








Health-care Workers' Willingness to Pay for COVID-19 Vaccines in Eastern Ethiopia: Using Contingent Valuation Method

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Background: Health-care workers (HCWs) are among the highest risk groups for COVID-19 infection. The vaccine is found to be vital for HCWs, their household contacts, and their patients to protect against COVID-19 infection and maintain the safety of health systems. The actual willingness to pay for COVID-19 vaccination and associated factors remain uncertain among health-care workers in Ethiopia. Therefore, studying health-care workers' willingness to pay (WTP) for COVID-19 vaccination helps to have an insight on valuation of the vaccine.

Methods: Institution-based cross-sectional study was conducted among 403 randomly selected health-care workers working in health facilities in eastern Ethiopia from February 3 to March 20, 2021. Pretested structured questionnaire was used to collect data. Binary logistic regression analysis was fitted to test the associations between outcome and explanatory variables. A p-value of <0.05 with 95% confidence interval was used to declare statistical significance.

Results: The magnitude of willingness to pay for a COVID-19 vaccine was 42.8%. The median amounts of money respondents willing to pay was 400 ETB (US\$ 10.04). Sex (male, AOR = 2.33; 95% CI: 1.39, 3.93), monthly income (>7000 ETB, AOR = 1.22; 95% CI: 1.11, 2.51), affordability (AOR = 1.99; 95% CI: 1.18, 3.35), fear of side effects (AOR = 3.75; 95% CI: 2.13, 6.60), support vaccinations (AOR = 2.97; 95% CI: 1.65, 5.35), the likelihood of getting COVID-19 infection (AOR = 2.11; 95% CI: 1.26, 3.52) were independent determinants of WTP for a COVID-19 vaccine.

Conclusion: Health-care workers' willingness to pay for COVID-19 vaccination was found to be low. Detailed health education and training about COVID-19 vaccines are required regarding their side effects, and efficacy to make an informed decision to enhance the willingness to pay for the vaccine. Moreover, the government should consider providing COVID vaccines free of charge for low-income groups and at an affordable price for those who could pay.

Keywords: COVID-19, vaccine, health workers, willingness to pay, Ethiopia

Introduction

Coronavirus disease 2019 (COVID-19) epidemic started from Wuhan city of China towards the end of December 2019 and since then spread rapidly to all the countries of the world.¹ It causes a range of human respiratory tract infections varying from mild cold to severe respiratory distress syndrome.² COVID-19 pandemic has continued causing severe diseases and economic burdens around the world.³ Among many others, health-care workers (HCW) face an infectious outbreak in the front line by exposing themselves to a substantial risk of contracting the infection and developing mental health problems.^{4,5} The increased susceptibility, morbidity, and mortality among the healthcare workers have further worsened the already strained health system, and consequently, worsened the fight against the pandemic.^{6,7}

Several public health measures have been tried in the fight against the disease, including the promotion of universal precaution, drugs and vaccinations.^{4,8-10} Ethiopia introduced COVID-19 vaccination on March 13, 2021, and several vaccines (e.g. Johnson & Johnson, AstraZeneca, Pfizer, Sinopharm, Sinovac) have been made available.¹¹ As of April 10, 2022, a total of 29,411,822 vaccine doses have been administered in Ethiopia which is <10% of the total population.¹² A narrative review mapping global COVID-19 vaccine acceptance rates indicated low vaccine acceptance rates (48.4%) among health-care workers in Ethiopia compared with other African countries, and high acceptance rate (92%) among general population in Ethiopia.¹³

The vaccine is vital for HCWs, their household contacts, and their patients to protect against COVID-19 infection and maintain the safety of health systems.¹⁴ Studies have consistently shown that health-care workers offer guidance on vaccine recommendations and help combat misinformation, confusion, and ignorance about the risks and benefits of vaccination to the public.¹⁵ However, absolute HCW support for vaccines should not be taken for granted. A recent study conducted in France found that 43% of health practitioners did not recommend vaccines to key demographic groups, and carried strong perceptions of vaccine risk based on decades-old societal controversies.¹⁶ Acceptance and willingness to pay for COVID-19 vaccines can be affected by factors such as vaccine effectiveness, safety and side effects.¹⁷ Sex, age, level of education and adherence to safety measures are associated with willingness to vaccinate.¹⁸

Willingness to pay (WTP) is an indicator of the monetary value that people would consider paying for a product or service.¹⁹ In the current context this term refers to the amount of money a person is ready to pay in exchange for COVID-19 vaccinations to avoid losses or reduce health risks for themselves and their contacts.²⁰ Willingness to pay is related to vaccine characteristics such as vaccine's effectiveness and side effects, and socio-demographic factors such as sex, marital status, religion, education, employment status, income, or ability to pay.²¹ To estimate the WTP, the contingent valuation approach was adopted. This method has been used to estimate WTP for many hypothetical vaccines such as against dengue,²²⁻²⁴ Zika,^{25,26} HIV,²⁷ rabies,²⁸ and COVID-19.²⁹

Evidence regarding the willingness to pay for COVID-19 vaccines among HCWs has paramount importance to ensure its acceptance and valuing that in turn result in positive outcomes for the largest community acceptance and willingness to pay. Therefore, the study assessed health-care workers' willingness to pay (WTP) for COVID-19 vaccination in eastern Ethiopia. Moreover, the study estimated the average amount of money health-care workers will be willing to pay for the vaccine. This may form the basis for projecting subsidization of the vaccine to ensure universal access.

Methods

Study Design, Period, and Settings

Institution-based cross-sectional study was conducted among health-care workers in Harari region public health facilities, Eastern Ethiopia from February 3 to March 20, 2021. Harar, the capital of Harari region is located 526 km away from Addis Ababa to the east. There are five hospitals (four public and one private), eight health centers, and 20 health posts in the region providing services to more than 5.2 million people around Harar and neighboring regions such as Dire Dawa administrative council, Oromia, and Somali regions.

Populations

In this study, the source populations were all health-care professionals working in Harari region public health facilities. The study population was all health-care professionals working at selected hospitals and health centers. All health-care professionals who are working in Harari region were included.

Sample Size and Sampling Procedure

Sample size was calculated by using single population proportion formula assuming $p = 0.5$, since there is no prior study done in the study area, $q = (1-p)$, critical value at 95% confidence limit (z) = 1.96, margin of error (d) = 0.05, sample size (n) = $(z_{\alpha/2})^2 pq/d^2 = (1.96)^2 (0.5) (0.5) / (0.05)^2$, $n = 384$. By considering 5% non-response rate, the final sample was calculated to be 403. Out of four public hospitals and 8 health centers found in the region, 2 public hospitals and 5 health centers were selected using a lottery method. Then, based on the number of health-care workers (HCWs) in the selected

health facilities, the total calculated sample size was proportionally allocated to each facility. Then the samples were selected from the list of health-care workers in the respective facility using simple random sampling.

Variables in the Study

The dependent variable of the study was willingness to pay for COVID-19 vaccination. Before asking about willingness to pay for COVID-19 vaccine, each participant was presented with a detailed standard COVID-19 vaccine scenario after consenting. The real amount of premium that they were willing to pay for COVID-19 vaccine was assessed using Double Bounded Dichotomous Choice Variant scenario on the contingent valuation method.

Explanatory Variables

The explanatory variables were socio-demographic characteristics (age, sex, marital status, educational status, monthly income, type of profession, family size), self-reported health status, existence of chronic disease, fear of side effects of the COVID-19 vaccine, concern about vaccine efficacy, support vaccine, affordability of the vaccine.

Data Collection Procedures

Data were collected using self-administered questionnaire. A pretest was conducted on 40 health-care workers from unselected health facilities to validate the questionnaire. Ten graduating class students participated in the data collection, while five public health professionals were involved as supervisors. Two days training was provided for both data collectors and supervisors mainly on how to approach the study participants, the objectives and relevance of the study. The questionnaires were prepared in English language. On average each interview took 20 minutes. No incentives were used to promote participation.

Eliciting Willingness to Pay

This study estimated WTP using contingent valuation methods. Contingent valuation is a survey-based economic technique for the valuation of non-market resources, typically the survey asks how much money people would be willing to pay (or willing to accept) to get the proposed services.³⁰ The respondents were told about a hypothetical COVID-19 vaccine with typical attributes based on common features of a vaccine. The question was:

suppose that a vaccine for COVID-19 was developed that assured 95% effective in a year. Suppose that there are no adverse effects. The bid vector (initial bid = 400 ETB) was obtained from a pretest study of 40 individuals who expressed their WTP for a vaccine in an open-ended format. Would you be willing to pay 400 ETB for getting vaccinated?

If the respondent replied “yes” to this question, after that, similar questions with the price of 800 ETB, then 1600 ETB were asked. If the respondent answered “no” to the initial question (400 ETB), they were asked the same question with a price at 200 ETB, then 100 ETB. A participant who refused to pay at the lowest bid (i.e. 100 ETB) was considered not willing to pay. We used double-bound dichotomous choice and bidding game approach to elicit WTP amount for COVID-19.

Statistical Analysis

The data were entered using EpiData version 3.1 and exported to SPSS 24.0 for analysis. Descriptive statistics were presented using percentages, mean and standard deviations. Variables with a p-value of <0.25 in the bivariable analysis were entered into the multivariable analysis. Both crude odds ratio (COR) and adjusted odds ratios (AOR) with a 95% confidence interval were estimated to show the strength of associations. Finally, a p-value of <0.05 in the multivariable logistic regression analysis was used to identify factors significantly associated with the willingness to pay for COVID-19 vaccine.

Ethical Statement

An ethical clearance was received from Haramaya University College of Health and Medical Sciences Institutional Health Research Ethical Review Committee (IHERC). Informed, voluntary, written, and signed consent was obtained

from each study participants before commencing the study. No personal identifier information was collected and confidentiality of the information obtained from the respondents was assured. Data were collected under strict adherence to WHO recommended COVID-19 prevention standards for all data collectors, supervisors, and study participants. This study complies with the Declaration of Helsinki.

Results

Socio-Demographic Characteristics of the Study Participants

From a total of 403 approached health-care workers, 348 (86.3% response rate) completed the questionnaire. More than half (54.6%) of them were males. The mean age of the respondents was 29.4 ± 6.8 , majority (43.1%) were in the age group of 26–30 years. Majority of the respondents (56.6%) have work experiences of less than or equal to five years. Two out five respondents had monthly income of 7000 ETB (Ethiopian birr) (see Table 1).

Table 1 Socio-Demographic Characteristics of Study Participants, Ethiopia, 2021 (n = 348)

Variables	Frequency	Percent
Sex		
Female	158	45.4
Male	190	54.6
Family size		
≥4 members	149	42.8
<4 members	199	57.2
Age in years		
20–25 years	106	30.46
26–30 years	150	43.1
31–60 years	92	26.43
Mean = 29.4 ± 6.85		
Experience in years		
≤5 years	197	56.6
>5 years	151	43.4
Marital status		
Married	189	54.3
Single	141	40.5
Divorced/separated	18	5.17
Monthly income		
2000–4999 Birr	77	22.1
5000–6999 Birr	119	34.2
>7000 Birr	150	43.1
Type of profession		
Nurse	132	37.93
Midwifery	77	22.13
Physician	44	12.64
Medical Laboratory	48	13.79
Environmental Health	4	1.15
Pharmacy	33	9.48
Other*	10	2.87

Notes: *Health officer, psychologist, dentist, anesthetist.

Perceptions About COVID-19 Vaccine

The majority (63.5%) of the health-care workers supported the COVID-19 vaccine. More than half (54.6%) of the respondents reported that the vaccine is not affordable in terms of its price. About 52.9% and 56% of the respondents have a concern on the side effects and its efficacy, respectively (see Table 2).

Willingness to Pay for COVID-19 Vaccine

Altogether 149 (42.8%) of participants showed WTP for a COVID-19 vaccine (95% CI: 37.68%, 48.1%). The median amounts of money respondents were willing to pay were 400 ETB (US\$10.04, using the average exchange rate between February 3 and March 20, 2021). Of the 149 respondents willing to pay, 63 (42.28%) were willing to pay the initial bid amount of 400 ETB. Of these, 14 (9.4%) participants who were willing to pay the initial bid were also willing to pay the first higher bid of 800 ETB, and 15 (10.1%) who were willing to pay the first higher bid were also willing to pay the second higher bid of 1600 ETB. Of total respondents who were not willing to pay the initial bid, 35 (23.49%) were willing to pay the first lower bid of 200 ETB, 51 (34.22%) who were not willing to pay the first lower bid were willing to pay 100 ETB.

Determinants of WTP for COVID-19 Vaccines

In multivariable analysis sex, monthly income, affordability, fear of side effects, support vaccinations, perceived chance of getting COVID-19 infection were independent determinants of WTP for COVID-19 vaccine.

The odds of willingness to pay for a COVID vaccine was 2.33 times higher among males compared with female respondents (AOR = 2.33; 95% CI: 1.39, 3.93). The odds of willingness to pay for a COVID vaccine was 1.22 times higher among respondents whose monthly income were >7000 ETB compared with those whose monthly incomes were 2000–4999 ETB (AOR = 1.22; 95% CI: 1.11, 2.51). The odds of willingness to pay for a COVID vaccine was 1.99 times

Table 2 Vaccine-Related Factors for Willingness to Pay for COVID-19 Vaccine, February, 2021, Harar, Ethiopia (n=348)

Variables	Frequency	Percent
Support vaccine		
Do not support	127	36.5
Support	221	63.5
Affordability of COVID-19 vaccine		
Not affordable	190	54.6
Affordable	158	45.4
Fear of side effect of COVID-19 vaccine		
Yes	184	52.9
No	164	47.1
Concern on efficacy of COVID-19 vaccine		
Yes	195	56
No	153	44
Self-reported health status		
Good	169	48.56
Fair	157	45.11
Poor	22	6.32
Pre-existing chronic illnesses		
Yes	55	15.80
No	293	84.20

higher among respondents who perceive the vaccine as affordable compared with those who perceive the vaccine as unaffordable (AOR = 1.99; 95% CI: 1.18, 3.35).

The odds of willingness to pay for a COVID vaccine was 3.75 times higher among respondents who did not fear side effects of the vaccine compared with those who feared side effects of the vaccine (AOR = 3.75; 95% CI: 2.13, 6.60). The odds of willingness to pay for a COVID vaccine was 2.97 times higher among respondents who support the vaccine compared with those who did not support the vaccine (AOR = 2.97; 95% CI: 1.65, 5.35). The odds of willingness to pay for a COVID vaccine was 2.11 times higher among respondents whose self-reported chance of getting COVID-19 infection was “likely” compared with those whose self-reported chance of getting COVID-19 infection was “unlikely” (AOR = 2.11; 95% CI: 1.26, 3.52) (Table 3).

Discussion

More than two-fifths (42.8%) of the health-care workers were willing to pay for a COVID-19 vaccine. This finding is in the range of results from eight surveys conducted among health-care workers (doctors and nurses) with vaccine acceptance rates ranging from 27.7% in the Democratic Republic of the Congo to 78.1% in Israel.³¹ Contrary to the expectation of high acceptance rate and willingness to pay among health-care workers, this study disclosed a significantly low figure which calls for health-care authorities to increase the COVID-19 vaccine acceptance by health-care workers.

The median amounts of money respondents were willing to pay were 400 ETB (US\$10.04 by average exchange rate between February 3 and March 20, 2021). Similar studies estimated significantly higher WTP values. For example, the mean WTP for a COVID-19 vaccine was US\$57.2 and US\$30.66 in Indonesia and Malaysia, respectively.^{32,33} A study from Kenya also showed higher values of willingness to pay with estimates of individuals’ mean WTP for the vaccine ranging from USD 49.81 to USD 68.25 (depending on vaccine characteristics).³⁴ This discrepancy may be attributed to the fact that the average income of health-care workers in Ethiopia is relatively low.

Our findings depict that male HCWs were more willing to pay for the vaccine compared with the female respondents. In line with this finding study evidence from other countries suggested that female respondents were less willing to accept COVID-19 vaccines.^{35–38} In spite of their crucial role regarding childhood vaccination it is unclear why female health-care workers are less willing to pay for the vaccine. Affordability of the vaccine was also found to be significantly associated with willingness to pay for COVID-19 vaccines. Health-care workers who perceived the COVID-19 vaccine as affordable were more likely to pay for the vaccine. This means that a higher price will reduce individuals’ willingness to pay and demand for a vaccine.

Income was found to be an independent determinant of willingness to pay for COVID-19 vaccines. Health-care workers with a higher income were more likely to pay for a vaccine. Other studies from Chile and Kenya support our finding.^{29,34,39} The demand for health-care service in preventive and non-threatening condition is income sensitive, and the demand and willingness to pay for vaccine is directly related to the income level. This implies that the government should consider providing the vaccine free of charge for low-income groups and allow those with higher incomes to acquire the vaccine through the private sector by paying.

Fear of the vaccine side effects were found to be significantly associated with willingness to pay for the vaccine. The higher the perceived risk of vaccine-associated adverse effects, the lower the demand for vaccination is. Studies revealed that vaccine-related factors such as vaccine effectiveness, safety and side effects were identified as determinants for acceptance of and willingness to pay for vaccines.^{17,39,40} This implies the need to give detailed information regarding vaccine safety and inviting witnesses who had previously experienced COVID-19 vaccinations to give reassurance to those with fear of side effects.

Respondents who supported the vaccine were more willing to pay for COVID-19 vaccines. Previously conducted studies revealed that it is commonly observed at different times that some individuals might be misinformed about the vaccines and may protest the vaccine-based interventions.^{41,42} This implies that those who do not consider the vaccine to be important will not get vaccinated and they will be less willing to pay for the vaccine. Therefore, the health-care workers should be provided with detailed information about the importance and protective capacity of COVID-19 vaccines.

Table 3 Determinants of WTP for COVID 19 Vaccine Among Health-Care Workers in Harari Region Public Health Facilities, Eastern Ethiopia, 2021

Variables	WTP		COR (95% CI)	AOR (95% CI)
	No	Yes		
Sex				
Female	108	50	Ref	Ref
Male	91	99	2.35 (1.51, 3.65)**	2.33 (1.39, 3.93)*
Family size				
≥4 members	87	62	Ref	Ref
<4 members	112	87	0.92 (0.59, 1.41)	0.97 (0.58, 1.63)
Age in years				
20–25 years	68	38	Ref	Ref
26–30 years	85	65	1.37 (0.82, 2.28)	0.83 (0.42, 1.62)
31–60 years	46	46	1.79 (1.01, 3.16)*	1.01 (0.41, 2.47)
Experience in years				
≤5 years	115	82	Ref	Ref
>5 years	84	67	1.12 (0.73, 1.72)	1.35 (0.71, 2.55)
Marital status				
Married	96	93	Ref	Ref
Single	91	50	0.57 (0.36, 0.89)*	1.10 (0.32, 3.75)
Divorced/separated	12	6	0.52 (0.18, 1.43)	0.54 (0.14, 1.99)
Monthly income				
2000–4999 Birr	51	26	Ref	Ref
5000–6999 Birr	75	44	1.15 (0.63, 2.10)	0.61 (0.29, 1.26)
>7000 Birr	72	78	2.12 (1.20, 3.76)*	1.22 (1.11, 2.51)*
Affordability				
Not affordable	129	61	Ref	Ref
Affordable	70	88	2.66 (1.72, 4.12)**	1.99 (1.18, 3.35)*
Fear of side effect				
Yes	120	64	Ref	Ref
No	79	85	2.17 (1.31, 3.10)**	3.75 (2.13, 6.60)**
Concern on efficacy				
Yes	104	91	Ref	Ref
No	95	58	0.70 (0.45, 1.07)	0.61 (0.35, 1.05)
Support vaccine				
Do not support	94	33	Ref	Ref
Support	105	116	3.15 (1.95, 5.07)**	2.97 (1.65, 5.35)**
Probability of getting COVID-19				
Unlikely	120	61	Ref	Ref
Likely	79	88	2.19 (1.42, 3.38)**	2.11 (1.26, 3.52)*
Existing chronic illness				
No	172	121	Ref	Ref
Yes	27	28	1.47 (0.83, 2.62)	1.32 (0.66, 2.64)

Notes: * significant at p-value<0.05, ** significant at p-value <0.001.

Perceived probability of getting COVID-19 infection was found to be an independent determinant of HCWs' willingness to pay for COVID-19 vaccines. Health-care workers who reported their probability of getting COVID-19 infection as "likely" were more willing to pay for COVID-19 vaccines. This finding is in line with studies from Malaysia

and Indonesia that individuals' risk perception influences their acceptance and willingness to pay for vaccines.^{43,44} The Health Belief model proposes that the decision to vaccinate is a function of perceived susceptibility to and severity of disease as well as concern about vaccine benefits and risks.^{17,45}

Lack of generalizability to the general population should also be noted since the study was institution-based and focused on a specific population. Furthermore, though a contingency valuation method is widely used to assess WTP, some authors hypothesize that biases can be introduced by the respondent's lack of understanding of the contingent market.⁴⁶ Moreover, establishing causal relationship between outcome and response variables may not be possible due to the cross-sectional nature of the study. Therefore, the findings of this study should be interpreted in light of the above-mentioned limitations.

Conclusions

Health-care workers' willingness to pay for COVID-19 vaccination was found to be low. The median willingness to pay of HCWs was 400 ETB (US\$10.04), considering a contingent valuation model (CVM) in double dichotomous format. Sex, income, affordability of the vaccine, fear of side effects, support for the vaccine, and perceived probability of acquiring COVID-19 infection were factors significantly associated with WTP for a COVID-19 vaccine.

Detailed health education and training about COVID-19 vaccines are required for sufficiency of information regarding their side effects, and efficacy to make informed decisions to enhance the willingness to pay for a COVID-19 vaccine. Moreover, the government should consider vaccine price subsidies in order to attain adequately high vaccination coverage.

Data Sharing Statement

Data that support the findings are available from the corresponding author on reasonable request.

Acknowledgments

The authors would like to thank Haramaya University College of Health and Medical Sciences for providing the opportunity to conduct this study and for intellectual and technical support throughout the work. We are also grateful to study participants, data collectors, and supervisors who were involved in the survey.

Author Contributions

All authors contributed to conception and design of the study, acquisition of data, data analysis and interpretation, drafting and revising the manuscript, agreed on the journal to which the article would be submitted, gave their final approval for submission and the version to be published, and agreed to be accountable for all aspects of the work.

Funding

No external funding was received.

Disclosure

The authors declared that they have no conflicts of interest for this work.

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