

Covid-19 Vaccine Side Effects and Its Associated Factors Among Healthcare Workers at Dessie Hospital, Ethiopia

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Background: Vaccines are a powerful choice to stop disease outbreaks, including covid-19. However, people are hesitant to take vaccinations due to uncertainty about side effects. So, this study aimed to assess covid-19 vaccine side-effect and its associated factors among healthcare workers in Dessie comprehensive specialized hospital, in Ethiopia.

Methods: An institution-based cross-sectional study was conducted at Dessie Comprehensive and Specialized Hospital among 351 vaccinated healthcare workers from April 25 to May 25, 2021. Self-administrated questionnaires were used by consented health workers. Variance inflation factor (VIF) was used to assess the multicollinearity of independent variables. Bivariable and multivariable binary logistic regression were used to identify significant factors of vaccine side effects. The adjusted odds ratio (AOR) with a 95% confidence interval (CI) was reported as the effect size. Statistical significance was considered at p-value <0.05.

Results: Overall, of vaccinated healthcare workers, 56.98% (95% CI, 50.86–61.26%) experienced at least one side effect. The majority of the side effects were fever (44.44%), headache (39.03%), fatigue (27.35%), injection site pain (25.93%), and nausea (24.22%). Healthcare workers with (≥10 years) of work experience (AOR: 3.74, 95% CI, 1.32–10.59), Hesitancy to take the first dose of the Covid-19 vaccine (AOR: 3.01, 95% CI, 1.82–4.99), underlying chronic disease (AOR: 14.41, 95% CI, (5.07–40.92)), being on antihypertensive medication (AOR: 0.15; 95% CI (0.02–0.93)), and unsafe perception of vaccine safety (AOR:3.50; 95% CI, 1.43–8.57) were independent factors of Covax vaccine side effect development.

Conclusion: Overall, common vaccine side effects were identified in healthcare workers who have taken the Covax vaccine. Healthcare workers with (≥10 years) of work experience, Hesitancy to take the first dose, unsafe perception of vaccine safety, and underlined chronic disease were predictors of vaccine side effect occurrence. So, providing vaccine-related information to the community to be vaccinated is mandatory to reduce hesitancy and flaws regarding vaccine safety.

Keywords: Covid-19, vaccine side effects, associated factors, health care workers, Ethiopia

Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the causative agent of coronavirus disease 2019 (COVID-19), has created a global pandemic that is transcending geographic boundaries and endangering billions of

lives. The transmission of respiratory pathogens is associated with three main modes known as contact, droplet and airborne.¹

By the end of April 2021, covid-19 globally infected 145,402,544 and killed 3,087,246 people and in Ethiopia, 247,989 cases and 3496 deaths were documented.² The pandemic has prompted a sensational loss of human life worldwide and presents an unprecedented challenge to public health, food systems, and the world of work.^{3,4} The economic and social disruption caused by the pandemic is devastating: tens of millions of individuals are in danger of falling into extreme impoverishment, whereas the number of malnourished individuals, currently (2021) estimated at nearly 690 million, may increase by up to 132 million before the year's over.^{4,5}

Vaccinations are a powerful choice to stop disease outbreaks, including covid-19.⁶ The ideal vaccine should be effective and well-tolerated. In practice, vaccine side effects such as fever, muscle ache, and injection site pain are common but generally mild. However, sometimes adverse reactions including anaphylaxis, shock, seizure, active infection, and death will occur.⁷ The Ministry of Health of Ethiopia (MOH) introduced the COVAX vaccine on 13 March 2021 against covid-19.⁸ It is a recombinant protein-based covid-19 vaccine developed by the south Australian-based biotech company vaccine.⁹

Since covid-19 vaccines are as yet in progress, data on their safety is limited.¹⁰ As a result, people hesitate to take the vaccine when there is a lack of knowledge and experience about the safety of a new vaccine.¹¹ However, any attainable risks which will exist are significantly under those related to covid-19 infection and immensely outweighed by the advantages of protecting individuals and preventing the virus from spreading.¹²

Different studies show various side effects reported from different individuals: lymphadenopathy,¹³ Injection site pain,^{14–16} fatigue,^{14,15} headache,^{14–16} muscle pain,^{14,15} chills,^{14,15} fever,^{15,16} joint pain, nausea.^{15,16}

Covid-19 vaccine hesitancy is a growing public health challenge fuelled by misinformation.¹⁷ Although, identifying the possible side effects of covid-19 will help not only in the management of adverse outcomes and side effects, but it is also very important in the enhancement of covid-19 vaccination, minimizing hesitancy related to vaccine side effects and overall covid-19-related morbidity and mortality reduction, there is no relevant data on side effects of the covid-19 vaccine in Ethiopia. So this study aimed to assess the prevalence and associated factors of the first dose covid-19 vaccine in Ethiopia among Dessie comprehensive and specialized referral hospital vaccinated health care workers in 2021.

Methods and Materials

Study Area and Period

The study was conducted among healthcare providers who took the Covid-19 vaccine in Dessie comprehensive and specialized referral hospital, North East Ethiopia, from April 25- May 25/ 2021. According to Dessie city of Finance Bureau and Economic Development (BOFED) estimation in 2018, the estimated population size of the town was 239,620.¹⁸ The town is found at an altitude of 2470 to 2550 meters above sea level and the temperature ranges from 15–17°C. There are two public hospitals and eight health centers in Dessie city that provide the Covid-19 vaccine.⁸

Study Design and Population

An institution-based cross-sectional study was conducted among healthcare workers who took the first dose of covid-19 vaccine.

Sample Size Determination and Sampling Procedure

The sample size was determined using a single population proportion formula, by considering the prevalence of at least one covid-19 vaccine side effect (P=65.9%), 5% precision, 95% confidence interval, and 80% power.

$$n = \left(\frac{za}{2} \right)^2 \frac{p(1-p)}{(d)^2}$$

$3.841 \times 0.224 = 0.863 / 0.0025 = 345$ then we added a 10% non-response rate which is 35 finally the required sample size after adding a 10% non-response rate became 378 healthcare providers were included in this study. The calculated sample sizes were included by the consecutive sampling method.

Variables of the Study and Their Measurement

Dependent Variable

A covid-19 vaccine side effect was measured as a nominal categorical variable (at least one side effect present =yes and otherwise no). Each side effect listed in Table 1 is coded one if the health care workers experienced it after the first COVAX vaccine and within three days of the vaccination and otherwise zero.

Table 1 Side Effects of COVAX Vaccine Among Healthcare Workers in Dessie Referral Hospital, Ethiopia, 2021

Variables	Categories	Frequency, Percentage (%)
Fever	Yes	156 (44.44)
	No	195 (55.56)
Headaches	Yes	137 (39.03)
	No	214 (60.97)
Chills	Yes	69 (19.66)
	No	282 (80.34)
Myalgia	Yes	103 (29.34)
	No	248 (70.66)
Injected site pain	Yes	91 (25.93)
	No	260 (74.07)
Sore throat	Yes	20 (5.70)
	No	331 (94.30)
Abdominal pain	Yes	10 (2.85)
	No	341 (97.15)
Leg swelling	Yes	30 (8.55)
	No	321 (91.45)
Nausea	Yes	85 (24.22)
	No	266 (75.78)
Vomiting	Yes	59 (16.81)
	No	292 (83.19)
Fatigue	Yes	96 (27.35)
	No	255 (72.65)
Insomnia	Yes	52 (14.81)
	No	299 (85.19)
Lymphadenopathy	Yes	13 (3.70)
	No	338 (96.30)

(Continued)

Table 1 (Continued).

Variables	Categories	Frequency, Percentage (%)
Shortness of breath	Yes	50 (14.25)
	No	301 (85.75)
Feeling of un-wellness	Yes	60 (17.09)
	No	291 (82.91)
Halitosis	Yes	3 (0.85)
	No	348 (99.15)
Ulcer	Yes	3 (0.85)
	No	348 (99.15)
Angular cheilitis	Yes	14 (3.99)
	No	337 (96.01)
Skin rash	Yes	20 (5.70)
	No	331 (94.30)
Overall at least one side effect developed	Yes	200 [56.98% (95% CI, 50.86–61.26%)]
	No	151 [43.02% (95% CI, 38.74–49.14%)]

Independent Variables

Socio-Demographic Factors

Age was measured as a continuous variable in completed years, sex is a nominal categorical variable and labelled as male and female, marital status, profession, and religion were also measured as a nominal categorical variable and work experience measured as ordinal categorical variable labelled as less than 10 and 10 or more years.

Underline Diseases and Medication-Related Factors

Having chronic diseases measured as a nominal categorical variable and labeled as yes and no, previous Covid-19 infection, exposure to Covid-19 patients, and taking chronic disease medications were measured as nominal categorical variables as yes and no.

Perception-Related Factors

Hesitancy to take the first Covid-19 vaccine measured as a nominal categorical variable as yes or no, perception of vaccine safety measured as an ordinal variable (safe, do not know, and unsafe).

Operational Definitions

Underlining Chronic Diseases

The presence of any one or more of chronic diseases in [Table 2](#) is considered as the presence of chronic disease otherwise no chronic disease.

Medication

Health care workers taking one or more medication(s) are considered as on medication other wise no.

Table 2 Medical and Medication Use Status of Dessie Referral Hospital Health Care Workers, 2021

Variables	Medical Condition		Medication-Taking Status of the Participants		
	Categories	Frequency (%)	Medications Type	Status	Frequency (%)
Allergy	Yes	16 (4.56)	Anti-asthmatic	Yes	14 (3.99)
	No	335 (95.44)		No	337 (96.01)
Asthma	Yes	14 (3.99)	Antibiotics	Yes	6 (1.71)
	No	337 (96.01)		No	345 (98.29)
Hypertension	Yes	19 (5.41)	Antiepileptic	Yes	11 (3.13)
	No	332 (94.59)		No	340 (96.87)
Diabetes mellitus	Yes	10 (2.85)	Cardiac medication	Yes	11 (3.13)
	No	341 (97.15)		No	340 (96.87)
Liver disease	Yes	8 (2.28)	Anti-hypertension	Yes	15 (4.27)
	No	343 (97.72)		No	336 (95.73)
Cardiac disease	Yes	9 (2.56)	Hypoglycemic agent	Yes	10 (2.85)
	No	342 (97.44)		No	341 (97.15)
Cancer	Yes	3 (0.85)	Steroid drug	Yes	2 (0.57)
	No	348 (99.15)		No	349 (99.43)
Pulmonary disease	Yes	3 (0.85)	Thyroid disease medication	Yes	1 (0.28)
	No	348 (99.15)		No	350 (99.72)
Kidney disease	Yes	7 (1.99)	Analgesics	Yes	9 (2.56)
	No	347 (98.01)		No	342 (97.44)
Neuro-psychiatric	Yes	14 (3.99)	At least one medication use	Yes	65 (18.52)
	No	337 (96.01)		No	286 (81.48)
Hematologic disease	Yes	3 (0.85)			
	No	348 (99.15)			
At least one medical condition	Yes	82 (23.36)			
	No	269 (76.64)			

Data Collection Procedures and Measurements

The data were collected by a self-administered questionnaire using a structured questionnaire prepared to address all the important variables. The questionnaire was adopted from different literature developed for similar purposes.^{14–16,19} It was collected by four nurses with a degree in Bachelor of Science (BSC) as data collectors, two Public health officers as a supervisor with a principal investigator.

Data Quality Control

The questionnaire was developed in English and administered as it is for health care professionals and translated into a local language for non-professional health workers. Data collectors and supervisors were trained for one day on the objective of the study, the content of the questionnaire, the data collection procedure, how to approach study participants,

and different ethical issues. During the data collection period, the collected data were checked continuously daily for completeness and consistency by the principal investigator and supervisors. Data entry was done in Epi-data version 3.1 and exported to Stata version 14.1 for analysis.

Data Processing and Analysis

Data were cross-checked, coded, and entered into Epi Data Version 3.1 and exported to Stata version 14.1 for statistical analysis. Cronbach's alpha was used to assess the consistency or reliability of questionnaires to measure the side effects of the COVAX vaccine. It ranges from 0 to 1. The closer Cronbach's alpha coefficient is to 1.0, the greater the internal consistency of the items in the measurement of the outcome. George and Mallery provided the following rules of thumb for Cronbach's alpha value: " ≥ 0.9 – Excellent, ≥ 0.8 – Good, ≥ 0.7 – Acceptable, ≥ 0.6 – Questionable, ≥ 0.5 – Poor, and ≤ 0.5 – Unacceptable".²⁰ Descriptive statistics such as frequency, percentage, and mean with standard deviation were computed. We used χ^2 and Student's *t*-tests to compare the study characteristics of individuals with the development of COVAX side-effect. Bivariable and multivariable binary logistic regression models were used to assess the significant association between independent variables and outcome variables. All independent variables having a p-value less than 0.2 were included in the multivariable binary logistic regression model. The multicollinearity test was checked by using the variance inflation factor (VIF) between independent variables. A VIF value of 10 or more was considered as a cut point for the elimination variable from the model and no collinearity was detected. The goodness of the model was checked by Hosmer and Lemeshow's test statistics considered a good fit if a p-value greater than 0.05 and the area under Receiver Operator Characteristic (ROC) curve the model has a good prediction if the area ROC curve is more than 0.6. Finally, variables with a P-value less than 0.05 in multivariable binary logistic regression will be taken as statistically significant and the adjusted odds ratio with its 95% confidence interval will be considered to see the strength and direction of the association.

Ethical Considerations

Ethical clearance was taken from the Ethical Review Committee of Wollo University College of Medicine and Health Sciences. A letter of permission to conduct the study was obtained from the Administrative Health Office of Dessie city administration. After explaining the purpose of the study, written informed consent was obtained from participants before the data collection. They were informed that participating in the study is voluntary and the right to withdraw from the study at any time during the interview was assured. The privacy of the participants and the confidentiality of the information they provided were secured at all levels anonymously. This study complies with the Declaration of Helsinki.

Results

Demographic Characteristics of Study Participants on the Side Effect of the Covid-19 Vaccine

From 378 study participants, 351 completed the questionnaire, making the response rate 92.86%. The mean age of the participants was 34 ± 6.89 years and the majority were males 213 (60.68%). Of all study participants, most of the health professionals 305 (86.89) had less than 10 years of work experience. About 114 (32.48%) and 110 (31.34%) participants were nurses and physicians respectively. More than half, 187 (53.28%) health workers were exposed to Known Covid-19 patients and 30 (8.55%) participants' experienced Covid-19 infection before the vaccination came into practice. More than half 204 (58.29%) health professionals hesitated to take the vaccine and their reasons were a side effect of the vaccine (53.23%), distrust of vaccine effectiveness (19.40%), fear of getting Covid-19 from the vaccine, and aggravation of underlying chronic diseases (3.99%) (Table 3).

Table 3 Demographic Characteristics of Study Participants Who Received the First Dose of COVAX Vaccine in Dessie Specialized Referral Hospital, 2021

Characteristics	Categories	Frequency of Respondents (Percentage %)
Age in years (mean \pm SD)		34.17 \pm 6.89
Sex	Male	213 (60.68)
	Female	138 (39.32)
Marital status	Married	166 (47.29)
	Single	115 (32.76)
	Divorced	54 (15.38)
	Widowed	16 (4.56)
Religion	Orthodox	195 (55.56)
	Muslim	107 (30.48)
	Catholic	25 (7.12)
	Protestant	24 (6.84)
Profession	Physicians	110 (31.34)
	Nurses	114 (32.48)
	Midwives	41 (11.68)
	Laboratory	25 (7.12)
	Pharmacy	24 (6.84)
	Others	37 (10.54)
Work experiences	<10 years	305 (86.89)
	\geq 10 years	46 (13.11)
Ever Covid-19 infection	Yes	30 (8.55)
	No	321 (91.45)
Exposure for Covid-19 patients	Yes	187 (53.28)
	No	164 (46.72)
Hesitation to take the first dose	Yes	204 (58.29)
	No	146 (41.71)
Reasons for hesitation	Side effect	107 (53.23)
	Distrust effectiveness	39 (19.40)
	Fear of getting Covid-19	47 (23.38)
	Presence of chronic disease	8 (3.99)
Perception of vaccine safety	Safe	194 (55.27)
	Do not know	115 (32.76)
	Unsafe	42 (11.97)

Note: Others =physiotherapy, radiologists, cleaner, and porters.

Characteristics of Study Participants by Medical Condition and Medication Use Before They Received the Covid-19 Vaccine

About a quarter of 82 (23.36%) study participants experienced at least one medical problem. Of these, the majority 19 (5.41%), 16 (4.56%), 14 (3.99%), 10 (2.85%), and 9 (2.56%) of problems were hypertension, allergy, asthma, diabetes mellitus, and cardiac problems respectively.

Regarding medication use, 65 (18.52%) healthcare workers used at least one medication for their underlying disease. From this, 15 (4.27%), 14 (3.99%) and 11 (3.13%) were on antihypertensive, anti-asthmatic, and anti-epileptic medications (Table 2).

The Magnitude of COVAX Vaccine Side-Effects Among Dessie Comprehensive Specialized Referral Hospital, 2021

The Cronbach's alpha for the side effects from 21 questionnaires was 85.51% and it was an indication of good variable consistency to measure the intended outcome. Overall, of healthcare workers who took the COVAX vaccine, 200 (56.98%) developed at least one side effect. The majority of the side effects were fever (44.44%), headache (39.03%), fatigue (27.35%), injected site pain (25.93%), and nausea (24.22%) (Table 1).

Distribution of the Side Effect Among Health Care Workers in Dessie Referral Hospital by Study Variables

Overall, 200 (56.98%) of the participants experienced at least one side effect of the COVAX vaccine side effect (Table 1). The mean age of the study participants was significantly higher in individuals developing side effects (independent *t*-test, *p*-value=0.03). The prevalence of COVAX-vaccine side effects was significantly altered between work experience ≥ 10 years and < 10 years (chi-square, *p*-value<0.001). Those health professionals at Dessie Referral Hospital that had a variety of perceptions of the safety of the vaccine were significantly different in the development of COVAX vaccine side effects (chi-square, *p*-value<0.001). Similarly, those health professionals who had at least one medical problem and who were hesitant to take the first dose of the Covid-19 vaccine was significantly varying in side effect development (Table 4).

Table 4 Covax Vaccine Side Effect Distribution by Study Characteristics in Dessie Referral Hospital, 2021

Variables	Categories	Vaccine Side Effect		Chi-Square/t-test (p-value)
		Yes	No	
		Frequency, Percentage (%)	Frequency, Percentage (%)	
Mean age \pm SD		34.85 \pm 7.1	33.26 \pm 6.48	0.03
Sex	Male	118 (55.40)	95 (44.60)	0.457
	Female	82 (59.42)	56 (40.58)	
Marital status	Married	86 (43.00)	80 (52.98)	0.076
	Single	65 (32.50)	50 (33.11)	
	Divorced	37 (18.50)	17 (11.26)	
	Widowed	12 (6.00)	4 (2.65)	

(Continued)

Table 4 (Continued).

Variables	Categories	Vaccine Side Effect		Chi-Square/t-test (p-value)
		Yes	No	
		Frequency, Percentage (%)	Frequency, Percentage (%)	
Religion	Orthodox	102 (51.00)	93 (61.59)	0.181
	Muslim	70 (35.00)	37 (24.50)	
	Catholic	14 (7.00)	11 (7.28)	
	Protestant	14 (7.00)	10 (6.62)	
Profession	Physicians	54 (27.00)	56 (37.09)	0.058
	Nurses	68 (34.00)	46 (30.46)	
	Midwives	21 (10.50)	20 (13.25)	
	Laboratories	19 (9.50)	6 (3.97)	
	Pharmacy	18 (9.00)	6 (3.97)	
	Others	20 (10.00)	17 (11.26)	
Work experiences	<10 years	162 (81.00)	143 (94.70)	<0.001
	≥10 years	38 (19.00)	8 (5.30)	
Ever Covid-19 infection	Yes	18 (9.00)	12 (7.95)	0.727
	No	182 (91.00)	139 (92.05)	
Exposure for Covid-19 patients	Yes	107 (53.50)	80 (52.98)	
	No	93 (46.50)	71 (47.02)	
On antiepileptic medication	Yes	9 (4.50)	2 (1.32)	0.091
	No	191 (95.50)	149 (98.68)	
On antihypertensive	Yes	12 (6.00)	3 (1.99)	0.066
	No	188 (94.00)	148 (98.01)	
Perception of vaccine safety	Safe	100 (50.00)	94 (62.25)	<0.001
	Do not know	67 (33.50)	48 (31.79)	
	Unsafe	33 (16.50)	9 (5.96)	
Medical condition	At least one	74 (37.00)	8 (5.30)	<0.001
	No medical problem	126 (63.00)	143 (94.70)	
Hesitation to take the first dose vaccine	Yes	136 (68.34)	68 (45.03)	<0.001
	No	63 (31.66)	83 (54.97)	
Overall at least one side effect of development	Yes	200 (56.98)	151 (43.02)	

Note: Others =physiotherapy, radiologist, cleaner, porters.

Multivariable Analysis of COVAX- Vaccine Side-Effects Among Health Care Workers in Dessie Comprehensive Specialized Hospital

In the current study, multivariable binary logistic regression showed that longer work experience, hesitancy to take the first dose of vaccine, presence of at least one medical condition, anti-hypertensive medication, and healthcare workers do not believe the vaccine is safe were significant predictors for the development of COVAX-vaccine side-effect. The mean VIF was 1.26 with a minimum of 1.04 and a maximum of 1.55. The overall goodness-of-fit test was good with (p -value=0.1011) and the area under the ROC curve was 76.95%.

The odds of Covax vaccine side effect was increased by 3.74 (95% CI, 1.32–10.59) among healthcare workers who had more than 10 years of work experience controlling for other factors. The odds of having a covid-19 vaccine side effect in healthcare workers was increased by a factor of 3.01 (95% CI, 1.82–4.99) for those who were hesitant to take the first dose of the covid-19 vaccine as compared to those not hesitated to take the vaccine. On the other hand, the odds of having a covid-19 vaccine side effect in healthcare workers was increased by a factor of 14.41 (95% CI, 5.07–40.92) for those who had at least one medical condition as compared to those who had no medical condition. The odds of Covid-19 vaccine side effects were reduced by 85% AOR=0.15 (95% CI, 0.02–0.93) among health workers on anti-hypertensive medication as compared to those not on antihypertensive medications. Among healthcare workers who did not believe the Covid-19 vaccine is a safe intervention, the odds of developing the side effect were 3.50 times more likely (95% CI, 1.43–8.57) than those who believe the vaccine is a safe intervention (Table 5).

Table 5 Multivariable Analysis of Covid-19 Vaccine Side Effects Among Health Workers in Dessie Comprehensive Specialized Referral Hospital, 2021

Variables	Categories	COR (95% CI)	AOR (95% CI)
Age		1.04 (1.00–1.068)	0.97 (0.93–1.014)
Sex	Male	1	1
	Female	1.19 (0.76–1.82)	0.67 (0.40–1.21)
Marital status	Married	1	1
	Single	1.21 (0.75–1.95)	1.19 (0.68–2.08)
	Divorced	2.03 (1.06–3.87)**	1.46 (0.65–3.24)
	Widowed	2.79 (0.86–9.01)	2.74 (0.701–10.70)
Work experiences	<10 years	1	1
	≥10 years	4.19 (1.89–9.28)**	3.74 (1.32–10.59)**
Hesitancy to take the first dose	Yes	2.64 (1.70–4.08)**	3.01 (1.82–4.99)**
	No	1	1
Medical condition	At least one disease	10.50 (4.87–22.62) **	14.41 (5.07–40.92) **
	No medical problem	1	
On anti-hypertension medication	Yes	0.32 (0.09–1.15)	0.15 (0.02–0.93)**
	No	1	1

(Continued)

Table 5 (Continued).

Variables	Categories	COR (95% CI)	AOR (95% CI)
On antiepileptic medication	Yes	3.51 (0.75–16.49)	3.39 (0.45–25.44)
	No	I	
Perception of vaccine safety	Safe	I	
	Do not know	1.31 (0.82–2.09)	0.95 (0.55–1.659)
	Unsafe	3.45 (1.56–7.58)**	3.50 (1.43–8.57)**

Note: **Significant at a 5% significance level.

Discussion

The current study was aimed at assessing the most common side effects of the COVAX vaccine among health workers in Dessie comprehensive specialized hospital and identifying certain associated factors related to the given vaccine. Based on the findings, the vaccine was associated with fever, headache, myalgia, injection site pain, nausea, fatigue, and chills, the most common side effects, followed by vomiting, insomnia, and leg swelling among the study participants. Longer work experience, hesitancy to take the first dose of covid-19 vaccine, presence of underlying medical conditions (disease), and perception that the vaccine is unsafe were positively associated with the development of vaccine side effects, and taking anti-hypertensive medication were negatively associated with vaccine side effects.

As mentioned above, we found that systemic side effects, including fever, headache, myalgia, nausea, and fatigue were the most common side effects affecting the study participants (24.22% to 44.44%). This finding was congruent with previous studies.^{16,19} On the other hand, reported side effects in our study were less frequent than the findings reported in.¹⁴ This variation could be due to the difference in the sex composition of the study participants. More than 88% of the study participants were female in the previous study¹⁴ and only about 39% were female in the current study (Table 3). Other studies have discovered a significant increase in the number of females who suffered from the vaccine's side effects compared to males.^{16,19,21} This implies that female individuals need to be actively followed and reassured about the occurrence of severe side effects before they are allowed to leave the vaccination site. In the current study, the most common local Covax vaccine side effects were injection site pain in almost 26% of study participants and leg swelling in 8.55% and this finding is also in agreement with a review reported in Europe.²²

Overall, the side effects were significantly more common among healthcare workers with longer work experience (≥ 10 years), participants who considered the vaccine unsafe, those who had at least one medical condition, and who were hesitant to take the first dose of the covid-19 vaccine.

In this study, longer work experience (≥ 10 years) was associated with increased COVAX vaccine side effect occurrence among study participants. This result is not explained by current evidence; rather, attempting to explain it with the age of the study participants contradicts current evidence that as age increases, vaccine side effects decrease significantly.^{14,19} His contradiction might be due to the age structure difference between the current study (younger age) and the older age participants in the previous study.¹⁹ However, we speculate that as working experience increases, the health workers' probability of developing the chronic disease may also increase, and this could be the potential reason for having the vaccine side effects with longer work experience. This also is supported by our current finding of the presence of at least one medical condition linked with the development of the CIOVAX vaccine side effects (Table 5).

Our finding highlights that the covid-19 vaccine side effect among healthcare workers was significantly higher for those who hesitated to take the first dose of the covid-19 vaccine than those who did not hesitate to take the vaccine. Even though we were unable to locate any relevant findings related to our result, in our view, the possible explanation for the present finding is that most mild and non-specific vaccine side effects may occur in individuals who are psychologically weak and fearful due to anxiety created by themselves.¹⁰ The result strongly implies the necessity of providing trustworthy information for the community to be vaccinated regarding vaccine safety to reassure vaccine participants before the campaign.

The presence of at least one medical condition (disease) was linked with the development of covid-19 vaccine side effects. This result is consistent with previous literature.²¹ This could be due to an underlying medical illness or medication-vaccine interaction that resulted in adverse reactions for these individuals. Another possible reason could be linked to the fact that those with the underlying chronic disease might have either a symptomatic or asymptomatic previous Covid-19 infection. Covid-19 vaccine side effects were more common in people who had previously been infected with COVID-19.¹⁹ This result strongly implies that special attention and care should be given to individuals with underlying medical conditions who take the first dose covid-19 vaccines.

Even though we cannot explain why it is at the current level of our understanding, healthcare workers who were on antihypertensive medication were at a lower probability of developing Covax vaccine side effects. However, it might be related to some antihypertensive medications like diuretics, that produce gradual and continuous blood flow²³ and others like beta-blockers and angiotensin-converting enzyme inhibitors that relax heart and blood vessels²⁴ and these reduce the stressful condition of the patient and this may also play its role on the comfort of the individuals after taking Covid-19 vaccine.

The current study revealed that healthcare workers who believe the Covid-19 vaccine is unsafe experienced a higher chance of covid-19 vaccine side effects. This notion is supported further by a finding in the European Union (EU).²² One reason for this finding could be that people who perceive the vaccine as unsafe will not be vaccinated, and the effective sample may become small. In our case, only 12% (Table 3) were perceived as unsafe and vaccinated. This argument supports the finding that believing in the safety of a potential vaccine is a strong predictor of higher vaccination acceptance.¹⁰ On the other hand, the perception of vaccine unsafeness and taking the vaccine will produce anxiety for partisans. This also results in discomfort and exaggerated reporting of vaccine side effects compared to those who perceive the vaccine as safe. This claim was in agreement with our descriptive result of the 42 people who perceived the vaccine was unsafe, and 33 of them reported that they experienced side effects from the vaccine (Table 4).

Our finding implies that the Covid-19 vaccine side effects are inevitable, like other vaccines, but mild and require the reassurance of individuals that vaccine side effects are common but have no significant harm to their health and that the vaccine benefits highly outweigh the cost of side effects.

Because of certain methodological limitations, the findings of this study should be interpreted with caution. The first is the self-administration technique of data collection, which may lead to self-reporting and social desirability bias when only the most interested participants respond to the questionnaire and the reality of the information depends on their common decency. The self-reporting nature of the collected data compromises its independence when it comes to clinical evaluation and standardization. This methodological confounding has been controlled to some extent because most of the study participants were healthcare workers with a high level of health literacy and medical expertise, so the results were expected to be reported precisely so as not to impede generalizability to other healthcare workers. To the best of our knowledge, this was the first study dealing with the Covax vaccine side effects and the factors associated with them among the Ethiopian population. Moreover, our survey study design may limit the factors' causal association, and the identified factors need further research with a strong design like cohort and should be evaluated with other settings and populations to establish cause-effect relationships besides mere statistical association.

Conclusion

Overall, as with other vaccines, the common vaccine side effects were identified in healthcare workers who had taken the COVAX vaccine. Hesitancy to take the first dose, unsafe perception of vaccine safety and chronic disease underlined were independently and positively associated with vaccine side effect development. On antihypertensive medication, covid-19 vaccine takers were negatively related to vaccine side effect development. So, providing vaccine-related information to the community to be vaccinated is mandatory to increase vaccine uptake by reducing hesitancy and misconceived vaccine safety issues. Moreover, individuals with chronic diseases should take the first dose of the vaccine under the close supervision of health professionals.

Abbreviations

AOR, adjusted odds ratio; CI, confidence interval; COR, crude odds ratio; VIF, variance inflation factor.

Data Sharing Statement

The datasets analysed in this study are available from the corresponding author upon reasonable request.

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Author Contributions

RD, EA, TD, and TB: Conception, study design, acquisition of data, formal analysis and writing the manuscript, SET, AM, BA and AA; acquisition of data, statistical analysis, interpretation, YWF, NC, MG, AA, MY and BA: execution, data interpretation, manuscript editing, KAS, YD, BK, ZAA, AM, WM, and MA: study design, interpretation and reviewing the manuscript.

Disclosure

The authors declare that they have no competing interests.

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