


Assessment of COVID-19 vaccine uptake and associated factors among healthcare workers in selected health facilities of the Somali Region, Eastern Ethiopia: a cross-sectional study conducted in 2021

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ABSTRACT

Background The global COVID-19 pandemic poses substantial health challenges. Vaccination is key in preventing COVID-19, particularly among healthcare workers (HCWs), essential in curbing the pandemic. Despite global data on HCWs' vaccine uptake, information about vaccination among HCWs in the Somali Region, Ethiopia, is scarce.

Objective This study aimed to assess COVID-19 uptake and determinant factors for HCWs in the Somali Region, Eastern Ethiopia, 2021.

Methods A facility-based cross-sectional study was conducted from 20 October 2021 to 30 October 2021, involving 440 systematically selected participants. Data were collected through self-administered questionnaires, cleaned, coded and entered into Epi Info software (V.3.5.1; CDC). Subsequently, the data were exported to Stata software (V14.1) for analysis. Descriptive statistics were used to report frequency, percentage, mean and SD. Multiple logistic regression analysis was performed to predict the relationship between independent and dependent variables. In the final model, statistical significance was determined with a 95% CI and a $p < 0.05$.

Result A total of 427 HCWs were involved in this study. About 192 (45%) of the participants had a history of test for COVID-19 and 64 (15%) were tested positive for COVID-19 infection. Three hundred and three (76%) at 95% CI (70.3% to 80.6%) of HCWs got at least one dose of the COVID-19 vaccine. Other professions such as paramedics, environmental health and pharmacist were less likely to get COVID-19 vaccine than nurses (adjusted OR, AOR 0.2; 95% CI (0.06 to 0.53)). Participants who were concerned about the availability of the COVID-19 vaccine were less likely to receive it than individuals who were not concerned (AOR 0.01; 95% CI (0.002 to 0.052)).

Conclusion The vaccination uptake among HCWs in the region was relatively low, with the type of profession and concerns about vaccine availability being significant factors affecting the uptake.

WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Globally, healthcare workers (HCWs) express vaccine hesitancy.
- ⇒ Vaccine uptake among Ethiopian HCWs is influenced by factors.
- ⇒ No study has been conducted to estimate the vaccine uptake among HCWs in Somali region Ethiopia.

WHAT THIS STUDY ADDS

- ⇒ COVID-19 vaccine uptake was low among health workers.
- ⇒ Nurses were more likely to be vaccinated than other professions.
- ⇒ Concerns about vaccine availability significantly decreased vaccination likelihood.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- ⇒ Guides future studies on interventions and cultural considerations for HCWs in Somali Region.
- ⇒ Helps healthcare practitioners customise vaccine acceptance strategies, ensuring workforce protection and sustainable services.
- ⇒ Informs policy-makers to shape vaccination policies, addressing specific HCW needs and fostering public trust.



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INTRODUCTION

The COVID-19 pandemic has posed increasing challenges to global health.¹ As per the worldometer report, until 13 December 2023, more than 699.5 million cases and 6954591 deaths were recorded globally.² In Ethiopia, more than 501087 cases and 7574 deaths were recorded.² As part of the worldwide strategy, efforts have been made to develop and distribute vaccines. According

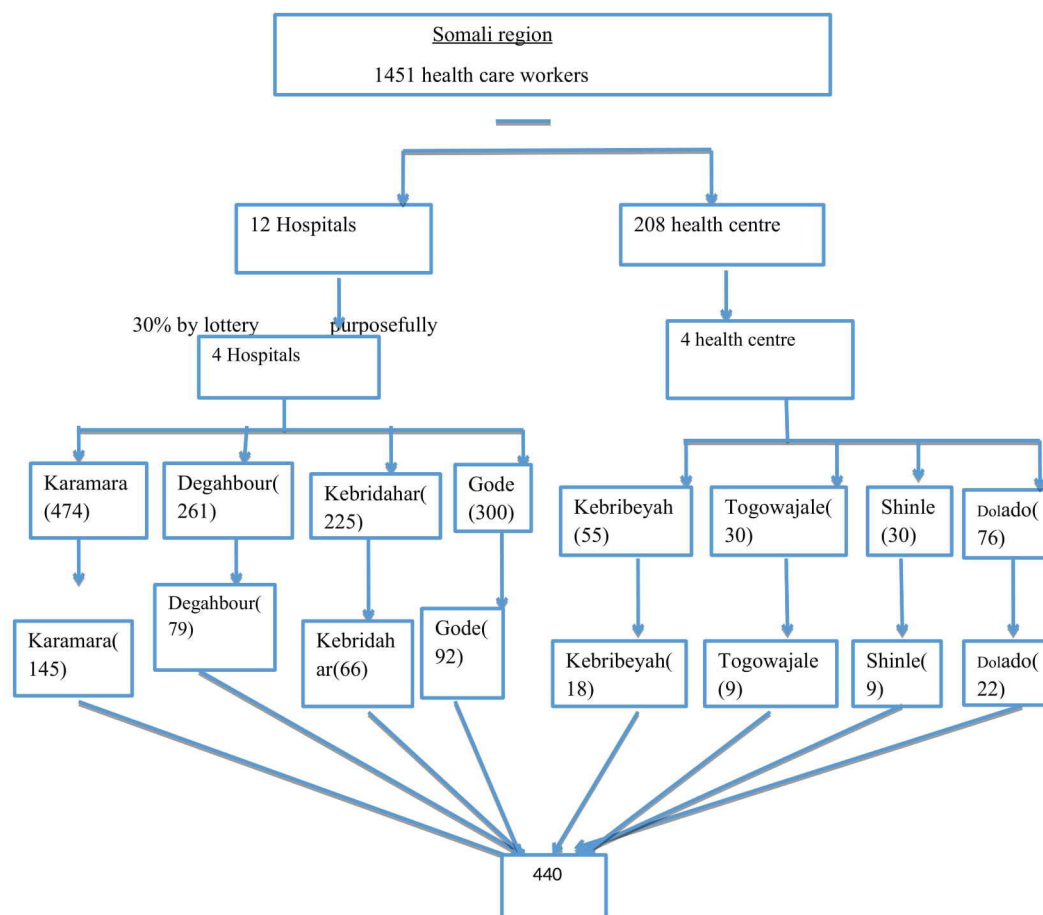


Figure 1 Schematic presentation of the sampling procedure in Somali Region health centres and hospitals, Ethiopia, 2021.

to recent findings, vaccination against COVID-19 has demonstrated significant efficacy in preventing infection among the general public, with a particular emphasis on safeguarding healthcare workers (HCWs).³ While it is important to acknowledge that vaccinations may induce some adverse effects, it is crucial to emphasise that the overall benefits for human health far outweigh these potential risks.^{4,5}

As of 15 January 2023 more than 5.51 billion people worldwide had received at least one dose of a COVID-19 vaccine.⁶ However, 24 African countries have vaccinated less than 3% of their populations during this time.⁶ Ethiopia has also implemented various strategies to control COVID-19, including declaring a state of emergency, issuing restrictions on mass gatherings, enforcing stay-at-home orders and promoting the use of personal protective equipment.^{7,8}

Lately, the Ministry of Health (MoH) of Ethiopia launched COVID-19 vaccine introduction at a high-level national event held at Eka Kotebe COVID-19 hospital where front-line health workers and other non-medical staff in a healthcare facility were vaccinated to mark the beginning of the vaccination campaign on 13 March 2021.⁹ Elderly people above the age of 60 and those above 50 years with chronic diseases were also given priority by the Ethiopian Federal MoH at an early stage.⁸

Willingness to receive a COVID-19 vaccine is a challenge in many countries,^{10–12} including Ethiopia.¹³ High hesitancy rates were also reported worldwide among HCWs. These HCWs play a central role in reducing the burden of the pandemic through their role in modelling preventive behaviour and administering vaccinations.^{14–16} A review of 35 studies revealed that vaccination hesitancy rates varied from 4.3% to 72% worldwide.¹⁷

Major concerns of HCWs about the COVID-19 vaccine were vaccine safety, vaccine efficacy and potential side effects. On the other hand, higher socioeconomic status, directly working with patients, perceived risk and fear of COVID-19, and a history of influenza vaccination were associated with higher vaccine uptake.¹⁶

Vaccination is highly effective at reducing severe illness and death from COVID-19 infection.^{18–19} COVID-19 vaccines are safe, with extremely low risks of severe adverse events.²⁰ Development a safe and effective COVID-19 vaccination is seen as the long-term solution to the COVID-19 pandemic. A critical step in extinguishing the pandemic will be vaccination of a high proportion of the population including HCWs.²¹ Health workers serve as role models and influencers within their communities. Their adherence to preventive measures and vaccine uptake can positively influence the public's behaviour and acceptance. Conversely, vaccine hesitancy

Table 1 Sociodemographic and other characteristics of healthcare workers in the Somali Region, Eastern Ethiopia, 2022 (n=427)

Variables		Frequency	Percentage
Age	18–34	229	53.6
	35–54	174	40.7
	>55	24	5.6
Sex	Male	251	58.8
	Female	176	41.2
Ethnicity	Somali	349	81.7
	Amhara	43	10.1
	Others†	35	8.2
Marital status	Married	208	48.7
	Single	208	48.7
	Others‡	11	2.6
Profession	Nurse	144	33.7
	Doctor	84	19.7
	Laboratory	65	15.2
	Other HWs*	134	31.4
Comorbidities	No	351	82.2
	Yes	76	17.8

*Pharmacist, paramedics, environmental health.
†Oromo, Tigray, Guragi
‡Widowed, divorced, cohabited
HW, health worker.

or non-adherence among health workers can undermine public trust.^{22–23} Studying the factors influencing COVID-19 uptake among health workers in the Somali Region will enable us to develop targeted interventions and communication strategies that address their concerns, enhance their knowledge and foster positive attitudes towards COVID-19 prevention measures

among both health workers and the general population.²⁴ While various studies have explored COVID-19 among health workers globally, there is a lack of research focusing specifically on the Somali Region in Ethiopia. Understanding the unique challenges faced by health workers in this region, such as limited resources, inadequate training and cultural factors, requires a localised approach.²⁵ This study will contribute to the limited literature on health workers in the Somali Region and provide valuable insights to inform future policies and interventions. Thus, the aim of this study was to assess COVID-19 uptake and determinant factors for HCWs in the Somali Region, Eastern Ethiopia, 2021. By studying COVID-19 vaccine uptake among health professionals, the concerned bodies can ensure their protection, maintain healthcare services, build public trust, monitor vaccine effectiveness and inform effective vaccination strategies. It is crucial for mitigating the impact of the pandemic and achieving widespread immunisation to control the spread of COVID-19.

METHODS AND MATERIALS

Study design and study area

The study was conducted at selected hospitals in the Somali Region between 20 October 2021 and 30 October 2021 using an institutional-based cross-sectional design. As per the Health and Health Related Indicators for the year 2019/2020 released by the MoH, the Ethiopian Somali region is documented to possess 12 hospitals and 208 health centres, with a cumulative count of 1451 HCWs.²⁶ In the context of this research, 30% (equivalent to 4 hospitals) of the hospitals were chosen randomly, and 4 health centres were specifically selected due to security considerations. The decision on health centre selection took into account the number of healthcare providers, recognising that numerous health centres grapple with security challenges and lack internet access.

Table 2 Experience of healthcare workers about COVID-19 in the Somali Region, Eastern Ethiopia, 2022 (n=427)

Variables		Frequency	Percentage
Perceived history of COVID-19 infection	Yes	287	67.2
	No	100	23.4
	Not sure	40	9.4
Perceived level of severity of COVID-19	Mild	114	39.7
	Sever	173	60.3
Confirmed by test	Yes	241	84.0
	No	43	16.0
Availability COVID-19 vaccine service	Yes	326	76.3
	No	101	23.7
Confidence of the healthcare workers in answering concern	Not confident at all	13	3
	A little confident	28	6.6
	Moderately confident	72	16.9
	Very confident	314	73.5

Table 3 Behavioural drivers of HCWs about COVID-19 infection and vaccination in the Somali Region, Eastern Ethiopia, 2022 (n=427)

Questions		Frequency	Per cent
Concern in getting COVID-19	Not at all concerned	101	23.7
	A little concerned	156	36.5
	Moderately concerned	119	27.9
	Very concerned	51	11.9
concern of HCW about their patients getting COVID-19 from them	Not at all concerned	129	30.2
	A little concerned	162	37.9
	Moderately concerned	51	11.9
	Very concerned	85	19.9
Perceived importance of getting a COVID-19 vaccine	Not at all important	19	4.5
	A little important	53	12.4
	Moderately important	103	24.1
	Very important	252	59
Perceived importance of getting a COVID-19 vaccine for yourself will protect others	Not at all	45	10.5
	A little	44	10.3
	Moderately	94	22.0
	Very much	244	57.1
Perceived safety of COVID-19 vaccine	Moderately safe	200	46.8
	A little safe	96	22.5
	Note at all safe	131	30.7

HCW, healthcare worker.

The remaining health facilities are located in sparsely populated areas where there is an insufficient presence of healthcare providers, and some are devoid of healthcare personnel altogether. Consequently, only four health facilities were deliberately chosen for inclusion in the study.

Source and study population

All HCWs who worked in selected hospitals and health centres during the study period were the source of population. The study population was sampled HCWs found in the selected health facility and fulfil inclusion criteria.

Eligibility criteria

All HCWs aged 18 and above, working in the selected health facility, and available during the study period were considered eligible to participate in this study.

Sample size and sampling procedure

Sample size was determined by using a single population proportion formula by considering the following assumptions: COVID-19 vaccine uptake in the previous study was 62.1%²⁷ margin of error ($d=5\%$), 95% CI (standard $z=1.96$) and 5% non-respondent rate: the final sample size was 440.

Four hospitals (Karamara, Degahbuur, Kabridahar and Gode) and four health centres (Kebribayah, Togwajaale, Shinile and Dolo-ado) were selected via simple random sampling techniques whereas the

study participants were recruited through systematic random sampling techniques and a log book. The proportional sample allocation method is used to get the required sample size. To obtain the necessary sample size of 440 HCWs, we compiled a list of HCWs from each hospital and health centre. We then used a log book to randomly select the study participants. See [figure 1](#) for a visual representation of the sampling procedure.

Sampling procedure

For this study, a total of 12 hospitals in the Somali region were subjected to the lottery method, resulting in the random selection of four hospitals—specifically, Karamara, Degahbour, Kebridahar and Gode hospitals. In contrast, the selection of health centres involved a purposive approach, with four health centres chosen deliberately due to security considerations. The decision to select health centres took into account the number of healthcare providers, acknowledging the prevalent security challenges and lack of internet access in many health centres. The remaining health facilities, situated in sparsely populated areas with insufficient healthcare providers and some entirely lacking personnel, were not included in the study. Consequently, the study focused on four intentionally chosen health centres: Kebribayah, Togowajale, Shinile and Dolado health centres. The

Table 4 Determinant factors of COVID-19 vaccination uptake among HCWs in Somali Region, Eastern Ethiopia, 2022 (n=427)

Variables		Vaccination uptake status of HCWs		COR	AOR
		Vaccinated	Not vaccinated	95% CI	95% CI
Age	18–34	163	66	9.31 (1.23 to 70.36)*	3.1 (0.31 to 30.68)
	35–54	140	34	5.6 (0.73 to 42.82)	2.5 (0.25 to 26.04)
	>54	23	1	1	1
Sex	Male	135	41	1 (0.66 to 1.63)	
	Female	191	60	1	
Profession	Doctor	69	15	0.5 (0.26 to 0.99)*	0.2 (0.04 to 1.03)
	Nurse	117	27	0.54 (0.31 to 0.95)*	0.2 (0.06 to 0.53)†
	Laboratory	46	19	0.97 (0.31 to 0.95)	0.4 (0.13 to 1.41)
	Others*	94	40	1	1
Chronic disease	Yes	60	16	0.84 (0.46 to 1.53)	
	No	266	85	1	
Concerned about getting COVID-19?	Not at all concerned	69	32	2.9 (1.18 to 7.18)*	2.3 (0.41 to 12.78)
	A little concerned	119	37	1.9 (0.81 to 4.71)	1.5 (0.25 to 8.41)
	Moderately concerned	94	25	1.7 (0.67 to 4.16)	1.9 (0.31 to 11.83)
	Very concerned	44	7	1	1
Concerned are you about your patients getting COVID-19 from you?	Not concerned at all	87	42	1.6 (0.84 to 2.92)	
	Little concerned	137	25	0.59 (0.31 to 1.15)	
	moderately concerned	37	14	1.2 (0.56 to 2.72)	
	Very concerned	65	20	1	
Availability COVID-19 vaccination	Yes	317	47	0.03 (0.01 to 0.05)*	0.01 (0.002 to 0.052)†
	No	9	54	1	1
How safe is COVID-19 vaccine is?	Not safe at all	118	13	0.6 (0.29 to 1.15)	0.26 (0.05 to 1.47)
	A little safe	40	56	4.4 (4.22 to 12.79)*	0.29 (0.07 to 1.29)
	Moderately safe	168	32	1	1

*p<0.05.

†p<0.01.

AOR, adjusted OR; COR, crude OR; HCW, healthcare worker.

sample size was distributed proportionally among each hospital and health centre, taking into account their respective sizes. Individual subjects were then chosen through simple random sampling until the estimated sample size was reached (figure 1).

Data collection process

A structured self-administered survey was used to gather data, developed through a comprehensive review of various kinds of literature.^{27–30} The questionnaire encompassed sociodemographic inquiries and items related to COVID-19. To ensure its effectiveness, the questionnaire underwent a pretest involving 5% of healthcare providers who, although employed elsewhere, were comparable to the study's participants. Minor adjustments were made based on the pretest results.

Daily collection of questionnaires took place with a thorough check for completeness. In instances of incomplete responses, efforts were made to contact

the respondents for completion. The data collection process was closely supervised by investigators to ensure accuracy. Data collectors and supervisors underwent a 2-day training session to ensure a shared understanding of data collection tools and procedures.

The data collection team, consisting of BSc nurses and master's degree supervisors, played a vital role in the study. Data collectors distributed self-administered questionnaires to HCWs, providing clear instructions and ensuring participants understood the study's purpose. They explained objectives, obtained informed consent and addressed concerns. Monitoring questionnaire completion, data collectors ensured accuracy and availability for participant queries.

Implementing measures for data quality, data collectors checked completeness and consistency, clarifying responses if needed. They collected

completed questionnaires timely, preserving data integrity. Upholding participant confidentiality, data collectors handled information securely, preventing individual responses from disclosure. Adherence to precautionary measures, such as wearing masks and maintaining physical distancing, was observed during the data collection process.

Variables

The dependent variable in the study was the uptake of COVID-19, while the independent variables included sociodemographic characteristics of health workers, comorbidity, history of COVID-19 infection, confirmed test results, perceived severity of COVID-19, availability of COVID-19 vaccine services, confidence of HCWs in addressing concerns and behavioural drivers of HCWs regarding COVID-19 infection and vaccination.

Operational definition and its measurements

Vaccine uptake: is the total number of participants who received at least one dose of the COVID-19 vaccination throughout the survey period. It was determined by the closed-ended question, 'Have you had one of the COVID-19 vaccines at least once recently?' (Yes/No). Participants were asked to indicate their vaccine uptake by responding 'yes' or 'no' to the question.^{17 31}

Data processing and analysis

Data were checked for completeness, consistency and cleaned, coded and entered into single Epi Info software (V.3.5.1; Center for Disease Control and Prevention (CDC) and exported into Stata software (V.14.1; StataCorp) for further analysis. Descriptive statistics were computed to describe participants' sociodemographic characteristics; continuous data were reported as mean±SD and percentages (frequencies) for categorical data.

Bivariable analysis was done to identify candidate variables for multivariable logistic regression. Those variables with a $p < 0.25$ during the bivariable analysis were used for the final multivariable logistic regression model. Hosmer and Lemeshow tests were used to determine the model's fitness. Adjusted OR (AOR) with 95% CIs was used to show an association between explanatory variables and dependent variables. In the final model, a CI of (95%) and a $p < 0.05$ were considered to indicate an association between dependent and independent variables.

Patient and public involvement

No patients or the public were directly involved in the development of research questions and outcomes. No patients were involved in the recruitment and design of this study. However, the study participants and administrative officials were informed about the research questions and study objectives. The findings of this research have been planned to be disseminated to Somalia Regional Health Bureau, Ethiopia; furthermore, the results of

this research will be disseminated to several stakeholders after being published in scientific journals.

RESULTS

Sociodemographic characteristics

A total of 427 HCWs were involved in this study with a response rate of 97%. Out of 427 participants, 285 (66.7%) were males and the mean age was 29.05 ± 8.03 . About 273 (63.9%) were nurses and 208 (48.7%) were married (table 1).

History of COVID-19 infection

About 192 (45%) of the participants were tested for COVID-19 and 64 (15%) showed positive results for COVID-19 infection (table 2).

Magnitude of vaccination uptake

Three hundred and twenty-six (76.3%) of HCWs were getting at least one dose of COVID-19 vaccination with CI at 95% (70.3% to 80.6%) and 349 (81.7%) had no problem accessing COVID-19 vaccine.

Behavioural drivers of COVID-19 infection and vaccination

About 101 (23.7%) were not concerned at all about getting COVID-19 infection and 129 (30.2%) of them were not worried at all about transmitting COVID-19 infection to others. Additionally, 252 (59% of the participants) considered the COVID-19 vaccine to be very important for their health but 131 (30.7%) believed that it was not safe at all (table 3).

Determinant factors of COVID-19 vaccination uptake among HCWs

In multiple logistic regression analysis, type of profession and availability of COVID-19 vaccine, were significantly associated determinants of COVID-19 vaccination uptake among HCWs. Thus, other professions like paramedics, environmental health and pharmacists were less likely to get COVID-19 vaccine than nurses (AOR 0.2; 95% CI (0.06 to 0.53)). Participants who were concerned about the COVID-19 vaccine availability were less likely to receive it than individuals who were not concerned (AOR 0.01; 95% CI (0.002 to 0.052)).

Nevertheless, sociodemographic characteristics, the safety, benefits and concern about contracting COVID-19 were not significantly related to the uptake of the COVID-19 vaccination (table 4).

DISCUSSION

Due to their professional responsibilities and commitment to disseminating information and improving the accessibility of COVID-19 vaccination services to the general public, HCWs uptake and perception of COVID-19 vaccines play a pivotal role in the community, according to the study's objectives.³² The study aimed to assess COVID-19 vaccine uptake and the influencing factors among HCWs in the Somali region.

In this study, it was found that approximately 76% (95% CI 70.3% to 80.6%) of HCWs received at least one dose of the COVID-19 vaccination. This figure is consistent with a study conducted in Cyprus, where the vaccination rate was reported at 70.5%.³³ However, it exceeds the rates found in Ethiopian studies³¹ at 62.1%, while falling below rates observed in Egypt³⁴ at 90%, the USA³⁵ at 81% and Greece³⁶ at 77.3%. The observed variation in vaccination rates across these regions may be attributed to several factors, including differences in awareness campaigns, cultural beliefs, healthcare infrastructure, vaccine availability and governmental policies promoting vaccination. It underscores the complexity of factors influencing vaccine uptake and the importance of context-specific considerations in understanding and addressing vaccination behaviours among HCWs in diverse settings.

Regarding perception towards the COVID-19 vaccine, about 45.4% of the participants thought that the vaccine was very safe. But, concern about unknown adverse effects was a key deterrent to COVID-19 vaccine uptake. Participants are more likely to be informed about the seriousness of the problem and to adopt positive attitudes and behaviours towards vaccination. But, the use of social media could lead to a rise in vaccination conspiracy beliefs.³⁷

In this study, other professions such as paramedics, environmental health professionals and pharmacist were less likely to get the COVID-19 vaccine as compared with nurse in profession. This finding is consistent with a study conducted in Southeast Asian Jurisdictions. In this study, vaccine acceptance was higher among HCWs involved in direct patient care and in HCWs with chronic medical conditions.³⁸

Incongruently, about 1/10th of HCWs were not concerned about COVID-19 infection for themselves and others including family members and patients. The most common overall obstacle among all participants, whether wanting or unwilling to get vaccinated, was apprehension about unknown adverse effects. Respondents in Pakistan expressed similar concerns about the vaccine's unknown negative effects.³⁹ The results of this study highlighted the issue of vaccine safety and the distrust of government policies. The findings of our study are in agreement with those of studies performed in Egypt and Pakistan.^{34 39}

Our study has the following limitations; first, the study was cross-sectional and could not identify causality. Second, the study was conducted in governmental health facilities and may not represent HCWs in private health facilities.

CONCLUSION

The study found that COVID-19 vaccine uptake was low among HCWs in the Somali region. The type of profession and the availability of the COVID-19 vaccine were identified as significant determinants of vaccine uptake among HCWs. To ensure a sufficient response to the pandemic among HCWs, it is important to develop strategies that

address these factors. Open and transparent communication about the uncertainties and risks associated with the vaccine, as well as emphasising its safety and benefits, can help motivate pharmacists and paramedics to get vaccinated. Additionally, addressing vaccine barriers among these specific groups is crucial to prevent widening health inequities highlighted by the pandemic.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Consent obtained directly from patient(s).

Ethics approval This study involves human participants and was approved by UNICEF's Ethiopia review board (UNICEF Ethiopia /097/2021). Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. The finding of this study is generated from the data collected and analysed based on the stated methods and materials. The original data supporting this finding will be available at any time upon request.

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