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Original Research Article

Correlates of COVID-19 vaccination drop-out among health care workers in a tertiary Care hospital of West Bengal

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ABSTRACT

Background: The Government of India launched "COVID-19 vaccination drive" on 16th January, 2021 and health care workers were the first to be prioritised for vaccination. However, the uncertainty regarding safety and efficacy of the vaccine was the major concern amongst them. These led to vaccine hesitancy and ultimately drop out.

Objectives: To estimate the proportion of drop out of COVID-19 vaccination among vaccine-hesitant health care workers (HCWs) of a tertiary care hospital and to find out their perception and other background characteristics responsible for drop out.

Materials and Methods: A facility based descriptive type of observational study, cross-sectional in design was carried out among 329 HCWs of a tertiary care hospital in Kolkata from 16th March- 12thApril, 2021using a pre-designed, pre-tested, structured questionnaire. The study population selected by simple random sampling technique. Data was analysed using Microsoft Excel 2010 and SPSS v25.0 in the form of descriptive statistics and binary logistic regression.

Results: About 44.1% of the study population didn't take the COVID-19 vaccine. Socio-demographic factors like age, gender, religion, education, occupation,perception regarding necessity of vaccination, vaccine efficacy, dose and contraindication, safety in humans and role in future infections were significantly associated with drop out.

Conclusion: There was a high proportion of vaccine drop out among health care workers. Different modifiable perceptions with socio-demographic factors had played important roles in COVID-19 vaccination drop out. As the global threat of COVID-19 continues, greater efforts through campaigns that target HCWs are needed to improve the intention of professionals' vaccine acceptance.

1. Introduction

Drop out is defined as "to not do something that you were going to do, or to stop doing something before you have completely finished."[1] Amidst the pandemic, scientists and research scholars all over globe united to develop a potent and safe vaccine for fighting the virus.

Even before completion of the clinical trials, the vaccines were unconventionally approved for emergency mass administration.[2] The Health Care Workers (HCWs) and other frontline workers, who were first prioritized to receive the vaccine, were also in a state of confusion whether to take the vaccine or not. Vaccine hesitancy is defined as a 'delay in acceptance or refusal of vaccination despite availability of vaccination services.'[3] WHO identified vaccine hesitancy as one of the top ten global health threats in 2019.[4] Various factors support vaccine hesitancy such as the type

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of vaccine, concerns about its safety and efficacy, anxiety of future infection, distrust in the government and early approval for use.

Out of a total of 9052 registered HCWs of the tertiary care hospital of Kolkata, 67.7% took the first dose of COVID-19 vaccine. Rest of 2922 (32.3%) HCWs were hesitant to take the vaccine. HCWs denying taking the vaccine are of great public health concern. This is because it affects the herd immunity of the healthcare workforce and ultimately the safety of patients and communities that they serve. Moreover, HCWs are a trust symbol for communities at large. They are a voice that influences others, so vaccine hesitancy in this group could undermine efforts to widely vaccinate general population and achieve herd immunity. With this background a study was conducted with the objectives of to estimate the proportion of drop out of COVID-19 vaccination among health care workers (HCWs) of a tertiary care hospital and to find out their perception and other background characteristics responsible for drop out.

2. Materials and Methods

2.1. Study design, study setting, study period, study population

A facility based descriptive type of observational study, cross-sectional in design was conducted over a period of 4 weeks (from 16^{th} March- 12^{th}April, 2021) amongst vaccine hesitant HCWs in a tertiary care teaching institute of Kolkata, West Bengal, India.

2.2. Inclusion and exclusion criteria

HCWs of a tertiary care hospital of Kolkata who were registered in COWIN portal but did not turn up for vaccination during data collection period and who agreed to participate in the study were included. Those who did not respond after 3 attempts of contact were excluded from the study.

2.3. Sample size

Considering the proportion (p) of vaccine hesitancy at 25.47%, from a global study[5] by Lazarus et al. of which India was also a part, standard normal deviate Z_α = 1.96 (for 95% confidence interval) and 5% absolute precision (d), sample size was calculated using Cochran's formula as $\frac{z_\alpha^2 \times p(1-P)}{d^2} = 292$

After finite population correction, i.e., multiplying with $\sqrt{\frac{N-n}{N-1}}$ = 0.95 (where N=finite population size= 2922, n=292) sample size = 292 x 0.95 =278.

After adding 25% non-response rate and rounding off, final sample size was calculated to be 350.

2.4. Sampling technique

From the data available in COWIN portal and hard data available at COVID Vaccination Center (CVC) of the Hospital, a line-listing of unvaccinated HCWs was prepared on March 16, 2021. From that list, 350 HCWs were selected by Simple Random Sampling without replacement using computer generated random numbers. Out of these 350 HCWs, 329 took part in final study, therefore, there was a non-response of 6%.

2.5. Study tool

A pre-designed, pre-tested structured questionnaire was used for data collection which was designed in consultation with 3 experts; 1 public health specialist, 1 social scientist and 1 psychologist. It was pretested among 30 HCWs of the same institution who were not included in final study; minor corrections were made in the questionnaire in language to ensure the understanding of the study population and validated by another 3 experts. Internal consistency was checked by Cronbach's Alpha (α) and the calculated 'r' value was 0.72. The questionnaire consisted of three parts:

First part included Socio-demographic characteristics (age, gender, religion, residence, education, occupation, family type, number of family members aged more than 45 years).

Second part included perception of study participants regarding COVID-19 vaccines and other COVID-19 related factors.

Third part had single question regarding Willingness of taking COVID-19 vaccine in future -whether they were just missed out the vaccination due to some reasons but want to take it later on (Missed out) or they had voluntarily dropped out (Drop out).

2.6. Study variables

The study variables were Dependent variables (proportion of COVID-19 vaccine drop out) and independent variables (socio-demographic and COVID related factors).

2.7. Data collection technique

Data was collected online using self-administered questionnaire (Google forms). Informed electronic consent was taken from all the participants in the initial page of online survey after explaining the purpose & nature of the study and ensuring their anonymity & confidentiality.

2.8. Data analysis

Data were entered in Microsoft Office Excel 2010 (Microsoft Corp, Redmond, WA, USA) and then imported to Statistical Package for Social Sciences (SPSS for Windows, version 25.0, SPSS Inc., Chicago, USA). Descriptive and Inferential Statistics for study variables

were performed. Multivariable binary logistic regression was done with variables with p<0.020 in the univariate model. Adjusted Odds Ratio (aOR) with 95% Confidence Intervals was calculated. A p value of <0.05 was considered statistically significant.

2.9. Operational definitions

1. Health Care Workers: Health care worker or "HCW" means any paid (by the government or by the contractors) or unpaid person (including health care students/ volunteers) working in a health care facility or hospital on permanent or contractual basis, and involved directly or indirectly in patient care/ academics/ hospital administration/ hospital upkeep and security on a consistent and regularly scheduled basis for five or more days per week.
2. Vaccine hesitancy: Delay in acceptance or refusal of vaccination despite availability of vaccination services.[3]
3. Vaccine drop out: HCWs who were yet to get the vaccine before the initiation of the study and not willing to take the COVID-19 vaccine in future, were considered as COVID-19 vaccine drop out.
4. Vaccine Missed out: HCWs who had missed the vaccination but willing to take it as and when they get the chance in future.

2.10. Ethical considerations

Approval from Institutional Ethics Committee was taken vide memo no. (Institute name)/IEC/2021/127 dated 06/02/2021. Informed electronic consent was taken prior to data collection and all ethical principles were adhered to throughout the course of the study.

3. Results

Among 329 study population, about 59.0% were in the age group of up-to 30 years with median age of 27 years and a range of 19 to 63 years; more than half were males (53.2%) and rest 46.8% were females; 67.2% were Hindus;77.2% belonged to joint families; so far education was concerned, about 51.1% were Higher Secondary passed; regarding occupation, 7.0% were paramedical staffs, 12.5% were doctors, 13.1% were nursing staff and 22.2% were students (Table 1).

Distribution of the study population according to their perception about COVID-19 vaccine and COVID-19 contact history was demonstrated in Table 2. Only 33.1% of participants had received intimation for vaccination through SMSs and/or phone calls. There were 8.5% of HCWs who thought they did not need the vaccines at all, 21.3% had doubt about vaccine efficacy. Regarding human safety, 10.9% marked vaccines as unsafe and another 71.7% had no knowledge about safety. Only 7.0% of the study population felt that vaccine will reduce complications of COVID-19 infection whereas 26.1% were of the opinion that it will prevent future infection.

About 44.1% of the study population voluntarily dropped out of COVID-19 vaccination (do not want to take vaccine in future) and 55.9% of the participants had missed out but they were willing to be vaccinated later on (Table 2)

Socio-demographic predictors of vaccination drop out which came statistically significant in the multivariable logistic regression model were male gender, younger age group (≤30 years), education up-to Higher Secondary, family with none or single member >45 years and occupation-doctor (Table 3).

COVID-19 related variables which were statistically significant in the multivariable logistic regression model were perception of non-requirement of vaccine, doubtful about vaccine efficacy, presence of contraindications like drug allergies and chronic diseases, concerns about human safety, inadequate knowledge regarding role of vaccine (Table 4).

Table 1: Distribution ofvaccine hesitant HCWs as per socio-demographic profile (n=329)

Socio-demographic variables		Number (%)
Age	≤30 years	194 (59.0)
	>30years	135 (41.0)
Gender	Female	154 (46.8)
	Male	175 (53.2)
Religion	Muslim	82 (24.9)
	Hinduism	221 (67.2)
	Others	26 (7.9)
Education	Secondary	48 (14.6)
	Higher secondary	168 (51.1)
	Graduation and above	113 (34.3)
Residence	Hostel	49 (14.9)
	Own house	199 (60.5)
	Rented house	81 (24.6)
Family type	Joint	75 (22.8)
	Nuclear	254 (77.2)
Family members aged>45 years	None	21 (6.4)
	One	123 (37.4)
	Two or more	185 (56.2)
Occupation	Paramedical staff	23(7.0)
	Doctor	41 (12.5)
	Nursing staff	43 (13.1)
	Students	73 (22.2)
	Others	149 (45.3)

4. Discussion

There is a dearth of studies pertaining to COVID-19 vaccination drop out especially in India. Thus, findings of this study have been explained and compared with few studies that were available.

Table 2: Distribution of vaccine hesitant HCWs according to their perception and other vaccine related factors (n=329)

Information sought		Number (%)
Did you receive intimation by phone call/ message regarding your vaccination?	Yes	109 (33.0)
	No	220 (67.0)
Were you available on scheduled vaccination day?	Yes	24 (7.2)
	No	85(25.8)
	Not applicable	220(67.0%)
Do you think vaccine is necessary?	Yes	301 (91.5)
	No	28 (8.5)
Do you have any doubt about efficacy of vaccines?	Yes	70 (21.3)
	No	259 (78.7)
What is the main contra-indication that has prevented you to take the vaccine?	Drug allergy	37 (11.3)
	Gynaecological issue	27 (8.2)
	Chronic disease	26 (7.9)
	No contraindication	239 (72.6)
How many doses of COVID-19 vaccines are required?	Didn't know	34 (10.3)
	Two doses	295 (89.7)
What do you think about safety of the vaccines?	Don't know	236 (71.7)
	Safe	57 (17.3)
	Unsafe	36 (11.0)
What is the role of the vaccines in protection against future infection?	Don't know	221 (67.2)
	Reduce complications	22 (6.7)
	Reduce infection	86 ((26.1)
What is the main source of your knowledge? (Multiple response)	Mass media	281 (85.4)
	Friends/ Colleagues	119 (36.2)
	Journal	36 (10.9)
	Social media	35 (10.6)

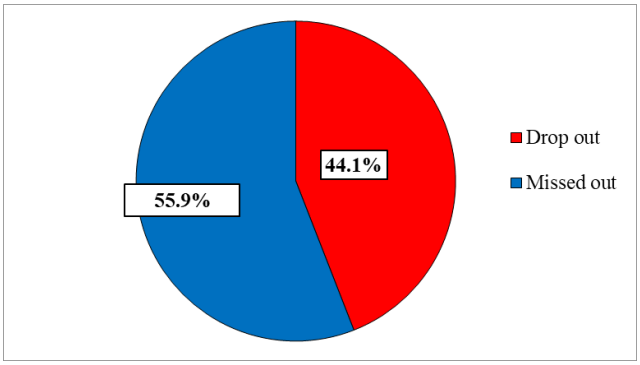

Fig. 1: Showing distribution of vaccine hesitant HCWs according to drop out status (n=329)

In this study, out of 329 HCWs who were hesitant to take the vaccine, 44.1% had dropped out of vaccination and 55.9% had missed out. A global survey by Lazarus JV, Ratzan SC, Palayew A et al. in June 2020 carried out amongst 13,426 potential COVID-19 vaccinees in 19 different countries including India, to determine COVID-19 vaccine acceptancy and its' influencing factors, it was found that 71.5% of participants were 'very' or 'somewhat likely' to accept a COVID-19 vaccine whereas 61.4% reported to accept on employer's recommendation.[5] Acceptance rate was highest in China (90%) and lowest in Russia (55%). In India, 74.53% participants agreed to accept COVID-19 vaccine and rest 25.47% included the potential drop outs. Here men were slightly less likely to accept the vaccine than women (OR= 0.84, 95% CI, 0.78- 0.91) which was similar to the findings in our study where women were less likely to drop out compared to men (aOR=0.255, 95% CI, 0.14-0.45). This may be because women in this study were more anxious that they could infect their family members and children at home if they did not take the vaccine.

This study found that younger participants of ≤30 years age group were more likely to drop out than those who were >30 years of age (aOR=2.13, 95% CI, 1.04-3.31). This may be due to lack of trust in a new vaccine and a generalized belief that younger age group people will have lesser complications even if they get infected.

Another longitudinal study by Fridman A, Gershon R, Gneezy A et al. in United States of America during March-August 2021 found that there was decreasing trend to take COVID-19 vaccine as they thought that the virus was not so threatening.[6] The present study also showed that vaccination drop out was associated with the perception of

Table 3: Multivariable binary logistic regression of Socio-demographic predictors and COVID-19 vaccination drop out (n=329)

Input variables	Drop out (n=145)	OR (95% CI)	aOR (95% CI)	p value
Gender				
Female	48	0.36 (0.23-0.57)	0.26 (0.14-0.45)	0.001
Male	97	Ref	Ref	
Age				
≤30 years	100	2.13 (1.35-3.36)	1.87 (1.04-3.31)	0.034
>30years	45	Ref	Ref	
Religion				
Hindu	31	0.27 (0.10- 0.70)	0.33 (0.110- 0.99)	0.048
Muslim	96	0.34 (0.14- 0.82)	0.38 (0.14- 1.02)	0.056
Others	18	Ref	Ref	
Education				
Secondary	9	0.30 (0.13- 0.68)	0.86 (0.28- 2.65)	0.797
Higher secondary	87	1.40 (0.87-2.27)	2.79 (1.24- 6.23)	0.013
Graduate and above	49	Ref	Ref	
Residence				
Hostel	22	1.54 (0.75- 3.19)	0.89 (0.31- 2.47)	0.817
Own house	95	1.73 (1.01- 3.00)	1.57 (0.75- 3.22)	0.226
Rented house	28	Ref	Ref	
>45years old family member				
Zero	12	3.00 (1.20- 7.50)	3.50 (1.22- 9.96)	0.019
One	76	3.61 (2.50- 5.86)	4.27 (2.33- 7.79)	0.001
Two or more	57	Ref	Ref	
Occupation				
Doctors	31	4.82 (1.60- 14.48)	5.33 (1.31- 21.65)	0.019
Nursing staffs	10	0.47 (0.16- 1.41)	1.24 (0.30- 5.08)	0.765
Others	56	1.78 (0.69- 4.64)	1.02 (0.30- 3.40)	0.969
Paramedical staff	9	0.93 (0.38-2.31)	0.61 (0.21- 1.75)	0.360
Students	39	Ref	Ref	

Model fitness: Cox and Snell R-Square=0.269, Nagelkerke R-Square=0.360, Omnibus Test was significant (p<0.001) and Hosmer-Lemeshow Test was not significant (p=0.20).

non-requirement of vaccine perhaps due to the impression that the infection will not produce adverse outcomes.

A longitudinal study in United Kingdom by Robertson E, Reeve KS, Niedzwiedz CL et al. among general population reported that "unknown effects of a vaccine in future" was the main reason for vaccine hesitancy as responded by 42.7% of the participants.[7] *Reduction* in chance of future infection and COVID-19 complications along with vaccine safety were the major factors for vaccine acceptance. Similar reasons were also found from this study. In the same study, females had higher odds of vaccine hesitancy than males (OR 1.55, 95% CI:1.28, 1.86) opposite to the findings of present study.

In the UK study vaccine hesitancy was inversely related to age with younger age groups having higher odds of vaccine hesitancy similar to what the present study reported.[7]

Lucia VC, Kelekar A, Afonso NM in their study conducted among medical students of Southeast Michigan medical school, reported that only 53% agreed to participate in a COVID-19 vaccine trial and 23% of students were not willing to take vaccine immediately after FDA approval. The most common factor for unwillingness was concern about serious vaccine side effects which corroborated with the findings of the current study.[8]

A community-based study in Turkey and a study among Egyptian medical students revealed 45.3% and 46% of the study population were hesitant to take the vaccine respectively, which was higher than the proportion of hesitant vaccinees in this study (32.3%).However, proportion of vaccine hesitancy was low (20.4%) among Canadian university students in a study by Mant et al.[9–11]

4.1. Strengths of this Study

1. 1. Dearth of epidemiological studies about drop out of COVID-19 vaccination among HCWs, especially in India.
2. 2. Large sample size.
3. 3. High response rate (94%).

5. Limitations of this Study

1. Lack of a validated scale.

2. Social desirability bias, that is, responses to some questions being socially favourable.

Table 4: Multivariable binary logistic regression of vaccine related predictors and COVID-19 vaccination drop out (n=329)

Input variables	Drop out (n=145)	OR (95% CI)	aOR (95% CI)	p value
Requirement of vaccine				
Yes	127	0.40 (0.18- 0.90)	0.10 (0.02- 0.40)	0.001
No	18	Ref	Ref	
Efficacy of vaccine				
Doubtful	53	5.66 (3.10- 10.34)	19.25 (6.98- 53.06)	0.001
Not doubtful	92	Ref	Ref	
Contradiction				
Drug allergy	31	9.89 (3.97- 24.68)	25.42 (7.76- 83.21)	p<0.001
Gynaecological	9	0.98 (0.41- 2.23)	1.65 (0.595- 4.62)	0.334
Chronic disease	23	14.68 (4.28- 50.54)	11.45 (23.48- 52.03)	p<0.001
Others	82	Ref	Ref	
Required dose				
Not known	22	2.56 (1.22- 5.38)	0.70 (0.24- 2.06)	0.523
Known	123	Ref	Ref	
Human safety				
Not known	105	0.45 (0.22- 0.98)	5.74 (1.88- 17.53)	0.002
Safe	17	0.24 (0.10-0.58)	2.09 (0.60- 7.29)	0.247
Unsafe	123	Ref	Ref	
Role of vaccine				
Not known	105	2.63 (1.52- 4.57)	2.81 (1.23- 6.42)	0.014
Reduce complication	18	13.09 (4.00- 42.89)	20.67 (4.41-96.79)	0.001
Reduce infection	22	Ref	Ref	

Model fitness: Cox and Snell R-Square=0.356, Nagelkerke R-Square=0.477, Omnibus Test was significant (p<0.001) and Hosmer-Lemeshow Test was not significant (p=0.07).

6. Conclusion and Recommendations

There was a high proportion of vaccination drop out. The socio-demographic factors significantly associated with drop out were age, gender, religion, education, occupation and presence of elderly in family. Perception related factors such as non-requirement of vaccine, efficacy, human safety, role of vaccine, knowledge on required dose and presence of contraindications were statistically significant factors for drop out. Information, education and counselling sessions for the hesitant HCWs by concerned authorities regarding importance of taking COVID-19 vaccine should be undertaken to reduce the drop out rate. As the global threat of COVID-19 continues, greater efforts through campaigns that target HCWs are urgently needed to improve the intention of professionals' vaccine acceptance.

7. Source of Funding

Nil

8. Conflict of Interest

There are no conflicts of interest.

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