

# BMJ Open COVID-19 vaccine hesitancy in Addis Ababa, Ethiopia: a mixed-method study

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## ABSTRACT

**Objective** Data on COVID-19 vaccine hesitancy is limited in Ethiopia and other parts of Africa. Therefore, the aim of this study was to determine the level of COVID-19 vaccine hesitancy and its associated factors in Addis Ababa, Ethiopia.

**Design** A community-based concurrent mixed-method study.

**Setting** In a community setting.

**Participants** Adult residents (n=422) of Akaki Kaliti subcity who were recruited by a two stage sampling technique and 24 adults who were selected purposively were included for the quantitative and qualitative part of the study respectively.

**Outcome measures** Data were collected by face-to-face interview using a semistructured questionnaire. Factors associated with COVID-19 vaccine hesitancy were identified by multivariable binary logistic regression model.

**Results** One out five (19.1%, 95% CI 15.3% to 24.6%) participants were not willing to get vaccinated. In the multivariable analysis, vaccine hesitancy was significantly associated with being female (aOR=1.97; 95% CI 1.10 to 3.89), having negative attitude towards COVID-19 and its preventive measures (aOR=1.75; 95% CI 1.08 to 3.02), and primary information source being social media (internet) (aOR=3.59; 95% CI 1.75 to 7.37). Study participants have predominantly stated that they did not have enough information about the vaccine, feared it would not be effective or have too many side effects, and reflected their uncertainty towards the quality of the vaccine.

**Conclusions** A considerable proportion of the people in Addis Ababa have concerns on COVID-19 vaccines and unwilling to accept them. This was due to the misconceptions, negative attitudes and use of social media as their primary source of information. Providing the community with health education and consistent efforts to enhance the prevention measures are important, particularly using different medias including social media.

## INTRODUCTION

COVID-19 is caused by SARS-CoV-2 also known as novel coronavirus.<sup>1</sup> Since its emergence, this pandemic has shown its capability to spread rapidly in the world causing the most dramatic global health crisis of our time resulting in devastating social, economic and political crises.<sup>2</sup> Therefore, on top of other preventive measures, it is crucial to receive

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ We employed a community-based study which could reflect the prevailing COVID-19 vaccine hesitancy in the general population.
- ⇒ A mixed-method approach allows for triangulation of findings from different perspectives.
- ⇒ Factors associated with the outcome variable (vaccine hesitancy) were adjusted for the known explanatory variables.
- ⇒ The study might be limited due to the social desirability bias during the data collection.

COVID-19 vaccines to halt the spread of COVID-19.<sup>3</sup>

Globally, more than 210 countries/territories have been affected by the virus, and Ethiopia is one of the five African countries with the highest case burden of COVID-19.<sup>4</sup> Although the government of Ethiopia has been striving to spread information on COVID-19 preventive measures, still the public is not consistently adhering to the precautions.<sup>5</sup> On the other hand, although the COVID-19 vaccines have been made available, it is highly controversial, as they are highly affected by disparities of access and distributions across the countries, where large proportions of the vaccines have been already sold-out to high-income countries.<sup>6</sup>

Moreover, myths and conspiracy theories on vaccinations have been spreading and can easily be accepted by the developing world. This may cause people to be reluctant towards vaccination, which has been demonstrated by a study in Nigeria by a low vaccine acceptability rate.<sup>7</sup> Furthermore, the WHO listed vaccine hesitancy as one of the ten global threats to public health.<sup>8</sup>

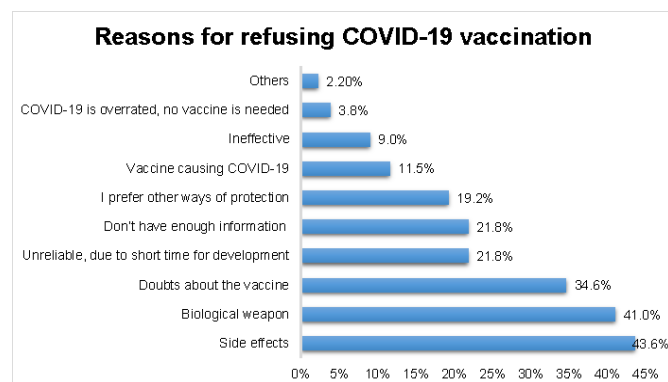
Some recent studies have also reported the magnitude of vaccine hesitancy varying from 76.4% to 3.0%, indicating variabilities across different countries.<sup>9–11</sup> This variability could be partly due to varying perceptions and attitudes towards the efficacy, quality and safety of the COVID-19 vaccines. Vaccine hesitancy could also be affected by the

**Table 1** Sociodemographic characteristics of the study participants

		Frequency (N)	Percent (%)
Sex	Male	115	28.1
	Female	294	71.9
Age	18–29	174	42.5
	30–40	147	35.9
	41–50	40	9.8
	>50	48	11.7
Marital status	Not married	123	30.1
	Married	255	62.3
	Widowed	20	4.9
	Divorced	11	2.7
Religion	Christian	349	85.3
	Muslim	60	14.7
Educational status	No formal education	39	9.5
	Primary school	105	25.7
	Secondary and above	265	64.8
Occupation	Unemployed/housewife	190	46.5
	Employed	219	53.5
Monthly income*	≤3200ETB (≤100USD)	175	42.8
	>3200ETB (>100USD)	228	57.2

\*Six participants' data missing.  
ETB, Ethiopian Birr; USD, United States Dollar.

sociodemographic, psychological and cultural factors of the population. Therefore, it is imperative to understand the varying vaccine attitudes among the community to design strategies to overcome the vaccine hesitancy. Furthermore, unravelling the specific fears and doubts of the community with regards to receiving the vaccine can help government and other concerned officials to adequately address the misconceptions and various conspiracy theories in their campaigns.

**Figure 1** Reasons of participants for refusing COVID-19 vaccination in Addis Ababa, Ethiopia.

## METHODS AND MATERIALS

### Study design and participants

A concurrent mixed-method study (QUAN +qual) was conducted from 20 to 31 January 2021 among adult population ( $\geq 18$  years) currently residing in Akaki Kality subcity of Addis Ababa, Ethiopia. The quantitative part of the study was addressed by a cross-sectional study design and the qualitative part of the study was addressed by a phenomenological study design. The qualitative part was mainly intended to explain the reasons for COVID-19 vaccine hesitancy, as a supplementary of the quantitative part.

A sample size for the quantitative part of the study ( $n=422$ ) was determined by using a single population proportion formula, by taking 95% CI, 5% margin of error, 50% proportion of vaccine hesitancy and adding up 10% non-response rate. For the qualitative part, 24 participants were included into the study based on the information saturation of the researchers.

Two-stage sampling technique was employed to recruit the participants for the quantitative part of the study. There were 13 districts in the subcity; of which 3 of them were selected randomly (lottery method). The total sample was allocated proportionally to the districts. Then, the households from each district were selected by employing a systematic random sampling (sampling interval=every fourth house). From the specific selected households, only one randomly selected eligible individual was interviewed. For the qualitative part of the study, purposive sampling method was used to recruit participants who have reach information.

### Patients and public involvement

Neither patients nor the public was involved in the study.

### Data collection tools and procedures

Data were collected by using a semistructured questionnaire which was adapted from reviewed literatures.<sup>7 12 13</sup> The contents of the questionnaire were validated by senior experts in the field. The questionnaire has four components: sociodemographic, knowledge towards COVID-19, attitude towards COVID-19 and COVID-19 vaccine acceptance. The questionnaire was first prepared in English and translated into Amharic (local language) for the sake of interview. The questionnaire was administered face to face by trained medical interns. For the qualitative part of the study, in-depth interviews were made by the investigators by using an in-depth interview guide (online supplemental file 1).

### Data management and analysis

Data were checked for completeness and consistency, coded and entered into SPSS-for windows version 25 for analysis. Frequency and proportions were used to summarise categorical variables, whereas mean and SD were used to summarise continuous variables.

The primary outcome variable of the study was COVID-19 vaccine hesitancy which was assessed by asking

a question ‘Will you get vaccinated if you get COVID-19 vaccine?’ then the response was dichotomised as ‘Yes’ or ‘No’. Knowledge of COVID-19 was assessed by 15 yes or no knowledge-based questions. Then, the knowledge score was categorised in two as below or above the mean score. The mean and below knowledge score was considered as poor knowledge while above the mean was considered as good knowledge. Attitude towards COVID-19 and its preventive measures was assessed by 11 questions which was in three Likert scale (agree, neutral, disagree) then mean score was calculated. Then, the attitude score was categorised in two as below or above the mean score. The mean and below attitude score was considered as negative attitude while above the mean was considered as positive attitude.<sup>7 12 13</sup>

Multivariable binary logistic regression analysis was carried out to identify factors associated with vaccine hesitancy, as expressed by adjusted OR (aOR) along with its respective 95% CI. Variables with <0.25 in bivariate analysis were considered for multivariable analysis. The explanatory variables entered into the multivariable model include sex, age, educational status, religion, attitude and primary source of information. Variables having  $p$  value<0.05 were considered statistically significant. Multicollinearity was assessed by the collinearity diagnostics (Variance Inflation Factor (2.30) and the tolerance test (0.43)). Goodness of the model was checked by the Hosmer Lemeshow goodness of fit test, and it was not significant ( $p$  value=0.81). The qualitative data analysis was initiated by transcription and translating of the interviews, then coded and analysed by thematic analysis. The findings of the qualitative study were used to supplement the findings of quantitative data.

### Ethical consideration

Ethical approval of this study was obtained from the Institutional Review Board (IRB) of Myung Sung Medical College (MMC/IRB/067/21). The participants of the study were informed about the purpose of the study and provided their written consent. At the end of the interview, the data collectors have provided information regarding the COVID-19 vaccine.

## RESULTS

### Sociodemographic characteristics

A total of 409 participants completed the questionnaire, with a response rate of 96.9%. Majority of the participants 294 (71.9%) were females and married (62.3%) (table 1). The mean ( $\pm$ SD) age of the participants was 34.1 years ( $\pm$ 12.9), ranging from 18 to 85 years.

### Knowledge and attitude towards COVID-19 preventive measures

Almost all the participants heard about COVID-19 from Mass media. However, the average ( $\pm$ SD) knowledge score was  $56.7\pm 3.7$ , with 46.7% ( $n=191$ ) exhibited poor level of knowledge. The mean ( $\pm$ SD) attitude score was found to

be  $20.3\pm 1.2$ , with 51.8% of the participants had negative attitude towards COVID-19 and its preventive measures.

These results were corroborated by the findings of the qualitative part of the study where participants stated that they were initially very concerned about getting infected with COVID-19. Paradoxically, participants also stated that they did not believe on the existence of the disease since they have not personally encountered an infected person. On the other hand, believing COVID-19 disease as if it was emanated because of the punishment of God was predominantly explained by the participants.

Participants stated the following to show how they perceived about COVID-19:

“I am not scared because I expected this to happen; we brought this on ourselves, and we are paying for our sins. It has been long time coming.” [Female, 50-year-old]

“I have been through an outbreak before...I got sick, and I had to be isolated from my family, but I recovered easily, and I don’t believe this would be any different.” [Female, 47-year-old]

“I was afraid that everyone in Ethiopia would die because even developed country people could not handle it. I think the only reason we have survived is because Ethiopia is God’s country.” [Female, 70-year-old]

### COVID-19 vaccine hesitancy and its associated factors

More than 90% of the participants heard about the COVID-19 vaccine mainly from Mass media. However, 78 (19.1%, 95% CI 15.3% to 24.6%) were not willing to get vaccinated. Out of them, 43.6% do not take the vaccine due to fear of side effects and 41.0% of them believe that the vaccine may be biological weapon (figure 1).

In the qualitative in-depth interview, participants stated that they did not have enough information about the vaccine and wanted to see other people take it first. For instance, a young man said that:

“...frankly speaking, I do not have adequate information about the COVID vaccine, and for sure I will not receive it until I see others take it first...” [Male, 32-year-old]

Participants also described their concerns over the effectiveness and quality of the vaccines.

“I fear that the vaccines might not be effective or of a lower quality, particularly those vaccines distributed to Africa. They may also have serious side effects, as they did not take longer time in laboratories or in trials before they are released for use.” [Male, 45-year-old]

Other predominant thought expressed by the participants was the vaccines would be used by the developed nations to cause infertility and control the population size of poor countries. For example, participants stated that:

**Table 2** Factors associated with COVID-19 vaccine hesitancy in Addis Ababa, Ethiopia, 2021

Variables	Vaccine hesitancy		cOR (95% CI)	aOR (95% CI)	P value
	Yes (%)	No (%)			
Sex					
Male	17 (21.8%)	98 (29.6%)	1.00	1.00	0.03
Female	61 (78.2%)	233 (70.4%)	1.49 (0.83 to 2.69)	1.97 (1.10 to 3.89)	
Age					
18–29	34 (43.6%)	140 (42.3%)	1.00	1.00	
30–40	24 (30.8%)	122 (36.9%)	0.81 (0.46 to 1.44)	1.03 (0.55 to 1.92)	0.934
41–50	12 (15.4%)	29 (8.8%)	1.77 (0.82 to 3.82)	2.22 (0.94 to 5.21)	0.067
>50	8 (10.2%)	40 (12.0%)	0.82 (0.35 to 1.92)	1.08 (0.39 to 2.97)	0.892
Religion					
Christian	8 (10.3%)	52 (15.7%)	1.00	1.00	0.621
Muslim	70 (89.7%)	278 (84.3%)	1.64 (0.74 to 3.60)	1.23 (0.54 to 2.83)	
Educational status					
No formal education	9 (11.5%)	30 (9.1%)	1.11 (0.50 to 2.48)	1.11 (0.39 to 3.16)	0.840
Primary education	13 (16.7%)	93 (28.1%)	0.53 (0.27 to 1.01)	0.81 (0.40 to 1.63)	0.560
Secondary and above	56 (71.8%)	208 (62.8%)	1.00	1.00	
Attitude					
Positive attitude	28 (35.9%)	169 (51.1%)	1.00	1.00	0.04
Negative attitude	50 (64.1%)	162 (48.9%)	1.87 (1.12 to 3.12)	1.75 (1.08 to 3.02)	
Primary source of information					
TV/radio	38 (48.7%)	255 (77.0%)	1.00	1.00	
Social media (internet)	40 (51.3%)	76 (23.0%)	3.53 (1.67 to 6.98)	3.59 (1.75 to 7.37)	0.0001

aOR, adjusted OR; cOR, crude OR.

“...I saw some videos circulating on social media stating that the vaccines are made to reduce the population size of the poor countries...” [Female, 35-year-old]

Moreover, it was also mentioned that the vaccines might be used as a weapon to insert microchips into the body as the ‘mark of the beast’ that would cause them to forsake their faith.

“...it seems the end of the world is near...as it is stated in the Bible, during the end times the mark of the beast will be labelled on the people...I fear these vaccines may be associated to this...” [Male, 40-year-old]

A few others did not think they needed the vaccine because they had God’s protection.

“I don’t think the vaccine will come to this country and even if it does, I don’t need it; God will be my vaccine.” [Female, 45-year-old]

In the multi-variable analysis (table 2), COVID-19 vaccine hesitancy was associated with being female, having negative attitude towards the vaccine and primary source of information about the vaccine being social media. The odds of vaccine hesitancy was two times (aOR=1.97; 95% CI 1.10 to 3.89) higher among female participants as compared with male participants, 1.8 times (aOR=1.75;

95% CI 1.08 to 3.02) higher among participants who have negative attitudes towards COVID-19 as compared with those who had positive attitudes, and four times (aOR=3.59; 95% CI 1.75 to 7.37) higher among those participants who got information from social media as a primary source as compared with those who received information only from mass media.

## DISCUSSION

For the COVID-19 battle, the population adherence to preventive measures and receiving COVID-19 vaccines is crucial; however, it is mainly affected by their knowledge and attitude towards the disease and vaccination.<sup>1</sup> The findings of this study showed that nearly half of the study participants demonstrated inadequate knowledge of COVID-19, indicating a great knowledge gap. This finding is higher than studies conducted in other parts of Ethiopia such as Arbaminch (23.5%) and Gedeo (39.5%), and other countries such as Ghana (34.9%), and Malaysia (22.7%).<sup>14–17</sup> The discrepancies might be due to differences in the community awareness creation through mass media and social media. Further, in our study, more than half of the participants had negative attitude towards COVID-19 and its preventive measures, which is higher than the findings of studies conducted in Southern

Ethiopia<sup>15 18</sup> and lower than study done among Dessie and Kombolcha town residents in Ethiopia.<sup>19</sup> The discrepancy in the findings may be due to differences in the study period. The later studies were conducted earlier in the pandemic when the declaration and enforcement of state of emergency and other measures were still in place. Our findings show a significant decrease in the community's attitude towards COVID-19 and its prevention measures which can lead people to become discouraged to consistently adhere to the measures set forth by the government and the WHO. These findings of the study have an implication on the public health and underscore the need for urgent concerted efforts to consistently promote the knowledge of the public in Ethiopia towards COVID-19 preventive measures, including COVID-19 vaccination. If the current trend evidenced by this study continues in Ethiopia, COVID-19 will pose a devastating outcome on the medical, financial and social aspect of citizens besides the potential for new strains of disease developing.

As COVID-19 continues to ravage the world, vaccination offers the most reliable hope for a permanent solution to controlling the pandemic. However, a vaccine must be accepted and used by a large majority of the population to create herd immunity.<sup>20</sup> The findings of this study showed that about one out of five participants are not willing to receive COVID-19 vaccine when it is available, which is higher than the findings reported from developed countries such as UK (3%).<sup>6 21 22</sup> The discrepancies might be due to insufficient knowledge about the vaccine and difference in the perception of the seriousness of the pandemic. This implies that if the doubts and fears of the majority regarding the vaccine are not addressed properly, we may not be able to attain herd immunity. Surprisingly, the finding of this study was lower than a study conducted in the USA (31%) and Nigeria (80%).<sup>13 20</sup> This might be due to difference in access to wide variety of conspiracy theories and doubts via internet.

Consistent to the study conducted in China,<sup>23</sup> vaccine hesitancy was more likely among females as compared with males in our study. This could be due to higher exposure of males for different media as compared with females in Ethiopia. In the present study, increased likelihood of vaccine hesitancy was also indicated among those with negative attitude towards COVID-19 and its preventive measures. The qualitative aspects of this study also found that those participants who would not take the vaccine stated one of their reasons to be their lack of implicit trust in the government and in health professionals. Thus, this lack of confidence in the government exhibited by 41.8% of our participants may be a potential hurdle we might face during the vaccination programmes in Ethiopia.

In our study, those participants who received their information from social media (internet) were more likely to have vaccine hesitancy as compared with those who got their information from mass media (TV/radio). This finding of the study is in line with a study conducted to assess health protective behaviours and conspiracy

theories during the pandemic, which has found a significant association between holding conspiracy beliefs and checking social media for news of COVID-19.<sup>24</sup> This finding of the study is justified by our findings on both the quantitative and qualitative aspects of our study, which revealed the predominant reasons given for vaccine hesitancy were associated with the participant's beliefs in the conspiracy theories. Thus, the spread of these conspiracy theories is a potential issue that needs attention during vaccination campaigns. It is critical to explicitly explain the details of the COVID-19 vaccines including its effectiveness, safety and quality to address the information need of the community.

This study is the first community-based study to assess the Ethiopian community's perception towards COVID-19 vaccine and its level of acceptance. We employed a mixed-methods design which enables us to make the deep understanding of the issue. However, the study might be limited due to social desirability bias during the data collection. However, to minimise this bias, the purpose of the study and assurance of the participant's anonymity were described to the participants prior to the administration of the interview. In addition to this, our sample over-represents female population because the majority of the study participants that were found at home during data collection time were housewives. Furthermore, the study was conducted in only one subcity. Therefore, generalisation of the study results needs to be cautious.

## CONCLUSIONS

A considerable proportion of the study participants in Addis Ababa have concerns on the COVID-19 vaccines and unwilling to accept them. This was mainly due to the prevailing misconceptions, negative attitudes, and use of social media as their primary source of information. Several conspiracy theories were put forth to justify their stance and this was mainly due to the misconceptions distributed from the use of social media as primary source of information about the vaccines. These findings of the study underscore the need to use social-media to disseminate reliable information regarding COVID-19 vaccination and the preventive measures, rather than only focusing on the mass-media messages. Overall, providing the community with health education and consistent government efforts in uphold the prevention measures are of paramount importance to tackle this pandemic.

**Correction notice** This article has been corrected since it was first published. Author name 'Saron Gideon' has been updated.

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for the overall content of the article. All authors have read and approved the manuscript.

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**Patient consent for publication** Not applicable.

**Ethics approval** Ethical approval of this study was obtained from the Institutional Review Board (IRB) of Myungsung Medical College (MMC/IRB/067/21). Participants gave informed consent to participate in the study before taking part.

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