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Original Research Article

Demographic and KAP determinants of COVID-19 vaccine hesitancy and vaccine refusal: a cross-sectional study in Indian population

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ABSTRACT

Background: Recent rise in vaccine non-acceptance is a threat to global health, especially with the ongoing COVID-19 pandemic. Examining the intentions of the Indian population towards the COVID-19 vaccine and the determinants of vaccine hesitancy and vaccine refusal is of utmost importance.
Methods: We conducted a cross-sectional web-based anonymous survey, using pre-validated questionnaires. Demographic and knowledge, attitude, and practice characteristics were collected, and a binary logistic regression was applied to analyse the association between these characteristics and the participants' intention to for the COVID-19 vaccine. Reasons for vaccine non-acceptance were then determined using a pre-validated vaccine hesitancy questionnaire.
Results: Out of the 1172 non-vaccinated participants, 190 (16.2%) refused vaccination, and 219 (18.6%) were hesitant. Adequate knowledge about the COVID-19 disease, made people less likely to be hesitant for vaccination (OR=0.39; 95% CI=0.27-0.57), and less likely to refuse it (OR=0.41; 95% CI=0.27-0.61). Females had a higher tendency to refuse the vaccination (OR=1.47; 95% CI=1.02-2.14), or to be hesitant for it (OR=1.80; 95% CI=1.29-2.52). Social media played an important role in decreasing vaccination refusal (OR=0.40; 95% CI=0.22-0.73), when compared to evidence-based literature.
Conclusions: Knowledge about the COVID-19 disease can help people make a more informed decision towards vaccination, and social media can be utilised as a medium to address the gaps in knowledge of the Indian population.

Keywords: COVID-19, KAP, India, Survey, Vaccine hesitancy, Vaccine refusal

INTRODUCTION

As the world was preparing for a new decade, China reported the first case of SARS-CoV 2 infection in December 2019. This newly mutated Coronavirus rapidly spread across the world, with WHO declaring it a pandemic on March 11th, 2020.[1] As of August 19th, 2021, there have been over 209 million confirmed cases of COVID-19 worldwide, with over 4.3 million deaths.[2] India, being one of the worst-hit countries, has witnessed almost 3 crore cases and more than 4.3 lac fatalities.[2]

From the experiences of the 2009 H1N1 pandemic, it was concluded that various non-pharmacological interventions (NPIs), including handwashing, social distancing, and isolation, were effective in slowing down the spread of the virus, especially during the initial days of a pandemic. However, the primary tool for controlling the pandemic was a well-matched pandemic vaccine.[3]

There are, however, two big challenges for a large-scale vaccination drive in a pandemic. Firstly, vaccine development is a time-consuming process, with an estimated time for different stages of clinical

development reaching up to one to one and a half years.[4] The second challenge is getting people to accept it, as the Vaccine Hesitancy (VH) and Vaccine Refusal (VR) are on the rise.

In 2019, WHO included the rising VH in the 'Top 10 threats to Global Health'.[5] VH is defined as a delay in acceptance or refusal of vaccination, despite the availability of vaccination services.[6] It changes the polarised view of attitude towards vaccine acceptance as 'pro' or 'anti' vaccine into a continuum by introducing a third category for the people who are not yet sure about their intentions to get vaccinated. This approach surpasses the previous one, as swaying a hesitant person can be easier than swaying someone who is totally against the notion of vaccination. VH is a complicated concept and is defined according to the '3C's model' which includes: 1) Confidence (lack of trust in the vaccine, its provider, or the makers of the policies); 2) Complacency (lack of perception for the need to be vaccinated); 3) Convenience (factors like physical availability, illiteracy, affordability, inadequate health literacy, and geographical accessibility).[7]

VH and VR are significant hurdles we are facing in this pandemic. In a survey conducted amongst over 13,000 people across 19 countries in June 2020, only 71.5% of participants reported that they would be very or somewhat likely to take a COVID-19 vaccine, whenever it becomes available. The acceptance rate varied from as high as 90% in China to less than 55% in Russia. In the Indian population, this acceptance rate was 74.5%.[8]

The Government of India approved two COVID-19 vaccines for the Indian population in January 2021. With the rise in COVID-19 cases due to the second wave, we wanted to check the determinants of VR and VH for the COVID-19 vaccine in the non-vaccinated section of the Indian population.

METHODS

Study design

To ensure the health and safety of our participants, a web-based cross-sectional survey was conducted among the Indian population from April 7th, 2021, to May 1st, 2021. It was designed on Google Forms, using questions from previously used and validated questionnaires 9, 10 and circulated on social media, i.e., WhatsApp and Facebook. Investigators used their personal and professional contacts to recruit the participants via purposive and snowball sampling techniques. The ethical approval was obtained from the Institutional Ethical Committee for an anonymous voluntary survey.

Study participants

People aged 18 years and above, representing different socio-demographic variables such as age, gender, education, and profession, were included. The eligibility criteria for the study included the willingness to participate, age more than 18 years, and ability to read in English. An exclusion criterion of being vaccinated was applied for further analysis.

Questionnaire

The introductory page of the survey questionnaire had a section for informed consent. It included the essential information about the survey, like its objectives, procedure, duration to complete, and the risks and benefits to the participants. Confidentiality and Voluntariness were assured. They could stop participation at any time. Only those who gave consent proceeded to the further sections of the survey. The questionnaire had four sections.

The first section collected the demographic information from the participants, which included age, sex, education, profession, type of settlement, i.e., rural vs. urban. COVID-19 related information was also collected, which included participants' risk stratification according to CDC guidelines history of COVID-19 infection, and the source of information they rely on for COVID-19 related updates, in which medical literature and government publications were included in evidence-based literature.[11]

The second section included a 24-item Knowledge, Attitude, and Practice questionnaire for the COVID-19 disease.[9] Each 'correct response' was given two points, 'incorrect' zero points, and in the knowledge and attitude sections, people who chose 'not sure' received one point. It included thirteen questions to assess the knowledge, five for attitude, and six questions for practice. Maximum scores for these categories were twenty-six, ten, and twelve, respectively. Higher scores indicated more knowledge, a more positive attitude, and better practices. A cut-off of 80% was chosen for adequate knowledge, positive attitude, and good practice.[12]

The third section had two questions. Firstly, people were asked about their vaccination status, and they could choose either 'fully vaccinated,' 'received one shot,' or 'not vaccinated.' People who had not yet received their COVID-19 vaccine were asked about their intentions to get vaccinated whenever it will be available to them. Participants could respond "Yes", "No" or "Not Sure."

In the fourth and the final section, participants who responded "No" or "Not sure" for the plan to get vaccinated, were provided with a Vaccine Hesitancy Questionnaire, 10 to determine the reasons for their decline.

Statistical analysis

The responses received on Google Forms were exported to Microsoft Excel. KAP scores and vaccination status were changed into categorical data. These categories and

the various demographic variables were then coded. A binary logistic regression analysis was used to evaluate the relation between the participants' Demographic and KAP variables and their intention to be vaccinated against COVID-19. Two separate analyses were done, which were 'vaccine acceptance' vs. 'vaccine refusal' and 'vaccine acceptance' vs. 'vaccine hesitancy.' A p value of <0.05 was considered statistically significant for all analyses. All the statistical analyses were performed using the SPSS version 23.0.

RESULTS

Complete responses were provided by 2093 subjects, and after applying the exclusion criteria of being vaccinated against COVID-19, 1172 non-vaccinated participants were included in further analysis. When asked about their intentions to get vaccinated against COVID-19, 763 (65.1%) said they were willing to do so, whereas 219 (18.6%) said 'No,' and 190 (16.2%) said they were 'Not Sure.' Details about the demographic and COVID-19 related information for the study participants are summarised in Table 1 and 2, respectively.

Table 1: Demographic characteristics of the sample population, along with their intention to vaccinate against COVID-19.

Demographic characteristic	Total non-vaccinated	Intent to vaccinate (among non-vaccinated)		
		Yes	No	Not sure
	N (%)	N (%)	N (%)	N (%)
Total sample	1172	763 (65.1)	190 (16.2)	219 (18.6)
Age (years)				
18-24	504 (43)	357 (70.8)	75 (14.9)	72 (14.3)
25-44	549 (46.8)	331 (60.3)	97 (17.7)	121 (22)
45-59	99 (8.4)	61 (61.6)	15 (15.2)	23 (23.2)
>59	20 (1.7)	14 (70)	3 (15)	3 (15)
Sex				
Male	729 (62)	510 (70)	108 (14.8)	111 (15.2)
Female	441 (37.6)	252 (57.1)	81 (18.4)	108 (24.5)
Others	2 (0.17)	1 (50)	1 (50)	--
Residence				
Urban	937 (79.9)	648 (69.2)	128 (13.7)	161 (17.2)
Rural	235 (20.1)	115 (48.9)	62 (26.4)	58 (24.7)
Education				
Primary school	35 (2.9)	20 (57.1)	6 (17.1)	9 (25.7)
High school	166 (14.1)	74 (44.5)	55 (33.1)	37 (22.2)
Graduate and higher	971 (82.8)	669 (68.8)	129 (13.2)	173 (17.8)
Profession				
HCW	295 (25.1)	175 (59.3)	63 (21.4)	57 (19.3)
Non-HCW	877 (74.8)	588 (67)	127 (14.5)	162 (18.5)

Table 2: COVID-19 related information of the sample population, along with their intention to vaccinate against COVID-19.

COVID-19 related information	Total non-vaccinated	Intent to vaccinate (among non-vaccinated)		
		Yes	No	Not sure
	N (%)	N (%)	N (%)	N (%)
Total sample	1172	763 (65.1)	190 (16.2)	219 (18.6)
Risk class (CDC)				
Low risk	972 (82.9)	635 (65.3)	157 (16.2)	180 (18.5)
Medium risk	151 (12.8)	103 (68.2)	23 (15.2)	25 (16.6)
High risk	49 (4.1)	25 (51)	10 (20.4)	14 (28.6)
Source of information for COVID-19				
Evidence based Lit.	126 (10.7)	77 (61.1)	30 (23.8)	19 (15.1)
Mass media	452 (38.5)	270 (59.7)	79 (17.5)	103 (22.8)
Social media	516 (44)	373 (72.3)	58 (11.2)	85 (16.5)
Friends and Family	69 (5.8)	39 (56.5)	20 (29)	10 (14.5)
None	9 (0.76)	4 (44.4)	3 (33.3)	2 (22.2)

Continued.

COVID-19 related information	Total non-vaccinated	Intent to vaccinate (among non-vaccinated)		
		Yes	No	Not sure
	N (%)	N (%)	N (%)	N (%)
History of COVID-19 self-infection				
Yes	128 (10.9)	82 (64.1)	24 (18.8)	22 (17.2)
No	1044 (89.1)	681 (65.3)	166 (15.9)	196 (18.8)
COVID-19 knowledge				
Inadequate knowledge	413 (35.2)	190 (46)	108 (26.2)	115 (27.8)
Adequate knowledge	759 (64.7)	573 (75.5)	82 (10.8)	104 (13.7)
COVID-19 attitude				
Negative attitude	534 (45.5)	330 (61.8)	90 (16.9)	114 (21.3)
Positive attitude	638 (54.4)	433 (67.9)	100 (15.7)	105 (16.5)
COVID-19 practice				
Bad practice	333 (28.4)	145 (43.5)	94 (28.2)	94 (28.2)
Good practice	839 (71.5)	618 (73.7)	96 (11.4)	125 (14.9)

Table 3: Knowledge, attitude, and practice towards COVID-19 disease among the study participants.

Question		Correct response (%)
Knowledge questions		
K1	The main clinical symptoms of COVID-19 are fever, fatigue, dry cough, and myalgia	1065 (90.8)
K2	Patients infected with the COVID-19 virus can have no symptoms at all.	809 (69.1)
K3	Patients infected with COVID -19 can present with red eye (Conjunctivitis)	509 (43.4)
K4	Elderly age group and people with Diabetes, Hypertension, and Asthma are more prone to develop severe infection	980 (83.6)
K5	There currently is no effective treatment for COVID-2019, but early symptomatic and supportive treatment can help most patients recover from the infection	967 (82.5)
K6	Animals can be affected by COVID 19 and may have the risk of spreading the same	379 (32.3)
K7	The virus spreads by sneezing and droplets of infected individuals	1016 (86.6)
K8	When fever and cough is not present in COVID-19 patient, he cannot infect another person	742 (63.3)
K9	Social distancing and use of mask can prevent infection to spread in normal individuals	1051 (89.6)
K10	To prevent infection by COVID-19, people should avoid crowded places like trains, malls, and public transport	1076 (91.8)
K11	Patients infected with COVID-19 should be kept under isolation and must be treated to reduce spread of virus	1095 (93.4)
K12	The quarantine period for COVID-19 infected patients is 14 - 21 days	1052 (89.7)
K13	Are you aware of Arogya Setu App recommended by Government of India?	971 (82.8)
	Adequate knowledge (>80%)	759 (52.4)
Attitude questions		
A1	Do you think regular hand wash can prevent the spread of COVID infection?	1076 (91.8)
A2	Do you think wearing a tight fit mask will decrease the chance of you getting the infection?	907 (77.3)
A3	Do you think COVID-19 infection can be completely eradicated from India?	515 (43.9)
A4	Do you think, if affected people maintain strict quarantine, COVID spread can be controlled?	1005 (85.7)
A5	Do you think people in your neighboring community are strictly practicing the precautions recommended by the government?	412 (35.1)
	Positive attitude (>80%)	638 (58.5)
Practice questions		
P1	In recent days, I have avoided crowded places	1007 (85.9)
P2	In recent days, I have regularly worn mask while stepping out of the home	1070 (91.2)
P3	In recent days, I have practiced regular hand washing	1044 (89.1)
P4	In recent days, I have avoided shaking hands for greeting people	1018 (86.8)
P5	In recent days, I have not gone to hot spots and maintained social distancing outdoors	1020 (87.1)
P6	I have downloaded Arogya Setu App in my mobile	738 (62.9)
	Good practice (>80%)	839 (51.5)

Table 4: Binary logistic regression analysis of vaccine intention versus participants' demographic characteristics.

Demographic characteristic	Intent to be vaccinated: No vs. Yes			Intent to be vaccinated: Not sure vs. Yes		
	OR	95% CI	P value	OR	95% CI	P value
Age (years)						
18-24	1.23	0.30-5.03	0.769	1.29	0.31-5.46	0.721
25-44	1.63	0.40-6.59	0.489	2.09	0.50-8.65	0.307
45-59	1.15	0.25-5.25	0.850	2.09	0.47-9.29	0.332
>59*						
Sex						
Female	1.47†	1.02-2.14	0.038	1.80†	1.29-2.52	0.001
Male*						
Residence						
Rural	1.28	0.83-1.99	0.261	1.25	0.82-1.90	.0294
Urban*						
Education						
Primary school	1.07	0.37-3.07	0.886	0.97	0.38-2.47	0.951
High school	2.75‡	1.73-4.37	<0.001	1.24	0.74-2.07	0.404
Graduate and higher*						
Profession						
Non HCW	0.70	0.46-1.07	0.102	0.89	0.59-1.34	0.583
HCW*						

*Reference category, †Significant at $p < 0.05$, ‡Significant at $p < 0.001$. OR: Odds ratio, CI: Confidence interval.

Table 5: Binary logistic regression analysis of vaccine intention versus participants' COVID-19 related information.

COVID-19 related information	Intent to be vaccinated: No vs. Yes			Intent to be vaccinated: Not sure vs. Yes		
	OR	95% CI	P value	OR	95% CI	P value
Risk class (CDC)						
Low risk*						
Medium risk	0.83	0.48-1.44	0.517	0.74	0.44-1.25	0.271
High risk	1.65	0.68-4.01	0.266	1.73	0.80-3.69	0.157
Information source for COVID-19						
EBL*						
Mass media	0.66	0.37-1.16	0.155	1.24	0.66-2.29	0.495
Social media	0.40†	0.22-0.73	0.003	0.93	0.49-1.74	0.825
Friends and family	0.89	0.41-1.96	0.777	0.71	0.27-1.85	0.491
None	0.96	0.18-5.10	0.967	1.14	0.17-7.48	0.888
History of COVID-19 self-infection						
No*						
Yes	1.03	0.57-1.86	0.904	0.68	0.38-1.22	0.203
COVID-19 knowledge						
Inadequate*						
Adequate	0.41‡	0.27-0.61	<0.001	0.39‡	0.27-0.57	<0.001
COVID-19 attitude						
Negative*						
Positive	1.13	0.78-1.65	0.498	0.91	0.64-1.29	0.622
COVID-19 practice						
Bad*						
Good	0.40‡	0.27-0.59	<0.001	0.49‡	0.33-0.72	<0.001

*Reference category, †Significant at $p < 0.05$, ‡Significance at $p < 0.001$. OR: Odds ratio, CI: Confidence interval, EBL: Evidence based literature (government publications + medical literature).

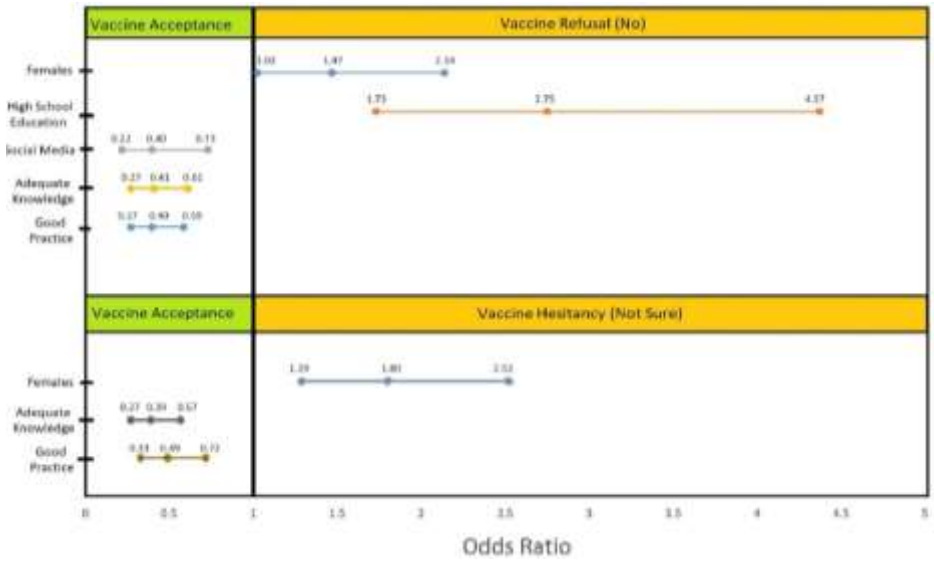

Figure 1: Forest plot to demonstrate Odds Ratio (with respective 95% Confidence Interval) between different categories of the statistically significant determinants of Vaccine Hesitancy and Vaccine Refusal for the COVID-19 vaccine in the Indian population.

Table 6: Reason for not accepting the COVID-19 vaccine, amongst the participants who responded 'No' or 'Not Sure' for their vaccine intentions, using a vaccine hesitancy questionnaire.

Reason for not accepting COVID-19 vaccine		Intent to be vaccinated		
		No (n=190)	Not Sure (n=219)	Total (n=409)
		N (%)	N (%)	N (%)
Concerns about the vaccine		132 (69.4)	165 (75.3)	297 (72.6)
C1	I am concerned about the vaccine efficacy	57 (30)	66 (30)	123 (30.0)
C2	I am concerned about the vaccine safety and side effects	72 (37.8)	106 (48.4)	178 (43.5)
C3	It might transmit the virus to me	20 (10.5)	11 (5)	31 (7.5)
C4	The vaccine will be new, I won't be the first to get the vaccine	28 (14.7)	20 (9.1)	48 (11.7)
C5	I am concerned about the vaccine rigor of testing	14 (7.3)	18 (8.2)	32 (7.8)
C6	The vaccine may contain heavy metals or odd materials	7 (3.6)	10 (4.55)	17 (4.1)
C7	Vaccines cause autism	5 (2.6)	4 (1.8)	9 (2.2)
C8	The vaccine may affect fertility	14 (7.3)	11 (5)	25 (6.1)
C9	Not convinced that it will be effective, look at the flu vaccine	20 (10.5)	19 (8.6)	39 (9.5)
C10	My immune system is weak, and I can't take inactivated vaccines/I have an allergy to many substances and I may have an allergy to this vaccine	14 (7.3)	13 (5.9)	27 (6.6)
C11	I don't think that I can afford the vaccine	4 (2.1)	5 (2.3)	9 (2.2)
Need additional information		76 (40)	89 (40.6)	165 (40.3)
N1	It depends on what my doctor recommends	29 (15.2)	59 (26.9)	88 (21.5)
N2	It depends on the scale of the pandemic at the time of the vaccine. If very low, I may not do it	39 (20.5)	37 (16.8)	76 (18.5)
N3	I don't want a vaccine I know nothing about. I'll make my decision if/when one becomes available	23 (12.1)	13 (5.9)	36 (8.8)
Attitudes		98 (51.5)	110 (50.2)	208 (50.8)
A1	I don't feel I'm at risk	37 (19.4)	33 (15.1)	70 (17.1)
A2	I am religious and God will protect me	15 (7.8)	23 (10.5)	38 (9.2)
A3	I don't take vaccines at all	10 (5.2)	11 (5)	21 (5.1)
A4	I am scared to put foreign objects in my body	19 (10)	23 (10.5)	42 (10.2)
A5	I would say that the vaccine should go to the people who are most risk of contracting it before I get it because I am not putting myself at risk	47 (24.7)	52 (23.7)	99 (24.2)

Continued.

Reason for not accepting COVID-19 vaccine		Intent to be vaccinated		
		No (n=190)	Not Sure (n=219)	Total (n=409)
		N (%)	N (%)	N (%)
Lack of trust		68 (35.7)	76 (34.7)	144 (35.2)
L1	Any vaccine made for this virus I do not trust	35 (18.4)	20 (9.1)	55 (13.4)
L2	If the government recommended it, I will not take it	8 (4.2)	17 (7.7)	25 (6.1)
L3	There is no way I trust big pharmaceutical companies	7 (3.6)	18 (8.2)	25 (6.1)
L4	I'm thinking a vaccine now might be approved too quickly because of political pressure	34 (17.8)	35 (15.9)	69 (16.8)
L5	I believe that this virus was developed by the governments, and I won't take any vaccine	12 (6.3)	14 (6.3)	26 (6.3)
L6	Because I heard the government was to put a chip in you when you get the vaccination and I do not want a chip inside of me	6 (3.1)	5 (2.2)	11 (2.6)
Others		29 (15.2)	28 (12.7)	57 (13.9)
O1	I am afraid of needles	29 (15.2)	28 (12.7)	57 (13.9)

KAP of the sample population

Results of the KAP questionnaire regarding COVID-19 are summarised in the appendix as Table 3. Among the 1172 non-vaccinated respondents, 64.7% had adequate knowledge about the COVID-19 disease, i.e., a score of more than or equal to 80%. 54.4% of the participants had a positive attitude that the ongoing pandemic can be controlled, and 71.5% of the participants followed the government-recommended preventive practices diligently.

Determinants of vaccine hesitancy and refusal

A binary logistic regression was then used to analyse the difference in the intention to get vaccinated against COVID-19 among participants from different demographic and COVID-19 related information categories. The results are shown in Table 4 and 5, respectively.

Females had a higher tendency to refuse the vaccine (OR=1.47; 95% CI=1.02-2.14; p value=0.038), or to be hesitant towards it (OR=1.80; 95% CI=1.29-2.52; p value=0.001). Education also played an important role in determining VR, i.e., saying 'No' to COVID-19 vaccine, with participants having high-school education were more likely to refuse the vaccine (OR=2.75; 95% CI=1.73 to 4.37; p value <0.001), when compared to participants with a graduate degree or higher.

Relying on social media as the primary source for information on COVID-19 played an essential role in decreasing VR for the COVID-19 vaccine (OR=0.40, 95% CI=0.22 to 0.73; p value=0.003) when compared to the people relying on evidence-based literature (EBL). We also observed that having adequate knowledge about the COVID-19 disease and diligently following the government-recommended preventive practices were significantly associated with a reduction in both VH and VR. People with inadequate knowledge about the COVID-19 disease and those not following the preventive practices, were almost twice more likely to refuse the vaccination or be hesitant about it. Figure 1 shows the forest plots for the statically significant determinants of VH and VR for the COVID-19 vaccine.

We did not observe any statistically significant difference for VR or VH based on other demographic variables like age, residence, profession, CDC risk strata, or history of COVID-19 infection. Also, attitude regarding the COVID-19 disease did not play any role in vaccine acceptance.

Reasons of vaccine hesitancy and refusal

People who responded with 'No' or 'Not Sure' for their vaccination intention were presented with a vaccine hesitancy questionnaire, results of which are summarised in Table 6. With over 70% of the participants having various 'concerns about the COVID-19 vaccine,' it was the most mentioned reason for not accepting it. The most common concerns included its safety and side effects, followed by its efficacy. The second most mentioned reason, seen in over 50% of the participants, included their 'attitudes' towards the vaccination and COVID-19 disease, with some participants unwilling to put themselves at risk by receiving their shot early in the vaccination drive, and others not feeling at risk of contracting the disease. The 'need for additional information' was the third most common barrier reported by over 40% of the vaccine non-accepting population. About 35% of the participants reported a 'lack of trust' as the reason for their VH or VR, with most of the people feeling that the vaccine was approved too quickly. A minority of the participants did not trust the government and the pharmaceutical companies.

DISCUSSION

Vaccination programs have helped in the eradication of many infectious diseases. At a population level, vaccination helps in the development of Herd Immunity (HI). When an immune person has a sick contact, they are

less likely to get infected, and thus the disease will not spread further. With a good percentage of immune people, transmission rates can be lowered adequately, thus achieving HI.[13] With the ongoing COVID-19 pandemic, the development of HI is the best shot we have against the virus. However, the proportion of immune individuals to reach HI can vary from 50% to 90%. Reaching this proportion of immunity via natural infection will come at a considerable cost of morbidity and mortality. Thus, an effective vaccination drive presents the safest way to reach HI.

With the remarkable effect that vaccines have had on our healthcare system, they have recently become victims of their success. With the horrors of the deadly infectious diseases becoming distant memories, people have started opting out of the vaccination programs, which has led to a return of infectious diseases in the western world. This is evidenced by the recent rise in measles cases in the United States, which was eradicated from the US in 2000, but affected over 1200 children during the first nine months of 2019, the highest number reported in the country since 1992.[14]

The rising trend of vaccine non-acceptance has become worse in the COVID-19 era. Issues like the rapid development of the vaccine, concerns about its probable side effects, and the rise in conspiracy theories worldwide have contributed to lowering the COVID-19 vaccine acceptance.[15,16] Our study included a sample of 1172 non-vaccinated people, of which only 763 (65%) were willing to get vaccinated. 190 (16%) of our sample refused to get vaccinated, whereas 219 (18%) of them were hesitant. This hesitancy rate was higher than the one previously reported.

Females in our study had a higher tendency of both VH and VR towards the COVID-19 vaccine. Similar results were observed in previous studies from Europe and China.[17,18] This is probably due to the biased infection rates, risks of COVID-19 complications, and COVID-19 related death among males, as concluded by several independent reports in the past.[19] Another factor playing a role in higher VH among females is the difficult accessibility of vaccination services to them. Efforts should be made to increase awareness among the females and take special steps to make vaccination services more accessible to them.

Higher education plays a significant role in increasing vaccine acceptance, as concluded by the previous studies from the United Kingdom and the United States.[20,21] These results were replicated in our study as well, with participants having high school education were more likely to say 'No' to the COVID-19 vaccine, as compared to the participants with a graduate degree or higher.

A significant difference in vaccine acceptance rates was expected among the different groups for the demographics like age, CDC COVID-19 risk groups, and profession, as concluded in previous studies from the United States and Australia.[21,22] But the results of our study did not show similar findings, which can be attributed to the fact that the COVID-19 vaccine in India was rolled out first for high-risk groups and frontline workers. Thus, most of the participants in these categories, i.e., 127 (86.4%) in >60 years, 103 (67.8%) in CDC high-risk strata, and 410 (58.2%) in healthcare workers were already vaccinated. Therefore, the remaining non-vaccinated people of these high-risk sections are expected to have higher hesitancy and refusal rates, comparable to the general population.

Among the COVID-19 related determinants, we observed that people who obtained their information from social media were less likely to refuse the vaccine, i.e., responding 'No' for their vaccine intention. Due to its easier accessibility and wider spread, social media has become an essential mode of sharing information. The results of our study substantiate the fact that social media could be utilised further to spread awareness among its users. Various measures like interactive health campaigns, informative sketches/comics suiting the regional population, and informative talks from the experts can share consistent and credible information using easy-to-understand language, which can address the population. On the other hand, some might use this platform to spread misinformation, and care should be taken to control this by developing and promoting a culture of fact-checking.

Our study also observed that people with adequate knowledge about the COVID-19 disease and those who followed the government-recommended preventive practices were more likely to accept the COVID-19 vaccination. Previous studies have shown variable results, with a positive correlation between knowledge and vaccine acceptance reported in studies from the United States.[23] Whereas, no significant association was found between them in a study from New Zealand.[24] There is an ongoing debate for the most appropriate method to promote vaccine acceptance, between the 'coercive' and 'persuasive' measures.[25] In our opinion, the latter will produce better results, as the coercive measures (e.g., making vaccination mandatory) do not address the root cause of VH or VR. Instead, they may trigger an increase in the denial of vaccination as a reaction to the policy. On the other hand, persuasive methods (e.g., educational measures) tend to address the root causes and thus can help in promoting vaccine acceptance.

For better outcomes, it is also essential to explore why people are not willing to get the COVID-19 vaccine. Even though extensive literature on COVID-19 vaccines' safety and efficacy is now available, the majority of the non-accepting population had concerns about the vaccine. Similar concerns have been reported in studies from the Middle East, Europe, and the United States.[10,17,21] Many participants also believed that they are not at risk for the infection.

The difference in vaccine acceptance among people with adequate or inadequate knowledge about the disease warrants the education of the population about the basics of the COVID-19, its potential long-term complications, and notable fatality rate. Along with this, addressing the reasons for VH and VR and providing them information about the availability of data about its safety and efficacy can help alleviate most of the concerns. Having all this information will help people understand the situation better, and thus they will be able to make a well-informed decision. From the results of our study and another recent study from India, we can conclude that knowledge about COVID-19 and its vaccine may help reduce the VR and VH.[26]

Limitations

Although we tried our best to address all the possible biases, our study had a few limitations. The primary limitation of our study was the cross-sectional design of the study. With the ongoing second wave in India, vaccine acceptance rates are prone to considerable variation. Secondly, though we tried to include all the demographic sections of our society, a stratified random sampling technique was not used. Thus, it is difficult to claim that the sample was representative of the Indian population. Thirdly, our study mainly focussed on KAP regarding COVID-19 disease. Future research should elucidate other dimensions responsible for vaccine non-acceptance, like vaccine literacy and perceived risk of COVID-19 disease.

CONCLUSION

Evidence from previous outbreaks of infectious diseases shows the pivotal role played by the vaccination drives in containing them. However, there has been a rise in the non-acceptance of vaccinations in recent years. Addressing this rise is of utmost importance, especially with the ongoing COVID-19 pandemic. Results of our study suggest that people with good knowledge and practice towards the COVID-19 disease were more likely to accept the COVID-19 vaccine. Thus, educating people on the basics of this disease, the importance of various preventive measures, and addressing their concerns regarding vaccination can improve the acceptance of the COVID-19 vaccine, which can eventually help control the pandemic. In addition, reduced VR amongst those who relied on social media for their COVID-19 information validates the further usage of this platform to disseminate consistent and credible information, which could reach the masses. Females tend to have a higher VR and VH, and efforts should be made to improve the information outreach to them and make vaccination services more accessible to them.

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