Knowledge and Attitude Towards Second COVID-19 Vaccine Dose Among Health Professionals Working at Public Health Facilities in a Low Income Country

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Background: Several vaccines have been approved in a lot of countries to combat coronavirus disease and distributed throughout the world. Health professional’s knowledge and attitude towards a second COVID-19 vaccine dose were poorly implemented and understood in Ethiopia’s health facilities. The main purpose of conducting this study was to investigate health professionals’ knowledge and attitude towards the second COVID-19 vaccine dose at public hospitals in Ethiopia.

Methods: A cross-sectional study design was conducted from January to March, 2021 to assess the knowledge and attitude towards second COVID-19 vaccine dose among health professionals working at public health facilities in Ethiopia. A multivariable logistic regression was performed to identify predictors that correlate with knowledge and attitude towards a second COVID-19 vaccine dose with a P-value<0.05 as a cut-off point for statistical significance at 95% confidence interval (CI).

Results: Four hundred and nine study subjects participated, with a response rate of 96.7%. In this study, more than half of the respondents had high knowledge towards second COVID-19 vaccine doses. Similarly, 95.6% of respondents had a favorable attitude towards second COVID-19 vaccine doses. Educational status (AOR=1.82, 95% CI=1.1–2.2), age (AOR=2.01, 95% CI=1.76–3.01), and profession (AOR=2.32, 95% CI=1.42–3.01) were variables associated with knowledge towards second COVID-19 vaccine doses. Educational status (AOR=5.42, 95% CI=4.1–6.7), age (AOR=12.4, 95% CI=10.54–15.8), professions (AOR=4.33, 95% CI=2.32–6.87), working experience (AOR=4.33, 95% CI=2.32–6.87), marital status (AOR=2.47, 95% CI=1.33–5.95), risk degree (AOR=2.33, 95% CI=1.31–4.11) and gender (AOR=3.42, 95% CI=2.91–4.98) were determinant factors of attitude towards the second COVID-19 vaccine dose.

Conclusion: Addressing problems related with risk degree, educational status, and socio-demographic factors will help to increase the overall knowledge and attitude towards second COVID-19 vaccine doses.

Keywords: COVID-19, health professionals, attitude, second vaccine dose, knowledge, Ethiopia

Background

The current COVID-19 pandemic facing the world in danger of all aspects.1–3 A retrospective investigation was conducted by the Chinese to identify the symptoms and onsets of the virus during early December 2019 to confirm SARS Cov-2 as the cause of COVID-19. The virus SARS-CoV-2 (abbreviation for severe acute respiratory syndrome coronavirus type 2), known as a (novel) coronavirus, is a pathogen
similar to the SARS coronavirus that emerged in 2002. Both Novel coronal virus and SARS corona virus belong to the beta-coronavirus group and are of probably zoonotic origin. The virus was confirmed as the cause of the COVID-19 disease in early 2020.

In Ethiopia, the COVID-19 situation has become a major issue and the government has been taking several measures to tackle the spread of the disease. Nevertheless, the COVID-19 pandemic is getting more difficult to control and reduce the transmission rate throughout the world. Even though a lot of effort has been made globally to develop vaccines against COVID-19, the loss of trust towards the effect of vaccination led to a low coverage of vaccination throughout the world. This has resulted in reduced productivity, increased absenteeism, and dangerous outbreaks of the virus.

Several studies have identified that knowledge and attitude determine the acceptance of vaccine against COVID-19. A study revealed that the importance of conducting research on knowledge and attitude towards vaccination has become a hot topic right now in Ethiopia to reduce the transmission rate of the disease. The knowledge about vaccines against COVID-19 was affected by the factors asymptomatic with COVID-19, household income, high-risk of COVID-19, age, belief about vaccine, education level, and religion. The factors vaccine history, perceived impact of COVID-19, understanding of vaccine immunity, political ideology, household income, and information about the vaccine were identified as the factors associated with attitude toward vaccination against COVID-19. It is identified that a lot of respondents responded “yes” when asked about COVID-19 vaccine, whereas only 80 (4.58%) of respondents said that they did not know about vaccinations against COVID-19.

In a study conducted in west India, knowledge, attitude, and practice (KAP) of the local population towards the COVID-19 vaccine was critical to understand the epidemiological dynamics of disease control, and the effectiveness, compliance, and success of the vaccination program. However, lack of knowledge about vaccine remained a reason in hindering vaccination where more than half of the respondents (56.4%) still had no knowledge about the presence of vaccines against COVID-19. Another study has shown that the majority (81.5%) of the respondents believed that it was important to get vaccinated to protect the community from COVID-19. This is directly related to the presence of high knowledge about vaccines against COVID-19. A study conducted on attitude towards vaccine against COVID-19 also revealed that timing, efficacy, and location will determine the attitude. However, around 70% of participants indicated that they had a positive attitude towards vaccines against COVID-19.

A study conducted on the vaccine supported that the side-effects of the vaccine will determine and directly associate with attitude, where over 80% of respondents stated that vaccines could have an adverse effect on participants health. Knowledge about health issues is a central component of health literacy and is considered a prerequisite for health decision-making process. The lack of scientifically accurate knowledge influenced negative attitude towards vaccine. Vaccine knowledge was one of the strongest factors associated with vaccination intention to receive COVID-19 vaccine in China.

In order to achieve an effective and efficient vaccination outcome against COVID-19, building trust and increasing awareness among health professionals is an important step to receive COVID-19 vaccine to prevent transmission of the COVID-19 pandemic.

As the Ethiopian federal ministry of health has tried to implement a vaccination strategy, it’s a mandatory step to know the knowledge and attitude of health professionals about the second COVID-19 vaccine doses. In addition to this, there has been no prior study among health professionals in our areas investigating their knowledge and attitude towards second COVID-19 vaccine doses. Generally, the study question is to examine the knowledge and attitude of health care providers towards second COVID-19 vaccine doses.

Methods

Study Design, Area, and Period
A cross-sectional study design was conducted from January to March 2021 at Karl referral hospital, Darimu hospital, Dembi hospital, Chora hospital and Bedelle hospital, south west Ethiopia.

Study Subjects and Participants
All health professionals working at all public hospitals of Ilu aba bore and Bedelle zones were included in the study. Health professionals who have less than 6 months working experience were excluded from the study.

Sample Size Determination and Sampling Procedure
A single population proportion formula \(n = \left[\frac{(Z_{\alpha/2})^2 \times p(1-p)}{d^2}\right]\) was determined to calculate the total sample size.
Fifty per cent (50%) was used to calculate the sample size due to no previous research being done on knowledge and attitude towards second COVID-19 vaccine dose. By considering the 95% confidence interval ($Z_{a/2} = 1.96$), a marginal of error (d) of 5% and 10% non-response, a sample size of 423 was used. Karl referral hospital, Darimu hospital, Dembi hospital, Chora hospital, and Bedelle hospital located within the two zones were selected for the study. There were a total of 851 health professionals in these study settings. A total sample size of 423 participants were proportionally allocated for each selected hospital. The participants were selected from each hospital using simple random sampling technique.

The data were collected using a self-administered questionnaire. The questionnaire was prepared in English. Seven data collectors, who have good experience in data collection, were recruited for data collection.

**Data Quality Control**
The questionnaire was pretested on 25 study participants who were working at Jimma referral hospital. Based on the pretest, necessary modifications of the questionnaire were done. The content validity of the questionnaire was checked, and the reliability was calculated using Cronbach alpha’s coefficient (overall Cronbach $\alpha = 0.87$). A total of three degree holder health professionals as supervisors and nine health professionals as data collectors participated in the data collection process after 2 days of training. During data collection process, the study participants were informed about the study and confidentiality of the information. Multi-collinearity was tested by running a false linear regression and the study result showed that the entire variance inflation factor (VIF) value was less than 2 and the tolerance was greater than 0.78 which confirmed the absence of multi-collinearity. The data was checked by box plot for outliers and there was no outlier observed in the study. The goodness of fit of the model was checked.

**Data Processing and Analysis**
The questionnaires were entered into software Epi info version 7 and SPSS version 20 was used for data analysis. Binary logistic regression analysis was used to identify factors associated with knowledge and attitude towards the second COVID-19 vaccine dose. Bivariable and multivariable logistic regression were conducted to describe the association between each factor with dependent variables. $P$-values $<0.2$ and $<0.05$ were significance test cut-off values for bivariable and multivariable analysis, respectively. Variables having a $P$-value $<0.2$ on the bivariate analysis were entered into a multivariable logistic regression analysis to check for confounding effects on the association from bivariable analysis. The strength of association was described at 95% CI, and a $P$-value less than 0.05 was considered for multivariable logistic regression analysis. A multi-collinearity test was conducted for the model and none of the variables were scored above 10 for the test statistics.

**Results**

**Socio Demographic Characteristics of the Participants**
Four hundred and nine participants were enrolled in the study. The mean age of the participants was 32.7 with a standard deviation of $\pm 11.8$. Two hundred and sixty (63.6%) of the participants were married. Two hundred and sixty-three (64.3%) of the study participants had a degree, and 44 (10.8%) of them were masters and above masters. Two hundred and fifty-three (61.9%) of the study participants had an income of 5,000 and only 27 (6.6%) of the participants earned 10,000–15,000 (Table 1).

**Participant’s Health Status**
One hundred and one (24.7%) of the respondents had chronic disease. Ninety percent of the respondents were at high risk of COVID-19 complications, and 9.0% were at medium risk, as shown in Table 2.

**Participant’s Knowledge Towards Second COVID-19 Vaccine Dose**
This study revealed that 298 (72.9%) of the participants perceived that the second COVID-19 vaccine dose increases allergic reaction. Knowledge about the second COVID-19 vaccine dose was 64.00%. Three hundred and eighty-four (93.9%) respondents declared that they know about the second COVID-19 vaccine dose, as shown in Table 3.

**Participants’ Attitude Towards Second COVID-19 Vaccine Dose**
About half of the participants (209; 51.1%) reported that the newly discovered second COVID-19 vaccine dose is safe. Around 201 (49.7%) of participants declared that it is not possible to reduce the prevalence of COVID-19 without a second vaccine dose. Three hundred and eighty-six
Participants stated that they will encourage their families and friends to get vaccinated again (Table 4).

Binary Logistic Regression Analysis of Knowledge Towards the Second COVID-19 Vaccine Dose

A total of nine variables were entered into the binary logistic regression model. From the total, gender, educational status, profession, monthly income, marital status, age, working experience, and chronic disease status were significantly associated with knowledge towards the second COVID-19 vaccine dose in bivariable analysis. Among nine variables, educational status, age, and profession were the only factors significantly associated with knowledge in the multivariable logistic regression analysis. Professionals who are MSc and above MSc had 2-times (AOR=1.82, 95% CI=1.1–2.2) higher knowledge towards the second COVID-19 vaccine dose as compared to professionals with Diploma. Regarding age, the odds of knowledge were 2 (AOR=2.01, 95% CI=1.76–3.01) times higher among professionals with age of 30–39 level as compared to professionals who are 20–29 (Table 5).

Binary Logistic Regression Analysis of Attitude Towards Second COVID-19 Vaccine Dose

A total of nine variables were entered into a bivariable logistic regression model. From the total, gender, profession, educational status, monthly income, marital status, age, working experience, and chronic disease status were significantly associated with attitude towards the second COVID-19 vaccine dose in bivariable analysis. Among nine variables, educational status, age, and profession were the only factors significantly associated with attitude in the multivariable logistic regression analysis. Professionals who are MSc and above MSc had 2.01 (AOR=2.01, 95% CI=1.76–3.01) times higher score as compared to professionals with Diploma. Regarding age, the odds of attitude were 2.01 (AOR=2.01, 95% CI=1.76–3.01) times higher among professionals with age of 30–39 level as compared to professionals who are 20–29 (Table 6).
status, Age, Working experience, and Risk degree status were factors associated with bivariable logistic regression at a $P$-value of less than 0.2 and entered into multivariable binary logistic regression analysis. From nine variables, only educational status, age, marital status, risk degree, and profession were found to be significantly associated with attitude in the multivariable logistic regression analysis. With respect to educational status, professionals who are MSc and above MSc had 5-times (AOR=5.42, 95% CI=4.1–6.7) higher attitude towards second COVID-19 vaccine dose as compared to professionals with Diploma. Regarding Age, the odds of attitude were 2 (AOR=0.2, 95% CI=1.84–3.26) times higher among professionals with age of >59 as compared to professionals who are 20–29. Professionals who have working experience of >10 years had 4-times (AOR=4.33, 95% CI=2.32–6.87) higher attitude towards COVID-19 as compared to professionals with <3 years (Table 6).

Table 4 Participants’ Attitude About Second COVID-19 Vaccine Dose

| Variables                                      | Category | Frequency % (n=409) |
|------------------------------------------------|----------|---------------------|
|                                                |          |                    |
| The newly discovered second COVID-19 vaccine   | Yes      | 209 (51.1)         |
| dose is safe                                   | No       | 200 (48.9)         |
| The second COVID-19 vaccine dose is essential | Yes      | 243 (59.4)         |
| for Ethiopia                                   | No       | 166 (40.6)         |
| I will encourage my family, friends and        | Yes      | 386 (94.4)         |
| relatives to get vaccinated against            | No       | 23 (5.6)           |
| COVID-19 again                                 |          |                    |
| I will take second COVID-19 vaccine dose       | Yes      | 341 (83.4)         |
| without any hesitation, if it is available in  | No       | 66 (16.6)          |
| Ethiopia                                       |          |                    |
| It is not possible to reduce the prevalence of | Yes      | 201 (49.1)         |
| COVID-19 without a second vaccine dose         | No       | 208 (50.9)         |
| The second COVID-19 vaccine doses should       | Yes      | 103 (25.2)         |
| be distributed fairly to all of us             | No       | 306 (74.8)         |

The magnitudes of knowledge about vaccine were assessed and 64.0% (95% CI=58.62–67.89%) of study participants had good knowledge about the second vaccine dose against COVID-19. This result was inconsistent with a study conducted in west India where 58.0% of the study subjects rejected the presence of a vaccine against COVID-19. Time variation might be the possible explanations for these variations. However, this result was lower than a study conducted in Greece, where the majority of subjects (88.3%) had a good level of knowledge about second vaccine doses against COVID-19. A study conducted in Romania was also greater than the result of this study, where only 4.85% of study participant said that they did not know the benefits of the second COVID-19 vaccine dose. Similarly, a study shows that the majority (81.5%) of the respondents agreed that it is important to take a second vaccine dose to protect people from COVID-19, which was greater than the result of this study. Possible explanations for this variation might be due to the prevalence of the COVID-19 pandemic, source of information, and vaccination policy. Similarly, sources of information also matters because more than half of Ethiopians are living in rural areas.

Educational status was significantly associated with knowledge about the second vaccine dose against COVID-19. The odds of a study subject with MSc and above educational status were about 2-times (AOR=1.82, 95% CI=1.1–2.2) more likely to have higher knowledge about second vaccination dose against COVID-19 as compared to subjects with diploma holders. This result was similar to a study conducted in west India and Bangladesh that study subjects with a higher level of educational status were more likely to have higher knowledge about the second vaccine dose against COVID-19. Accordingly, the odds of knowledge were 2 (AOR=2.01, 95% CI=1.76–3.01) times higher among professionals aged 30–39 as compared to professionals who are 20–29. Similarly, a study conducted in west India and

### Discussion

The study was conducted among health care providers collected from public hospitals in Ethiopia to assess the knowledge and attitude towards second COVID-19 vaccine dose to achieve efficient and effective vaccination policy in Ethiopia. It is essential to determine and focus
Physicians were about 2-times (AOR=2.32, 95% CI=1.42–3.01) more likely to have higher knowledge about second vaccination against COVID-19 as compared to subjects not being a physician. The result of this study was consistent with studies conducted in Greece and the Democratic Republic of the Congo.43,45 The attitude of healthcare providers in this study was also assessed where 87.1% of respondents have a favorable attitude towards the second vaccination dose.

### Table 5 Binary Logistic Regression Analysis of Knowledge Towards Second COVID-19 Vaccine Dose

| Variables               | Knowledge | COR (95% CI) | AOR (95% CI) |
|-------------------------|-----------|--------------|--------------|
|                         | Yes       | No           |              |
| **Gender**              |           |              |              |
| Male                    | 200       | 87           | 0.45 (0.39–0.57) | 0.31 (0.21–1.55) |
| Female                  | 102       | 20           | 1            | 1            |
| **Profession**          |           |              |              |
| Nurse                   | 101       | 62           | 0.33 (0.12–0.42) | 0.27 (0.19–1.98) |
| Psychiatry              | 5         | 2            | 0.52 (0.36–0.62) | 0.42 (0.31–2.01) |
| Optometry               | 4         | 2            | 0.41 (0.32–0.53) | 0.37 (0.26–2.21) |
| Midwifery               | 59        | 9            | 1.34 (1.85–2.31) | 0.87 (0.72–2.13) |
| Physician               | 98        | 7            | 2.87 (1.23–3.91) | 2.32 (1.42–3.01)** |
| Health officer          | 5         | 1            | 1.03 (1.01–2.32) | 0.75 (0.70–1.25) |
| Anesthesia              | 5         | 2            | 0.51 (0.46–0.61) | 0.47 (0.37–1.99) |
| Other                   | 39        | 8            | 1            | 1            |
| **Marital status**      |           |              |              |
| Married                 | 191       | 86           | 0.63 (0.56–0.78) | 0.57 (0.53–1.56) |
| Not Married             | 102       | 29           | 1            | 1            |
| **Educational Status**  |           |              |              |
| Diploma                 | 79        | 23           | 1            | 1            |
| Degree                  | 192       | 71           | 0.79 (0.66–0.95) | 0.59 (0.44–1.23) |
| MSc and Above           | 38        | 6            | 1.84 (1.13–2.43) | 1.82 (1.1–2.2)** |
| **Monthly income**      |           |              |              |
| >5,000                  | 200       | 53           | 1            | 1            |
| 10,000                  | 89        | 40           | 0.59 (0.51–0.78) | 0.54 (0.51–2.31) |
| 10,000–15,000           | 19        | 8            | 0.63 (0.44–1.95) | 1.5           |
| **Age**                 |           |              |              |
| 20–29                   | 79        | 24           | 1            | 1            |
| 30–39                   | 181       | 40           | 1.37 (1.21–2.55) | 2.01 (1.76–3.01)** |
| 40–49                   | 29        | 8            | 1.10 (0.85–1.74) | 0.67 (0.57–2.01) |
| 50–59                   | 23        | 10           | 0.70 (0.45–0.91) | 0.41 (0.31–1.53) |
| >59                     | 9         | 6            | 0.46 (0.33–0.56) | 1.33 (1.21–2.55) |
| **Working experience**  |           |              |              |
| 1–3 years               | 69        | 20           | 1            | 1            |
| 3–5 years               | 83        | 40           | 0.60 (0.44–2.12) | 0.43 (0.34–1.67) |
| 5–10 years              | 129       | 50           | 0.75 (0.55–0.88) | 0.29 (0.24–1.30) |
| >10 years               | 10        | 8            | 0.36 (0.24–0.58) | 1.33 (1.21–2.55) |
| **Have chronic disease(s)** |       |              |              |
| Yes                     | 90        | 56           | 0.52 (0.41–0.65) | 0.48 (0.39–0.61) |
| No                      | 199       | 64           | 1            | 1            |

**Notes:** **Significant at P<0.01, 1Reference category.**

Bangladesh were consistent with the results of this study.17,21
against COVID-19 was high. Studies conducted in Belgium and Canada (79.6%), the USA (68%), the UK (38%), and Italy (75%) were among those conducted studies with results lower than this study. \(^4\, 46-48\) This might be due to the fact that COVID-19 prevalence was getting worse than ever in Ethiopia. \(^12\, 49\)

Educational status was found to be a significant factor for attitude towards second vaccine dose against COVID-19.

**Table 6 Binary Logistic Regression Analysis of Attitude Towards COVID-19 Second Vaccine Doses**

| Variables          | Knowledge | COR (95% CI) | AOR (95% CI) |
|--------------------|-----------|--------------|--------------|
|                    | Yes       | No           |              |
| Gender             |           |              |              |
| Male               | 196       | 91           | 4.41 (3.21–5.67) | 3.42 (2.91–4.98)*** |
| Female             | 40        | 82           | 1            | 1            |
| Profession         |           |              |              |
| Nurse              | 91        | 72           | 0.78 (0.61–0.99) | 0.54 (0.48–1.63) |
| Psychiatry         | 4         | 3            | 0.83 (0.66–0.92) | 0.48 (0.35–1.91) |
| Optometry          | 3         | 3            | 0.62 (0.41–0.78) | 0.55 (0.51–1.11) |
| Midwifery          | 40        | 28           | 0.88 (0.81–0.97) | 0.83 (0.77–1.24) |
| Physician          | 86        | 19           | 2.80 (1.23–3.91) | 2.42 (1.55–4.43)*** |
| Health officer     | 2         | 4            | 0.31 (0.19–1.32) | 0.24 (0.18–1.88) |
| Anesthesia         | 4         | 3            | 0.31 (0.21–0.41) | 0.24 (0.18–1.88) |
| Other              | 29        | 18           | 1            | 1            |
| Marital status     |           |              |              |
| Married            | 214       | 63           | 2.83 (1.46–3.56) | 2.47 (1.33–5.95)*** |
| Not Married        | 72        | 60           | 1            | 1            |
| Educational Status |           |              |              |
| Diploma            | 70        | 32           | 1            | 1            |
| Degree             | 189       | 74           | 0.79 (0.66–0.95) | 0.59 (0.44–1.23) |
| MSc and Above      | 41        | 3            | 6.2 (4.56–8.55) | 5.43 (4.1–6.7)*** |
| Monthly income     |           |              |              |
| >5,000             | 98        | 155          | 1            | 1            |
| 10,000             | 89        | 40           | 0.59 (0.51–0.78) | 0.54 (0.51–2.31) |
| 10,000–15,000      | 23        | 4            | 0.63 (0.55–1.95) |              |
| Age                |           |              |              |
| 20–29              | 51        | 52           | 1            | 1            |
| 30–39              | 179       | 42           | 4.3 (2.98–5.54) | 3.72 (2.13–4.52)*** |
| 40–49              | 27        | 10           | 0.78 (0.74–1.54) |              |
| 50–59              | 19        | 14           | 1.38 (1.21–1.87) | 1.21 (0.43–1.75) |
| >59                | 10        | 4            | 2.54 (1.96–3.87) | 2.2 (1.84–3.26)*** |
| Working experience |           |              |              |
| 1–3 years          | 48        | 41           | 1            | 1            |
| 3–5 years          | 63        | 60           | 0.60 (0.44–2.12) |              |
| 5–10 years         | 109       | 70           | 1.33 (0.79–1.99) |              |
| >10 years          | 16        | 2            | 6.83 (5.33–7.98) | 4.33 (2.32–6.87)*** |
| Risk degree        |           |              |              |
| High Risk          | 300       | 65           | 1.54 (1.24–3.43) | 2.33 (1.31–4.11)*** |
| Medium Risk        | 30        | 6            | 1.67 (1.21–5.28) | 1.37 (0.98–3.66) |
| Low Risk           | 6         | 2            | 1            | 1            |

Notes: **Significant at P<0.01, ***Significant at P<0.001. Reference category.
Thus, professionals who are MSc and above MSc had 5-times (AOR=5.42, 95% CI=4.1–6.7) higher attitude towards the second COVID-19 vaccine dose as compared to professionals with a Diploma. Studies conducted in the UK and Italy were consistent with the result of this study.\textsuperscript{48,50} However, the result of this study was inconsistent with studies conducted in Bangladesh and Romania.\textsuperscript{15,21} A possible explanation for this variation might be that in Ethiopia, respondents with a higher education status were more likely to get information about vaccines, whereas those with a diploma and the like are most likely living in rural areas. However, advancement of technology that encourages information about vaccines against COVID-19 in the two countries might be the reason for the differences.

Another significant factor was age, where the odds of attitude were 2 (AOR=2.2, 95% CI=1.84–3.26) times higher among professionals aged >59 as compared to professionals who are 20–29. This result was inconsistent with another study conducted in the UK where young people were significantly less likely than older adults to have a negative attitude towards the second COVID-19 vaccine dose,\textsuperscript{50} but similar to studies conducted in Belgium and Canada.\textsuperscript{46} The study is inconsistent with a study conducted in Italy, which revealed that age has no significant association with attitude towards the second vaccine dose against COVID-19.\textsuperscript{48} This might be due to the fact that there is an opinion that older people could be more exposed to COVID-19 than those who are young.

Health care providers who have long periods of working experience were more likely to have a favorable attitude towards the second COVID-19 dose. Thus, professionals who have working experience of >10 years had a 4-times (AOR=4.33, 95% CI=2.32–6.87) higher attitude towards the second vaccine dose against COVID-19 as compared to professionals with <3 years. This result was inconsistent with a study conducted in Greece showing that respondents with fewer work experience years were more likely to be vaccinated than participants unwilling to be vaccinated and Democratic Republic of the Congo.\textsuperscript{43,45} Older people possible being more exposed to the pandemic than the younger generation might be a possible explanation for this variation.

This study shows that subjects who were married were 2-times (AOR=2.47, 95% CI=1.33–5.95) more likely to have favorable attitudes towards the second vaccine dose against COVID-19 when compared to those who were not married. The study is consistent with a study conducted in China that being married made subjects more likely to have vaccine acceptance as compared to being single.\textsuperscript{20} However, as with a study conducted in the Democratic Republic of the Congo, marital status has no association towards the intention to receive second COVID-19 vaccine doses.\textsuperscript{43} When the risk degree was assessed, respondents with a high risk were 2-times more likely to have a good attitude towards second vaccine dose against COVID-19 (AOR=2.33, 95% CI=1.31–4.11). Another study conducted in Italy was consistent with the result.\textsuperscript{43}

Gender also associated with attitude towards the second COVID-19 vaccine doses. Accordingly, being male was 3-times (AOR=3.42, 95% CI=2.91–4.98) more likely to have a favorable attitude towards second COVID-19 vaccine doses. This result was inconsistent with a study conducted in Bangladesh and west India.\textsuperscript{17,21} Socio-demographic culture could be the possible explanations for this variation due to gender responsibility in Ethiopia and India.\textsuperscript{17} It has variation especially in the manner of marriage. It was consistent with other studies that being male in general had a significant association towards second COVID-19 vaccine doses.\textsuperscript{46,48,50}

**Conclusion**

The total knowledge score of study participants’ towards COVID-19 second vaccine doses was 64, whereas 87% for attitude. The study has found significant factors that affect healthcare providers’ knowledge and attitude towards second COVID-19 vaccine doses. The study found that profession, educational status, and age have a significant impact on health care professionals’ knowledge towards second COVID-19 vaccine doses. It is also suggested that other factors like marital status, work experience; age, educational status, profession; risk degree and gender were the determinant factor for attitude towards second COVID-19 vaccine dose in this study. Knowledge of healthcare providers’ towards second COVID-19 vaccine doses in the study setting is relatively low. This clearly implicate that the need to fill the knowledge gap in second COVID-19 vaccine doses among healthcare professionals which may help them to increase their knowledge to improve distribution of second COVID-19 vaccine doses for all targeted groups to reduce the transmission rate of the pandemic.

**Abbreviations**

CI, confidence interval; COR, crude odds ratio; AOR, adjusted odds ratio; MoH, Ministry of Health; WHO, World Health Organization.
Data Sharing Statement
The datasets generated and/or analyzed during the current study will be available upon request from the corresponding author.

Ethics Approval and Consent to Participate
The study protocol was reviewed and approved board of Mettu University and Informed consent was obtained from each study participant. The participants consent included publication of anonymous responses and this study was conducted in accordance with the Declaration of Helsinki.

Acknowledgments
The authors would like to thank Mettu University College of health sciences for the approval of ethical clearance.

Author Contributions
All authors contributed to data analysis, drafting or revising the article, have agreed on the journal to which the article will be submitted, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

Disclosure
The authors declare that they have no conflicts of interest in this work.

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