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Understanding Factors Influencing COVID-19 Vaccination Acceptance Among Pregnant Women

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Abstract

Background

The coronavirus disease (COVID-19) outbreak began in December 2019, leading to severe acute respiratory syndrome. By January 30, 2020, the World Health Organization (WHO) declared it a Public Health Emergency of International Concern, and by March 11, 2020, it was classified as a pandemic. Pregnant women were identified as a particularly vulnerable group, facing a heightened risk of adverse outcomes, including preterm delivery, ICU admission, cesarean section, and in some cases, death.

Objective

The primary objective of this study was to identify factors associated with COVID-19 vaccine acceptance among pregnant women at AMCH, Roorkee.

Methods

A descriptive cross-sectional study was conducted at AMCH, Roorkee, involving 196 pregnant women. Data were collected using a semi-structured questionnaire, with a sampling frame created by listing pregnant women from each of the seven health institutions at AMCH, Roorkee. Convenience sampling was employed to proportionately select the required sample. Data analysis was performed using IBM SPSS-20, with bivariate analysis to examine the relationship between COVID-19 vaccine acceptance and other explanatory variables.

Results

The study found that several factors were associated with the acceptance of the COVID-19 vaccine among pregnant women. These factors included:

- Perception of the respondent
- Age
- Ethnicity
- Education level
- Occupation
- History of COVID-19 infection
- COVID-19 vaccinations among family members
- Degree of infection risk

Conclusion

The study concluded that various demographic and contextual factors are significantly associated with COVID-19 vaccine acceptance among pregnant women at AMCH, Roorkee. These findings can guide healthcare professionals and policymakers in developing strategies to improve vaccine acceptance and mitigate the risks associated with COVID-19 during pregnancy.

Key words: COVID-19, Vaccination, Acceptance, Pregnant women

Introduction

Background

In December 2019, there was news of the coronavirus disease outbreak of 2019 (COVID-19), which was brought on by severe acute respiratory syndrome. On January 30, 2020, the World Health Organization (WHO) formally classified the epidemic as a Public Health Emergency of International Concern. On March 11, 2020, the outbreak was formally recognized as a pandemic.[1,2] It causes enormous burdens on morbidity and mortality along with disrupting societies and economics globally.[3] The World Health Organization along with numerous research team and clinical experts globally are engaged in efforts and campaigns for prevention, early diagnosis and medical management of COVID-19.[4]

Large scale physical distancing measures and movement restrictions (lockdown) have been implemented in various countries as a mitigation measure,[5] but the pandemic is still ongoing despite such measures. Although managing the spread of this pandemic is key by implementation of personal protective measures, vaccination could be the key protective measures against the pandemic.[6]

COVID-19 Vaccination is considered as the most effective measures for preventing the pandemic and avoiding various complications caused by the disease.[7] However, vaccine hesitancy does exist and it can delay the implementation of vaccination and increase refusal towards vaccination among potential vaccine receivers.[8] Vaccine hesitancy refers to the delay in accepting the vaccine or completing refusing it although the vaccination services are been available.[9] Many factors could involve in vaccine acceptance. Safety and efficacy of the vaccine, adverse health outcomes after vaccination, misconceptions about the vaccine, lack of trust towards the health system, etc. and lack of information about the vaccine preventable diseases are the major factors for vaccine hesitancy.[10,11] The World Health Organization (WHO) declared the vaccine hesitancy among the top ten health threat in 2019 as its concern are growing globally.[12]

The most susceptible category is pregnant women, who have a higher chance of experiencing COVID-19-related poor pregnancy outcomes, such as preterm delivery, ICU admission, cesarean section, and even death.[13,14] Pregnant women's acceptance of the COVID-19 immunization varies by nation. According to a study conducted in 14 nations, the adoption of the COVID-19 vaccination was lowest in Russia, the US, and Australia, and highest in Latin America, the Philippines, and India. [15]

Ministry of Health and Population, Nepal has approved the use of COVID-19 vaccination for pregnant women and lactating women. Maternal and fetal complications can be prevented by the use of COVID-19 vaccination but many studies have showed that the acceptance of COVID-19 vaccination among pregnant women and lactating women is low. Safety and efficacy of the vaccine, trust in health system and fear of harming the foetus are the major factors affecting the acceptance of COVID-19 vaccination.[16,17]

Pregnant women's low rate of acceptance of the COVID-19 vaccine was mostly caused by a lack of awareness about COVID-19 infection and uncertainties over the safety and effectiveness of the vaccine, according to multiple studies.[18,19] Similarly, unemployment, younger age and high perceived stress decrease the chance of being vaccinated and history of depression increased the chance of being vaccinated.[20]

Statement of the Problem

As of May 24, 2022, the WHO had received reports of 52,27,83,196 confirmed cases of COVID-19 worldwide, including 62,76,210 fatalities. South-East Asia has reported 5,80,78,211 confirmed cases of COVID-19, with 7,88,244 deaths. In a similar vein, the SAARC area has recorded 4,86,83,179 confirmed cases of COVID-19, including 6,20,447 deaths. There have been 9,79,076 confirmed cases of COVID-19 in Nepal, with 11,952 deaths recorded.[21]

As of May 24, 2022, 5.9% of individuals worldwide had received a partial COVID-19 vaccination and 60% of people had received the full vaccination. Likewise, in high-income nations, 4.9% of individuals have had only a partial COVID-19 vaccination, whereas 75% of people have received the complete dose. In lower middle-income nations, 8.1% of individuals have had only a partial COVID-19 vaccination, compared to 53% who have received the complete dose. Of those living in low-income countries, 13% have received all COVID-19 vaccinations, while 16% have received some vaccinations.[22]

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In an interview, Nepal's Health Minister informed that Nepal to vaccinate all adults by mid-April, 2022. Health ministry records show 44 % of Nepal's adults have received at least one dose and 37.5 % are fully vaccinated.[23] However, it could be a great challenge to achieve the target as vaccine hesitancy could play a negative role in those pregnant women. They may have concerns about the adverse effect of vaccination along with its safety and effectiveness.

A study in Turkey showed low acceptance of COVID-19 vaccination in pregnant women (37%). The major reason for the low rate of COVID-19 vaccine acceptance was vaccine safety.[24] Similarly, only 30.3% of pregnant women were vaccinated against COVID-19 in Singapore. Most of the pregnant women (70.0%) showed willingness to accept the vaccine when more safety data were available.[25]

Pregnant women are at a high risk from Covid-19 infection. In Nepal, at least 354 maternal deaths has been reported after March 2020, where more than 44 deaths were due to coronavirus. According to doctors, pregnant and lactating women are the most vulnerable group to have serious effects from COVID-19 vaccination. But still Minister of Health and Population has not listed those women as a priority for vaccination. Studies has shown that more risk of severe illnesses, complications and death are higher in pregnant women as compared to ordinary women.[26]

Conceptual Framework

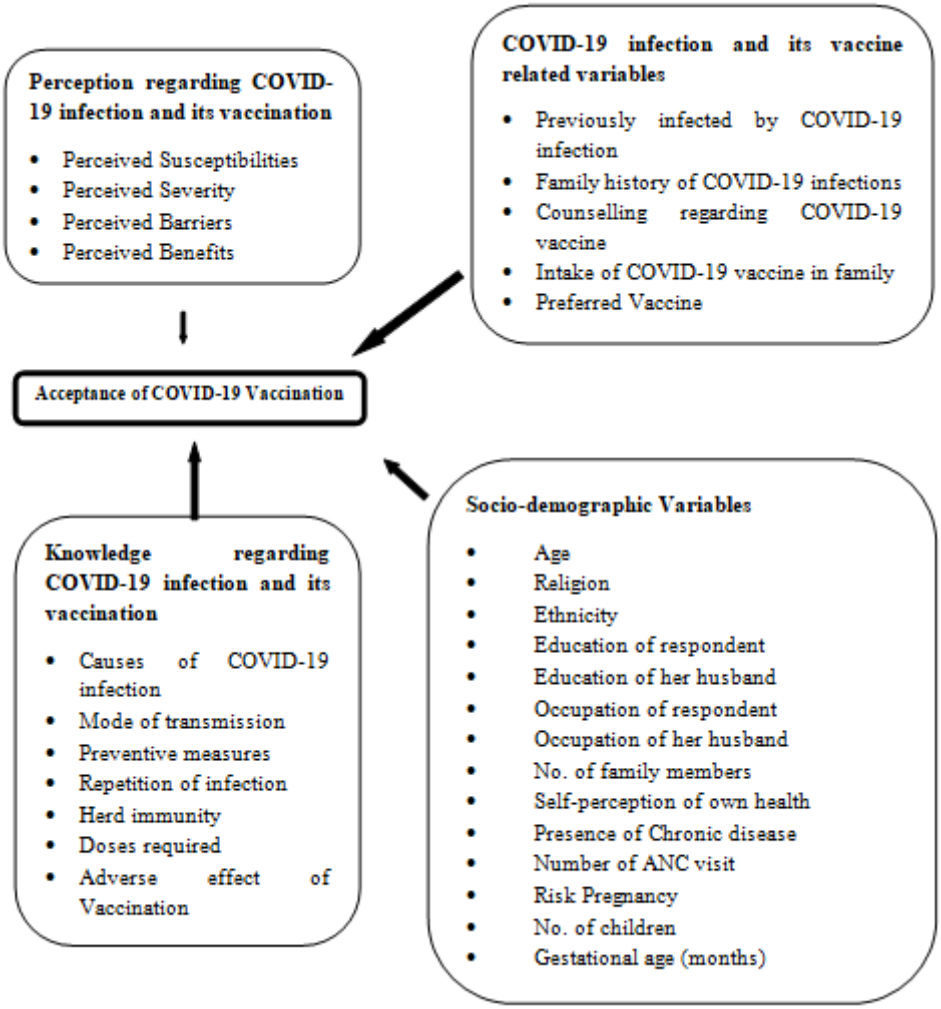

Fig no.1.1: Conceptual Framework for acceptance of COVID-19 vaccination

Objectives of the Study

General Objective

To assess the factors associated with the acceptance of COVID-19 vaccination among pregnant women of AMCH, Roorkee.

Specific Objectives
To find out the magnitude of COVID-19 vaccine acceptance among the pregnant women in AMCH, Roorkee.
To find out the association between acceptance of COVID-19 vaccination with some explanatory variables.

Methodology

Research Design
Descriptive cross-sectional design was used to assess factors associated with the acceptance of COVID-19 vaccination among pregnant women in AMCH, Roorkee.

Study Site and Justification
The study was conducted in all seven wards of AMCH, Roorkee, Morang as it consists of various people with different religion, ethnicity, educational status, socio-economic status, etc. Also, it was easy and convenient for me to conduct the research in AMCH, Roorkee.

Sampling Technique
All seven wards of AMCH, Roorkee were selected for the study. The list of pregnant women was obtained from all the seven health institutions of AMCH, Roorkee. Pregnant women of each ward were included in the study in a proportionated way. The sample population for the study were selected on the basis of convenience.

Study Unit
Individual pregnant women living in AMCH, Roorkee.

Study Variables
Dependent Variable
Acceptance of COVID-19 Vaccination.

Independent Variables

Table no. 3.1: Independent Variables

Socio-demographic Variable	COVID-19 infection and its vaccine-related variables	Perception regarding COVID-19 infection and its vaccination	Knowledge regarding COVID-19 infection and its vaccination
Age Religion Ethnicity Education of herself Education of husband Occupation of herself Occupation of husband No. of family members Self-perception of own health Presence of Chronic disease Number of ANC visit Risk Pregnancy No. of children Gestational age (months)	Previously infected by COVID-19 Family history of COVID-19 infections Counselling regarding COVID19 vaccine Intake of COVID-19 vaccine in family Preferred Vaccine	Perceived susceptibilities Perceived severity Perceived barriers Perceived benefits	Causes of COVID-19 infection Mode of transmission Preventive measures Repetition of infection Herd immunity Doses required Adverse effect of Vaccination

Operational Definition
COVID-19 vaccination:
Refers to the administration of a vaccine to produce immunity against COVID-19 infection.

Acceptance of COVID-19 vaccination:
Refers to the acceptance for administration of COVID-19 vaccination during the period of pregnancy from the time of availability of vaccine for them.

Hesitancy of COVID-19 vaccination:
Refers to the delay in acceptance or refusal of vaccination despite availability of vaccination services for them.

Vaccine Outright Refusal:
Refers to the statement that the people declared, they would never get vaccinated against COVID-19 infection during pregnancy period.

Factors associated with COVID-19 vaccination:
Those factors which directly or indirectly leads towards either acceptance or hesitancy of COVID-19 vaccination.

Chronic disease:
It refers to the condition or disease that is persistent or long-lasting in its effects, generally for more than three months. It includes arthritis, asthma, cancer, COPD, diabetes, autoimmune diseases, genetic disorders and some viral diseases such as hepatitis C and acquired immunodeficiency syndrome.

Perceived susceptibilities:
Refers to whether the respondent feels himself/herself at a risk of spreading the COVID-19 virus to others.
Perceived severity:
Refers to whether the respondent keeps himself/herself at a risk of getting a severe COVID-19 infection.
Perceived barriers:
Refers to whether the respondent feels himself/herself safe to get vaccinated against COVID-19 or not.
Perceived benefits:
Refers to whether the respondent feels himself/herself that the COVID-19 vaccination is beneficial to them.
Preferred vaccine:
Refers to the COVID-19 vaccine, which is in top priority for the respondent.
Repetition of infection:
Refers to whether COVID-19 infection can re-occur in those people of previously infected or not.

Herd immunity:
Refers to the form of indirect protection from infectious disease that can occur with some diseases when a sufficient percentage of a population has become immune to an infection.

Doses required:
Refers to how many doses of COVID-19 vaccination is required as per the respondents.

Level of perception towards COVID-19 infection and its vaccination
Each question from four domain was assessed and the obtained score was compared with the cut-off point. Cut off point was obtained by adding the lowest value and the highest value followed by the dividing it with 2. Any score above or/and equal to cut off was categorized as satisfactory and below was categorized as unsatisfactory.
Level of knowledge towards COVID-19 infection and its vaccination
Each question from seven domains was assessed and its score ranges from 0 to 7. The obtained score has normality test. Cut off point was obtained by adding the lowest value and the highest value followed by the dividing it with 2. Any score above or/and equal to cut off wase categorized as satisfactory and below was categorized as unsatisfactory.

Data Collection Technique/ Methods
Interview guidelines was used to collect data from respondents. Researcher himself was completely responsible for collecting the data. All the pregnant women invited for participants were briefed about the study objectives. Data was collected in the presence of researcher himself.

Data Collection Tools
Data was collected by using semi-structured questionnaire. Questionnaire contained four parts: Part contained questions related to socio-demographic information, part II contained questions related to COVID-19 infection and its vaccine**,** part III contained questions related to the perception of COVID-19 infection and vaccination and part IV contained questions related to the knowledge of COVID-19 infection and vaccination.

Data Management and Analysis
After a careful examination, the completed questionnaire was loaded into IBM SPSS 20 and data mining and editing were done in preparation for additional analysis. Using IBM-SPSS version 20, data management and analysis were carried out.

The researcher entered the data, and with the assistance of a subject matter expert, descriptive and inferential analysis was completed. Frequencies, percentages, means, standard deviation, median, and interquartile range were calculated in terms of descriptive analysis. A 0.05 level of statistical significance (α level) was established. To investigate the relationship between the acceptability of the COVID-19 immunization and other variables, bivariate analysis was used.

Validity and reliability of study tools

Validity

Using items from previously validated surveys, creating things based on a thorough literature search, and regularly going over the questions with the supervisor were the methods used to ensure content validity. With back-and-forth translation between English and Indian languages, translation authenticity was guaranteed.

Reliability

Pretesting of questionnaire was done among 20 pregnant women. Then the data was entered on SPSS version 20 and coefficient of alpha (Cronbach's alpha) was calculated. The obtained value of alpha was 0.83.

Limitations of the Study

As this study was cross sectional, its result cannot be generalized. Similarly, the research was conducted among the pregnant women of only one rural municipality of Morang that cannot represent the whole pregnant women of the country.

Result

This chapter of report contains the findings obtained from analysis of responses from 196 pregnant women of AMCH, Roorkee in relation to factors associated with the acceptance of COVID-19 vaccination. It has been divided into two broad sections to give clear picture of findings. The first section presents description of study variables whilst its bivariate analysis part is presented in second section.

Descriptive Analysis

Socio-demographic Characteristics of the respondents

This study assessed information on age, religion, ethnicity, educational status of the respondent and her husband, occupation of the respondent and her husband and number of family members of each participant as individual demographic characteristics of participants. Individual demographic descriptive findings of study population are summarized in Table 4.1.

Around two-thirds (64.3%) of respondents were aged 17 to 24 years. Median age of participants was 23 with maximum and minimum reported age being 40 years and 17 years respectively and an IQR of 6. Majority of the respondents (84.2%) were Hindu. More than one-third (37.2%) of respondents belonged to the ethnic group Tribe. Most of the respondents had educational status (42.9%) of primary education and their husband had educational status (47.4%) of secondary education. Almost half of the respondents were found to be unemployed (housewife) (50.5%) and their husband's main occupation was agriculture (40.3%). Also, more than half of the respondents (55.6%) had 5 to 8 family members in their house.

Table 4.1: Socio-demographic characteristics of pregnant women of AMCH, Roorkee (n=196)

Variables	Categories	Frequency (N)	Percentage (%)
Age (in years)	17-24	126	64.3
	25-32	59	30.1
	33-40	11	5.6
	Median (IQR)=23(6),	*Min/Max = 17/40*	
Religion	Hindu	165	84.2
	Buddhist	12	6.1
	Islam	5	2.6
	Christian	14	7.1
Ethnicity	Brahmin/Chhetri	62	31.6
	Jana Jati	73	37.2
	Dalit	53	27.0
	Madhesi	8	4.1
Education status of the	Illiterate	19	9.7

respondent	Primary education	84	42.9
	Secondary education	61	31.1
	Higher education	32	16.3
Education status of her husband	Illiterate	8	4.1
	Primary education	26	13.3
	Secondary education	93	47.4
	Higher education	69	35.2
	Agriculture	72	36.7
Current occupation of the respondent	Business	14	7.1
	Governmental services	7	3.6
	Non-governmental services	4	2.0
	Housewife	99	50.5
Current occupation of her husband	Agriculture	79	40.3
	Business	31	15.8
	Governmental services	10	5.1
	Non-governmental services	7	3.6
	Foreign employment	69	35.2
Number of family members	1-4	87	44.4
	5-8	109	55.6

Other personal information of the respondents

Most of the respondents (96.4%) have self-perceived to have good health with almost the same numbers (96.9%) reported been free from chronic diseases. More than one-third of the respondents (37.8%) had two times of ANC visits and some of the respondents (12.2%) haven't still visited for ANC. Most of the respondents (97.4%) didn't have any type of pregnancy risk. Also, majority of the respondents (61.7%) had children. Also, more than one-third of the respondents (36.2%) had a gestational age of 7-8 months.

Table 4.2: Other personal information of pregnant women of AMCH, Roorkee (n=196)

Variables	Categories	Frequency (N)	Percentage (%)
Self-perception of own health	Good	189	96.4
	Average	6	3.1
	Bad	1	0.5
Presence of chronic disease	Yes	6	3.1
	No	190	96.9
Number of ANC visit	0	24	12.2
	1	47	24.0
	2	74	37.8
	3	42	21.4
	4	9	4.6
Risk pregnancy	Yes	5	2.6
	No	191	97.4
Number of children	0	75	38.3
	1-3	121	61.7
Gestational age (months)	0-4	46	23.5
	5-6	65	33.2
	7-8	71	36.2
	9	14	7.1

COVID-19 infection and vaccine related information of the respondents

Around three-fourth of the respondents (74.5%) had no cases of previously infected by COVID-19 with almost the same number of respondents' family members (75%) reported to be uninfected from COVID-19 infection. Most of the respondents (90.3%) received counseling from either health professionals or other people. More than three-fourth of the respondents' family members (78.6%) were vaccinated against COVID-19 whereas only one-third of the respondents (34.7%) were vaccinated against COVID-19 during their pregnancy period. Among the vaccinated respondents, only two-third of the respondents (38.23%) received two doses of COVID-19 vaccination. Also, most of the unvaccinated respondents' family members (90.63%) didn't want the respondents to be received COVID-19 vaccine. Most of the unvaccinated respondents (39.1%) preferred Johnson & Johnson vaccine if they got a chance to be vaccinated in the future.

Table 4.3: COVID-19 infection and vaccine related information among pregnant women of AMCH, Roorkee (n=196)

Variables	Categories	Frequency (N)	Percentage (%)
Previously infected by COVID-19			
	Yes	50	25.5
	No	146	74.5
Family members suffered from COVID-19	Yes	49	25.0
	No	147	75.0
Received counselling about COVID-19 vaccination	Yes	177	90.3
	No	19	9.7
Family members vaccinated against COVID-19	Yes	154	78.6
	No	42	21.4
Respondent vaccinated against COVID-19	Yes	68	34.7
	No	128	65.3
If yes, doses of COVID-19 (n = 68)	1	42	61.77
	2	26	38.23
If no, does family members want the respondent to be vaccinated (n=128)			
	Yes	12	9.37
	No	116	90.63
Preferred vaccine (n=128)			
	Oxford-AstraZeneca (Covishield)	38	29.7
	Janssen (Johnson and Johnson)	50	39.1
	Sinopharm (Vero Cell)	40	31.2

Perception regarding COVID-19 infection and its vaccination among the respondents

More than half of the respondents (54.6%) disagreed to spread the virus to other people at the current time and more than that number (61.2%) disagreed to be at risk of getting COVID-19 infection at the current time. Around half of the respondents (42.9%) agreed COVID-19 vaccine may not cause infection and around half of the respondents (53.6%) agreed COVID-19 vaccine may be effective.

Among unvaccinated respondents, more than half of the respondents (57%) agreed to be worried about the adverse effect of the vaccine while only a few were uncertain whether to be vaccinated or not. Also, among unvaccinated respondents, 26.6% of the respondents perceived vaccines to be unsafe while 35.1% of the respondents perceived vaccines to be safe. Half of the respondents (50%) agreed on vaccines protect them from infection while more than one-third of the respondents (38.3%) can't decide whether vaccines protect other people who are not vaccinated or not. Among the unvaccinated respondents, more than half (53.1%) agreed that after vaccination, they can lead a normal lifestyle.

Also, majority of the respondents (63.3%) has satisfactory level of perception on COVID-19 infection and its vaccination.

Table 4.4: Perception regarding COVID-19 infection and its vaccination among pregnant women of AMCH, Roorkee (n=196)

Variables	Frequency (N) Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)
I can spread the virus to other people	59 (30.1)	107 (54.6)	15 (7.7)	13 (6.6)	2 (1.0)

I am at risk of getting a severe COVID-19 infection	55 (28.1)	120 (61.2)	2 (1.0)	13 (6.6)	6 (3.1)
COVID-19 vaccine may not cause infection	-	6 (3.1)	24 (12.2)	84 (42.9)	82 (41.8)
COVID-19 vaccine may be effective	19 (9.7)	17 (8.7)	11 (5.6)	105 (53.6)	44 (22.4)
I am worried about the adverse effects of the vaccine (n=128)	11 (8.6)	19 (14.9)	25 (19.5)	73 (57.0)	-
I am not sure whether or not I have to get the vaccine (n=128)	4 (3.1)	61 (47.7)	49 (38.3)	13 (10.1)	1 (0.8)
It is safe to get vaccinated (n=128)	-	34 (26.6)	48 (37.5)	45 (35.1)	1 (0.8)
Vaccine protects me from getting infected	20 (10.2)	22 (11.2)	48 (24.5)	98 (50.0)	8 (4.1)
Vaccine also protects other people who are not vaccinated	28 (14.3)	28 (14.3)	75 (38.3)	64 (32.7)	1 (0.5)
After vaccination, I can lead a normal lifestyle (n=128)	-	30 (23.5)	27 (21.1)	68 (53.1)	3 (2.3)

Table 4.5: Level of perception regarding COVID-19 infection and its vaccination among pregnant women of AMCH, Roorkee (n=196)

Variables	Frequency	Percentage
Level of perception		
Unsatisfactory	72	36.7
Satisfactory	124	63.3

Knowledge regarding COVID-19 infection and its vaccination among the respondents

More than three-fourth of the respondents (77%) knew that COVID-19 is caused by virus and only less than half of the respondents (41.3%) knew all the modes of transmission of COVID-19. Large number of respondents (70.4%) knew all the necessary preventive measures of COVID-19 and almost the same numbers (72.4%) knew that COVID-19 infection can be repeated to those who were previously infected. Less than half of the respondents (41.3%) had good knowledge on herd immunity against COVID-19 and most of the respondents (88.3%) had good knowledge on doses of COVID-19 vaccination required. Among unvaccinated respondents, only about half of the respondents (42.2%) knew the possible adverse effect of COVID-19 vaccine.

Also, majority of the respondents (75.5%) has satisfactory level of knowledge on COVID-19 infection and its vaccination.

Table 4.6: Knowledge regarding COVID-19 infection and its vaccination among pregnant women of AMCH, Roorkee (n=196)

Statement	Correct response	
	Frequency (N)	Percentage (%)
COVID-19 is caused by virus	151	77.0
COVID-19 can be transmitted through contaminated objects or surfaces, close contact with infected person and droplet nuclei of infected person	81	41.3
COVID-19 can be prevented through cleaning hands with soap and water/sanitizer, wearing mask and maintaining atleast 1 m distance with peoples	138	70.4
COVID-19 infection can be repeated	142	72.4
Herd immunity against COVID-19 hasn't been developed	81	41.3
Two doses of vaccine are fully needed to protect against COVID-19 infection	173	88.3
Adverse effect of vaccination includes fever, fatigue and headache	54	42.2

Table 4.7: Level of knowledge regarding COVID-19 infection and its vaccination among pregnant women of AMCH, Roorkee (n=196)

Variables	Frequency	Percentage
Level of knowledge		

Unsatisfactory	48	24.5
Satisfactory	148	75.5

Bivariate Analysis

The association between dependent variables and independent variables was tested using chi-square test. A p-value of less than 0.05 was considered to be statistically significant.

Association between acceptance of COVID-19 vaccination and socio-demographic variables of the respondents

From the analysis, it was found that acceptance of COVID-19 vaccination was significantly associated with age (p<0.001), ethnicity (p<0.001), educational status of the respondent (p<0.001), educational status of respondents' husband (p=0.002) and occupation of respondents' husband (p=0.001), while it was not associated with religion, occupation of respondent and number of family members.

Table 4.8: Association between acceptance of COVID-19 vaccination and socio-demographic variables of pregnant women of AMCH, Roorkee (n=196)

Variables	Categories	COVID-19 vaccine acceptance		χ^2 value	P-value
Age					
	17-24	35 (27.8)	91 (72.2)	15.788	**<0.001***
	25-32	32 (54.2)	27 (45.8)		
	33-40	1 (9.1)	10 (90.9)		
Religion					
	Hindu	59 (35.8)	106 (64.2)	0.521	0.470
	Others [a]	9 (29.0)	22 (71.0)		
Ethnicity					
	Brahmin/Chhetri	29 (46.8)	33 (53.2)	16.018	**<0.001***
	Janajati	30 (41.1)	43 (58.9)		
	Others [b]	9 (14.8)	52 (85.2)		
Education of the respondent	Primary education or below	21 (20.4)	82 (79.6)	19.607	**<0.001***
	Secondary and higher education	47 (50.5)	46 (49.5)		
Education of her husband	Primary education or below	4 (11.8)	30 (88.2)	9.545	**0.002***
	Secondary and higher education	64 (39.5)	98 (60.5)		
Occupation of the respondent	Agriculture/Housewife	62 (36.3)	109 (63.7)	1.446	0.229
	Others [c]	6 (24.0)	19 (76)		
Occupation of her husband	Agriculture	38 (48.1)	41 (51.9)	10.500	**0.001***
	Others [c]	30 (25.6)	87 (74.4)		
No. of family members	1-4	25 (28.7)	62 (71.3)	2.451	0.117
	5-8	43 (39.4)	66 (60.6)		

** denotes significant at p<0.05*

a: Others include Buddhist, Islam and Christian

b: Others include Dalit and Madhesi

c: Others include Business, Government services and Non-government services

Association between acceptance of COVID-19 vaccination and other personal information of the respondents

From the analysis, it was found that acceptance of COVID-19 vaccination doesn't show any association with self-perception of own health, presence of chronic disease, number of ANC visit, risk pregnancy, number of children and gestational age (months). Self-perception of own health, presence of chronic disease and risk pregnancy didn't fit chi-square test as the frequency on two tables on cross tab was less than 5, so, Fisher exact test was used on it.

Table 4.9: Association between acceptance of COVID-19 vaccination and other personal information of pregnant women of AMCH, Roorkee (n=196)

Variables	Categories	COVID-19 vaccine acceptance		Chi-square value	P-value
		Yes (%)	No (%)		
Self-perception of own health					
	Good	67 (35.4)	122 (64.6)		0.425##
	Average/Bad	1 (14.3)	6 (85.7)		
Presence of chronic disease					
	Yes	2 (33.3)	4 (66.7)		1.000##
	No	66 (34.7)	124 (65.3)		
No. of ANC visit					
	0	9 (37.5)	15 (62.5)	0.860	0.650
	1-2	44 (36.4)	77 (63.6)		
	3-4	15 (29.4)	36 (70.6)		
Risk pregnancy					
	Yes	1 (20.0)	4 (80.0)		0.484##
	No	67 (35.1)	124 (64.9)		
No. of children					
	0	20 (26.7)	55 (73.3)	3.455	0.063
	1-3	48 (39.7)	73 (60.3)		
Gestational age (months)					
	1-4	20 (43.5)	26 (56.5)	3.626	0.305
	5-6	19 (29.2)	46 (70.8)		
	7-8	26 (36.6)	45 (63.4)		
	9	3 (21.4)	11 78.6)		

denotes application of Fisher Exact Test

Association between acceptance of COVID-19 vaccination and COVID-19 infection and vaccine related information of the respondents

From the analysis, it was found that acceptance of COVID-19 vaccination was significantly associated with the respondents previously infected by COVID-19 (p=0.022) and family members vaccination against COVID-19 (p<0.001), while it was not associated with family members suffered from COVID-19 and received counselling from the health professionals or other people.

Table 4.10: Association between acceptance of COVID-19 vaccination and COVID-19 infection and vaccine related information of pregnant women of AMCH, Roorkee (n=196)

Variables	Categories	COVID-19 vaccine acceptance		Chi-square value	P-value
		Yes	No		
Previously infected by COVID-19					
	Yes	24 (48.0)	26 (52.0)	5.245	**0.022***
	No	44 (30.1)	102 (69.9)		

Family members suffered from COVID-19	Yes	20 (40.8)	29 (59.2)	1.081	0.299
	No	48 (32.7)	99 (67.3)		
Perceived Counselling about COVID-19 vaccination					
	Yes	61 (34.5)	116 (65.5)	0.043	0.836
	No	7 (36.8)	12 (63.2)		
Family members vaccinated against COVID-19 infection					
	Yes	67 (43.5)	87 (56.5)	24.634	**<0.001***
	No	1 (2.4)	41 (97.6)		

** denotes significant at p<0.05*

Association between acceptance of COVID-19 vaccination and level of perception of the respondents
From the analysis, it was found that acceptance of COVID-19 vaccination was significantly associated with the level of perception of the respondents (p<0.001).

Table 4.11: Association between acceptance COVID-19 vaccination and level of perception regarding COVID-19 infection of pregnant women of AMCH, Roorkee (n=196)

Variables	Categories	COVID-19 vaccine acceptance		χ^2 value	P-value
		Yes (%)	No (%)		
Level of perception					
	Unsatisfactory	8 (11.1)	64 (88.9)	27.935	**<0.001***
	Satisfactory	60 (48.4)	64 (51.6)		

** denotes significant at p<0.05*

Association between acceptance of COVID-19 vaccination and level of knowledge of the respondents
From the analysis, it was found that acceptance of COVID-19 vaccination wasn't associated with the level of knowledge of the respondents.

Table 4.12: Association between acceptance COVID-19 vaccination and level of knowledge regarding COVID-19 infection of pregnant women of AMCH, Roorkee (n=196)

Variables	Categories	COVID-19 vaccine acceptance		χ^2 value	P-value
		Yes (%)	No (%)		
Level of knowledge					
	Unsatisfactory	16 (33.3)	32 (66.7)	0.863	0.482
	Satisfactory	52 (35.1)	96 (64.9)		

Discussion

This chapter discusses findings of this study and compares the results with findings of other similar studies. This study has examined factors associated with the acceptance of COVID-19 vaccination among pregnant women in AMCH, Roorkee.

Vaccination programs of any area can only be effective if they have a high level of acceptance and coverage. Acceptance of COVID-19 vaccine among the sample of pregnant women of this study was low, with only 34.7% of them vaccinated against COVID-19. It might be due to the lack of awareness among them regarding the vaccine. The acceptance rate of the study was much lower than that found in a study in China (77.4%)[37], Saudi Arabia (68%)[38] and Thailand (60.8%)[39].

Majority of the respondents with good self-perception of own-health and absence of chronic disease, i.e., 64.6% and 65.3% respectively were unvaccinated against COVID-19. It might be due to the perception of self-capability of their body to fight against COVID-19 infection. It was also found that number of ANC Visit had no any significant changes on the acceptance of COVID-19 vaccination. 64.9% of the pregnant women without any risk pregnancy were still unvaccinated against COVID-19. Also, number of children and gestational age was

found to be unassociated with the acceptance of COVID-19 vaccination. A study conducted in Thailand also found number of children to be unassociated with the acceptance of COVID-19 vaccination but it also showed association between COVID-19 vaccine acceptance and gestational age[39].

Majority of the respondents (74.49%) and about 75% of the family members weren't infected from COVID-19 infection previously. Also, around 69.9% of pregnant women previously uninfected by COVID-19, are still unvaccinated against it. It might be due to the perception that they mightn't get infected in the future. Majority of the respondents who received counselling from others regarding vaccination (65.5%) are still unvaccinated against COVID-19. Almost all of the respondents (97.6%), whose family members are not vaccinated, are still unvaccinated against it. It might be due to family pressure regarding the safety issues of the vaccine.

The findings of this study shows that 63.3% of the respondent have satisfactory perception on COVID-19 infection and about 51.6% of them are still unvaccinated against COVID-19. Also, 75.5% of the respondent have satisfactory knowledge on COVID-19 infection and its vaccination and about 64.9% of them are still unvaccinated against COVID-19. It shows that even if the pregnant women gave good perception of knowledge, large number of them are unwilling to get vaccinated against COVID-19. It might be due to trust issues related to vaccine, perceived side effects or pressure from the family members.

This study illustrates the relationship between acceptance of COVID-19 vaccination and age ($p<0.001$), ethnicity ($p<0.001$), educational status of the respondent ($p<0.001$), educational status of her husband ($p=0.002$), occupation of her husband ($p=0.001$), respondent previously infected by COVID-19 ($p=0.022$), family members vaccinated against COVID-19 ($p<0.001$) and level of perception ($0<0.001$).

Conclusions

Conclusions

The objective of the study was to assess the factors associated with the acceptance of COVID-19 vaccination among pregnant women of AMCH, Roorkee. Based on the finding of descriptive analysis, it is concluded majority of the pregnant women were found to be unvaccinated against COVID-19 during the period of their pregnancy. Also, majority of the pregnant women living in AMCH, Roorkee had satisfactory perception and also had satisfactory knowledge on COVID-19 infection and its vaccination. The inferential analysis shows that there is significant association between the acceptance of COVID-19 vaccination with age, ethnicity, educational status of the pregnant women as well as their husband's educational status, occupation of their husband, previously infected by COVID-19, family members vaccinated against COVID-19 and level of perception.

DECLARATIONS

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Contributions
Vikas Tiwari: acquired the data, or analysis and interpretation of data, designed and drafted the work and substantively revised it for content Jaishree Tiwari: revised the manuscript, worked on the English, and made the final version. All authors contributed to the article and approved the submitted version.

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Conflict of interests
The authors declare no conflict of interests.

Ethical Consideration
The AMCH Institutional Ethical Committee provided ethical approval. Before any data was collected, the participants received a thorough explanation of the study's objectives and methodology. The participants'

privacy and confidentiality were guaranteed and upheld. At any point during the data collection process, participants were made aware of their right to withdraw from the study or to refuse to participate. Participants were guaranteed of the anonymity of their answers, and no personal information was recorded. Prior to the collection of data, the participants provided written informed consent.

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