



Explore the reasons for SARS-CoV-2 vaccine hesitancy among healthcare workers: a cross-sectional study

Gudisa Bereda, BPharm, MPH

Background: Vaccine hesitancy is described by the WHO as “a delay in acceptance or refusal of safe immunizations notwithstanding the availability of vaccine services.” In Ethiopia, the cumulative acceptance rate of the COVID-19 vaccination was 57.8%. Ethiopia had a lower rate of COVID-19 vaccination acceptance than was required to create herd immunity. This study was carried out to determine the prevalence of COVID-19 vaccine reluctance and its contributing factors. Based on the findings of the study, recommendations were made to the relevant bodies in order to reduce vaccine hesitancy and increase vaccination acceptability.

Objectives: A cross-sectional online-based study was conducted to better understand the reasons for SARS-CoV-2 vaccine hesitancy among healthcare workers (HCWs) in Oromia regional state, Ethiopia.

Materials and methods: A cross-sectional survey using an internet platform was conducted from 18 June 2021, to 29 June 2022. A multistage cluster sampling strategy was used to find participants, with each cluster representing a sampling unit made up of a set of population elements. Participants are then randomly chosen from those clusters. The data were entered in Epi Info 7.2.0.1, then exported to Microsoft Excel and imported into statistical programs for social sciences (26.0 version) for statistical analysis. Statistical significance was considered to be a *P* value of less than 0.05.

Results: Four hundred twenty-two HCWs completed the online survey. The majority of the HCWs were male ($n = 234$, 55.5%), urban residents ($n = 396$, 93.8%), protestants ($n = 168$, 39.8%), and married people ($n = 232$, 55.0%). The prevalence of HCWs reluctant to receive the SARS-CoV-2 vaccination was 69.7% ($n = 294$). Age from 19 to 34 [adjusted odds ratio (AOR) = 1.48, 95% CI: 1.69–7.42, $P = < 0.001$], female sex (AOR = 3.68, 95% CI = 1.370–6.413, $P = 0.002$), income between 3501 and 8500 ETB (AOR = 1.67, 95% CI = 1.380–5.697, $P = 0.048$), information from websites (AOR = 1.79, 95% CI = 1.720–31.179, $P = 0.013$), vaccine skepticism (AOR = 4.75, 95% CI = 3.210–8.152, $P = 0.009$), and potential adverse effects of a SARS-CoV-2 vaccine (AOR = 2.18, 95% CI = 1.732–5.248, $P = 0.043$) were independent predictors of SARS-CoV-2 vaccine hesitancy among HCWs.

Conclusion and recommendations: HCWs were reluctant to get the SARS-CoV-2 immunization at a high percentage overall. To reduce hesitancy to receive the SARS-CoV-2 vaccination among HCWs, the Oromia regional state health bureau should be required to increase HCWs’ knowledge of the COVID-19 vaccine by providing proper training for all HCWs.

Keywords: explore, healthcare workers, hesitancy, Oromia regional state, SARS-CoV-2 vaccine

Introduction

At the end of December 2019, the WHO declared the coronavirus-2019 pandemic, which was caused by SARS-CoV-2, a pandemic^[1]. It is thought to have started at the Huanan Seafood

Pharmacy, All Africa Leprosy, Tuberculosis and Rehabilitation Training Centre, Zenebework, Kolfe Keranio, Addis Ababa, Ethiopia

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*Corresponding author. Address: Pharmacy Department, All Africa Leprosy, Tuberculosis and Rehabilitation Training Centre, Zenebework, Kolfe Keranio, Addis Ababa, 182609, Ethiopia; Tel.: + 251913118492/ + 251910790650. E-mail address: gudisabareda95@gmail.com (G. Bereda).

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HIGHLIGHTS

- COVID-19 vaccine is a vital strategy to prevent and control SARS-CoV-2 Virus pandemic.
- COVID-19 vaccine hesitancy is refusal of accepting vaccine despite its availability.
- Fear of vaccine side effects is the most common reason for COVID-19 vaccine hesitancy.

Wholesale Market in Wuhan, Hubei Province, China. On 14 February 2020, the COVID-19 pandemic was officially approved as having reached Africa^[2], with the first confirmed case being reported in Egypt. At the end of February 2020, Nigeria reported that it had received the first approved case in sub-Saharan Africa^[1]. On 13 March 2020, it was determined that the SARS-CoV-2 had entered Ethiopia^[3]. A total ban on public transportation systems was issued for the city of Adama in the Oromia regional state on 29 March 2020.

More than 579 million people have been infected with the virus worldwide, and as of 29 June 2022, there have been 6 413 476 reported fatalities. This affects more than 228 nations and

territories. In terms of SARS-CoV-2, Ethiopia was placed 106th, with around 490 816 people infected and 7559 people dying (29 June 2022)^[4]. The COVID-19 pandemic can be prevented with vaccination to reduce severe disease and fatalities^[1]. Respiratory viruses like SARS-CoV-2 have been linked to three main mechanisms of transmission: “contact,” “droplet,” and “airborne.” Contact transmission can occur directly via physical contact or indirectly via objects containing settled droplets. Droplet transmission involves large droplets (larger than 20 micrometres in diameter) that are directly deposited on the conjunctiva or mucous membranes of a susceptible host rather than being caught by inspiratory air flows and deposited along the respiratory tract. Airborne or aerosol transmission is caused by small respiratory droplets or droplet nuclei less than 10 micrometers in diameter. These droplets or nuclei may lodge deep within the respiratory tract, including the alveolar region, and remain airborne long enough to transmit the disease^[5]. Low vaccination uptake poses a serious danger to the effectiveness of immunization in reducing morbidity and mortality from COVID-19^[4]. Vaccine hesitancy is defined by the WHO as a behaviour that is influenced by a variety of factors, including issues with confidence (do not trust the vaccine or provider), complacency (do not perceive a need for a vaccine, do not value the vaccine), and convenience (can't afford to get immunized)^[1]. Due to high-income nations' bulk pre-ordering of COVID-19 vaccines, COVID-19 vaccine worldwide access (COVAX) is particularly pertinent to closing the access gap. Fear has been exacerbated, and the data has been biased in favour of men due to rumours that immunizations can interrupt the menstrual cycle and lower fertility^[6]. Numerous low-income and middle-income nations have joined the COVID-19 vaccine worldwide access (COVAX) facility in order to guarantee vaccine procurement and equitable distribution, with phase one coverage of 20% of their national populations^[7]. Behavioural factors may influence vaccine effectiveness, particularly in trials, depending on the natural infection. For instance, older people may be less likely to be exposed to SARS-CoV-2 because they avoid social situations or using public transportation. Reluctance to receive the SARS-CoV-2 vaccination might significantly reduce herd immunity^[8]. Socioeconomic and healthcare inequities, structural racism, earlier unethical research involving some ethnic minority groups, social disadvantages such as lower levels of education and limited access to accurate information, misinformation, rumours, and conspiracy theories, especially through social media, and a lack of effective public health messages or targeted campaigns are the main causes and drivers of COVID-19 vaccine hesitancy^[9]. During the early stages of the pandemic (March–April 2020), online population-representative surveys revealed varying levels of SARS-CoV-2 vaccine hesitancy when it became available, ranging from 14% in Australia to 26% in France and 42% in the United States^[10], with some sociodemographic variations^[11]. A successful and fair vaccination upsurge depends on understanding the SARS-CoV-2 vaccine jargon and using it effectively. This was the only study conducted in Oromia, a regional state, to evaluate the healthcare workers (HCWs)' vaccine hesitancy. This study set out to identify the factors that are connected with vaccination reluctance, examine behavioural aspects that are correlated with vaccine hesitancy, and quantify vaccine hesitancy in the Oromia regional state.

Methodology

Study design, and study area

A cross-sectional study design was carried out in 21 zones of the Oromia regional state. The Oromia regional state has a population of over 60 million and a land area of about 286 612 km². In the Oromia regional state, there are 100 hospitals, of which 62 are primary care hospitals, 34 are general hospitals, and 4 are referral hospitals, with the exception of Shashamane referral hospitals and Jimma University specialty hospitals. There were 20 541 HCWs working at the Oromia regional state hospitals, with 11 422 men and 9119 females. Of them, 7793 worked in primary hospitals, 9411 in general hospitals, and 1839 in referral hospitals. The work has been reported in line with the criteria for the strengthening the reporting of cohort studies in surgery (STROCSS 2021)^[12].

Study subjects and study duration

The target (reference) population included all HCWs who were present in the study region, and the sampling population included all HCWs who were present in the selected study zones. Ultimately, the study population included only those HCWs who met the requirements for inclusion throughout the study period. One year was spent carrying out the study (from 18 June 2021, to 29 June 2022).

Eligibility criteria

Inclusion criteria

Participants in the study had to be willing to give their consent, be able to use the internet on a computer or smartphone, or have access to the internet. Those who were older than 18 years, a health professional working in a registered healthcare setting, and have recently worked in one zone of the Oromia regional state.

Exclusion criteria

The study excluded younger HCWs (those under the age of 18), individuals with known or suspected mental issues, those without smartphones, laptops, or a reliable internet connection because enrolment was done online, non-HCWs, and those who refused to participate.

Sample size determination and calculation

Due to a lack of data in Ethiopia, it was estimated that 50% of the population was hesitant to get the COVID-19 vaccination among healthcare professionals when calculating the sample size using the single population proportion formula. The sample size was calculated using Open-Epi version 2.3.1 software^[13]. For a cross-sectional study with a dependent value of two categories, the sample size was calculated by using the single proportion formula: $n = (Za/2)^2 P(1 - P)/d^2$,

Where:

n is the estimated sample size.

z is the static, which determines the requisite degree of confidence.

p is an estimate of the key indicator to be measured by the survey in the population group of interest.

d is the intended level of precision, or the margin of relative error to be gained. The z -statistic for the 95% confidence level is typically 1.96. The value of 0.5 (or 50%) is used if the predicted estimate of the key indicator (p) is unknown. For indicators with estimated prevalence between 20% and 80%, d for national-level estimates is typically around 5%.

$n = (1.96)^2 * 0.5 (1 - 0.5) / (0.05)^2$, $n = 3.8416 * 0.5 (0.5) / 0.0025$, $n = 3.8416 * 0.25 / 0.0025$, $n = 0.9604 / 0.0025 = 384$. A finite population correction factor is not needed because the total population of this study is greater than 10,000, which is 20 541 people.

Sample technique

Multistage sampling techniques were used to approach the individuals by forming clusters and sub-clusters. To choose the participants, a multistage cluster sampling strategy was used, wherein a cluster—a collection of population components—constituted the sample unit. Then, a random selection is made of individuals inside those clusters. The key justification for the multistage sample approach was its low resource cost and feasibility, which eased possible data collection difficulties during a pandemic and reduced the number of areas that needed to be visited and mapped. This study estimated 125 clusters with an average of 3.1 HCWs per cluster ($n = 384$). The required sample size for clustering sampling is corrected using the design effect.

$$DEFF = 1 + \delta (n - 1),$$

Where;

DEFF is the design effect,

δ is the intraclass correlation for the statistic in question ($\pm 5\%$),

n is the average size of the cluster (3.1 HCWs per cluster)

$$DEFF = 1 + 0.05 (3.1 - 1) = 1 + 0.05 (2.1) = 1 + 0.105 = 1.105, \text{ approximately to } 1.1.$$

As a result, the sample size calculation would take into account the expected DEFF for HCWs for a survey with 3.1 HCWs in each cluster, which is 1.1.

$$n = (Za/2)^2 P (1-P) * DEFF/d^2 = (1.96)^2 * 0.5 (1 - 0.5) * 1.1 / (0.05)^2, n = 3.8416 * 0.5 (0.5) * 1.1 / 0.0025, n = 3.8416 * 0.25 * 1.1 / 0.0025, n = 0.96 * 1.1 / 0.0025, n = 1.056 / 0.0025 = 422$$

study participants were included.

Measurement and variables

Because it was difficult to conduct face-to-face research during the active SARS-CoV-2 outbreak, data were gathered online using a structured questionnaire via e-mail or telegram services from HCWs working in different units of selected hospitals of Oromia regional state. The vaccine hesitancy rate of the SARS-CoV-2 vaccination among HCWs has been assessed using data from a well-designed online self-administered questionnaire. Because Afaan Oromoo is the working language of the Oromia regional state, the questionnaire was translated into Afaan Oromoo. There were five sections to the questionnaires. Section I: Sociodemographic and socioeconomic data include age, sex, marital status, religion, employment, monthly income, category of healthcare personnel, comorbidity, addiction, place of residence, and information source. Section II: Questions concerning the opinions of healthcare professionals about SARS-CoV-2 vaccinations were posed using a 5-point Likert scale (5 = strongly agree, 4 = agree, 3 = unsure, 2 = disagree, 1 = strongly disagree). Section III: Reasons for refusing

SARS-CoV-2 vaccination were trichotomized as Yes = 1, No = 0, and I don't know = 2. Section IV: Behavioural characteristics of SARS-CoV-2 vaccination hesitancy were trichotomized as 1 = always, 0 = sometimes, and 2 = never. Section V: Factors that make it difficult for HCWs to obtain a SARS-CoV-2 vaccination were classified as Yes = 1, No = 0, and Not at all = 2. In this study, HCWs are health professionals who had primary contact with patients during clinical examination and biological specimen collection. They include physicians, midwives, nurses, health officers, and laboratory technicians and others.

Data quality assurance

To ensure uniformity and consistency, the translator checked answers in both English and Afaan Oromoo. The questionnaire was reviewed by the primary investigator for completeness, correctness, clarity, and consistency to assure its quality. HCWs have received thorough instructions and have practiced completing the questionnaire that has been provided to them. By limiting each response to one, duplicate responses were prevented.

Statistical analysis

The data were entered in Epi Info 7.2.0.1, then exported to Microsoft Excel and imported into statistical programs for social sciences (26.0 version) for statistical analysis. Frequency (n) and percentage (%) were used for categorical variables. The variables associated with vaccination reluctance were identified using bivariate and multivariable logistic regression analyses. To reduce the confounding factors, the multivariable model was fitted using variables that had a P value of less than 0.2 in the bivariate analysis. The Hosmer–Lemeshow goodness of fit test was used to determine the model's fitness ($P = 0.29$); the model was therefore considered to be fitted. The relationships between the study and outcome variables were described using the odds ratio at 95% confidence intervals. Significant variables in the multivariable model were those with a P value of less than 0.05.

Operational definitions

The initial outbreak of Coronavirus disease 19 (COVID-19) is an extremely contagious viral infection caused by SARS-CoV-2 and first broke out in China, in Hubei province, on 29 December 2019^[5].

The COVID-19 vaccine is an active immunization vaccine used to prevent the COVID-19 pandemic caused by the SARS-CoV-2 virus^[8].

Vaccine hesitancy is defined according to the WHO as difficulty accepting or an outright refusal of vaccines, despite their availability^[7].

Results

Sociodemographic and socioeconomic data of HCWs

There were a total of 422 HCWs who completed the online survey. The majority ($n = 241$, 57.1%) of the 422 HCWs were between the ages of 19–34. The majority of the HCWs were men ($n = 234$, 55.5%), urban dwellers ($n = 396$, 93.8%), protestants ($n = 168$, 39.8%), and married people ($n = 232$, 55.0%). While 98 people (23.2%) had a confirmed history of comorbidity, only 87 people (20.6%) had a history of a chronic condition. More

Table 1
Information on the sociodemographic and socioeconomic characteristics of HCWs in the Oromia regional state, Ethiopia, June 2022 (n = 422).

Variable	Category	Frequency	Percent
Age	19–34 years	241	57.1
	35–54 years	169	40.1
	> 54 years	12	2.8
Sex	Male	234	55.5
	Female	188	44.5
Residence	Urban	396	93.8
	Rural	26	6.2
Income	< 3500 ETB	117	27.7
	3501–8500 ETB	251	59.5
	> 8500 ETB	54	12.8
Religion	Protestant	168	39.8
	Orthodoxy	133	31.5
	Muslim	101	23.9
	Others	20	4.8
Marital status	Married	232	55.0
	Unmarried	190	45.0
Profession	Nurse	133	31.5
	Doctors	46	10.9
	Midwives	82	19.4
	Clinical laboratory	40	9.5
	Pharmacy	79	18.7
	Psychiatry	27	6.4
Any chronic illness	Yes	15	3.6
	No	87	20.6
Addiction	Yes	335	79.4
	No	103	24.4
Comorbidity	Yes	319	75.6
	No	98	23.2
Source of information	Yes	324	76.8
	No	98	23.2
	TV	221	52.4
	Websites	113	26.7
Prevalence of SARS-CoV-2 vaccine hesitancy	Telegram and Facebook	70	16.6
	Previously published article	18	4.3
	Yes	294	69.7
No	128	30.3	

ETB, Ethiopian Birr; HCWs, healthcare workers; TV, television.

than half ($n=251$, 59.5%) of HCWs only got salary between 3501 and 8500 ETB each month. The majority of HCWs ($n=319$, 75.6%) had no addiction-related habits. In terms of information sources, the majority of HCWs watched television ($n=221$, 52.4%). The professions with the largest proportions were nurses and midwives ($n=133$, 31.5%, and $n=82$, 19.4%), respectively. In all, 69.7% of HCWs were reluctant to receive the COVID-19 vaccination ($n=294$) (Table 1).

SARS-CoV-2 vaccination attitudes and government trust

The majority of healthcare professionals ($n=201$, 47.6%) disagreed with the notion that vaccines should be easily accessible, while just approximately ($n=6$, 1.4%) expressed significant agreement. The majority of HCWs ($n=152$, 36.1%) disagreed with the falsehoods that claimed that the government provided an effective vaccine and with the statement that it managed the pandemic properly ($n=269$, 64.7%). About one-third of HCWs ($n=155$, 36.7%) are doubtful about whether the federal

government puts public safety first. The majority of HCWs ($n=200$, 47.4%) agreed that they were concerned about side effects, and ($n=177$, 42.0%) agreed that they suspected the SARS-CoV-2 virus (Table 2).

Reasons for refusing COVID-19 vaccination

I prefer alternative forms of protection to the SARS-CoV-2 vaccine, which was the top reason given for not getting the COVID-19 vaccine ($n=263$, 62.3%), followed by the vaccine's possible negative effects ($n=249$, 59.0%) and ineffectiveness ($n=245$, 58.1%), lack of knowledge ($n=189$, 44.8%), and on the other hand, doubts about the vaccine ($n=212$, 50.2%), and SARS-CoV-2 is overrated and no vaccine is necessary ($n=196$, 46.6%) were the next two weak justifications for SARS-CoV-2 (Table 3).

Behavioural characteristics

The majority of HCWs ($n=249$, 59.0%) always wore a face mask outside of their homes, and ($n=301$, 71.3%) always wore a mask indoors at work. More than half (237, 55.1%) of HCWs always used masks when doing their indoor grocery shopping, and ($n=322$, 76.3%) always covered their mouth and nose when coughing or sneezing. More than half of HCWs ($n=290$, 68.7%) never maintained social distance in the community, and ($n=349$, 82.7%) never avoided small social gatherings. The majority of HCWs ($n=195$, 46.2%) occasionally shied away from large social events (more than 10 people). The majority of HCWs ($n=312$, 73.8%) always washed their hands with soap and water and avoided contact with those who were exhibiting symptoms ($n=336$, 79.6%) (Table 4).

Factors make it hard for healthcare workers to get a COVID-19 vaccine

Conspiracy theories, particularly those spread through social media ($n=319$, 75.6%), ranked first among the reasons why HCWs find it difficult to receive the SARS-CoV-2 vaccine, followed by the fact that the vaccine is not yet available ($n=246$, 58.3%) and the fact that the opening hours of vaccination sites are inconvenient ($n=157$, 37.2%), in that order. Only a small percentage of healthcare professionals, on the other hand, indicated that the waiting period is too long ($n=15$, 3.5%), that a small number of unvaccinated people are turned away ($n=10$, 2.4%), and that the meager justification for the SARS-CoV-2 vaccine was based on prior unethical research involving some ethnic minority groups ($n=31$, 7.3%) (Table 5).

Factors associated with SARS-CoV-2 vaccine hesitancy

The variables that are associated with healthcare professionals' hesitancy to receive the SARS-CoV-2 vaccination contain factors that were significant at the bivariate level. The study revealed a significant relationship between SARS-CoV-2 vaccination hesitancy and sex, healthcare professional category, attitudes toward the SARS-CoV-2 virus, and belief in the government's ability to combat SARS-CoV-2. When compared to other age groups, the relative probabilities of being hesitant to receive the SARS-CoV-2 vaccination were 2.41 times higher [adjusted odds ratio (AOR) = 2.41, 95% CI = 1.629–3.681, $P=0.019$] among HCWs aged 19–34. Regarding sex, female HCWs were 3.68 times more likely than male HCWs to be reluctant to receive the SARS-CoV-2 vaccination (AOR = 3.68, 95% CI = 1.370–6.413,

Table 2
HCWs' opinions on the SARS-CoV-2 vaccination and their confidence in the administration, Oromia regional state, Ethiopia, June 2022
(n = 422).

Statement	N (%)				
	Strongly agree	Agree	Unsure	Disagree	Strongly disagree
Quick availability of vaccination	6 (1.4)	25 (5.9)	166 (39.3)	201 (47.6)	24 (5.8)
The government provides efficient vaccination	20 (4.7)	76 (18.0)	146 (34.6)	152 (36.1)	28 (6.6)
The government handled the outbreak successfully	—	—	78 (18.5)	269 (63.7)	75 (17.8)
The federal government places a high priority on citizen safety	17 (4.0)	89 (21.1)	155 (36.7)	108 (25.6)	53 (12.6)
Regarding potential adverse effects	49 (11.7)	200 (47.4)	76 (18.0)	85 (20.1)	12 (2.8)
Suspected about COVID-19 infection	57 (13.5)	177 (42.0)	52 (12.3)	105 (24.9)	31 (7.3)

HCWs, healthcare workers.

P = 0.002). Compared to other categories, HCWs with monthly incomes between 3501 and 8500 ETB were 1.67 times more likely to be reluctant to receive the SARS-CoV-2 vaccination (AOR = 1.67, 95% CI = 1.380–5.697, *P* = 0.048). Regarding information sources, HCWs who got their information from websites were 1.79 times more likely to be hesitant to receive the SARS-CoV-2 vaccination than those who got it from other sources (AOR = 1.79, 95% CI = 1.720–31.179, *P* = 0.013).

Table 3
Reasons for healthcare professionals' refusal to get the SARS-CoV-2 vaccine in the Oromia regional state, Ethiopia, June 2022
(n = 422).

Variable	Category	Frequency	Percent
Possible negative effects of the SARS-CoV-2 vaccination	Yes	249	59.0
	No	141	33.4
	I don't know	32	7.6
Uncertainty over the vaccination	Yes	212	50.2
	No	165	39.1
	I don't know	45	10.7
Do not possess sufficient knowledge	Yes	189	44.8
	No	143	33.9
	I don't know	90	21.3
Unreliable because of a lack of development time	Yes	217	51.4
	No	154	36.5
	I don't know	51	12.1
Ineffective	Yes	245	58.1
	No	129	30.6
	I don't know	48	11.3
I prefer alternative forms of defense	Yes	263	62.3
	No	109	25.8
	I don't know	50	11.9
No vaccination is required for SARS-CoV-2; it is overrated	Yes	196	46.6
	No	165	39.1
	I don't know	61	14.3
Others	Yes	180	42.7
	No	173	41.0
	I don't know	69	16.3

HCWs who had doubts about the vaccination were 4.75 times more likely to be reluctant to receive the SARS-CoV-2 vaccine than those who had not (AOR = 4.75, 95% CI = 3.210–8.152, *P* = 0.009). HCWs who were concerned about possible COVID-19 vaccine side effects were 2.18 times more likely to have been hesitant to receive the SARS-CoV-2 vaccination than those who had not (AOR = 2.18, 95% CI = 1.732–5.248, *P* = 0.043). HCWs who had heard conspiracy theories, particularly through social media, were 2.43 more likely to be reluctant to receive the SARS-CoV-2 vaccine than those who had not (AOR = 2.43, 95% CI = 1.948–5.170, *P* = 0.005) (Table 6)

Discussion

Because HCWs are trusted providers of health information and because of their higher personal exposure to illnesses acquired in a healthcare context, vaccine hesitancy among HCWs is a matter of worry^[9]. Low trust in vaccinations and low uptake are mostly caused by structural factors, such as health disparities, socio-economic disadvantages, institutional racism, and access restrictions^[14,15]. According to the current study, 69.7% of HCWs were hesitant to receive SARS-CoV-2 vaccinations. This study outperformed (to a greater extent than) studies done in the UK (18%), Black Africa (58.8%), people of Bangladeshi origin (42%), and Egypt (46%). The safety and efficacy of the COVID-19 vaccine would not be approved in this study due to beliefs regarding the benefits and effectiveness of vaccines, suspicion of the motivations behind them, the influence of family, especially parents' attitudes, and caution with friends on vaccination decisions, as well as due to false claims that vaccines contain agents that cause infertility or can spread infectious pathogens like the human immunodeficiency virus. The current study was in line with the study done in Black Caribbean, which had a 68.7% failure rate^[16]. Black people in the Caribbean have a long history of being ignored and intentionally mistreated by medical professionals. Additionally, the fact that vaccine registration systems are largely online and that there is frequently a racial divide in who has reliable internet access is partly to blame^[17]. The results of the current study were lower than those of a study on South Asian Pakistanis, which showed that 72% of people of black ethnicity exhibited significant levels of hesitation. People of colour are more likely to work on the front lines, doing necessary tasks that cannot be done from home, making them more susceptible to SARS-CoV-2 risk factors and increasing their risk of infection^[18–21].

Table 4**Behavioural characteristics of healthcare workers in Oromia regional state, Ethiopia, June 2022 (n = 422).**

Statement	N (%)		
	Always	Sometimes	Never
Worn a mask outside of their residence	249 (59.0)	154 (36.5)	19 (4.5)
Indoor mask at the office	301 (71.3)	102 (24.2)	19 (4.5)
Shop for groceries under a mask	237 (55.1)	148 (35.1)	37 (8.8)
The time they coughed or sneezed, they covered their mouth and nose	322 (76.3)	91 (21.6)	9 (2.1)
Community perceptions of social distance	23 (5.5)	109 (25.8)	290 (68.7)
I shunned small social events (not more than 2 people)	7 (1.7)	66 (15.6)	349 (82.7)
Stayed away from huge social gatherings (more than 10 people)	51 (12.1)	195 (46.2)	176 (41.7)
Hand washing with soap and water	312 (73.8)	107 (25.3)	4 (0.9)
Avoided making touch with symptomatic persons	336 (79.6)	83 (19.7)	3 (0.7)

According to this study's sex-related findings, female HCWs were 3.68 times more likely than male HCWs to have been hesitant to get the SARS-CoV-2 vaccination (AOR = 3.68, 95% CI = 1.370–6.413, $P = 0.002$), which is in line with study from China^[22]. Given that expecting moms were not included in any vaccination studies and that women of reproductive age also have serious concerns regarding infertility, which has lately become another reason to reject the vaccine^[2,3], pregnant women and breastfeeding mothers have a reason to be concerned.

In this study, HCWs who believed in conspiracies, particularly those spread via social media, were 2.43 times more likely to be reluctant to have received the SARS-CoV-2 vaccine than those who did not (AOR = 2.43, 95% CI = 1.948–5.170, $P = 0.005$). This finding is in line with a study that evaluated health-protective behaviours and conspiracies during the pandemic and discovered a significant correlation between believing in conspiracies and monitoring social media for SARS-CoV-2. People also claim that the government is reporting a fictitious number of COVID-19 cases because a high number of cases would result in more revenue and donations. Myths regarding the virus's genesis have also surfaced. Many individuals also think that it is God's wrath, and other people think that the virus is a weapon used in biowarfare^[24].

Table 5**Factors making it hard for healthcare workers to get a SARS-CoV-2 vaccine in Oromia regional state, Ethiopia, June 2022 (n = 422).**

Statement	N (%)		
	Yes	No	Not at all
The wait time is excessive	—	404 (95.7)	18 (4.3)
It is inconvenient when they open	157 (37.2)	169 (40.1)	96 (22.7)
Too far away from the immunization location	11 (2.6)	398 (94.3)	13 (3.1)
The SARS-CoV-2 vaccine is not yet available	246 (58.3)	123 (29.1)	53 (12.6)
Conspiracy theories, especially those spread on social media	319 (75.6)	87 (20.6)	16 (3.8)
Earlier unethical research involving some ethnic minority populations	31 (7.3)	288 (68.2)	103 (24.5)
Without a vaccine, they are sent away	—	381 (90.3)	41 (9.7)
Others	79 (18.7)	268 (63.5)	75 (17.8)

In contrast to other age groups, HCWs aged 19–34 had relative probabilities of being hesitant to receive the SARS-CoV-2 vaccine that were 2.41 times higher (AOR = 2.41, 95% CI = 1.629–3.681, $P = 0.019$), which was in line with a UK study that found that younger age groups (28% of 25–34 year olds) were hesitant^[25]. Although the COVID-19 virus spread from person to person of all ages, young people said that they felt liberated and were immune to harm no matter what they did. Additionally, they asserted that they were impervious to damage^[26].

HCWs with monthly incomes between 3501 and 8500 ETB were 1.67 times more likely to have vaccination hesitancy for the SARS-CoV-2 virus (AOR = 1.67, 95% CI = 1.380–5.697, $P = 0.048$) than other categories, consistent with a study conducted in New York City^[16]. Participants in this study stated that they would have declined the first term if the immunizations had been paid for out of pocket in the second term because they could not afford it^[27].

Contrary to the results of the study conducted in UK households, a longitudinal survey showed concerns regarding side effects (11.4%)^[26]. In this study, the majority of HCWs (47.4%) agreed that they were concerned about side effects. SARS-CoV-2 side effects were preventing HCWs from accepting vaccinations since vaccines can have unintended side effects. Some HCWs may have been reluctant to receive vaccinations since they may have caused cardiac issues, discomfort at the injection site, muscular pain, headache, blood clots, fever, chills, and diarrhoea^[28].

In a study conducted in the USA, it was found that participants who received their information from social media (the internet) were more likely to have vaccine hesitancy as compared to those who only received it from TV or radio^[29]. In this study, regarding the source of information, HCWs who obtained information from websites were 1.79 times more likely to have SARS-CoV-2 vaccine hesitation (AOR = 1.79, 95% CI = 1.720–3.179, $P = 0.013$) than those who obtained it from other sources. Users who seek out health information on online platforms run the risk of being exposed to false information that might endanger public health^[30,31]. Health information is frequently magnified by rumours and conspiracy theories that are not always supported by scientific facts.

Table 6
Factors associated with SARS-CoV-2 vaccination hesitancy of healthcare workers in Oromia regional state, Ethiopia, June 2022 (n = 422).

Statement (variables)	Category	N (%)	AOR (95% CI)	p value
Age (ref: > 54 years)	19–34 years	169 (40.1)	2.41 (1.629–3.81)	0.019*
	35–54 years	241 (57.1)	1.05 (0.968–1.427)	0.071
Sex (ref: male)	Female	188 (44.5)	3.68 (1.370–6.413)	0.002**
Income (ref: > 8500 ETB)	< 3500 ETB	117 (27.7)	1.67 (1.380–5.697)	0.048*
	3501–8500 ETB	251 (59.5)	0.72 (0.561–1.027)	0.713
Marital status (ref: unmarried)	Married	232 (55.0)	1.64 (1.296–1.903)	0.064
Addiction (ref: No)	Yes	103 (24.4)	0.91 (0.627–1.031)	0.375
Comorbidity (ref: No)	Yes	98 (23.2)	2.96 (2.562–9.371)	0.076
Source of information (ref: Previously published article)	TV	221 (52.4)	1.02 (1.017–1.343)	0.61
	Websites	113 (26.7)	1.79 (1.720–3.179)	0.013*
	Telegram and Facebook	70 (16.6)	0.19 (0.126–1.025)	0.93
Skepticisms over the vaccine (ref: I don't know)	Yes	212 (50.2)	4.75 (3.210–8.152)	0.009**
	No	165 (39.1)	0.23 (0.107–1.016)	0.06
A SARS-CoV-2 vaccine's potential adverse effects (ref: Strongly disagree)	Yes	249 (59.0)	2.18 (1.732–5.248)	0.043*
	No	141 (33.4)	1.02 (1.017–1.630)	0.07
Not yet available is the SARS-CoV-2 vaccine (ref: Not at all)	Yes	246 (58.3)	1.19 (1.130–1.741)	0.08
	No	123 (29.1)	0.92 (0.519–1.721)	0.26
Myths of conspiracy (ref: Not at all)	Yes	319 (75.6)	2.43 (1.948–5.170)	0.005**
	No	87 (20.6)	0.84 (0.614–1.491)	0.09

AOR, adjusted odd ratio; ETB, Ethiopian Birr; ref: reference.

*P value <0.05 is statistically significant.

**P value <0.01 is highly statistically significant.

Limitations of the study

Due to difficulties doing in-person research when the SARS-CoV-2 outbreak was still ongoing, one constraint was a significant non response bias. After taking the train, reading some published papers, and viewing other information sources, no follow-up was done on the individual to check if they completely refused or accepted the vaccination. Due to the study's online nature, it is possible that third parties with no real affiliation filled out the questionnaire. When this study was being done, the participant and the lead investigator did not interact face-to-face; instead, if the participant had a question, they made an educated guess and answered the inquiry.

Conclusion and recommendations

“Vaccine hesitancy” is the term used to describe those who are reluctant to get safe and readily available vaccinations. SARS-CoV-2 vaccination hesitancy rates among HCWs were generally high. Conspiracy theories, particularly those spread through social media, were the main reasons for healthcare professionals' hesitation to receive the SARS-CoV-2 vaccine, followed by the fact that the vaccine is not yet accessible and the SARS-CoV-2 vaccine is not yet available. HCWs aged 19–34 years, those who expressed concerns about potential side effects of a SARS-CoV-2 vaccine, as well as HCWs who obtained information from websites, were all strongly associated with SARS-CoV-2 vaccine hesitancy. By providing the training, the Oromia regional state health bureau should be able to reduce hesitancy among medical professionals over the SARS-CoV-2 vaccination. To increase the acceptability of the SARS-CoV-2 vaccination, the Oromia regional state health bureau has to develop the trust of HCWs through clear communication and providing proper training.

Ethical approval

The study was commenced after approved by health research ethical review committee of health research directorate of Oromia regional health bureau (Ref: BEFO/HBTFHQQF/1-9/2011).

Consent

The study participants were informed about behind the scenes and oral consent were obtained from each participant. All the HCWs were informed about the objectives of the study, and they agreed to participate. HCWs had been informed of detailed information with practice on how to complete and sent the questionnaire. The anonymity of participants was guaranteed during the data collection process. Behind the scenes were kept, and data were accessible only to the researcher.

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Author contribution

G.B. contributes to the preparation of the proposal, participated in preparing the first draft of the manuscript and edits of the manuscript. The author checked and confirmed the final version of the manuscript.

Conflicts of interest disclosure

The authors declared that they have no competing interest.

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