COVID-19 vaccine acceptability, determinants of potential vaccination, and hesitancy in public: A call for effective health communication

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Abstract:

BACKGROUND: Coronavirus disease rapidly spreads across the entire world in < 2 months and gravely jeopardizes the regular human routine. The medical fraternity recommends a vaccine as one of the best solutions to save the universe. However, to be effective, the population should reflect an encouraging attitude to accept it. The study aimed to measure vaccine acceptability and reason for hesitancy among the public.

MATERIALS AND METHODS: Eight hundred and forty one adults visiting a tertiary care hospital responded to a pretested validated questionnaire on vaccine acceptability and hesitancy. The Chi-square test and independent t-test, followed by multinomial logistic regression, were used to analyze the findings.

RESULTS: Overall, 53.4% ($n = 445$) of participants interested to take vaccine, 27.2% ($n = 229$) were not sure, and the remaining 19.4% ($n = 163$) did not intent to vaccinate. Gender ($P = 0.013$), information on the vaccine ($P = 0.022$), chances to get coronavirus disease in the next 6 months ($P < 0.001$), awareness on India COVID-19 vaccine ($P < 0.001$), Indian manufacturing company of vaccine ($P < 0.001$), family history of the laboratory-confirmed case ($P < 0.001$), and health status ($P = 0.011$) found a significant association with intention to vaccination (a response "yes" vs. "no" and "not sure"). Reasons for vaccine hesitancy included specific antivaccine attitudes and beliefs, a concern of fear and phobia, lack of information, and safety issues on the vaccine.

CONCLUSIONS: This institute-specific survey revealed that approximately every 4 in 8 people were not sure to take the vaccine, and one in five people refused to be vaccinated. The study recommends using target-based health education to understand and address vaccine-specific concerns to enhance vaccine coverage, and boost confidence among the population.

Keywords:

Adult, coronavirus, COVID-19 vaccines, intention, vaccination, vaccine

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Introduction

The severe acute respiratory syndrome coronavirus-2 pandemic has rapidly spread across the globe and taken hundreds to thousands of lives and left millions of infected populations untreated.[1,2] While most of the nations are struggling to win the race against the invisible enemy, India (as of February 19, 2021, 08:00 GMT + 5:30) crossed a death toll of 156,111 and 10.7 million infected cases (https://www.mohfw.gov.in). While the country is facing severe economic crises and downfalls and the future is uncertain, a vaccine to prevent the further spread of COVID-19 shows the rays of hope to the medical fraternity.[3]

India is currently facing a critical situation to handle such a large and scattered infected population. To add to the worries, social media, electronic handles, and news channels are irresponsibly spreading

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myths and misinformation about coronavirus, creating panic and unrest in the population.[4] Therefore, the government agencies and medical fraternities must start working on the ground level to spread practical information and strategies before the actual vaccination drive begins. However, it is no surprise that research still keeps on exploring many new symptoms and treatment lines for the virus.[5-7]

India already struggled with reaching a high rate of all due vaccines – with 61% infant vaccinated in 2009.[8,9] Understandably, successful execution of vaccination programs, ensuring a high level of vaccine coverage, is a challenging task. Likewise, earlier research mentioned numerous causes for vaccine hesitancy, including sociodemographic factors, trust (or mistrust) in government organizations and policies, biomedical science, and health literacy.[3,4,10]

Health communication can play a pivotal role in educating the masses on the vaccine's need and safety.[1] A high acceptance, confidence in the population, and an extensive coverage rate are vital to make the vaccination drive successful.[1,11] Vaccine played a crucial role in preventing and eradicating many viral illnesses in the past century.[12] Apart from providing natural immunity to an individual, a vaccine will reduce infection chances through herd immunity if enough portion of the population is immune to the disease.[13]

Many big pharmaceutical groups and researchers are working day and night to develop an effective vaccine to control COVID-19 and are in a different phase of the trial to use.[14,15] Sceptical attitude and vaccine hesitancy may be a forefront challenge to widespread vaccination coverage and use.[12] The success of the COVID-19 vaccination drive will depend on willingness and confidence to accept the vaccines. The fundamental breakdown in public confidence and acceptability still dilutes the effort of health care agencies. Therefore, it is critical to understand the population's intent to potential vaccination and perceived causes of vaccine hesitancy to accomplish a mass vaccination campaign. The purpose of this study is to describe the current acceptance of the COVID-19 vaccine among Indian nationals with the aims to (1) explore the determinants of potential vaccination and (2) identify perceived causes of vaccine hesitancy.

Materials and Methods

Study design and setting
This cross-sectional survey was conducted at All India Institute of Medical Sciences (AIIMS), Rishikesh, Uttarakhand, North India.

Study participants and sampling
A sample of 841 eligible adults aged more than 18 years visiting hospitals for seeking medical advice and their family members participated in the survey. The survey questionnaire was distributed to 5000 eligible samples and filled by 841 participants with a response rate of 16.82%. The sample size was calculated by considering the daily census of patients attending the outpatient department with a duration of 2 months using the following formula: (DEFF × Np [1 − p])/([d2/Z2 1−α/2] × [N − 1] +p × [1 − p]): = 362 for the final study; however, it was decided to cover a large sample size for accurate representation and possible generalization of the findings. The final sample size analyzed in the study was 841.

Data collection tool and technique
The survey questionnaire and consent form were designed in bilingual language (English and Hindi) to use. The details of the questionnaires used in the study are as follows:

Sociodemographic sheet
This sheet is used to collect information on age, gender, education, occupation, religion, residence, monthly family income (INR), family size, and family history of laboratory-confirmed COVID-19 self-rated health status. Information regarding COVID-19 and vaccine consisted of awareness and information of the vaccine, awareness of the Indian COVID-19 vaccine pharmaceutical company, and chances to get coronavirus vaccine in the next 6 months. The profile sheet sought validation from physicians in critical care medicine, family medicine, microbiology, and nursing and was pretested in an eligible population before final use.

Vaccine hesitancy measure
Intent to vaccination for coronavirus disease was assessed using a single question, "are you ready to receive coronavirus vaccine?" followed by the response options "yes," "no," and "not sure." Further, a subsequent question was asked in case of "no" or "not sure" response, "what makes you decide not to receive the vaccine?" or "what makes you unsure (not sure) to receive the vaccine." A list of 16 responses based on earlier research was asked to explore the hesitancy factors toward the COVID-19 vaccine.[1,11,12] The questions were "God help and save his people," "I never had a vaccine in the past for any disease, so I don't need this one also," "I don't believe taking a vaccine," "no vaccine can cure the viral problem," "I may fall sick after taking a vaccine for the disease," "I had a terrible experience with a vaccine," "I need more information on the vaccine," "I need a doctor consultation before taking the vaccine," "I am phobic to injection," "I am not aware of the ingredients of vaccine they are putting in my body," "vaccine is not effective for a mutating virus," and "I don't want to take vaccine first." Further, to assess the perceived fear or risk of infection to coronavirus in future, we explored,

what is your opinion to get coronavirus infection in the coming 6 months? Response options were "I don't think I will get coronavirus infection," "I think a mild infection will attack me," "I think I had been infected with the COVID-19 virus and recovered by now," and "I think a severe infection of coronavirus will hit me." For the analysis purpose, these 16 factors were grouped under six themes for analysis reason of vaccine hesitancy including, lack of information (1), not in risk group (1), new vaccine (1), a concern of fear and phobia (3), antivaccine attitude and belief (7), and concern about safety (3) [Supplementary File 1]. The questionnaire was translated into the Hindi language and pretested among the eligible population before using it for final use.

Ethical consideration

The ethical committee of the institute approved the project (AIIMS/IEC/21/64). The participants were ensured for privacy and confidentiality during each phase of research and informed for voluntary participation. However, no personal information was asked by the participants.

Statistical analysis

Data were transferred to a Microsoft Excel sheet and analyzed using descriptive and inferential statistics as appropriate. Frequencies and percentages are used to describe the characteristics of subjects. The Chi-square test and independent-sample *t*-test were used to analyze the unadjusted association of three categories outcome intent to potential vaccination with participants' characteristics. Multinomial logistic regression analysis was used to estimate the adjusted association of sociodemographic characteristics with potential vaccination: "yes," "no," and "not sure." This analysis measures different associations with covariates with two outputs and provides an overall *P* value for the covariates. The binominal logistic regression model's coefficient is presented in the form of an odds ratio (ORs) with a 95% confidence interval (CI). The participants' characteristics that did not show significant association (*P* > 0.05) with intent to be vaccinated were excluded in the multinomial modeling. Characteristics that show significant association with intent to be vaccinated were included in the subsequent analysis model (for example, gender, information on the vaccine, manufacturing pharmaceutical company in India, and family history of laboratory-confirmed COVID-19), chances to get coronavirus infection in the next 6 months and health status. Cox and Snell and Nagelkerke statistics were separately used to measure model performance for nominal regression for intent to be vaccinated; "yes" vs. "no" and "not sure." All analyses were completed using IBM SPSS Statistics for Window, Version 23.0, NY: IBM Corp.[16] *P* < 0.05 was considered significant for testing all statistical tests. (two-sided).

Results

The survey questionnaire was distributed to 5000 population visiting a tertiary care center and 859 (17.18) responded. Eighteen participant's questionnaires were found incomplete on data scrutiny and excluded from the final analysis. All the results analyzed in the paper were based on 841 participants who responded to the questionnaire and found it complete for analysis.

Of the participants, 51.5% were men and 48.5% were women with a mean age of 34.02 (±12.68) years. Approximately two-third of the participants (66.2%) were married and belonged to the Hindu community (80.3%). Approximately half (49.4%) of the participants reported being in very good health status [Table 1].

In terms of education, 36.5% of participants studied up to graduation, followed by 27.8% who completed primary schooling. About 43.2% worked in private jobs, 20.2% were in government jobs, and 42.8% had a monthly salary <10,000 INR. A greater number of participants (49.2%) belonged to the rural community [Table 1]. A large number of participants (42.1%) denied the risk of coronavirus infection in the coming days. Only 21.4% predicted a milder infection and 15.9% predicted an attack of severe coronavirus infection [Table 2].

Overall, 53.4% of people wanted to be vaccinated. About 27.2% were not sure and 19.4% did not intend to be vaccinated against COVID-19. Participant's characteristics found to be associated with intent to be vaccinated with a response of "yes" versus "no" and "not sure" were gender (*P* = 0.013), information on COVID-19 vaccine (*P* = 0.022), family history of laboratory-confirmed COVID-19 case (*P* < 0.001), prediction of getting coronavirus infection in the next 6 months (*P* < 0.001), awareness of Indian vaccine (*P* < 0.001), and manufacturing by an Indian pharmaceutical company (*P* < 0.001) and health status (*P* = 0.011) [Table 2]. In addition to these differences, participants who responded more to "no" were more likely to belong to lower family monthly income and rural background. Likewise, participants who did not intend to be vaccinated were more likely to be highly educated, have more information about vaccines, and work in private jobs. Further, a proportion of the younger population and females were most likely not to intend to be vaccinated against COVID-19. Similarly, people with more information about vaccines were found not intent to be vaccinated against coronavirus but did not reach a statistical significance level for both response cargoes (yes vs. no and yes vs. not sure) [Table 3].

Of the participants, 392 (46.6%) were "not sure" or did not intend to be vaccinated against coronavirus

Table 1: Participants' characteristics (*n*=841)

Characteristics	F (%)/mean±SD (range)
Age (years), mean±SD	34.03±12.68
Gender	
Male	433 (51.5)
Female	408 (48.5)
Marital status	
Unmarried	255 (30.3)
Married	557 (66.2)
Others#	29 (3.4)
Occupation	
Government	170 (20.2)
Private	363 (43.2)
Self-employed	308 (36.6)
Educational status	
Informal	94 (11.2)
Up to 5th standard	234 (27.8)
Up to secondary education	206 (24.5)
Graduate and above$	307 (36.5)
Monthly family income (INR)	
<10,000	360 (42.8)
10,001-20,000	276 (32.8)
>20,001	205 (24.4)
Religion	
Hindu	675 (80.3)
Muslim	131 (15.6)
Sikh	19 (2.3)
Christian	16 (1.9)
Residence	
Urban	345 (41.0)
Rural	414 (49.2)
Semi-urban	82 (9.8)
Family size, mean±SD	5.29±2.16
Family history of laboratory-confirmed COVID-19	
Yes	160 (19.0)
No	681 (81.0)
Self-related health status	
Very good	412 (49.0)
Good	348 (41.4)
Bad	81 (9.6)

$Frequency of postgraduate and professional education are presented under the category of graduation, #Widow, divorced, and separated. SD=Standard deviation

Table 2: Vaccine-related characteristics of the participants (*n*=841)

Characteristics	F (%)
Information about the COVID-19 vaccine	
Yes	798 (94.9)
No	43 (5.1)
Source of COVID-19 vaccine's information	
Books/newspaper/institutional lectures	228 (17.5)
Internet/social media	447 (34.3)
Television/radio	412 (31.6)
Friends/family members/neighbor	215 (16.5)
Information on Indian vaccineǀ	
Yes	564 (67.1)
No	277 (32.9)
Information on Indian manufacturing pharmaceutical vaccine companyǀ	
Yes	548 (65.2)
No	293 (34.9)
Chance to get coronavirus disease in the next 6 months	
I feel that I am already got coronavirus disease	173 (20.6)
I feel I will never get a coronavirus infection	354 (42.1)
I may get a mild infection of coronavirus	180 (21.4)
I will be severely affected by coronavirus disease	134 (15.9)
COVID-19 vaccine should be free like other vaccines	
Yes	723 (86.1)
No	117 (13.9)
Intent to vaccinated against COVID-19	
Yes	449 (53.4)
No	163 (19.4)
Not sure	229 (27.2)

ǀData under the "No" category represents "no" and "do not know"

sick after taking vaccine) and concerns (vaccine newness and I do not want vaccine first of all) and worst experience with the vaccine in life [Figure 1 and Supplementary File 1]. The government and public health officials need to address these concerns to win the public's confidence to make the vaccination campaign successful.

Factors that show significant association with vaccine hesitancy (responses yes vs. no and not sure) were included in the multinomial model to quantify association strength. The findings show that male participants have a higher chance of not intent to vaccinate than females (OR- 0.597, 95% CI 0.415–0.858, $P < 0.05$). Further, the population with information on the vaccine has a five times higher likelihood of not intent to vaccinate (OR: 4.546, 95% CI: 1.062–19.44, $P < 0.05$). Population predicted mild chances of getting corona infection in the future were associated with a more than fourfold higher chances (OR: 4.028, 95% CI: 2.351–6.901, $P < 0.05$) of not sure for vaccination to population predicted a severe attack of COVID-19 in the next 6 months. Further, the population who had stated to have coronavirus infection had lower chances of intent to vaccine compared to participants predicted to get a severe coronavirus infection attack in future (OR 1.955, 95% CI 0.856 – 2.269,

disease and gave a specific reason for their hesitancy. A list of vaccine hesitancy reasons was provided to the participants to identify the best specific reason for their vaccine hesitancy. The most common reason cited by the participants who were either do not intend to vaccinate or not sure whether they will be vaccinated included antivaccine attitude and belief, followed by a concern of fear or phobia to take the vaccine, safety issues, and lack of information on the vaccine [Figure 1].

More number of participants concern for being unsure or not intending to vaccinated included specific antivaccine belief (a sick person does not need a vaccine and falling

Table 3: Association of intention to be vaccinated against COVID-19 (*n*=841)

Characteristics	Intention to vaccination			P
	Yes (*n*=449), *n* (%)	No (*n*=163), *n* (%)	Not sure (*n*=229), *n* (%)	
Age (years), mean±SD	34.39±13.08	32.83±10.50	34.18±13.11	0.394
Gender				
Male	242 (53.9)	67 (41.1)	124 (54.1)	0.013*
Female	207 (46.1)	96 (58.9)	105 (45.9)	
Marital status				
Unmarried	127 (28.3)	53 (32.5)	75 (32.8)	0.205
Married	302 (67.3)	104 (63.8)	151 (65.9)	
Others#	20 (4.5)	6 (3.7)	3 (1.3)	
Occupation				
Government	90 (20.0)	30 (18.4)	50 (21.8)	0.928
Private	193 (43.0)	74 (45.4)	96 (41.9)	
Self-employed	166 (37.0)	59 (36.2)	83 (36.2)	
Educational status				
Informal	45 (10.0)	27 (16.6)	22 (9.6)	0.060
Up to 5th standard	126 (28.1)	46 (28.2)	62 (27.1)	
Up to secondary education	125 (27.8)	31 (19.0)	50 (21.8)	
Graduate and above	153 (34.0)	59 (36.2)	95 (41.4)	
Monthly family income (INR)				
<10,000	190 (42.3)	71 (43.6)	99 (43.2)	0.262
10,001-20,000	154 (34.3)	58 (35.6)	64 (27.9)	
>20,001	105 (23.4)	34 (20.9)	66 (28.8)	
Family size	5.20±2.21	5.63±2.44	5.23±1.60	0.074
Residence				
Urban	187 (41.6)	62 (38.0)	96 (41.9)	0.171
Rural	210 (46.8)	91 (55.8)	113 (49.3)	
Semi-urban	52 (11.6)	10 (6.1)	20 (8.7)	
Information about the COVID-19 vaccine				
Yes	425 (94.7)	161 (98.8)	212 (92.6)	0.022*
No	24 (5.3)	2 (1.2)	17 (7.4)	
What is your chance to get coronavirus disease in the next 6 months?				
I feel that I have already got coronavirus disease	112 (24.9)	29 (17.8)	32 (14.0)	<0.001*
I feel I will never get a coronavirus infection	205 (45.7)	74 (45.4)	75 (32.8)	
I may get a mild infection of coronavirus	79 (17.6)	40 (24.5)	61 (26.6)	
I will be severely affected by coronavirus disease	53 (11.8)	20 (12.3)	61 (26.6)	
Information on Indian vaccine$				
Yes	306 (68.1)	69 (15.4)	147 (64.2)	<0.001*
No	185 (84.6)	52 (31.9)	82 (35.8)	
Information on Indian manufacturing pharmaceutical vaccine company$				
Yes	312 (69.35)	93 (57.1)	143 (62.4)	<0.001*
No	137 (30.50	70 (42.9)	86 (37.5)	
Family history of laboratory-confirmed COVID-19				
Yes	365 (81.3)	116 (71.2)	200 (87.3)	<0.001*
No	84 (18.7)	47 (28.8)	29 (12.7)	
Self-reported health status				
Very good	244 (54.3)	72 (44.2)	96 (41.9)	0.011*
Good	169 (37.6)	76 (46.6)	103 (45.0)	
Bad	36 (8.0)	15 (9.2)	30 (13.1)	

*P<0.05, $Data under the "No" category represents "no" and "do not know"; NA-Chi-square not applicable; Religion cross-tab does not fulfill the Chi-square criteria. SD=Standard deviation, NA=Not available

$P < 0.05$). However, participants presumed never to have exposure to coronavirus disease have approximately threefold lower (OR: 2.703, 95% CI: 1.614–4.526, P<0.05) chances of vaccinating than a population presumed a severe coronavirus attack. Likewise, participants reported good health status to have lower chances (OR 0.472, 95% 0.275–0.809, $P < 0.05$) to intent to vaccine themselves compared to a population with bad or poor
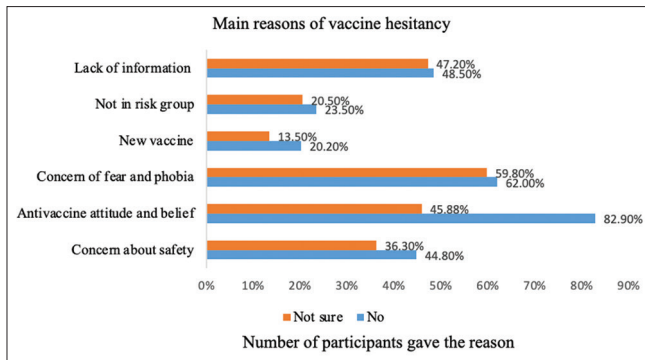
Figure 1: Reasons for vaccine hesitancy

health report card [Table 4]. A multivariable multinomial analysis is used to combine the effects of all the variables found significant in the bivariate multinomial analysis. It has been reported that participants with information on vaccines have sevenfold higher chances (OR: 7.088, 95% CI: 1.581–31.782, $P < 0.05$) for not sure to vaccinate themselves. Female participants show a higher likelihood of vaccinating (OR: 0.545, 95% CI: 0.358–0.828, $P < 0.05$) than males. Likewise, participants who were presumed to have a mild infection (OR: 0.362, 95% CI: 0.174–0.751, $P < 0.05$) or assure not to have an infection (OR: 0.727, 95% CI: 0.371–1.423, $P < 0.05$) found to be less interested in vaccination than counterparts [Table 5].

Discussion

In this preliminary yet extensive sample survey, around half (47.6%) of participants show hesitancy to be vaccinated against COVID-19. These findings are alarming and should be taken seriously for a successful vaccination drive in a large, catered country like India. Furthermore, these findings also have particular importance considering that the nationwide COVID-19 vaccination drive was not yet rolled out for India's common public and was kept for health-care workers across the country in the first round.[17] Interestingly, the number of deaths at the beginning of the vaccination drive was significantly less, and India enables to flatten the pandemic curve.[18] Only 53.4% of the population expressed an interest in accepting the vaccine once available for use and proven safe and effective. However, considering an individual interest in taking a vaccine might not be considered valid predictors of hesitancy as vaccine acceptance is multifactorial and can change over time.[19] However, vaccine acceptance is far or less in consensus with the earlier work on vaccine acceptance in developing countries, including South Africa, Brazil, and India. This vaccine acceptance is comparatively high in some Asian countries, including Singapore, South Korea, and China where citizens expressed higher trust in government agencies.[19] In the USA, the cohort who intend to be vaccinated against COVID-19 is around

57%, slightly higher than the routine influenza vaccine.[12] Surprisingly, this acceptance was expected to be very high considering increased severity, death rate, and resultant media coverage as one of the worst affected countries worldwide.[20] Likewise, the response to accept the COVID-19 vaccine was found between 62%–80% from France to Denmark in the work conducted at UK.[21] Although, in another survey referendum, it has been estimated that three in four people would accept the vaccine and merely 8% of people denied vaccination in the UK.[22]

Indian began one of the most ambitious vaccination drives on January 16, 2021, to inoculate 300 billion of the population by July 2021.[17] However, lack of confidence, trust, and negative stories on the vaccine's safety and efficacy legged the vaccination drive and stopped large masses for the second dose of vaccine.[23-25] Astonishing, we find a low acceptance for the COVID-19 vaccine compared to all routine vaccines for noncommunicable diseases in India.[8] Lack of confidence and trust indicates a grave concern for vaccine acceptability and an important call for the health-care agencies and government to address the issues related to the development, testing, and efficacy of the COVID-19 vaccine. Addressing the public's issues at an early stage can play a crucial role in vaccine acceptability and allay any concern.

Furthermore, it is imperative to understand the cause of such variations for acceptance of a vaccine for a disease that haunted millions of people and records a significantly high number of deaths. Timely addressing the causes will help ensure the vaccination drives successful one and proves potential to control the spread of the pandemic and ensure human life and economic recovery.

The main reasons for refusing to take the vaccine were lack of information on vaccine on safety and efficacy, doctor consultation, fear of injection, antivaccine attitude and belief, and newness, including not want to take before others or first to get the vaccine. These findings support the earlier work on vaccine hesitancy in the UK and USA and reported uncertainties on safety and effectiveness concern, disease risk, newness, and not wanted to be the first person to have vaccine before others.[12,21,26] Concern about lack of information on development and safety of vaccine cited a primary reason for not accepting or being unsure in the present work, constant with the earlier work in different countries worldwide.[1,10-12,21,22] The health-care agencies and the government should have taken a lesson from earlier vaccine controversy and program to reassure the public to avoid any negative impression on one of the large vaccination drives.[19,27] Inequalities in vaccine acceptance in different economic strata are already well-documented in earlier work and noticed in the present study.[12,21,28]

Table 4: Multinomial logistic regression regarding intent to be vaccinated against COVID-19

Characteristics	Intent to be vaccinated: Yes versus No		Intent to be vaccinated: Yes versus Not sure	
	ORs (95% CI)	SE	ORs (95% CI)	SE
Gender				
Male	0.597 (0.415-0.858)	0.185*	1.010 (0.734-1.390)	0.163
Female	Reference		Reference	
Source of information				
Yes	4.546 (1.062-19.454)	0.742*	0.704 (0.370-1.339)	0.328
No	Reference		Reference	
What is your chance to get coronavirus disease in the next 6 months?				
I have already got coronavirus disease	1.394 (0.856-2.269)	0.249	1.280 (0.797-2.056)	0.242
I will never get a coronavirus infection	1.955 (1.119-3.417)	0.285*	2.703 (1.614-4.526)	0.263*
I may get a mild infection	1.457 (0.756-2.811)	0.335	4.028 (2.351-6.901)	0.275*
I will get a severe infection	Reference		Reference	
Self-reported health status				
Very good	0.708 (0.367-1.366)	0.355	0.472 (0.275-0.809)	0.275*
Good	1.079 (0.588-2.089)	0.337	0.731 (0.425-1.259)	0.277
Bad	Reference		Reference	

*P<0.05. OR=Odds ratio, CI=Confidence interval, SE=Standard error

Table 5: Multivariable multinomial analysis regarding intent to be vaccinated against COVID-19

Characteristics	Categories	Intent to be vaccinated: Yes versus No		Intent to be vaccinated: Yes versus Not sure	
		ORs (95% CI)	SE	ORs (95% CI)	SE
Gender	Male	0.900 (0.645-1.258)	0.171	0.545 (0.358-0.828)	0.214*
	Female	Reference		Reference	
Source of information	Yes	1.486 (0.750-2.944)	0.349	7.088 (1.581-31.782)	0.766*
	No	Reference		Reference	
Chance to get coronavirus disease in the next 6 months?	I have already got coronavirus disease	0.837 (0.516-1.358)	0.247	1.111 (0.601-2.052)	0.313
	I will never get coronavirus infection	0.424 (0.248-0.275)	0.273*	0.727 (0.371-1.423)	0.343
	I may get mild infection	0.270 (0.156-0.468)	0.281*	0.362 (0.174-0.751)	0.373*
	I will get severe infection	Reference		Reference	
Self-reported health status	Very good	1.669 (0.946-2.945)	0.290	1.303 (0.631-2.690)	0.370
	Good	1.229 (0.695-2.174)	0.291	1.253 (0.612-2.562)	0.365
	Bad	Reference		Reference	

*P<0.05. OR=Odds ratio, CI=Confidence interval, SE=Standard error

Many of the participants in our study indicated hesitancy to be the first person to have a vaccine, which will probably halt the success of a mega vaccination drive. These findings are not surprising and in accordance with the previous work and need timely effort to allay anxiety and other vaccine concerns.[12,29] Physician consultation and desire for the recommendation were other important reasons for vaccine hesitancy in the studied population. The facts cannot be overlooked that physician recommendation for a vaccine is likely to improve vaccine acceptance chances.[30] It has been mentioned that physicians are in positions to address and deal with the issues related to misinformation, safety, and other antivaccine attitude and belief over the seriousness of the prevailing disease.[31] Further, earlier work reported that some religious groups were differently impacted by exposure to misinformation about the vaccine.[32] However, preliminary analysis shows more participants in not intent to vaccinate or

dilemma to go for vaccination in all religious groups but could not reach a level of significance. The authors advise to take precautions extrapolating the findings on the willingness for vaccination over religious groups and recommend further study including multicentric settings to reach a specific conclusion. Meanwhile, we have to understand the threat posed by social media on forthcoming vaccination campaigns and control fringe information to improve vaccination coverage.[23] Governments and policymakers mandate to control social media circulating antivaccine content with immediate effect. Further, the findings reported that participants with good health status and no family history for COVID-19 are significantly more interested in taking a vaccine. These findings agree with previous work, which reported that acceptance was higher among participants who considered themselves at higher risk. Likewise, it is also reported that people who already had COVID-19 show less willingness to vaccines.[21]

In a nutshell, the findings suggest that timely and transparent addressing of the public concern over safety and other vaccine-related issues is likely to be a practical approach to win the confidence and trust to make the mass vaccination campaign successful.[33]

The strength of our study lies in the large representative sample that allows the generalization of the findings. Besides, the timing of the study before the vaccination drive rolls out for the public in India and only opens up for health-care workers (HCWs). These findings develop insight into all the possible reasons for vaccine hesitancy and urge to provide additional training to the physician to address vaccine-related concerns. Furthermore, to make the vaccination drive successful, an organized campaign for systematically monitoring the media for circulating antivaccination messages is critically essential. Effective harnessing to curb the antivaccination drive by using trusted community networks to provide clear, honest, and transparent information in all languages spoken may help vaccine confidence.

Limitations and recommendations
This study has certain limitations. First, the survey was conducted when vaccination is not yet available for the common public in India. There is a probability that the vaccine will reach a commoner by the time, and some individuals may get additional information about the vaccine and change their response. Second, this is a one-time survey that is limited to explore few reasons for vaccine hesitancy. Many more reasons for vaccine hesitancy would be leftover; hence, the use of open-ended responses and interviews may become an alternative strategy to develop insight into factors underpinning quantitative reactions. Third, the long duration of pandemic and frequent waves may yield different responses and demand longitudinal design to measure the response at different periods. Still, the study was conducted in the initial days before opening the vaccination drive for the common public in India. This was a modest attempt to understand the issues and concerns of the public toward accepting COVID-19 vaccines. Preliminary findings recommend using a more practical approach to educate the community in India on developing steps of vaccine and other concerns related to the COVID-19 vaccine. The findings strongly recommend giving credible information on the safety and effectiveness of vaccines to foster vaccine acceptance among the public.

Conclusions

The study was completed during the launch of the vaccination drive for HCWs in India. The success of the COVID-19 vaccine drive will depend on the public's willingness and confidence to accept the vaccine.

Antivaccine belief and attitude were the primary concerns raised by the Indian population visiting a tertiary care hospital. There is an urgent need to address these doubts and concerns regarding COVID-19 using clear health communication and information circulation on developing and testing the vaccine. Tertiary care hospitals can play a vital role in opening a statement to educate India's masses to boost vaccination. An immediate and practical approach to address the doubt and concerns related to the COVID-19 vaccine will undoubtedly make the mega vaccination campaign more successful.

Conflicts of interest
There are no conflicts of interest.

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Supplementary File 1: Reason for vaccine hesitancy among the population

Theme	Reason for vaccine hesitancy
Concern about safety	I do not want to take vaccine first and before other
	I am not aware of the ingredients of vaccine they are putting in my body
	Safety and efficacy concern
Antivaccine belief and attitude	God help and save his people
	I will get sick again after taking the vaccine
	I do not believe taking the vaccine
	No vaccine can ever kill the virus
	I never had a vaccine in the past for any disease, so I don't need this one also
	A vaccine does not help against a mutating virus
	I have the worst experience with vaccine
Fear and phobia of vaccine	I need a doctor consultation before taking the vaccine
	I am phobic to injection
Not in risk group	I do not think I am sick, and I need the Vaccine
New vaccine	The vaccine is new, making me nervous
Lack of information	I do not have much information about the vaccine (ingredients, safety, and security)
	I am allergic to the vaccine