# The Practice of Post-vaccination COVID-19 Prevention Strategy Among Healthcare Professionals in Felege Hiwot Referral Hospital, Northwest Ethiopia

Authors: Engdaw, Garedew Tadege, Worede, Eshetu Abera, and Destaw Bitew, Bikes

Source: Environmental Health Insights, 16(1)

Published By: SAGE Publishing

URL: https://doi.org/10.1177/11786302221146892

# The Practice of Post-vaccination COVID-19 Prevention Strategy Among Healthcare Professionals in Felege Hiwot Referral Hospital, Northwest Ethiopia

Environmental Health Insights
Volume 16: 1–9
© The Author(s) 2022
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/11786302221146892

Garedew Tadege Engdaw, Eshetu Abera Worede and Bikes Destaw Bitew

Department of Environmental and Occupational Health and Safety, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia.

**ABSTRACT**

**BACKGROUND:** Coronavirus Disease 2019 (COVID-19) is an acute respiratory illness first discovered and identified in China. Countries are taking precautions to prevent COVID-19 in accordance with WHO guidelines.

**OBJECTIVE:** The objective of this study was to assess the practice of the COVID-19 prevention strategy post-vaccination and associated factors among health care professionals in Felege Hiwot Referral Hospital, Bahir Dar, Northwest Ethiopia, in 2021.

**METHODS:** An institutional-based cross-sectional study was carried out at Felege Hiwot Referral Hospital, Bahir Dar. Data were entered into Epi-Info software, version 7.1, and exported to SPSS, version 23, for analysis. Descriptive statistics were used to describe the socio-demographic characteristics of the respondents. The crude odds ratio (COR) and the adjusted odds ratio (AOR) with 95% CI were calculated to determine the coefficient of the COVID-19 prevention strategy.

**RESULTS:** In this study, 68.7% (95% CI: 63.7, 73.8) of health care professionals had good practice of the COVID-19 prevention strategy post-vaccination. Sex (AOR: 1.76; 95% CI: 1.08, 2.89), marital status (AOR: 1.75; 95% CI: 1.09, 2.93), and good attitude toward vaccination (AOR: 3.24; 95% CI: 2.13, 5.48) were significantly associated with the practice of COVID-19 prevention strategies post vaccination.

**CONCLUSIONS:** The practices of COVID-19 preventive strategies post-vaccination were good among healthcare professionals. Good attitude toward vaccination, sex (male), marital status (married) were factors determining the occurrences of COVID-19 preventive strategies post-vaccination.

**KEYWORDS:** COVID-19 prevention, public health, healthcare professionals, Ethiopia

**RECEIVED:** August 9, 2022. **ACCEPTED:** December 5, 2022.

**TYPE:** Original Research

**FUNDING:** The author(s) received no financial support for the research, authorship, and/or publication of this article.

**DECLARATION OF CONFLICTING INTERESTS:** The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**CORRESPONDING AUTHOR:** Garedew Tadege Engdaw, Department of Environmental and Occupational Health and Safety, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar, 196, Ethiopia. Emails: garedewtadi@gmail.com; garedewtadi27@gmail.com

## Background

The first COVID-19 case in Ethiopia was reported on March 13, 2020.[1,2] Epidemics are much more likely in Ethiopia due to a lack of good infrastructure and a health system, large family sizes, a lack of sanitation, population turnover, and an increase in the population. The wide variety of COVID-19 instances in Ethiopia has persisted and is expected to increase. For instance, the total number of COVID-19 cases within Ethiopia by December 16, 2021, was 373 960.[3] The mortality from the disease within Ethiopia is likewise high, with an estimated 6846 deaths attributed to the disease.[3]

The burden of severe COVID-19 outcomes was the highest in African countries with older populations, limited healthcare resources, and a high frequency of pre-existing health risks such as cancer, diabetes, air pollution, and obesity.[4-7] However, multiple factors can weaken epidemic preparedness. Preparedness in low-income countries (LICs) is further faced by the general weakness of health structures: poor quality of healthcare, low human resources capacity, lack of equipment and facilities, and vulnerable supply chains. The Center for Strategic and International Studies (CSIS) estimates the financing gap in epidemic preparedness at $4.5 billion per year in LICs and lower-middle income countries (LMICs).[8]

Vaccines are life-saving interventions and are responsible for eradicating and controlling many infectious diseases in many parts of the world.[9] The fight against coronavirus disease (COVID-19) by vaccination does not depend solely on the effectiveness and safety of the vaccine.[10-12]

Countries in Africa and Ethiopia are taking various precaution measures to prevent COVID-19 in accordance with the WHO guidelines, including frequent hand washing, social distancing, wearing a face mask, limiting travel to crowded areas, and avoiding and preventing consumption of raw meat to prevent cross-contamination.[13] Multiple interventions were employed simultaneously to minimize the spread of the disease because no one method is sufficient to prevent its transmission.[14] Beyond vaccination, it is important to encourage common sense public health precautions

including hand washing, staying home when ill, regularly cleaning high-touch surfaces, wearing masks as necessary and frequently as possible, enhancing ventilation through dilution and air filtration, maintaining physical distance, and avoiding crowds.[15-19] However, in Ethiopia, compliance with these strict measures is very low. For instance, in a study conducted in southern Ethiopia, only 12.3% of the population has taken precautions against COVID-19.[20] There is a paucity of literature on the practice of COVID-19 prevention strategy post vaccination toward the COVID-19 pandemic.

The magnitude and associated factors of COVID-19 prevention strategies post vaccination among health care professionals is a major public health problem in Ethiopia Because these HCWs were on the front lines, they could be a source of infections that people contract while receiving care in a healthcare facility. Although there were no studies done on this issue in the study area (Felege Hiwot Referral Hospital), this is an unknown and a gap in the literature. In this study, the magnitude and some of the factors associated with COVID-19-prevention strategies from Felege Hiwot Referral Hospital were assessed. Therefore, the purpose of this study was to assess the practice of COVID-19 prevention and associated factors among healthcare professionals in Felege Hiwot Referral Hospital, Bahir Dar, Northwest Ethiopia. Thus, this study will help researchers, policymakers, and employers to be aware of COVID-19 prevention strategies post-vaccination of health care professionals.

## Methods and Materials

### *Study design and period*

An institutional-based cross-sectional study[21] was conducted from September 1 to October 29, 2021

### *Study area*

Felege Hiwot Referral Hospital is located in Bahir Dar, the capital of Amhara, 565 km from Addis Ababa, the capital of Ethiopia. It was established as a district hospital in 1963 and was upgraded to a referral hospital in 1994. The hospital has departments of surgery, medicine, pediatrics, obstetrics and gynecology, psychiatry, dentistry, and orthopedics, as well as outpatient and inpatient departments and follow-up departments. The hospital has a total of 455 health care professionals. An infection prevention and control (IPC) committee at the facility is actively supporting the IPC program. Although, based on the local context/epidemiology of occupational health, it has all of the following guidelines and/or standard operating procedures (SOPs) available: standard precautions, transmission-based precautions, decontamination of medical devices, aseptic technique for invasive procedures, including surgery, and specific SOPs to prevent the most prevalent hospital-acquired infections.

### *Source and study population*

The source populations were all fully vaccinated health care professionals at Felege Hiwot Referral Hospital, and the study population was all fully vaccinated health care professionals who had worked at Felege Hiwot Referral Hospital for at least the previous 6 months.

### *Inclusion criteria*

All health care professionals who had been working at the Felege Hiwot Referral Hospital for at least the past 6 months.

### *Exclusion criteria*

Health care professionals who were absent at the time of data collection for different reasons were excluded (sick leave, annual leave, and maternity leave).

### *Sample size determination*

The sample size was calculated for both determinant factors and practice toward COVID-19 prevention post vaccination. Then, the maximum sample size was considered for this study. Thus, the final sample size was calculated using a single population proportion formula with the following assumptions: 5% type I error, 95% confidence interval, and a 50% proportion for practice toward COVID-19 prevention post vaccination level since an intensive literature search didn't show any value for this problem. Finally, the researchers added 10% to compensate for the non-response of participants, and the final sample size became 422.

$$n = \frac{\left(z^2_{\frac{a}{2}} p(1-p)\right) D}{d^2} = [(1.96)2 * 0.5 \quad (1-0.5)]/(0.05)2 = 384$$

and adding 10% it becomes 422. Where: n = required sample size, $Z\alpha/2$ = critical value for normal distribution at 95% confidence level (1.96), $P$ = proportion and $d$ = 0.05 (5% margin of error).

### *Sampling technique*

Simple random sampling technique was employed to select the healthcare professionals from the hospital.

### *Data collection tools and procedures*

Questionnaires and observation checklists were developed from different sources of literature to gather the information needed for the study population.[22,23] The questionnaire was initially written in English, translated into Amharic (the local language), and then translated back into English to check for inconsistencies and distortions in the meaning of

words and terms. Data collectors and supervisors were trained for 2 days before starting data collection. For the data gathering process, 3 Bachelor of Science (BSC) nurses and 1 BSC in environmental health were hired as data collectors and supervisors, respectively, to collect the data from health-care professionals using a self-administered, structured questionnaire. An Amharic questionnaire that included detailed questions about all the research variables was used. The questionnaire was divided into 4 sections: socio-demographic characteristics, knowledge and attitudes about COVID-19 prevention strategies post vaccination, and observational practices of health care professionals on COVID-19 prevention strategies.

### *Variables*

*Dependent variable.* Practice of COVID-19 prevention strategy.

*Independent variables*

*Socio-demographic factors.* Sex, religion, age, marital status, educational level.

Knowledge about the practice of COVID-19 prevention strategy (like eligible persons for vaccination).

Attitude about the practice of COVID-19 prevention strategy (eg, willing to take the COVID-19 vaccine).

Sources of information.

### *Operational definitions*

*Practice of COVID-19 prevention strategy.* Fully vaccinated health care professionals who apply all the WHO COVID-19 prevention strategy post vaccination (social distancing, hand washing or using alcohol based hand rub, and mask use).[23,24]

*Fully vaccinated.* A person is considered fully vaccinated when they have received a complete vaccine series and $\geqslant$2 weeks has passed since the final vaccine; as well as any boosters consistent with manufacturer instructions and applicable agency approval or authorization.[25]

*Knowledge.* Respondents were asked 31 questions (Cronbach's alpha .83) about their knowledge of and practice of COVID-19 prevention strategy post vaccination, such as; whether they know about a group of people who may or may not be eligible for taking the COVID-19 vaccine; the achievement of protective immunity against COVID-19 infection; the source of information The correct answers were coded as 1 and the wrong answers were coded as 0. The respondent's knowledge questions responses were computed to get the total knowledge score. Those study participants who scored mean ($\bar{x} = 13.7$) and above the mean of the sum of the knowledge questions were considered to have good knowledge.[23]

*Attitude.* Attitude toward COVID-19 prevention strategy post-vaccination was measured using 21 Likert scale questions, each rated from 1 to 5 (Strongly Disagree = 1, Disagree = 2, Neutral = 3, Agree = 4, Strongly Agree = 5 (Cronbach's alpha = .97). First, the total number of responses for each sentiment level (strongly disagree, disagree, neutral, agree, strongly agree) was calculated. Then, the totals were added and divided by the total number of respondents. Those study participants who scored a mean ($\bar{x} = 5.4$) and above the mean of the sum of the attitude questions were considered to have a good attitude.[23]

*Practice.* In this study, preventive practice refers to how clients go about preventing the COVID-19 pandemic. Clients who answered mean and above the mean score value ($\bar{x} = 3.7$) from practice-related questions (3) were regarded to have good practice in COVID-19 prevention, whereas those who answered below the mean score value from practice-related questions were judged to have poor practice.[23]

### *Data quality control*

Data collectors and a supervisor were trained to select study participants to collect data from. The questionnaire was pretested on 5% of the surveyed population. The completeness and accuracy of the data were checked when the data was collected. Trained data collectors were closely monitored by a trained supervisor. The supervisor closely monitored the data collection process and provided advice and feedback on the data collected daily. The daily exchange of information between the principal investigator and the supervisor took place over the phone. The principal investigator regularly supervised the supervisor and data collectors in the field on a daily basis.

### *Data processing and analysis*

The data collected was rechecked for completeness and consistency. After entering the data into Epi-Info version 7.1 software, it was exported to SPSS version 23 for analysis. Descriptive statistics were used to describe the socio-demographic characteristics of the respondents. We performed bivariate and multivariable logistic regression and used the variable selection method of forward logistic regression to identify independent predictive variables or variables that were significantly associated with the practice of the COVID-19 prevention strategy. The crude odds ratio (COR) and adjusted odds ratio (AOR) of 95% CI were calculated to determine the associated practice of the COVID-19 prevention strategy coefficient, and *P*-values below .05 were declared statistically significant. The goodness of fit of the model was tested during the analysis using the goodness of fit of Hosmer and Lemeshow ($P = .3012$).

**Table 1.** Socio-demographic characteristics of the health care professionals, Bahir Dar, Northwest Ethiopia, September 1 to October 29, 2021 (n = 406).

| CHARACTERISTICS CATEGORIES | FREQUENCY | PERCENT (%) |
|---|---|---|
| Sex | | |
| Male | 261 | 64.3 |
| Female | 145 | 35.7 |
| Age | | |
| 18-24 | 7 | 1.7 |
| 25-30 | 274 | 67.5 |
| 31-40 | 117 | 28.8 |
| >40 | 8 | 2.0 |
| Marital status | | |
| Single | 176 | 43.7 |
| Married | 218 | 53.3 |
| Others** | 12 | 3.0 |
| Educational level | | |
| Diploma | 50 | 12.3 |
| First degree | 329 | 81.0 |
| Second degree and above | 27 | 6.7 |

**Widowed, divorced, and separated.

### *Patient and public involvement*

There was no patient or public involvement in the study.

## Results

### *Socio-demographic characteristics of respondents*

From a total of 422 study participants, 406 healthcare professionals were enrolled in this study, with a response rate of 96%. The majority of the 261 (64.3%) of the study participants were males; 364 (88.7%) and 218 (53.3%) were married. The mean (±SD) age of study participants was 30.4 ± (5.4) years (Table 1).

### *Knowledge regarding the COVID-19 vaccine*

More than half (58.9% with 95% CI: 53.2, 61.6) of the study participants had good knowledge of individuals eligible to take the COVID-19 vaccination. However, 348 (85.5) did not know about the legally mandated COVID-19 vaccine (Table 2).

According to 62.6% of healthcare professionals, vaccination provided protective immunity against COVID-19 infection. However, 9.6% of health care professionals understood that the second dose of vaccination and 28.7% recognize that 14 days after the first dose of vaccination, protective immunity against COVID-19 infection was acquire.

In this study, 17.2%, 36%, and 46.8% of the health professionals reported that information from healthcare professionals had insignificant, somewhat significant, and very significant effects on implementing the COVID-19 preventive strategy after vaccination, respectively (Table 3).

### *Attitude regarding COVID-19 vaccination*

About 69.0% of the health care professionals had a good attitude toward taking the COVID-19 vaccination. The details are shown in Table 4.

### *Magnitude of practice of prevention strategy after COVID- 19 vaccination*

According to this study (68.7%, 95% CI: 63.7, 73.8) of health care professionals had good practice of COVID-19 prevention strategy post vaccination. However, nearly one-third (31.3%) of participants were exposed to poor practice of the COVID-19 prevention strategy post vaccination.

### *Factors associated with practice of COVID-19 prevention strategies*

Bivariable and multivariable logistic regression analysis was conducted to determine the factors associated with COVID-19 prevention strategies post vaccination among health care professionals. On bivariable analyses, sex, marital status, profession, and good attitude toward vaccination had an association with the practice of COVID-19 prevention strategies post vaccination among health care professionals.

In multivariable logistic regression 2 socio-demographic factors and attitude were significantly associated with the practice of COVID-19 prevention strategies post vaccination among health care professionals. Male study participants were 1.76 times more likely than their female counterparts to implement a COVID-19 prevention strategy post vaccination (AOR: 1.76; 95% CI: 1.08, 2.89). Although, the odds of implementing the COVID-19 prevention strategy post vaccination were increased by a factor of 1.75 times more likely among health care professionals who were married as compared to a single encounter (AOR: 1.75; 95% CI: 1.09, 2.93). Health care professionals who had a good attitude toward COVID-19 vaccination were 3.24 times more likely to implement COVID-19 prevention strategies post vaccination as compared to those who had a poor attitude toward COVID-19 vaccination (AOR: 3.24; 95% CI: 2.13, 5.48) (Table 5).

## Discussion

This study aimed to assess the practice of the COVID-19 prevention strategies post vaccination and its associated factors among health care professionals in Felege Hiwot Referral Hospital. More than two-thirds of the participants in this study had prior experience with following the COVID-19 preventive strategy post vaccination. This is consistent with a

**Table 2.** Knowledge of health care professionals regarding eligibility to take COVID-19 vaccine, Bahir Dar, Northwest Ethiopia, September1 to October 29, 2021 (n=406).

| KNOWLEDGE QUESTIONS | ELIGIBLE FREQUENCY (%) | NOT ELIGIBLE FREQUENCY (%) | DO NOT KNOW FREQUENCY (%) |
|---|---|---|---|
| It is legally mandatory to take COVID-19 vaccine. | 53 (13.3) | 5 (1.2) | 348 (85.5) |
| infant <1 year of age | 179 (44.1) | 111 (27.3) | 116 (28.6) |
| Children and adolescents <18 years of age | 341 (84) | 40 (9.8) | 25 (6.2) |
| Adults >18 years | 392 (96.6) | 8 (2.0) | 6 (1.4) |
| Pregnant ladies and lactating mothers | 249 (61.3) | 78 (19.3) | 79 (19.4) |
| Patients with chronic diseases like Diabetes, hypertension and heart diseases. | 309 (76.1) | 55 (13.5) | 42 (10.4) |
| Persons having active COVID-19 Infection | 177 (43.6) | 155 (38.3) | 74 (18.1) |
| Persons recovered from COVID-19 Infection | 271 (66.7) | 55 (13.6) | 80 (19.7) |
| Persons allergic to food items drugs | 174 (42.9) | 79 (19.8) | 153 (37.3) |
| Immuno-compromised patients | 225 (55.4) | 95 (23.4) | 86 (21.2) |

**Table 3.** Health care professionals sources of information to implement COVID- 19 prevention strategies, Bahir Dar, Northwest Ethiopia, September to October 2021 (n=406).

| SOURCE OF INFORMATION | INSIGNIFICANT EFFECT FREQUENCY (%) | SOMEWHAT SIGNIFICANT EFFECT FREQUENCY (%) | VERY SIGNIFICANT EFFECT FREQUENCY (%) |
|---|---|---|---|
| News from National TV/Radio | 93 (22.9) | 128 (31.5) | 185 (45.6) |
| Government agencies | 111 (27.3) | 149 (36.7) | 146 (36.0) |
| Social media (Facebook, Instagram and Whatspp) | 102 (25.1) | 155 (38.2) | 149 (36.7) |
| Discussion amongst friends and family | 139 (34.2) | 198 (48.8) | 69 (17.0) |
| Healthcare provider | 70 (17.2) | 146 (36.0) | 190 (46.8) |

study conducted in southwestern Ethiopia, in which 67.1% of respondents had good COVID-19 prevention practices.[26] However, the findings of this study were higher than those of a national systematic review and meta-analysis in Ethiopia (40.3%),[27] the Jimma zone (46.08%),[28] Dilla University Hospital (56.3%),[29] and in Northwest Ethiopia (38.73%).[30] This difference might be due to differences in risk perception regarding COVID-19 infection and re-infection. This finding, on the other hand, is lower than that of a study conducted in China (89%)[31] and Uganda (74%).[32] This might be due to the difference in the hospital community's COVID-19 prevention strategies post-vaccination practice and the presence of a lower-quality infection prevention committee. Another possible reason may be a lack of ongoing follow-up by the personnel and heads of each department.

Despite the fact that female participants are more willing to follow rules and regulations, the number of male 261 (64.3%) participants in this study was larger than their female 145 (35.7%) counterparts.

The sex bias identified in COVID-19 is a universal phenomenon with few exceptions. While there is no difference in the proportion of males and females with confirmed COVID-19, male patients have nearly 3 times the odds of seeking intensive treatment unit admission and have a higher risk of death than females.[33] In multivariable analysis, we found that male healthcare professionals had higher COVID-19 prevention strategies post vaccination. This finding is supported by research done in the Republic of Congo.[34] Although another controversy from China reported that death rates and the gender gap in causality rates were also related to the COVID-19 prevention strategy after vaccination; 64 per 100 (4.7% mortality rate) for men as compared to 36 per 100 (2.8% mortality rate) for women.[34] Biologically, a mixture of factors such as genes, hormones, and dosage causes females and men to respond differently to many vaccines.[35] New evidence suggests that COVID-19 is killing more men globally and regionally. Females, on the other hand, are more likely to report long-term COVID-19 infection symptoms and worse vaccine side effects.[36,37] Males are more likely to practice the COVID-19 prevention strategy post vaccination as compared to females. This may be from the difference in mortality and morbidity with gender. Age is also another predictor for following prevention strategies. This study is consistent with a

**Table 4.** Attitude of health care professionals toward COVID-19 vaccination, Bahir Dar, Northwest Ethiopia, September to October 2021 (n = 406).

| ATTITUDE RELATED CHARACTERISTICS | STRONGLY AGREE | AGREE | NEUTRAL | DISAGREE | STRONGLY DISAGREE |
|---|---|---|---|---|---|
| When my turn of vaccination comes, I'm willing to take the COVID-19 vaccine. | 99 (24.4) | 225 (55.4) | 28 (6.9) | 44 (10.8) | 10 (2.5) |
| I will prefer to acquire immunity against COVID-19 naturally (by having the disease/subclinical infection) rather than by vaccination. | 1 (0.2) | 20 (4.9) | 86 (21.3) | 89 (21.9) | 210 (51.7) |
| I am willing to get the COVID-19 vaccine, even if I have to pay to get it. | 62 (15.3) | 203 (50.0) | 45 (11.1) | 65 (16.0) | 31 (7.6) |
| I will recommend my family and friends to get vaccinated against COVID-19 | 52 (12.8) | 240 (59.1) | 70 (17.9) | 32 (7.9) | 52 (12.8) |
| There is no harm in taking COVID-19 vaccine. | 46 (11.3) | 122 (30.0) | 67 (16.5) | 96 (23.6) | 75 (18.6) |
| COVID-19 vaccine will be useful in protecting me from the COVID-19 infection. | 61 (15.0) | 37 (9.1) | 220 (54.1) | 42 (10.8) | 46 (11.0) |
| COVID-19 vaccine is available free of cost. | 54 (13.3) | 213 (52.4) | 73 (17.9) | 20 (4.9) | 46 (11.5) |
| I feel the benefits of taking the COVID-19 vaccine outweighs the risks Involved | 21 (5.4) | 55 (13.5) | 63 (15.5) | 69 (16.9) | 198 (48.7) |
| Taking the COVID-19 vaccine is a societal responsibility | 31 (7.5) | 242 (60.0) | 61 (15.0) | 43 (10.7) | 28 (6.8) |
| There is sufficient data regarding the vaccine's safety and efficacy | 54 (13.5) | 34 (8.3) | 174 (42.8) | 76 (18.7) | 68 (16.7) |
| Many people are taking the COVID-19 vaccine. | 35 (8.6) | 135 (33.4) | 89 (21.9) | 99 (24.3) | 48 (11.8) |
| It will help in eradicating COVID-19 infection | 30 (7.3) | 168 (41.6) | 67 (16.5) | 77 (18.9) | 64 (15.7) |
| Role models/politicall leaders/senior doctors/scientists have taken COVID-19 vaccine. | 52 (12.8) | 187 (46.1) | 38 (9.3) | 78 (19.2) | 51 (12.6) |
| Concerns regarding the COVID-19 | | | | | |
| COVID-19 vaccine might not be easily available to me. | 44 (11.0) | 151 (37.1) | 46 (11.3) | 118 (29.0) | 47 (11.6) |
| I might have immediate serious side effects after taking COVID-19 vaccine. | 63 (15.7) | 181 (44.5) | 67 (16.5) | 70 (17.2) | 25 (6.1) |
| COVID-19 vaccine may be faulty or I fake. | 15 (3.6) | 105 (26.0) | 107 (27.5) | 96 (22.5) | 83 (20.4) |
| COVID-19 vaccine was rapidly developed and approved. | 40 (10.0) | 158 (38.9) | 71 (17.5) | 103 (25.3) | 34 (8.3) |
| I might have some unforeseen future effects of the COVID-19 vaccine. | 42 (10.3) | 173 (42.6) | 86 (21.1) | 62 (15.5) | 43 (10.5) |
| COVID-19 vaccine is being promoted for commercial gains of pharmaceutical companies. | 42 (10.3) | 29 (7.1) | 127 (31.0) | 102 (25.0) | 106 (26.6) |
| Overall attitude toward COVID-19 vaccine | Good | 280 (69.0) | | | |
| | Poor | (31.0) | | | |

Numbers in a parenthesis shows percentage.

study conducted in Chiang Mai, Thailand,[38] but inconsistent with America[39] and Algerian Healthcare Workers.[40] The plausible reasons may be the method of data analysis and the study population (students and staff) in Thailand being different Furthermore, the age of health care professionals in this study was in the young and middle age range(15-24 years and commencing at about 40-59 years). There is also a difference in sample size in Algeria.

Marital status was directly associated with the COVID-19 prevention strategy post-vaccination in the current study. Accordingly, married health care professionals were more likely to implement the COVID-19 prevention strategy post vaccination as compared to a single encounter. In this study, married participants had a higher chance of applying a COVID-19 prevention strategy post vaccination than single people. This finding is supported by research done in Jimma, Ethiopia.[28] Those who were married individuals were 3.36 times more likely to implement the COVID-19 prevention strategy compared to single individuals. This may be due to married individuals taking additional responsibility for their family members and having a higher risk perception of ignoring the COVID-19 prevention strategy even after vaccination.

**Table 5.** Binary logistic regression analysis and factors associated with COVID-19 prevention strategy after vaccination, Bahir Dar, Northwest Ethiopia, September to October 2021 (n = 406).

| VARIABLE | PRACTICE | | COR (95% CI) | AOR (95% CI |
|---|---|---|---|---|
| | POOR | GOOD | | |
| Sex | | | | |
| Male | 73 | 188 | 1.53 (0.99, 2.35) | 1.76 (1.08, 2.89)* |
| Female | 54 | 91 | 1 | 1 |
| Marital status | | | | |
| Single | 67 | 109 | 1 | 1 |
| Married | 56 | 162 | 1.78 (1.16, 1.95) | 1.75 (1.09, 2.93)* |
| Others | 4 | 8 | 1.23 (0.36, 4.24) | 2.32 (0.55, 9.7) |
| Educational level | | | | |
| Diploma | 22 | 28 | 0.54 (0.19, 1.45) | 0.44 (0.15, 1.29) |
| First degree | 97 | 232 | 1.01 (0.43, 2.38) | 0.93 (0.36, 2.37) |
| Second degree and above | 8 | 19 | 1 | 1 |
| Attitude toward vaccination | | | | |
| Poor | 62 | 64 | 1 | 1 |
| Good | 65 | 215 | 3.20 (2.05, 5.01) | 3.42 (2.13, 5.48)* |
| Knowledge of vaccine | | | | |
| Poor | 46 | 121 | 1 | 1 |
| Good | 81 | 158 | 0.74 (0.48, 1.14) | 0.82 (0.51, 1.32) |

Abbreviations: AOR, Adjusted Odds Ratio; COR, Crude Odds Ratio.
1, reference group. Hosmer–Lemeshow goodness-of-fit test was 0.3012.
*Significant at $p < .05$.

Furthermore, the attitude of health care professionals was another significant factor associated with the COVID-19 prevention strategies implemented post-vaccination. Health care professionals who had a good attitude toward COVID-19 vaccination were triple times more likely to implement COVID-19 prevention strategies post-vaccination. However, healthcare professionals, with a positive attitude toward COVID-19 vaccination were 3 times more likely than those with a negative attitude to implement COVID-19 preventative strategies post vaccination. This could be due to health care professionals that had a good attitude toward the COVID-19 vaccine and might have properly implemented the preventive strategies in order to prevent COVID-19 infection and re-infection. This finding is consistent with a research finding in the Republic of Congo[34] and Southwestern Ethiopia[26] where the stated intention to accept the COVID-19 vaccine was more likely among those with a positive attitude toward COVID-19 prevention than their counterparts. The possible reason may be fewer acceptances among study participants who had a negative attitude toward COVID-19 vaccination, which shows the optimistic bias since they are more inclined to underestimate their chance of contracting COVID-19. Hence, study participants who had a negative attitude toward COVID-19 vaccination were less likely to adhere to preventive measures like wearing a face mask, social distancing, and hand washing than other age groups.

### *Recommendations*

The hospital management and each department head should design and implement sustainability strategies to improve and maintain the practice of COVID-19 prevention strategies post the vaccination of health professionals (coordination and planning, engage and mobilize hospital communities to limit exposure and adapt strategies based on risk, capacity, and vulnerability). However, personal measures that reduce the risk of person-to-person transmissions, such as having positive attitude, hand washing, physical distancing, and respiratory etiquette, should be implemented.

Furthermore, further investigation with continuous observational study design and qualitative study methods is needed to improve and maintain the practice of COVID-19 prevention strategies post-vaccination of health care professionals.

*Limitation*

Our study has the following limitations: first, the study was cross-sectional and couldn't identify causality because both outcome and exposure are examined at the same time. Second, the practice of health care professionals, implementing COVID-19 prevention strategy post vaccination working in private hospitals was not taken into account. Third, the study was conducted in one hospital out of hospitals found in Northwest Ethiopia, and the study explores the practice of implementing a COVID-19 prevention strategy post vaccination in this hospital. Healthcare professionals, working in public hospitals were also members of private hospitals (part-time, contract). Compared to the other hospitals, Felege Hiwot referral hospital has the largest number of staff, professional mix, and clinical services, which are also found in the capital of the Amhara region (Bahirdar city).

## Conclusions

The overall degree of the practice of COVID-19 preventive strategies post vaccination was good among healthcare professionals. Sex, marital status, and a good attitude toward vaccination were found to be significant predictors of the practice of COVID-19 preventive strategies post vaccination. Thus, a strengthening strategy for the practice of COVID-19 prevention post vaccination (availing necessary materials, giving training for staff about the vaccine, and taking precaution) is necessary for sustainability. Hospital administrations and the infection prevention committee should establish and implement preventative plans.

## Acknowledgements

We are highly indebted to the College of Medicine and Health Sciences, University of Gondar, for supporting this research project. We would like to extend our thanks to the Felege Hiwot Referral Hospital administration for permission to conduct the study. We would also like to extend our appreciation to the study participants, supervisors, and data collectors.

## Authors' Contributions

GTE conceived and designed the study. GTE, EAW, and BDB prepared the questionnaire. GTE conducted the statistical analysis and interpretation of the findings and wrote the first draft of the manuscript. GTE, EAW, and BDB provided manuscript editing. All authors read and approved the final version of this manuscript.

## Data availability statement

All the data supporting our results is shown in the manuscript. The datasets used and/or analyzed in the current study are available from the corresponding author upon legitimate request.

## Ethical Consideration

Ethical clearance was approved and obtained from the Institutional Review Board of the University of Gondar College of Medicine and Health Science, Institute of Public Health with reference number 2944/13. Then an official permission letter was collected from the Felege Hiwot Referral Hospital admin offices. Written informed consent was obtained from each study participant after they were included in this study. Study participants get an explanation of the purpose of the study before giving consent. We deliver information on the right to interrupt and refuse to fill out the self-administered questionnaires. All the Method followed the tenets of the Declaration of Helsinki and also complied with the ethical requirements set by the University of Gondar. Written informed consent was obtained from each respondent before commencing data collection after an explanation of the nature and possible consequences of the study. The information sheet that clearly shows the research topic, the objectives of the study, confidentiality of the participant's responses, the study benefits, and associated risks was prepared and presented. We removed any personal identifiers to assure confidentiality of the participants and only anonymous data were used for interpretations.

## ORCID iD


Eshetu Abera Worede https://orcid.org/0000-0002-2939-8329

## Supplemental material

Supplemental material for this article is available online.

## REFERENCES

1. WHO. *First Case of COVID-19 Confirmed in Ethiopia*. WHO Regional Office for Africa; 2020.
2. Islam MS, Sujan MSH, Tasnim R, Sikder MT, Potenza MN, van Os J. Psychological responses during the COVID-19 outbreak among university students in Bangladesh. *PLoS One*. 2020;15:e0245083.
3. Worldometer. Ethiopia. 2021. Accessed December 16, 2021. https://www.worldometers.info/coronavirus/country/Ethiopia/
4. Kousi T, Vivacqua D, Dalal J, et al. COVID-19 pandemic in Africa's island nations during the first 9 months: a descriptive study of variation in patterns of infection, severe disease, and response measures. *BMJ Global Health*. 2022;7:e006821.
5. Flaherty GT, Hession P, Liew CH, et al. COVID-19 in adult patients with pre-existing chronic cardiac, respiratory and metabolic disease: a critical literature review with clinical recommendations. *Trop Dis Travel Med Vaccines*. 2020;6:16.
6. Ioannidis JPA. Global perspective of COVID-19 epidemiology for a full-cycle pandemic. *Eur J Clin Investig*. 2020;50:e13423.
7. Shweta DS, Raydah A. *Uneven Impact of COVID-19 on Ethnic or Racial Minorities Explained by Differences in the Prevalence of Pre-existing Health Conditions*. Brac University; 2021.
8. WHO. *WHO Coronavirus Disease (COVID-19) Dashboard*. WHO; 2021.
9. Fisher KA, Bloomstone SJ, Walder J, Crawford S, Fouayzi H, Mazor KM. Attitudes toward a potential SARS-CoV-2 vaccine: a survey of US adults. *Ann Intern Med*. 2020;173:964-973.
10. Goshu D, Ferede T, Diriba G, Ketema M. Economic and welfare effects of COVID-19 and responses in Ethiopia: initial insights, 2020.
11. Alle YF, Oumer KE. Attitude and associated factors of COVID-19 vaccine acceptance among health professionals in Debre Tabor Comprehensive Specialized Hospital, North Central Ethiopia; 2021: cross-sectional study. *Virusdisease*. 2021;32:272-278.
12. Emeto TI, Alele FO, Ilesanmi OS. Evaluation of the effect of border closure on COVID-19 incidence rates across nine African countries: an interrupted time series study. *Trans R Soc Trop Med Hyg*. 2021;115:1174-1183.

13. WHO. *Coronavirus Disease (COVID-19) Advice for the Public*. WHO; 2020. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public
14. Honein MA, Christie A, Rose DA, et al. Summary of guidance for public health strategies to address high levels of community transmission of SARS-CoV-2 and related deaths, December 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69:1860-1867.
15. Brooks JT, Butler JC. Effectiveness of mask wearing to control community spread of SARS-CoV-2. *JAMA*. 2021;325:998-999.
16. Tomshine JR, Dennis KD, Bruhnke RE, et al. Combined effects of masking and distance on aerosol exposure potential. *Mayo Clin Proc*. 2021;96:1792-1800.
17. Vassella CC, Koch J, Henzi A, et al. From spontaneous to strategic natural window ventilation: improving indoor air quality in Swiss schools. *Int J Hyg Environ Health*. 2021;234:113746.
18. Lindsley WG, Derk RC, Coyle JP, et al. Efficacy of portable air cleaners and masking for reducing indoor exposure to simulated exhaled SARS-cov-2 aerosols - United States, 2021. *MMWR Morb Mortal Wkly Rep*. 2021;70:972-976.
19. Gonçalves MR, Dos Reis RCP, Tólio RP, et al. Social distancing, mask use, and transmission of severe acute respiratory syndrome coronavirus 2, Brazil, April-June 2020. *Emerg Infect Dis*. 2021;27:2135-2143.
20. Bante A, Mersha A, Tesfaye A, et al. Adherence with COVID-19 preventive measures and associated factors among residents of Dirashe District, southern Ethiopia. *Patient Prefer Adherence*. 2021;15:237-249.
21. Cuschieri S. The STROBE guidelines. *Saudi J Anaesth*. 2019;13:S31-S34.
22. Meher B, Joshua N, Asha B, Mukherji D. A questionnaire based study to assess knowledge, attitude and practice of pharmacovigilance among undergraduate medical students in a Tertiary Care Teaching Hospital of South India. *Perspect Clin Res*. 2015;6:217.
23. Dewau R, Mekonnen TC, Tadesse SE, Muche A, Bogale GG, Tadesse Amsalu E. Knowledge and practice of clients on preventive measures of COVID-19 pandemic among governmental health facilities in South Wollo, Ethiopia: a facility-based cross-sectional study. *PLoS One*. 2021;16:e0247639.
24. Al-Hanawi MK, Angawi K, Alshareef N, et al. Knowledge, attitude and practice toward COVID-19 among the public in the Kingdom of Saudi Arabia: a cross-sectional study. *Public Health Front*. 2020;8:217.
25. Christie A, Brooks JT, Hicks LA, Sauber-Schatz EK, Yoder JS, Honein MA. Guidance for implementing COVID-19 prevention strategies in the context of varying community transmission levels and vaccination coverage. *MMWR Morb Mortal Wkly Rep*. 2021;70:1044-1047.
26. Angelo AT, Alemayehu DS, Dachew AM. Health care workers intention to accept COVID-19 vaccine and associated factors in southwestern Ethiopia, 2021. *PLoS One*. 2021;16:e0257109.
27. Lake EA, Demissie BW, Gebeyehu NA, Wassie AY, Gelaw KA, Azeze GA. Knowledge, attitude and practice towards COVID-19 among health professionals in Ethiopia: a systematic review and meta-analysis. *PLoS One*. 2021;16:e0247204.
28. Gebremedhin T, Abebe H, Wondimu W, Gizaw AT. COVID-19 prevention practices and associated factors among frontline community health workers in Jimma Zone, southwest Ethiopia. *J Multidiscip Healthc*. 2021;14:2239-2247.
29. Tsehay A, Endashaw Hareru H, Molla W, et al. Factors associated with preventive practices of COVID-19 among health care workers in Dilla University Hospital, southern Ethiopia. *Environ Challenges*. 2021;5:100368.
30. Kassie BA, Adane A, Abebe Kassahun E, Ayele AS, Kassahun Belew A. Poor COVID-19 preventive practice among healthcare workers in northwest Ethiopia, 2020. *Adv Public Health*. 2020;2020:1-7.
31. Zhang M, Zhou M, Tang F, et al. Knowledge, attitude, and practice regarding COVID-19 among healthcare workers in Henan, China. *J Hosp Infect*. 2020;105:183-187.
32. Olum R, Chekwech G, Wekha G, Nassozi DR, Bongomin F. Coronavirus disease-2019: knowledge, attitude, and practices of health care workers at Makerere University Teaching Hospitals, Uganda. *Public Health Front*. 2020;8:181.
33. Peckham H, de Gruijter NM, Raine C, et al. Male sex identified by global COVID-19 meta-analysis as a risk factor for death and ITU admission. *Nat Commun*. 2020;11:6317-6410.
34. Kabamba Nzaji M, Kabamba Ngombe L, Ngoie Mwamba G, et al. Acceptability of vaccination against COVID-19 among healthcare workers in the Democratic Republic of the Congo. *Pragm Observ Res*. 2020;11:103-109.
35. Klein SL, Flanagan KL. Sex differences in immune responses. *Nat Rev Immunol*. 2016;16:626-638.
36. Ramírez-Soto MC, Ortega-Cáceres G, Arroyo-Hernández H. Sex differences in covid-19 fatality rate and risk of death: an analysis in 73 countries, 2020-2021. *Infez Med*. 2021;29:402-407.
37. Hawkes S, Tanaka S, Pantazis A, et al. Recorded but not revealed: exploring the relationship between sex and gender, country income level, and COVID-19. *Lancet Glob Health*. 2021;9:e751-e752.
38. Kasatpibal N, Oberdorfer P, Katip W, Mektrirat R, Wattananandkul U, Thummathai K. Factors predicting practices in prevention of COVID-19 and impacts among population in Chiang Mai, Thailand. *Medicina*. 2022;58:505.
39. Kim JK, Crimmins EM. How does age affect personal and social reactions to COVID-19: results from the national Understanding America Study. *PLoS One*. 2020;15:e0241950.
40. Lounis M, Rais MA, Bencherit D, et al. Side effects of COVID-19 inactivated virus vs. adenoviral vector vaccines: experience of Algerian Healthcare Workers. *Front Public Health*. 2022;10:896343.