.5%)	230 (98.7%)	
Requirement of ICU care			0.284 (Fisher's)
Yes	1 (0.2%)	2 (0.9%)	
No	428 (99.8%)	231 (99.1%)	

*- Chi square value ** - p value < 0.05

TABLE 2 DISTRIBUTION OF VACCINATED HCWS THOSE DIAGNOSED WITH COVID-19

Characteristics	One dose (n=129)	Both dose (n=300)	P value
Mean age	28 (5.4)	29.4 (6.2)	
Gender			0.114
Male	78 (60.5%)	205 (68.3%)	
Female	51 (39.5%)	95 (31.7%)	
Profile			4.38*, 0.036**
Doctor	114 (88.4%)	240 (80%)	
Others	15 (11.6%)	60 (20%)	
Type of vaccine			0.06 (Fisher's)
Covishield	125 (96.9%)	298 (99.3%)	
Covaxin	4 (3.1%)	2 (0.7%)	
Symptomatic			0.874
Yes	118 (91.5%)	273 (91%)	
No	11 (8.5%)	27 (9%)	
Exposure with covid positive			0.135
Yes	79 (61.2%)	206 (68.7%)	
No	50 (38.8%)	94 (31.3%)	
Hospitalization			0.009** (Fisher's)
Yes	7 (5.6%)	3 (1%)	
No	122 (94.6%)	297 (99%)	
O2 therapy			0.511 (Fisher's)
Yes	1 (0.8%)	1 (0.3%)	
No	128 (99.2%)	299 (99.7%)	
ICU care			1 (Fisher's)
Yes	0 (0%)	1 (0.3%)	
No	129 (100%)	299 (99.7%)	
Mean duration between vaccination and being tested positive	49.18	47.56	0.681

*- Chi square value ** - p value < 0.05