Infection and Drug Resistance

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ORIGINAL RESEARCH

Uptake of the COVID-19 Vaccination and Associated Factors Among Health Care Providers in Addis Ababa, Ethiopia

Worku Fikadu[1], Adamu Addissie[2], Awgichew Kifle[2]

[1]Department of Public Health, Institute of Health Science, Wollega University, Nekemt, Ethiopia; [2]Department of Preventive Medicine, School of Public Health, Addis Ababa University, Addis Ababa, Ethiopia

Correspondence: Worku Fikadu, Department of Public Health, Institute of Health Science, wollega University, P.O. Box =395, Nekemt, Ethiopia, Tel +251-901658807, Email wfikadu2@gmail.com; worku.fikadu.@aau.edu.et

Background: The COVID-19 vaccine is intended to provide acquired immunity against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). As a result, 12 billion doses of the COVID-19 vaccination have been given globally as of August 1, 2022. Due to occupational exposure, health professionals obtained priority for COVID-19 vaccination. However, despite the availability of COVID-19 vaccines in countries, there is a discrepancy in the uptake of vaccine among different populations including Health-Care Providers.

Objective: Assessments of the factors associated with uptake of COVID-19 vaccination among health-care providers in Addis Ababa, Ethiopia in 2022.

Methods: From June 10 to July 10, 2022, a facility-based cross-sectional study was carried out in Addis Ababa, Ethiopia, involving 473 health-care professionals, used descriptive statistics to summarize the participant's characteristics, and multivariable logistic regression to analyze factors affecting COVID-19 vaccination uptake. P-value <0.05 was used to determine the level of significance.

Results: The response rate of the participants was 94.2%. The uptake rate of COVID-19 vaccine among health-care providers was 359 (75.8%). Vaccine uptake was positively associated with higher perceived concerns regarding COVID-19 [AOR = 7.45, (4.041–13.754)], higher monthly income, [AOR: 2.623 (1.398 −4.923)] compared those who earned lower, being married [AOR: 2.114, (1.068–4.181)] and being advanced age (36–45) years old [AOR =0.486 (0.258–0.916)] compared to 18–26 years old. However, being female professional reduced the odds of vaccine uptake [AOR = 0.486 (CI; 0.258–0.916)] in contrast of their counterpart.

Conclusion: The uptake of COVID-19 vaccine among health professionals is relatively higher than in earlier reports. However, this was not yet sufficient for the level required to achieve herd immunity. Hence, the Ministry of health should work in collaboration to address concerns about the safety and effectiveness of COVI D-19 vaccine to increase COVID-19 vaccine uptake. Moreover, Health professionals, social media, regular media outlet should strengthen health education on concerns of covid-19 infection.

Keywords: COVID-19, vaccine uptake, health center, healthcare providers, Ethiopia

Introduction

Background Review

COVID-19 is a communicable severe acute respiratory syndrome caused by SARS-COV-2 viruses, originally detected in December 2019 in Wuhan province in China. Globally, more than 579 million people have been infected, and 6.4 million have died from the virus. Similarly, in Ethiopia, 492 thousand people have been infected and 7.5 thousand have died from the virus as of August 3, 2022.[1] Even though non-pharmaceutical prevention methods have been in place, COVID-19 infection and transmission remain unchanged.[2] Hence, effective vaccines against coronavirus have been developed and approved to be used as an effective preventive method since August 23, 2021. Accordingly, 12 billion doses of vaccines had been administered globally as of August 3, 2022.[1,2] Ethiopia administered the first dose of vaccine at Yeka Kotebe

Received: 16 May 2023
Accepted: 6 July 2023
Published: 11 July 2023

hospital for HCWs to mark the beginning of vaccination on March 13, 2021.[3,4] So far, more than 52.4 million doses of COVID-19 vaccines have been administered in the country.[3]

HCWs are the most exposed segment of the population to coronavirus disease due to their occupational exposure. Furthermore, ensuring vaccination among health-care providers enhances vaccine uptake among the general population[2,5,6]. In order to develop herd immunity, high coverage of vaccination should be achieved.[7–9] However, COVID-19 vaccine uptake among health professionals is lower, as evident by studies in the United States, United Kingdom, Vietnam, and Saudi Arabia that revealed low acceptance.[10–14] A study conducted in south western Ethiopia among health-care providers showed low intention to accept the COVID vaccine.[10]

However, despite the provision of priority for HCWS, addressing all barriers to vaccine uptake among HCWs, including socio-demographic factors, occupational factors, sources of information, and vaccine hesitancy, is important for the government and policymakers.[4,8,15,16]

Previous studies in Ethiopia assessed willingness and intention to get vaccinated when vaccines are available.[16] However, this study aims to assess real-time factors associated with COVID-19 vaccine uptake among HCWs.[4,16] The findings will help to adopt healthy behaviors towards vaccine acceptance and provide insight for decision-makers and programmers.

Statement of the Problem

Vaccination is critical to tackling the spread of coronavirus disease. However, herd immunity is only achieved if the coverage is sufficiently high.[7–9,14,17] However, despite the availability of vaccines, the acceptance rate among health-care workers is not the same.[10,12,13] A study conducted in Jordan found that the public's acceptance of the COVID-19 vaccine was only slightly above average.[7] Different studies conducted in various countries revealed vaccine hesitancy is the major factor in low vaccine acceptance, as has been proven in HPV vaccine and flu vaccine acceptance.[9,18] Most countries reported that less than half of the target population received the vaccine. Hence, vaccine hesitancy remained pervasive in the general public and among health-care providers across the world.[5,10,19] As a result, public health authorities must take systematic measures to lower vaccine hesitancy levels and increase vaccine acceptance.[13,20] Even though health-care providers are the most vulnerable segments of the population, they have low acceptance of the COVID-19 vaccine, as shown by studies conducted in the United States, the United Kingdom, Vietnam, and Saudi Arabia.[6,21–23] A further study conducted in south-western Ethiopia among health professionals revealed low intention to accept the COVID vaccine. Health professionals should be given priority due to the high risk of exposure and as an example for the general population; therefore, it is crucial to take into account HCW attitudes towards the COVID-19 vaccine.[7,16,24] Addressing barriers to vaccine uptake among health-care workers is crucial for the government and policymakers, as patients rely on health-care workers as sources of information and behavior. Low vaccine uptake is often due to misunderstandings and false beliefs about vaccine effectiveness.[4] This study aims to assess real-time factors associated with COVID-19 vaccine uptake among health-care workers, which may vary after the program is established.

Methods

Study Setting and Period

The study area is located in Addis Ababa, the capital of Ethiopia, which has eleven sub-cities and has been estimated to have 2,739,551 residents as of the 2007 census. According to data from the Addis Ababa Health Bureau, the Addis Ababa City Administration has 6 hospitals and 101 public health centers. The city administration has 13,541 total different including 575 physicians, 1034 pharmacists, 4829 Nurses, 2273 health officers, 983 laboratory technicians, 1125 midwifery, 181 HIT, 56 psychiatrist and 2489 other professionals according to the information found from Addis Ababa Health Bureau. The data was collected from June 10, 2022 to July 10, 2022. The study was conducted in four sub-cities randomly chosen based on lottery methods. Addis-Ketema, Gullele, Lideta, and Yeka are the selected sub-cities. There are 42 health centers in total, with 10, 10, 8, and 14 health centers in each sub-city, correspondingly.

Study Design

Facility-based cross-sectional study was conducted to assess uptake of COVID-19 vaccine and associated factors among health-care providers in Addis Ababa.

Source Population

Health professionals who were full-time employees in public health centers located in Addis Ababa city administration.

Study Population

The study population for health facility-based survey was all clinicians who provide direct or indirect care to patients from chosen health facilities.

Study Objectives

This study had two specific objectives. The first objective was to determine the level of uptake of COVID-19 vaccine among health-care providers in Addis Ababa and the second objective was to identify factors associated with uptake of COVID-19 vaccine among health-care providers in Addis Ababa.

Sample Size Determination

Sample size was determined using two population proportions formula, Using 58 proportion of vaccine uptake level from the online study conducted among health care in Ethiopia.[25]

Using the prevalence of uptake among those who perceived not healthy family = 21.3% and prevalence of uptake among those who perceived healthy family = 78.7%

$$n = \frac{\left((za/2 + zB)^2 * (p1q1 + p2q2)\right)^2}{(p2 - p1)^2} = 324 * DEF(1.5) = 486$$

The final sample would consist of 512 participants who were chosen by simple random sampling after adding a 5% non-response rate. A total of 21 health centers, representing 50% of the 42 health centers in the four sub-cities of Gualle, Lideta, Addis-Ketema, and Yeka, were chosen by multi-stage sampling.

Sampling Technique

Multistage sampling method was used to select candidate health facilities and a simple random sampling technique was employed to select health-care providers' the final study unit.

Sampling Procedure

Four sub-cities were randomly chosen using the lottery method from a total of 11 sub-cities in Addis Ababa for this study, and they were Gulalle, Lideta, Addis-Kete ma, and Yeka. These sub-cities had a combined 42 health centers. According to the AACRHB, each health center was anticipated to provide care for about 100,000 persons within its designated catchment area. Then, from among these 42 health centers, half were chosen at random; as a result, 21 health centers were chosen through a lottery system. The sample size was allocated proportional to each sub-city, then to the respective health facility proportionally. Within each health center, health professionals included in the study were; Doctors, Midwives, Nurses, Laboratory technicians, Health officers, Pharmaceutical professionals, psychiatrist, midwives and the sample size allocated to the facilities were randomly selected from the list found from human resources of respective health centers (Figure 1).

Inclusion and Exclusion Criteria

Health-care workers who were greater than 18 years of age and who worked for six or more months in public health centers before study commenced were included.

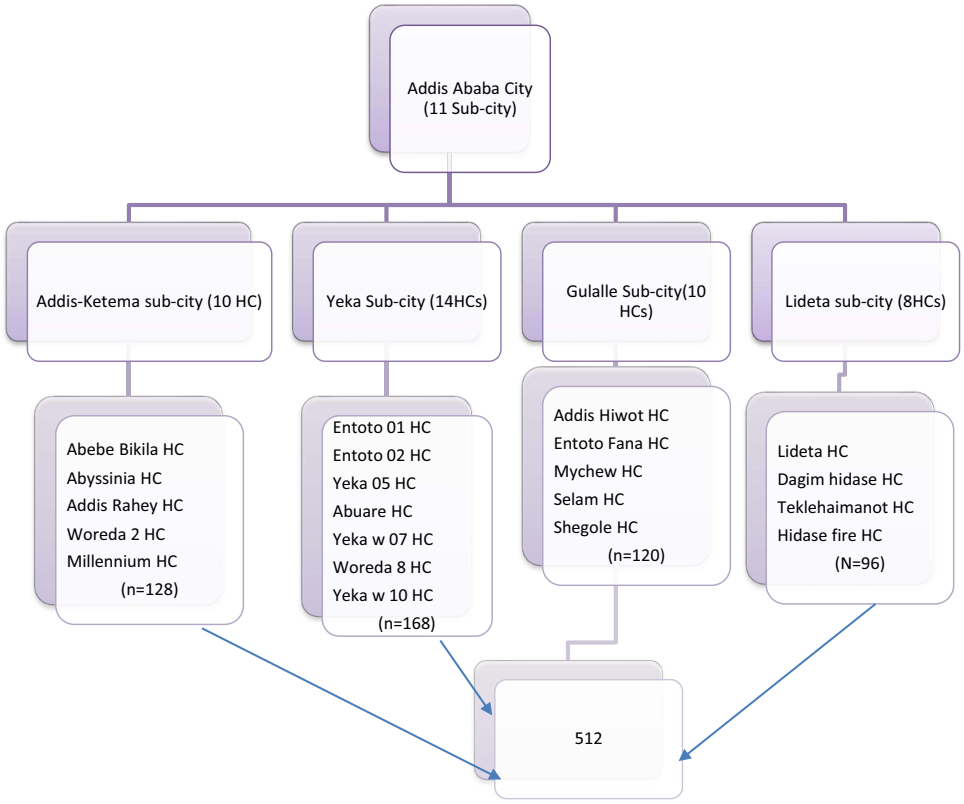

Figure 1 Schematic presentation showing sampling procedure and technique of public health centers; Addis Ababa, Ethiopia, 2022.

Exclusion Criteria

Health-care workers who got severely ill and cannot provide responses to the questionnaire during data collection.

Data Collection Method

The English version of the questionnaire was translated into Amharic, and then, for consistency's sake, it was translated back into English by other experts. Data was collected with a pretested interviewer-administered structured Amharic version questionnaire. Data will be collected by questionnaire developed from relevant literatures.[7,26–29] Questionnaires that were pre-tested in health-care facilities other than the selected study setting internal consistency were checked through Cronbach alpha for Likert scale items, which was 0.752.

Data Collection Tool

Standardized structured questionnaires were used to collect relevant information. The survey consists of the following sections: part I has three sections; the first section includes the Sociodemographic characteristics (age, sex, religion, level of education, marital status, occupation, presence of comorbidities and profession). The second section assesses past COVID-19 infection and vaccination history (previous infection, family history, types of COVID-19 vaccines, Influence of others, and source information of COVID-19 vaccine). The third section assesses risk-perception of COVID-19 and vaccines (a perceived concern towards COVID −19 infection, attitude towards covid-19 vaccines, and mistrust in health system). Attitude towards covid-19 vaccines Contains questions with a 5-point Likert scale (1 to 5) where 1 is least score and 5 is the largest score then based on the mean score of the total item it will be dichotomized as positive or negative attitude towards the vaccine. Those above the mean will be considered as having a positive attitude and those with scores below the mean will be categorized as having a negative attitude towards the vaccine.

Data Collection Procedure

Interviewer-administered structured questionnaire was provided for the participants and their responses were documented by the interviewer.

Data Quality Assurance

The survey was written in English, translated into Amharic, and returned to English for consistency. Seven data collectors and one supervisor received training to ensure completeness, accuracy, and consistency. Data quality was ensured through supervision by the lead investigator, training on sample techniques, and pre-testing with a 5% sample from other health facilities. Inconsistent and incomplete data were handled appropriately.

Operational Definitions

Covid-19 vaccine uptake is defined as individual respondents who had already at least received a single dose of any type of COVID-19 vaccine.

Previous exposure: participant who had laboratory-confirmed covid-19 infection or had contact with laboratory-confirmed covid-19 infected person.

Perceived concerns: HCWs perception of the risk of becoming infected from COVID-19 themselves or their close family, due to their roles in the health facility.

Attitude towards vaccines: Perceived confidence level in a vaccine safety and effectiveness.

Mistrust in the health system: Belief of HCWs in science and decision of ministry of the health in favour of their benefits.

Permanent health-care worker: Health-care workers who served six months or more in the facility as direct or indirect service for clients.

Health-care facilities: Health-care service providing government health centers.

Data Processing

From open data kit version 2022.2.1, data was exported to excel, and from there, it was exported to SPSS for analysis. Data were cleaned for outliers and missing value.

Analysis

While means and standard deviation were used to summarize continuous variables, percentages, frequencies, and proportions were used to summarize categorical variables. Binary logistic regression was carried out to assess factors associated with uptake of COVID-19 vaccine expressed by adjusted odds ratio (AOR) along with its respective 95% (CI).

A five-point Likert scale was used to assess the attitude towards covid-19 vaccine which has a scoring system from strongly disagree which were given 1 for those who have not concerned about covid-19 vaccine safety and efficacy to strongly agree were given 5 for those who have concerned about the COVID-19 vaccine safety and efficacy. Attitude towards vaccine was measured using items about concerns about the safety and efficacy of covid-19 vaccine and then the overall mean was calculated and assessed across the gender and professions. Concerns about Covid-19 vaccine were given a score of 1, those who have one concern 1, and two concern 2, and a maximum of score 3.

All assumptions for binary logistic regression including no category containing less than 5 expected value, multi-collinearity was considered for variables included in the equation with variance inflation factor (VIF) greater than 10. Linearity of continuous variables were checked against their log odds. Outliers of continuous variables were checked using Mahalanobis distance significance for at 0.001 and there were no outliers figured out. Independent variables with P-value <0.25 were considered in multivariate logistic regression. The Hosmer and Lemeshow test with a p-value of >0.05 was used to evaluate the model's goodness. Statistical significance was assigned to variables with p values less than 0.05.

Ethical Approval

Ethical approval and clearance letter was obtained from Addis Ababa University and Addis Ababa health bureau with reference number of SPH/321/14. Letter of permission was secured from AACHB and selected respective sub-city health offices.

Results

Socio-Demographic Characteristics of Respondents

The total number of participants was 473 out of a possible 512 health-care providers, which resulted in a response rate of 92.4%. Among them, 34.5% were male and 65.5% were female. The mean age of the participants was about 34.87 years with a standard deviation of 7.21. More than one-third of respondents, 43.8%, were aged between (27–35) years old. Most of the respondents were nurses, 31.9%, followed by health officers, 15 0.4%. Of all of the total respondents, 34.1% were married, and 39.1% were Orthodox religious followers. More than half, 53.3% of respondents had a diploma, 37.2% of respondents earned less than 6193 (USD 120) and 32 (6.8%) of respondents earned more than 9057 Ethiopian birrs monthly. Nearly 42% of the health-care providers were responsible for direct medical provision (Table 1).

Table 1 Socio-Demographic Factors Distribution Among Health-Care Providers in Addis Ababa Ethiopia 2022

S. No	Variables	Category	Frequency	Percentage
1	Age-group	18–26 years	46	9.7
		27–35 years	207	43.8
		36–45 years	173	36.6
		Above 45 years	47	9.9
2	Gender	Male	163	34.5
		Female	310	65.5
3	Religion	Orthodox	185	39.1
		Muslim	135	28.5
		Protestant	115	24.5
		Catholic	33	7.0
		Others	5	1.1
4	Ethnic	Amhara	182	38.5
		Oromo	123	26.0
		Gurage	107	22.6
		Tigray	37	7.8
		Others	24	5.1
5	Sub-city	Addis ketema sub-city	90	19.0
		Lideta sub-city	102	21.6
		Gullalle sub-city	121	25.6
		Yeka sub-city	160	33.8

(*Continued*)

Table 1 (Continued).

S. No	Variables	Category	Frequency	Percentage
6	Marital status	Married /in union	163	34.1
		Never married	286	60
		Divorced/ Widowed	24	5.1.
7	Educational level	Diploma	252	53.3
		BSc degree	192	40.6
		Masters and above	29	6.1
8	Profession	Doctor	17	3.6
		Nurse	151	31.9
		Health officer	73	15.4
		Laboratory	59	12.5
		Pharmacist	49	10.4
		Physiatrist	18	3.8
		Midwife	90	19
		Other	16	3.4
9	Family size	≤2 family members	99	20.9
		3–5 family members	325	68.7
		≥6 family members	49	10.4
10	Unit of work	Direct patient care provider	179	37.9
		Direct medical provider	198	41.9
		Administrative staff	9 6	20.3
11	Salary	≤ 6193 Ethiopian birr monthly	223	47.1
		6194–9056 Ethiopian birr monthly	238	50
		≥ 9057 Ethiopian birr monthly	12	2.5

Previous COVID Exposure

The study found that 27% of health-care professionals had contact with COVID-19-positive patients, and 16% had comorbidities. Over 78.6% had been tested for COVID-19 and 16.3% were infected. Most professionals trusted the science of COVID-19 vaccine development and the ministry of health's safety. 27.4% of health-care providers were concerned about COVID-19 due to their roles in the health facility, while 52.9% were concerned about the potential risk to their family (Table 2).

Sources of Information

Most health-care professionals (36.32%) acquired their information about COVID-19 vaccination from television, while 30.51% came from social media (Telegram, Facebook, Google, WhatsApp). The majority of health-care professionals (20.46%) and patients (9.52%) rely on their peers for information (Figure 2).

Table 2 Health-Care Provider's Previous Exposure Among Health Workers in Addis Ababa 2022

S. NO	Variables	Category	Frequency	Percentage
1	Contact with COVID-19 positive family member or friend	Yes	129	27.3
		No	149	31.5
		Not remember	195	41.5
2	Comorbidity	No medical condition	398	84.1
		Medical condition	75	15.8
3	Have been caring for COVID-19 patients	No	344	72.7
		Yes	129	27.3
4	Smoking status	Previous smoker	14	3
		Current smoker	9	1.9
		Never smoked	450	95.1
5	Tested for COVID-19	Yes	372	78.6
		No	101	21.4
6	Infected with confirmed COVID-19 disease	Yes	77	16.3
		No	396	83.7
7	Trust the science of vaccine development	Yes	316	66.8
		No	39	8.2
		Not sure	118	24.9
8	Trust in ministry health to ensure safety and effectiveness of vaccine	No	130	27.5
		Yes	343	72.5
9	Contact with COVID-19 positive infected patients	Yes	154	32.6
		No	180	38.1
		Unsure	139	29.4

Vaccine Concerns

The overall vaccination concerns were relatively low. However, concerns with regard to attitude towards covid-19 vaccines are prevalent. Most health-care providers believe that in general COVID19 vaccines are important for their health (72.8%) and (63.7%) for the health of their community. Most of HCP believe covid-19 vaccines are effective (54.1%) and safe (57.5%). Most health-care providers (64.9%) were confident regarding the decisions made on COVID-19 vaccination by political leaders is in the best interest of the community. A majority of health-care providers (65.8%) did not believe. The vaccination sites are too far for them. In addition, more than two-third (65.5%) of HCP did not consider the process of getting vaccinated is stressful. However, 29.2% health-care providers believe the process of getting vaccinated is stressful (Figure 3).

Multivariate Logistic Regression

After bi-variate logistic regression was done variables with the p-value <0.25 were taken into multivariable logistic regression analysis. A multi-variable logistic regression analysis was done for socio-demographic factors; gender, age,

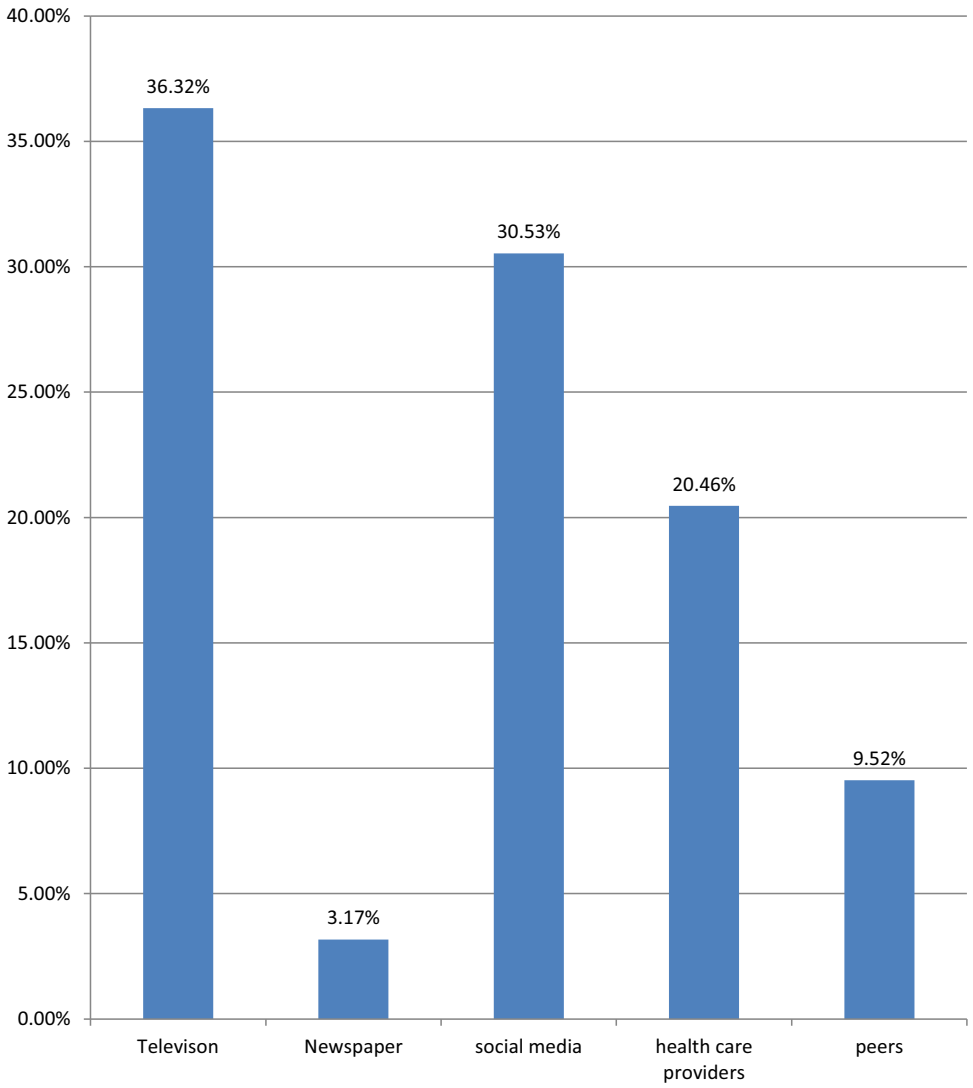

Figure 2 Source of information for covid-19 vaccination uptake for Health care providers among health care providers in Addis Ababa in Ethiopia, 2022.

marital status, educational status and monthly salary were significantly associated with a COVID-19 vaccine uptake. Being female was associated significantly with COVID-19 vaccine uptake and females were 51% less likely compared to male professionals [AOR (95% C.I): 0.486 (0.258–0.916)]. Health-care Workers whose age was between (36–45) years were nearly three times more likely to accept covid-19 vaccine as compared to those below 25 years AOR: (2.7 (95% C. I): (1.03–7.613)]. Married health-care providers were two times more likely to receive COVID-19 vaccine compared to unmarried health-care provider [AOR: 2.114 (95% C.I: 1.068−4.181)]. Educational status was significantly associated to COVID-19 vaccine uptake and professionals who had BSc. Degree were twice more likely to receive covid-19 vaccine as compared to HCPs who had Diploma [AOR: 2.118 (95% C.I: 1.067 4.203)]. HCWs who had monthly income between 6194 and 9056 ETB were significantly associated with COVID-19 vaccine uptake 2.6 times more likely to receive vaccine as compared to workers paid below 6194 [AOR: 2.623 (95% C.I): 1.398−4.923)]. HCPs who were unsure of their contact history were 66% less likely to take covid-19 vaccine compared to their counterparts [AOR: 0.340 (95% C. I): 156–0.741)]. HCPs who got vaccination information from their peers were four times more likely to receive covid-19 vaccine [AOR: 4.48 (95% C.I): 1.77–11.284] compared to others source. HCWs with higher risk perception were 7 times more likely to take vaccines compared to their counterparts [AOR: 7.455 (95% C.I): 4.041–13.754)]. Variables such as being tested for covid-19, family size and recommendation of vaccination by others were non-significant (Table 3).

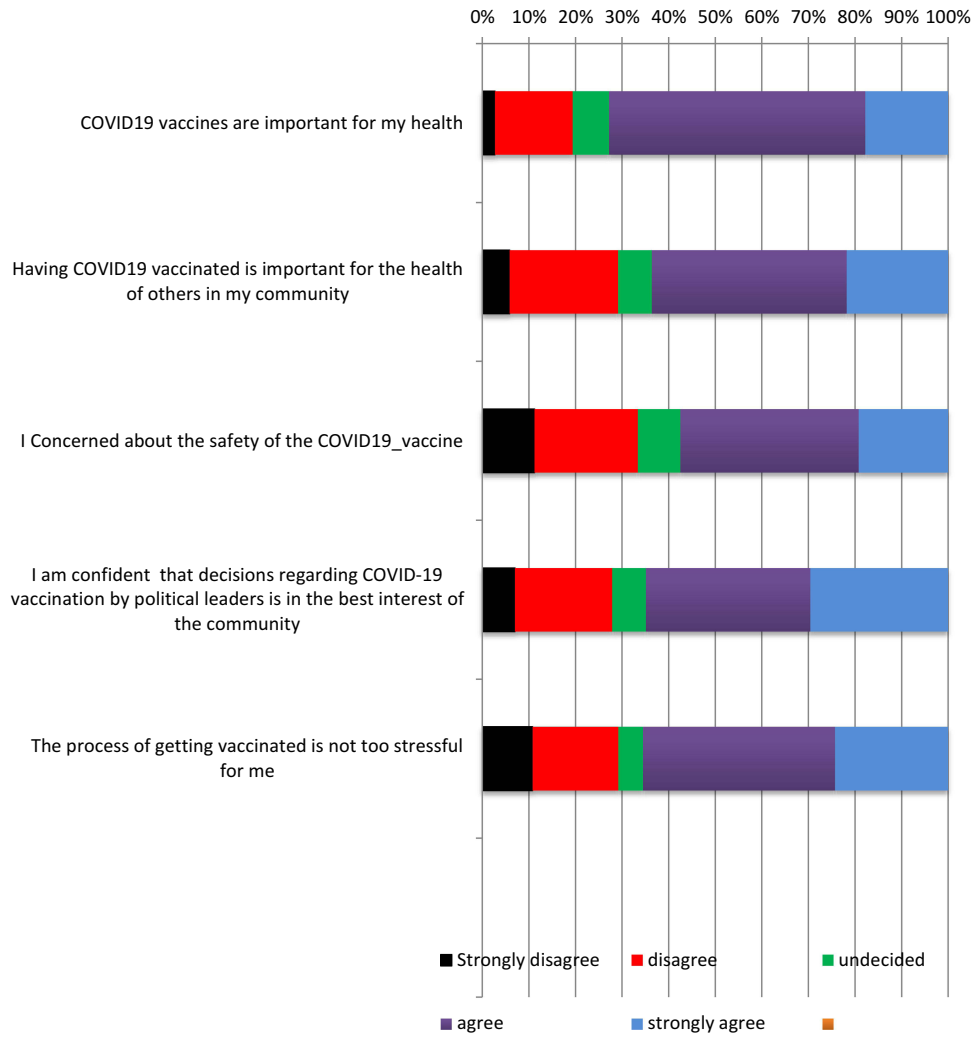

Figure 3 Attitude of health care providers towards covid-19 vaccine Addis Ababa, Ethiopia, 2022.

Discussion

In the current study vaccine, uptake among health-care providers was 75.8%. This finding was higher compared to the study conducted a year ago in three cities of Ethiopia among health workers to estimate future vaccine uptake against SARS-CoV-2 when the vaccine is available, which was revealed (72.2%).[30,31] Similarly, this finding was higher than an online study conducted among health workers in Ethiopia to assess vaccination uptake, which showed 62.1%.[25] This might be due to these studies being conducted early when vaccination was not launched widely and the late arrival of additional doses of COVID-19 vaccines. However, this finding was lower than the outcome of the study conducted in Greece and Turkey[18,32]. This discrepancy might be due to the difference in socio-demographic characteristics, risk perception, and vaccine hesitancy.

The most important factors identified as predictors of COVID-19 vaccine uptake by this study were gender, advanced age, marital status, educational status, monthly salary, previous contact with COVID-19-infected patients, trust in the science to develop a vaccine, trust in the ministry of health to ensure COVID-19 vaccine safety and effectiveness, perceived concerns of COVID-19 infection and source of information for COVID-19 vaccination (Table 3).

This study identified that female professionals were 51% less likely to take the COVID-19 vaccine [AOR=0.486 [CI; 0.258–0.916, P-value=0.026] compared to their counterparts.[30] This result was congruent with a similar study conducted among health-care workers in Ethiopia, America, and UK which revealed female health providers were less likely to take

Table 3 Multivariable Logistic Regression to Determine Associated Socio-Demographic Factors Among Health-Care Providers in Addis Ababa, Ethiopia, 2022

Variables	Categories	COVID-19 Vaccine Uptake		COR with 95%C.I.	AOR with 95%C.I.	P-value
		Vaccinated	Not Vaccinated			
Age	18–26 years old	25	21	1	1	
	27–35 years old	160	47	2.86[1.47,5.56]	1.85[0.70,4.9]	0.21
	36–45 years old	143	30	4.0[1.98,8.07]	2.70[1.03,7.61]	0.048*
	Above 45 years old	30	17	1.48[0.64,3.4]	0.62[0.18,2.15]	0.46
Gender	Male	134	29	1	1	
	Female	224	86	0.56[0.35,0.9]	0.48[0.25,0.91]	0.026*
Marital status	Never married	205	81	1	1	
	Married	138	25	2.18[1.32,3.58]	2.11[1.06,4.18]	0.032*
	Divorced/widowed	15	9	0.65[0.27,1.56]	0.67[0.18,2.48]	0.55
Family size	<2 individuals	67	32	1	1	
	3–4 individuals	252	73	1.64[1.00,2.70]	1.58[0.73,3.10]	0.26
	5–7 individuals	39	10	1.86[0.82,4.19]	1.84[0.56,6.02]	0.31
Educational Status	Diploma	168	84	1	1	
	BSc. Degree	167	25	3.34[2.03,5.48]	2.11[1.06,4.20]	0.032*
	Masters and above	23	6	1.91[1.12,4.88]	0.91[0.28,2.94]	0.87
Salary	4609–6193birr monthly	144	79	1	1	
	6194–9056birr	205	33	3.40[2.15,5.39]	2.62[1.39,4.92]	0.003*
	More than 9056 birr	9	3	1.64[0.43,6.25]	0.48[0.05,4.31]	0.52
Tested-for COVD19	No	267	105	1	1	
	Yes	91	10	3.57[1.79,7.14]	2.16[0.91,5.12]	0.080
Influenced to take covid-19 vaccine	No	217	82	1	1	
	Yes	141	33	1.61[1.02,2.54]	1.4[0.75,2.61]	0.28
Had contact with a COVID-19-infected patient	Yes	129	25	1	1	
	No	131	49	0.51[0.30,0.88]	0.47[0.22,1.0]	0.050
	Unsure	98	41	0.46[0.26,0.81]	0.34[0.15,0.74]	0.007*
Trust science to develop covid vaccines	Yes	249	67	1	1	
	No	17	22	0.208[0.104,0.414]	0.29[0.11,0.78]	0.014*
	Not sure	92	26	0.952[0.57,1.58]	1.00[0.48,2.07]	0.997
Trust-ministry of health to ensure the safety of COVID19vaccine	No	93	62	1	1	
	Yes	265	53	3.3[2.15,5.15]	3.31[1.8,6.08]	<0.0001*

(*Continued*)

Table 3 (Continued).

Variables	Categories	COVID-19 Vaccine Uptake		COR with 95%C.I.	AOR with 95%C.I.	P-value
		Vaccinated	Not Vaccinated			
TV	No	10	5	1	1	
	Yes	348	110	1.94[0.59,6.33]	1.82 [0.302,6.01]	0.156
Newspaper	No	327	106	1	1	
	Yes	31	9	1.01[0.43,2.37]	0.67[0.23,1.96]	0.471
Social media	No	71	17	1	1	
	Yes	287	98	1.09[0.57,2.07]	0.69[0.31,1.54]	0.375
Health care providers	No	140	75	1	1	
	Yes	218	40	3.29[2.08,5.21]	2.98[1.62,5.51]	0.0001*
Peers	No	248	105	1	1	
	Yes	110	10	5.39[2.6,10.9]	4.47 [1.77,11.28]	0.001*
Perceived-concern toward-covid-19 disease	Not concerned	104	86	1	1	
	Concerned	254	29	0.13[0.08,0. 22]	7.45[4.04,13.7]	<0.0001*

Notes: P-value with *Shows significant association between independent and dependent variables.

the COVID-19 vaccine.[25,28,33] This might be due to pregnancy or being a lactating mother and fear of vaccine-induced COVID-19 infection transmission to their baby. Moreover, this might be related to the fear of receiving an injection shot.

The rate of COVID-19 vaccine uptake was higher among health professionals aged (36–45) years old compared to younger professionals (18–26) years [AOR: 2.7 (1.03–7.613)]. This finding was parallel to the findings from Turkey and World Health Organization reports that showed the COVID-19 pandemic is more prevalent and more severe among people of advanced age than younger ones, which increased the perception of the advanced age as a risk group for COVID-19.[32] This could be thought of, as with increasing age, perceptions of risk and vulnerability to COVID-19 infection will be increased.[30]

Professionals who married were twice more likely to take COVID-19 vaccines compared to those who did not. It can be thought as people who were married and lived with their family would be more likely to have the behavior protecting their families from the infection.[22]

Health-care workers who earned a higher monthly salary of 6194–9056 were three times more likely to take a COVID-19 vaccine [AOR: 2.623 (1.398 −4.923)] than those who earned less. This is in line with a study conducted on the general population that revealed higher acceptance of the COVID-19 vaccine among those who earned a higher income.[25,30]

In this study, having family members tested positive and contact with infected patients was found to be non-significant. This finding contradicts a similar study on willingness to accept the COVID-19 vaccine and affecting factors among health-care professionals from Turkey and Egypt.[32,34] This is due to the perceived decrease in risk of transmission, complications, and death from Covid-19 disease reports from the media and less attention given to the disease as of its beginning.[32,34]

Health professionals who did not trust the science to develop effective covid-19 vaccines were 70% less likely to take COVI D-19 vaccines [AOR = 0.293(0.110–0.782)] compared to their counterparts. This is supported by another study

which revealed higher odds of vaccine hesitancy among participants who did not trust science to produce safe and effective.[35] This might be related to conspiracy theories and religious impressions towards the virus and the vaccines.

The probability of COVID-19 vaccine uptake was three times more likely among professionals who trusted the Ethiopian ministry of health to ensure the safety of the COVID-19 vaccine [AOR = 3.312 (1.802–6.085)] than those who did not trust the ministry of health. This finding is congruent with a study conducted in Greece that revealed health-care providers who trusted Greek Public Health Authorities were twice more likely to receive vaccines.[18] This might be thought of as infodemic from other sources, which consequently influences the formal information reach out properly to the health-care providers.

Health professionals who were concerned about the risk of COVID-19 infection were nearly seven times more likely to take the COVID-19 vaccine [AOR = 7.455 (4.041–13.754)] compared to those who did not. This finding is in parallel with findings from a study conducted in the US.[22] Despite its significance in bivariate logistic regression, variables like profession type, unit of work, and attitude towards vaccine were non-significant in multivariate logistic regression. This is contradictory to findings from other studies conducted among health-care providers[34,36].

Strength of the Study

In this study, the response rate of the study participants in the area was good enough. In an attempt to keep the validity and reliability; data was collected by a pretested questionnaire to ensure reliability. The Data collector was trained on questionnaire, method of data collection and data was collected by open data kit (ODK) to manage data quality.

Limitation of Study

The study was conducted in four sub-cities in 21 health centers and sampling was limited to primary government health centers and did not include private clinics and hospitals. Moreover, this study was based on a quantitative questionnaire. This research can be improved by adding qualitative questions. Recall bias could happen on the number of whether the HCPs had previous contact. Difficult to establish any causal relationship between COVID-19 vaccine uptake and associated factors due to cross-sectional study of the study. Selection bias might be introduced due to non-stratification of the health professionals.

Conclusions

Overall, COVID-19 vaccine uptake among health-care providers was found to be relatively high. However, it is not sufficient to achieve herd immunity to eradicate COVID-19 infection, which was reported to be at least 82.5% from studies on the population in America. Advanced age, being married, earning a higher monthly salary, having trust in science to develop vaccines, the FMoH to ensure the safety of the vaccines, and higher perceived risk of COVID-19 infections were associated with an increased rate of COVID-19 vaccine uptake. Systemic measures for educating the HCPs, and disseminating information on the efficacy and safety of the COVID-19 vaccine should be prioritized alongside strengthening the vaccination supply.

Recommendation

Based on the findings of this study, the following recommendations have been forwarded.

Federal Ministry of Health

- Work with influential and religious people to address health system mistrust.
- Building trust and confidence with health-care providers through different duties.
- Work with media owners and social media agents to address misinformation.
- Should put in place reasonable mandates to HCPs to increase vaccination rate.
- Clearly and continually communicate pre and post–marketing vaccine surveillance through media to address concerns toward vaccine safety and efficacy.

AARHB and Public Health Associations Should

- Should decentralize vaccination sites to increase vaccination coverage.
- Should develop special health plan to address disadvantaged groups such as women and low-income HCPs.

Health Centers

- Should encourage their respective health professionals to take vaccine.
- Should provide adequate information through formal channels.
- Work with peer group to increase awareness and risk perception of covid19.
- Encourage COVID-19 testing to increase acceptance rate.

Scholars and Expertise of Infectious Disease

- Large scale studies including both private health facilities and public health facilities should be conducted.
- This study suggests further qualitative studies to explore the actual reason behind health-care providers.

Abbreviation

AARHB, Addis Ababa regional health bureau; AOR, Adjusted Odd Ratio; CI, Confidence Interval Level; CO, Crude Odd Ratio; COVAX, Covid-19 Vaccines Global Access; COVID-19, Coronavirus disease 2019; FMoH, Federal Ministry of health; HCPs, health-care providers; LMICS, low and middle-income countries; SARS –COV-2, severe acute respiratory syndrome coronavirus 2; VIF, Variance inflation factor; WHO, World Health Organization; WHO-Sage, World Health Organization Strategic advisory group expert.

Data Sharing Statement

All relevant data will be available on reasonable request from corresponding author.

Ethical Approval

The study was conducted in accordance with the Declaration of Helsinki and approved by Addis Ababa University's Institutional Review Board (Protocol number SPH-324-2022). The participants were provided written consent, and Confidentiality was maintained. The findings were presented as aggregate and would not reveal respondents' identities.

Acknowledgment

First and foremost, we would like to thank the College of Health Sciences at Addis Ababa University for giving us the opportunity to conduct this study. The John Hopkins University-Addis Ababa University research ethics training program provided financial support for this study, which the authors are grateful for. Finally, we would like to express our sincere gratitude to the Addis Ababa Regional Health Bureau, health facilities, data collectors, supervisors, and study participants.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

Through Addis Ababa University, the John Hopkins University-Addis Abeba University research ethics training program (JHU-AAU-RETP), R25 project provided funding for this study. The funder had no involvement in the creation of study's plan, the gathering or analysis of study data, the choice to publish the results, or the writing of the manuscript.

Disclosure

The authors declare no conflicts of interest in this work.

References

1. Weekly epidemiological update on COVID-19; 2022. Available from: https://www.who.int/publications/m/item/weekly-epidemiological-update-on-covid-17. Accessed July 7, 2023.
2. Maraqa B, Nazzal Z, Rabi R, Sarhan N, Al-Shakhra K, Al-Kaila M. COVID-19 vaccine hesitancy among health care workers in Palestine: a call for action. *Prev Med*. 2021;149:106618. doi:10.1016/j.ypmed.2021.106618
3. Africa WRf. Ethiopia introduces COVID-19 vaccine in a national launching ceremony; 2021.
4. Belsti YGY, Akalu Y, Dagnew B, et al. Willingness of Ethiopian population to receive COVID-19 vaccine. *J Multidiscip Healthc*. 2021;14:1233–1243. doi:10.2147/JMDH.S312637
5. Gagneux-Brunon A, Detoc M, Bruel S, et al. Intention to get vaccinations against COVID-19 in French healthcare workers during the first pandemic wave: a cross-sectional survey. *J Hosp Infect*. 2021;108:168–173. doi:10.1016/j.jhin.2020.11.020
6. Sharma O, Sultan AA, Ding H, Triggle CR. A review of the progress and challenges of developing a vaccine for COVID-19. *Front Immunol*. 2020;1:14.
7. El-Elimat T, AbuAlSamen MM, Almomani BA, Al-Sawalha NA, Alali FQ. Acceptance and attitudes toward COVID-19 vaccines: a cross-sectional study from Jordan. *PLoS One*. 2021;16(4):e0250555. doi:10.1371/journal.pone.0250555
8. Glampson B, Brittain J, Kaura A, et al. Assessing COVID-19 vaccine uptake and effectiveness through the North West London vaccination program: retrospective cohort study. *JMIR Public Health Surveill*. 2021;7(9):e30010. doi:10.2196/30010
9. Graupensperger S, Abdallah DA, Lee CM. Social norms and vaccine uptake: college students' COVID vaccination intentions, attitudes, and estimated peer norms and comparisons with influenza vaccine. *Vaccine*. 2021;39(15):2060–2067. doi:10.1016/j.vaccine.2021.03.018
10. Aemro A, Amare NS, Shetie B, Chekol B, Wassie M. Determinants of COVID-19 vaccine hesitancy among health care workers in Amhara region referral hospitals, Northwest Ethiopia: a cross-sectional study. *Epidemiol Infect*. 2021;149:e225. doi:10.1017/S0950268821002259
11. Al-Sanafi M, Sallam M. Psychological determinants of COVID-19 vaccine acceptance among healthcare workers in Kuwait: a cross-sectional study using the 5C and vaccine conspiracy beliefs scales. *Vaccines*. 2021;9(7):701. doi:10.3390/vaccines9070701
12. Dube E, MacDonald NE. How can a global pandemic affect vaccine hesitancy? *Expert Rev Vaccines*. 2020;19(10):899–901. doi:10.1080/14760584.2020.1825944
13. Dzieciolowska S, Hamel D, Gadio S, et al. Covid-19 vaccine acceptance, hesitancy, and refusal among Canadian healthcare workers: a multicenter survey. *Am J Infect Control*. 2021;49(9):1152–1157. doi:10.1016/j.ajic.2021.04.079
14. Solis Arce JS, Warren SS, Meriggi NF, et al. COVID-19 vaccine acceptance and hesitancy in low- and middle-income countries. *Nat Med*. 2021;27(8):1385–1394. doi:10.1038/s41591-021-01454-y
15. Abdou MS, Kheirallah KA, Aly MO, et al. Psychological antecedents towards COVID-19 vaccination using the Arabic 5C validated tool: an online study in 13 Arab countries. *medRxiv*. 2021;2021:2021–2028.
16. Alle YF, Oumer KE. Attitude and associated factors of COVID-19 vaccine acceptance among health professionals in Debre Tabor comprehensive specialized hospital, North Central Ethiopia. Cross-sectional study. *Virus disease*. 2021;32(2):272. doi:10.1007/s13337-021-00708-0
17. Barry M, Temsah M-H, Alhuzaimi A, et al. COVID-19 vaccine confidence and hesitancy among health care workers: a cross-sectional survey from a MERS-CoV experienced nation. *PLoS One*. 2021;16(11):e0244415.
18. Georgios R 1, Papagiannis DRG, Malli D, et al. Determinants of influenza vaccination coverage among Greek health care workers amid COVID-19 pandemic. *Infect Dis Rep*. 2021;13(3):757–762. doi:10.3390/idr13030071
19. Luo C, Yang Y, Liu Y, et al. Intention to COVID-19 vaccination and associated factors among health care workers: a systematic review and meta-analysis of cross-sectional studies. *Am J Infect Control*. 2021;49(10):1295–1304. doi:10.1016/j.ajic.2021.06.020
20. Holzmann-Littig C, Braunisch MC, Kranke P, et al. COVID-19 vaccination acceptance and hesitancy among healthcare workers in Germany. *Vaccines*. 2021;9(7):777. doi:10.3390/vaccines9070777
21. Huynh G, Tran T, Nguyen HN, Pham L. COVID-19 vaccination intention among healthcare workers in Vietnam. *Asian Pac J Trop Med*. 2021;14(4):159. doi:10.4103/1995-7645.312513
22. Shekhar R, Sheikh AB, Upadhyay S, et al. COVID-19 vaccine acceptance among health care workers in the United States. *Vaccines*. 2021;9(2):119. doi:10.3390/vaccines9020119
23. Qattan A, Alshareef N, Alsharqi O, Al Rahahleh N, Chirwa GC, Al-Hanawi MK. Acceptability of a COVID-19 vaccine among healthcare workers in the Kingdom of Saudi Arabia. *Front Med*. 2021;8:83. doi:10.3389/fmed.2021.644300
24. Shaw J, Stewart T, Anderson KB, et al. Assessment of US healthcare personnel attitudes towards Coronavirus Disease 2019 (COVID-19) vaccination in a large university healthcare system. *Clin Infect Dis*. 2021;73(10):1776.
25. Terefa DR, Shama AT, Feyisa BR, et al. COVID-19 vaccine uptake and associated factors among health professionals in Ethiopia. *Infect Drug Resist*. 2021;14:5531.
26. Al-Metwali BZ, Al-Jumaili AA, Al-Alag ZA, Sorofman B. Exploring the acceptance of COVID-19 vaccine among healthcare workers and general population using health belief model. *J Eval Clin Pract*. 2021;27(5):1112–1122. doi:10.1111/jep.13581
27. Malik A, Malik J, Ishaq U. Acceptance of COVID-19 vaccine in Pakistan among health care workers. *PLoS One*. 2021;16(9):e0257237. doi:10.1371/journal.pone.0257237
28. Pacella-LaBarbara ML, Park YL, Patterson PD, et al. COVID-19 vaccine uptake and intent among emergency healthcare workers. *J Occup Environ Med*. 2021;63(10):852. doi:10.1097/JOM.0000000000002298
29. FdMVE BSA, Siau CS, Chen WS, et al. Factors affecting COVID-19 vaccine acceptance: an international survey among LMICs countries. *Vaccines*. 2021;9(5):515.
30. Guangul BA, Georgescu G, Osman M, et al. Healthcare workers attitude towards SARS-COVID-2 vaccine, Ethiopia. *Glob J Infect Dis Clin Res*. 2021;29:043.

31. Seboka BT, Yehualashet DE, Belay MM, et al. Factors influencing COVID-19 vaccination demand and intent in resource-limited settings: based on health belief model. *Risk Manag Healthc Policy*. 2021;14:2743–2756. doi:10.2147/RMHP.S315043
32. Kaplan AK, Sahin MK, Parildar H, Adadan Guvenc I. The willingness to accept the COVID-19 vaccine and affecting factors among healthcare professionals: a cross-sectional study in Turkey. *Int J Clin Pract*. 2021;75(7):e14226. doi:10.1111/ijcp.14226
33. Martin CA, Marshall C, Patel P, et al. Association of demographic and occupational factors with SARS-CoV-2 vaccine uptake in a multi-ethnic UK healthcare workforce: a rapid real-world analysis. *MedRXiv*. 2021;2021:2021.
34. Fares S, Elmnyer MM, Mohamed SS, Elsayed R. COVID-19 vaccination perception and attitude among healthcare workers in Egypt. *J Prim Care Community Health*. 2021;12:21501327211013303. doi:10.1177/21501327211013303
35. Mohammed R, Nguse TM, Habte BM, Fentie AM, Gebretekle GB. COVID-19 vaccine hesitancy among Ethiopian healthcare workers. *PLoS One*. 2021;16(2):e0261125. doi:10.1371/journal.pone.0261125
36. Berihun G, Walle Z, Berhanu L, Teshome D. Acceptance of COVID-19 vaccine and determinant factors among patients with chronic disease visiting Dessie comprehensive specialized hospital, Northeastern Ethiopia. *Patient Prefer Adherence*. 2021;15:1795–1805. doi:10.2147/PPA.S324564