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Factors Associated with Acceptance of COVID Vaccination Among the Potential Beneficiaries of the Program: A Comparative Cross-Sectional Study

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ABSTRACT

COVID vaccine appears as the ray of hope to control the raging pandemic. However, vaccine delivery to the large population is a herculean task affected by several factors. Hence, this study aims to understand the factors which might be influencing the acceptance of vaccine. This knowledge can be used to plan measures to improve the vaccine acceptance. Two groups were involved in the study. Vaccine accepted group comprised of the beneficiaries visiting the COVID vaccination booth and vaccine not accepted group comprised the patients visiting the out-patient department of Urban Health Centre of Department of Community Medicine. Study participants were given a pre-tested, semi structured printed questionnaire. Descriptive statistics were represented as proportions. Associations were tested using Chi square test and t test. The salient demographic characteristics of the vaccine accepted group were females (54.7%), graduates (51.3%) and professionals (45.9%). Whereas, the vaccine not accepted group were males (59.6%), educated till pre-university (21.2%) and home makers (33.6%) followed by agriculturists (18.5%). Knowledge score of the group which accepted the vaccine was significantly better than the group which did not accept (5.11±1.18 v/s 4.48±1.67, $p<0.05$). Apprehension was observed to be more in the vaccine not accepted group (34.2% v/s 29.8%). The knowledge score of the participants was significantly related to apprehension regarding the vaccine ($p<0.05$). Factors such as gender, education, occupation, knowledge score and source of information were associated significantly with the vaccine acceptance ($p<0.05$). Individuals with better knowledge had lesser apprehension and accepted the vaccine more. Hence, health educational efforts must be increased to enhance the vaccine related knowledge. And these efforts must be targeted towards men, potential beneficiaries of younger age group, individuals educated below pre-university level, housewives and agriculturists. Media and doctors must be used more to deliver vaccine related information and influence the beneficiaries towards acceptance.

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Key Words
Covishield, covaxin, vaccine knowledge, vaccine belief, vaccine acceptance

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INTRODUCTION

COVID pandemic has been raging in India since the end of January 2020. Peak of the first wave spanned through the months of September to November, 2020. Vaccination was launched on 16th January 2021. Two vaccines namely Covishield and Covaxin were introduced in India. During the Phase 1 of vaccination, health workers were vaccinated followed by Frontline workers. During the phase 2 of vaccination, senior citizens and citizens aged above 45 years with certain co-morbidities are being vaccinated along with left out health care workers and front-line workers. Vaccination was opened to all citizens aged above 18 years on 1st May 2021. Second wave in India started almost in the month of March 2021. During the second wave, India witnessed severe consequences in the form of spiralling cases, reduced supplies of essential treatments and increased deaths particularly in the young population[1]. Introduction of vaccination is a ray of hope in the abyss of COVID pandemic. Hence, it is important to increase vaccination coverage as one of the measures to control the occurrence of third wave apart from other COVID preventive measures. Totally 2,79,32,889 out of 30,00,00,000 eligible beneficiaries had completed taking the second dose of the vaccination as on 30th April 2021[2]. This amounts to 9.3% of coverage in a span of 3 months 13 days which is quite low. The coverage had reached 88,34,70,578 as on 30th September 2021[3]. It is still a long way to go. Previous vaccination experiences have shown that there are several factors that determine vaccine acceptance. Competing traditional and religious beliefs, distrust towards modern medicine, past personal or community experiences, self-perceived risk of infection, complications and side effects associated with vaccines were found to be certain factors in studies related to such vaccines in the past[4,5]. Several socio-demographic factors like place of residence, gender, age, education, occupation etc can decide the numbers accepting the vaccine. It is essential to understand the factors determining vaccine acceptance and vaccine hesitancy to plan remedial measures which can improve the acceptance. Hence, we conducted this study to understand the factors associated with the acceptance of COVID vaccination.

MATERIALS AND METHODS

The study was conducted in a tertiary care hospital in North Karnataka. The study involved two groups. Ethical clearance was obtained from Institutional Ethics Committee. First group consisted of individuals who visited the COVID vaccination booth at SDM Hospital for their vaccination. This was the vaccine accepted group. All the potential beneficiaries aged above 18 years, visiting the vaccination booth who consented for the study and were able to read and comprehend either English or Kannada were included in the study. Beneficiaries with physical handicap leading to inability to read or write or those who were unable to comprehend the questionnaire and write answers for the same were excluded from the study. Data from the vaccine accepted group was collected between 1st to 15th April 2021. These were totally 386 study participants. Second group consisted of patients aged above 18 years of age who were visiting the outpatient department of Urban Health Centre under the Department of Community Medicine who have not taken vaccination. This was the vaccine not accepted group. All the potential beneficiaries aged above 18 years, visiting the vaccination booth who consented for the study and were able to read and comprehend either English or Kannada were included in the study. Beneficiaries with physical handicap leading to inability to read or write or those who were unable to comprehend the questionnaire and write answers for the same were excluded from the study. Data from the vaccine not accepted group was collected between 1st to 15th June 2021. These were totally 146 study participants. After taking an oral informed consent, study participants were given a pre-tested, semi structured printed questionnaire. The questionnaire consisted of questions related to the socio-demographic characteristics of the study participants, their knowledge and attitude towards COVID-19 vaccination. Knowledge score was calculated by giving one point to each of the 7 knowledge questions. Descriptive statistics were represented as proportions. Associations were tested using Chi square test and t test. Analysis was done using IBM SPSS Statistics for Windows, Version 25.0.

RESULTS AND DISCUSSIONS

(Table 1) represents the demographic characteristics of the study participants. Mean age of study participants in the vaccine accepted group was 54.96 with a standard deviation of ±15.77 years and that of the group which did not accept vaccination was 43.88± 14.87 years. Difference in the mean ages of the two groups was statistically significant (t=7.34, dF=530, p<0.001). A majority of 87 (59.6%) study participants who did not accept the vaccination were males whereas, a majority of 211 (54.7%) study participants who accepted the vaccination were females. As many as 198 (51.3%) study participants in the vaccine accepted group were graduates and 31 (21.2%) study participants in the vaccine not accepted group had studied till Pre-University. In the vaccine accepted group a majority of 177 (45.9%) were professionals and among the vaccine not accepted group 49 (33.6%) and 27 (18.5%) were home makers and agriculturists respectively. (Table 2) shows the various aspects related to the knowledge regarding vaccination. Among the vaccine accepted group 363 (94%) knew that vaccine given in our vaccination centre is

Table 1: Demographic Characteristics of the Study Participants

Demographic characteristic	Vaccine accepted group (%)	Vaccine not accepted group (%)
Sex		
Male	175 (45.3)	87 (59.6)
Female	211 (54.7)	59 (40.4)
Education		
Illiterate	4 (1)	28 (19.2)
Primary school	8 (2.1)	23 (15.8)
High school	55 (14.2)	28 (19.2)
Pre-university	45 (11.7)	31 (21.2)
Graduation	198 (51.3)	28 (19.2)
Post-graduation	76 (19.7)	8 (5.4)
Occupation		
Home maker	122 (31.6)	49 (33.6)
Agriculturist	5 (1.3)	27 (18.5)
Semi professional	12 (3.1)	19 (13.0)
Professional	177 (45.9)	19 (13.0)
Self employed	28 (7.3)	19 (13.0)
Govt employee	6 (1.5)	2 (1.4)
Student	36 (9.3)	11 (7.5)

Table 2: Distribution of the Study Participants According to the Knowledge Related to Vaccine

Vaccine related knowledge	Vaccine accepted group (%)n=386	Vaccine not accepted group (%)n=146
Vaccine given		
Covishield	363 (94.0)	48 (32.9)
Covaxin	19 (4.9)	12 (8.2)
Other	1 (0.3)	36 (24.7)
Do not know	3 (0.8)	50 (34.2)
Protection given by vaccine against COVID disease		
Yes	302 (78.2)	79 (54.1)
No	14 (3.6)	17 (11.6)
Do not know	70 (18.1)	50 (34.2)
Post vaccination, antibodies produced after		
1st dose	86 (22.3)	20 (13.7)
2nd dose	186 (48.2)	31 (21.2)
Do not know	114 (29.5)	95 (65.1)
Antibody lasts for a duration of		
<6 months	41 (10.6)	9 (6.2)
6 months-1 year	118 (30.6)	10 (6.8)
>1 year	62 (16.1)	19 (13.0)
Do not know	165 (42.7)	108 (74.0)
Number of doses to be taken		
1	15 (3.9)	7 (4.8)
2	348 (90.2)	101 (69.2)
3	6 (1.6)	13 (8.9)
Do not know	17 (4.4)	25 (17.1)
Optimum gap between the 2 doses		
<4 weeks	32 (8.3)	11 (7.5)
4-8 weeks	322 (83.4)	59 (40.4)
>8 weeks	23 (6.0)	48 (32.9)
Do not know	9 (2.3)	28 (19.2)
Side effects after the vaccination		
Fever	87 (22.5)	21 (5.4)
Cough	6 (1.6)	0
Running nose	1 (0.3)	0
Sore throat	1 (0.3)	0
Body ache	54 (14.0)	17 (11.6)
Many of the above said symptoms in combination	193 (50.0)	94 (64.4)
Do not know	23 (6.0)	5 (3.4)
No effect	21 (5.4)	9 (6.2)
Source of information		
Media	227 (58.8)	81 (55.5)
Children	44 (11.4)	10 (6.8)
Doctor	63 (16.3)	6 (4.1)
Friends/relatives	44 (11.4)	27 (18.5)
Miscellaneous	8 (2.1)	22 (15.1)
Knowledge score	5.11±1.18	4.48±1.67

Table 3: Association of Knowledge Score with Apprehension Regarding the Vaccine

Knowledge score	Apprehension regarding the vaccine		
	Present (n=165)	**Absent (n=367)**	**χ2, dF, p value**
Poor knowledge (≤4)	43 (26.1%)	34 (9.3%)	25.94, 1, <0.001
Good knowledge (>4)	122 (73.9%)	333 (90.7%)	

Table 4: Association of Socio-Demographic Factors, Knowledge Score and Source of Information with Vaccine Acceptance

Factors		Vaccine acceptance		
		Accepted (n=386)	Not accepted (n=146)	χ2, dF, p value
Gender	Female	211 (54.7%)	59 (40.4%)	8.61, 1, 0.003*
	Male	175 (45.3%)	87 (59.6%)	
Education	Illiterate	4 (1%)	28 (19.2%)	139.71, 5, <0.001*
	Primary school	8 (2.1%)	23 (15.8%)	
	High school	55 (14.2%)	28 (19.2%)	
	PUC/Diploma	45 (11.7%)	31 (21.2%)	
	Graduate	198 (51.3%)	28 (19.2%)	
	Post graduate	76 (19.7%)	8 (5.5%)	
Occupation	Housewife	122 (31.6%)	49 (33.6%)	105.45, 6, <0.001*
	Agriculturist	5 (1.3%)	27 (18.5%)	
	Semi Professional	12 (3.1%)	19 (13%)	
	Professional	177 (45.9%)	19 (13%)	
	Self employed	28 (7.3%)	19 (13%)	
	Government employee	6 (1.6%)	2 (1.4%)	
	Student	36 (9.3%)	11 (7.5%)	
Knowledge score	<4	37 (9.6%)	40 (27.4%)	27.15, 1, <0.001*
	>or equal to 4	349 (90.4%)	106 (72.6%)	
Source of information	Media	227 (58.8%)	81 (55.5%)	50.27, 4, <0.001*
	Children	44 (11.4%)	10 (6.8%)	
	Doctor	63 (16.3%)	6 (4.1%)	
	Friends/Relatives	44 (11.4%)	27 (18.5%)	
	Others	8 (2.1%)	22 (15.1%)	

Author Contributions

Author name	Contribution
Ashwini S.	Conceptualization, Methodology, Formal Analysis, Investigation, Provision of study materials, Data Curation, Writing-Original Draft, Data presentation, Project Administration
Bhavana R. Hiremath	Conceptualization, Methodology, Investigation, Provision of study materials, Writing-Review and Editing
Deepthi	Conceptualization, Methodology, Validation, Formal Analysis, Investigation, Provision of study materials, Data Curation, Writing-Review and Editing
Vandana Hiregoudar	Methodology, Validation, Investigation, Provision of study materials, Writing-Review and Editing
Pushpa S. Patil	Conceptualization, Methodology, Validation, Investigation, Provision of study materials, Writing-Review and Editing, Supervision, Project Administration

Covishield and among the vaccine not accepted group, only 48 (32.9%) knew this and 50 (34.2%) could not name any vaccine at all. As many as 302 (78.2%) in vaccine accepted group knew that the vaccine gives protection against COVID disease and a lesser number of 79 (54.1%) in the vaccine not accepted group knew this. More number of 186 (48.2%) study participants in the vaccine accepted group knew that antibodies develop against COVID disease after the second dose as compared to lesser number of 31 (21.2%) study participants in the vaccine not accepted group. As many as 186 (48.2%) study participants in the vaccine accepted group knew that the antibodies again SARS-CoV 2 will appear in the body after 2nd dose of the vaccination. On the contrary, a large number of 95 (65.1%) participants in the vaccine not accepted group did not know at all when the antibodies will develop. A large number of 108 (74%) study participants in vaccine not accepted group did not know how long the protection will last after vaccination and this was 40% lesser in vaccine accepted group with 165 (42.7%) study participants not knowing till when the protection would last. In the vaccine accepted group, 348 (90.2%) study participants knew that they need to take 2 doses whereas, in the vaccine not accepted group only 101 (69.2%) knew they have to take 2 doses. In the vaccine accepted group, 322 (83.4%) study participants knew the gap between the two doses must be 4-8 weeks and in the vaccine not accepted group this was known only to 50% lesser participants than the vaccine accepted group i.e., 59 (40.4%) of the total. As many as 94 (64.4%) study participants in vaccine not accepted group thought vaccine has combination of many side effects like fever, myalgia, headache, cough, sore throat, running nose and only 193 (50%) study participants in vaccine accepted group thought so. Source of this vaccine related knowledge was mainly media in both the groups. As many as 277 (58.8%) in vaccine accepted and 81 (55.5%) in vaccine not accepted group had gotten to know about vaccine through media. Peculiarity of the vaccine accepted group was that a large number of 63 (16.3%) beneficiaries had received vaccine related information from doctors. This number was as small as 6 (4.1%) in the vaccine not accepted group. The mean knowledge score of the vaccine accepted group was 5.11±1.18 and of the vaccine not accepted group was 4.48±1.67. This difference in the mean knowledge score of the two groups was statistically significant (t=5.34, dF=530, p<0.001). As many as 384 (99.5%) in the vaccinated group and 135 (92.5%) among the non-vaccinated group were aware they must wear mask even after getting the vaccination. Among the vaccinated group 358 (92.7%) felt that the COVID vaccination must be

made mandatory and only 76 (52.1%) in the non-vaccinated group felt the same. In the vaccinated group 115 (29.8%) were apprehensive about the vaccination and in the non-vaccinated group this number was greater with 50 (34.2%) being apprehensive. In the vaccine accepted group, 384 (99%) participants said they will motivate others to take vaccination. Reason for taking the vaccination was kept as an open-ended question among the participants who had accepted the COVID vaccine. Responses given were grouped into 4 themes. The first theme was "vaccine will produce antibodies against SARS-CoV 2 and hence, prevent the infection among the vaccinees". As many as 274 (70.9%) had quoted the reasons which fitted in this theme. The next three themes were "vaccine would reduce the severity of the infection", "vaccine would boost the immunity of a vaccinee" and "the vaccine will break the chain of transmission". Responses fitting into these three themes were quoted by 6 (1.6%) participants each. There were several other reasons for accepting the vaccination like insistence by children or doctor, old age, existence of co-morbidities, peer pressure and safety of the vaccine. As many as 114 (29.5%) participants in the vaccination accepted group had heard rumours regarding the vaccine. Responses given for the rumours were grouped into 3 themes. A total of 28 (24.6%) participants had heard rumours which were grouped under the theme "side effects like fever, myalgia and headache persist for a long duration". Responses which were grouped under the theme "side effects will be severe like clotting of the blood, allergy, nerve disease, paralysis and infertility" were given by 20 (17.5%) participants. Few more rumours were grouped under the theme "Vaccine provides no protection" and 22 (19.3%) participants gave this response. Reason for not taking the vaccination was kept as an open-ended question among the participants who had not accepted the COVID vaccine. Responses given were grouped into 4 themes. Response matching the themes "apprehension and indecisiveness", "Disinterest", "ineffective vaccine" and "medical reasons" were recorded among 37 (25.3%), 12 (8.2%), 4 (2.7%) and 19 (13.0%) participants respectively. As many as 55 (37.7%) participants in the vaccination accepted group had heard rumours regarding the vaccine. Responses given for the rumours were grouped into 4 themes. Responses grouped under the 4 themes were "Vaccine causes death", "Vaccine causes COVID disease", "Vaccine has too many side effects" and "Vaccine is ineffective" were given by 12 (21.8%), 24 (43.6%), 13 (23.6%) and 5 (9.1%) respectively. A total of 117 (30.3%) study participants in the vaccine accepted group had tried online registration and only 6 (5.1%) had problems during online registration. Five (1.3%) of these study participants had problem in vaccination process as well which included slowness of the COWIN server. Out of the total 386 vaccinees, only 68 (17.6%) had experienced pain., a majority of 28 (41.2%) out of these 68 had experienced only mild pain of Likert point 1. In this group 177 (45.9%) had come for second dose of vaccination. When these vaccinees were asked about the effects they had experienced after their first dose, a majority of 82 (27.3%) told they had no effect, followed by 77 (25.7%) who had multiple symptoms like fever, myalgia and headache which were mild. None of the study participants had no severe side effects which warranted absence from work, hospitalization or assistance in activities of daily living. A total of 19 (13%) study participants in the vaccine not accepted group had tried online registration and 41 (28.1%) had visited the vaccination centre. (Table 3) shows association between Apprehension and knowledge score of the study participants. Study participants were classified as having good knowledge if their knowledge score was >or equal to 4 and as having poor knowledge if their knowledge score was <4. As many as 43 (26.1%) study participants who had poor knowledge were apprehensive about the vaccine as opposed to only 34 (9.3%) study participants who were not apprehensive despite having poor knowledge. A majority of 333 (90.7%) study participants with good knowledge were not apprehensive as opposed to only 122 (73.9%) participants having apprehension despite a good knowledge. This association between knowledge score and apprehension of the study participants related to vaccine was statistically significant ($p<0.001$). (Table 4) shows association of socio-demographic factors, knowledge score and source of information with vaccine acceptance. Association of gender with vaccine acceptance is statistically significant with 211 (54.7%) females accepting the vaccine and 87 (59.6%) males not accepting the vaccine. Education was also significantly associated with vaccine acceptance. As many as 198 (51.3%) graduates had accepted the vaccine and as less as 28 (19.2%) graduates had not accepted the vaccine. Similar statistical significance was observed between occupation and vaccine acceptance. As many as 177 (45.9%) professionals had accepted the vaccine and as less as 17 (13%) professionals had not accepted the vaccine. As many as 27 (18.5%) agriculturists had not accepted the vaccine as opposed to lesser number of 5 (1.3%) accepting the vaccine. Knowledge score of a majority of 349 (90.4%) study participants who accepted the vaccine was >or equal to 4 compared to 106 (72.6%) study participants who had not accepted the vaccine. This association was statistically significant. More number of study participants in the group which accepted the vaccine had got the information regarding vaccine by children

[44 (11.4%)] or doctors [63 (16.3%)] as opposed to lesser number of study participants in group which did not accept the vaccine who got the information from children [10 (6.8%)] or doctors [6 (4.1%)].

The salient demographic characteristics of the group which accepted vaccine were females by gender (54.7%), graduates educationally (51.3%) and professionals occupationally (45.9%). Whereas, the salient demographic characteristics of the group which had not accepted vaccine were males by gender (59.6%), educated till pre-university (21.2%) and home makers (33.6%) followed by agriculturists in occupation (18.5%). Significant difference in the mean age of the two groups showed that the older age had accepted the vaccine than the younger age group. Knowledge score of the group which accepted the vaccine was better than the group which did not accept (5.11±1.18 v/s 4.48±1.67) and this difference was statistically significant. Hence, we can say knowledge is an extremely important determinant of vaccine acceptance. Apprehension was observed to be more in the vaccine not accepted group than the vaccine accepted group (34.2% v/s 29.8%). The common reason quoted by the participants for non-acceptance was "apprehension and indecisiveness". Interestingly, the knowledge score of the participants regarding the COVID vaccination was significantly related to apprehension regarding the vaccine proving the fact again that knowledge alleviates apprehension thus enhancing the vaccine acceptance. Factors such as gender, education, occupation, knowledge score and source of information were associated significantly with the vaccine acceptance. Media and doctors were observed to be the prime sources of information in the vaccine accepted group. We must note here that 30.3% of the vaccinees had tried online registration for the vaccination slot and almost everyone had succeeded at that. Also, almost none of the beneficiaries had any problem in the process of vaccination. On a positive note, one of the dreaded events relating to vaccination is the pain of injection and that was noted only among 17.6% of the vaccinees, majority of which had only mild pain. Another dread event related to a new vaccine is the side effect following the vaccination. However, our study reports that side effects seen post vaccination were very mild and there was no hospitalization, absence from work or assistance for activities of daily living observed among the ones who came for their second dose. A survey-based study using google forms in West Bengal among the potential vaccine beneficiaries showed that 12.24% of the responders were indecisive about accepting the vaccine[6] which was higher at 25.3% among vaccine non accepted group in our study. A self-administered questionnaire was shared online across India in January 2021-February 2021 by Richa Bhargava *et al.* in which it was shown that males were more inclined towards vaccination[7] which was also observed in our study with 45.3% males accepting the vaccine. However, in our study vaccine accepted group consisted more females than males. The above stated study also showed that 47.3% individuals who have done post-graduation were more ready to accept the vaccine[7] and in our study a similar proportion of 51.3% had accepted the vaccine who were graduates. As many as 22% professionals and 49.1% of salaried were ready to accept the vaccine as per the above stated study[7] which was similar to 45.9% professionals in our study who had accepted the vaccine. A study on beliefs and barriers affecting COVID vaccine acceptance showed that one of the important barriers is the side effects and doctor recommendation improved the vaccine acceptance[8]. Doctors were noted to be the major source of information regarding vaccine to the vaccine accepted group as opposed to the vaccine not accepted group in our study as well. The qualitative finding in our study also observed that 'vaccine has too many side effects' was one of the rumours believed by the vaccine not accepted group. As it was found in the study that the ones who had better knowledge had lesser apprehension related to the vaccine and accepted the vaccine more, health educational efforts must be increased to enhance the knowledge regarding the vaccine. And these efforts must be targeted towards men as their acceptance is less and they are the decision makers in most of the families, potential beneficiaries of younger age group, individuals educated below pre-university level, housewives and agriculturists. Media appears to be the most influential source of information in our study followed by doctors. Hence, media and doctors can be used to deliver vaccine related information and influence the beneficiaries towards acceptance. Experiences of the vaccine beneficiaries relating to ease of online registration, non-hindrance in the vaccination procedure, almost painless injection and relatively no after effects of vaccine must be highlighted in the media as well as during information, education and communication sessions. This study was conducted among the potential beneficiaries after the vaccine was made available and after a lot of information was disseminated regarding the same in the media. Hence, it gives a fair idea of the factors influencing the vaccine acceptance. Also, data regarding the experiences relating to the vaccine are collected quantitatively and presented in the words of the beneficiaries. Similarly, the thoughts of the group which has not accepted the vaccine is also collected giving real insight into the attitude and belief of the potential beneficiaries. Similar studies can be conducted in other areas to understand the area

specific factors determining the vaccine acceptance. More studies have to be conducted among the vaccinees in order to provide scientific evidence against the rumours like 'vaccine causes serious side effects' or 'vaccine provides no protection against the disease'. Improving the vaccine acceptance in general is one of the most important steps in future pandemic or epidemic preparedness. Hence, the factors determined in this study to be affecting the vaccine acceptance can be applied in future for other vaccines as well.

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