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Research Article

Prevalence of COVID-19 Vaccine Hesitancy and Its Associated Factors among Chronic Disease Patients in a Resource Limited Setting in Ethiopia: A Cross-Sectional Study

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Background. The COVID-19 pandemic disproportionately affects patients with chronic diseases. Thus, chronic disease patients are among the first high-risk population groups to get vaccinated. This might be challenged by vaccine hesitancy as it is one of the top ten global health issues for 2019. Furthermore, vaccination myths and conspiracy theories have been proliferating, and the developing world can readily embrace them, which might cause vaccine hesitancy. However, there is a paucity of evidence regarding chronic illness patient's willingness to be vaccinated. As a result, the aim of this study is to determine the magnitude of vaccine hesitancy and associated factors among chronic disease patients in Ethiopia. *Method*. An institutional-based cross-sectional study was conducted among adult ambulatory chronic disease patients who were selected using stratified sampling technique from June 1 to August 1, 2021. Data were collected through a face-to-face interviewer-administered questionnaire. Vaccine hesitancy was measured based on a questionnaire which was adapted from the reviewed literature. Bivariable and multivariable logistic regression was used to identify factors, and variables with $p < 0.05$ were considered statistically significant. *Result*. A total of 422 respondents participated in the survey; the response rate was 99.7%. The mean age of the participants was 45 years ± 16.95 and 228 (54%) of them were male. Almost half of the respondents (49.5%) were hesitant toward the COVID-19 vaccine. Participants who were male (AOR = 1.56, 95% CI: 1.03, 2.35), having good knowledge about the COVID-19 vaccine (AOR = 1.60 95% CI: 1.06, 2.41) and having a comorbidity (AOR = 3.36, 95% CI: 1.73, 6.56), were factors associated with the acceptance of the COVID-19 vaccine. *Conclusion*. The level of COVID-19 vaccine hesitancy was high. The COVID-19 vaccine's acceptability was influenced by being a man, having knowledge about the vaccine and having comorbidities. Furthermore, the most prevalent reason for refusing to take the vaccination is a fear that it may not be safe. As a result, public awareness campaigns should concentrate on delivering more information about the COVID-19 vaccine's safety and efficacy. Furthermore, it is critical to disseminate accurate information, particularly among women, and to educate people about the vaccine.

1. Introduction

COVID-19 is a respiratory morbidity caused by a severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) [1]. It is a global public health pandemic [2]. The World Health Organization (WHO) declared it an international public health emergency on January 30, 2020, and appealed to all countries to work together to reduce the wide transmission of COVID-19 [2]. Worldwide, numerous activities such as physical distancing and other preventive measures are being undertaken to alleviate this emergency [3]. But mass vaccination is vital to control transmission [3]. Several brands of vaccines have been developed and distributed around the world [4]. On March 13, 2021, the Ethiopian Ministry of Health launched the COVID-19 vaccine, and the deployment plan prioritizes the first doses

for health and essential workers and other at-risk groups. Thus, chronic disease patients are among the first high-risk population groups to get vaccinated [5]." This might be challenged by vaccine hesitancy as it is one of the top ten worldwide health threats for 2019 [3]. The term "vaccine hesitancy" refers to a "delay in accepting or refusing immunization notwithstanding the availability of vaccination services [6]." The COVID-19 pandemic disproportionately affects patients with chronic diseases [7–10]. Previous research has depicted individuals with chronic illnesses as being less likely to be vaccine hesitant [11, 12]. However, there is a paucity of evidence regarding chronic illness patients' willingness to be vaccinated [13]. Furthermore, vaccination myths and conspiracy theories have been proliferating, and the developing world can readily embrace them and might cause vaccine hesitancy. A previous study has reported the global acceptance level for COVID-19 vaccines was suboptimal [14]. In addition, the availability of evidence regarding safety and efficacy which might be a factor in vaccine acceptance, a narrative review showed that currently available vaccines are highly effective but there are concerns regarding their safety and adverse effects [15]. Similarly, a Chinese study discovered only slightly more than half of their population (54%) planned to get vaccinated [16]. Moreover, it is reported that the majority of Indians would accept the vaccine in India; even a small proportion of hesitancy should be addressed [17]. On the other hand, in the case of developed countries, a U.S study reported that almost a fifth (22%) of the respondents were vaccine hesitant [18].

However, there were significant demographic differences in vaccination acceptance, with black Americans reporting lower COVID-19 vaccine acceptance (40%) than other racial groups [19]. In Ethiopia, there is a considerable disparity between studies conducted in the Gurage zone [20] and Addis Ababa [21], with 37.4 percent and 19.1 percent, respectively. As a result, addressing the magnitude of COVID-19 vaccine hesitancy in different settings is recommended. During the study period, the vaccine was available only to health care professionals and chronic disease patients, but later on, as of November 2021, it became available for the entire population starting at the age of 12. As of 24 November 2021, a total of 370,712 confirmed cases and 6,702 deaths have been reported in Ethiopia, and more than 5.4 million people have been vaccinated [22].

In addition, there is inadequate evidence regarding chronic disease patient's level of vaccine hesitancy [20]. Thus, this study is aimed at assessing the magnitude of vaccine hesitancy and associated factors among chronic disease patients in Ethiopia.

2. Method

2.1. Study Design, Study Setting, and Study Period. An institutional-based cross-sectional study was conducted at a referral hospital in the northwest of Ethiopia among ambulatory chronic disease patients. Non-communicable chronic disease patients' follow-up runs from Monday to Friday, and cardiovascular diseases like hypertension, chronic respiratory diseases like asthma, epilepsy, and type II diabetes are the top chronic disease morbidities in the hospital during the study period. The study was conducted from June 1 to August 1, 2021.

2.2. Population of the Study. The source population was all patients with a noncommunicable chronic disease who were attending in the northwestern of Ethiopia, could speak the local language, Amharic, and had the ability to provide informed consent. While the study population were all patients with noncommunicable chronic disease who visited the hospital during the data collection period.

2.3. Inclusion and Exclusion Criteria. All adult patients whose ages were greater than or equal to 18 years and who were on chronic disease follow-up were included in the study. Those participants who did not give consent to participate and those who were not able to respond to the questionnaire because of critical illness, dementia, psychosis, or profound deafness were excluded from the study.

2.4. Sample Size and Sampling Procedure. The sample size for the current study was calculated by using a single population proportion formula with a 95% confidence level and a proportion of vaccine hesitancy 50% to get maximum sample size and relative precision was assumed to be 5%. With a 10% nonresponse rate, the total sample size was found to be 423.

It was calculated as shown in the following equation:

$$\text{sample size}\,(n) = \frac{(\mathbf{Z\alpha}/2)\mathbf{x}\,\mathbf{p}\,(\mathbf{1}-\mathbf{P})}{\mathbf{d}^{\mathbf{2}}},\ (n) = \frac{(\mathbf{1.96})\mathbf{x}\,\mathbf{0.5}\,(\mathbf{1}-\mathbf{0.5})}{(\mathbf{0.05})^{\mathbf{2}}} = 384, \tag{1}$$

where

(i) n is the calculated sample size

(ii) P is the proportion of vaccine hesitancy $\longrightarrow$ to get a maximum sample size $p = 50\%$ was used

(iii) $Z_{\alpha/2}$ is the value of standard normal distribution (Z-statistic) at the 95% confidence level ($\alpha = 0.05$) which is 1.96

(iv) d is the margin of error 5% (0.05)

(v) Nonresponse rate of 10% was added to get the final the sample size of 384 + 38.4≈423

The participants for this study were selected using a stratified random sampling with proportional allocation technique. Stratified sampling is appropriate to have a representative sample of the population under study since it is useful for a population with subsets of known size where the subsets make up different proportions of the whole [23]. The stratification was made by using the prevalent chronic diseases in the study setting. The stratification includes hypertension, heart diseases, chronic kidney disease, diabetes mellitus, and the remaining chronic diseases were categorized as other chronic diseases hoping for vaccine hesitancy difference among patients with different chronic cases. Thus, stratification was done after gaining the number of patients in each disease, and then proportional allocation was done based on the following formula: sample size/population size x stratum size. Then random samples were selected from each stratum using a lottery method.

2.5. Study Variables

2.5.1. Dependent Variables. The dependent variable was vaccine hesitancy which has dichotomous outcomes of yes or no.

2.5.2. Independent Variables. Independent variables include age, sex, residence, marital status, occupation, educational status, income, duration since diagnosis, number of medications, close contacts infected with COVID-19, presence of comorbidity, attitude towards vaccines in general, source of information, knowledge of COVID-19 vaccine, and attitude towards COVID-19 vaccine.

2.6. Data Collection Instrument and Procedure. Clarification was given on the purpose of the study. Then respondents who met the inclusion criteria were interviewed face-to-face by using structured and pretested questionnaires that were adapted from reviewed literature [24–26].

The questionnaire used to assess vaccine hesitancy and reasons for refusal was a validated tool which developed by Maria Cordina, Mary A. LaurI, and Josef Lauri and used after obtaining permission [25]. This questionnaire was used previously, and it has been established that it is appropriate, sensitive, reliable, and valid [25]. Data were collected by three-degree level pharmacy students who have taken three-day training before the data collection and were fluent in the local language Amharic. The reason for using pharmacists for data collection was to give health education at the end of data collection for those who were vaccine hesitant. The trained data collectors were supervised by a supervisor. The questionnaire was initially developed in English and translated to Amharic language which is the local language of the study area and back to English to maintain consistency. The questionnaire was pretested on 22 participants, and the reliability (internal consistency) of the translated tools was assessed with Cronbach's alpha coefficient of 0.94 for knowledge about COVID-19 vaccine, 0.79 for attitude toward COVID-19 vaccine, and 0.86 for vaccine hesitancy, respectively, which reported acceptable reliability of the questionnaire. The face validity of the questionnaire was assessed by experts and to assess the convergent validity, associations were examined between vaccine hesitancy and attitude towards the COVID-19 vaccine. Similarly, those participants who scored higher in the attitude domain showed lower vaccine hesitancy score compared to participants who did not. The questionnaire has six components: sociodemographic characteristics, clinical characteristics, knowledge about COVID-19 vaccine questions, attitude towards COVID-19 vaccine, source of information, and general attitude towards vaccines and finally, the questioner ends with COVID-19 vaccine acceptance and reasons for refusal related questions. The responses were measured on a likert scale with 1 being "strongly disagreed/not at all," and 5 being "strongly agreed/very much" and categorized based on the mean score [25].

2.7. Data Quality Control and Assurance. A pretest was done among 22 chronic medical patients which were 5% of the total sample size, to assure the quality of the data, and those participants who were involved in the pretest were excluded from the final analysis. Some items were modified, and appropriate amendments were made after the pretest result. Training was provided for data collectors and supervisors about the objective of the study, confidentiality of information, participants' right, and ethical aspects before data collection. On a daily basis, supervision was done. The supervisor and principal investigator checked the completeness, accuracy, and consistency of the questionnaire. The collected data were entered into Epi Info 7 to maintain consistency and accuracy. Finally, a multivariable logistic regression analysis was run to control the confounding variables.

2.8. Data Processing and Analysis. After the data were entered into Epi Info 7, they were transferred to Statistical Package for Social Science (SPSS) version 23 for analysis. Descriptive statistics (frequencies, percentages, mean, median, standard deviation, and interquartile range) were reported for the important variables. Associations between variables were assessed using the Chi-square test. The association between the dependent variable and independent variables was identified by a binary logistic regression model. Variables with a p value of less than 0.2 in the bivariable binary logistic regression were fitted in the multivariable logistic regression to control confounding variables. An adjusted odds ratio (AOR) with a p value <0.05 and 95% CI was reported, and the association between the dependent variable and the independent variables was determined. Overall model fitness was checked with the Hosmer and Lemeshow test, and the model was fit with a p value of >0.05.

2.9. Ethical Consideration. This study was reviewed and ethically approved by the Institutional Review Committee of the School of Pharmacy, University of Gondar with the

approval number of (UOG-SOP272/2021) on 23/6/2021. The data collected were kept anonymous and no personal identifier was used. A written informed consent was obtained from the study participants and participation in the study was fully voluntary. The criteria set by the declaration of Helsinki were followed while conducting this study.

2.10. Operational Definition

2.10.1. Vaccine Hesitancy. Vaccine hesitancy was explored using one question. Respondents were asked whether they would take or had taken COVID-19 vaccine with possible responses being yes, no, or unsure. Those that answered no or unsure were considered as vaccine hesitant [25].

2.10.2. Knowledge about the COVID-19 Vaccine. Seven items were used to assess respondents' knowledge about the COVID-19 vaccine. Correctly answering the question received one point, while incorrect responses was given zero points. Respondents who scored 70% and above were categorized as having good knowledge [24].

2.10.3. Attitude towards the COVID-19 Vaccine. The attitudes towards COVID-19 vaccines' section consists of 6 statements with a 5-point likert scale (5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, 1 = strongly disagree) [26].

3. Result

3.1. Sociodemographic and Clinical Characteristics. In this study, 423 participants were approached, and 422 participants agreed to take part in the study, giving a response rate of 99.7%. The mean age of the participants was 45 years ± 16.95 and 228 (54%) of them were male. Slightly less than one-third (29.9%) of the participant's educational level were college and above. Two hundred seventy-three (64.7%) of the participants were urban dwellers, and 32.7% of the participants were self-employed. In this study, 194 (46%) of the participants had an average monthly income of ≥3500 Ethiopian Birr. Among the study participants, 287 (68%) of them were married. In this study one hundred forty-seven (34.8%) of the participants had hypertension, followed by diabetes mellitus 145 (34.4%). Meanwhile, slightly less than two-third of the respondents 273 (64.7%) took two to four medications (Table 1).

3.2. Knowledge about the COVID-19 Vaccine. About half of the participants (215, or 50.9%) had good knowledge about the COVID-19 vaccine. Moreover, in this study, 342 (81%) of the participants knew that COVID-19 can be prevented by the vaccine. Half of the participants (211 or 50%) knew that AstraZeneca and Covishield are the two vaccines used in

Table 1: Sociodemographic and clinical characteristics of chronic noncommunicable disease patients in Northwest Ethiopia, 2021 ($N = 422$).

Variables	*N*	%
Age		
19	5	1.2
20–29	102	24.2
30–39	68	16.1
40–49	76	18.0
50–59	71	16.8
≥60	100	23.7
Sex		
Male	228	54.0
Female	194	46.0
Monthly income*		
<1500	116	27.5
1500–3500	112	26.5
≥3500	194	46.0
Marital status		
Single	103	24.4
Married	287	68
Divorced	6	1.4
Widowed	22	5.2
Separated	4	0.9
Educational status		
No formal education	84	19.9
Primary school education	103	24.4
Secondary school education	109	25.7
Diploma and above	126	29.8
Religion		
Orthodox	316	74.9
Muslim	89	21.1
Protestant	14	3.3
Catholic	2	0.5
Other	1	0.2
Number of medications taken		
One	143	33.9
Two–four	273	64.7
≥Four	6	1.4
Do you consider yourself as high risk for COVID?		
Yes	97	23.3
No	325	76.7
Residency		
Urban	273	64.7
Rural	149	35.3
Occupational status		
Unemployed	49	11.6
Governmental jobs	99	23.5
Private jobs	138	32.7
House wife	87	20.6
Others**	49	11.6
Types of disease		
Diabetes mellitus	145	34.4
Hypertension	147	34.8
Heart disease	56	13.3
Kidney disease	28	6.6
Others**	46	10.9

*The monthly income currency is in Ethiopian Birr (ETB), 1USD = 48.5492
**retired, unable to work, **epilepsy, asthma, COPD.

Ethiopia, while the other half of the participants answered incorrectly.

More than half of the participants (226 or 53.6%) did not know that the vaccine is given two times within 28 days apart. On the other hand, three-quarters (316, or74.9%) of the respondents correctly answered that the vaccine is provided for free in Ethiopia.

The majority of the participants 349 (82.7%) knew that the provision of the vaccine was provided on a voluntary basis.

More than three-quarters (331 or 78.4%) of the respondents knew that healthcare professionals, chronic patients, and elders are prioritized for vaccination. About half of the respondents (215 or 50.9%) correctly knew that the COVID-19 vaccine had been started.

3.3. Attitudes towards the COVID-19 Vaccine and General Attitudes towards Vaccines. Slightly less than one-third (28.9%) of the participants chose "disagree" for the statement "in general, vaccines are safe," and 116 (27.5%) participants chose "agree" for the same statement and 174 (17.5%) of the participants reported that they know someone who had a bad reaction to a vaccine. Almost half of the participants (210 or 49.8%) agreed that it is important to get the vaccine to protect people from COVID-19. More than a quarter (28.7%) of the participants agreed that pharmaceutical companies are going to develop safe and effective COVID-19 vaccines. Seventy-four (17.5%) participants agreed that vaccines made in Europe or America are safer than those made in other countries. One hundred forty-eight (35.1%) of the participants chosen "agreed" to the statement "my concerns about related side effects will prevent me from taking a vaccine for the prevention of COVID-19." Most of the study participants (258 or 61.1%) thought that most Ethiopians would refuse to take the COVID-19 vaccine. While more than half (58.8%) of participants strongly disagreed that the government will make the vaccine available for all citizens free of charge. All statements on attitude significantly correlated with vaccine hesitancy but the effect size is small (Tables 2 and 3).

3.4. Sources of Trusted Information about the COVID-19 Vaccine. The findings revealed that the majority of 334 (79.1%) of the participants trusted health institutions as sources of information towards the COVID-19 vaccine, followed by media (television, radio, and newspapers) with 120 (28.4%) (Table 4).

3.5. Prevalence of Vaccine Hesitancy. The magnitude of vaccine hesitancy was found to be almost a half (207 or 49.05%) (95% CI 46–56). The most common reason for not wanting to take the vaccine is related to the belief that it may not be safe (180 or 42.65%) followed by unreliable due to the short period of development (120 or 28.44%) and wanting more information about the vaccine (120 or 28.44%) (Figure 1).

3.6. Factors Associated with Vaccine Hesitancy among Noncommunicable Chronic Patients. Demographic factors and clinical factors such as gender, residency, comorbidity, knowledge, and sources of information were assessed for their association with hesitancy toward the COVID-19 vaccine among chronic disease patients. As shown in Table 5, hesitancy for the COVID-19 vaccine among the participants was significantly associated with gender, presence of comorbidity, and knowledge towards the COVID-19 vaccine.

Sex, residency, number of family members, comorbidities, number of medications, knowledge about the vaccine, and source of trusted information were all associated with vaccine hesitancy at $p < 0.2$ after the bivariate binary logistic regression was run. The multivariable binary logistic regression analysis revealed that sex, comorbidity, and knowledge were found to be significantly associated with the hesitancy level of the respondents. In this study, sex was found to affect vaccine hesitancy.

The odds of accepting COVID-19 vaccine were about 1.5 times (AOR = 1.56, 95% CI: 1.03, 2.35) higher for males than their female counterparts. With regard to comorbidity, the odds of accepting COVID-19 vaccine were about three times (AOR = 3.36, 95% CI: 1.73, 6.56) higher for persons with comorbidities as compared to those participants without comorbidity. Knowledge towards COVID-19 vaccination was significantly associated with the odds of accepting the COVID-19 vaccine. It was found that the odds of accepting the COVID-19 vaccine among those respondents who had good knowledge were about 1.6 times (AOR = 1.60 95% CI: 1.06, 2.41) higher than those respondents who had poor knowledge. Table 6 shows the bivariable and multivariable regression in detail.

4. Discussion

The goal of this study was to determine vaccine hesitancy and associated factors among noncommunicable chronic disease patients in Ethiopia. Vaccine hesitancy was found to be 207 (49.1%), (95% CI, 46–56). This proportion is insufficient to obtain herd immunity because, according to estimations of the basic reproduction number, with an estimated reproductive number (R) of 3, COVID-19 herd immunity may be attained by immunizing at least 70% of the population, provided the vaccine is 100% effective [27]. The rapid development of these vaccinations within a year explains the substantial vaccine reluctance. Some people are concerned about the vaccines' safety because of their unprecedented speed [28–30]. Furthermore, this study was conducted among chronic disease patients and evidence suggested that chronically ill people in lower-income countries have a significant hesitancy about obtaining the vaccine due to misleading information and inadequate communication [31]. Despite this, chronic disease patients may be hesitant to receive the vaccine due to concerns about unintended side effects [4, 32, 33].

This finding is similar to a study conducted in Ethiopia (53.9%) [34], Sodo Town, Ethiopia (54.5%) [35], 16 countries across the continent (48%) [36], and Nigeria (49.8%) [37].

Table 2: Attitude towards COVID-19 vaccination among chronic patients in Northwest Ethiopia ($N = 422$).

Attitude-related questions		Vaccine hesitancy	
		Yes	No
It is important to get a vaccine to protect the people from COVID-19	Strongly agree	22 (5.2%)	61 (14.5%)
	Agree	77 (18.2%)	133 (31.5%)
	Neutral	25 (5.9%)	11 (2.6%)
	Disagree	57 (13.5%)	7 (1.7%)
	Strongly disagree	26 (6.2%)	3 (0.7%)
Pharmaceutical companies are going to develop safe and effective COVID-19 vaccines	Strongly agree	5 (1.2%)	16 (3.8%)
	Agree	39 (9.2%)	82 (19.4%)
	Neutral	66 (15.6%)	93 (22.0%)
	Disagree	60 (14.2%)	19 (4.5%)
	Strongly disagree	37 (8.8%)	5 (1.2%)
I believe COVID-19 vaccines made in Europe or America are safer than those made in other world countries	Strongly agree	9 (2.1%)	13 (3.1%)
	Agree	17 (4.0%)	57 (13.5%)
	Neutral	75 (17.8%)	104 (24.6%)
	Disagree	69 (16.4%)	32 (7.6%)
	Strongly disagree	37 (8.8%)	9 (2.1%)
My concerns about related side effects will prevent me from taking COVID-19 vaccine	Strongly agree	26 (6.2%)	15 (3.6%)
	Agree	70 (16.6%)	78 (18.5%)
	Neutral	33 (7.8%)	16 (3.8%)
	Disagree	58 (13.7%)	79 (18.7%)
	Strongly disagree	20 (4.7%)	27 (6.4%)
Most people will refuse to take the COVID-19 vaccine in Ethiopia	Strongly agree	36 (8.5%)	31 (7.3%)
	Agree	89 (21.1%)	102 (24.2%)
	Neutral	27 (6.4%)	43 (10.2%)
	Disagree	40 (9.5%)	33 (7.8%)
	Strongly disagree	15 (3.6%)	6 (1.4%)
The government will make the vaccine available for all citizens for free	Strongly agree	25 (5.9%)	48 (11.4%)
	Agree	70 (16.6%)	99 (23.5%)
	Neutral	46 (10.9%)	31 (7.3%)
	Disagree	52 (12.3%)	33 (7.8%)
	Strongly disagree	14 (3.3%)	4 (0.9%)

Significance at $p < 0.05$.

Table 3: Attitude towards COVID-19 vaccination among chronic patients in Northwest Ethiopia ($N = 422$).

Attitude-related questions	Vaccine hesitancy		t	(Cohen's d)	p value
	Yes	No			
	Mean (SD)				
It is important to get a vaccine to protect the people from COVID-19	2.9 (1.3)	1.9 (0.8)	10.61	0.92	0.0001
Pharmaceutical companies are going to develop safe and effective COVID-19 vaccines	0.3 (1.1)	2.6 (0.8)	8.67	0.78	0.0001
I believe COVID-19 vaccines made in Europe or America are safer than those made in other world countries	3.5 (1.0)	2.9 (0.9)	7.24	0.67	0.002
My concerns about related side effects will prevent me from taking COVID-19 vaccine	2.9 (1.2)	3.1 (1.2)	−1.95	−1.89	0.052
Most people will refuse to take the COVID-19 vaccine in Ethiopia	2.6 (1.2)	2.5 (1.0)	1.06	0.10	0.289
The government will make the vaccine available for all citizens for free	2.8 (1.1)	2.3 (1.0)	4.92	0.47	0.0001

On the contrary, the current vaccine hesitancy was higher than a study conducted in Dessie, Ethiopia (40.6%) [38], Ethiopia (37.4%) [20], Arab (3 7.6%) [39], Canada (19.1%) [40], Mexico and India (20%) [36], Italy (33%) [41], India (21.4%) [42], another study from India (10%) [17], Bangladeshi (25.5%) [43], France (22.4%), UK (28.9%), Ecuador (3%), Italy (17.8%), Thailand (44.3%), India (40.7%), U.S (22%) [18], and Canada (13%). This higher reluctance in the present study groups could be due to socioeconomic differences, as most of the studies showing lower vaccine hesitancy were conducted in wealthy countries. This is supported by prior research, which found that vaccine hesitancy is more prevalent in low-resource settings. The combined frequency of acceptance rates for the COVID-19 vaccination among patients in Africa is estimated to be relatively low, which leads to higher vaccine hesitancy in those settings [44]. Furthermore, the low educational status observed in these study groups may contribute to vaccine hesitancy, as lower educational achievement has been linked to vaccine hesitancy due to preexisting vaccine hesitancy in

Table 4: Trusted source of information among chronic patients in Northwest Ethiopia ($N = 422$).

Trusted sources of information about vaccines	N (%)
Internet	3 (0.7)
Social media (facebook, WhatsApp, twitter)	20 (4.8)
Health institutions	334 (79.1)
Family members	8 (1.9)
Government	24 (5.7)
Pharmaceutical companies	16 (3.8)
Scientific literature	23 (5.5)
Mass media (TV/radio)	120 (28.4)
I did not trust any source	18 (4.3)

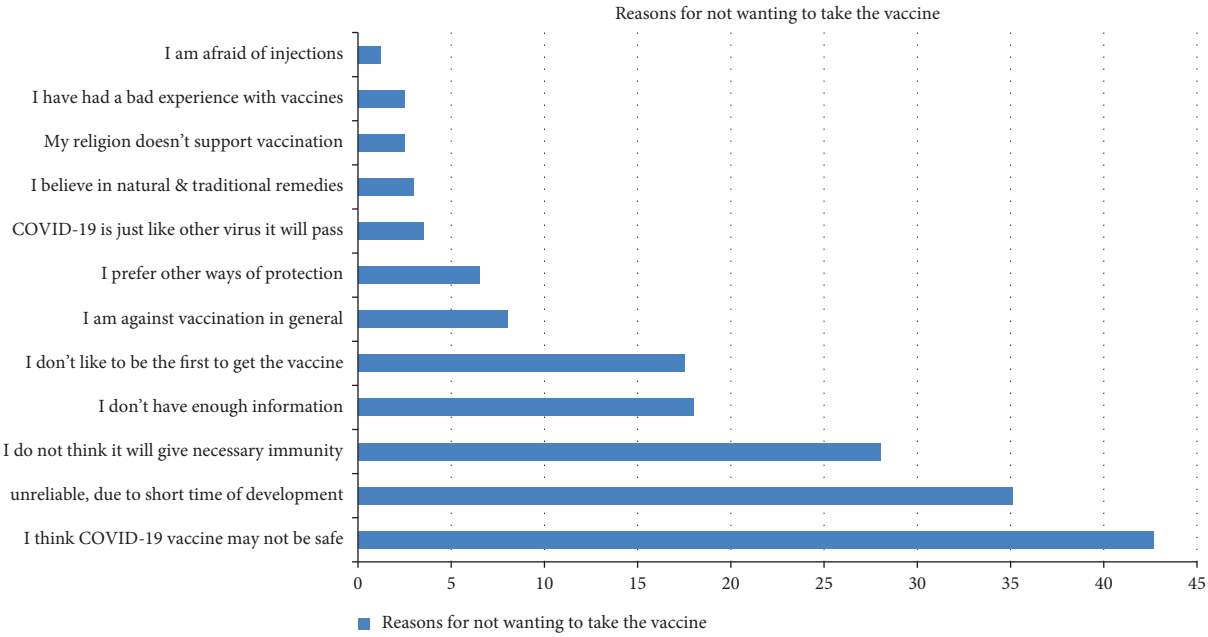

Figure 1: Reasons for vaccine hesitancy among chronic disease patients in 2021 ($N = 207$).

these groups, as well as lower awareness, health literacy, trust, and interaction with healthcare providers [45–48].

Another reason for the lower COVID-19 vaccination acceptance rate could be the fragmented healthcare system in sub-Saharan African countries, which could hinder vaccine uptake because the healthcare system is a reliable source for patients to determine whether or not to get the vaccine [49].

Furthermore, studies conducted in Ethiopia (68.6%), the United States (64%), and Turkey (70.8%) found higher vaccine hesitancy rates. These differences could be in part due to the timing of studies, where these studies were conducted just before the start of the vaccination program or in the early stages of vaccination, where efficacy and safety data was still being collected at the time of the surveys, which increases vaccine hesitancy as medical mistrust specific to COVID-19, Antivax groups' statements, conspiracy theories, myths, and misperceptions, questions about the speed of vaccine development and long-term side effects, and expert opinion on challenges with the COVID-19 vaccine were proliferating in the national media. References [50–53] this in turn leads to vaccine hesitancy as belief in COVID-19 conspiracies was associated with lower vaccination intentions [54]. Furthermore, because the majority of the studies were conducted using online modalities such as social media, study participants may be vulnerable to false information via social media as widespread misinformation about the pandemic, misleading healthcare information, conspiracy theories, and mistrust to vaccines are released on different social media, such as Facebook, Twitter, and YouTube, leading to vaccine refusal [55–58]. In addition, concerns on the safety of two Adeno-viruses based vaccines (from AstraZeneca and Johnson and Johnson) may deter people who are already hesitant and give room for the spread of misinformation [59]. It is recommended that new and specific educational programmes are transmitted among the young generation to mitigate controversial issues regarding COVID-19 vaccines [60].

Vaccine acceptance is higher among males compared to females. This lends weight to the concept that females are more hesitant than males. Previous studies were inconclusive on the association between hesitancy and gender, where women were found to have higher [21, 45, 61] or lower [29, 62, 63] hesitancy compared with men.

Table 5: Factors correlated with vaccine hesitancy of chronic medical patients in Northwest Ethiopia in 2021.

Variables	Vaccine hesitancy		Chi-square	Effect size (Cramer's V)	p value
	Yes Frequency (proportion)	No Frequency (proportion)			
Gender					
Female	84 (19.90%)	110 (26.07%)	4.7556	**0.1062**	**0.029**
Male	123 (29.15%)	105 (24.88%)			
Residence					
Rural	82 (19.43%)	67 (15.88%)	3.2973	0.0884	0.069
Urban	125 (29.62%)	148 (35.07%)			
Comorbidity					
No	176 (41.71%)	147 (34.83%)	16.286	**0.1965**	**0.000054**
Yes	31 (7.35%)	68 (16.11%)			
Knowledge					
Poor	85 (20.14%)	122 (28.91%)	4.7326	**0.1059**	**0.0295**
Good	111 (26.30%)	104 (24.64%)			
Is social media your source?					
No	200 (47.39%)	202 (47.87%)	1.6589	0.0627	0.1978
Yes	7 (1.66%)	13 (3.08%)			

Significance at $p < 0.05$. The bold values are those variables which were significant at $p<0.05$.

Table 6: Factors associated with vaccine hesitancy of chronic medical patients in Northwest Ethiopia in 2021.

Variables	Acceptance		Crude OR (95% CI)	Adjusted OR (95% CI)	p value
	No	Yes			
Sex					
Female	84	110	1	1	
Male	123	105	1.53 (1.04, 2.26)	1.56 (1.03, 2.35)	**0.035**
Residence					
Rural	82	67	1	1	
Urban	125	148	1.45 (0.97, 2.16)	1.10 (0.71, 1.70)	0.669
Comorbidity					
No	176	147	1	1	
Yes	31	68	2.63 (1.63, 4.24)	3.37 (1.73, 6.56)	**0.001**
Knowledge					
Poor	85	122	1	1	
Good	111	104	1.53 (1.04, 2.25)	1.60 (1.06, 2.41)	**0.025**
Number of medications			1.2 (0.81, 1.76)	0.78 (0.58, 1.04)	0.093
No of people with close contact			1.18 (1.05, 1.32)	1.06 (0.95, 1.17)	0.324
Is social media your source					
No	200	202	1	1	
Yes	7	13	1.83 (0.72, 4.7)	2.58 (0.93, 7.15)	0.068

The bold values indicate the significant values at $p<0.05$.

With regard to comorbidity, the odds of having vaccine acceptance were about three times higher for persons with comorbidities as compared to those participants without comorbidity. This conclusion is backed up by findings which reported people with comorbid illnesses are more likely to accept COVID-19 immunization [31].

This could be owing to the fact that individuals with comorbid medical conditions may perceive a greater danger of severe repercussions or death as a result of SARS-COV-2 infection, and as a result, they may be more ready to obtain the vaccine, as demonstrated by studies which reported multiple comorbidities increase the risk of death from COVID-19 [64].

Another finding of the current study revealed that vaccine reluctance was substantially linked to knowledge of COVID-19 immunization. This conclusion is consistent with research conducted in Southeast Asia and England that found comparable results [65, 66]. This result is explained by the fact that having a solid understanding of the COVID-19 vaccine will aid in understanding the vaccine's benefits, and the perception of having a good understanding of COVID-19 vaccines is linked to better vaccination acceptability.

4.1. Limitations of the Study. Because of the cross-sectional nature of the data, this study is limited in that it lacks temporal relations between the exposure and outcome variables. Furthermore, another drawback of this study was the self-reported nature of the questionnaires used, and since the study was carried out in the initiation stage of vaccination, it might overestimate the vaccine hesitancy. Thus consecutive study is recommended especially after

November 2021 as the vaccine is available to the general population starting from this time. Moreover, the data collection instrument was not validated in our study and was limited by a lack of factor analysis, so we would like to recommend future researchers determine the psychometric properties of the questionnaire.

5. Conclusion

The level of the COVID-19 vaccine hesitancy was high. The COVID-19 vaccine's acceptability was influenced by being a man, being aware of the vaccine, and having comorbidities. Furthermore, the most prevalent reason for refusing to take the vaccination is a fear that it may not be safe, followed by a short development period and a lack of information. As a result, public awareness campaigns should concentrate on delivering more information about the COVID-19 vaccine's safety, significance, and efficacy. Furthermore, it is critical to disseminate accurate information, particularly among women, and to educate people about the vaccine.

6. Practical Implications

Combating vaccine hesitancy is a necessary first step toward mass immunization. As a result, it would be better if many stakeholders, such as policymakers, community leaders, and governments, collaborated effectively to promote vaccination acceptability by raising awareness about the COVID vaccine.

It is suggested that stakeholders create and implement relevant measures. It is recommended that stakeholders devise and put in place appropriate strategies to provide the best targeted and tailored information to the public to convince them about the necessity of COVID-19 vaccination by effectively communicating on safety and efficacy, along with greater transparency on vaccine development, to ensure successful mass immunization programs related to the COVID-19 vaccine. Moreover this study will help in designing public educational campaigns and programs regarding the effectiveness of the vaccines and side effect and adverse effects of vaccines. In addition, laws and policies can be developed to reduce controversial issues regarding COVID-19 vaccines. On the other hand, data on vaccination is important to accurately estimate the hesitancy of the population and helps in underlying the need for the allocation of additional resources to combat the vaccine hesitancy and also reduce the burden of COVID-19 related morbidity and mortality.

Abbreviations

AOR: Adjusted odds ratio
CI: Confidence interval
COVID-19: Coronavirus infectious disease 2019
HIV: Human immune virus
IQR: Interquartile range
N: Number of participants
PMTCT: Prevention of mother to child transmission
RNA: Ribonucleic acid
SARS-CoV-2: Severe acute respiratory syndrome coronavirus-2
SD: Standard deviation
SPSS: Statistical package for the social sciences program
TB: Tuberculosis
TV: Television
UK: United Kingdom
USA: United States of America
US: United States
USD: United States Dollar
WHO: World Health Organization.

Data Availability

The datasets analyzed during the current study are available from the corresponding author on request.

Ethical Approval

Ethical clearance was obtained from the Ethical Review Committee of the School of Pharmacy, University of Gondar. Confidentiality of the information was maintained. Relevant guidelines and regulations were followed to perform the methods. The criteria set by the Declaration of Helsinki were maintained while conducting this research.

Consent

The purpose of the study was informed for the study participants and written informed consent was obtained. The participants' consent was taken to publish this work.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article and revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agreed to be accountable for all aspects of the work.

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