







BMJ Open COVID-19 vaccine acceptance and associated factors among adult clients at public hospitals in eastern Ethiopia using the health belief model: multicentre cross-sectional study

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ABSTRACT

Objective Immunization is still one of the best ways to reduce viral-related morbidity and mortality. Therefore, this study aimed to assess COVID-19 vaccine acceptance and associated factors among adult clients at public hospitals in Eastern Ethiopia.

Method A multicentred facility-based cross-sectional study design was utilised. The systematic random sampling technique was used to select 420 study participants. The characteristics of individuals were described using descriptive statistical analysis such as frequency, median and IQR. Mean was used for health belief model components. The association was assessed using bivariate and multivariable logistic regression and described by the OR along with a 95% CI. Finally, a p-value<0.05 in the adjusted analysis was used to declare a significant association.

Outcome measure COVID-19 vaccine acceptance and associated factors.

Result A total of 412 adult clients were interviewed, with a response rate of 98.1%. Of the total study participants, 225 (54.6%; 95% CI: 50.0% to 59.7%) were willing to accept the COVID-19 vaccine. Age≥46 (adjusted OR, AOR=3.64, 95% CI: 1.35 to 9.86), college and above level of education (AOR=2.50, 95% CI: 1.30 to 4.81), having health insurance (AOR=1.79, 95% CI: 1.11 to 2.87) and experiencing chronic disease (AOR=1.96, 95% CI: 1.02 to 3.77) were predictor variables. Also, components of the health belief model were significantly associated with COVID-19 vaccine acceptance.

Conclusion COVID-19 vaccine acceptance among the adult population was low compared to other study. Factors associated with COVID-19 vaccine acceptance were age, college and above level of education, having a chronic disease, having health insurance, perceived susceptibility, perceived severity, perceived benefit and perceived barrier.

Improving awareness about COVID-19 among all sections of the population is crucial to improving vaccine acceptability.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ An adequate sample size was used, which allowed the generalizability of the study's findings.
- ⇒ The health belief model was used to assess factors that affect the outcome variable.
- ⇒ A cross-sectional study design was used, which does not develop a cause-and-effect relationship.
- ⇒ Better if supported by a qualitative study.

INTRODUCTION

A new acute respiratory infectious disease called COVID-19 is caused by the coronavirus.¹ COVID-19 creates public health crisis by affecting social, psychological and economic dimensions.² Over 5.5 million deaths have been reported worldwide since the COVID-19 pandemic began, with an estimated 280 million confirmed cases.³

The use of vaccines to prevent disease began in the 18th century.⁴ The best strategy to avoid infectious diseases is by vaccination, and when enough people are immunised, herd immunity can be produced.⁵ It is suggested that a minimum herd-immunity threshold of 67% among the general population is necessary to attain population immunity.⁶ Vaccination is still one of the best approaches to lower viral-related mortality and morbidity.⁷ Immunisation prevents about 4–5 million deaths every year.⁸

Development of the COVID-19 vaccine alone does not end the pandemic, as vaccine hesitancy is another challenge.⁹ The success of a vaccination programme depends on population coverage, high levels of public acceptance and unambiguous scientific safety facts.¹⁰ Vaccine hesitancy has coexisted and

hampered immunization effectiveness since the development of vaccines. Vaccine hesitancy is a significant concern globally and is designated by the WHO as one of the top 10 health risks.^{11 12}

Why vaccine hesitancy is the question to be answered. Some witnesses indicated social environment, belief in herbal medicine,¹³ poor attitude towards a vaccine, failure to accept the existence of disease,¹⁴ lack of trust for the vaccine and need to wait for more,¹⁵ issues of vaccine safety, and fear of being infected with COVID-19 vaccine were some the barrier.^{16 17}

Additionally, myths and incorrect assertions about vaccines, and a lack of general understanding of the disease were among the causes of vaccine hesitation.^{18 19} Doubtfulness about the efficiency and safety of the COVID-19 vaccine as well as the longevity of its immunity is evident in many countries, which results in hesitancy.^{20–22}

Understanding the anticipated acceptability of COVID-19 vaccination and the barriers to uptake is important given the growing availability of COVID-19 vaccines. Until 5 January 2022, around 50.3% of the world's population was fully vaccinated, while only 1.4% of Ethiopia's population was fully vaccinated.²³ However, by the end of 2021, the Ministry of Health aims to vaccinate about 20% of the Ethiopian population.²⁴

A study conducted in Zambia revealed lower levels of vaccine acceptance.²⁵ A study conducted in Sodo town, southern Ethiopia, found that 45.5% of participants accepted the COVID-19 vaccine.²⁶ There are individual, group, contextual and vaccine-specific factors that determine vaccine acceptance.²⁷ A lack of confidence, inconvenience, and cost was identified as barriers to vaccine uptake.¹⁸

The Ethiopian government has taken different measures to tackle the spread of COVID-19, ranging from emergency response to a state of emergency (guidelines and protocol development to lockdown).²⁸ The other initiative is making the COVID-19 vaccine available and encouraging the community to take the vaccine through influencers like health experts and community leaders.²⁹ Additionally, the Ethiopian government gave priority to the elders for vaccines.³⁰

Understanding the factors that influence people's decisions to get or refuse vaccinations and having evidence regarding COVID-19 vaccine acceptability among the adult population in Ethiopia is crucial for implementing the most successful immunization strategy and tackling the COVID-19 pandemic in Ethiopia. The goal of this research was to evaluate adult client acceptance of the COVID-19 vaccine and related factors in public hospitals in eastern Ethiopia.

METHODS

Study setting, study design and study period

The study was conducted in seven randomly selected public hospitals (Dilchora, Deder, Bisidimo, Chiro, Haramaya, Gelemso and Gara Mulata) in eastern Ethiopia.

There are five, four and two public hospitals in eastern, western and Dire Dawa cities, respectively. Dilchora Hospital is one of the public hospitals in Dire Dawa City that provides compressive services for about five million people in Dire Dawa and neighbouring Oromia and Somali regions. The entire population of the East Hararghe zone is 3 587 042, while the total population of the West Hararghe zone is 2 467 364. A multicentred facility-based cross-sectional study was conducted from 1 June to 30 June 2021.

Study population

All adult patients who attended public hospitals in eastern Ethiopia during the study period were source populations, while those clients visiting a selected public hospitals during study periods were study populations.

Eligibility criteria

All adult patients visiting selected public hospitals during the study period were included, but those who were severely ill and unable to respond to survey questions were excluded.

Sample size determination and sampling procedure

The required sample size was determined using the single population proportion formula ($n = (Z/2)^2 p(1p)/d^2$) under the following assumptions: COVID-19 vaccine acceptance in Walaita Sodo, southern Ethiopia ($p=46.1\%$); confidence level at 95% ($Z/2 = 1.96$); margin of error (d)=0.05 and non-response rate=10%. So, the final sample size was 420. Seven public hospitals (Dilchora hospital, Bisidimo hospital, Haramaya hospital, Gara Muleta hospital, Deder hospital, Chiro hospital and Gelemso hospital) providing service for all adult clients at the time of the study were purposefully selected. The required study samples from each public hospital were allocated proportionally according to client flow. The study subjects were selected using a systematic random sampling technique based on hospital patient records. There were about 2075 monthly average adult patients in selected public hospitals. Based on the average monthly patient follow, the interval k was calculated ($K=N/n=2075/420=4.95 \approx 5$) and a study subject was chosen for every 5 until the specified sample size was reached. The initial eligible study subject was chosen randomly by the lottery method.

Data collection procedures and tools

Data collection will be undertaken using an interviewer-administered structured questionnaire using kobo collection software. The questionnaire was adapted by extensive searching of previous literature and considering the local context.^{14 31–33} The questionnaire was first prepared in English, then translated into local languages (Amharic and Afan Oromo). The questionnaire was developed to gather data on sociodemographic variables, vaccination acceptance and health belief measures based on the health belief model (HBM). Ten skilled BSc Nursing and Midwifery graduates, under the supervision of three

MSc nurses, collected the data. Data collectors briefed the study participants with a short overview of the study objective and the significance of their participation. Then participants, who were volunteers, were interviewed face-to-face using a structured and pretested questionnaire.

Measurements and operational definition

Acceptance of the COVID-19 vaccine refers to the percentage of adult clients who are willing to receive the vaccine once it becomes available.³⁴ Adult clients' acceptance of the COVID-19 vaccine was measured by asking, 'Will you take the COVID-19 vaccine when it becomes available?' with 'Yes' and 'No' response options. If the respondent answered 'yes', he/she is considered to have the willingness to accept the COVID-19 vaccine; otherwise, no.

The health belief model (HBM)

The five components of the HBM were perceived susceptibility, perceived severity, perceived benefits, perceived barriers and cues to action. *Perceived susceptibility* was measured with five items (The chance of getting COVID-19 in the next few months is great; getting COVID-19 is currently possible for me; I'm worried about the chance of getting COVID-19; I'm afraid of getting COVID-19 unless I get the vaccine and my family may get infected if they don't get the COVID-19 vaccine). *Perceived severity* was measured with three items (complications from COVID-19 are serious; I will be very sick if I get COVID-19 and recovering from COVID-19 would take a long time). *Perceived benefits* were measured with three items: vaccination is a good idea; the COVID-19 vaccine may reduce my fear of infection; the vaccine will be highly effective to reduce the spread of COVID-19. *Five items were used to assess perceived barriers* (Concern about potential side effects of the COVID-19 vaccine; concern about the efficacy of the COVID-19 vaccine; concern about the COVID-19 vaccination interfering with daily activities; concern about my affordability of the COVID-19 vaccine and concern about a faulty or fake COVID-19 vaccine). *The cue to action* is measured by four items (I will only take the COVID-19 vaccine if I was given adequate information; I will only take the COVID-19 vaccine if it was taken by many in the public; I will only take the COVID-19 vaccine if it was recommended by doctors and I will only take the COVID-19 vaccine if it was recommended by the ministry of health's published guidelines). All HBM questions were rated by respondents on a five-point scale that ranged from 1 to 5 (strongly disagree to strongly agree). The mean score for each domain was calculated, along with the overall score for each dimension. Scores higher than the mean indicate higher levels of a particular dimension, except the perceived barrier dimension, which was reversely coded.

Data quality assurance

Before beginning the actual data collection, the questionnaire was pretested on 21 of the study participants,

at Jigol Hospital. Training was provided to data collectors and supervisors on the purpose of the study, information confidentiality, respondent rights, maintaining privacy and interviewing techniques. The completed questionnaires were checked by the investigators for completeness, accuracy and clarity of data and required corrections were made immediately by the principal investigator and supervisors daily.

Data processing and analysis

Kobo Collect version 2021.3.4 software was used to collect the data, and SPSS V.25 was used to analyse it. Participants' sociodemographic characteristics, awareness of the COVID-19 vaccine and HBM components were described using descriptive statistical analyses like frequency, mean and SD. After that, frequency tables were used to show the information. The VIF and tolerance tests were used to identify colinearity, while the Hosmer-Lemeshow statistic and Omnibus tests were used to assess the goodness of fit. The associations between each independent variable and the outcome variables were assessed using bivariate and multivariate analysis. All variables with $p \leq 0.25$ in the bivariate analysis were included in the final model of multivariate analysis. An adjusted OR and a 95% CI were used to show the strength of statistical correlations. Finally, a p-value of less than or equal to 0.05 was used to declare statistical significance.

Patient and public involvement

There is no patient or other people involved in this study

RESULTS

Sociodemographic characteristics

From a total of 420 study samples, 412 responded to the interview, making the response rate 98.1%. Nearly half of the study participants were in the 25–36 age group, with a median age of 28 and an IQR of 24–33 years. The majority of study participants (63.4%) lived with three or more family members. Most of the respondents were married individuals (table 1).

COVID-19 vaccine awareness and acceptance among adult clients

Of the total study participants, 225 (54.6; 95% CI: 50.0% to 59.7%) were willing to get the COVID-19 vaccine. Contrarily, the most frequent justifications for choosing not to receive the vaccine were concern over side effects (75, 44.6%), a lack of knowledge (66, 39.3%) and uncertainty regarding its efficacy (37, 22%) (table 2).

Health believes model measures

The mean score and SD of perceived susceptibility, perceived severity, perceived benefits, perceived barriers and cues to action were 13.88 ± 3.03 , 8.07 ± 2.28 , 7.85 ± 2.41 , 12.55 ± 2.66 and 8.68 ± 2.89 , respectively. Of the total study participants, 237 (57.5%) and 148 (43.2%) scored above the calculated mean for perceived susceptibility and perceived severity domains, respectively. Similarly, for the

Table 1 Sociodemographic characteristics of adult clients at public hospitals in eastern Ethiopia in 2021 (n=412)

Variable	Category	Frequency	Percentage
Age	18–25	130	31.6
	26–35	195	47.3
	36–45	56	13.6
	≥46	31	7.5
Sex	Male	196	47.6
	Female	216	52.4
Residence	Urban	221	53.6
	Rural	191	46.5
Level of education	No formal education	103	25.0
	Primary education	85	20.6
	Secondary education	85	20.6
	College and above	139	33.7
Type of occupation	Housewife	102	24.8
	Governmental employee	130	31.6
	Private employee	134	32.5
	Farmer	46	11.1
Marital status	Married	236	57.3
	Divorced	38	9.2
	Separated	31	7.5
	Widowed	22	5.3
	Single	85	20.6
Number of family members	≤2	149	36.2
	3–4	133	32.3
	≥5	130	31.6
Have health insurance	Yes	191	46.4
	No	221	53.6

perceived benefit and perceived barrier domains, 207 (50.2%) and 217 (51.7%) scored above the calculated mean (table 3).

Factors associated with COVID-19 vaccine acceptance

Age, gender, residence, level of education, having health insurance, having heard about the COVID-19 vaccine, experiencing chronic disease, experiencing COVID-19, rating health status positively, and, from the HBM component, susceptibility perception, severity perception, perception of benefit, perception of barrier and cues to action were all associated with COVID-19 vaccine acceptance in bivariate regression (candidates for multivariable regression). However, in multivariable regression, only age, education level, health insurance, having a chronic disease and four of the five components of HBM

(susceptibility perception, severity perception, benefit perception and perception of barrier) were significantly associated with the COVID-19 vaccine's acceptance.

Adults over the age of 46 were 3.64 times more likely than those between the ages of 18 and 25 to receive the COVID-19 vaccine. Attending education to the level of a diploma and above increased willingness to be vaccinated 2.50 (AOR=2.5; 95% CI: 1.30 to 4.81) times compared with those having no formal education. Those who have health insurance are 1.79 (AOR=1.79, 95% CI: 1.11 to 2.87) times more likely to be vaccinated as compared with those who have no health insurance. The odds of having the willingness to be vaccinated are 1.96 (AOR=1.96, 95% CI: 1.02 to 3.77) times more likely among adult clients diagnosed with chronic diseases compared with those who were ever not diagnosed with chronic diseases. The odd willingness to take the COVID-19 vaccine was 4.11 (AOR=4.11, 95% CI: 2.49 to 6.80) more likely among adult clients who perceive COVID-19 infection as severe than those who do not perceive it as severe. Similarly, those participants who considered themselves susceptible to COVID-19 were 2.90 (AOR=2.90, 95% CI: 1.34 to 3.60) times more likely to accept the COVID-19 vaccine when compared with those who do not consider themselves susceptible to COVID-19. Furthermore, the perception of benefit increases willingness to be vaccinated by 1.81 (95% CI: 1.14 to 2.87) times among those who perceive benefit when compared with their counterparts. Whereas the perception of barriers affects willingness to be vaccinated negatively. In other words, those who do not perceive the barrier will accept the COVID-19 vaccine 2.27 (AOR=2.27, 95% CI: 1.42 to 3.64) times more likely when compared with those who perceive the barrier (table 4).

DISCUSSION

Vaccine hesitancy was a significant problem in tackling the spread of COVID-19 infection. Furthermore, identifying the determinants of COVID-19 vaccine acceptance among the adult population has a paramount significance in setting policies and strategies in decreasing the burden of infection. Therefore, the purpose of this study was to pinpoint the factors that influence adult clients' acceptance of the COVID-19 vaccine.

This study found that adult clients accepted the COVID-19 vaccine at a rate of 54.6%. This is in line with a study done in Dasse Hospital (59.4%),³³ a nationwide survey conducted in Ghana (54.1%)³⁵ and a study conducted in Kuwait (53.1%).³⁶ This finding, however, was lower than that of studies conducted in the Gurage zone (62.6%),³⁷ Addis Ababa (80.9%),³⁸ Ethiopia (88%),¹⁴ Indonesia (93.3%),³⁹ Mozambique (64.8%),⁴⁰ South Africa (67%)⁴¹ and sub-Saharan African countries (82.27%).⁴² This variation could be related to differences in data collection technique, sociodemographic characteristics of study participants and the scope of the study.

The finding of this study is higher than that of a study conducted among general population in Ethiopia

Table 2 Awareness, health status and willingness to take the COVID-19 vaccine among adult clients at public hospitals in eastern Ethiopia in 2021 (n=412)

Variables	Category	Frequency	Percentage
Have you ever heard about the COVID-19 vaccine?	Yes	282	68.4
	No	130	31.6
From whom have you heard about COVID-19 vaccine? (n=282)	Friends	60	14.6
	Mass media	184	44.7
	Health professional	38	9.2
Have you ever been diagnosed with a chronic disease?	Yes	68	16.5
	No	344	83.5
Have you ever experienced COVID-19 disease?	Yes	38	9.2
	No	374	90.8
What do you think about your general state of health?	Very good	189	45.9
	Good	121	29.4
	Fair	40	9.7
	Poor	29	7.0
	Very poor	33	8.0
Is there anybody diagnosed with chronic disease in your family?	Yes	53	12.9
	No	359	87.1
Is there anybody aged 64 and above in your family?	Yes	118	28.6
	No	294	71.4
Will you accept the COVID-19 vaccination?	Yes	225	54.6
	No	187	45.4
Reason for refusing COVID-19 vaccination	Fear of side effects	75	44.6
	It is a biological weapon	9	5.4
	Doubt about vaccine	26	15.5
	Unreliable due to the short time for vaccine development	20	11.9
	No enough information	66	39.3
	Vaccine cause COVID-19	21	12.5
	Vaccine is ineffective	37	22.0
	No vaccine is needed (COVID-19 is over-rated)	24	14.3

(31.4%)⁴³ and a study done in the Wolaita zone, southern Ethiopia (45.5%).²⁶ This might be because the study in Ethiopia only looked at a general population, whereas our study focused on a specific segment of the population. The study setting was the other explanation for this discrepancy. In our study, an institutional-based cross-sectional study was used, and the health-seeking tendency was expected to be higher.

In this study, adults 46 years of age and older had an increased likelihood of accepting the COVID-19 vaccine. A research study among the adult population in the Gurage zone of Ethiopia provided evidence in support of this conclusion,³⁷ as did a study conducted in Bangladesh.³² The relationship between age and vaccination acceptability may be explained by the fact that COVID-19 sickness worsens with age and that elderly unvaccinated

individuals are more likely to require hospitalisation or pass away from COVID-19 infection.⁴⁴ The elderly population becomes anxious and fearful as a result. They are therefore in need of COVID-19 immunisation as a coping mechanism.

Similarly, educational status had a positive association with COVID-19 vaccine acceptance. Having a college or higher level of education was associated with an increased likelihood of COVID-19 vaccine acceptance. This finding was supported by a study conducted among the adult population in Gurage zone, Ethiopia,³⁷ a study conducted in Sodo Town, Ethiopia,²⁶ and a national survey conducted in Ghana.³⁵ This may be appropriate because adults with higher educational levels can easily grasp the need to get vaccinated, including against COVID-19. Furthermore, people with higher educational status may have a

Table 3 COVID-19-related health beliefs among clients at public hospitals in eastern Ethiopia, 2021

Variables	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Perceived susceptibility					
The possibility of getting COVID-19 in near future is very strong.	51 (12.4)	106 (25.7)	95 (23.1)	129 (31.3)	31 (7.5)
Getting COVID-19 is currently possible for me.	55 (13.3)	128 (31.1)	77 (18.7)	117 (28.4)	35 (8.5)
Worry about the possibility of contracting COVID-19.	40 (9.7)	149 (36.2)	101 (24.5)	109 (26.5)	13 (3.2)
I am afraid of getting COVID-19 unless I get the vaccine.	47 (11.4)	178 (43.2)	90 (21.8)	89 (21.6)	8 (1.9)
My family may get infected if they do not get the COVID-19 vaccine.	47 (11.4)	158 (38.3)	95 (23.1)	104 (25.2)	8 (1.9)
Perceived severity					
The complications from COVID-19 are serious.	48 (11.7)	174 (42.2)	108 (26.2)	63 (15.3)	19 (4.6)
I will be very sick if get COVID-19.	34 (8.3)	139 (33.7)	137 (33.3)	78 (18.9)	24 (5.8)
Recovering from COVID-19 would take a long time.	52 (12.6)	151 (36.7)	119 (28.9)	59 (14.3)	31 (7.5)
Perceived benefit					
Vaccination is a good idea.	17 (4.1)	143 (34.7)	137 (33.3)	103 (25)	12 (2.9)
The COVID-19 vaccine may reduce my fear of infection.	49 (11.9)	144 (35)	93 (22.6)	102 (24.6)	24 (5.8)
The vaccine will be highly effective in reducing COVID-19 spread.	117 (28.4)	167 (40.5)	63 (15.3)	59 (14.3)	6 (1.5)
Perceived barrier					
Worry about possible side effects of the COVID-19 vaccine.	75 (18.2)	140 (34)	134 (32.5)	54 (13.1)	9 (2.2)
Concern about the efficacy of the COVID-19 vaccine.	37 (9)	145 (35.2)	141 (34.2)	81 (19.7)	8 (1.9)
The COVID-19 vaccination may interfere with my daily activities.	30 (7.3)	129 (31.3)	192 (46.6)	49 (11.9)	12 (2.9)
Concerning the cost of the COVID-19 vaccine.	123 (29.9)	178 (43.2)	85 (20.6)	26 (6.3)	
Concern over the possibility of substandard or fake COVID-19 vaccines being produced.	54 (13.1)	146 (35.4)	121 (29.4)	83 (20.1)	8 (1.9)
Cues to action					
I will only take the COVID-19 vaccine if I am given adequate information.	107 (26)	197 (47.8)	58 (14.1)	45 (10.9)	5 (1.2)
I will only take the COVID-19 vaccine if it is taken by many people in the public.	102 (24.8)	163 (39.6)	103 (25)	39 (9.5)	5 (1.2)
I will only take the COVID-19 vaccine if it is recommended by doctors.	106 (25.7)	207 (50.2)	60 (14.6)	35 (8.5)	4 (0.9)
If the Ministry of Health recommends the COVID-19 vaccine, I will only get it.	108 (26.2)	159 (38.6)	95 (23.1)	44 (10.7)	6 (1.5)

better understanding of preventative strategies for health-related issues.

Those who have health insurance were more likely to be willing to accept the COVID-19 vaccine. This finding is supported by a study conducted at Dasse Compressive Specialised Hospital, Ethiopia.³³ This could be due to having health insurance, which may let them feel free of payment even if the vaccine was provided freely. This indicates that there is a segment of the community that views vaccines as a service provided for a fee. Therefore, healthcare professionals were expected to create community awareness as the COVID-19 vaccine is given freely to all Ethiopians.

Those diagnosed with chronic diseases were more likely to be willing to take the COVID-19 vaccine. Similar findings were reported from a study conducted in Mozambique.⁴⁰ This could be because people with chronic diseases are more likely to acquire COVID-19, making recovery difficult. Thus, since populations with chronic

diseases appear to be at a higher risk of developing complications and are at a higher risk of death, they are more likely to be interested in being vaccinated.

Four of the five components of HBM indicated a significant association with willingness to take the COVID-19 vaccine. Perceived susceptibility, perceived severity and perceived benefit were found to increase the likelihood of COVID-19 vaccine acceptance. This finding is supported by a study conducted in Bangladesh,³² Saudi Arabia,⁴⁵ Malaysia⁴⁶ and a population-based survey in Hong Kong.⁴⁷ The reason for this could be that when there is a perception of susceptibility and severity, stress is felt and people are more willing to take the COVID-19 vaccine as a coping mechanism. The other possible justification could be that as more people learn about the value of COVID-19 vaccination, their willingness to get vaccinated will improve.⁴⁸

On the other hand, the other component of the HBM perceived barrier affects the likelihood of COVID-19

Table 4 Factors associated with acceptance of the COVID-19 vaccine among adult patients at public hospitals in Dire Dawa City and the East and West Hararghe zones, Ethiopia, in 2022

Variable	COVID-19 vaccine acceptance		UOR 95% CI	AOR 95% CI	P value
	Yes	No			
Age					
≥46	23	8	2.70 (1.13 to 6.48)	3.64 (1.35 to 9.86)	0.01
36–45	28	28	0.94 (0.50 to 1.76)	1.39 (0.64 to 3.04)	0.40
26–35	107	88	1.14 (0.73 to 1.78)	1.65 (0.96 to 2.84)	0.07
18–25	67	63	1	1	
Residence					
Urban	132	89	1.56 (1.05 to 2.31)	1.55 (0.95 to 2.50)	0.08
Rural	93	98	1	1	
Level of education					
College and above	86	53	1.93 (1.15 to 3.24)	2.50 (1.30 to 4.81)	0.01
Secondary	50	35	1.70 (0.95 to 3.04)	1.86 (0.918 to 3.77)	0.08
Primary education	42	43	1.16 (0.65 to 2.06)	0.94 (0.47 to 1.89)	0.86
No formal education	47	56	1		
Do you have health insurance					
Yes	113	78	1.41 (0.95 to 2.08)	1.79 (1.11 to 2.87)	0.02
No	112	109	1	1	
Have you ever heard about the COVID-19 vaccine?					
Yes	161	121	1.37 (0.90 to 2.08)	1.50 (0.90 to 2.49)	0.12
No	64	66	1	1	
Have you ever been diagnosed with a chronic disease?					
Yes	46	22	1.92 (1.11 to 3.34)	1.96 (1.02 to 3.77)	0.04
No	179	165	1	1	
Have you ever experienced COVID-19?					
Yes	27	11	2.18 (1.05 to 4.52)	1.30 (0.54 to 3.12)	0.55
No	198	196	1	1	
How do you rate overall your health status?					
Very poor	22	11	1.93 (0.89 to 4.22)	1.89 (0.75 to 4.80)	0.18
Poor	21	8	2.54 (1.07 to 6.03)	1.28 (0.47 to 3.49)	0.62
Fair	22	18	1.18 (0.60 to 2.35)	0.86 (0.39 to 1.90)	0.71
Good	64	57	1.09 (0.68 to 1.72)	0.92 (0.53 to 1.58)	0.75
Very good	96	93	1	1	
Susceptibility perception					
Perceived susceptible	148	89	2.12 (1.42 to 3.15)	2.90 (1.34 to 3.60)	0.002
Not perceived susceptible	77	98	1	1	
Severity perception					
Perceived severity	128	50	3.62 (2.38 to 5.49)	4.11 (2.49 to 6.80)	0.00
Not perceived severity	97	137	1	1	
Benefit perception					
Perceived benefit	132	75	2.12 (1.43 to 3.15)	1.81 (1.14 to 2.87)	0.01
Not perceived benefit	93	112	1	1	
Perception of barrier					
Not perceived barrier	126	73	1.99 (1.34 to 2.95)	2.27 (1.42 to 3.64)	0.00
Perceived barrier	99	114	1	1	

Continued

Table 4 Continued

Variable	COVID-19 vaccine acceptance		UOR 95% CI	AOR 95% CI	P value
	Yes	No			
Cues action					
Cue to act	107	72	1.45 (0.98 to 2.15)	1.03 (0.63 to 1.67)	0.90
Not cue to act	118	115	1	1	

.AOR, adjusted OR; PV, p value; UOR, unadjusted OR.

vaccine acceptance negatively. In other words, those who did not perceive a barrier had a better chance of being willing to take the COVID-19 vaccination. This can be justified as participants who disagreed with HBM obstacles and constructs were more inclined to take the COVID-19 vaccine. Another factor could be that misinformation has drastically affected vaccine acceptance.⁴⁹

The study has several strengths. One of its strengths is that it is a multicentre study, which enables the generalizability of the study findings to the source population. Again, the study used an HBM to assess perceptions towards vaccine acceptance, which was adapted from a different validated tool with high internal consistency. However, the study is not without limitations, as it is cross-sectional, and does not indicate a causal relationship. Furthermore, acceptance of the COVID-19 vaccine was self-reported, which could lead to information bias. The study also does not indicate change over time as perceptions towards COVID-19 risk and awareness change over time and influence the acceptability of the vaccine.

CONCLUSIONS

COVID-19 vaccine acceptance among the adult population was low compared to other study. Factors associated with COVID-19 vaccine acceptance were age, college and above level of education, having a chronic disease, having health insurance, perceived susceptibility, perceived severity, perceived benefit and perceived barrier.

Improving awareness about COVID-19 among all sections of the population is crucial to improving vaccine acceptability. A responsible body should work on community perception and clarify any myths about COVID-19 and its vaccine, which is recommended.

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