Original Article

Prevalence and Risk Factors of COVID-19 Vaccine Hesitancy among Healthcare Workers at a Tertiary Care Center: A Cross-Sectional Study

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ABSTRACT

Background: Vaccine hesitancy is hesitancy to take vaccine. Studies are required to identify prevalence of coronavirus disease 2019 (COVID-19) vaccine hesitancy. It is equally important to recognize factors responsible for this hesitancy. This data will help to plan health education measures so that healthcare workers can overcome the barriers for vaccine hesitancy. **Objective:** The objective of this article is to study prevalence and factors associated with COVID-19 vaccine hesitancy among healthcare workers. **Methods:** This was a single-center, cross-sectional study carried out over a period of two months among 1063 healthcare workers. Those with missing information, not consenting and absent on the day of survey were excluded. Healthcare workers included doctors including postgraduates, nurses, para-medical staff, admin staff, and housekeeping staff either working in hospital or medical college. **Results:** Prevalence of vaccine hesitancy was 15.1%. On logistic regression, as age increased odds of vaccine hesitancy decreased significantly (OR = 0.95; 95%CI = 0.92-0.98; $P < 0.05$). Patient contact of <10/day was associated with the decreased odds of vaccine hesitancy compared to those with patient contact of >40/day. Odds of vaccine hesitancy among those with poor knowledge was 2.84 (95%CI = 1.91-4.21; $P < 0.05$) times more compared to those with good knowledge. Odds of vaccine hesitancy was 3.22 (95%CI = 1.09-9.48; $P < 0.05$) times and 3.31 (95%CI = 1.05-10.48; $P < 0.05$) times more among educated up to primary and illiterate respectively compared to higher educated persons. **Conclusion:** We conclude that low levels of education, poor knowledge, and young age were independently and significantly associated with vaccine hesitancy among healthcare workers. Prevalence of vaccine hesitancy was still high at 15.1%.

KEYWORDS: *COVID-19, education, knowledge, pandemic, vaccine hesitancy*

INTRODUCTION

The coronavirus disease 2019 (COVID-19) has acquired pandemic nature with nearly 289 million confirmed cases and over 5.4 million deaths as of January 6, 2022.[1] As of January 10, 2022; there were 305,914,601 confirmed cases globally with 5,486,304 deaths, while total vaccine doses administered were 9,126,987,353.[2] As of January 11, 2022; total number of cases in India are 35,391,577 with 484,213 deaths and about 1,528,970,294 doses of vaccines administered.[3]

Government of India launched first vaccine for use on January 16, 2021.[3] Mass vaccination is an important strategy to deal with further spread/wave of the pandemic and reducing the disease severity.[4]

Vaccine hesitancy is something that people are still in dilemma to take vaccine or not. The concern about the efficacy, safety, side effects, trust over the vaccine/manufactures, local beliefs affecting the social factors

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affect the vaccine intake among not only the general population but also the healthcare workers.[4,5]

Hence, studies are required and are important to identify prevalence of COVID-19 vaccine hesitancy. It is equally important to recognize factors responsible for this hesitancy. This data will help to plan health education measures so that healthcare workers can overcome the barriers for vaccine hesitancy.

With this background, the present study was carried out to study COVID-19 vaccine hesitancy among healthcare workers at a tertiary care center and to study factors associated with COVID-19 vaccine hesitancy among healthcare workers.

Material and Methods

Institutional Ethics Committee permission was obtained vide letter no. MRIMS-DHR-IEC-91/2021 dated 30-09-2021. The written informed consent was taken from the study participants.

This was a single-center, cross-sectional study carried out over a period of two months from October 1 to November 30, 2021. All healthcare workers from Malla Reddy Health City, Hyderabad, Telangana, India, willing to participate in the present study were included. Those with missing information, not consenting and absent on the day of survey were excluded.

Based on a previous study by Biswas N *et al.*[6] the prevalence of vaccine hesitancy among healthcare workers was 22.51%. Taking this as prevalence with 95% confidence level, design effect of 2 and 5% as absolute precision, the sample size came out to be 546. As we planned to carry out logistic regression analysis (due to dichotomous outcome, i.e., vaccine taken: yes/no); we also used G power software version 3.1 to calculate the sample size. In this software we used critical z = 1.959; two-tailed test; alpha = 0.05; beta = 0.95 and least extreme odds ratio to be detected as 1.4; the sample size came out to be 726. Hence, we decided to use this higher 726 sample size in the present study. After excluding the missing information cases, we could achieve final 1063 sample size in the present study.

There were nearly 1400 healthcare workers in this center. Out of them, we could contact nearly 1250 healthcare workers. Finally, we could include 1063 of them in the final analysis.

Healthcare workers included doctors including postgraduates, nurses, para-medical staff, admin staff and housekeeping staff either working in hospital or medical college. Healthcare workers were defined and classified as per the World Health Organization criteria,

"health workers to be all people engaged in actions whose primary intent is to enhance health."[7]

COVID-19 vaccine hesitancy is defined as not taken even single dose of the vaccine until the time of survey of this study. Variables included in the present study were age in completed years, sex, occupation (Doctor + nurse, para-medics, admin staff and housekeeping staff), education (illiterate, primary, i.e., up to 5th class, secondary, i.e., 6-10th class, and higher), monthly income (in Indian Rupees), patient contact per day and place of work. Five questions related to COVID-19 disease and vaccine were included to assess knowledge of the participants. All participants who had not taken even single dose of vaccine were also asked about the reasons for vaccine hesitancy.

Statistical analysis

The data was analyzed using SPSS version 22. Chi-square and t-test was applied for univariable analysis. Factors found significant were entered in the logistic regression model to study the independent association of factors with vaccine hesitancy using odds ratio with 95% confidence intervals. *P* less than 0.05 was taken as statistically significant.

Results

Majority were in the age group of 18-49 (92.5%) years with Mean = 31.87 + 9.98. Females (61%) were more than males. 23.1% were doctors and 28.2% were nurses. 73.1% were working in the hospital. Only 4% were illiterate and majority (75%) were educated to more than 10 + 2 education. Majority had income between 5,000 and 10,000 INR and majority said that (35.8%) they had no patient contact. [Table 1]

The knowledge was classified as correct or in-correct knowledge. Correct knowledge was given 1 point and in-correct knowledge was given as zero point. The knowledge score thus ranged from 0-5. Knowledge score of four and more was considered as good knowledge and else was considered as poor knowledge. 48.1% had poor knowledge and 51.9% had good knowledge [Table 2]

The overall prevalence of vaccine hesitancy was 15.1% among the healthcare workers in the present study. Most commonly taken vaccine was Covishield in 64.1% of the cases and majority (59.4%) completed the two-dose schedule. [Table 3]

Bivariable analysis as seen from Table 4 shows that except gender and place of work, all other factors like occupation, education, income, patient contact per day, age, and knowledge score were significantly associated with the vaccine hesitancy. Like being occupied other than doctor, low level of education, lower monthly

Table 1: Distribution of study subjects as per sociodemographic characteristics		
Variables	Frequency	Percent
Age (years) Mean=31.87+9.98		
18-49	983	92.5
50-74	80	7.5
Sex		
Male	415	39.0
Female	648	61.0
Occupation		
Doctor + Nurse	546	51.4
Para-medic	131	12.3
Admin staff	169	15.9
House keeping	217	20.4
Place of work		
Working in hospital side	777	73.1
Working in college side	286	26.9
Education		
Higher education	846	79.6
secondary education	103	9.7
Primary education	71	6.7
Illiterate	43	4.0
Monthly income		
More than 20,000	165	15.5
10,000 to under 20,000	358	33.7
5,000 to under 10,000	400	37.6
Less than 5,000	140	13.2
Patient contact per day		
More than 40	159	15.0
10 to 40	376	35.4
0 to 9	147	13.8
Zero	381	35.8

Table 2: Distribution of study subjects as per knowledge about COVID-19 vaccine		
Variables	Frequency	Percent
how it is transmitted		
in-correct knowledge	67	6.3
correct knowledge	996	93.7
how COVID can be prevented		
in-correct knowledge	147	13.8
correct knowledge	916	86.2
how many COVID-19 vaccines are licensed for use in India		
in-correct knowledge	91	8.5
correct knowledge	914	85.9
Do not know	58	5.5
vaccine prevents disease or its severity		
no	132	12.4
yes	931	87.6
Dose schedule of COVID-19 vaccine		
in-correct knowledge	432	40.6
correct knowledge	631	59.4
knowledge score		
good knowledge	552	51.9
poor knowledge	511	48.1

income, poor knowledge, and more patient contact per day were associated with the vaccine hesitancy.

All the factors from bivariable analysis were entered in the binary logistic regression model. Three outliers (more than + 3SD) were deleted from the data and the model was run again. The final model is as shown in Table 5. The Omnibus test of model coefficient was statistically significant implying that the model was significantly predicting the vaccine hesitancy over the null model (X^2 = 112.172;p = 0.000) and residuals are independent of each other. The Nagelkerke r^2 was 0.177 implying that the 17.7% of variability in the vaccine hesitancy was explained by the entered variables. Hosmer and Lemeshow test was not found to be statistically significant (X^2 = 5.818; P = 0.668) implying that the difference between the observed and predicted values is not significant and the data fits well in the model.

The odds for age was 0.95 (0.92-0.98) which meant that as the age increased by one year, the odds of vaccine

hesitancy decreased by 5%. Having patient contact of <10 per day was associated with the decreased odds of vaccine hesitancy compared to those with patient contact of >40 per day. The odds of vaccine hesitancy among those with poor knowledge were 2.84 (1.91-4.21) times more compared to those with good knowledge. The odds of vaccine hesitancy was 3.22 (1.09-9.48) times and 3.31 (1.05-10.48) times more among educated up to primary and illiterate respectively compared to higher educated persons. Other factors like gender, education up to secondary level, occupation, patient contact of 10-40 or no patient contact, income, place of work were not significantly associated with vaccine hesitancy.

Most common reason for not taking the vaccine as mentioned by participants was "Vaccine was not available when I wanted to take it" in 26.9% followed by "COVID-19 vaccine is associated with serious side effects" in 18.8% of the cases. [Table 6]

DISCUSSION

In the present study, prevalence of vaccine hesitancy was 15.1% (95%CI = 13.0-17.3). Biswas N et al.[6] in their scoping review of 35 studies which had 76,471 participants noted that the vaccine hesitancy ranged from 4.3 to 72% (average = 22.51% across all studies with 76,471 participants). Paris C et al.[8] noted from their study that 23.1% of the healthcare workers were hesitant for taking the COVID-19 vaccine while 3.9%

were against it. Amuzie CI et al.[9] reported a very high rate of vaccine hesitancy among the 422 healthcare workers, that is, 50.5% (95%CI: 45.6-55.3%). Ashok N et al.[10] found that the prevalence was 27.6%. Their sample size was also less, that is, 264. Aemro A et al.[11] reported a very high vaccine hesitancy of 45.9% among the healthcare workers and again their sample size was lesser, that is, 418. Maraqa B et al.[12] also reported a high rate of vaccine hesitancy among healthcare workers, that is, 30.7% among 1159 subjects. Toth-Manikowski SM et al.[13] found a vaccine hesitancy rate of 15% among healthcare workers that is similar to present study and their sample size was 1974. Kumar R et al.[14] reported a vaccine hesitancy rate of 12.9% among 7821 adult healthcare workers. The variation of COVID-19 vaccine hesitancy among the healthcare workers across globe is due to some factors like sample size and timing of their study. Studies reporting vaccine hesitancy at the time of launch of the COVID-19 vaccines and with smaller sample size have usually reported a higher vaccine hesitancy. This may be attributed to higher levels of apprehensions among the people at the time of launch of the vaccine and the emergency use approvals of the vaccines. Nevertheless,

Table 3: Prevalence of vaccine hesitancy among healthcare workers

Variables	Frequency	Percent
have you taken the vaccine		
yes	903	84.9
no	160	15.1
which vaccine taken		
Covaxin	221	20.8
Covishield	682	64.1
no vaccine taken	160	15.1
how many doses taken		
1	272	25.5
2	631	59.4
not applicable	160	15.1

Table 4: Bivariable analysis for exploring risk factors for vaccine hesitancy

Variables	have you taken the vaccine		Total	Chi square/t	P
	yes	no			
gender					
male	355 (78.1%)	60 (21.9%)	415	0.188	0.665
female	548 (84.6%)	100 (15.4%)	648		
occupation					
Doctor + Nurse	485 (89.3%)	58 (10.7%)	543	21.943	0.000
para-medic	110 (83.9%)	21 (16.1%)	131		
admin staff	143 (84.6%)	26 (15.4%)	169		
house keeping	165 (76.1%)	52 (23.9%)	217		
place of work					
working in hospital side	667 (85.8%)	110 (14.2%)	777	1.808	0.179
working in college side	236 (82.5%)	50 (17.5%)	286		
education					
Higher	738 (87.5%)	105 (12.5%)	843	25.061	0.0000
Secondary	85 (82.5%)	18 (17.5%)	103		
Primary	51 (71.8%)	20 (28.2%)	71		
Illiterate	29 (67.4%)	14 (32.6%)	43		
monthly income					
more than 20,000	157 (95.2%)	8 (4.8%)	165	38.277	0.000
10,000 to under 20,000	290 (81%)	68 (19%)	358		
5,000 to under 10,000	324 (81%)	76 (19%)	400		
less than 5,000	132 (94.3%)	8 (5.7%)	140		
patient contact per day					
more than 40	123 (77.4%)	36 (22.6%)	159	12.856	0.005
10 to 40	330 (87.8%)	46 (22.2%)	376		
less than 10	132 (89.8%)	15 (10.2%)	147		
Zero	318 (83.5%)	63 (16.5%)	381		
knowledge score					
good knowledge	504 (91.3%)	48 (8.7%)	552	36.282	0.000
poor knowledge	399 (78.1%)	112 (21.9%)	511		
Age (years)					
Mean+SD	32.26+10.003	29.63+9.673	---	t=3.054	0.002

Table 5: Association of factors with vaccine hesitancy: Binary logistic regression model

Variables	Crude odds ratio			Adjusted odds ratio		
	OR	95% CI	P	OR	95% CI	P
Occupation						
Doctor + Nurse	1			1		
Para-medic	1.59	0.93-2.74	0.09	1.04	0.55-1.96	0.913
Admin staff	1.52	0.92-2.51	0.100	0.97	0.51-1.83	0.918
Housekeeping	2.64	1.74-3.99	0.000	0.99	0.34-2.74	0.985
Education						
Higher	1			1		
Secondary	1.49	0.86-2.58	0.155	1.41	0.53-3.79	0.494
Primary	2.76	1.58-4.81	0.000	3.22	1.09-9.48	0.034
Illiterate	3.39	1.74-6.63	0.000	3.31	1.05-10.48	0.042
Income						
> 20,000 INR	1			1		
10,000-20,000 INR	4.61	2.16-9.82	0.000	2.21	0.98-5.00	0.057
5,000-10,000 INR	4.61	2.17-9.78	0.000	1.89	0.78-4.54	0.159
< 5,000 INR	0.74	0.24-2.37	0.610	0.36	0.11-1.23	0.102
Patient contact/day						
> 40	1			1		
10-40	0.46	0.28-0.74	0.002	0.58	0.33-1.01	0.055
< 10	0.36	0.19-0.71	0.003	0.41	0.19-0.87	0.02
No patient contact	0.68	0.43-1.07	0.096	0.58	0.33-1.02	0.063
Place of work						
Teaching hospital	1			1		
Teaching college	1.32	0.92-1.91	0.138	1.54	0.95-2.49	0.081
Knowledge score						
Good	1			1		
Poor	3.14	2.17-4.55	0.000	2.84	1.91-4.21	0.000
Sex						
Male	1			1		
Female	1.07	0.76-1.53	0.681	0.95	0.62-1.46	0.083
Age (years)						
--	0.97	0.95-0.99	0.003	0.948	0.92-0.98	0.000

over the period, the apprehensions associated with the side effects and other aspects of the vaccines have come down over the period. Hence, later studies have started reporting lesser prevalence.

We found that low levels of education, poor knowledge and younger age were significantly and independently associated with vaccine hesitancy among the healthcare workers. Biswas N et al.[6] noted that being female and not having doctoral degree were associated with vaccine hesitancy, which is similar to the present study except that we did not find significant differences between males and females. Paris C et al.[8] also reported that age, fear about the vaccine side effects, previous history of taking flu vaccine and occupation were independently associated with intention to take COVID-19 vaccine. Amuzie CI et al.[9] found that younger age predicted vaccine hesitancy significantly (aOR = 9.34, 95%CI: 2.01-43.39); being single, having lower income had positive odds of vaccine hesitancy while being doctor and nurse had lower odds of vaccine hesitancy. These findings are also similar to present study findings except that we did not include marital status. Maraqa B et al.[12] noticed from their study that being male, younger age, being physician, non-government healthcare workers, previously received influenza vaccine, and higher knowledge related to COVID-19 were associated with intention to take the COVID-19 vaccine. While we found that younger age workers were less likely to take, the vaccine and being physician was not associated with the vaccine hesitancy. However, having higher knowledge finding was in agreement with this study. Aemro A et al.[11] reported that age less than 25 years, not using the mask, not following the social distancing, lack of clarity of information, vaccine fear were associated with the vaccine hesitancy. We also found that younger age and poor knowledge was significantly associated with the vaccine hesitancy. Kumar R et al.[14] found that being female; safety concerns and low understanding about the

Table 6: Reasons for not taking the vaccine

Reason	Frequency	%
Vaccine was not available when I wanted to take it	43	26.9
COVID-19 vaccine is associated with serious side effects	30	18.8
I am using face mask, so I do not need vaccine	09	5.6
Already affected with COVID-19 recently	12	7.5
COVID-19 vaccine itself can cause COVID-19 disease	10	6.3
Vaccine is costly for me	10	6.3
Lactating/pregnancy	09	5.6
Not having time/did not get registration slot of the vaccine	06	3.8
Ignorance on how to register for vaccination/lack of time	04	2.5
Vaccine is not effective	04	2.5
I feel that COVID-19 vaccine was prepared in a hurry without giving sufficient time for its preparation	03	1.9
Anaphylactic reaction before to some other injection	02	1.3
Health issues	02	1.3
Alcoholism	01	0.6
Reason not mentioned	15	9.4
Total	160	100

COVID-19 and its vaccine were significant predictors of vaccine hesitancy. We did not find that being female is a significant predictor of vaccine hesitancy. However, poor knowledge was associated with the vaccine hesitancy.

We also noted that the most common reason for not taking the vaccine as mentioned by participants was "Vaccine was not available when I wanted to take it" in 26.9% followed by "COVID-19 vaccine is associated with serious side effects" in 18.8% of the cases. Biswas N *et al.*[6] also noted from their scoping review that when healthcare workers are concerned with the efficacy, side effects of the vaccine, it becomes an important cause for the vaccine hesitancy. Fares S *et al.*[15] found that 91.4% of the healthcare workers expressed fear of side effects and 92.4% were concerned with the emergency approval of the vaccine in Egypt. These proportions are very high compared to present study.

Limitations and strengths of the study

The present study was a single-center study. Some did not take the vaccine at the time of study, as they were pregnant or lactating or recently had COVID-19 disease. They were also included in the analysis. However, as their number was small, hence, it may not affect the results. There were only three doctors who did not take the vaccine and therefore, we had to combine the doctor and nurse group for comparison to avoid vide variation in the 95% confidence intervals. Overall, the sample size was robust to predict the vaccine hesitancy. Poor knowledge, lower levels of literacy, and young age were found to be independent predictors of vaccine hesitancy based on the logistic regression model.

CONCLUSION

Prevalence of vaccine hesitancy was high at 15.1%. Low levels of education, poor knowledge and young age were independently and significantly associated with COVID-19 vaccine hesitancy among healthcare workers. However, occupation, income, place of work, and gender were not associated with the vaccine hesitancy. This data shows the importance of the health education for newer vaccines among the healthcare workers to improve its acceptance. Most common reason for not taking the vaccine as mentioned by participants was "Vaccine was not available when I wanted to take it" in 26.9%. Hence, it is important that the vaccine should be made universally available and accessible.

Hence, Community Medicine/public health specialist should be involved to target health education activities especially among housekeeping and para-medicals toward the young population to improve COVID-19 vaccination coverage.

ETHICAL APPROVAL

Institutional Ethics Committee permission was obtained vide letter no. MRIMS-DHR-IEC-91/2021 dated 30-09-2021.

Patient consent

Obtained.

Previous presentation in any conference

This article is a fresh study and not submitted elsewhere either in any conference or any journal.

What was known before this study? It was known that COVID-19 vaccine hesitancy is fairly common among the healthcare workers especially among housekeeping and para-medicals.

What does this study add to the existing knowledge? Poor knowledge about COVID-19 and its vaccine is an independent risk factor of COVID-19 vaccine hesitancy especially among younger age groups.

Hence, Community Medicine specialist should be involved to target health education activities especially among housekeeping and para-medical young population to improve COVID-19 vaccination coverage.

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Conflicts of interest

There are no conflicts of interest.

References

1. World Health Organization. Weekly epidemiological update on COVID-19 – 6 January 2022. Available from: https://www.who.int/publications/m/item/weekly-epidemiological-update-on-covid-19---6-january-2022. [Last accessed on 2022 Jan 11].

2. World Health Organization. Numbers at a glance. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019?gclid=EAIaIQobChMIiLqSk6uV8wIVVD5gCh1i-QZ7EAAYASAAEgJND_D_BwE. [Last accessed on 2022 Jan 11].

3. MoHFW. COVID-19. New Delhi: Ministry of Health and Family Welfare, Government of India; 2022. Available from: https://www.mohfw.gov.in/. [Last accessed on 2022 Jan 11].

4. Kumar VM, Pandi-Perumal SR, Trakht I, Thyagarajan SP. Strategy for COVID-19 vaccination in India: The country with the second highest population and number of cases. NPJ Vaccines 2021;6:60.

5. Manning ML, Gerolamo AM, Marino MA, Hanson-Zalot ME, Pogorzelska-Maziarz M. COVID-19 vaccination readiness among nurse faculty and student nurses. Nurs Outlook 2021;69:565-73.

6. Biswas N, Mustapha T, Khubchandani J, Price JH. The nature and extent of COVID-19 vaccination hesitancy in healthcare workers. J Community Health 2021;20:1-8.

7. World Health Organization. Health Workers. Available from: https://www.who.int/whr/2006/06_chap1_en.pdf. [Last accessed on 2021 Oct 01].

8. Paris C, Benezit F, Geslin M, Polard E, Baldeyrou M, Turmel V, et al. COVID-19 vaccine hesitancy among health care workers. Infect Dis Now 2021;51:484-7.

9. Amuzie CI, Odini F, Kalu KU, Izuka M, Nwamoh U, Emma-Ukaegbu U, et al. COVID-19 vaccine hesitancy among healthcare workers and its socio-demographic determinants in Abia State, Southeastern Nigeria: A cross sectional study. Pan Afr Med J 2021;40:10.

10. Ashok N, Krishnamurthy K, Singh K, Rahman S, Md Majumder AA. High COVID-19 vaccine hesitancy among healthcare workers: Should such a trend require closer attention by policymakers? Cureus 2021;13:e17990.

11. Aemro A, Amare NS, Shetie B, Chekol B, Wassie M. Determinants of COVID-19 vaccine hesitancy among healthcare workers in Amhara region referral hospitals, Northwest Ethiopia: A cross sectional study. Epidemiol Infect 2021;149:e225.

12. Maraqa B, Nazzal Z, Rabi R, Sarhan N, Al-Shakhra K, Al-Kaila M. COVID-19 vaccine hesitancy among health care workers in Palestine: A call for action. Prev Med 2021;149:106618.

13. Toth-Manikowski SM, Swirsky ES, Gandhi R, Piscitello G. COVID-19 vaccination hesitancy among healthcare workers, communication, and policy-making. Am J Infect Control 2022;50:20-5.

14. Kumar R, Alabdulla M, Elhassan NM, Reagu SM. Qatar healthcare worker's COVID-19 vaccine hesitancy and attitudes: A national cross-sectional survey. Front Public Health 2021;9:727748.

15. Fares S, Elmnyer MM, Mohamed SS, Elsayed R. COVID-19 vaccination perception and attitude among healthcare workers in Egypt. J Prim Care Community Health 2021;12:21501327211013303.