

Why Does COVID-19 Vaccine Acceptance Rate Remain Low Among Patients with Chronic Diseases? Evidences from Public Hospitals of Ethiopia

Chala Daba^{1,*}, Lechisa Asefa², Hailu Lemma², Amanuel Atamo¹, Edosa Kebede³, Mesfin Gebrehiwot^{1,*}

¹Department of Environmental Health, College of Medicine and Health Sciences, Wollo University, Dessie, Ethiopia; ²Department of Environmental Health, Institute of Health, Bule Hora University, Bule Hora, Ethiopia; ³Department of Medical Laboratory, College of Medicine and Health Sciences, Ambo University, Ambo, Ethiopia

*These authors contributed equally to this work

Correspondence: Chala Daba, Email chaladaba293@gmail.com

Background: Elders and patients with chronic diseases are more vulnerable to coronavirus disease 2019 (COVID-19) infection. In Ethiopia, these groups of people are given vaccination priorities amongst others. However, there is limited information on the acceptance of COVID-19 vaccine among patients with chronic diseases. Therefore, this study aimed to assess the acceptance of COVID-19 vaccine and associated factors among patients with chronic diseases visiting public hospitals in West Guji zone (Ethiopia).

Methods and Materials: Facility-based cross-sectional study was employed among 408 chronic disease patients visiting two public hospitals in Ethiopia from September to October 2021. Data was collected using structured questionnaire. Multivariable logistic regression was computed to identify factors associated with acceptance of COVID-19 vaccine. Independent variables with p-value less than 0.05 were considered statistically significantly associated with the acceptance of COVID-19 vaccine.

Results: The acceptance of COVID-19 vaccine among patients with chronic diseases was 39.5% (95% CI: 35–44). Factors positively associated with the acceptance of COVID-19 vaccine were age ≥ 40 years (AOR = 2.84; 95% CI: 1.53–5.28), urban residence (AOR = 0.6; 95% CI: 0.38–0.95), having upper respiratory tract infection (AOR = 1.32; 95% CI: 1.03–2.8), previous COVID-19 infection (AOR = 2.1; 95% CI: 1.22–3.47), having health insurance (AOR = 2.55; 95% CI: 1.23–5.28), those not drinking alcohol (AOR = 1.95; 95% CI: 1.24–3.06), those not chewing Khat (AOR = 2.01; 95% CI: 1.27–3.2), and having good knowledge (AOR = 1.55; 95% CI: 1.03–2.87) and positive attitude (AOR = 2.05; 95% CI: 1.26–3.33) towards the vaccine.

Conclusion: The overall proportion of COVID-19 vaccine acceptance is low among patients with chronic diseases. Therefore, to improve the acceptance of COVID-19 vaccine, the government and health professionals should provide continuous health education.

Keywords: COVID-19, vaccine acceptance, chronic disease, Ethiopia

Introduction

Coronavirus disease 2019 (COVID-19) is one of the viral diseases affecting human respiratory system.^{1–3} It is transmitted mainly through respiratory droplets that are released from an infected person while sneezing, coughing, and talking.⁴ As of 8 February 2022, it affected more than 398 million people and caused 5.7 million deaths globally.⁵ In Africa, over 10.9 million cases and 241,723 deaths were reported as of 8 February, 2022. Similarly, till this period, there were 466,677 confirmed cases and 7373 deaths in Ethiopia.⁶

Although the virus is infecting all age groups, elders and patients living with chronic diseases, such as hypertension, tuberculosis, cardiac disease, lung disease, cancer, and diabetes, are almost five times more likely to develop severe

COVID-19 illnesses and deaths.^{7,8} To curb the transmission of this pandemic, different prevention and control measures, including social distancing, wearing face masks, proper hand washing with soap, and staying at home, are being applied.^{8,9} In spite of the implementation of different prevention and control methods, the transmission is not decreasing substantially.¹⁰ Hence, development of other effective control method, particularly vaccination, is becoming a significant protective measure against COVID-19 transmission.^{10–12} Accordingly, as of 28 September 2021, approximately 104 vaccines have been tested in human clinical trials, of which 46 in phase II and 35 in phase III clinical trials.¹³

However, the acceptance of these vaccines varied from place to place. For instance, a study conducted in northeast Ethiopia by Berihun et al has reported about 59.4% acceptance of COVID-19 vaccine among patients with chronic diseases.¹⁴ Other studies performed in northwest Ethiopia, Arab world, and France also reported an acceptance rate of 54.8%,¹⁷ 62.4%,⁹ and 65.6%,¹⁵ respectively. Higher acceptance rates were also indicated in China (91.3%)¹⁹ and Indonesia (93.3%).²⁵ Age, gender, educational level, income, and knowledge were found to be associated with vaccine acceptance.^{9,14,16–18,24}

In Ethiopia, the government has given vaccination priority for the elders and patients with chronic diseases. However, the acceptance of COVID-19 vaccine is reported to be low among patients with chronic diseases,¹⁴ which could lead to the loss of many lives since they are more vulnerable to COVID-19 infection. Except for few studies, there is limited evidence that shows the level of acceptance of COVID-19 vaccine and its determinant factors in Ethiopia. Therefore, this study aimed to assess the acceptance of COVID-19 vaccine and associated factors among patients with chronic diseases visiting public hospitals in West Guji zone (Ethiopia). The findings of this study could help suggest priorities of intervention so as to reduce the spread of COVID-19 in Ethiopia and other similar developing countries.

Methods and Materials

Study Design, Period, and Setting

Facility-based cross-sectional study design was employed among 408 patients with chronic diseases who were visiting public hospitals in southern Ethiopia from September to October 2021. The study was conducted on two public hospitals located in West Guji zone, namely Bule Hora teaching hospital and Malka Soda hospital. In West Guji zone, there are three public hospitals which serve more than three million people.

Source and Study Population

All patients with chronic diseases who were visiting the public hospital of West Guji zone were the source population, whereas all patients with chronic diseases who were visiting the randomly selected public hospitals during the data collection time were the study population.

Inclusion and Exclusion Criteria

All patients with chronic diseases who were attending the public hospitals in West Guji zone were included, whereas those who were seriously ill, not volunteer to participate, and under 18 years old were excluded from the study.

Sample Size Determination

The sample size was computed using a single population proportion formula²¹

$$n = \frac{(Z_{\alpha/2})^2 p (1 - p)}{d^2}$$

Where, “ $Z_{\alpha/2}$ ” = 1.96, “ p ” = 59.4%, and “ d ” -margin of error = 5.0%. “ p ” is the proportion of COVID-19 vaccine acceptance among patients with chronic diseases which was taken from a study done in Amhara region.¹⁴ Accordingly, the calculated sample size becomes 371 and by adding a 10% of non-response rate, the final sample size becomes 408.

Sampling Techniques and Procedure

From the three public hospitals in West Guji zone, two public hospitals (Bule Hora teaching hospital and Malka Soda hospital) were randomly selected by using a lottery method. According to the reports obtained from registration records, about 1457 chronic disease patients of different cases were registered for follow-up in the selected hospitals at the time of the study. Of the

total 1457 patients, 569 were scheduled to be present between 1st September, 2021 and 30th October, 2021 for care or pharmacy pick-ups, and hence fulfilled the inclusion criteria. Proportional allocation was then made considering the number of patients in each hospital. Accordingly, 217 patients with chronic diseases from Bule Hora teaching hospital and 191 patients from Malka Soda hospital were interviewed. A simple random sampling technique was used to select the study participants.

Operational Definitions

The dependent variable, acceptance of COVID-19 vaccine, was measured using “Yes” or “No” questions. Comprehensive knowledge towards COVID-19 vaccine was computed considering seven knowledge-related questions. The correct answer for each item was scored “1” and the incorrect answer was scored “0.” Accordingly, patients who scored above the mean value (4.1) were taken as having good knowledge, while those who scored below the mean value (4.1) were considered as having poor knowledge. Similarly, the attitude of the respondents towards COVID-19 vaccine was computed using six attitude-related questions. The correct answer for each item was scored “1” and the incorrect answer was scored “0.” Accordingly, respondents who scored above the mean value (3.2) were considered as having positive attitude and vice versa.

Data Collection Method and Quality Control

The data was collected using a structured questionnaire which was adapted from different published articles.^{9,14,20,22–25} The questionnaire was prepared in English, translated to local language, and then translated back to English. The internal consistency of the questionnaire was checked using Cronbach’s alpha coefficient and was found to be 0.85. Pre-test was conducted in Karca public hospital (n = 21) and amendment was made before the actual data collection. Face-to-face interview was used as a means of data collection. Three nurses and two supervisors (health officers) were recruited for data collection. The completeness and consistency of the data was checked daily by the supervisors. In addition, to ensure accuracy, 5% of the data was double-entered.

Data Management and Statistical Analysis

The collected data was checked, coded, and entered into EpiData version 3.1 and exported to SPSS version 25.0 for data cleaning and analysis. Logistic regression analyses (bivariate and multivariable logistic regression) were carried out to analyze the data. In the bivariate analysis, variables with p-value ≤ 0.25 were retained for the multivariable logistic regression analysis. Multivariable logistic regression was computed to identify significant factors associated with the acceptance of COVID-19 vaccine. Variables with p-value < 0.05 were considered to be significantly associated with the acceptance of COVID-19 vaccine. Hosmer Lemeshow test²⁶ with a p-value of 0.157 indicated that the model was fit.

Ethical Considerations

The study complies with the declaration of Helsinki. All procedures, including ethical approval and research permission, were performed in accordance with national standards, guaranteeing the anonymity of the respondents. Ethical approval (BHU/IH 3015/2/2013) was obtained from the Ethical Review Committee of the Institute of Health, Bule Hora University. Besides, written consent was obtained from the heads of the selected hospitals. In addition, respondents were informed about the purpose of the study, and their informed consent was obtained. The respondents’ right to refuse or withdraw from the study was fully maintained, and the information provided by each respondent was kept strictly confidential.

Results

Socio-Demographic Characteristics

A total of 408 respondents have participated, giving a response rate of 100%. More than one-third (42.6%) of the respondents were within the age group of 30–39 years, and the slight majority of the study participants were male (n = 210, 51.5%). More than three-fourths (77.2%) of the study participants had no previous COVID-19 infection and 99.5% of the patients with chronic diseases had no family death due to COVID-19. Again, more than three-fourths (85.8%) of the patients had health insurance. Regarding the types of chronic diseases, majority (121, 29.7%) of the study participants had TB diseases followed by HIV (110, 27%) (Table 1).

Table I Socio-Demographic Characteristics of Patients with Chronic Disease (September to October, 2021)

Variables	Categories	Frequency (n)	Percentage (%)
Age (years)	20–29	152	37.2
	30–39	174	42.6
	≥40 and above	82	20.2
Sex	Female	198	48.5
	Male	210	51.5
Religion	Orthodox	109	26.7
	Protestant	173	42.4
	Muslim	91	22.3
	Wakefata	35	8.6
Marital status	Single	134	32.8
	Married	235	57.6
	Divorced	39	9.6
Educational status	Cannot read and write	205	50.2
	Elementary (1–8 grade)	118	28.9
	High school (9–12 grade)	77	18.9
	Diploma and above	8	2
Occupation	Farmers	205	50.2
	Merchants	150	36.8
	Government employees	35	8.6
	Others*	18	4.4
Residence	Urban	208	51
	Rural	200	49
Previous COVID-19 infection	Yes	93	22.8
	No	315	77.2
Family death due to COVID-19	Yes	2	0.5
	No	406	99.5
Types of chronic disease	TB	121	29.7
	HIV	110	27
	Heart disease	56	13.7
	URTI	79	19.4
	Diabetes	42	10.3
Do you have information about COVID-19 vaccine	Yes	294	72.1
	No	114	27.9

(Continued)

Table 1 (Continued).

Variables	Categories	Frequency (n)	Percentage (%)
Do you have health insurance	Yes	350	85.8
	No	58	14.2
Do you drink alcohol	Yes	197	48.3
	No	211	51.7
Do you chew khat	Yes	220	53.9
	No	188	46.1

Note: Others *include students and housewives.

Abbreviation: URTI, upper respiratory tract infection.

Willingness to Accept COVID-19 Vaccine

In the current study, only 161 (39.5%, 95% CI: 35–44) of the patients with chronic diseases were willing to accept COVID-19 vaccination.

Knowledge of the Study Participants Towards COVID-19 Vaccine

More than one-third (161, 39.6%) of the study patients with chronic diseases had good knowledge about COVID-19 vaccine. Two-thirds (270, 66.2%) of the respondents knew COVID-19 vaccine could reduce the risk of virus infection and less than two-thirds (237, 58.1%) of patients knew COVID-19 vaccination has started in Ethiopia (Table 2).

Attitude of the Study Participants Towards COVID-19 Vaccine

Only about one-third (144, 35.3%) of the participants had positive attitude towards COVID-19 vaccine. On top of that, more than half (229, 56.1%) of the respondents believed COVID-19 vaccine had side effects. Despite this, 217 (53.2%) of the respondents believed they are susceptible to COVID-19 (Table 3).

Table 2 Knowledge of Respondents Towards COVID-19 Vaccine (September to October, 2021)

Variables		Yes	No
		Frequency (n) (%)	Frequency (n) (%)
Vaccine helps provide long term immunity		182 (44.6)	226 (55.4)
Vaccine helps reduce risk of virus infection		270 (66.2)	138 (33.8)
AstraZeneca, Johnson & Johnson, Pfizer -BioNTech'S and Covishield are the four vaccines used in Ethiopia		249 (61)	159 (39)
Vaccination is an effective way to prevent and control COVID-19		253 (62)	155 (38)
COVID-19 affects elders than young people		267 (65.4)	141 (34.6)
COVID-19 vaccine is completely safe		215 (52.7)	193 (47.3)
COVID-19 vaccination has started in Ethiopia		237 (58.1)	171 (41.9)
Knowledge	Good	161 (39.6%)	
	Poor	247 (60.4%)	

Table 3 Attitude of Respondents Towards COVID-19 Vaccine (September to October, 2021)

Variables		Yes	No
		Frequency (n) (%)	Frequency (n) (%)
Do you have trust on COVID-19 vaccine		208 (51)	200 (49)
Do you believe that COVID-19 vaccine has side effect		229 (56.1)	179 (43.9)
Do you believe that taking COVID-19 vaccine can contradict with your religion		198 (48.5)	210 (51.5)
Do you think that you are susceptible to COVID-19 infection		217 (53.2)	191 (46.8)
Do you believe that the vaccine is necessary for the prevention of COVID-19		204 (50)	204 (50)
It is not possible to reduce the incidence of COVID-19 without vaccination		237 (58.1)	171 (41.9)
Attitude	Positive	144 (35.3%)	
	Negative	264 (64.7%)	

Factors Associated with the Willingness to Accept COVID-19 Vaccine

In the multivariable logistic regression analysis, the factors knowledge and attitude towards COVID-19 vaccine, age, residence, health insurance, previous COVID-19 infection, chewing Khat, alcohol use, and types of chronic diseases were significantly associated with the acceptance of COVID-19 vaccine. To indicate some, patients who had upper respiratory tract infection (URTI) were 1.32 times more likely to accept COVID-19 vaccine than patients with other types of chronic diseases (AOR = 1.32, 95% CI: 1.03–2.80). Patients older than 40 years were also likely to accept COVID-19 vaccine (AOR = 2.84, 95% CI: 1.53–5.28).

The odds of COVID-19 vaccine acceptance were 1.95 times higher among non-alcohol user patients than others (AOR = 1.95, 95% CI: 1.24–3.06). Patients who did not chew Khat were two times more likely to accept COVID-19 vaccine than those who did chew (AOR = 2.01, 95% CI: 1.27–3.2). Once more, participants who had good knowledge about COVID-19 vaccine were 1.55 times more likely to accept COVID-19 vaccine than these with poor knowledge (AOR = 1.55, 95% CI: 1.03–2.87). In the same way, the odds of COVID-19 vaccine acceptance were two times higher among patients who had positive attitude towards COVID-19 vaccine (AOR = 2.05, 95% CI: 1.26–3.33) (Table 4).

Discussion

The aim of this study was to assess the acceptance of COVID-19 vaccine among patients with chronic diseases, who visited public hospitals in West Guji (Ethiopia). The study showed that the acceptance rate of COVID-19 vaccine among patients with chronic diseases was only 39.5% (95% CI: 35–44) which is lower than the findings in Chile (49%),³⁷ Northern Ethiopia (59.4%),¹⁴ Arab world (62.4%),⁹ Southern Ethiopia (62.6%),²⁴ the Netherlands (73%),²⁷ Australia (77.3%),²⁹ Denmark (80%),²⁷ China (91.3%),¹⁹ Indonesia (93.3%),²⁵ and Malaysia (94.3%).²⁸ On the other hand, our finding is consistent with a study done in the USA,³⁰ where vaccine acceptance was 36%. The generally low COVID-19 vaccine acceptance in this study might be due to perceived benefits, action signals, susceptibility, and severity of COVID-19.³⁷ Difference in vaccine acceptance among different countries might also be associated with variations in socio-demographic characteristics of the participants, time of the study period, and availability of health facility.

The present study revealed that knowledge and attitude towards COVID-19 vaccine, age, residence, health insurance, previous COVID-19 infection, khat chewing, habit of drinking alcohol, and type of chronic disease were significant factors associated with the acceptance of COVID-19 vaccine. COVID-19 vaccine was three times more likely to be accepted by patients with age greater than 40 years old as compared to patients with age group between 20 and 29 years old. This finding is consistent with the finding in other parts of Ethiopia²⁴ and Arab world.⁹

Table 4 Factors Associated with the Acceptance of COVID-19 Vaccine Among Patients with Chronic Diseases (September to October, 2021)

Variable	Categories	COVID-19 Vaccine Acceptance		COR (95% CI)	AOR (95% CI)	P-value
		Yes	No			
Age (years)	30–39	58	116	0.84 (0.53–1.32)	0.8 (0.48–1.32)	0.38
	≥40 and above	48	34	2.32 (1.33–4.02)	2.84 (1.53–5.28)	<0.0001
	20–29	58	94	1	1	
Types of chronic diseases	TB	45	76	0.59 (0.29–1.20)	0.55 (0.24–1.27)	0.163
	HIV	47	63	0.74 (0.36–1.52)	0.82 (0.36–1.85)	0.641
	Heart diseases	26	30	0.86 (0.38–1.93)	1.23 (0.49–3.03)	0.652
	URTI	22	57	0.38 (0.17–0.84)	1.32 (1.03–2.80)	0.014
	Diabetes	21	21	1	1	
Residence	Urban	72	136	0.7 (0.44–0.98)	0.6 (0.38–0.95)	0.03
	Rural	89	111	1	1	
Previous COVID-19 infection	Yes	46	47	1.7 (1.06–2.71)	2.1 (1.22–3.47)	0.006
	No	115	200	1	1	
Health insurance	Yes	147	203	2.27 (1.2–4.3)	2.55 (1.23–5.28)	0.01
	No	14	44	1	1	
Drink alcohol	No	98	113	1.84 (1.23–2.76)	1.95 (1.24–3.06)	0.003
	Yes	63	134	1	1	
Chew Khat	No	85	103	1.56 (1.04–2.33)	2.01 (1.27–3.2)	0.003
	Yes	76	144	1	1	
Knowledge	Good	54	108	0.65 (0.43–0.98)	1.55 (1.03–2.87)	0.01
	Poor	107	139	1	1	
Attitude	Positive	69	74	1.74 (1.15–2.63)	2.05 (1.26–3.33)	0.004
	Negative	92	172	1	1	

In this study, more than one-third (39.6%) of the study patients had good knowledge about COVID-19 vaccine. The finding of this study was in line with the reports from West India (35.5%).³⁵ This figure was, however, lower than that reported in South Ethiopia (74%),²⁴ Bangladesh (62.1%),³³ Southeast Ethiopia (62.7%),¹⁴ France (81.2%),¹⁵ and south-west Ethiopia (87%).³⁴ This disparities may be due to dissemination of information about COVID-19 vaccine to the risk group, variations of the study period, and accessibility of health facility. Patients who had good knowledge towards COVID-19 vaccine were almost one and half times more likely to accept the vaccine as compared to those who had poor knowledge. The finding of this study corroborates other previous reports from northeastern Ethiopia, Southern Gondar, Pakistan, and the USA.^{14,24,31,32} Similarly, the present study revealed that only 35.3% of the participants had positive attitude towards COVID-19 vaccine which was lower than the findings in China (70.1%),³⁶ Ethiopia (44%),²⁴ and Bangladesh (78%).³³ This difference might be due to the variation of the target population, study design, and variation in risk perception towards COVID-19.

The odds of COVID-19 vaccine acceptance were two times higher among patients who had health insurance than those who had no health insurance. This is in agreement with studies done in Southeastern Ethiopia,¹⁴ USA,³⁰ and China.²² We also found that the likelihood of vaccine acceptance was two times higher among patients who had previous COVID-19 infection than those who had no previous COVID-19 infection. As more than two-thirds (77.2%) of the participants were not previously infected by COVID-19, the low acceptance rate of the vaccine is alarming. Indeed, our finding is in agreement with that found in the Arab world.⁹

Furthermore, participants who did not consume alcohol and who did not chew khat were likely to accept COVID-19 vaccine as compared to their counterparts. This is possibly associated with addiction-related negligence and carelessness to avoid COVID-19.

Conclusions

In this study, we found the proportion of COVID-19 vaccine acceptance among patients with chronic diseases to be low. This low acceptance of COVID-19 vaccine would have a significant adverse effect. The main factors that were positively associated with COVID-19 vaccine acceptance were age greater than forty years, being resident in urban area, having upper respiratory tract infection, previous COVID-19 infection, having health insurance, those not drinking alcohol, those not chewing khat, and positive attitude and good knowledge towards COVID-19 vaccine. Therefore, we recommend that interventions, such as continuous health education and awareness creation about the risks of the pandemic, and benefit, safety, and efficacy of the vaccine should be delivered to patients with chronic diseases. These factors influencing the acceptance/rejection of vaccine should also be considered in developing promotional mechanisms and formulating public health policies towards controlling COVID-19.

Limitation of the Study

This cross-sectional study was based on self-reported vaccine acceptance, and hence the results were possibly liable to social desirability and recall biases. The study also did not consider those people who were hesitant to get vaccinated.

Abbreviations

AOR, adjusted odds ratio; CI, confidence interval; COR, crude odds ratio; COVID-19, coronavirus disease 2019; Ref, reference.

Data Sharing Statement

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Ethical Approval

The study complies with the declaration of Helsinki. All procedures, including ethical approval and research permission, were performed in accordance with national standards, guaranteeing the anonymity of the respondents. Ethical approval (BHU/IH 3015/2/2013) was obtained from the Ethical Review Committee of the Institute of Health, Bule Hora University. Besides, written consent was obtained from the heads of the selected hospitals. In addition, respondents were informed about the purpose of the study, and their informed consent was obtained. The respondents' right to refuse or withdraw from the study was fully maintained, and the information provided by each respondent was kept strictly confidential.

Acknowledgments

We would like to forward our heartfelt thanks to Bule Hora University, Institute of Health, for providing ethical clearance for this study. The authors also want to extend their pleasure to the heads of the hospitals for their permission to conduct this study. Besides, we acknowledge the data collectors, supervisors, and study participants for their commitment, efforts, and willingness to participate in this study.

Funding

There is no funding to report.

Disclosure

The authors declare that there are no competing interests in this study.

References

1. Zhu N, Zhang D, Wang W, et al. A novel coronavirus from patients with pneumonia in China, 2019. *N Engl J Med*. 2020;382(8):727–733. doi:10.1056/NEJMoa2001017
2. Saqlain M, Munir MM, Rehman SU, et al. Knowledge, attitude, practice and perceived barriers among healthcare workers regarding COVID-19: a cross-sectional survey from Pakistan. *J Hosp Infect*. 2020;105(3):419–423. doi:10.1016/j.jhin.2020.05.007
3. Elhadi M, Msherghi A, Alkeelani M, et al. Assessment of healthcare workers' levels of preparedness and awareness regarding Covid-19 infection in low-resource settings. *Am J Trop Med Hyg*. 2020;103(2):828–833. doi:10.4269/ajtmh.20-0330
4. Kumar J, Katto MS, Siddiqui AA, et al. Knowledge, attitude, and practices of healthcare workers regarding the use of face mask to limit the spread of the new coronavirus disease (COVID-19). *Cureus*. 2020;12(4):e7737.
5. Worldometers report COVID-19 case in the world; 2022 Available from: <https://www.worldometers.info/coronavirus/>. Accessed February 8, 2022.
6. Worldometer report COVID-19 cases in Ethiopia; 2022. Available from: <https://www.worldometers.info/coronavirus/country/ethiopia>. Accessed February 8, 2022.
7. Kebede Y, Yitayih Y, Birhanu Z, Mekonen S, Ambelu A. Knowledge, perceptions and preventive practices towards COVID-19 early in the outbreak among Jimma University Medical Center visitors, Southwest Ethiopia. *PLoS One*. 2020;15(5):1–15. doi:10.1371/journal.pone.0233744
8. Hoque AM, Hoque M, Hoque ME, Van Hal G. Estimates and determinants of psychological problems of pregnant women during COVID-19 epidemic in South Africa. *Eur J Med Heal Sci*. 2021;3(1):143–149.
9. Kaadan MI, Abdulkarim J, Chaar M, Zayegh O, Keblawi MA. Determinants of COVID-19 vaccine acceptance in the Arab world: a cross-sectional study. *Glob Heal Res Policy*. 2021;6(1):1–7.
10. Tran VD, Pak TV, Gribkova EI, et al. Determinants of covid-19 vaccine acceptance in a high infection-rate country: a cross-sectional study in Russia. *Pharm Pract*. 2021;19(1):1–9.
11. The New York Times. Coronavirus vaccine tracker. Available from: <https://www.nytimes.com/interactive/2020/science/coronavirus-vaccine-tracker.html>. Accessed October 10, 2021.
12. A phase 2a, randomized, observer-blind, placebo controlled, dose-confirmation study to evaluate the safety, reactogenicity, and immunogenicity of mRNA-1273 SARS-CoV-2 vaccine in adults aged 18 years and older. Available from: <https://clinicaltrials.gov/ct2/show/NCT04405076>. Accessed May 24, 2022.
13. Adaptive phase IB-II randomized clinical trial of preventive vaccine consisting of autologous dendritic cells loaded with antigens from severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), with or without GM-CSF, in subjects negative for COVID-19. Available from: <https://clinicaltrials.gov/ct2/show/NCT04386252>. Accessed May 24, 2022.
14. Berihun G, Walle Z, Berhanu L, Teshome D. Acceptance of covid-19 vaccine and determinant factors among patients with chronic disease visiting Dessie comprehensive specialized hospital, northeastern Ethiopia. *Patient Prefer Adherence*. 2021;15:1795–1805. doi:10.2147/PPA.S324564
15. Verger P, Scronias D, Dauby N, et al. Attitudes of healthcare workers towards COVID-19 vaccination: a survey in France and French-speaking parts of Belgium and Canada, 2020. *Eurosurveillance*. 2021;26(3):1–8. doi:10.2807/1560-7917.ES.2021.26.3.2002047
16. Famuyiwo TB, Ogunwale A, Des Bordes J, Raji M. COVID-19: perceived infection risk and barriers to uptake of Pfizer-BioNTech and moderna vaccines among community healthcare workers. *J Racial Ethn Heal Disparities*. 2021;15:7–12.
17. Handebo S, Wolde M, Shitu K, Kassie A. Determinant of intention to receive COVID-19 vaccine among school teachers in Gondar City, Northwest Ethiopia. *PLoS One*. 2021;16(6 June):1–11. doi:10.1371/journal.pone.0253499
18. Paul E, Steptoe A, Fancourt D. Attitudes towards vaccines and intention to vaccinate against COVID-19: implications for public health communications. *Lancet Reg Heal - Eur*. 2021;1:100012.
19. Lin Y, Hu Z, Zhao Q, Alias H, Danaee M, Wong LP. Understanding COVID-19 vaccine demand and hesitancy: a nationwide online survey in China. *PLoS Negl Trop Dis*. 2020;14(12):e0008961. doi:10.1371/journal.pntd.0008961
20. Wang J, Jing R, Lai X, et al. Acceptance of covid-19 vaccination during the covid-19 pandemic in China. *Vaccines*. 2020;8(3):1–14. doi:10.3390/vaccines8030482
21. Kelsey JL, Whittemore AS, Evans ASTW. *Methods in Observational Epidemiology: Monographs in Epidemiology and Biostatistics*. New York, Oxford: Oxford University Press; 1996:2245–2252.
22. Liu R, Zhang Y, Nicholas S, Leng A, Maitland E, Wang J. COVID-19 vaccination willingness among Chinese adults under the free vaccination policy. *Vaccines*. 2021;9(3):1–10. doi:10.3390/vaccines9030292
23. Ademas A, Adane M, Keleb A, et al. Covid-19 prevention practices and associated factors among diabetes and HIV/AIDS clients in south-wollo zone, Ethiopia: a health facility-based cross-sectional study. *J Multidiscip Healthc*. 2021;14(August):2079–2086. doi:10.2147/JMDH.S325207
24. Abebe H, Shitu S, Mose A. Understanding of COVID-19 vaccine knowledge, attitude, acceptance, and determinates of COVID-19 vaccine acceptance among adult population in Ethiopia. *Infect Drug Resist*. 2021;14:2015–2025. doi:10.2147/IDR.S312116
25. Harapan H, Wagner AL, Yufika A, et al. Acceptance of a COVID-19 vaccine in Southeast Asia: a cross-sectional study in Indonesia. *Front Public Heal*. 2020;8(July):1–8.
26. Hosmer J, Lemeshow SSR. *Applied Logistic Regression*. 3rd. Hoboken (NJ): John Wiley and Sons; Vol. 2013, 2013: 4379–4387.
27. Neumann-Böhme S, Varghese NE, Sabat I, et al. Once we have it, will we use it? A European survey on willingness to be vaccinated against COVID-19. *Eur J Heal Econ*. 2020;21(7):977–982. doi:10.1007/s10198-020-01208-6
28. Wong LP, Alias H, Wong PF, Lee HY, AbuBakar S. The use of the health belief model to assess predictors of intent to receive the COVID-19 vaccine and willingness to pay. *Hum Vaccines Immunother*. 2020;16(9):2204–2214. doi:10.1080/21645515.2020.1790279

29. Rhodes A, Hoq M, Measey MADM. Intention to vaccinate against COVID-19 in Australia. *Lancet Infect Dis.* 2020;21(January):2020–2021.
30. Shekhar R, Sheikh AB, Upadhyay S, Singh M, Kottewar S. COVID-19 vaccine acceptance among health care workers in the United States. *Vaccine.* 2021;9:1–15.
31. Guidry JPD, Laestadius LI, Vraga EK, et al. Willingness to get the COVID-19 vaccine with and without emergency use authorization. *Am J Infect Control.* 2021;49(1):137–142. doi:10.1016/j.ajic.2020.11.018
32. Maraqa B, Nazzal Z, Rabi R, Sarhan N, Al-Shakhray K, Al-Kaila M. COVID-19 vaccine hesitancy among health care workers in Palestine: a call for action. *Prev Med.* 2021;149(January):106618. doi:10.1016/j.ypmed.2021.106618
33. Saiful Islam M, Siddique AB, Akter R, et al. Knowledge, attitudes and perceptions towards COVID-19 vaccinations: a cross-sectional community survey in Bangladesh. *medRxiv.* 2021;2021. doi:10.1101/2021.02.16.21251802
34. Mose A, Yeshaneh A. COVID-19 vaccine acceptance and its associated factors among pregnant women attending antenatal care clinic in southwest Ethiopia: institutional-based cross-sectional study. *Int J Gen Med.* 2021;14(June):2385–2395. doi:10.2147/IJGM.S314346
35. Bhartiya S, Kumar N, Singh T, Murugan S, Rajavel SWM. Knowledge, attitude and practice towards COVID-19 vaccination acceptance in West India. *Int J Community Med Public Heal.* 2021;8(3). doi:10.18203/2394-6040.ijcmph2021048
36. Jiang N, Wei B, Lin H, Wang Y, Chai S, Liu W. Nursing students' attitudes, knowledge and willingness of to receive the coronavirus disease vaccine: a cross-sectional study. *Nurse Educ Pract.* 2021;55(May):103148. doi:10.1016/j.nepr.2021.103148
37. Cerda AA, García LY. Hesitation and refusal factors in individuals' decision-making processes regarding a coronavirus disease 2019 vaccination. *Front Public Heal.* 2021;9(April). doi:10.3389/fpubh.2021.626852

Patient Preference and Adherence

Dovepress

Publish your work in this journal

Patient Preference and Adherence is an international, peer-reviewed, open access journal that focusing on the growing importance of patient preference and adherence throughout the therapeutic continuum. Patient satisfaction, acceptability, quality of life, compliance, persistence and their role in developing new therapeutic modalities and compounds to optimize clinical outcomes for existing disease states are major areas of interest for the journal. This journal has been accepted for indexing on PubMed Central. The manuscript management system is completely online and includes a very quick and fair peer-review system, which is all easy to use. Visit <http://www.dovepress.com/testimonials.php> to read real quotes from published authors.

Submit your manuscript here: <https://www.dovepress.com/patient-preference-and-adherence-journal>