PSUMJ
PSU MEDICAL JOURNAL

Original Article

The Untoward Effects of COVID-19 Vaccines and Determinant Factors among Vaccinated Healthcare Workers at Public Health Facilities in Addis Ababa, Ethiopia

Tesfaye Desalegn Belay, MPH, M.Sc., Yohannes Woldkidan, M.D., M.Sc., Zerihun Alemu, MPH, Kassahun Yimam, MPH, Binyam Degeffe, MPH, Ulfet Abdurahman, MPH

Department of Public Health Research and Emergency Management, Addis Ababa Health Bureau, Addis Ababa 30738, Ethiopia.

ABSTRACT

Objective: The overall objective of this study was to investigate the adverse effects of coronavirus disease 2019 (COVID-19) vaccines, and their associated factors among vaccinated health care workers working (HCWs) at public health facilities in Addis Ababa, Ethiopia: 2021/22.

Material and Methods: This study was implemented on 542 study participants found in Addis-Ababa city administration public health facilities, Addis Ababa, Ethiopia. A quantitative approach and facility-based cross-sectional study design, using proportionate allocation of the samples among each health facility, was adopted. The study used a questionnaire as a tool to collect data.

Results: Out of 542 samples, 526 study subjects participated (61.5% females): response rate was 97.05%. The proportion of HCWs having had post-COVID-19 vaccine adverse effects outcome among the study participants was 319 (60.6%, 95% confidence interval: 56.7%-64.6%). Logistic regression analysis results revealed that the odds of having history of allergic reaction to any vaccine were found 11.108 times higher (p-value<0.05), and the odds of having co-morbidity were found to have 2.299 times higher (p-value<0.05) determinant effects to develop and significantly associate with the post-COVID-19 vaccine adverse effects.

Conclusion: Experiences of post-COVID-19 vaccine adverse effects is higher and more common. Following side effects, a significant number of study participants have also undertaken treatment options to reduce post-vaccine discomforts/pains. Additionally, individuals that have history of allergic reactions to any vaccine and co-morbidities are positively associated with post-vaccine side effects. Therefore, even though post-COVID-19 vaccine side effects are very common,

Corresponding author: Tesfaye Desalegn Belay, MPH, M.Sc.
Department of Public Health Research and Emergency Management, Addis Ababa Health Bureau, Addis Ababa 30738, Ethiopia.
E-mail: tesfayedes62@gmail.com
doi: 10.31584/psumj.2025278888
https://he01.tci-thaijo.org/index.php/PSUMJ/

PSU Med J 2025;5(2):61-74
Received 20 April 2025
Revised 17 June 2025
Accepted 19 June 2025
Published online 22 August 2025

the advantages of taking the vaccine outweigh its disadvantages, and vaccinated individuals can seek treatment options when they experience severe post-vaccine side effects.

Keywords: Addis Ababa; adverse effect; COVID-19 vaccine; healthcare worker; public health facility

INTRODUCTION

The Coronavirus disease 2019 (COVID-19) pandemic has emerged as one of the most severe global public health crises in modern history, affecting over 216 countries and territories[1]. The World Health Organization (WHO) declared it a public health emergency of international concern on 30 January 2020. By 12 August 2021, more than 204 million confirmed cases and 4.3 million deaths had been reported worldwide: with Africa accounting for 5.2 million cases and 124,493 deaths[2]. In Ethiopia, 277,137 cases and 4,343 deaths were recorded by July 2021, with Addis Ababa contributing to 65% of infections[2]. Health care workers (HCWs) were significantly impacted, with 3,334 cases and 37 deaths reported[2].

Vaccinations have been recognized as a critical intervention to curb the pandemic[3]. As of June 2021, 21 COVID-19 vaccines had been authorized globally, with varying efficacy rates-Pfizer-BioNTech (95%), AstraZeneca (81.3%), Sinopharm (79.34%), and Janssen (66.0%)[4]. However, some vaccines lacked peer-reviewed efficacy data[4]. Vaccination is recommended for persons with co-morbidities that have been identified as increasing the risk of severe COVID-19; including obesity, cardiovascular disease, respiratory disease, and diabetes[5]. Despite global vaccination efforts, Africa received only 5.7% of administered doses, while high-income countries secured the majority[6]. Ethiopia obtained AstraZeneca, Sinopharm, and Janssen vaccines through COVAX and bilateral agreements, with a target to vaccinate 20% of its population by the end of 2021[7-9].

Common side effects of COVID-19 vaccines include: mild-to-moderate reactions; such as injection-site pain, fatigue, headache and fever, typically resolving within 48 hours[5,11,12]. Rare adverse events; such as blood clotting associated with the AstraZeneca vaccine have been reported; however, regulatory agencies emphasize that the benefits outweigh the risks[5,10]. Additional symptoms; including thromboembolic events (chest pain, leg swelling) and neurological effects (blurred vision), were noted but remain uncommon[5].

An Adverse Event Following Immunization (AEFI) is any untoward health event occurring after vaccination; however, it may or may not necessarily be caused by the vaccine. AEFIs are typically reported within 28 days of vaccination; however, there is no set time limit for reporting these events[13]. The AstraZeneca, Janssen, and Sinopharm vaccines were widely used globally to fight COVID-19; even though side effects; such as pain at the injection site, fatigue, fever and headaches, are often reported. Among the mRNA vaccines, BNT162b2 (BioNTech) is generally linked to fewer reactions compared to mRNA-1273[14,15].

The National Institute for Communicable Diseases (NICD) classifies AEFIs into minor local reactions (such as: swelling and redness), minor systemic reactions (including: mild headaches and body aches), severe local reactions (e.g., abscesses) and severe systemic reactions (including: hospitalization and severe allergic reactions) [13]. The Centers for Disease Control (CDC) has documented rare cases of thrombosis and thrombocytopenia following vaccination with AstraZeneca and Janssen vaccines. Symptoms include:

chest pain, shortness of breath, leg swelling, abdominal pain, neurological symptoms, and tiny blood spots beneath the skin[8,12].

By April 2021, over 133 million doses had been administered in the European Union (EU), with 354,177 (0.2%) cases of suspected adverse reactions[16]. Research in Poland and Saudi Arabia indicated that 60–80% of vaccinated people experienced side effects; mainly fatigue, pain and fever[14,17].

In Ethiopia, the food and drug regulatory authority reported 35 side effects among 1,400 vaccinated individuals, with no severe reactions[9]. However, limited research on post-vaccination side effects in Ethiopia has been observed. Side effects may appear up to two months after vaccination, and studies recommend monitoring vaccines for at least eight weeks post-administration[18].

The WHO recommended two versions of the AstraZeneca/Oxford COVID-19 vaccine for emergency use by March 2021, with updates reflecting the safety guidance from the global advisory committee on vaccine safety. These vaccines were recommended to be administered in two doses, 8 to 12 weeks apart[1]. However, concerns over vaccine-related adverse events have emerged. The European Medicines Agency conducted a review in March 2021, which found no definitive evidence linking thrombotic events to the AstraZeneca vaccine. However, it noted rare events; such as disseminated intravascular coagulation, cerebral venous sinus thrombosis and hemorrhagic stroke[2]. Meanwhile, the CDC reported anaphylaxis incidents in approximately 4.5 per million doses of mRNA COVID-19 vaccines[3]. Most side effects of COVID-19 vaccines are mild; such as fever, headache and pain at the injection site, but severe allergic reactions, though rare, can occur. These require emergency treatment; including fluid, oxygen, and adrenaline[4].

COVID-19 vaccines are recommended for individuals with co-morbidities like obesity, cardiovascular disease, respiratory issues and diabetes, with exceptions for those with history of severe allergic reactions to vaccine components[1]. The majority of vaccine side effects are mild to moderate, typically resolving within a few days. The NICD notes that symptoms; such as thrombosis and thrombocytopenia, usually appear 10–14 days post-vaccination, with symptoms of stroke or bleeding[5]. Long-term side effects are uncommon, and immunity against SARS-CoV-2 generally develops over weeks. Some individuals may contract COVID-19 shortly before or after vaccination due to insufficient immune protection at the time[3]. Vaccine monitoring has shown that serious long-term health problems are exceedingly rare, and adverse events typically occur within six weeks post-vaccination[6]. According to ECDC's report, most reactions to the vaccine are "flu-like" symptoms that occur within two days of vaccination, with serious reactions like anaphylaxis being extremely rare[7].

As of August 2021, global vaccination data shows that 30.4% of the world's population had received at least one dose of a COVID-19 vaccine, with a significantly lower percentage (1.2%) in low-income countries[8]. A study from Wroclaw Medical University in Poland found that 80% of vaccinated individuals reported some post-vaccination reactions. However, only 4.6% of individuals reported these reactions to authorities[9]. Similarly, clinical trials have reported common side effects like headache, fatigue, muscle pain and fever[10]. Out of 19.5 million doses of the AstraZeneca vaccine, only 0.002% resulted in anaphylaxis[11]. A study conducted in the UK revealed that systemic side effects occurred in 13.5% of individuals after the first dose of the Pfizer vaccine and 33.7% after the first dose of AstraZeneca[12]. Notably, side effects were more common in individuals with previous SARS-CoV-2 infection. Local reactions; such as pain at the injection site, were reported in 71.9% of individuals after the first Pfizer dose and 58.7% after the first AstraZeneca dose. Both vaccines showed substantial effectiveness, with a 72% reduction in infection risk after 45–59 days post-vaccination[12].

In Saudi Arabia, a study found that 60% of vaccinated individuals experienced side effects, with fatigue and pain being the most common[13]. The majority of these reactions lasted from one to three days, with only 11% reporting side effects lasting more than five days. Data from the EU also showed that 354,177 cases (0.2%) of suspected adverse reactions were reported from 133 million doses administered[7]. In Poland, common side effects included: pain at the injection site, fatigue, muscle pain, fever and chills[9].

A study from Saudi Arabia reported mild to moderate reactions within 24 hours of vaccination; including fatigue, fever and headache, though five serious events; including thrombotic events, were reported[13]. Additionally; while rare, the Janssen vaccine has shown safety and effectiveness in protecting against severe COVID-19, with the WHO acknowledging reports of very rare side effects; such as blood clotting[14]. The majority of side effects occur after the second dose, with 60% of individuals experiencing more symptoms after the second dose compared to the first[9].

In Ethiopia, the food and drug regulatory authority reported side effects in 35 individuals out of 1,400 vaccinated people, with no serious adverse events reported. Common side effects included: fatigue, muscle aches, fever and headaches[15].

Objective

The objective of this study was to investigate the adverse effects of the COVID-19 vaccines and their associated factors among vaccinated HCWs at public health facilities in Addis Ababa, Ethiopia, 2021/22.

MATERIAL AND METHODS

Study setting and period

The study was conducted from September 15, 2021, to January 2022, in public health facilities within Addis Ababa, Ethiopia. The city has a population of approximately 4 million people, and it is divided into 11 sub-cities, with 115 public health facilities; including 101 health centers and 14 public hospitals (Central Statistical Agency, 2013; Addis Ababa Health Bureau, 2021).

Study design

A facility-based, cross-sectional, quantitative study was used to assess the adverse effects of the COVID-19 vaccine and the factors influencing these effects among healthcare workers in public health facilities in Addis Ababa.

Population and eligibility

The source population included healthcare workers at public health facilities in Addis Ababa having received at least one dose of any COVID-19 vaccine. Eligible participants were healthcare workers having had received at least one dose of the COVID-19 vaccine: excluding those that were seriously ill and on leave.

Sample size determination

Sample size calculation was based on a 60% prevalence of vaccine-related side effects, with a 95% confidence level, 5% precision, a design effect of 1.5, and a 10% non-response rate. The final sample size was calculated to be 542 participants.

Sampling technique

The study used both probability and non-probability sampling techniques. From the 101 public health centers, 30 (30%) were selected using purposive sampling, while judgmental sampling was applied to select two hospitals from the six under the Addis Ababa Health Bureau. The sample from each facility was proportionally allocated, and systematic sampling with a calculated sampling interval (Kth value) was used to select participants.

Data collection

Data collection was conducted by 13 health professionals; including six supervisors and two coordinators,

who were trained on the study procedures and ethical guidelines. Semi-structured, closed-ended questionnaires were used to gather data, both through self-administered and interviewer-administered techniques. The instruments were pre-tested on 5% of the sample size for clarity and relevance, and modifications were made based on feedback.

Data quality assurance

To ensure data quality, training was given to all data collectors. The questionnaires were pretested, and the completeness of the data was monitored during collection. Supervisors and the principal investigator ensured consistency and accuracy throughout the process.

Data management and analysis

The data were entered into EpiData (version 3.1) software and analyzed using statistical package for the social sciences (version 22). Descriptive statistics (frequencies, percentages) were used to summarize the data, then bivariate and multivariable binary logistic regression analyses were performed to identify factors associated with vaccine-related adverse effects. Variables with a p-value<0.05 were considered statistically significant.

Operational definition

An untoward effect: an adverse health event or symptom reported after receiving a vaccine[13]. It usually occurred within 28 days after vaccination; however, there is no time limit in reporting an event[13].

Severe or serious adverse event; any medical occurrence; such as death, life-threatening illness, hospitalization or permanent disability, potentially requiring clinical management[22-24].

Non-serious/minor adverse events: reactions that resolved on their own or are part of the immune response to the vaccine[22,24].

Adverse event frequency categories: very common (≥10%), common (1-10%), uncommon (0.1-1%), rare (0.01-0.1%), and very rare (<0.01%), based on vaccination occurrence[24].

Ethical considerations

The study was approved by the Institutional Review Board of the Addis Ababa Health Bureau. Informed consent was obtained from all participants, ensuring their autonomy, right to withdraw and confidentiality. Participants were informed of potential risks and benefits as well as being assured that their participation would not affect their access to healthcare services.

Dissemination

The findings of the study will be shared with the Addis Ababa Health Bureau, the Federal Ministry of Health (FMOH), and relevant public health facilities involved in the COVID-19 vaccination efforts. The findings will also be published in a reputable international journal.

RESULTS

This chapter presents the findings of a study on COVID-19 vaccine adverse effects and their determinants among healthcare workers. The chapter covers socio-demographic characteristics, vaccine types, adverse effects, treatments, and factors influencing side effects along with discussions of the results.

Socio-demographic characteristics

Of the 542 participants, 526 responded, giving a 97.05% response rate, and 318 (61.5%) were female with 9 participants were missing. The age range was from 19 to 68 years, with a mean age of 33.26±7.14 (mean±standard deviation) years. The majority (32.9%) of the participants were nurses; wherein, 63.2% were married. Regarding education, 58.5% had a university degree, and 18.3% held diplomas (Table 1).

Table 1 Socio-demographic characteristics of healthcare workers at public health facilities in Addis Ababa, Ethiopia: 2021/22

Variable	Frequency	Percent
Gender (n=517)		
Male	199	38.5
Female	318	61.5
Age (Year) (n=519)		
29 Years	175	33.7
30-34 Years	156	30.1
>=35 Years	188	36.2
Profession (N=526)		
Medical doctor	10	1.9
Health officer	113	21.5
Nurse	173	32.9
Midwife	33	6.3
Laboratory	20	3.8
Anesthetist	3	0.6
Pharmacist or druggist	24	4.6
Environmental health	7	1.3
Radiologist	2	0.4
Others	141	26.8
Work station/department (n=525)		
Intensive care unit	4	0.8
Outpatient department	93	17.7
Inpatient department	14	2.7
Operation room	11	2.1
Emergency	27	5.1
Deliver room	32	6.1
Card room	4	0.8
Triage	17	3.2
Pharmacy dispensary	20	3.8
Laboratory	22	4.2
Administrative staff	112	21.3
Others	169	32.2
Marital status		
Married	332	63.2
Unmarried	176	33.5
Divorced	8	1.5
Widowed	7	1.3
Not defined	2	0.4
Educational status (n=525)		
1 to 12 grade	56	10.7
Certificate	6	1.1
Diploma	96	18.3
University or college degree	307	58.5
Specialist medical doctor	7	1.3
Master's degree and above	53	10.1

Type of COVID-19 vaccine received

The study found that 76% of participants received the AstraZeneca vaccine, followed by Johnson & Johnson at 20% (Figure 1). In terms of doses, 89.2% received the full vaccination dose; including those whom received the Johnson & Johnson vaccine (Figure 2).

Post-COVID-19 vaccine adverse effects

Among the 526 participants, 60.6% (319 participants) reported their experiences of post-vaccine adverse effects. In this study, both severe and mild/moderate adverse reactions were addressed. The term severe or serious adverse event is any medical occurrence; such as death, life-threatening illness, hospitalization, or permanent disability or potentially requiring clinical management. On the other hand, non-serious/minor adverse events refers to reactions that resolve on their own or are part of the immune response to the vaccine.

Mild or non-serious side effects were most common (85.7%). For those who experienced adverse events after the first dose, 56.8% reported such reactions, and 85.1% of these were mild. Most reactions (56.1%) were systemic, while 26.9% were a combination of local and systemic effects. Approximately 31.8% of participants reported these reactions to healthcare professionals, with 60.9% of them reporting within 24 hours (Table 2).

Willingness to take the second dose COVID-19 vaccine

Regarding the willingness to take the second dose of any given vaccine among the participants showed that half (50%) of them were willing. The reasons for those not willing to take a second dose were due to the fear of side effects, fear of allergy and some others did not believe that the vaccine was effective.

In contrast, concerning the second vaccine dose, 20.9% of participants reported side effects. Approximately, 41.9% of participants found the second dose to be less severe, while 41.9% felt it was more severe. Systemic effects were reported by 53.8% of these individuals. During the post-second dose, 32.0% of participants reported their side effects to health facilities (Table 2).

Table 2 The COVID-19 vaccine adverse effects the study subjects noticed during both first and the second dose vaccinations, Addis Ababa, Ethiopia: 2021/22

Post-COVID-19 vaccine adverse effects	Frequency	Percent
Overall (during 1st or second or both doses) Faced any post-COVID-19 vaccine adverse effects (N=526)		
No	207	39.4
Yes	319	60.6
Severity status of the adverse effects (n=300)		
Mild/non-serious	257	85.7
Severe/serious	43	14.3
Side effects during the first dose Faced post-COVID-19 vaccine adverse effects after taking the first dose (N=526)		
Yes	299	56.8
No	227	43.2
Severity status of the adverse effects after taking the FIRST dose (n=295)		
Mild/non-serious	251	85.1
Severe/serious	44	14.9
Which local/systemic adverse effects were more severe (n=294)		
Local only	50	17.0
Systemic only	165	56.1
Both local and systemic	79	26.9
Reports made to the health facility/health profession after 1st dose vaccine (n=302)		
Yes	96	31.8
No	206	68.2
Report day to the health facility/health professional after adverse effects occurred (n=92)		
Immediately/within 24 hours	56	60.9
On the 2nd day of the onset of the adverse effects	28	30.4
After the 3rd day	8	8.7
Second/full dose Faced post-COVID-19 vaccine adverse effects after the second/full dose (n=378)		
Yes	79	20.9
No	299	79.1
The general severity status of side effects in the SECOND dose as compared with the FIRST dose (n=74)		
The second was more severe	31	41.9
No d/c b/n the two doses	12	16.2
The second was less severe	31	41.9
Type of adverse effects of the second/full dose (n=78)		
Local only	17	21.8
Systemic only	42	53.8
Both local and systemic	19	24.4
Reports made to the health facility/health profession after 2nd/full dose vaccine (n=76)		
Yes	24	31.6
No	52	68.4
The Report day to the health facility/health professional after adverse effects occurred (n=24)		
Immediately within 24 hours	18	75.0
On the 2nd day of the onset of the adverse effects	6	25.0
On which vaccine doses did you see more numbers post vaccine side effects (1st dose Vs 2nd dose) (n=89)		
During the first dose	42	47.2
During the second dose	33	37.1
Almost Similar for both doses	14	15.7

COVID-19=coronavirus disease 2019

Types of post-vaccine adverse effects local effects

Among 219 responses, the most common, local effects were swelling at the injection site (59 cases/26.9%), followed by redness/rash (43/19.6%) and limb pain (41/18.7%); whereas, soreness at the injection site took third place: occurring in 20 participants (9.1%) (Table 3).

Systemic effects

Systemic side effect results indicated multiple responses per participant. The most frequently reported systemic adverse effects were headache (23.0%), fatigue (11.4%), joint/bone pain (10.2%) and fever (9.4%). Severe systemic reactions included: headache (24.1%), joint/bone pain (11.8%), and fatigue (10.1%). Three blood clotting cases were reported, two linked to AstraZeneca and one to Sinopharm. Moreover, 11.0% of participants had comorbidities, while 3.6% had history of allergic reactions to vaccines and 2.2% to drugs (Table 3).

Table 3 Types of the post-COVID-19 vaccine local and Systemic; both severe and non-severe AEs reported by the study participants, Addis Ababa, Ethiopia, 2021/22

Variables/side effects	Reported both severe & Non-severe AEs	Reported severe AE
	Frequency (%)	Frequency (%)
Systemic adverse effects (Both severe and non-severe AEs, n=935; and only severe AEs, n=397)		
Headache	215 (22.99)	96 (24.18)
General body aches	81 (8.66)	27 (6.80)
Fainting	9 (0.96)	9 (2.27)
Fever less than 38°C	88 (9.41)	32 (8.06)
Circulatory collapse	3 (0.32)	3 (0.76)
High & prolonged fevers (>38°C)	16 (1.71)	16 (4.03)
Shortness of breath	9 (0.96)	5 (1.26)
Chest pain	10 (1.07)	3 (0.76)
Back pain	68 (7.27)	32 (8.06)
Abdominal pain	6 (0.64)	3 (0.76)
Blurred vision	6 (0.64)	2 (0.50)
Fatigue	107 (11.44)	40 (10.08)
Chills	62 (6.63)	20 (5.04)
Nausea	29 (3.10)	8 (2.02)
Vomiting	11 (1.18)	5 (1.266)
Joint/or bone pain	95 (10.16)	47 (11.84)
Diarrhea	5 (0.53)	3 (0.76)
Flu-like illness	10 (1.07)	5 (1.26)
Dizziness	32 (3.42)	10 (2.52)
Myalgia	15 (1.60)	6 (1.51)
Tachycardia	1 (0.11)	1 (0.25)
Malaise	14 (1.5)	4 (1.01)
Seizures	4 (0.43)	3 (0.76)
Insomnia	8 (0.86)	2 (0.50)
Cough	15 (1.60)	5 (1.26)
Hair loss	1 (0.11)	0 (0.0)
Epigastric pain	4 (0.43)	1 (0.25)
Cardiac arrest	3 (0.32)	3 (0.76)
Pulmonary embolism	3 (0.32)	3 (0.76)
Blood clotting	3 (0.32)	3 (0.76)
Other (specify)	2 (0.21)	0 (0.0)

AE=adverse effects; n=number

Timing of adverse effects

The majority of participants (86.0% after the first dose and 85.3% after the second dose) reported adverse effects within one day of vaccination. The time for adverse effects to appear ranged from 10 minutes to 7 days after the first dose, and 30 minutes to 3 days after the second.

Duration of adverse effects

For the first dose, 53% of participants experienced side effects lasting 2-3 days. Similarly, 61.6% reported side effects lasting 2-3 days after the second dose. In total, adverse effects persisted for 1 to 30 days, with the mean duration for the first dose being 2.97±2.949 days (Figure 3).

Age and duration of adverse effects

As age increased, the persistence of adverse effects also increased. Among participants under 29, 36.4% had side effects lasting ≤1day, while only 3.8% experienced side effects lasting over 7 days. For participants aged 30–34 and ≥35 years, the percentage of those experiencing prolonged adverse effects (lasting more than 7 days) increased to 38.5% and 57.7%, respectively (Figure 4).

Treatment options for adverse effects

Approximately, 50% of participants having reported adverse effects sought treatment. Common treatments included: analgesics (129 participants) and antipyretics (22 participants). More than half (52.6%) visited health facilities, and 72% purchased over-the-counter medications. Most participants (94.6%) found these treatments effective in alleviating pain and discomfort.

Econometric (logistic regression) analysis

Logistic regression analysis identified two significant factors associated with post-vaccine adverse effects: a history of allergic reactions to vaccines (adjusted odds ratio [AOR]=11.108; 95% confidence interval [CI]: 1.430, 86.293; p-value<0.05) and the presence of comorbidities (AOR=2.299; 95% CI: 1.139, 4.644; p-value<0.05). Those with history of allergic reactions had 11.1 times the odds of experiencing adverse effects, while those with comorbidities were 2.3 times more likely to report side effects (Table 4).

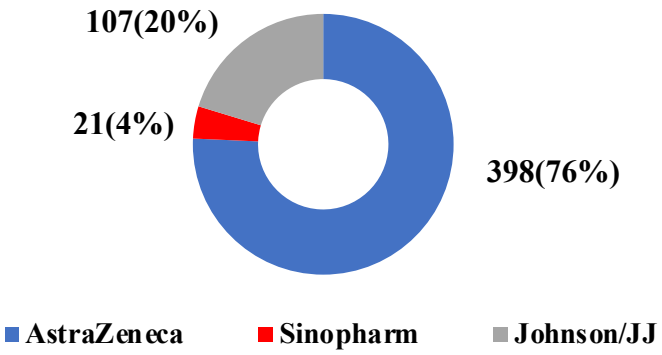

Figure 1 Percentage of COVID-19 vaccine type healthcare workers received, 2021/22

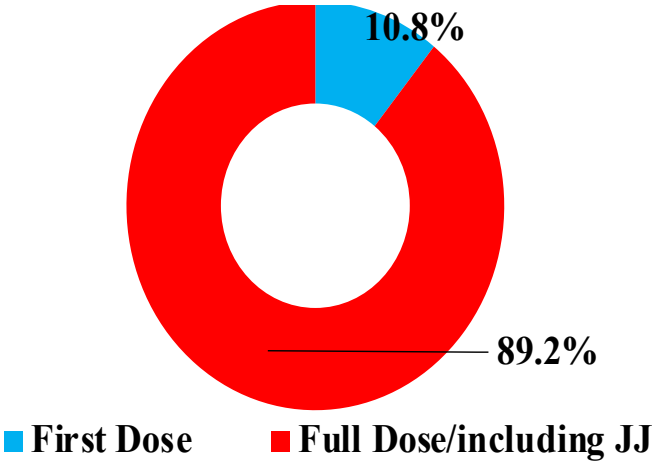

Figure 2 The proportion of vaccine doses healthcare workers have taken, 2021/22

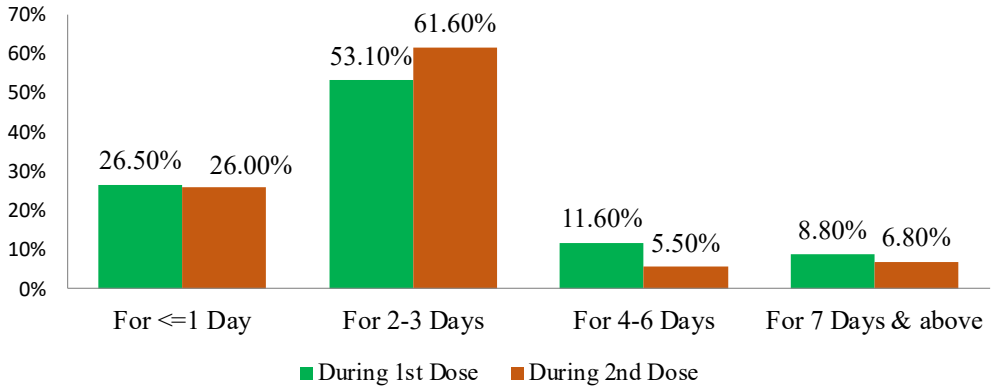

Figure 3 The length of time /days that the post-COVID-19 vaccine adverse effects persisted before disappearing among the individuals having experienced side effects during first and second doses, Addis Ababa, Ethiopia, 2021/22

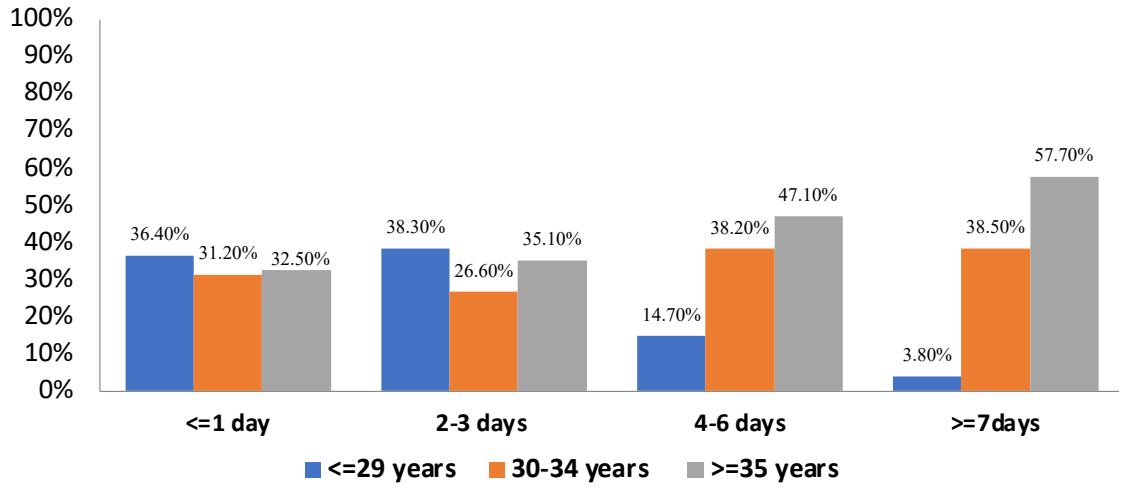

Figure 4 The persistence of COVID-19 Vaccine adverse effects across the participants' age category, 2021/22

Table 4 Logistic regression analysis to identify the determinant factors that exacerbate the COVID-19 vaccine adverse effects among vaccinated healthcare workers at public health facilities in Addis Ababa, Ethiopia, 2021/22

Variable	Post-COVID-19 vaccine adverse effects		COR (95%CI)	AOR (95%CI)	p-value
	No (%)	Yes (%)			
Age (Years)					
<=29	73 (41.7)	102 (58.3)	1	1	
30-34	63 (40.4)	93 (59.6)	1.056 (0.681, 1.638)	0.980 (0.613, 1.567)	0.932
>=35	68 (36.2)	120 (63.8)	1.263 (0.827, 1.928)	1.019 (0.636, 1.631)	0.939
Sex					
Male	77 (38.7)	122 (61.3)	1.040 (0.723, 1.495)	0.894 (0.605, 1.322)	0.575
Female	126 (39.6)	192 (60.4)	1	1	

Table 4 (continued)

Variable	Post-COVID-19 vaccine adverse effects		COR (95%CI)	AOR (95%CI)	p-value
	No (%)	Yes (%)			
Vaccine dose					
First dose	22 (38.6)	35 (61.4)	1.036 (0.589, 1.822)	0.984 (0.526, 1.840)	0.960
Full dose	185 (39.4)	284 (60.6)	1	1	
Vaccine type					
AstraZeneca	150 (37.7)	248 (62.3)	1.295 (0.841, 1.995)	1.120 (0.696, 1.802)	0.640
Sinopharm	10 (47.6)	11 (52.4)	0.862 (0.337, 2.202)	0.755 (0.265, 2.147)	0.598
Johnson/Johnson	47 (43.9)	60 (56.1)	1	1	
History of vaccine allergy					
Yes	2 (11.1)	16 (88.9)	5.135 (1.168, 22.586)	11.108 (1.430, 86.293)	0.021
No	190 (39.1)	296 (60.9)	1	1	
History of allergy to drugs					
Yes	3 (27.3)	8 (72.7)	1.654 (0.433, 6.310)	0.791 (0.177, 3.537)	0.759
No	191 (38.3)	308 (61.7)	1	1	
Presence of co-morbidity					
Yes	14 (24.6)	43 (75.4)	2.059 (1.095, 3.872)	2.299 (1.139, 4.644)	0.020
No	183 (40.1)	273 (59.9)	1	1	

COR=crude odds ratio; AOR=adjusted odds ratio; 95% CI=95% confidence interval; COVID-19=coronavirus disease 2019

DISCUSSION

This research aimed to assess the adverse effects and the determinants of COVID-19 vaccines among healthcare workers in Addis Ababa, Ethiopia, during 2021/22. The study included participants having received AstraZeneca, Sinopharm, or Johnson & Johnson vaccines. The majority (76.0%) of participants received AstraZeneca, followed by Johnson & Johnson (20.0%), and 89.2% received the full vaccine dose; including the single-dose Johnson & Johnson vaccine.

Conducted across 30 primary health centers and two referral hospitals, the study achieved a high response rate of 97.1%, with 526 from 542 subjects participating. In line with previous research, a significant proportion of participants (60.6%) reported post-vaccine side effects, with 85.7% of those experiencing mild or non-serious reactions. This is consistent with findings from Wroclaw Medical University in Poland; wherein, 80.0% of vaccinated individuals reported side effects, and similar studies in Saudi Arabia (60.0%)[14,17]. In Ethiopia, however, the reported side effects were lower, possibly due to under-reporting[9].

The willingness to take the second dose vaccine among the participants showed that half of them were willing. The reasons for those not willing to take the second dose were due to fear of side effects, fear of allergy and some others not believing that the vaccine is effective. However, there was no other studies were found on this issue when this study was conducted.

Systemic side effects were the most commonly reported, followed by a combination of systemic and local reactions. Of the 241 local side effects reported, swelling at the injection site (24.5%) was the most common, followed by redness/rash (18.0%) and limb pain (17.0%).

Regarding systemic side effects, headaches were the most frequent (23.0%), followed by fatigue (11.4%) and joint or bone pain (10.2%). In terms of severity, headaches (24.1%), joint/bone pain (11.8%) and fatigue (10.1%) were the most severe. These results align with the CDC's findings; wherein, headache, fatigue, nausea, fever and weakness were the predominant side effects[5,13,18]. In a Polish study, fatigue was experienced by 30% to 45.7% of vaccine recipients[14].

In addition to the common side effects, 11% of participants had co-morbidities, and 3.6% had history of allergic reactions to vaccines. The duration of post-vaccine side effects varied, with 86.0% of participants reporting side effects within one day of the first dose and 85.5% after the second dose. This supports findings from the US vaccination program; wherein, most non-serious reactions occurred within two days[16].

Regarding the duration of side effects, 53% of participants experienced prolonged effects after the first dose and 62.2% after the second dose, with effects typically lasting 2-3 days. This finding aligns with studies in Saudi Arabia; wherein, 75.0% of participants experienced side effects lasting 1-3 days[17]. Notably, some participants reported side effects persisting for up to 30 days, with the maximum duration being 15 days for the second dose.

Treatment options were also explored in this study. Of the 306 individuals having experienced side effects, 50% sought treatment, with 52.6% visiting health facilities and 71.6% purchasing over-the-counter medications. The most commonly used treatments were analgesics (129 participants) and antipyretics (22 participants). An overwhelming 95.0% of those that used treatment options found them helpful in alleviating discomfort and pain. This is consistent with CDC recommendations to use over-the-counter medications; such as ibuprofen and acetaminophen for post-vaccine side effects[18].

Finally, logistic regression analysis identified key determinants of post-vaccine side effects. The results showed that individuals with history of allergic reactions to vaccines and those with co-morbidities were significantly more likely to experience adverse effects. Specifically, individuals with history of vaccine allergic reactions had 11.1 times higher odds of experiencing side effects (AOR=11.108, 95% CI: 1.430, 86.293; p-value<0.05), and those with co-morbidities were 2.3 times more likely to experience adverse effects (AOR=2.299, 95% CI: 1.139, 4.644; p-value<0.05). The wide CI in the history of allergic reaction occurred due to the small number of participants (n=18) having reported history of vaccine allergic reactions. Even though the AOR suggests a potential association between vaccine allergy history and the outcome of interest, the wide CI indicates that this estimate should not be overinterpreted.

This study underscored the widespread occurrence of post-vaccine side effects among healthcare workers in Addis Ababa, Ethiopia, with systemic, mild, and the most commonly reported post-COVID-19 vaccine temporary side effects.

CONCLUSION

The study found a high prevalence of post-vaccine side effects among healthcare workers, with common, local (swelling, redness) and systemic (headache, fatigue) reactions. Individuals with comorbidities or history of allergic reactions were more likely to experience these effects. Vaccination should be encouraged despite side effects, which are usually temporary. Health facilities should enhance vaccine registration and consultation services, and further research should focus on community-level side effects.

ACKNOWLEDGEMENT

I would like to express my deepest and heartfelt thanks to the Addis Ababa Public Health Research and Emergency Management, Department Health Research Ethical Committee members for their constructive comments and the support they provided me for the betterment and well completion of this research.

I would like to acknowledge all sub-city health offices and selected study sites /health centers and hospitals for the cooperation they provided for the data collection of this study.

My heartfelt thanks also goes to all the data collectors for their overly cautious and scrupulous commitments and efforts that they have contributed during data collection/ interview/works.

Last, but not least, I would also like to thank the APHREM Department for its financial support that was used to conduct and facilitate this study and organize the result dissemination conference.

Author's contributions

TDB, Dr. YWK, BD, KY, UA, and ZA: designed the study; TDB obtained and analyzed the data. TDB, Dr. YWK, BD, KY, UA, and ZA obtained the resources; TDB, Dr. YWK, BD, KY, UA, and ZA validated data; TDB wrote the original draft, and TDB, Dr. YWK, BD, KY, UA, and ZA reviewed and edited the final manuscript.

All authors contributed to the interpretation of results and critical revision of the manuscript for intellectual content and have given final approval of the version to be published.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

REFERENCES

1. Alene KA, Gelaw YA, Fetene DM, Koye DN, Melaku YA, Gesesew H, et al. COVID-19 in Ethiopia: a geospatial analysis of vulnerability to infection, case severity and death. BMJ Open 2021;11:e044840. doi:10.1136/bmjopen-2020-044840.
2. World Health Organization. WHO Coronavirus (COVID-19) dashboard [homepage on the Internet]. Geneva: WHO; 2021 [cited 2025 Jun 17]. Available from: https://covid19.who.int/
3. Kim MA, Lee YW, Kim SR, Kim JH, Min TK, Park HS, et al. COVID-19 vaccine-associated anaphylaxis and allergic reactions: consensus statements of the KAAACI urticaria/angioedema/anaphylaxis working group. Allergy Asthma Immunol Res 2021;13:526-44. doi:10.4168/aair.2021.13.4.526.
4. Jeong M. Global COVID-19 vaccine summary: side effects [homepage on the Internet]. Brighton: Medical News Today; 2021 [cited 2025 Jun 17]. Available from: https://www.medicalnewstoday.com/articles/global-covid-19-vaccine-summary-side-effects
5. World Health Organization. The Oxford/AstraZeneca COVID-19 vaccine: what you need to know [homepage on the Internet]. Geneva: WHO; 2021 [cited 2025 Jun 17]. Available from: https://www.emro.who.int/health-topics/corona-virus/oxford-covid-19-vaccine.html
6. Holder J. Tracking coronavirus vaccinations around the world [homepage on the Internet]. New York: The New York Times; 2021 [cited 2025 Jun 17]. Available from: https://www.nytimes.com/interactive/2021/world/covid-vaccinations-tracker.html
7. Getachew A. Ethiopia begins COVID-19 vaccine rollout [homepage on the Internet]. Ankara: Anadolu Agency; 2021 [cited 2025 Jun 17]. Available from: https://www.aa.com.tr/en/africa/ethiopia-begins-covid-19-vaccine-rollout/2174904
8. World Health Organization. Ethiopia introduces COVID-19 vaccine in a national launching ceremony [homepage on the Internet]. Geneva: WHO; 2021 [cited 2025 Jun 17]. Available from: https://www.afro.who.int/news/ethiopia-introduces-covid-19-vaccine-national-launching-ceremony
9. AllAfrica News. Ethiopian government vaccinates, reports serious side effects from COVID-19 jab [homepage on the Internet]. Washington DC: AllAfrica News; 2021 [cited 2025 Jun 17]. Available from: https://allafrica.com/stories/2021xxxx.html
10. Jeong M. Oxford-AstraZeneca (Covishield) COVID-19 vaccine: known side effects [homepage on the Internet]. Brighton: Medical News Today; 2021 [cited 2025 Jun 17]. Available from: https://www.medicalnewstoday.com/articles/oxford-astrazeneca-vaccine-what-to-know-about-side-effects
11. Johns Hopkins Bloomberg School of Public Health. Side effects and COVID-19 vaccines: what to expect [homepage on the Internet]. Maryland: Johns Hopkins Bloomberg School of Public Health; 2021 [cited 2025 Jun 17]. Available from: https://www.jhsph.edu/covid-19/articles/side-effects-and-covid-19-vaccines-what-to-expect.html
12. World Health Organization. Side effects of COVID-19 vaccines [homepage on the Internet]. Geneva: WHO; 2021 [cited 2025 Jun 17]. Available from: https://www.who.int/news-room/feature-stories/detail/side-effects-of-covid-19-vaccines
13. National Institute for Communicable Diseases. COVID-19 vaccination: reporting adverse effects FAQ [homepage on the Internet]. Johannesburg: National Institute for Communicable Diseases; 2021 [cited 2025 Jun 17]. Available from: https://www.nicd.ac.za/covid-19-vaccination-faq/
14. Jęśkowiak I, Wiatrak B, Grosman-Dziewiszek P, Szeląg A. The incidence and severity of post-vaccination reactions after vaccination against COVID-19. Vaccines (Basel) 2021;9:502. doi:10.3390/vaccines9050502.
15. Edwards KM, Orenstein WA. COVID-19 vaccines to prevent SARS-CoV-2 infection [homepage on the Internet]. Waltham: UpToDate; 2021 [cited 2025 Jun 17]. Available from: https://www.uptodate.com
16. European Medicines Agency. Suspected adverse reactions to COVID-19 vaccination and the safety of substances of human origin: key facts [homepage on the Internet]. Amsterdam: European Medicines Agency; 2021 [cited 2025 Jun 17]. Available from: https://www.ema.europa.eu/en/human-regulatory-overview/public-health-threats/coronavirus-disease-covid-19/covid-19-medicines/covid-19-vaccines-key-facts
17. Alhazmi A, Alamer E, Daws D, Hakami M, Darraj M, Abdelwahab S, et al. Evaluation of side effects associated with COVID-19 vaccines in Saudi Arabia. Vaccines (Basel) 2021;9:674. doi:10.3390/vaccines9060674.
18. Centers for Disease Control and Prevention. Possible side effects after getting a COVID-19 vaccine [homepage on the Internet]. Atlanta: Centers for Disease Control and Prevention; 2021 [cited 2025 Jun 17]. Available from: https://www.cdc.gov/coronavirus/2019-ncov/vaccines/expect/after.html

19. Esba LCA, Al Jeraisy M. Reported adverse effects following COVID–19 vaccination at a tertiary care hospital, focus on cerebral venous sinus thrombosis (CVST). Expert Rev Vaccines 2021;20:1037–42. doi:10.1080/14760584.2021.1940145.
20. Our World in Data. Coronavirus (COVID–19) vaccinations [homepage on the Internet]. Oxford: Our World in Data; 2021 [cited 2025 Jun 17]. Available from: https://ourworldindata.org/covid–vaccinations
21. World Health Organization. The Janssen Ad26.COV2.S COVID–19 vaccine: what you need to know [monograph on the Internet]. Geneva: WHO; 2021 [cited 2025 Jun 17]. Available from: https://www.who.int/docs/default–source/coronaviruse/act–accelerator/covax/26072022–janssen–vaccine–explainer–update–final.pdf
22. Centers for Disease Control and Prevention. Understanding adverse events and side effects [homepage on the Internet]. Atlanta: Centers for Disease Control and Prevention; 2021 [cited 2025 Jun 17]. Available from: https://www.cdc.gov/vaccinesafety/ensuringsafety/sideeffects/index.html
23. Centers for Disease Control and Prevention. Reporting adverse events to VAERS [homepage on the Internet]. Atlanta: Centers for Disease Control and Prevention; 2021 [cited 2025 Jun 17]. Available from: https://www.cdc.gov/vaccinesafety/ensuringsafety/monitoring/vaers/index.html
24. World Health Organization. MODULE 1 – adverse events: frequency and severity [monograph on the Internet]. Geneva: WHO; 2021 [cited 2025 Jun 17]. Available from: https://www.who.int/vaccine_safety/initiative/tech_support/Part–2.pdf