



HEALTH PROMOTION

COVID-19 vaccination intention and hesitancy: Mistrust on COVID-19 vaccine benefit a major driver for vaccine hesitancy among healthcare workers; a cross-sectional study in North India

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Keywords

COVID-19 vaccination hesitancy • Vaccine acceptance • Intention to vaccinate • Anti-vaccination attitude • Vaccine mistrust

Summary

Background. The advent of an effective novel COVID-19 vaccine could extinguish the current devastating pandemic but the vaccine hesitancy is a hurdle for the public health system, so this study estimated the COVID-19 vaccination intention and hesitancy among the healthcare workers, the priority target group for the COVID-19 vaccination in India.

Methods. A web-based cross-sectional survey was conducted among the healthcare workers in Chandigarh, a union territory in North India, using a Snowball sampling technique. A total of 403 healthcare workers participated in the study between 2nd and 25th January 2021. The primary data collected were the intention to get vaccinated against the available COVID-19 vaccine and the concerns regarding the new vaccines. The attitude towards novel COVID-19 vaccine was assessed using developed Vaccine attitude examination scale. These questionnaire, which were delivered via WhatsApp, was filled by the participants over Google forms.

Results. Among the 403 respondents surveyed, the majority

(54.6%) reported they were definitely intended to get vaccinated against COVID-19, however, 7% expressed a resistance for inoculation with COVID-19 vaccination. The perceived susceptibility (aOR = 0.511, CI 0.265-0.987) and severity of COVID-19 infection (aOR = 0.551 CI 0.196-0.704) and not being concerned about the efficacy of new COVID-19 vaccines (aOR = 0.702 CI 1.109-26.55) were found to have the highest significant odds of intention to take the COVID-19 vaccine. The majority (62%) were concerned about the safety of the vaccine, in terms of side-effects, quality control, and doubted efficacy of the vaccine. The mistrust of the benefits of the vaccine is a significant predictor for vaccine hesitancy among the healthcare workers (aOR = 5.205 CI 3.106-8.723).

Conclusion. Therefore, strategic communication and vaccine-acceptance programs should be formulated in order to combat the prevailing mistrust on the vaccine safety and efficacy and attain effective coverage to gain herd immunity.

Introduction

The severe acute respiratory syndrome corona virus-2 (COVID-19) pandemic had infected over 83 million people globally (affected more than 200 countries or territories) and reported about 1.8 million deaths since the start of the pandemic [1], and in India its estimated approximately 8.6 million cases and a 130000 deaths. Approximately 1.4 billion population in India are at risk of acquiring this infection with many are at risk for developing severe form of the infection. Hence this pandemic poses a significant threat to the public health system and for health care providers in India [2]. The widespread use of the effective SARS-CoV-2 vaccine could prevent the morbidity and mortality associated with COVID-19 infection and mitigate the other catastrophic impacts on the global economy and psycho-social well-being of the citizens with the enforcement of non-pharmacological strategies, such as testing, quarantine, lockdown, social distancing measures [3-10].

So the development of an effective and safe vaccines

against COVID-19 infection is the most effective strategy for limiting the spread of this disease by establishing a higher level of herd immunity and preventing repeated or continuous epidemic curves [3, 10]. The intensified international efforts resulted in the development of the safe and effective COVID-19 vaccines at an unprecedented speed and are made available for the public use [11, 12]. Therefore, almost all the health care workers and general population are eagerly waiting for the COVID-19 vaccine.

But many healthcare workers are anxious and afraid of the safety and efficiency of the vaccines, its adverse health outcomes, therefore, vaccine hesitancy among them is really worrisome and it might percolate down to the general population. So in this present situation, for the containment of this pandemic vaccine hesitancy will have a negative impact and forms a big barrier to overcome. For this it's necessary to address the factors behind this hesitancy and why the people are skeptical. Vaccine hesitancy is highly prevalent among those vaccines which had shown their efficiency through

years of accumulative scientific evidences, therefore, the acceptance of the novel vaccine which is being developed over a short span of time for the COVID-19 remains uncertain [5, 13, 14]. The experiences from previous pandemics reports that the acceptance of vaccines for H1N1 and H7N9 shown unsatisfying results with an acceptance rate varying from 8 to 67% in many developed countries [15-17]. Even among the health care workers in China during domestic H1N1 outbreak, only 25% received the vaccination, when the vaccine was provided for free [18].

So, vaccine hesitancy is a complex public health issue, as the intention to vaccination is the important factor in the success of vaccination program in an epidemic. There are multiple factors affecting the vaccine hesitancy, when a new vaccine is introduced. These includes varying social, cultural and political differences across the nation, public concern about vaccine safety and efficacy, adverse health outcomes, misconceptions about the need for vaccination, lack of trust in the health system, cost of vaccine, attitude and previous uptake history of influenza vaccination, perceived risk of infection, the severity of the event, personal consequences, history of previous vaccination etc. [15, 16, 19-22].

The equitable vaccination coverage across the population is essential for the containment of the COVID-19 pandemic, as the severity of the infection and burden caused to the nation are huge, compared with previous influenza pandemics. But, in order to flatten the epidemic curves higher vaccine coverage is required. The vaccine hesitancy affects not only the individual who are not willing to take the vaccine, but the whole community is affected, by not reaching the threshold to confer herd immunity. So, the vaccine hesitancy by the population undermines the public health benefits of the COVID -19 vaccination program and efforts.

Understanding individual's concerns regarding COVID-19 vaccine safety and efficacy should be assessed at the earliest for formulating strategic communication programs as this will strongly influence their intention to get vaccinated. The willingness of health workers to get vaccinated and a positive response towards vaccination are motivating factors to enhance the vaccination rate not only in the health workers, but also among general public. Due to the high risk of exposure to the virus, a high vaccination rate among the healthcare workers is mandatory to curb the rate of virus transmission. So far, we could not find any literature on COVID vaccination acceptance among health workers in India. Hence, this study was conducted for urgent understanding to assess the willingness of the health care workers in taking the COVID-19 vaccine in a union territory in North India, in order to formulate effective promotion strategies. The health care workers, they are of first to receive this novel vaccine, they will have diverse views on vaccination ranging from advocating for vaccination or demanding through to those who reject them and even a small group with anti-vaccine attitude.

Materials and methods

STUDY DESIGN AND SETTING

We conducted a cross-sectional study among the Nurses working in the COVID-19 units of two tertiary care hospitals in Chandigarh, a Union territory in North India. The study was conducted in January 2021, when the country was planning for the immunization against COVID-19 using COVAXIN and COVISHIELD.

STUDY SAMPLE

The researchers calculated the sample size using OpenEpi.com. The study by Lin et al. [22] showed a acceptance for COVID-19 vaccination as 46.8% in China, hence, the estimated sample size was 383 with a confidence interval of 95%. The researchers distributed the questionnaires among 500 nurses working in the COVID-19 units of selected tertiary care centers, we excluded persons with specific contraindications for the COVID-19 vaccine. We got 403 (80.6%) valid responses with repeated reminders. Incomplete questionnaires were excluded from the sample and were not analyzed.

TOOLS AND TECHNIQUES

The survey consisted of a validated self-administered electronic questionnaire, designed and developed by the investigators after a thorough literature review based on the objectives of the study. The research experts in the field of public health were reviewed the questionnaire and the content validity of the tools were established. The questionnaire was drafted and distributed in English language. The tool was designed as short, simple, and concise statements, easy to comprehend and quick to complete. The validity of the tool was obtained from the research experts in the field of public health and nursing. The final questionnaire consisted of:

Perception of healthcare workers regarding COVID-19 infection and COVID-19 vaccines: health belief model derived items under the headings of perceived susceptibility to COVID-19 (3 items), perceived severity of COVID-19(3 items), perceived benefits of COVID-19 vaccine (2 items), perceived barriers for the uptake of COVID-19 vaccine (5 items) and cues to action (2 items) were used to assess the respondents perception on a four point Likert scale ranging from strongly agree to strongly disagree [22-24].

Intention to receive a COVID-19 vaccine and vaccine preference, the intention for getting Vaccine against COVID-19 was assessed using a single four point scale (definitely no to definitely yes) question. The participants preference for domestically made and imported vaccine was assessed, and their level of confidence in these vaccines on a 4 point scale (completely confident to completely not confident) were assessed [3, 22-26].

Concerns for vaccinating against COVID-19: the participants were asked for the potential barriers/ concerns regarding COVID-19 vaccine using a multiple response question [26, 27].

COVID-19 vaccination attitude examination

scale: A specific attitude towards COVID-19 vaccine were examined using an 8-item Vaccination attitude examination scale (VAX) developed by the research team based on the literature [28, 29]. The participants were asked to focus specifically on the COVID-19 vaccine and were free to respond on a five point scale from strongly agree to strongly disagree under three specific subscales, viz 1) Mistrust on the COVID-19 vaccines benefits, 2) Safety concerns on the COVID-19 vaccination, and 3) preference for natural immunity over COVID-19 vaccination. Internal consistency of this tool in the current study was found to be good ($\alpha = 0.78$).

DATA COLLECTION

The data collection started after obtaining permission from the Institutional Ethics Committee. A self-administered questionnaire was made using Google forms and distributed among the nurses through WhatsApp. At the beginning of the questionnaire, the participants were briefly informed about the objectives of the study, and informed consent was obtained within the introductory web page before the survey enrollment. The data collected were stored in Google drive and protected by username and password.

ETHICAL CONSIDERATION

The study was conducted after getting approval from the Institutional Ethics Committee. This study was an online survey conducted among the health care workers, the identification details of the participants were not collected in this study. Informed consent was collected in the introductory page of the Google form and informed that the participation in the study is voluntary and non-commercial.

STATISTICAL ANALYSIS

Collected data were analyzed using Google form and SPSS version 20. Descriptive statistics including frequencies and percentage were used to present the demographic data, Chi-square test was used to assess the significance of the association between COVID-19 vaccine acceptance and demographic variables and perception regarding COVID-19 vaccine. Logistic regression analysis was used to identify the predicting variables of vaccine acceptance.

Results

We got completely filled survey forms from 403 participants through a snowball sampling technique from various health care workers from the Government tertiary care centers in Chandigarh, a Union territory in North India.

Demographic and other characteristics of the participants In the present study, the participants were the health care professionals working in the government tertiary care center in Chandigarh, a Union territory in North India. Among the participants around half of the participants were in the age group of 28-35 (47%) with a mean age

of 30.12 ± 6.93 range from 21-53, 68.7% were females and married consisted of 253 (62.8%) participants. About 82% of the participants were living with family consisting of more than 3 members and 50% were having children up to the age of 18years. More than half of the respondents (54.6%) were planning to get vaccinated immediately whenever it is made available.

Table I shows that majority (69%) of the participants were had a degree level of education, In total, 74.2% thought that their health status was good or very good 85% of the participants reported perceived overall health condition as very good/good and 65% perceived themselves at the risk of COVID-19 infection because of occupational exposure. Type of the exposure with the patients showed that 46.4% were working with direct contact with the COVID-19 sick patients in isolation ward and 15.4% reported that they had a COVID-19 infection in any of the family members from the start of the pandemic.

Most of the participants (69.5%) revealed that they had not vaccinated against influenza in the previous years, and the intention to vaccinate against COVID-19 infection shows that overall, three in five participants (54.6%) would definitely get the vaccine, 38.5% had low levels of hesitancy, 6.5% had high levels of hesitancy, and only 2 were resistant (they expressed they were definitely not going to get the vaccine).

Majority (60%) of the participants expressed a preference for the foreign-made/imported vaccines, when they expressed 32% complete confidence on those vaccines. Among the participants, 64% expressed a confidence on the domestically made vaccine, while 94% for the imported vaccines.

CONCERNS/BARRIERS REGARDING COVID-19 VACCINE UPTAKE AMONG THE HEALTHCARE WORKERS

The major concerns about the COVID-19 vaccines among the healthcare workers were assessed using multiple response question, with the various aspects of major concerns on efficacy, safety and the perceived severity of the infection were considered. Only 5.9% of the responders mentioned no concerns on the vaccines, while majority concerned about the complications and adverse events following the immunization (62%), and 33.33% lacked confidence in the efficacy of the vaccines. The quality control of the vaccine was doubted by 22%, and 17.8% were planned to wait until tested by others in the community and confirm the safety and efficacy of the vaccines, whereas 11.6% were expressed a belief in the natural immunity over vaccination.

HEALTH BELIEFS REGARDING COVID-19 INFECTION AND COVID VACCINATION

The participants perceptions regarding the COVID-19 infection and the COVID-19 vaccine were assessed based on the HBM construct, the participants expressed a high level of perceived susceptibility for COVID-19 infection with a mean percentage score of 78.41% (SD = 1.600) and perceived barriers, the mistrust in

Tab. I. Socio-demographic characteristics and the COVID-19 vaccination intention and preference and confidence on the COVID-19 vaccines (n = 403).

Variables	Frequency (%)
Age	
20-27	147 (36.5%)
28-35	190 (47.1%)
36-42	30 (7.4%)
> 43	36 (9%)
Gender	
Female	277 (68.7%)
Male	126 (31.3%)
Marital status	
Unmarried	150 (37.2%)
Married	253 (62.8%)
Educational status	
Diploma	28 (6.9%)
Degree	278 (69%)
Postgraduate and above	97 (24.1%)
Number of members in household	
Alone	24 (6%)
2	47 (11.7%)
3-4	208 (51.6%)
> 5	124 (30.8%)
Having children up to age 18 years	
Yes	202 (50.1%)
No	201 (49.9%)
Ever diagnosed with chronic diseases	
Yes	62 (15.4%)
No	341 (84.6%)
Perceived overall health	
Very good	103 (25.6%)
Good	240 (59.6%)
Fair/Poor	60 (14.8%)
Self-perception, at risk of severe illness from COVID-19	
Yes	262 (65%)
No	141 (35%)
Have you or anyone in the family got sick with COVID-19 since the start of pandemic	
Yes	62 (15.40%)
No	341 (84.60%)
How would you describe your exposure to COVID-19 sick patients while at work?	
Direct interaction with verified sick patients	86 (21.30%)
Direct interaction with non-verified patients	29 (7.2%)
No direct interactions	
No known interactions with COVID-19 patients	56 (13.9%)
Students	45 (11.2%)
Trust on the Government in addressing unexpected health threats to our nation, including COVID-19 epidemic	
Yes	272 (67.5%)
No	131 (32.5%)
Have you been vaccinated against the flu in the last year?	
Yes	123 (30.50%)
No	280 (69.50%)
Refused a recommended vaccine in the past	
Yes	50 (12.4%)
No	353 (87.6%)

Variables	Frequency (%)
COVID-19 vaccination intention	
Definitely Yes	220 (54.6%)
Probably Yes	155 (38.5%)
Probably No	26 (6.4%)
Definitely No	2 (0.50%)
Preference for COVID-19 vaccine	
Domestically-made vaccine	161 (40%)
Foreign made vaccine	242 (60%)
Confidence in domestically made vaccine	
Completely confident	36 (8.9%)
Confident	222 (55.2%)
Not confident	109 (27%)
Completely not confident	36 (8.9%)
Confidence in foreign-made made vaccine	
Completely confident	129 (32%)
Confident	250 (62%)
Not confident	12 (3%)
Completely not confident	12 (3%)

the efficacy of the vaccine and worrying about the adverse effects of the vaccination for COVID-19 was expressed a score of 75.2% (SD = 1.52). The mean percentage score for perceived benefits of the COVID-19 vaccination and cues to action were 61.74% (SD = 1.02) and 64% (SD = 1.1).

Table II shows that the participants in the present study expressed a significant level of susceptibility of COVID-19 infection, more than 80% of the respondents were agreed that there is a great chance of getting COVID-19, and are worried about the complications. The participants had a high perception of the severity of COVID-19; 89% agreed that complications of COVID-19 are serious but only 55% were worried about becoming sick by COVID-19 infection. A higher proportion reported a higher confident on the perceived benefits of the COVID-19 vaccination in the prevention of the illness and its complications. Concerns about the safety and efficacy of the vaccines were expressed and found to be higher among the participants. Most of the participants (94%) reported they would take the vaccine when they are provided with adequate information and some (76%) reported they will take only when they got sufficient evidence from others taken.

ATTITUDE OF HEALTHCARE WORKERS REGARDING COVID-19 VACCINATION

The total mean percentage scores for the attitude of healthcare workers towards COVID-19 vaccines in mistrust on the vaccine benefits, safety concerns on the vaccination, and preference for natural immunity were 52.09% (7.814 out of 15, SD = 1.743), 72.47% (10.87 out of 15, SD = 2.152), and 12.25% (1.225 out of 10, SD = 0.35) respectively. This data clearly shows that the healthcare workers were concerns about the safety of the COVID-19 vaccines, the main driver of hesitancy or reluctance.

Tab. II. Health belief and perceptions of healthcare workers regarding COVID-19 infection and COVID-19 vaccination. (n = 403).

Health believes and perceptions	Strongly agree	Agree	Disagree	Strongly disagree
Perceived susceptibility				
Chance of getting COVID-19 for me and my family is still high	121 (30)	212 (52.6%)	67 (16.6%)	3 (0.7%)
Worry about the likelihood of getting COVID-19	75 (18.6%)	258 (64%)	64 (15.9%)	6 (1.5%)
COVID-19 pandemic had a severe impact on daily life	156 (38.7%)	209 (51.9%)	38 (9.4%)	0
Perceived severity				
Complications from COVID-19 are serious	115 (28.5%)	245 (60.8%)	41 (10.2%)	2 (0.5%)
I will be very sick if I get COVID-19	48 (11.9%)	177 (43.9%)	163 (40.4%)	15 (3.7%)
Perceived benefits				
Vaccination is a good idea because it makes me feel less worried about catching COVID-19	104 (25.8%)	260 (64.5%)	39 (9.7%)	0
Vaccination decreases my chance of getting COVID-19 or its complications	73 (18.1%)	265 (65.8%)	62 (15.4%)	3 (0.7%)
Perceived barriers				
Worry the possible side effects of COVID-19 vaccination would interfere with my usual activities	64 (15.9%)	214 (53.1%)	116 (28.8%)	9 (2.2%)
Concern about the efficacy of the COVID-19 vaccination	75 (18.6%)	289 (71.7%)	33 (8.2%)	6 (1.5%)
Concern about the safety of the COVID-19 vaccination	90 (22.3%)	278 (69%)	29 (7.2%)	6 (1.5%)
Cues to action				
I will only take the COVID-19 Vaccine if I was given adequate information about it	169 (41.8%)	210 (52%)	24 (5.9%)	0
I will only take the COVID-19 Vaccine if the vaccine is taken by many in the public and found effective	115 (28.5%)	194 (48%)	91 (22.5%)	3 (0.7%)

Figure 2 shows that majority (44.9%) among the respondents expressing a concern on the safety of the COVID-19 vaccines available. So adequate measures to combat this concern is the prime focus of the vaccination process. Only 18.3% were believing on a natural immunity over vaccination, and 3% expressing a

severe negative attitude regarding the efficacy/benefits of up taking this novel vaccine. But these concerns should be addressed at the earliest to spread among the vast majority and the general public encounter with these healthcare workers in the professional and personal life.

Fig. 1. Concerns expressed by the Health care workers regarding COVID-19 vaccination (n = 403).

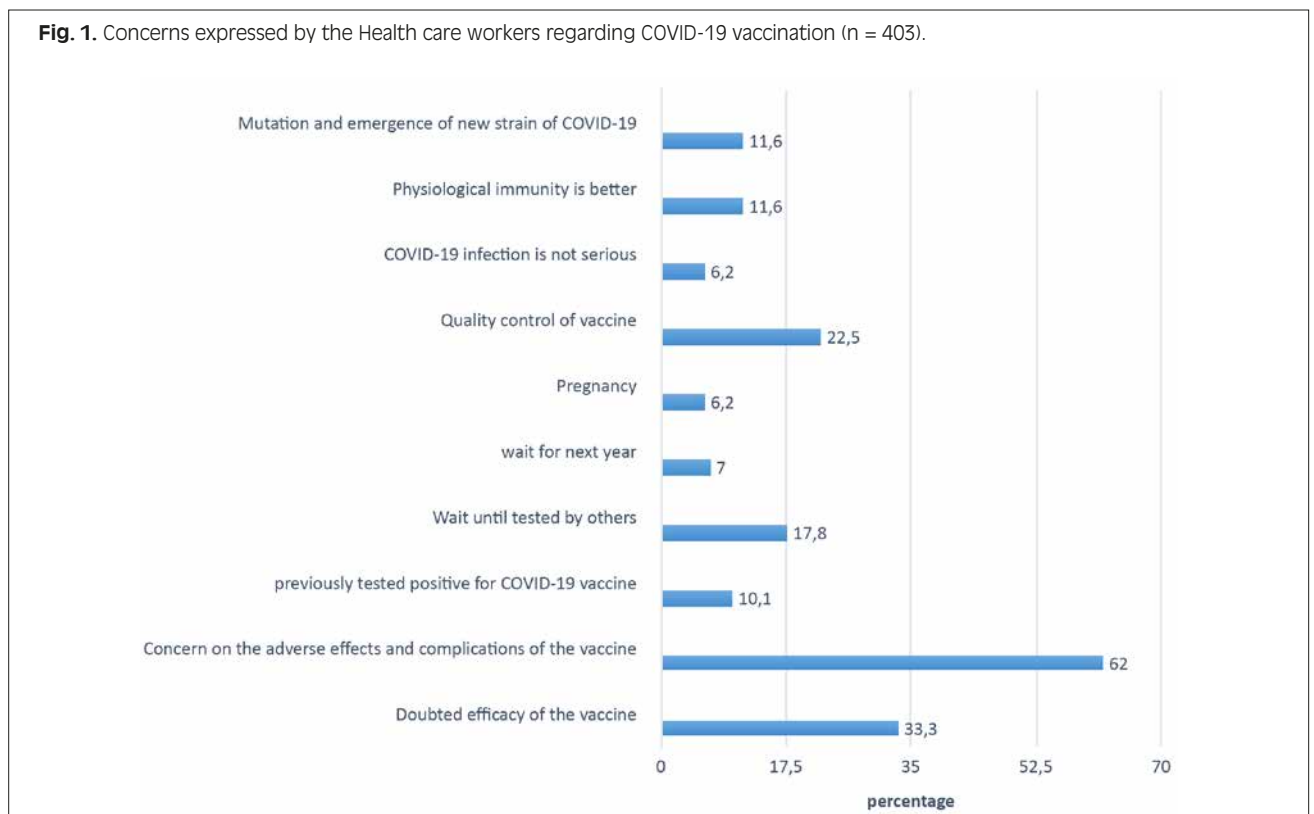
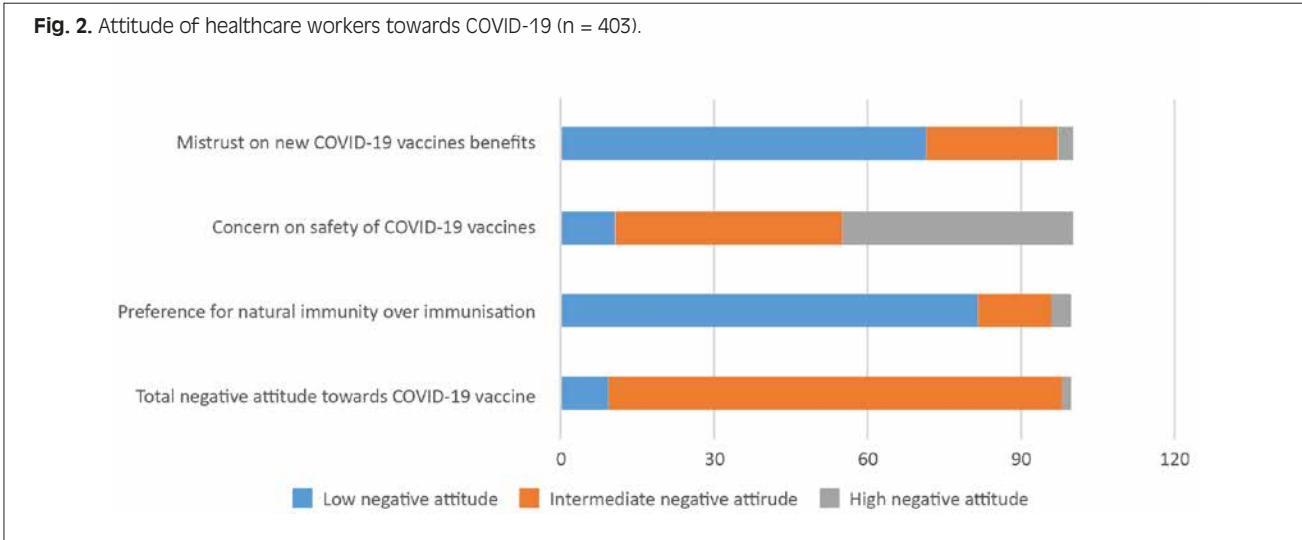


Fig. 2. Attitude of healthcare workers towards COVID-19 (n = 403).

PREDICTORS OF WILLINGNESS OF THE HEALTHCARE WORKERS TO VACCINATE AGAINST COVID-19

Since the majority of the participants expressed an acceptance for COVID-19 vaccine, binomial regression was performed between those who definitely accept vaccine immediately and delay the uptake the vaccine to determine the predictive factors of COVID-19 vaccination acceptance. The comparison of the baseline characteristics of the two groups of vaccine acceptance was done using chi-square test.

Binary logistic regression analyses showed that as the age increases, significantly higher proportion of participants expressed a definite intention to vaccinate. Those who are educated diploma showed a lower vaccine acceptance (2.23%) whereas 4.72% were hesitant, with people with lower levels of education more likely to be unwilling. Those who had children less than 18 years expressed an increased intention to get vaccinated (30%); however the association was not found significant in the logistic analysis. Those healthcare workers who perceived an increased risk of COVID-19 infection shown a definite intention to get vaccinated (38.96%) while only 26% were delay the vaccine, the binary logistic analysis revealed that perceived risk for COVID-19 infection (aOR = 0.540, 95% CI 0.357-.817) and those who had trust on the government in addressing this pandemic (aOR = 0.582, 95% CI 0.343-.805) were strong significant association of having definite intention to vaccinated against COVID-19. Participants who had refused any of the recommended vaccine previously shown a strong correlation with denial or delaying the vaccine for COVID-19 (50.12%, aOR = 4.026, 95% CI 1.880-4.959).

Table III shows, in binary logic regression analysis, perceived susceptibility of COVID-19 infection for self and family, those who perceived that this pandemic will severely affects the daily life if not contained effectively, and worrying about the severity of the infection were showing a significant association with the vaccine acceptance. Perceived benefits of the vaccination

against COVID-19 and more cues to action through appropriate communication strategies were found to be significant predictive factors for the adequate coverage of the vaccination program; whilst perceived concern on the efficacy of the vaccine is a negative factor associated with the acceptance. Mistrust on the benefits of the COVID-19 vaccination is found to be a significant predictor for the vaccine hesitancy among the health care workers.

Discussion

Vaccination is considered as a greatest public health achievement of the mankind, since the vaccines and immunization programs had resulted in the prevention and control of many life-threatening epidemics. However, many are reluctant or refuse recommended vaccination or delay some vaccines, because of the concerns about the vaccine safety and its regulations. So vaccine hesitancy is an unacceptable behavior caused by lack of confidence or trust in vaccines or provider, lack of perceived benefits or the need for vaccination, and inconvenience or unavailability (affordability) of vaccines [30]. So the next hurdle in the containment of the present COVID-19 pandemic is the adequate coverage of the vaccination, only by which we could substantially reduce the morbidity and mortality rates and thereby decreases the strain on the health care system and economy of the nation.

This study assessing intention to get vaccinated against COVID-19 among health care workers in Chandigarh, majority (54.6%) respondents reported they will definitely accept the vaccine against COVID-19 immediately although 45% expressed a vaccine hesitant behavior. This result of the study is especially striking as there is no reduction in the mortality and morbidity associated with the COVID-19 as in the initial stages, the acceptance rate for COVID-19 vaccine among health care workers in the present study is far lower than the

Tab. III. Binary Logic regression of factors associated with intention to vaccinate against COVID-19 (n = 403).

Variables	Intention to vaccinate against COVID-19		Chi square	p	aOR	SE	Sig	95% CI	
	Definitely Yes	No						Lower	Upper
Age groups									
20-27	75 (18.61)	72 (17.86)	12.694**	0.005	0.480	0.390	0.060	.223	1.031
28-35	111 (27.54)	79 (19.60)			0.356**	0.383	0.007	.168	0.754
36-42	22 (5.46)	8 (1.96)			0.182**	0.544	0.002	0.063	0.528
> 43	12 (2.98)	24 (5.96)			Reference				
Gender									
Female	145 (35.98)	75 (18.61)	1.800	0.180	1.339	0.218	0.180	0.874	2.051
Male	132 (32.75)	51 (12.66)			Reference				
Marital status									
Unmarried	78 (19.35)	72 (17.87)	0.647	0.421	0.910	0.424	0.824	0.397	2.088
Married	142 (35.23)	111 (27.54)							
Educational attainment									
High school/Diploma	9 (2.23)	19 (4.72)	11.096**	0.004	8.611	0.600***	<0.001	2.658	27.893
Degree/equivalent	147 (36.48)	131 (32.50)			1.591	0.407	0.722	0.520	2.570
Post-graduation and above	64 (15.88)	33 (8.2)			Reference				
Having children									
Yes	121 (30)	81 (20.1)	4.607*	0.032	1.156	0.407	0.722	0.520	2.570
No	99 (24.57)	102 (25.31)			Reference				
Self-perception, at risk of severe illness from COVID-19									
Yes	157 (38.96)	105 (26)	8.592**	0.003	0.540**	0.211	0.004	0.357	0.817
No	63 (15.63)	78 (19.35)			Reference				
Have you or anyone in the family got sick with COVID-19 since the start of pandemic									
Yes	30 (7.44)	190 (47.15)	1.137	0.286	0.748	0.433	0.530	0.320	1.748
No	32 (7.94)	151 (37.47)			Reference				
Job nature of exposure to COVID-19 sick patients while at work.									
Direct interaction with verified sick patients	106 (26.30)	81 (20)	6.764	0.149	1.064	0.504	0.903	0.396	2.859
Direct interaction with non-verified patients	54 (13.40)	32 (7.94)			0.796	0.580	0.694	0.255	2.480
No direct interactions	12 (2.98)	17 (4.22)			1.620	0.691	0.485	0.418	6.279
No known interactions with COVID-19 patients	27 (6.7)	29 (7.2)			2.105	0.646	0.250	0.593	7.474
Students	21 (5.21)	25 (6.20)			Reference				
Trust on the Government in addressing unexpected health threats to our nation, including COVID-19 epidemic									
Yes	162 (40.20)	110 (27.30)	8.332**	0.004	0.582**	0.217	0.003	0.343	0.805
No	58 (14.40)	73 (18.11)			Reference				
Perceived overall health									
Good	193 (47.89)	27 (6.7)	14.588	0.106	0.636	0.281	0.108	0.366	1.104
Poor	150 (37.22)	33 (8.2)			Reference				
Refused a recommended vaccine in the past									
Yes	18 (4.47)	202 (50.12)	7.958**	0.005	4.026**	0.477	0.004	1.880	4.959
No	32 (7.94)	151 (37.47)			Reference				
Preference for COVID-19 vaccine									
Domestic	81 (20)	139 (34.5)	1.981	0.159	1.293	0.361	0.476	0.637	2.625
Foreign-made	80 (19.85)	103 (25.55)			Reference				
Confidence in domestically made vaccine									
Confident	69 (17.12)	76 (18.86)	4.483*	0.034	1.555	0.210*	0.035	1.031	2.345
Not confident	151 (37.47)	107 (26.55)							
Confidence in foreign-made vaccine									
Confident	9 (2.23)	211 (52.36)	3.007	0.083	2.095	0.436	0.090	0.891	4.929
Not confident	15 (3.72)	168 (41.69)							



Variables	Intention to vaccinate against COVID-19		Chi square	p	aOR	SE	Sig	95% CI	
	Definitely Yes	No						Lower	Upper
Health beliefs regarding COVID-19 infection and vaccines									
Perceived susceptibility									
Chance of getting COVID-19 for me and my family is still high									
Strongly agree/agree	193 (47.89)	140 (34.74)	8.769**	0.003	0.511*	0.335	0.046	0.265	0.987
Strongly disagree/disagree	27 (6.7)	43 (10.67)			Reference				
Worry about the likelihood of getting COVID-19									
Strongly agree/agree	187 (46.40)	146 (36.23)	1.896	0.169	1.186	0.344	6.19	0.389	2.630
Strongly disagree/disagree	33 (8.2)	37 (9.2)			Reference				
COVID-19 pandemic had a severe impact on daily life									
Strongly agree/agree	208 (51.62)	157 (38.95)	8.962**	0.003	0.341*	0.450	0.017	0.072	0.858
Strongly disagree/disagree	12 (2.98)	26 (6.45)			Reference				
Perceived severity									
Complications from COVID-19 are serious									
Strongly agree/agree	199 (49.38)	161 (40)	0.643	0.423	1.417	0.382	0.362	0.385	3.049
Strongly disagree/disagree	21 (5.21)	22 (5.46)			Reference				
I will be very sick if I get COVID-19									
Strongly agree/agree	136 (33.75)	89 (22)	7.042**	0.008	0.551*	0.243	0.014	0.196	0.704
Strongly disagree/disagree	84 (20.84)	94 (23.33)			Reference				
Perceived benefits									
Vaccination is a good idea because it makes me feel less worried about catching COVID-19									
Strongly agree/agree	205 (50.87)	159 (39.45)	4.531*	0.033	0.757	0.470	0.555	0.383	2.063
Strongly disagree/disagree	15 (3.72)	24 (6)			Reference				
Vaccination decreases my chance of getting COVID-19 or its complications									
Strongly agree/agree	193 (48)	145 (36)	5.326**	0.021	0.638	0.341	0.187	0.383	2.063
Strongly disagree/disagree	27 (6.7)	38 (9.42)			Reference				
Perceived barriers									
Worry the possible side effects of COVID-19 vaccination would interfere with my usual activities									
Strongly agree/agree	147 (36.48)	131 (32.50)	1.061	0.303	1.276	0.259	0.347	0.752	2.933
Strongly disagree/disagree	73 (18.11)	52 (12.90)			Reference				
Concern about the efficacy of the COVID-19 vaccination									
Strongly agree/agree	193 (48)	171 (42.43)	3.733	0.063	3.979*	0.702	0.049	1.109	26.55
Strongly disagree/disagree	27 (6.7)	12 (2.98)			Reference				
Concern about the safety of the COVID-19 vaccination									
Strongly agree/agree	199 (49.38)	169 (41.94)	0.452	0.501	0.397	0.734	0.209	0.089	2.828
Strongly disagree/disagree	21 (5.21)	14 (3.47)			Reference				
Cues to action									
I will only take the COVID-19 Vaccine if I was given adequate information about it									
Strongly agree/agree	211 (52.36)	168 (42)	3.007	0.094	2.661*	0.295	0.05	0.077	1.026
Strongly disagree/disagree	9 (2.23)	15 (3.72)							
I will only take the COVID-19 Vaccine if the vaccine is taken by many in the public and found effective.									
Strongly agree/agree	159 (39.5)	150 (37.22)	5.256	0.022	3.488***	0.747	0.001	1.389	5.747
Strongly disagree/disagree	61 (15.14)	33 (9)							



Variables	Intention to vaccinate against COVID-19		Chi square	p	aOR	SE	Sig	95% CI	
	Definitely Yes	No						Lower	Upper
Attitude towards COVID-19 vaccines									
Mistrust on benefits of COVID-19 vaccines									
Low negative attitude	188 (46.65)	26 (6.5)	45.159	<0.001	5.205	0.263	<0.001	3.106	8.723
Intermediate negative attitude	100 (24.8)	77 (19)			1.614	0.813	0.556	0.328	7.937
High negative attitude	6 (1.5)	6 (1.5)			Reference				
Safety concerns on COVID-19 vaccines									
Low negative attitude	24 (5.95)	100 (24.8)	0.354	0.838	0.726	0.533	0.541	0.256	2.064
Intermediate negative attitude	100 (24.8)	809 (19.85)			0.685	0.548	0.490	0.234	2.005
High negative attitude	96 (23.82)	180 (44.66)			Reference				
Preference for natural immunity									
Low negative attitude	188 (46.65)	141 (35)	6.412	0.041	1.376	0.311	0.305	0.748	2.534
Intermediate negative immunity	27 (6.7)	30 (7.44)			2.685	0.593	0.096	0.840	8.588
High negative attitude	5 (1.21)	12 (3)			Reference				

result of the study conducted during first epidemic curve in France [31]. But the findings of the national survey in China, Malaysia and United States, the definite intention to get vaccinated against COVID-19 among the general public was found only 54.8%, 48.2% and 57% respectively [32-34]. But the vaccine hesitancy among the health care workers in the present study is considerably worrying as this will threaten the adequate coverage, and could negatively impact the vaccination compliance among the general public. Among the healthcare workers the vaccine acceptance rates among the nurses for the influenza vaccines were often found less than other health workers, this is a concern as they had more and longer contacts with the patients in providing care, and were the most affected by SARS-CoV-2 among health care workers worldwide [27]. The adherence to the preventive measures and willingness to uptake COVID-19 vaccines may change according to the severity of the ongoing pandemic in terms of morbidity and mortality rates.

Since the vaccination is the only effective means to contain this pandemic, increasing vaccination rates confers a substantial achievement of expected benefits. The defined COVID -19 herd immunity can be achieved only when we reach a vaccination coverage of 70% in best-case scenario with efficient vaccine, using a pooled estimate of the R_0 of 3.32 [35, 36]. So a planned and coordinated programs should be organized at the earliest, in order to motivate a larger population to be vaccinated, otherwise those who are unsure about or resistant to being vaccinated will create a substantial gap in the number needed to be vaccinated to achieve herd immunity. The most significant concerns expressed by the responders regarding the novel COVID-19 vaccination program was the vaccines safety, the most frequently noted safety concerns were the efficacy, quality control and the occurrence of COVID-19 infection with the newly developed vaccine, consistent with studies on other

vaccines [27, 37, 38]. Similarly in a survey the study participants expressed an acceptance of the vaccine if they receive adequate assurance about the safety of the vaccine, since the vaccine was manufactured in an unprecedented speed and the production of a large quantity of the vaccines in order to protect the entire global community makes them concern about the effective vaccine approach in clinical trials [39]. Hence these findings suggest that the vaccine safety should be addressed effectively through appropriate strategic communication to promote the COVID-19 vaccine compliance rates in the entire population.

In the study we observed that intention to get vaccinated against COVID-19 exceed the influenza vaccine rates in the previous season, but the health care workers are accepting COVID-19 vaccine irrespective of the previous influenza vaccination behavior, similar findings was found in a study among general population in US [34].

In this study, self-perception of increased susceptibility of COVID-19 infection for self and family and those who perceived COVID-19 pandemic if still persist will affect their daily life were significantly found associated with COVID-19 vaccine acceptance. So the perceived susceptibility to and seriousness of the COVID-19 are recognized as a significant predictors of vaccine acceptance, similarly in France where health care staff involved in the care of COVID-19 patients and those individuals who perceived at risk of severe diseases were reported a higher chance of acquiescence of vaccination against COVID-19 [31, 38]. But a concern on the efficacy of the new COVID-19 vaccine may contribute to the low vaccine acceptance, so everyone probably needed a highly effective COVID-19 vaccine, however due to the fast generation of the vaccine, inadequate clinical trial, have limited effectiveness, which could lead to mistrust. Doubtful safety, efficacy and effectiveness about COVID-19 were the main perceived barriers among the health care workers to uptake COVID-19 vaccine [38-40].

The study participants expressed a high confidence in the foreign made/imported COVID-19 vaccine and a higher preference was given to the foreign made COVID-19 vaccines. As the efficacy for prevention of COVID-19 after administration of 2 doses of Pfizer BNT162b2 was found 95% in the phase 3 clinical trial, so majority developed a trust in that vaccine [41].

The perceived benefits of obtaining a vaccination against COVID-19 was also found significantly found associated with definite intention for COVID-19 vaccination, however no predictive effects were not identified. External cues to action were found to be significant in the intention for getting vaccinated immediately, imparting adequate information through effective communication strategies and provision of transparent evidence of safety and efficacy of the vaccine from field trials will definitely improve the coverage of vaccination. In this study 75% reported they would more likely to accept the vaccine when the vaccine is taken by many in the public. So these findings imply that advertorials and testimonials of healthcare workers and significant persons in the society may serve as a cues to action to get adequate coverage for the vaccination.

Healthcare workers plays a key role in the vaccination behavior of the general public through the consultation, role modelling and providers of substantial information, that are contributing the decision to be vaccinated or not. Therefore, the low intention to inoculate COVID-19 vaccine among the participants is significantly threatening, should be addressed immediately through effective communication strategies to solve the concerns and to improve the awareness, thereby we can ensure an adequate coverage among the population.

In this study the researchers specifically assessed the factors that predict the uncertainty or unwillingness to get vaccinated against COVID-19, so that specific interventions could be programmed among the target groups at the earliest. In this study the uncertain group consist of 38% which was a larger than the unwilling group (8%). This echoes findings from the national surveys in European and UK studies among the general public, so there is no significant difference found between the healthcare workers and general population [38, 42]. Notably, our research identified certain factors predict the unwillingness and uncertainty such as the age group 28-43, lower educational status, lack of trust on the government in addressing the pandemic, refusal of a recommended vaccine in the past. In this study gender was not regarded as a contributing factor for the vaccine hesitancy, but males were more likely to accept the Vaccine in Israel [27]. Having younger children indicated a negative association with accepting the COVID-19 vaccine.

So this means that appropriate public health campaign should be initiated to increasing the COVID-19 vaccine uptake, mainly focusing on the education and increasing trust on the efficacy and safety of the vaccination. Thus motivational communication campaigns targeted towards population at risk of vaccine hesitancy need to be urgently developed to combat mistrust in the vaccination and to improve the inoculation rates.

Limitations

Though we followed strict protocols to ensure the validity of the responses, the credibility of an online survey needs to be considered. In this study majority of the respondents were nurses, so the results could not be generalized to the other categories like hospital and sanitary assistants. Reaching to the large participants of different categories through social media and over a short period is difficult and the study was a cross-sectional in nature, so limiting inference for long term. In fact the sample in the study was not a representative nor certain specific sub groups within the population of health care workers. So a future intervention programs and its effectiveness should be addressed at the earliest on a priority basis. Compliance with second dose of vaccine needed to be addressed, many well-intentioned individual may be influenced by several factors and behaviors that prevent the recommended second stage.

Conclusion

The low COVID-19 vaccination acceptance rates among the healthcare workers is a concern, this should be addressed immediately without any fail as this could threaten the adequate coverage of the vaccination among the general public too. When the communication inadequate, it can negatively influence the vaccination uptake, results in vaccine hesitancy. So developing a trust among the population through appropriate communication strategies are beneficial to decrease the decreased inoculation rates.

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Conflict of interest statement

Authors declare no competing interests.

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Authors' contributions

SJ, MCC and MD developed the research concepts and design; SJ and MCC collected data and analysed. MD and SJ involved in the interpretation of results and drafting manuscript. JJ overall supervision of the research and manuscript reviewing. All authors reviewed and approved the final manuscript.

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