



# Understanding of COVID-19 Vaccine Knowledge, Attitude, Acceptance, and Determinates of COVID-19 Vaccine Acceptance Among Adult Population in Ethiopia

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**Introduction:** Although many vaccines are in development and clinical trials, and at least seven vaccines have been distributed worldwide, the world has faced a huge challenge in line with the willingness to accept a COVID-19 vaccine in a different country including Ethiopia. However, no study has been conducted on the knowledge, attitudes, acceptance, and determinates of COVID-19 vaccine acceptance in Ethiopia. Therefore, this study was aimed to investigate the knowledge, attitudes, acceptance, and determinants of acceptance of the COVID-19 vaccine among the adult population in Ethiopia.

**Methods:** A community-based cross-sectional study was conducted among 492 study participants from March 1 to March 15, 2021. A multistage sampling technique was used to recruit study participants. Six skilled and qualified data collectors had participated to gather the data using a pretested structured-administered questionnaire. A multivariable logistic regression model was used to identify factors associated with the acceptance of the COVID-19 vaccine. P-value <0.05 was considered to indicate statistically significant association.

**Results:** This study revealed that the level of good knowledge, positive attitude and intention to accept the COVID-19 vaccine were 74%, 44.7%, and 62.6%, respectively. Moreover, having an age  $\geq 46$  years with an adjusted odds ratio of 2.36 [95% CI, 1.09–5.39], attended secondary and above education adjusted odds ratio 2.59 [95% CI, 1.52–4.39], having a chronic disease adjusted odds ratio of 3.14 [95% CI, 1.21–8.14], and having good knowledge about COVID-19 vaccine adjusted odds ratio 2.59 [95% CI, 1.67–4.02] were significantly associated with COVID-19 vaccine acceptance.

**Conclusion:** In this study, the level of good knowledge, positive attitude, and intention to accept the COVID-19 vaccine were 74%, 44.7%, and 62.6%, respectively. Thus, health education and communication from government sources are very crucial methods to alleviate the negative attitude of the COVID-19 vaccine.

**Keywords:** knowledge, attitudes, acceptance, vaccine, Ethiopia

## Introduction

As the number of cases of coronavirus disease (COVID-19) is increasing worldwide, promising COVID-19 vaccine candidates are being produced, necessitating consideration of their potential demand, distribution, and adoption to optimize their desired effects. COVID-19 was first identified in December 2019 in Wuhan, Hubei Province, China, and quickly spread to other countries before being declared a pandemic on March 11, 2020.<sup>1</sup>

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The COVID-19 pandemic has disrupted not only the world economy but also health systems including routine childhood vaccination in many countries.<sup>2</sup> COVID-19 also causes persistent symptoms that can impact the quality of life of survivors.<sup>3</sup>

This pandemic has affected 223 countries, with over 118, 278, 711 reported cases and 2, 624, 426 deaths worldwide.<sup>4</sup> Of these, North America (34,228,219 cases and 781,745 deaths), Europe (35,456,449 cases and 843,039 deaths), Asia (25,748,391 cases and 406,251 deaths), and South America (18,779,624 cases and 485,659 deaths) have higher rates than Africa (4,013,352 cases and 106,623 deaths) and Oceania (4,013,352 cases and 106,623 deaths) (51,955 cases and 1094 deaths).<sup>4</sup>

On March 13, 2020, the first COVID-19 case in Ethiopia was identified.<sup>5,6</sup> Since then, the number of new cases in the country has been rapidly increasing. As of March 10, 2021, the country had 168,335 COVID-19 positive cases and 2451 deaths domestically.<sup>4</sup> As a result, Ethiopia became one of the five African countries with the largest COVID-19 case burden.<sup>7</sup> Ethiopia's government, on the other hand, has been working hard to disseminate information about COVID-19 prevention measures through television, radio, and social media, and has declared a state of emergency.<sup>8</sup>

To fight the coronavirus disease (COVID-19) pandemic, researchers from all over the world have made remarkable efforts to create vaccines against the disease.<sup>9</sup> At least seven vaccines across three platforms have been carried out in countries. Vaccination is prioritized for vulnerable groups in all countries. Simultaneously, more than 200 additional vaccine candidates are being produced, with more than 60 of them in clinical trials.<sup>10</sup>

Seventy percent of available COVID vaccines have been pre-ordered by 16% of the global population in 2021,<sup>11</sup> and 312.25 million COVID19 vaccines have been distributed worldwide by March 8/2021.<sup>12</sup> COVID-19 infection will continue to advance, according to a group of virus experts, unless low-income countries have access to vaccines.<sup>11</sup> As a result, we have been eagerly waiting for the launch of safe and successful COVID-19 vaccines as the COVID-19 pandemic continues while any vaccination program's effectiveness is dependent on participants' awareness, behaviors, and willingness to accept the COVID-19 vaccine.<sup>13–24</sup>

Previous studies showed that the general population's knowledge and attitudes toward the COVID-19 vaccine ranged from 31.6% to 86.2% in Africa, Europe, India,

England, and France, respectively.<sup>19–21,25,26</sup> Despite this, more than 200 COVID-19 vaccines were being produced around the world, with numerous governments negotiating agreements to gain access to advance doses. However, access is just one issue.

Throughout the pandemic, countries' aspirations to use a COVID-19 vaccine as it becomes available to have differed significantly. In the United States, the United Kingdom, New Zealand, France, and Austria, it varies from 58% to 86%.<sup>27–31</sup> The intent to use the COVID-19 vaccine was found to be 54.6% in China.<sup>17</sup> In addition, COVID-19 vaccine intentions in Africa ranged from 43.55% in Egypt to 82.765% in Mauritius.<sup>18</sup>

Accordingly, studies conducted in different countries of the world, the most determinate of intention to use COVID-19 vaccine are age, parity, occupational status, gender, marital status, educational status, income, perceived risk of COVID-19 infection, a healthcare worker, attitude towards, knowledge of COVID-19, being sick with COVID-19, the pre-existence of chronic disease.<sup>17,23–26,32</sup> Moreover, multiple myths and conspiracy theories on vaccines and COVID-19 would also potentially affect the COVID-19 vaccine acceptance in a population,<sup>33</sup> perception of government performance, health care status, recovery status from COVID-19, efficacy, side-effects, and speed of development of a COVID-19 vaccine are also the determinant of COVID-19 vaccine acceptance.<sup>17,34–36</sup>

These low levels of knowledge, attitude, and low level of intention to accept vaccine for COVID-19 may be a concern of the globe. Since the most efficient means of stopping the virus from spreading is by protecting oneself from being infected to COVID-19, it is also important to vaccinate the most vulnerable people as soon as possible.<sup>37</sup>

We need to know the general public's awareness, behavior, expectation, hesitancy, and determinates of the intention to use the COVID-19 vaccine and to introduce the most successful vaccination strategy in Ethiopia. People's awareness, behaviors, desire to use, expectations, hesitancy, and ability to pay for the COVID-19 vaccine are critical for government and policymakers to overcome all obstacles to vaccine delivery in such a scenario. To date, no prior study has been conducted among the adult population to investigate the mentioned issues of COVID-19 vaccine. Therefore, this study was aimed to determine the level of knowledge, attitudes, acceptance, and determinates of COVID-19 vaccine acceptance among the adult population in Ethiopia.

## Methods and Materials

### Study Setting and Period

This research was carried out in Gurage Zone which is one of administrative areas in the south region, Ethiopia. Gurage Zone is divided into 13 districts and two local administrations. It is located 156 kilometers southwest of Addis Ababa capital, Ethiopia. According to the 2007 national household census, the zone has a total population of 1,279,646, with 657,568 women.<sup>22</sup> All peoples found in Gurage Zone are served by eight hospitals (five public and two private). All hospitals offer comprehensive emergency care, including COVID-19 treatment. In addition to these, the Zone has 74 health centers that offer basic emergency care. This study was taken place from March 1 to March 15, 2021.

### Study Design

A community-based cross-sectional study was conducted among the adult population in Gurage Zone.

### Populations

All adult populations over the age of 18 years old were included in the source population. The research participants were all adult populations over the age of 18 who had lived in the Gurage Zone for at least 6 months.

### Eligibility Criteria

Adult populations over the age of 18 years old who had lived in the study area for at least 6 months were included in the study. Respondents who were mentally or seriously ill at the time of the study were not eligible.

### Sample Size Determination

The research sample size was estimated using the Epi InfoTM version 7 StatCalc function of the population survey, with the assumption of a 95% confidence interval (CI), a 5% margin of error, and 27% of the adult population intention to accept COVID-19 vaccine from a similar study was done in France.<sup>30</sup> By considering a 10% non-response rate, a total of 334 research participants were estimated for this study. Finally, because of the 1.5 design effects, the minimum sample size for this study was 501.

### Sampling Procedure

The study participants were recruited using a multi-stage sampling technique. Using a simple random sampling technique, six districts and one town administration were

selected from the woreda of the zone. Then, three kebeles from each district and two kebeles from Wolkite town were chosen at random. Households with adult populations were identified in the family folders of health extension staff (HEWs), and study participants were chosen using a systematic random sampling process. Hence, a systematic random sampling technique was done by determining the K value via dividing the source population of each kebele (small administrative unit Ethiopia) by the calculated sample size. Finally, after determining the K value we had taken a single number between 0 and the K value using the lottery method then by accustoming this selected number in each K value we recruited the study participants.

### Data Collection Tools and Procedure

A pre-tested, standardized interviewer-administered questionnaire was used to collect the data. The instrument was created after a detailed analysis of several related types of literature.<sup>24–31</sup> Socioeconomic variables, attitude-related variables, knowledge-related variables, individual health-related variables, and intention to accept related variables were all included in the questionnaire. The reliability of variables such as awareness, attitude, and acceptance toward COVID-19 were determined using Cronbach's alpha coefficient. The Cronbach's alpha value for questions about knowledge and attitude toward COVID-19 were found to be 0.761 and 0.832 respectively. According to the rule of Griethuysen criteria, the range of Cronbach's alpha from 0.6 to 0.7 is considered sufficient and accurate measurement. As a result, the item used to evaluate the knowledge and attitude towards the COVID-19 vaccine was scientifically acceptable. The data were collected using six diploma nurses with the supervision of three BSc nurses who spoke the local language. The data were obtained at the household level through face-to-face interviews. The household head or anyone over the age of 18 was told of all the details of the study before giving their consent to participate.

Adult populations were encouraged to feel free and guaranteed that their responses would be kept private and no information would be exchanged with third parties, except the researcher. The participants who were willing to integrate and sign the informed consent document were then interviewed in a quiet and spacious space. The investigator had also taken corrective efforts to boost the validity of the conclusion by reviewing and

cross-checking the questionnaires or data for completeness, accuracy, and consistency.

## Operational Definitions/Study Variables

### Knowledge of Respondents Towards COVID-19 Vaccine

Comprehensive knowledge of COVID-19 vaccine was computed from summing up all relevant five knowledge related “Yes” and “No” questions, respondents were asked “Does COVID-19 vaccination increase allergic reactions”; respondents who respond “yes” will score 1 and “No” response will earn zero scores. The correct answer for each item was scored “1” and the incorrect answer was scored “0.” The same pattern of questioning and scoring was made for the rest of the four knowledge-related items. Accordingly, respondents who scored greater than or equal to the mean value of the sum of knowledge assessment questions were thought as having good knowledge, and respondents who answered less than the mean value of the sum of knowledge assessment questions were thought as having poor knowledge.

### Attitude of Respondents Towards COVID-19 Vaccine

Attitude of COVID-19 vaccine was computed from summing up all relevant six attitude related ‘Agree’, ‘Undecided and disagree’ questions, respondents were asked “Does the newly discovered COVID-19 vaccine is safe”; respondents who respond “agree” will score 1 and “Undecided and disagree” response will earn zero scores. The correct answer for each item was scored “1” and the incorrect answer was scored “0.” The same pattern of questioning and scoring was made for the rest of the five attitude-related items. Accordingly, respondents who scored greater than or equal to the mean value of the sum of attitude-related questions were thought of as having a positive attitude, and respondents who answered less than the mean value of the sum of knowledge assessment questions were thought as having a negative attitude.

### Intention of Respondents Towards COVID-19 Vaccine Acceptance

COVID-19 vaccine acceptance was measured using “Yes” and “No” questions, respondents were asked “Did you have an intention to accept COVID-19 vaccine if it is available in the future”; respondents who respond “yes” will score 1 and “No” response will earn zero scores. Accordingly, respondents who scored 1 were thought of as having the intention to accept the COVID-19 vaccine,

and respondents who scored 0 were thought of as having no intention to accept the COVID-19 vaccine.

## Data Quality Control

Data collectors and supervisors received a two-day intensive training on data collection methods, the research aim, data collection techniques, and the template for data abstraction. In addition, the principal investigator and supervisors performed frequent reviews of the data collected for accuracy, quality, and completeness, and any necessary changes were made on the spot.

## Data Analysis and Processing

The data were coded, cleaned, modified and entered into Epi data version 4.0.0 before being exported to SPSS version 24 for analysis. The results of the Univariate analysis were provided in the form of texts, graphs, and figures. Binary logistic regression was used to determine the relationship between each independent variable and the outcome variable.

Hosmer–Lemeshow test was used to determine model fitness because it was insignificant ( $p$ -value = 0.790) and the Omnibus test was significant ( $P$ -value 0.001). All variables with a  $P \leq 0.25$  in the bivariate analysis were included in the multivariate analysis to adjust for all potential confounders. Furthermore, even if the above parameters were not met, variables from the context point of view and that were significant in previous studies were included in the final model.

A standard error of more than two and a variance inflation factor of more than ten was used to infer the presence of multi co-linearity. An odds ratio with a 95% confidence interval was used to assess the direction and strength of statistical association between the response and covariate variables. A  $p$ -value of less than 0.05 was used to assert statistical significance in this analysis.

## Results

### Socio-Demographic Attributes of Participants

A total of four hundred ninety-two adult populations were successfully interviewed, giving a 98.2% response rate. The mean age of the study participants was 27.3 with a standard deviation of 4.8. Nearly two-thirds, 310 (63.0%) of the respondents were Orthodox followers by religion. Nearly three-fourths, 359

(73.0%) of the participants were Gurage by ethnicity. Nearly two-fifths, 194 (39.4%) of the respondents had attended primary education. Almost one-fourth, 128 (26.0%) of the study participants were merchants by their occupation. Nearly half, 241 (49.0%) of the respondents had 2000–3999 Ethiopian birr average monthly income (See Table 1).

**Table 1** Sociodemographic Characteristics of Respondents in the Gurage Zone, Ethiopia, 2021

Variable	Frequency	Percent
<b>Age (Year)</b>		
18–25	181	36.8
26–35	106	21.5
36–45	150	30.5
>46	55	11.2
<b>Residence</b>		
Urban	390	79.3
Rural	102	20.7
<b>Education</b>		
No formal Education	116	23.6
Primary Education	194	39.4
Secondary Education	182	37.0
<b>Occupation</b>		
Housewife	20	4.1
Merchant	128	26.0
Government Employee	105	21.3
Student	113	23.0
Farmer	126	25.6
<b>Sex of respondents</b>		
Male	274	55.7
Female	218	44.3
<b>Religion</b>		
Orthodox	310	63.0
Muslim	146	29.7
Protestant	36	7.3
<b>Ethnicity</b>		
Gurage	359	73.0
Amhara	103	20.9
Oromo	30	6.1
<b>Average monthly income</b>		
< 1999	143	29.1
2000–3999	241	49.0
> 4000	108	22.0

## Knowledge of Respondents Towards COVID-19 Vaccine

Three hundred sixty-two, (73.6%) of the participants had been aware of the development of the COVID-19 vaccine. More than four-fifth, 410 (83.3%) of the respondents knew about the effectiveness of the developed COVID-19 vaccine. Nearly three-fourths, 347 (70.5%) of the study participants had responded the overdose of COVID-19 vaccine would become dangerous for humans. Three-fourths, 369 (75.0%) of the respondents explained that COVID-19 vaccination did not increase allergic reactions. Two-hundred eight six, (58.1%) of the participants explained that COVID-19 vaccination would not increase autoimmune diseases. Nearly three-fourths, 364 (74.0%) of the participants had good comprehensive knowledge about the COVID-19 vaccine (See Table 2).

## Attitude of Respondents Towards the COVID-19 Vaccine

Nearly one-fourth, 108 (22.0%) of the participants had agreed that the newly discovered COVID-19 vaccine was safe. Almost one-fourth, 126 (25.6%) of the participants had agreed that the COVID-19 vaccine was essential for us. One hundred thirteen, (23.0%) of the participants had agreed that the COVID-19 vaccine developed in Europe and America is safer than those made in other countries. Almost one-tenth,

**Table 2** Respondents Knowledge Towards COVID-19 Vaccine in Gurage Zone, Ethiopia, 2021

Variable	Category	Frequency	Percent
Do you know about the COVID-19 vaccine development	Yes	362	73.6
	No	130	26.4
Do you know about the effectiveness of the COVID-19 vaccine	Yes	410	83.3
	No	82	16.7
Is it dangerous to use an overdose of COVID-19 vaccines	Yes	347	70.5
	No	145	29.5
Does COVID-19 vaccination increase allergic reactions	Yes	123	25.0
	No	369	75.0
Does vaccination increase autoimmune diseases	Yes	206	41.9
	No	286	58.1
Knowledge toward COVID-19	Good	364	74.0
	Poor	128	26.0



56 (11.4%) of the respondents had agreed to encourage family/friends/relatives to get vaccinated. Nearly one-fifth, 84 (17.1%) of the respondents had agreed that it is not possible to reduce the incidence of COVID-19 without vaccination. Almost one-fourth, 124 (25.2%) of the participants agreed that the COVID-19 vaccine should be distributed fairly to all of us. Almost two-fifth, 229 (44.7%) of the respondents had a positive attitude toward the newly developed COVID-19 vaccine (See Table 3).

## Respondent's Intention to Accept Towards COVID-19 Vaccine

Regarding respondents' intention to accept the COVID-19 vaccine, 308 (62.6%) of the respondents had the intention to use the COVID-19 vaccine if the vaccine will be available in Ethiopia. While the remaining, 184 (37.4%) of the respondents were hesitant to receive any COVID-19 vaccine if available in Ethiopia vaccine (See Figure 1).

**Table 3** Respondents Attitude Towards COVID-19 Vaccine in Gurage Zone, Ethiopia, 2021

Variable	Category	Frequency	Percent
Does the newly discovered COVID-19 vaccine is safe	Agree	108	22.0
	Undecided	214	49.0
	Disagree	143	29.0
Does the COVID-19 vaccine is essential for us	Agree	126	25.6
	Undecided	193	39.2
	Disagree	173	35.2
COVID vaccine developed in Europe and America are safer than those made in other world countries	Agree	113	23.0
	Undecided	299	60.8
	Disagree	80	16.2
May you encourage your family/friends/relatives to get vaccinated.	Agree	56	11.4
	Undecided	301	61.2
	Disagree	135	27.4
It is not possible to reduce the incidence of COVID-19 without vaccination	Agree	84	17.1
	Undecided	255	51.8
	Disagree	153	31.1
The COVID-19 vaccine should be distributed fairly to all of us	Agree	124	25.2
	Undecided	253	51.4
	Disagree	115	23.4
Respondents comprehensive attitude toward COVID-19 vaccine	Positive	229	44.7
	Negative	272	53.3

## Factor Associated to Accept Towards COVID-19 Vaccine

To determine the factors associated to accept with the COVID-19 vaccine, bi-variable and multivariable logistic regression analysis was carried out. Multivariable logistic regression was performed for variables with a  $p$ -value  $\leq$  of 0.25 on bi-variable logistic regression. Accordingly, variables including the age of respondents, educational status, residence, chronic disease, health insurance, perceived severity of the disease, received all the necessary vaccines, and knowledge towards COVID-19 vaccine have a  $p \leq 0.25$  on bi-variable logistic regression; thereby further analyzed on multivariable logistic regression.

The independent predictors of the outcome variable include age  $\geq 46$  years with AOR 2.36 [95% CI, 1.09–5.39], attending secondary education and above, AOR 2.59 [95% CI, 1.52–4.39], having a chronic disease AOR 3.14 [95% CI, 1.21–8.14], and having good knowledge 2.59 [95% CI, 1.67–4.02].

COVID-19 vaccine is nearly three times more likely to be accepted by adult population with age greater than 46 years old as compared to adult population with age in between 18 and 25 years old.

Attending secondary education and above is also one of the factors associated to accept the COVID-19 vaccine. Hence, adult populations who had attended secondary education and above were nearly three times more likely to accept the COVID-19 vaccine compared to the counterpart. Having chronic disease would increase the acceptance of the COVID-19 vaccine by almost three times on adult populations compared to adult populations with no chronic disease. Good knowledge about the COVID-19 vaccine was also another main factor for the intention to accept the COVID-19 vaccine. Adult populations who had good knowledge about COVID-19 were nearly three times more likely to accept the COVID-19 vaccine as compared to the counterpart (See Table 4).

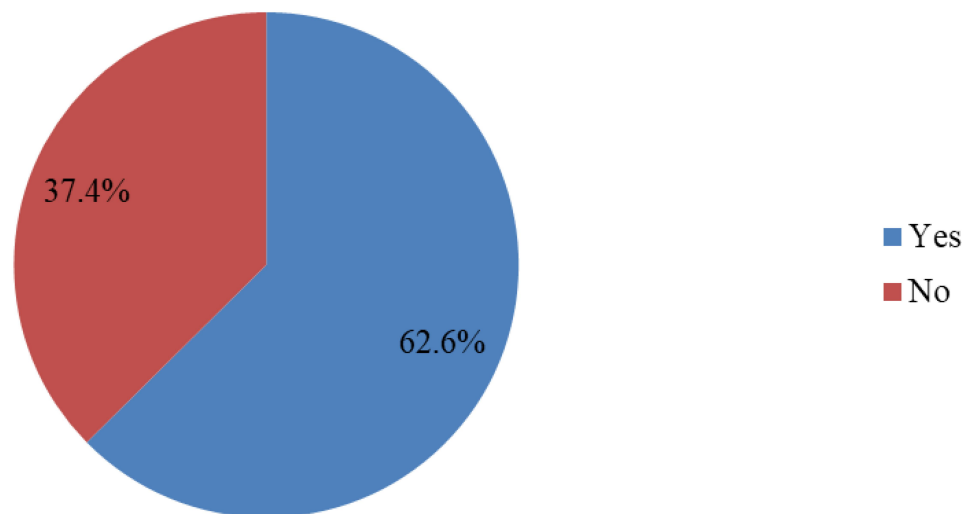
## Source of Information About COVID-19 Vaccine

Concerning the source of information about the development of the COVID-19 vaccine, almost one-fourth, 112 (22.8%) and 141 (28.7%) of the respondents had heard about the COVID-19 vaccine from their family members and relative, and friends and neighbors respectively (See Figure 2).

## Discussion

This study revealed that the level of good knowledge, positive attitude, and intention to accept towards

## Intention to accept COVID-19 vaccine



**Figure 1** Respondents intention and hesitancy towards COVID-19 vaccine in Ethiopia, 2021.

COVID-19 vaccine was found to be 74%, 44.7%, and 62.6% respectively. Besides, attending secondary education and above, age  $\geq 46$  years, having a chronic disease and good knowledge about COVID-19 are the determinate factors of intention to accept towards COVID-19 vaccine. For healthcare planners, the finding is important. This information can then be used to create relevant programs, channeling limited resources to teach what is necessary, as opposed to distributing already established messages.

The level of good knowledge towards the COVID-19 vaccine is found to be 74% in this study. This study was higher than a study conducted in West India (35.5) and Bangladeshi (62.1%).<sup>26,38</sup> As compared to a study conducted in France (81.2%) and England (83.0%) the finding is low. The disparity in the methodology used and research setting, socio-demographic features of the participants in the study and the availability and accessibility of health service infrastructures may be the possible reason.

In this study, the level of positive attitude towards the COVID-19 vaccine is also found to be 44.7%. Hence, this is higher than the study conducted in England (36.9%) and Egypt (34.3%).<sup>16,23</sup> However, this study is lower than a study done in Belgium (72.4%) and Italy (66%).<sup>23,39</sup> The discrepancy of these findings might be explained by the difference in socio-demographic characteristics of the study participants, method used and study settings and the availability and accessibility of the health services infrastructures. Based on the finding it is inferred that there is

a lack of balance that the zone health office and regional health bureau could work in collaboration with the local health care provider to enhance a positive attitude towards the COVID-19 vaccine among adult populations in Ethiopia.

Similarly, the level of intention to accept the COVID-19 vaccine is found to be (62.6%). This means the finding is lower than a study reported in Australia (89.88%), UK (71%), and the USA (69%).<sup>18,25,39</sup> This finding is higher than the study conducted in Libya, Morocco, Russia, and France.<sup>25,39</sup> This difference can be explained by the difference in the respondent socio-demographic attribute and material and method used, and the availability and accessibility of the infrastructures. In addition to this, the health system-related factors might be contributing to this difference. This study inferred that there is a created platform for COVID-19 prevention task forces in Ethiopia which could help them to be aware of local norms, cultures, and traditions to enhance and fit the demands of adult populations and work with them to mitigate the pandemic of COVID-19.

In this finding, attending secondary education and above can increase the intention to use the COVID-19 vaccine compared to no formal education. The adult population who had attended secondary and above education were almost three times more likely to accept the COVID-19 vaccine compared to adult populations who did not attend formal education. This might be, adult populations

**Table 4** Factors Associated with Intention to Accept COVID-19 Vaccine Among Adult Population in Ethiopia, 2021 (N=492)

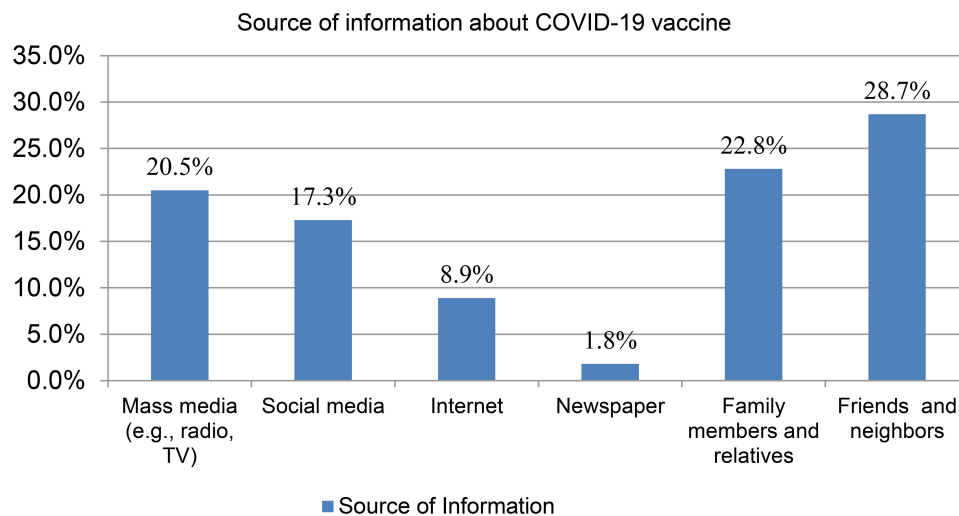
Variables	Intention to Accept COVID-19 Vaccine		COR (95%)	P-value	AOR (95%)	P-value
	Yes (%)	No (%)				
Educational status						
Secondary education and above	138(44.8%)	44(23.9%)	2.83(1.72–4.65)	< 0.001	2.59(1.52–4.39)	< 0.001
Primary education	109(35.4%)	85(46.2%)	1.16(0.73–1.84)	0.23	1.16(0.71–1.89)	0.563
No formal education	61(19.8%)	55(29.9%)	1.00		1.00	
Residences						
Urban	250(81.2)	140(76.1%)	1.35(0.87–2.11)	0.179	1.32(0.81–2.17)	0.270
Rural	58(18.8%)	44(23.9%)	1.00		1.00	
Age						
≥46	44(14.3%)	11(6.0%)	2.62(1.34–5.71)	0.013	2.36(1.09–5.39)	0.028
36–45	100(32.5%)	50(27.2%)	1.31(0.88–2.17)	0.213	1.39(0.86–2.27)	0.172
26–35	57(18.5%)	49(26.6%)	0.76(0.49–1.30)	0.361	0.94(0.56–1.58)	0.812
18–25	107(34.7%)	70(40.2%)	1.00		1.00	
Health insurance						
Yes	183(59.4)	98(53.3%)	1.28(0.89–1.86)	0.233	1.11(0.71–1.89)	0.600
No	125(40.6%)	86(46.7%)	1.00		1.00	
Chronic Disease						
Yes	30(9.7%)	6(3.3%)	3.20(1.31–7.85)	0.011	3.14(1.21–8.14)	0.018
No	278(90.3%)	178(96.7%)	1.00		1.00	
Severity Perception						
Perceived severe at all	48(15.6%)	20(10.9%)	1.51(0.87–2.64)	0.138	1.56(0.85–2.98)	0.146
Perceived not severe at all	260(84.4%)	164(89.1%)	1.00		1.00	
Received all the necessary vaccines in your lifetime						
Yes	254(82.5%)	143(77.7%)	1.35(0.86–2.13)	0.168	1.41(0.84–2.35)	0.191
No	54(17.5%)	41(22.3%)	1.00		1.00	
Knowledge of COVID-19 vaccine						
Good	250(81.2%)	114(62.0%)	2.65(1.75–3.99)	< 0.001	2.59(1.67–4.02)	< 0.001
Poor	58(18.8%)	70(38.0%)	1.00		1.00	

attending secondary and above education can easily understand the benefit of taking the COVID-19 vaccine on the health of the adult population and the society at large. Moreover, adult populations who had attended secondary and above education will have better awareness about the benefits of the preventive health-related problem including the pandemic of COVID-19 and higher receptivity to new health-related information. The same finding is reported in Saudi Arabia.<sup>13</sup> This finding implies that improving educational status could be one of the strategies for achieving

a full immunization of the adult population in alleviating any disease influencing the globe.

Adult populations who had aged  $\geq 46$  years old were almost two times more likely to accept the COVID-19 vaccine than those adults who had ages between 18 and 25 years old. This report is in line with a study done by Saudi Arabia, China, and South Africa.<sup>13,24,32</sup> Since the world health organization has declared the COVID-19 pandemic is a killer for the elder population and more prevalent in the aged human population, and as age





**Figure 2** Respondents source of information about COVID-19 vaccine in Ethiopia, 2021.

increases adult population will prone to infection and chronic inflammation. This leads to adult populations who had an age greater than 46 years old will have a fear for COVID-19 related morbidities and mortality this in turn the adult population age group need to have a vaccine for COVID-19 infection.

Intention to accept the COVID vaccine had significantly correlated with chronic disease. Adult populations who had a chronic disease were almost three times more likely to accept the COVID-19 vaccine than those adult populations who had no chronic disease. This result is consistent with a report from WHO and Australian studies.<sup>10,21</sup> This finding showed us there should be a created platform that could enable adult populations whose age greater than 46 years old is a first age group to be vaccinated if a COVID-19 vaccine is available in Ethiopia.

Adult populations who had good knowledge about the COVID-19 vaccine are significantly associated to accept the COVID-19 vaccine. This result is in line with a survey carried out in Southeast Asia and England.<sup>28,30</sup> This study indicates that creating awareness towards the COVID-19 vaccine will increase the utilization of the COVID-19 vaccine among the adult population so that the government of Ethiopia has to work on enhancing the knowledge of the population about the COVID-19 vaccine. This finding is also explained by having good knowledge about the COVID-19 vaccine will help the adult population to know the benefit of the COVID-19 vaccination program.

The main importance of this study for any organization working in COVID-19 prevention is: identifying the

determinate of intention to accept the COVID-19 vaccine to mitigate the pandemic of COVID-19 and to provide immediate intervention. The finding of this study is also motivated the different organizations to lay out suitable techniques and objectives for the intervention to give attention to the determinate of COVID-19 vaccine acceptance, both in the health care organization as well as in the society at large. This study becomes one tool for health policy planners for focusing on COVID-19 in the health care system.

## Conclusions

In this study, the level of good knowledge, positive attitude, and intention to accept towards COVID-19 vaccine was found to be 74%, 44.7%, and 62.6% respectively. Besides, having attended secondary education and above, having age  $\geq 46$  years old, having a chronic disease, and good knowledge about the COVID-19 vaccine were significantly associated to accept the COVID-19 vaccine. Therefore, all COVID-19 vaccine taskforce which were established by the World Health Organization and Ethiopia's Ministry of Health including the public health institute in collaboration with regional and zonal health offices should create awareness about the efficacy and safety of the COVID-19 vaccine. Besides, health planners and policymakers should encourage COVID-19 vaccine uptake behaviors in all regions of Ethiopia by providing trusted information about the COVID-19 vaccine and aiming to provide COVID-19 vaccine for the most vulnerable group for the COVID-19 pandemic including the elder population,

who have a chronic disease, who have no formal education and who have poor knowledge toward COVID-19 vaccines are recommended.

## Abbreviations

AOR, adjusted odds ratio; CI, confidence interval; COR, crude odds ratio; COVID-19, corona virus disease; UK, United Kingdom; US, United States.

## Data Sharing Statement

On reasonable requests, the full data set and other materials relevant to this study can be obtained from the corresponding author.

## Ethical Approval and Consent to Participate

Wolkite University College of Medicine and Health Science research ethical review board had approved the study procedure, and Ethical clearance had been provided to the research group. The Gurage Zone health office and the respective district health office had given a permission letter. Before the interview, each respondent had given their informed consent after receiving clear and relevant details about the study's aim. Adult populations who could read and understand the Amharic language were used to give information which was obtained a one-page written summary of the research. The adult populations who met the criteria were voluntarily included in the study while the adult populations who were unable to participate were withdrawn from the study since this research was carried out under the Helsinki Declaration. The data were collected anonymously, and the participants' information was kept private.

## Consent for Publication

Not applicable.

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## Disclosure

The authors reported no conflicts of interest for this work.

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