

# COVID-19 Vaccine Acceptance and Associated Factors Among College Students in Dessie City, Northeastern Ethiopia

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**Background:** The COVID-19 vaccine is regarded as an effective measure for reducing the pandemic's impact. But, COVID-19 disease burden reduction efforts are being affected by the rising vaccine resistance.

**Objective:** To assess the COVID-19 vaccine acceptance and associated factors among college students in Dessie city, Northeastern Ethiopia.

**Methods:** An institutional-based cross-sectional study was carried out among college students in Dessie town from July 1–20, 2021. The association between independent and dependent variables was assessed by binary logistic regression analysis using crude odds ratio and adjusted odds ratio. Variables having p values of less than 0.05 at the 95% confidence interval were regarded as potential determinants of COVID-19 vaccine acceptance.

**Results:** A total of 422 college students participated in the study with a response rate of 95.6%. More than half 226 (56.2%) of the participants had willingness to accept COVID-19 vaccine. Respondents who had history of chronic medical illness (AOR: 4.340, 95% CI: 1.166, 16.149), training on COVID-19 vaccine (AOR: 4.755, 95% CI: 2.606, 6.674), history of regular vaccine uptake (AOR: 2.534, 95% CI: 1.412, 4.549), perception of COVID-19 severity (AOR: 4.109, 95% CI: 2.190, 7.710), perception that COVID-19 can be prevented by vaccine (AOR: 2.420, 95% CI: 1.160, 5.049), and development of herd immunity against COVID-19 vaccines (AOR: 2.566, 95% CI: 1.431, 4.599) were factors significantly associated with COVID-19 vaccine acceptance.

**Conclusion:** The acceptance of COVID-19 vaccine among college students was low. The history of chronic medical illness, training on COVID-19 vaccine, history of vaccine uptake, perception that COVID-19 can be prevented by vaccine, perception of herd immunity development against COVID-19, and severity of COVID 19 infection were factors significantly associated with the acceptance of COVID-19 vaccine. Hence, it is necessary to promote COVID-19 vaccination among college students through health education and vaccine outreach.

**Keywords:** COVID-19, vaccine, acceptance, college students, Ethiopia

## Introduction

The global pandemic of Coronavirus Disease 19 (COVID-19) continues to impose enormous burdens on morbidity and mortality.<sup>1–3</sup> COVID-19 is a fatal viral disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), a novel coronavirus strain that has spread all over the world and has become a serious public health problem.<sup>4</sup> On March 11, 2020, the World Health Organization (WHO) pronounced the COVID-19 to be pandemic. At present, the illness has impacted 223 nations, producing more than 133.978 million recorded cases and 2.9 million fatalities.<sup>5,6</sup>

COVID-19 typically affects the respiratory system with a range of symptoms from asymptomatic to severe respiratory distress syndrome.<sup>7,8</sup> The elderly and people with a history of co-morbid conditions like hypertension, obesity, diabetes, and kidney disease are typically more fatally affected by this virus.<sup>9,10</sup> Due to their poor health infrastructure and training, African

countries are more vulnerable to the spread of disease.<sup>11</sup> Additionally, their inability to quickly receive the vaccination raises the danger of disease spread.<sup>12</sup> Vaccination programs for Africans may be further delayed by vaccine-related expenses and transfer problems until late 2021 or early 2022. The majority of globally recognized vaccinations were purchased by developed nations.<sup>13</sup>

Different COVID-19 prevention strategies, including the implementation of lockdowns and quarantines, social isolation tactics, constant facemasking, travel limitations, and personal hygiene were implemented across the world.<sup>14–17</sup> However, these have had a significant negative impact on people's health and psychological well-being as well as a dramatic drop in the world economy.<sup>18</sup> International efforts to create an effective prevention strategy to keep epidemics under control have increased due to the COVID-19 outbreak's multifaceted disastrous effects.<sup>19,20</sup>

It has long been believed that immunizations are the most effective way to stop the spread of infectious diseases.<sup>13,21</sup> Ethiopian health authorities opted to use the COVID-19 vaccine of Astra Zeneca through the COVAX Facility. As a result, on March 7, 2021, the nation received 2.184 million doses of COVID-19 vaccination. At a high-profile national event conducted at the Eka Kotebe COVID-19 Hospital on March 13, 2021, the Ethiopian Ministry of Health debuted the COVID-19 vaccine and marked the beginning of the immunization campaign by immunizing front-line healthcare workers.<sup>5</sup> Literatures estimated that up to 82% of the population should be vaccinated to develop herd immunity against SARS-CoV-2.<sup>21</sup> The success of COVID-19 vaccination program will largely depend on people's acceptance of the vaccine.<sup>22</sup> However, rumors and conspiracy theories aimed at preventing the introduction of the new COVID-19 vaccine are spreading all over the world.<sup>23</sup> Hence, vaccine hesitancy has become a key challenge for COVID-19 management.<sup>1,21</sup> Many Ethiopians are reluctant to receive the COVID-19 vaccine.<sup>24–27,29,30</sup> Forty eight percent of the study populations are unsure about the COVID-19 vaccines, according to a global assessment of possible COVID-19 vaccine approval.<sup>5</sup> Consequently, in May 2020, the 73rd World Health Assembly passed a resolution endorsing broad immunization as a global public health objective for halting the spread of SARS-CoV-2.<sup>30</sup> Some of the factors affecting COVID-19 vaccine acceptance are demographic and psychosocial correlates such gender, age, faith in research, comprehension and concerns about the novel immunization, people's judgment and beliefs about COVID-19 danger, as well as risk exposure.<sup>22,31,32</sup>

The college years are a crucial time for establishing healthy habits and decision-making procedures. Adopting favorable health behaviors, such as accepting immunizations, may be influenced by having sufficient knowledge and using trustworthy information sources.<sup>33</sup> A number of circumstances, including shared residence in on-campus and off-campus accommodation, the reopening of college campuses and activities, and the need to travel between their place of residence and campus, make college students vulnerable to SARS-Cov-2 infection. In addition, it has been determined that college campuses are susceptible to COVID-19 instances and have the potential to spread the virus to nearby populations.<sup>34</sup> Greater acceptance of the COVID-19 vaccine was found in an Italian study of college students, medical students, students who had already had the flu shot, students who had a higher level of COVID-19 worry, and students who were very vulnerable to the disease.<sup>35</sup> There is no research conducted on COVID-19 vaccination among college students in Ethiopia. Therefore, the study aimed to assess the acceptance and determinant factors of COVID-19 vaccine among college students in Dessie city, Northeastern Ethiopia.

## Methods and Materials

### Study Design, Period, and Setting

An institutional-based cross-sectional study was conducted in Dessie City, Northeastern Ethiopia, from July 1–20, 2021, to evaluate college students' perceptions of the COVID-19 vaccine. Dessie town is found in South Wollo Zone, Amhara region of Northeastern Ethiopia. The city is situated in a mountainous area 480 kilometers from Bahirdar, the Amhara Region's main city, and 401 kilometers north of Addis Ababa. A total of 23,507 students are engaged in three public institutions, one private university, and eight private colleges.

### Populations of the Study

The source population of the study was all college students in Dessie city during the data collection time. On the other hand, the study population was college students from randomly selected colleges (Alkan, Tropical, Admass, Unity, and Dessie health science) found in Dessie city.

## Inclusion and Exclusion Criteria

The study involved all college students who volunteered to take part. Students who were unable to answer because of a serious sickness or another personal reason, however, were not included in the study.

## Sample Size Determination and Sampling Technique

Using the single population proportion formula, the sample size was calculated as 384 with the assumptions of  $Z_{\alpha/2}$  at 95% CI = 1.96, an estimate of the proportion (p) of 50%, and a margin of error (d) of 5%. The study's final sample size, after accounting for non-response rates of 10%, was 422. Five colleges out of a total of 12 were initially chosen using a simple random sampling technique. The number of participants from each chosen college was then distributed proportionally based on the enrollment at each college at the time the data were collected. Then, using a lottery system, departments were chosen at random. Each department provided a list of every student in the chosen departments. The study participants were selected using a simple random sampling technique using the lists of the students from their registrar offices' as a sampling frame.

## Operational Definitions

Vaccine acceptance is defined as the willingness of the study participants to receive the COVID-19 vaccine. The participants were then asked if they would be interested in receiving the COVID-19 vaccine, with the options being Yes or No. Yes responses received a score of "1", and No responses received a score of "0."<sup>36</sup>

## Data Collection and Quality Assurances

The data was collected using a structured questionnaire adapted from previous published papers<sup>23–27,29,30,34,37–41</sup> and contextualized according to the study setting. The questionnaire consists of socio-demographic characteristics of the participants, socio-political perception and attitude towards COVID-19 vaccine, and willingness towards the acceptance of COVID-19 vaccine. The questionnaire was initially written in English, then translated into the local language (Amharic) for the purpose of gathering data, and finally retranslated back into English to ensure consistency. The validity of the questionnaire was pre-tested using 5% of the study sample size. The feedback from pre-test was used for the amendment of the questionnaire, including avoiding of repeated questions, less irrelevant questions, and unclear questions. Data collectors and supervisors received training on the purpose of the study and the questionnaire's components. Four nursing professionals administered the interviewer, while two MSc. public health experts provided oversight. To reduce data entering errors, double data entry was used. There were no missing records. Data cleaning was then done before statistical analysis.

## Data Processing and Analysis

Data cleaning and analysis were carried out using the Statistical Package for Social Science (SPSS) version 25.0 after being exported from the Epi-Data software version 4.6. The study's findings were represented using descriptive statistics. The association between independent variables and the willingness to accept COVID-19 vaccine was determined using a binary logistic regression analysis at 95% CI. Binary logistic regression with a 95% CI was used to analyze the data using bivariable analysis (COR, or crude odds ratio), as well as multivariable analysis (AOR, or adjusted odds ratio). Variables from the bivariable analysis that had p-values under 0.25 were kept for the multivariable analysis. Then, in a multivariate analysis, the variables were selected as significant predictors of college students' willingness to accept the COVID-19 vaccine at a 95% CI when the p-value was less than 0.05. Using the standard error at the threshold value of -2 to +2, the presence of multicollinearity among the study's independent variables was examined for each variable, but none of them revealed it. Additionally, the Hosmer–Lemeshow test was used to determine the model's fitness, and we discovered a fit model with a p-value of 0.894 which was fit to run further statistical analysis.

## Ethical Consideration

The study was carried out in accordance with the Helsinki Declaration. The ethical clearance was obtained from College of Medicine and Health Sciences, Wollo University. Higher officials of the chosen college granted permission for the study to be carried out. All participants were told of the study's purpose and goals before participating, and participation was anonymous. Each study participant provided their written consent. Those who did not want to participate have the option of being excluded from the study. The data collection was done in compliance with the COVID-19 preventative strategies that were advised.

## Results

### Socio-Demographic Characteristics of the Respondents

In the current study, 422 college students participated in the study with a response rate of 95.6%. More than one-third 163 (40.5%) of the participants were males and less than half 186 (46.3%) of the participants were in the age range of 18–20 years. More than three fourth of the respondents 316 (78.6%) were single. Besides, lower than half 188 (46.8%) of the respondents were attending health science fields. Furthermore, only 27 (6.5%) of the participants had faced one or more chronic medical illness conditions and 35 (8.7%) had history of COVID-19 infection. On the other hand, slightly more than half, 212 (52.7%) of the study participants took training about COVID-19 vaccine. The current finding also revealed that about half 199 (49.5%) of the respondents used health insurance and 214 (51.9%) of the participants knew anyone diagnosed with COVID-19. Regarding the sources of information about COVID-19 vaccine, majority 345 (85.8%) of the respondents used peers as a source of information followed by mass-media such as (TV and radio) 243 (60.4%) (Table 1).

### Perception and Attitude Towards COVID-19 Vaccine

The finding of the present study revealed that three-fifth 244 (60.7%) of the participants perceived that COVID-19 infection is severe for human beings. On the other hand, more than two-thirds 281 (69.9%) of the participants agreed that the infection of COVID-19 can be prevented by vaccination. Besides, nearly three-quarter 298 (74.1%) of the respondents trust the government of Ethiopia towards the current COVID-19 vaccination. Additionally, near two-thirds 265 (65.9%) of the respondents perceived that the vaccine of COVID-19 infection is safe, while 278 (69.2%) perceived the vaccine is effective against the disease causing virus. Finally, this study pointed that more than half 226 (56.2%) of the participants had a willingness to accept of COVID-19 vaccine (Table 2).

### Factors Associated with the Acceptance of COVID-19 Vaccine

According to a multivariable logistic regression analysis, history of chronic medical illness, training on COVID-19 vaccine, history of regular vaccine uptake, perception of COVID-19 severity, perception that COVID-19 can be prevented by vaccine, and the development of herd immunity against COVID-19 vaccines were all factors that were significantly associated with willingness to accept COVID-19 vaccine among college students in Dessie, Northeastern Ethiopia. The current finding revealed that participants who had a history of chronic medical illness were four times more likely to accept COVID-19 vaccine (AOR: 4.340, 95% CI: 1.166, 16.149) than those who did not have chronic medical illness. Participants who had training on COVID-19 vaccine were four times more likely to accept COVID-19 vaccine (AOR: 4.755, 95% CI: 2.606, 6.674) than those who did not take training on COVID-19 vaccine. Besides, participants who had history of regular vaccine uptake were two times more likely to accept COVID-19 vaccine (AOR: 2.534, 95% CI: 1.412, 4.549) than those who did not have a history of vaccine uptake. Participants who perceived that COVID-19 is severe infection were four times more likely to accept COVID-19 vaccine (AOR: 4.109, 95% CI: 2.190, 7.710) than the corresponding groups who perceived COVID-19 is not severe infection. In addition, participants who perceived that COVID-19 can be prevented by vaccine were two times more likely to accept COVID-19 vaccine (AOR: 2.420, 95% CI: 1.160, 5.049) than the corresponding groups who perceived COVID-19 cannot be prevented by vaccine. Moreover, participants who perceived as they did not develop herd immunity against COVID-19 were two times more likely to accept COVID-19 vaccine (AOR: 2.566, 95% CI: 1.431, 4.599) than the corresponding groups (Table 3).

**Table 1** Socio-Demographic Characteristics of College Students in Dessie City, Northeastern Ethiopia

Variable	Category	Frequency (n)	Percentage (%)
Sex	Male	163	40.5
	Female	239	59.5
Age (years)	18–20	186	46.3
	Above 20 years	216	53.7
Religion	Muslim	102	25.4
	Orthodox	256	63.7
	Protestant	44	10.9
Marital status	Single	316	78.6
	Married	86	21.4
Field of study	Health sciences	188	46.8
	Non-health sciences	214	53.2
Year of study	First year	106	26.4
	Second year	155	38.6
	Third year and above	141	35.0
Residency	Urban	271	67.4
	Rural	131	32.6
Average monthly family income	<1000	130	32.3
	1000–3000	104	25.9
	>3000	168	41.8
Live with	Families	120	29.9
	Relatives	150	37.3
	Alone	132	32.8
Family size	<5	187	46.5
	5 and above	215	53.5
History of chronic medical illness	Yes	27	6.7
	No	375	93.3
Training on vaccine covid-19	Yes	212	52.7
	No	190	46.3
Do you have history of regular vaccine uptake prior to COVID-19?	Yes	218	53.2
	No	188	46.8
Have you infected with COVID-19?	Yes	35	8.7
	No	367	91.3

(Continued)

**Table 1** (Continued).

Variable	Category	Frequency (n)	Percentage (%)
Have any relatives hospitalized or died due to COVID-19?	Yes	165	41.0
	No	237	59.0
Do you use health insurance?	Yes	199	49.5
	No	203	50.5
Is there any child in your home?	Yes	205	51.0
	No	197	49.0
Do you live with elders or chronic patients in your home?	Yes	172	42.8
	No	230	57.2
Know any one diagnosed with COVID-19?	Yes	214	51.9
	No	198	48.1
Use healthcare professionals as sources of information?	Yes	196	48.8
	No	206	51.2
Neighbours	Yes	204	50.7
	No	198	49.3
Family members and relatives	Yes	207	51.5
	No	195	48.5
Newspapers	Yes	235	58.5
	No	167	41.5
Social media	Yes	243	60.4
	No	159	39.6
Peers	Yes	345	85.8
	No	57	14.2
Mass media (radio and TV)	Yes	321	79.9
	No	81	20.1
Religious institutions	Yes	128	31.8
	No	274	68.2

## Discussion

An institutional-based cross-sectional study design was implemented among college students in Dessie city, Northeastern Ethiopia from July 10–30, 2021. The study was aimed to assess the acceptance and determinant factors of COVID-19 vaccine among college students of Dessie city Northeastern Ethiopia. The urgency for vaccination is growing by the day, with increasing numbers of cases and reports of the virus variants across the world.<sup>24</sup> For many years, vaccinations have been regarded as the most effective way to combat infectious diseases that spread quickly, including COVID-19.<sup>2,13</sup> The effectiveness of this method will be determined by the rate of vaccination acceptance, which is based on a risk-benefit analysis.<sup>1,39</sup> However, vaccine hesitancy and misinformation are obstacles to establishing high coverage and community

**Table 2** Perception and Attitude Towards COVID-19 Vaccine Among College Students in Dessie City, Northeastern Ethiopia

Variable	Category	Frequency (n)	Percentage (%)
Do you think the infection of COVID-19 is severe?	Yes	244	60.7
	No	158	39.3
Do you think COVID-19 can be prevented by vaccine?	Yes	281	69.9
	No	121	30.1
Are you susceptible for COVID-19 infection?	Yes	237	59.0
	No	165	41.0
Do you trust the government of Ethiopia towards COVID-19 vaccination?	Yes	298	74.1
	No	104	25.9
Do you trust the health authority?	Yes	328	81.6
	No	74	18.4
Do you think COVID-19 vaccine is safe?	Yes	265	65.9
	No	137	34.1
Do you think COVID-19 vaccine is effective?	Yes	278	69.2
	No	124	30.8
Do you think you have developed herd immunity against COVID-19?	Yes	173	43.0
	No	229	57.0
Do you trust the vaccine producers?	Yes	256	63.7
	No	146	36.3
Do you have willingness to accept COVID-19 vaccine?	Yes	226	56.2
	No	176	43.8

immunity against COVID-19 infection.<sup>1,13</sup> Vaccinations have long been seen to be the most effective way to combat quickly spreading infectious diseases.<sup>13</sup> The COVID-19 vaccine is widely recognized as the most promising method for containing or ending the pandemic.<sup>1</sup>

The finding of the present study revealed that more than half, 226 (56.2%) 95% CI: 51.5; 60.9% of the participants were willing to accept COVID-19 vaccine. Near to half 176 (43.8%) 95% CI: 39.1; 48.5 of the respondents were either refused or hesitated to receive COVID-19 vaccine. This finding matched the findings of studies in France (58.1%),<sup>40</sup> USA (53%),<sup>37</sup> USA (52.8%),<sup>33</sup> Nigeria (55.5%),<sup>41</sup> UAE (56.3%),<sup>42</sup> Libya (60.9%),<sup>13</sup> and Algeria (53.51%).<sup>24</sup> The current finding was lower than the study conducted in Italy (86.1%),<sup>43</sup> Canada (77.8%),<sup>44</sup> 16 countries (69.2%),<sup>45</sup> Italy (91.9%),<sup>46</sup> and Ethiopia (69.3%).<sup>36</sup> However, this finding is higher than the study conducted in Gonder, Ethiopia (34.2%).<sup>34</sup> In our study, less than 75% of participants were willing to get the COVID-19 vaccination, which is the minimum rate needed to achieve herd immunity and halt the coronavirus outbreak.<sup>41</sup> The novelty of COVID-19 disease may be the cause of the poor prevalence of vaccination uptake. Possible reasons for this finding include widespread pandemic conspiracy theories and a psychological need to comprehend numerous pandemic-related occurrences. As a result, particularly in LMIC nations, there may be mistrust and unfavorable perceptions about the vaccine, a lack of faith in the current healthcare system, and information shortages.<sup>38</sup> When a safe and effective vaccine is offered for free or at a low cost, the acceptance of the COVID-19 vaccine can rise.<sup>47</sup>



**Table 3** Factors Associated with Willingness of COVID-19 Vaccine Acceptance Among College Students in Dessie City, Northeastern Ethiopia

Variables	Category	Willingness		COR(95% CI)	AOR(95% CI)	p-value
		Yes	No			
Sex	Male	114	49	2.638 (1.733–4.016)	1.377(0.758–2.502)	0.294
	Female	112	127	Ref	Ref	
Age	18–20	77	109	Ref	Ref	
	Above 20	149	67	3.148(2.089–4.744)	0.776(0.416–1.446)	0.424
Field of study	Health	135	53	3.443(2.268–5.227)	1.585(0.891–2.821)	0.117
	Non-health	91	123	Ref	Ref	
Study year	1st	37	69	Ref	Ref	
	2nd	87	68	2.386(1.433–3.973)	1.015(0.468–2.205)	0.969
	3rd and above	102	39	4.877(2.832–8.401)	0.890(0.391–2.026)	0.781
Residency	Urban	175	96	2.859(1.859–4.398)	1.579(0.812–3.070)	0.178
	Rural	51	80	Ref	Ref	
Monthly income	<1000	52	78	Ref	Ref	
	1001–3000	54	50	1.620(0.962–2.727)	0.541(0.249–1.176)	0.121
	>3000	120	48	3.750(2.309–6.090)	0.839(0.294–1.176)	0.651
History of chronic illness	Yes	23	4	4.872(1.653–14.361)	4.340(1.166–16.149)	0.029
	No	203	127	Ref	Ref	
Training on COVID-19 vaccine	Yes	160	52	5.781(3.751–8.909)	4.755(2.606–8.674)	<0.0001
	No	66	124	Ref	Ref	
History of vaccine uptake	Yes	152	62	3.777(2.492–5.724)	2.534(1.412–4.549)	0.002
	No	74	114	Ref	Ref	
Relatives died or hospitalized by COVID - 19	Yes	107	58	1.829(1.216–2.753)	1.353(0.747–2.450)	0.318
	No	119	118	Ref	Ref	
Use health insurance	Yes	126	73	1.778(1.193–2.648)	0.829(0.466–1.475)	0.524
	No	100	103	Ref	Ref	
Presence of child in home	Yes	132	73	1.981(1.328–2.955)	1.358(0.752–2.455)	0.331
	No	94	103	Ref	Ref	
Live with elders and chronic patients	Yes	117	55	2.361(1.564–3.565)	1.178(0.660–2.102)	0.579
	No	109	121	Ref	Ref	
Use social media	Yes	160	83	2.716(1.799–4.101)	1.211(0.628–2.335)	0.567
	No	66	93	Ref	Ref	

(Continued)



**Table 3** (Continued).

Variables	Category	Willingness		COR(95% CI)	AOR(95% CI)	p-value
		Yes	No			
COVID-19 is severe	Yes	182	62	7.606(4.841–11.949)	4.109(2.190–7.710)	<0.001
	No	44	114	Ref	Ref	
COVID-19 can be prevented by vaccine	Yes	196	85	6.995(4.307–11.358)	2.420(1.160–5.049)	0.018
	No	30	90	Ref	Ref	
You are susceptible to COVID-19	Yes	196	85	3.732(2.455–5.673)	1.404 (0.758–2.600)	0.281
	No	30	90	Ref	Ref	
Do you trust the government	Yes	205	93	8.712(5.088–14.918)	1.072(0.442–2.604)	0.878
	No	21	83	Ref	Ref	
COVID-19 vaccine is safe	Yes	178	87	3.794(2.456–5.859)	0.504(0.125–2.040)	0.337
	No	48	89	Ref	Ref	
COVID-19 vaccine is effective	Yes	180	98	3.114(2.007–4.834)	1.053(0.505–2.193)	0.891
	No	46	78	Ref	Ref	
Do you think you have developed herd immunity against COVID-19	Yes	60	113	4.962(3.239–7.604)	2.566(1.431–4.599)	0.002
	No	166	63	Ref	Ref	
Trust vaccine producers	Yes	176	80	4.224(2.742–6.507)	1.666(0.418–6.644)	0.470
	No	50	96	Ref	Ref	

History of chronic medical illness condition, training towards COVID-19 vaccine, previous history of vaccine uptake, and concern of becoming infected with COVID-19, perception of herd immunity development against COVID-19 and severity of COVID-19 infection were factors significantly associated with the acceptance of COVID-19 vaccine among the participants of the current study. The pandemic of COVID-19 affects all groups of the population. However, literature has revealed that individuals with a history of chronic medical illness conditions are highly vulnerable to developing severe risk of morbidity and mortality due to COVID-19 infection.<sup>9,38</sup> The problem is highly severe in developing countries due to the shift of the planned resource budget from routine management of chronic illness disease to the ongoing COVID-19 cases.<sup>14</sup> This finding revealed that respondents with a history of chronic medical illness were 4.340 times more likely to accept COVID-19 vaccine than the corresponding groups which was supported by studies conducted in Jordan,<sup>48</sup> Bangladesh,<sup>49</sup> Italy,<sup>46</sup> Mozambique,<sup>50</sup> and Ethiopia.<sup>51,52</sup>

The perception of becoming infected by COVID-19 is an important factor that may motivate individuals to take vaccine against COVID-19.<sup>50</sup> The finding of the current study revealed that individuals with the concern of being infected by COVID-19 were 4.109 times more likely to accept the COVID-19 vaccine than the corresponding groups which was supported by the studies conducted in Mozambique,<sup>50</sup> Uganda,<sup>53</sup> and Nigeria.<sup>41</sup> According to literature, knowledge contributes to the judgment on the vaccination concept.<sup>12</sup> The finding of the current study revealed that individuals who took training on COVID-19 vaccine were 4.755 times more likely to accept COVID-19 vaccine than the corresponding groups. This finding is in agreement with the study conducted in Ethiopia.<sup>38</sup> Participants who had a history of vaccination reluctance for their children were considerably less likely to take the COVID-19 vaccine. This finding revealed that respondents with a previous history of vaccine uptake were two times more likely to accept COVID-19 vaccine (AOR: 2.534, 95% CI: 1.412, 4.549) than their corresponding groups which was in line with the study conducted in Uganda,<sup>53</sup> Switzerland,<sup>54</sup> New Jersey,<sup>33</sup> and Jordan.<sup>55</sup>

The vaccine hesitancy affects both the person who refuses to take the vaccine and the entire population, posing a significant challenge to reaching the threshold for conferring COVID-19 herd immunity.<sup>12</sup> This study revealed that participants who perceived as they did not develop herd immunity against COVID-19 were two times more likely to accept COVID-19 vaccine (AOR: 2.566, 95% CI: 1.431, 4.599) than the corresponding groups, which was in line with the study conducted in Uganda.<sup>56</sup>

The strongest predictors of vaccine acceptance included confidence in vaccine safety or effectiveness, worrying about COVID-19, belief in the importance of vaccines to their own country, compliance to mask guidelines, trust of public health agencies/health science, as well as attitudes towards routine vaccines.<sup>1</sup> Our study revealed that participants who perceived that COVID-19 is severe infection were four times more likely to accept COVID-19 vaccine (AOR: 4.109, 95% CI: 2.190, 7.710) than the corresponding groups. This is consistent with the findings of Saudi Arabia.<sup>57</sup> According to the literature, women were also more likely than men to state that the vaccine was too new that they were fearful of side effects and that they had a medical contraindication to the vaccine.<sup>38</sup> However, in our study, it was not statistically significant.

## Limitation of the Study

This study has several restrictions. In the beginning, self-administered interviews were used to get the data. The result is flawed by a cross-sectional study design, as is common. In these reports, a longitudinal research might be of utmost value. Additionally, the students who made up the sample are not all population-representative.

## Conclusion

In general, the acceptances of COVID-19 vaccine among college students were low which was lower than the vaccination level required for the development of herd immunity. History of chronic medical illness condition, training on COVID-19 vaccine, previous history of vaccine uptake, and concern of becoming infected with COVID-19, perception of herd immunity development against COVID-19 and severity of COVID 19 infection were factors significantly associated with the acceptance of COVID-19 vaccine. Hence, it is necessary to promote COVID-19 vaccination among college students through health education and vaccine outreach. Healthcare practitioners should continuously promote awareness of the COVID-19 vaccine's significance, safety, and efficacy, with a focus on populations with a higher risk of contracting the disease. Public health authorities must implement systematic measures to lower vaccination reluctance levels and increase vaccine uptake.

## Abbreviations

AOR, adjusted odds ratio; COR, crude odds ratio; CI, confidence interval; COVID-19, Corona virus disease 2019; LMIC, low- and middle-income country; SARS COV-2, Severe Acute Respiratory Syndrome COV 2; UAE, United Arab Emirates; USA, United States of America; WHO, World Health Organization.

## Data Sharing Statement

The corresponding authors will provide the datasets used and/or analyzed during the current work upon reasonable request.

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## Disclosure

The authors report no conflicts of interest in this work.

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