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Original Article

COVID -19 vaccine hesitancy and determinants in Ethiopia: A national pilot survey

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Abstract

Introduction: *Despite major advances in Corona Virus Disease 2019 (COVID-19) vaccine development, vaccine hesitancy threatens the progress made to curb the disease. We aimed to assess the level of COVID-19 vaccine hesitancy and the underlying determinants in Ethiopia.*

Methods: *A pilot mobile phone survey of adults in Ethiopia with mobile phones selected randomly.*

Results: *The pilot survey included 614 participants who were predominantly male (71.7%), and married (68.2%) with a median age of 34 years (interquartile range [IQR] = 14.0). Overall, 150 (24.4%) participants reported to have been vaccinated; either the first [57 (38%)], second [19 (12.7%)], or both [74 (49.3%)] doses. About one in six participants (16.3%; n=100) reported vaccine hesitancy, with a significant difference by employment status, with self-employed more likely to show hesitancy [adjusted odds ratio (AOR) 1.85, 95% CI (1.05-3.27)], and region. Major drivers of hesitancy were lack of interest [n=30 (30%)], fear of side-effects [n=24 (24%)], and lack of trust in the vaccine [n=13 (13%)]. Having chronic disease conditions in the family had no association with hesitancy (p > 0.05).*

Conclusion: *While representativeness of the sample is an issue, the findings show a relatively low rate of COVID-19 vaccine hesitancy among the Ethiopian population. The major drivers of hesitancy, lack of interest, fear of side-effects, and lack of trust in the vaccine, may be reversed by disseminating accurate and timely information using credible sources across communities.*

Keywords*: Vaccine, hesitancy, COVID-19, mobile phone, Ethiopia.*
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Introduction

First reported in late 2019, COVID-19 is a pandemic that has impacted and continues to impact millions across the globe. According to the latest World Health Organization (WHO) report, there are over 340 million confirmed cases globally, with Africa accounting for 2.3% of the cases (1). In Ethiopia, there were a total of 467,975 confirmed cases as of 18th February 2022 and COVID-19 has taken the lives of 7430 individuals (2). The best way to tackle the pandemic is implementing public health control measures, including mass vaccination.

Thus far, nine vaccines have been evaluated for safety and efficacy and endorsed by the World Health Organization (WHO) (3), and there were 140 clinical and 194 pre-clinical studies underway (4).

Despite such major advances, vaccine hesitancy – the reluctance or refusal to vaccinate despite the availability of vaccines – threatens to reverse progress made in tackling COVID-19 (5).
According to a systematic review of worldwide COVID-19 vaccine hesitancy, the highest vaccine acceptance rates among the general public were found in Ecuador (97.0%), Malaysia (94.3%), Indonesia (93.3%) and China (91.3%), while the lowest vaccine acceptance rates were from Kuwait (23.6%), Jordan (28.4%), Italy (53.7), Russia (54.9%), Poland (56.3%), US (56.9%), and France (58.9%) (6). A study conducted on Health Care Workers (HCW) in Ethiopia indicated that nearly two-thirds of HCWs were hesitant to the COVID-19 vaccine (7). These figures are particularly alarming considering HCWs were cited as the most trusted source of information about the COVID-19 (8). On the other hand, one out of five residents of Addis Ababa, the capital city of Ethiopia, were not willing to get vaccinated (7, 9). While studies such as these give us an idea about the potential extent of vaccine hesitancy in a limited geographic region and population, national data is required to estimate the scope of the problem and plan interventions accordingly.

Vaccine hesitancy and the underlying reasons are complex and context-specific that vary with geography, period, and vaccine type. The reason for hesitancy can also arise from a range of factors such as complacency around the disease, convenience of access, and trust in the vaccine. The recognition of these factors could help develop targeted interventions across different sets of populations to increase vaccination uptake once the vaccines are available (10, 11).

Little is known about COVID-19 vaccine hesitancy and the underlying determinants in sub-Saharan Africa where access to the vaccine is suboptimal and most of the available evidence is from developed nations. Hence, we aimed in this study to assess the level of COVID-19 vaccine hesitancy and the underlying determinants in Ethiopia.

Methods

Study Design

This was a pilot cross-sectional mobile phone survey in all the regions of Ethiopia. and was conducted from September to November 2021. Mobile Phone surveys were used because these were safer research tools at the time of COVID-19 where face-to-face data collection could put the health of the study participants and the data collectors in jeopardy.

Study setting and population

We recruited participants nationwide, from all the ten regions and two city administrations in Ethiopia. Adults who spoke one or more of the working languages and with no hearing or cognitive impairment or serious mental illness that impedes interview were eligible to participate.

Sample size and sampling procedure

We approached 4180 participants from the pool of randomly generated phone numbers that were obtained from phone registries retained in Addis Ababa and the regions. Of these, we were able to include 614 participants who answered the phone call meeting also the eligibility criteria and consented. This was considered a sufficient sample size to obtain preliminary evidence on the extent of vaccine hesitancy and about the feasibility of a larger scale study.

Measurements

Socio-demographic and household factors hypothesized to have an impact on vaccine hesitancy (age, gender, education, marital status, occupation, residence, region, economic status (self-reported status ranging from very low to high), participant's perceived risk of getting COVID 19 and living with people aged 65 years and above) were assessed using a structured questionnaire developed for this purpose. Information about known risk factors for a complicated course of illnesses, mainly chronic medical conditions (hypertension, diabetes, asthma, TB, physical frailty, over or underweight) and older age was also assessed at the participant and household level. Vaccine hesitancy was evaluated by asking multiple questions including if the participants have been vaccinated for COVID-19, whether they got the opportunity to be vaccinated, and whether they will be vaccinated if they got the opportunity. Participants who were considered vaccine hesitant were those who were unvaccinated and would not be willing to take the COVID 19 vaccine if presented with the opportunity. These participants these were asked further questions on their reason for hesitancy.

Data collection procedures

Data was collected through telephone (mobile phone) interviews. Potential participants were randomly selected from the population of individuals with mobile phones registered centrally with the Federal or the regional authorities. For Ethical reasons no identifier information other than phone numbers that are accessible to the general public were obtained.

The questionnaire was implemented using an electronic data capture platform. Data collectors were recruited and trained on all the instruments and Good Clinical Practice (GCP) before starting data collection. The survey procedures and tools were pre-tested with 50 interviews for utility, feasibility, and acceptability.

Data processing and analysis

Data was entered using Open Data Kit (ODK) software and exported into STATA 14.0 for data cleaning, coding, and further analysis. Descriptive statistics was conducted using frequency and proportions. We also applied measures of central tendency. In describing participant characteristics, all the variables were disaggregated based on vaccine hesitancy.

The association between vaccine hesitancy and determinants was assessed using crude and adjusted odds ratios (OR), with 95% confidence intervals (95% CI). From the bivariate analysis, all variables with a likelihood ratio p-value < 0.25 were included in the multivariable analysis. For the multivariable analysis, p-values $\leq$ 0.05 were considered significant. We also used Pearson's chi-square test (fisher's exact test for those with observations less than 10) to explore the distribution of household or participant level risk factors against vaccine hesitancy.

Ethical considerations

Ethical approval was obtained from the Institutional Review Board of the College of Health Sciences, Addis Ababa University, Ethiopia (Protocol no. 086/20/CDT). Verbal consent was obtained from participants once the information sheet was read to the study participants. Clarification was given based on the queries from study participants, where thereafter verbal informed consent was obtained.

Results

Socio-demographic and household characteristics of participants are summarized in **Table 1**. A total of 4180 calls were made, out of which, 1194 calls were answered (12). The remaining 2986 calls were either unavailable, unanswered or switched off. Among the answered calls, 580 were excluded because they got disconnected, refused, or hung up. Overall, we were able to call and successfully administer the questionnaires to 614 participants.

Participants were predominantly male (71.7%), married (68.2%) with a median age of 34 (IQR = 14.0) years. Most resided in an urban area (77.9%) where more than half reportedly had an average economic status (54.7%) and received at least secondary level education (91%). One-fifth of the participants were living with one or more people aged 65years and above. A little less than half (48.4%) of them stated they believe they are at risk of getting COVID 19.

Overall, 150 (24.4%) participants reported that they have received the COVID-19 vaccine. Of those who were not vaccinated, 100 (21.5%) were are not willing to take the vaccine or were vaccine hesitant. The most frequent reasons for hesitancy were lack of interest (30%) or fear of potential side-effects of the vaccine (24%) including potential infertility or death (**Table 2**).

Table 3 summarizes participants or any member of their household's having a comorbid condition that can increase the chance of getting severe COVID-19 and whether it bears any relationship with vaccine hesitancy. The results indicate that having someone in the household with chronic conditions (hypertension, diabetes or asthma), being physically frail, and being over or overweight bears no relationship with participants' willingness to get vaccinated.

Self-employed participants were more likely to be hesitant to take the COVID-19 vaccine [Adjusted odds ratio (AOR) 1.85, 95% CI (1.05-3.27)] compared to those who were government-employed. On the other hand, compared to those living in Addis Ababa, those living in the Oromia region [AOR 0.54, 95% CI (0.29-0.99)] and other regions (i.e., regions outside Amhara, SNNPR) were found to be less likely to be hesitant to take the vaccine (**Table 4**). Living with a person with any chronic medical condition that could complicate the course of COVID-19 was not associated with acceptance (p >0.25 in crude analysis; not shown in Table 4)

Table 1 Socio-demographic and household characteristics disaggregated by vaccine hesitancy (n = 614)

Characteristics	**Vaccine Hesitancy**				**Total**	
	Non-hesitant		Hesitant		n	%
Sex	N	%	N	%		
Male	374	85.0	66	15.0	440	71.7
Female	140	80.5	34	19.5	174	28.3
Age						
Less than 30years	176	85.0	31	15.0	207	33.7
30-39 years	177	83.1	36	16.9	213	34.7
40-49 years	95	80.5	23	19.5	118	19.2
50 years and above	66	86.8	10	13.2	76	12.4
Residence						
Urban	392	82.0	86	18	478	77.9
Rural	122	89.7	14	10.3	136	22.2
Region						
Addis Ababa	168	75.7	54	24.3	222	36.2
Oromia	124	86.2	20	13.9	144	23.5
Amhara	122	87.8	17	12.2	139	22.6
SNNPR	60	90.9	6	9.1	66	10.8
Others	40	93.0	3	7.0	43	7.0
Level of education						
Primary school or less	50	90.9	5	9.1	55	9.0
Secondary school	108	87.1	16	12.9	124	20.2
Certificate	125	84.5	23	15.5	148	24.1
College/University	231	80.5	56	19.5	287	46.7
Occupation						
Farming/ Pastoralist	53	94.6	3	5.4	56	9.1
Self-employed/daily laborer	204	78.5	56	21.5	260	42.4
Government employee/ pensioner	153	86	25	14.0	178	29.0
Housewife/Homemaker	24	80	6	20	30	4.9
Unemployed	40	88.9	5	11.2	45	7.3
Other	40	88.9	5	11.1	45	7.33
Marital status						
Single	142	82.6	30	17.4	172	28.0
Married	352	84.0	67	16.0	419	68.2
Divorced or widowed	20	87.0	3	13.0	23	3.8
Economic status						
Very low	44	83.0	9	17.0	53	8.6
Low	191	84.9	34	15.1	225	36.6
Average	279	82.9	57	17.0	334	54.4
High	2	100	0	0	2	0.3
Living with people aged ≥65						
No	404	82.3	87	17.7	491	80.0
Yes	110	89.4	13	10.6	123	20.0
Perceived risk						
No	268	84.5	49	15.5	317	51.6
Yes	246	82.8	51	17.2	297	48.4

Table 2: COVID-19 vaccine hesitancy of participants (n = 614)

Variable name	Status	n, %	Proportion (95% CI)
Vaccination (n=614)	No	464	75.6 (72.0-78.8)
	Yes	150	24.4 (21.2- 28.0)
Dose received (n=150)	First	57	38 (30.5-46.1)
	Second	19	12.7(8.2- 19.1)
	Both	74	49.3(41.3-57.4)
Vaccine Hesitancy (n=614)	No	514	83.7(80.6-86.4)
	Yes	100	16.3(13.6-19.4)
Reason for hesitancy (n=100)	Lack of trust in the vaccine	13	13 (7.6-21.3)
	No interest	30	30 (21.7-39.8)
	Fear of side-effects	24	24(16.5-33.5)
	Religious or other beliefs	4	4(1.5-10.3)
	Not willing to dis-close	17	17 (10.8-25.8)
	No reason or unde-cided	12	12(6.9-20.1)

Table 3: Household-level risk factor for COVID-19 disaggregated based on vaccine hesitancy (n = 614)

Characteristics		**Participants**		**Vaccination**				**Chi-square**	**P value**
		N	**%**	Non-hesitant/ vaccinated		Hesitant			
				N	%	N	%		
Hypertension	No	542	88.3	451	83.2	91	16.8	0.86	0.35
	Yes	72	11.7	63	87.5	9	12.5		
Diabetes	No	564	91.9	470	83.3	94	16.7	0.73	0.39
	Yes	50	8.1	44	98.0	6	12.0		
Asthma	No	566	92.2	475	83.9	91	16.1	0.23	0.63
	Yes	48	7.8	39	81.3	9	18.8		
Physically frail	No	604	98.4	505	83.6	99	16.4		1.00*
	Yes	10	1.6	9	90	1	10.0		
Underweight	No	602	98.1	502	83.4	100	16.6		0.23*
	Yes	12	2.0	12	100	0	0		
Overweight/ obese	No	598	97.4	97	83.8	501	16.2		0.73*
-	Yes	16	2.6	3	81.3	13	18.8		
Household risk of COVID-19	No	466	75.9	79	83.0	387	17.0	0.63	0.43
	Yes	148	24.1	21	85.8	127	14.2		

* *P* values *based on* Fisher's exact test)

Table 4: Factors associated with COVID vaccine hesitancy

Characteristics	Crudes Odds ratio (95% CI)	Adjusted Odds ratio (95% CI)	P-Value
Level of Education			
Primary school or less	1	1	
Secondary school	1.48(0.51-4.27)	1.51(0.50-4.57)	0.47
Certificate	1.84(0.66-5.11)	1.50(0.51-4.46)	0.46
College/University	2.42(0.92-6.36)	2.34(0.81-6.74)	0.11
Gender			
Male	1	1	
Female	1.37(0.87-2.17)	1.32(0.79-2.22)	0.29
Residence			
Urban	1	1	
Rural	0.52(0.29-0.95)	0.99(0.48-2.01)	0.97
Occupation			
Farming/ Pastoralist	0.35(0.10-1.19)	0.69(0.17-2.81)	0.60
Self-employed/daily laborer	1.68(1.00-2.81)	1.85(1.05-3.27)	0.03
Government employee and pensioner	1	1	
Housewife/Homemaker	1.53(0.57-4.11)	1.47(0.49-4.46)	0.49
Unemployed	0.77(0.28-2.12)	0.87(0.29-2.54)	0.80
Other	0.77(0.28-2.12)	0.34(0.28-2.80)	0.97
Region			
Addis Ababa	1	1	
Oromia	0.50(0.29-0.88)	0.54(0.29-0.99)	0.05
Amhara	0.43(0.24-0.78)	0.53(0.27-1.02)	0.06
SNNPR	0.32 (0.13-0.76)	0.40 (0.15-1.04)	0.06
Others*	0.24(0.07-0.78)	0.25(0.07-0.88)	0.03
Living with a person 65years of age and older			
No	1.82(0.98-3.39)	1.59(0.83-3.04)	0.16
Yes	1	1	
Control Measures			
No	3.1(1.27-7.61)	4.0(1.5-10.50)	0.005
Yes	1	1	

*other regions include; Diredawa = 8(1.3%), Tigray = 1(0.2%), Somali= 4(0.7%), Afar= 7(1.1%), Benishangul= 6(1.0%), Gambella= 2(0.3%), Harari=4(0.7%), Sidama= 11 (1.8%)

Discussion

In this study that aimed to assess the level of COVID-19 vaccine hesitancy and the underlying determinants in Ethiopia, COVID-19 vaccine hesitancy was relatively low at 16.3%. Thus, the proportion who expressed vaccine hesitancy are much smaller than those who may be considered vaccine accepting. This is an encouraging result considering the fact that 60–75% of the population needs to be vaccinated to halt the forward transmission and community spread of the virus (6). This also demonstrates the need to direct vaccination campaigns towards converting positive intentions into uptake. Dissemination of reliable information about the effectiveness and safety of the vaccine is equally important to address the knowledge gap in the community (13). This must be coupled with improving access opportunities to vaccination.

Our finding of low vaccine hesitancy was consistent with studies from some low- and middle-income countries (LMICs) that reported an average hesitancy rate of (19.7%) (13). A systematic review that compared COVID-19 vaccine acceptance rate in over 33 countries reported the lowest vaccine hesitancy at < 10% and the highest at > 40% (6). The reason for low vaccine hesitancy in LMICs may be because of the lived experience of people in these countries where many vaccine-preventable infectious diseases are still causing millions of deaths annually, which is likely to result in a higher perceived need for or value of vaccines (14). On the other hand, the nature of the study is such that people who are more likely to have positive attitude towards the vaccine may have participated. This would underestimate the level of vaccine hesitancy.

Reasons for hesitancy were mostly related to fear of vaccine side effects and lack of interest to take the vaccine. Some mentioned lack of trust and religious or traditional beliefs. Fear of side effects seems a common reason for vaccine hesitancy. For example, an online survey conducted in the US reported fear of side effects and lack of trust as the main reasons for vaccine hesitancy (15). Other studies conducted in Ethiopia also mentioned fear of safety and side effects as one of the main reasons for hesitancy (9, 16). These reasons may be amenable to awareness campaigns and modelling. Further exploration of those that stated "no interest" as a reason for not accepting vaccines is also required to support development of more robust evidence for intervention.

One of the factors influencing vaccine hesitancy was region of residence, with nearly 25% of those living in Addis Ababa expressing vaccine hesitancy with 13% or less from other regions expressing similar sentiment. This is in line with a previous study, which reported that one in five people residing in Addis Ababa were not willing to be vaccinated (9). This should be of major concern Since Addis Ababa is the epicentre of the COVID-19 pandemic and an international hub that could serve as a 'reservoir' for infection and transmission. Moreover, the relatively higher exposure of persons living in bigger cities to diverse social media information (some of which could be misleading and anti-vaccine) could have sensitized residents in these high-risk areas against the vaccine (8, 9, 17). Another predictor of vaccine hesitancy was occupation, where self-employed participants were found to be more likely to be vaccine hesitant. This is counter-intuitive since one would expect those who are self-employed would want to get vaccinated to avoid loss of productivity due to sick days. However, self-employed people may have less structured day, and limited time to access vaccine, to obtain information or to 'be sick' if they become sick from side effects.

We would like to acknowledge some of the limitations of our study. The study was based on a mobile phone survey, which might have impacted the reliability and representativeness of the data. Only people with mobile phones and those having mobile networks were able to participate in the study. The low proportion of rural respondents in the dataset is an important indicator of the generalisability gap. Secondly, self-reports may be influenced by a recall and social desirability bias. However, the findings are consistent with our findings from Ethiopia and elsewhere, supporting the value and robustness of the information collected. Qualitative approach may have allowed exploration of vaccine hesitancy, particularly the reasons, in a more nuanced way.

Conclusion

The findings show a relatively low rate of COVID-19 vaccine hesitancy among the Ethiopian population. Major drivers of hesitancy were lack of interest, fear of side-effects, and lack of trust in the vaccine that should be reversed by disseminating accurate and timely information using credible sources and across communities. Replication of the findings and larger scale studies are required. If the findings are taken at face value, ensuring access to vaccines is the primary challenge at present.

Abbreviation

Corona Virus Disease 2019 (COVID-19), World Health Organization (WHO), Health Care Workers (HCW), Good Clinical Practice (GCP), Open Data Kit (ODK), low- and middle-income countries (LMICs)

Declaration

Ethics approval and consent to participate:
The study was approved by the Institutional Review Board of the College of Health Sciences, Addis Ababa University (Protocol no. 086/20/CDT). Data collectors were trained in Good Clinical Practice and phone interviews were conducted after informed verbal consent was obtained. The data were kept confidentially and used for the purpose of the study only.

Consent for publication
Not applicable

Availability of data and material
The datasets supporting the conclusions of this article are included within the article and its additional files. Any additional material can be obtained upon reasonable request.

Competing interests
The authors declare that they have no competing interests.

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Authors' contributions

AF, YW and TM conceived and designed the study. ST and AF performed the data analysis and interpretation of the findings. ST drafted the manuscript. HN, BF, MS, EG, WB, AW and TE contributed contents to include into the draft. AF, TM, CH and YW critically reviewed the manuscript. All authors read and approved the final manuscript.

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Supplementary Material

None

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