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Research article

# Prevalence and determinants to COVID-19 vaccine hesitancy among people living with HIV in Bench Sheko zone, Southwest Ethiopia: A multi-center study

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ABSTRACT

*Introduction:* In 2019, the World Health Organization (WHO) identified coronavirus disease-2019 (COVID-19) as one of the top 10 threats to global health. Currently, vaccine hesitancy is the most common obstacle to reducing COVID-19 incidence and achieving herd immunity worldwide. Understanding the factors influencing vaccine hesitancy in this specific population is crucial for developing targeted interventions to improve vaccine uptake and protect vulnerable communities. Therefore, this study aimed to evaluate the prevalence and determinants of COVID-19 vaccine hesitancy among people living with human immunodeficiency virus (HIV) who receive care at public health facilities in Bench Sheko Zone, Southwest Ethiopia.

*Methods:* A multi-center study was employed, involving multiple healthcare facilities within the Bench Sheko Zone from January 1 to 30 February 2023 to assess the prevalence and determinants of hesitancy to COVID-19 vaccination among people living with human deficiency virus (PLHIV). Data were collected by using pre-tested interviewer administered questionnaires and document review, and entered into Epi-data version 3.1 then exported to and analyzed by using SPSS version 24. Statistical significance was assessed by using multivariable logistic regression analysis by determining odds ratios and 95% confidence interval. Multi-Collinearity and model fitness were also checked.

*Results:* According to the study, the prevalence of COVID-19 vaccine hesitancy was found to be 47.9%, [95% CI, 43.8–52.0]. One significant finding was that younger individuals (age ≤25years) [AOR = 2.30, 95%CI, 1.15–4.57] exhibited a higher level of hesitancy compared to their older counterparts. Additionally, the study identified monthly income≤3000 birr [AOR = 0.57, 95%CI, 0.31–0.92], urban residence [AOR = 0.61, 95%CI, 0.42–0.91], HIV stage one [AOR = 0.44, 95% CI, 0.27–0.73] and human immunodeficiency virus (HIV) clinical stage two of HIV [AOR = 0.60, 95CI, 0.39–0.93] as determinants of vaccine hesitancy.

*Conclusion:* According to our study finding in southwest Ethiopia, individuals living with HIV were found to have a higher level of hesitancy towards receiving the COVID-19 vaccine as compared with center for disease control and prevention estimate of vaccine hesitancy. The study also identified several factors that contribute to vaccine hesitancy, including age, urban of residence, income level, and HIV clinical stage. Addressing the identified factors in this specific population could decrease the hesitancy. To ensure the success of vaccination campaigns in the

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region, policymakers and stakeholders should take steps to address these underlying factors and promote greater acceptance of the COVID-19 vaccine among the population.

## 1. Introduction

Coronavirus disease-2019 (COVID-19) was declared a global health emergency by the World health organization (WHO) in January 2020 and has since spread rapidly, causing millions of infections and hundreds of thousands of deaths worldwide [1,2]. Ethiopia is among the five African countries most affected by the pandemic [3]. Vaccines are crucial in controlling and eradicating diseases, with a recommended vaccination coverage of 80%–90% to curb the pandemic [4–6].

In Ethiopia the estimated human immunodeficiency virus (HIV) infected individuals was 603,537 and of them 570,511 were adult in Ethiopia with prevalence 0.92 and in Bench Sheko Zone 0.8 with incidence rate 0.1 and ART coverage was 84.5% [7]. It is worth noting that in Ethiopia, ART services are provided free of charge and treatment begins immediately after a positive HIV diagnosis [8]. According to WHO individuals living with HIV (PLHIV) face an elevated risk of developing severe illness and potentially succumbing to COVID-19 [9,10]. Regrettably, vaccination coverage among PLHIV has significantly decreased [10,11]. PLHIV are more vulnerable to COVID-19 and are at a higher risk of experiencing severe outcomes. Studies in different countries have shown that PLHIV have twice the mortality risk compared to those without HIV. In addition to the direct health impacts, the COVID-19 pandemic has also had other negative consequences for PLHIV [12–15].

Vaccine hesitancy is a major problem globally, ranging from delaying acceptance to outright refusal of vaccination. It's a top 10 threat to global health, and COVID-19 vaccine hesitancy is complicated by vaccine development, misinformation, and politics [4,6,16,17]. Vaccine hesitancy can lead to lower vaccination rates and decreased population immunity [4]. In Ethiopia, vaccine hesitancy remains a significant obstacle to achieving community-wide herd immunity [18].

Vaccine hesitancy rates vary across different countries and populations and it ranges from 7% to 77.9% [19]. In Italy, COVID-19 vaccine hesitancy is around 13.1% [20], while in the Arab world, it ranges from 5.4% to 83.0% [21]. A scoping review of 82 published articles, showing that vaccine hesitancy among the general population ranged from 10.0% to 57.8% [22]. Previously identified factors for COVID-19 vaccine hesitancy was younger age, female sex, holding negative attitudes towards COVID-19 and its preventive measures, receiving unreliable information from public health authorities, perceiving a low risk of infection, and expressing concerns about vaccine safety [21,23–28]. We have formulated the hypothesis that there are factors influencing vaccine hesitancy among people living with HIV, which serves as the alternative hypothesis for our study. Our study aims to investigate the factors that contribute to vaccine hesitancy among people living with HIV (PLHIV) in the South West region of Ethiopia. Previous research in this area has primarily used online surveys, which may not accurately capture the experiences of rural residents. To address this limitation, we conducted face-to-face interviews with PLHIV living in remote areas. Additionally, existing research on vaccine hesitancy in Ethiopia has not specifically focused on PLHIV, which is a gap we aim to fill. By including health centers in remote areas as part of our research, we hope to gain a better understanding of COVID-19 vaccine hesitancy among PLHIV in this region. Therefore, our objective is to evaluate COVID-19 vaccine hesitancy and its contributing factors among PLHIV in the South West region of Ethiopia.

## 2. Methods

### 2.1. Study design and setting

A Facility based cross sectional study was conducted in Bench Sheko Zone from January 1 to 30 February 2023 among adult people living with HIV. In the Bench Shako zone, there are 1 Teaching Hospital, 26 HCs, 9 medium clinics, 122 primary clinics, 35 drug stores, 128 health posts, and 5 rural drug stores. Of the 26 health centers found in the Bench Shako zone, 25 were governmental and the remaining 1 was non-governmental. Among the above health facilities, 8 of them are HIV/AIDS treatment centers. People living with HIV in ART service provided health facilities were included in the study. The study was conducted in four health facilities such as Mizan Tepi university teaching hospital, Mizan health center, Sheko health center and Kite health center. For this specific study people living with HIV age greater than or equal to 18 year were included.

Cross-sectional research provides a valuable advantage by employing cross-case analysis. Through conducting a cross-sectional study, researchers seek to describe broad relationships between different elements and conditions. This type of study focuses on examining multiple instances and cases, facilitating the development of general models that connect various elements with one another under specific circumstances. The findings derived from cross-sectional studies enable the testing and potential refutation of theories related to these relationships [29]. A cross-sectional study is a type of observational study that is both simple and cost-effective. In this study design, both the exposure and the outcome are determined simultaneously for each participant. Cross-sectional studies can be either descriptive or analytical, depending on whether the researchers assess potential associations between outcomes and risk factors or exposures. The data on outcomes and exposures are collected at the same time, allowing for a comprehensive analysis [30].

## 3. Study participants

### 3.1. Source population

All peoples living with HIV age 18 and above were the source population.

### 3.2. Study population

The study included a sample of individuals aged 18 and above living with HIV in the Bench Sheko Zone. The selection process was carried out randomly, using each individual's Unique Antiretroviral Therapy (ART) number. Initially, the UAR numbers of all participants were obtained from the smart care system of each facility's health information management system. Subsequently, the authors selected the study participants through a lottery method based on their UAR numbers.

### 3.3. Inclusion criteria

All peoples living with HIV and age≥18 and lived in Bench Sheko Zone for 6 months in the selected health facility were included under the study**.** All adult PLHIV on active treatment were included in the study.

### 3.4. Exclusion criteria

Severely ill, and deaf PLHIV were excluded from the study.

### 3.5. Sample size determination and procedure

Sample size was calculated by using single population formula with 95% confidence level, 4% margin of error and prevalence of vaccine hesitancy in among ART users in Weldia Comprehensive hospital33.7% [31].

Sample size was calculated using the formula:

$$n = \left(Z_{1-\alpha/2}\right)^2 * P\,(1-P) = (1.96)^2 0.337(1-0.337) = 536$$

$$d^2\ (0.04)^2$$

Where n = sample size.

Z = the standard normal value at 95% CI is 1.96.

P = prevalence of vaccine hesitancy P = 0.337.

D = margin of error = 0.04.

The initial sample size calculated for the study was 536, considering a 10% non-response rate. However, to account for potential non-response, the final sample size was increased to 590 PLHIV individuals. Out of the total eight ART provided health facilities, four were randomly selected. After selecting the HIV treatment health facilities, the total sample size was proportionally allocated based on the size of each selected facility (supplementary file 1). To select the participants, a systematic random sampling method was employed. The authors enrolled respondents at each health facility while they were waiting to be seen by healthcare providers. On a daily basis, approximately 40 PLHIV individuals receive care and treatment follow-up services at the health facility. To conduct the sampling process, simple random sampling was used, and random numbers were assigned to potential study participants in the waiting area of the health center on each data collection day.

### 3.6. Data collection and its process

Structured questionnaires were created by adapting various literature sources [6,19–21,23,27,31–38]. Prior to distributing the questionnaires to the data collectors, a meticulous examination was conducted to ensure that the questionnaires were accurate and complete. Additionally, a comprehensive review was carried out to identify any missing information before distributing the questionnaires. The data collectors were given a detailed briefing on the questionnaires before starting the data collection process. The responsibility of collecting the data was assigned to five BSc nurse data collectors who were supervised by two BSc public health professionals. The data collectors briefly explained the objective of the study and the expected benefits to each study participant. They also explained how much time was needed to complete the interview and assured the participants that there was no harm from the study. The supervisors and principal investigator took great care in auditing, coding, and organizing the collected questionnaires on a daily basis. The data collection process involved conducting interviews with clients after they received healthcare services, as well as reviewing relevant documents. Trained data collectors performed face-to-face exit interviews with randomly selected study participants. Specific variables, such as the client's last viral load result, weight, height, and World Health Organization clinical stage at the last visit, were extracted from follow-up charts.

The data collectors were well-acquainted with the data collection tools and arrived ahead of schedule. The tools used for data collection were to accommodate the local language, Amharic. The data collection process was short and it took approximately 20–30

min. The objectives and benefits of the study were clearly communicated to the participants. As authors, we defined a specific population for the study and calculated the maximum sample size required. In cases where study participants were absent on the first day, we made repeated attempts to interview them.

### 3.7. Survey questionnaires

The questionnaire for this study was developed by referring to previous literature and following the guidelines provided by the World Health Organization. Structured questionnaires were created by adapting various literature sources [6,19–21,23,27,31–38]. Initially, it was prepared in English and then translated into the local language, Amharic, ensuring consistency throughout the process. To maintain consistency, the translated questionnaire was retranslated back into English by the same translator. The questionnaire consisted of four sections, covering various aspects such as sociodemographic information, knowledge about vaccines, attitudes towards COVID-19 infection and vaccine acceptance.

## 4. Variables

### 4.1. Dependent variable

COVID-19 vaccine hesitancy: COVID-19 vaccine hesitancy among PLHIV, a delay in the acceptance or refusal of vaccination despite the availability of vaccination services. In this study, we assessed COVID-19 vaccine hesitancy by asking a question, ‘‘Do you have an intention to be vaccinated against COVID-19 infection, if the COVID-19 vaccine is available right now?’’. Those study participants who answered ‘Yes’ are coded as COVID-19 vaccine acceptance and those students who answered ‘No’ are coded as COVID-19 vaccine hesitancy [4,27].

### 4.2. Independent variables

Age, Sex, Religion, Marital status, Educational status, Occupation, Monthly income, Use of public media, Chronic illness, Residence, TB co-infection, Past HIV related hospitalization, Ever tested for COVID-19, Family member ever tested for COVID-19, previously suffered from COVID-19,having HIV infected kids, body mass index. Residence, literacy, and community level educational status were independent variables incorporated in the analysis.

### 4.3. Data management and analysis

Auditing, coding and sorting of the collected questionnaire was done manually every day to check for completeness. After checking the completeness of the data, the data were entered by Epi-data manager version 3.1 and then exported to SPSS version 24 statistical package for analysis. Descriptive analysis was done for both dependent and independent variables and presented in terms of frequency, mean, percentage and text. A bivariate analysis was conducted using analysis of variance (ANOVA) and chi-square tests to assess statistical significance. Variables that yielded a p-value of 0.25 or lower in both ANOVA and chi-square tests were considered eligible for inclusion in the multivariable logistic regression analysis. Finally, multivariable binary logistic regression analysis was performed to control the possible confounding effect of the selected variables and variables with the P-value $<0.05$ were taken as statistically significant association with COVID-19 vaccine hesitancy. Backward elimination method was used to run multivariable logistic regression analysis. Model fitness was checked by using Hosmer and Lemeshow goodness of fit test ($x^2 = 1.727$, p-value $= 0.988$). Statistical significance between dependent and independent variables were assessed by odds ratios and 95% confidence intervals.

### 4.4. Data quality management

The questionnaire was first prepared in English and then translated to Amharic and retranslated back to English by other person to ensure its consistency and accuracy. Pre-test was carried out on 5% of the sample size which was 30 PLHIV for one day. After conducting pre-test some correction of tool was done. Training was given for one day for both data collectors and supervisors. The supervisors supervise the performance of the data collectors on daily basis. The collected data were checked for completeness, consistency and clarity by principal investigator and trained supervisors. We adhere to and follow the guidelines set forth by the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) initiative. This initiative has developed recommendations on the essential components that should be included in a comprehensive and accurate report of an observational study [39]. We calculated the internal reliability of the questionnaire, which fell within an acceptable range. Cronbach’s α coefficient were computed to test internal consistency of the tool and it was 0.747. To ensure the validated data, a collaborative effort was made by two health information management experts, along with two epidemiologists and communicable disease specialists by conducted panel discussion on the tools. Their expertise was utilized to identify and address any noisy or abnormal values, errors, duplicates, and meaningless questionnaires. The experts also assess the contents of each subtitled questionnaire. After discussion, minor errors and rearrangements were corrected accordingly. The final version of the tool were used for data collection of the study.

### 4.5. Study participant selection

The Bench Sheko Zone has a total of 4253 individuals who are living with the human immunodeficiency virus (PLHIV). Out of these, 1459 individuals who were either fully or partially vaccinated were excluded from the study. A detailed CONSORT diagram, which provides a visual representation of the study's design and participant flow, is presented in Fig. 1. The diagram helps to illustrate the number of participants who were included and excluded at each stage of the study, as well as the reasons for their exclusion. The final study participants were selected from 2215 randomly by using their unique antiretroviral treatment number of the individuals. The schematic presentation of this study was presented in supplementary file 1. From the total 2215 eligible study participant's 590 people living with HIV were selected systematically by systematic random sampling method. There was no responses were excluded in this study, while there were 18(3.05% of sample size) non-response in this study which never give consent for the study.

### 4.6. Ethics approval and consent to participate

A permission letter was obtained from the Mizan Tepi University, college Medicine and health science, and permission was obtained from each health facility to conduct the study. Verbal consent was obtained from each study participants. The respondents' right to refuse or withdraw from participating in the interview at any time was fully respected. At the same time, the information provided by each respondent was kept confidential by making each questionnaire coded and not sharing the personal information of any patient to third party.

### 4.7. Operational definition

#### 4.7.1. Hesitancy to COVID-19 vaccination

was defined as when an individual has a delay in acceptance, reluctance, or refusal of vaccination despite the availability of vaccination services [40].

#### 4.7.2. Knowledge of the COVID-19 vaccine

Participants were requested to provide a comprehensive list of preventive measures and control strategies for COVID-19. Those

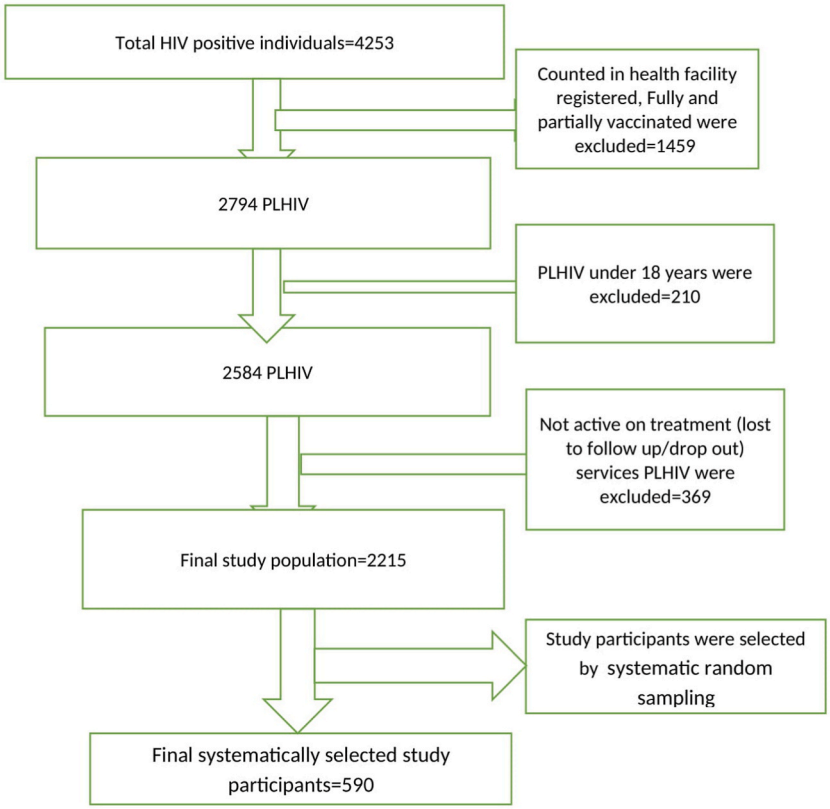


**Fig. 1.** CONSORT diagram of the study participant selection on study conducted in Bench Sheko Zone, Southwest Ethiopia, 2023
PLHIV= People living with Human immunodeficiency virus, HIV=Human immunodeficiency virus, CONSORT= Consolidated Standards of Reporting Trials.

who included the "COVID-19 vaccine" as one of the methods were considered to possess knowledge on the subject. Conversely, individuals who did not mention any specific method for preventing and controlling COVID-19 were categorized as lacking knowledge in this area [34].

#### 4.7.3. Media exposure

A study participant said to be media exposed if they listen/read on COVID-19 vaccine at least one media in the week (Radio or TV or Newspapers).

#### 4.7.4. Community level education

Based on the ratio of educated individuals, which includes those who have completed primary, secondary, and higher education, communities were classified into two categories: low and high educational attainment. The low category refers to communities where less than 50% of individuals have received any formal education, while the high category includes communities where 50% or more of the population has achieved educational milestones.

#### 4.7.5. TB co-infection

Any types of TB diagnosed and on treatment was categorized as TB co-infection in this study.

**Table 1**
Characteristics of the study participants in the study conducted in Bench Sheko Zone, Southwest Ethiopia, 2023.

| Variables | Category | Frequencies | Percentage |
|---|---|---|---|
| Age | ≤25 years | 62 | 10.8 |
| Mean = 34.64 | 26–35 years | 237 | 41.4 |
| SD = 6.71 | 36–45 years | 244 | 42.7 |
| | ≥46 years | 29 | 5.1 |
| Sex | Male | 211 | 36.9 |
| | Female | 361 | 63.1 |
| Marital status | In marital union | 416 | 72.7 |
| | Not in marital union | 156 | 27.3 |
| Religion | Orthodox | 276 | 48.3 |
| | Protestant | 168 | 28.7 |
| | Muslim | 110 | 19.2 |
| | Others | 22 | 3.8 |
| Ethnicity | Bench | 218 | 38.1 |
| | Amhara | 167 | 29.2 |
| | Keficho | 82 | 14.3 |
| | Others | 105 | 18.4 |
| Educational status | No formal education | 397 | 69.4 |
| | Primary education | 92 | 16.1 |
| | Secondary education | 52 | 9.1 |
| | Tertiary and above | 31 | 5.4 |
| Residence | Rural | 449 | 78.5 |
| | Urban | 123 | 21.5 |
| Occupation | Employed | 108 | 18.9 |
| | Farmer | 114 | 19.9 |
| | Unemployed | 350 | 61.2 |
| Monthly income | ≤3000Eth Birr | 197 | 34.4 |
| | 3001-5000 Eth Birr | 96 | 16.8 |
| | 5001-7000Eth Birr | 223 | 39.0 |
| | ≥7001 Eth birr | 56 | 9.8 |
| Religion | Orthodox | 276 | 48.3 |
| | Protestant | 164 | 28.7 |
| | Muslim | 110 | 19.2 |
| | Others | 22 | 3.2 |
| Medial exposure | Yes | 236 | 41.3 |
| | No | 336 | 58.7 |
| Community level literacy | Above median | 143 | 25.0 |
| | Below median | 429 | 75.0 |
| Community level education | Above median | 380 | 66.4 |
| | Below median | 192 | 33.6 |
| Continuous medical education | Yes | 229 | 40.0 |
| | No | 343 | 60.0 |
| Distance from health facility | ≤2 KM | 185 | 32.3 |
| | ≥2 KM | 387 | 67.7 |
| Body mass index | <18.5 | 327 | 57.2 |
| | 18.5–24.5 | 142 | 24.8 |
| | >24.5 | 103 | 18.0 |

KM=Kilometers, SD=Standard deviation, others = catholic, traditional.

#### 4.7.6. Viral load

Plasma viral load suppression is defined as having a viral load of less than 1000 copies/ml, indicating that the virus is effectively controlled (Suppressed). On the other hand, a plasma viral load exceeding 1000 copies/ml is considered unsuppressed.

## 5. Results

### 5.1. Characteristics of the participants

According to the study, a large percentage of participants, specifically 96.95%, responded to the survey. The average age of those who participated was 34.64 years old, with a standard deviation of ±6.71. The majority of participants, approximately 72.7%, were married or in a marital union. In terms of educational attainment, 69.4% of the participants did not have any formal education. Furthermore, the study found that the majority of participants, around 78.5%, resided in rural areas. Interestingly, 58.7% of the participants had not been exposed to any media, such as radio, television, or newspapers, regarding the COVID-19 vaccine, as shown in Table 1.

**Table 2**
Health related characteristics of the study participants in Bench Sheko Zone, Southwest Ethiopia, 2023.

| Variables | Category | Frequencies | Percentage |
|---|---|---|---|
| Knowledge on COVID-19 vaccine | Good | 335 | 58.6 |
| | Poor | 237 | 41.4 |
| Knowledge on COVID-19 risk factors | Good | 367 | 64.2 |
| | Poor | 205 | 35.8 |
| WHO clinical stage | Stage 1 | 107 | 18.7 |
| | Stage 2 | 178 | 31.1 |
| | Stage 3 | 127 | 22.2 |
| | Stage 4 | 160 | 28.0 |
| Last Viral load | Suppressed | 313 | 54.7 |
| | Unsuppressed | 259 | 45.3 |
| Perceived barrier | High | 252 | 44.1 |
| | Low | 320 | 55.9 |
| TB-Coinfection | Yes | 97 | 17.0 |
| | No | 475 | 83.0 |
| Additional chronic illness | Yes | 84 | 14.7 |
| | No | 488 | 85.3 |
| Family or friend contracting COVID-19 | Yes | 176 | 30.8 |
| | No | 396 | 69.2 |
| Ever tested COVID-19 | Yes | 340 | 59.4 |
| | No | 232 | 40.6 |
| Having HIV infected Kids | Yes | 303 | 53.0 |
| | No | 269 | 47.0 |
| Confidence on COVID-19 vaccine | Confident | 400 | 69.9 |
| | Not confident | 172 | 30.1 |
| Perceived overall health | Very good | 401 | 70.1 |
| | Good/fair | 171 | 29.9 |
| Past HIV related hospitality in last 6 months | Yes | 177 | 30.9 |
| | No | 395 | 69.1 |
| Perceived susceptibility | Low | 395 | 69.1 |
| | High | 177 | 30.9 |
| Perceived severity | Low | 379 | 66.3 |
| | High | 193 | 33.7 |
| Perceived benefits | Low | 297 | 51.9 |
| | High | 275 | 48.1 |
| Cue to action | Low | 289 | 50.5 |
| | High | 283 | 49.5 |
| Perceived barrier | Low | 320 | 55.9 |
| | High | 252 | 44.1 |
| Perceived self-efficacy | Low | 355 | 62.1 |
| | High | 217 | 37.9 |
| Complacency | Disagree | 391 | 68.4 |
| | Neutral | 159 | 27.8 |
| | Agree | 22 | 3.8 |
| Calculation | Disagree | 281 | 49.1 |
| | Neutral | 74 | 12.9 |
| | Agree | 217 | 37.9 |
| Collective responsibility | Not much | 190 | 33.2 |
| | Neutral | 329 | 57.5 |
| | Much | 53 | 9.3 |

COVID= Coronavirus disease, WHO=World health organization, HIV = human immunodeficiency virus, TB = Tuberculosis.

### 5.2. Health related characters of the study participants

The study findings revealed that 58.6% of the participants had good knowledge about the COVID-19 vaccine. Out of the total 572 participants, 59.4% were tested for COVID-19 during the pandemic. In terms of confidence in the vaccine, 69.9% of the participants expressed confidence in its effectiveness. Additionally, more than half of the participants, specifically 55.9%, had a low perceived barrier for COVID-19 vaccination. When considering perceived overall health, 70.1% of the participants reported good perceived overall health, as shown in Table 2.

### 5.3. Magnitude of COVID-19 vaccine hesitancy

Vaccine hesitance in the current study was 47.9%, (95% CI; 43.8–52.0) of people living with HIV had hesitance to vaccinate during the vaccination time (Fig. 2).

### 5.4. Reasons for hesitancy towards the COVID-19 vaccine among the participants

According to the study, a significant number of participants, specifically 267 individuals, expressed hesitance towards receiving the COVID-19 vaccine. The primary reason behind this hesitance was identified as a lack of trust in the vaccine. It is worth noting that out of the total participants, 231 individuals cited religious grounds as their specific reason for not wanting to take the vaccine (Fig. 3). These findings shed light on the complex factors contributing to vaccine hesitancy, emphasizing the importance of addressing concerns and building trust to promote widespread vaccination.

### 5.5. Factors associated with hesitancy toward the COVID-19 vaccine among the participants

In a bivariable logistic regression analysis, sixteen variables were identified as eligible for multivariable logistic regression. However, during the final model, only five variables were found to be significantly associated with COVID-19 vaccine hesitancy. Among these variables, it was observed that people living with HIV in younger age groups (age ≤25years) [AOR = 2.30, 95%CI, 1.15–4.57] were more likely to hesitate getting vaccinated against COVID-19 than those in older age groups. Furthermore, individuals living with HIV in urban areas [AOR = 0.61, 95%CI, 0.42–0.91] had a 39% lower likelihood (P-value = 0.006) of vaccine hesitancy compared to those living in rural areas. Additionally, monthly income (monthly income≤3000 birr) [AOR = 0.57, 95%CI, 0.31–0.92] was found to be a significant determinant of COVID-19 vaccine hesitancy in Southwest Ethiopia. The study showed that participants earning less than or equal to 3000 Ethiopian birr were 43% less likely to hesitate in getting vaccinated. Lastly, the WHO clinical stage was identified as another determinant of COVID-19 vaccine hesitancy. Specifically, people living with HIV in the first [AOR = 0.44, 95%CI, 0.27–0.73] and second clinical stages [AOR = 0.60, 95%CI, 0.39–0.93] 56% and 40% less likely to hesitate in getting vaccinated as compared to those in advanced HIV stages respectively. In Addition PLHIV living in urban area were 49% less likely experienced COVID-19 vaccine hesitancy as compared with PLHIV in rural area[AOR = 0.61, 95% CI, 0.42–0.91] (as shown in Table 3).

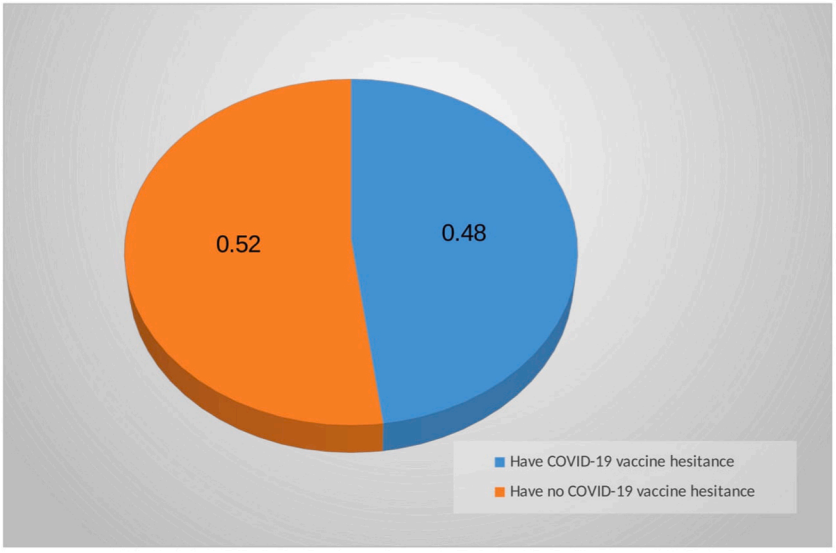


**Fig. 2.** COVID-19 vaccine hesitance among people living with HIV in bench Sheko Zone, Southwest Ethiopia, 2023
COVID-19 = Coronavirus disease-2019.

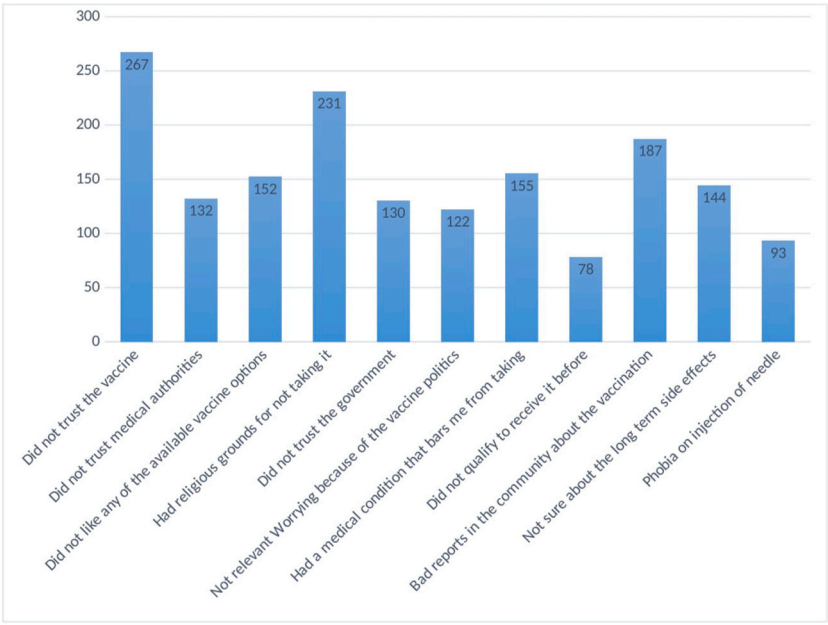


**Fig. 3.** Reasons of study participants hesitate to COVID-19 vaccine in Bench Sheko Zone, Southwest Ethiopia, 2023
COVID-19 = Coronavirus disease-2019
NB: the total number greater than the sample size due to multiple response of the questions.

## 6. Discussion

Since the declaration of the global pandemic, various efforts have been made to control its spread. One significant aspect of these efforts has been the development and distribution of vaccines, including to Ethiopia through the COVAX worldwide program [41–43]. However, vaccine hesitancy has emerged as a global health threat, which was recognized early on by the World Health Organization [44]. In light of this, a study was conducted in southwest Ethiopia to assess the prevalence and determinants of COVID-19 vaccine hesitancy among people living with HIV (PLHIV). The primary objective of the study was to determine the prevalence of vaccine hesitancy among PLHIV. The findings revealed that among PLHIV in southwest Ethiopia, the prevalence of COVID-19 vaccine hesitancy was 47.9%, 95%CI (43.8–52.0). This figure aligns closely with similar studies conducted in the Amhara regional state (45.9%) [37], South Gonder Zone (46.02%) [35], Wolaita Zone southern nation nationality peoples regional state(54.5%) [18], Kuwait (47.9%) [45] and Nigeria(53.8%) [46]. The similarity in findings can be attributed to comparable background characteristics of the study participants. For example, in South Gonder, more than half of the participants had not received formal education, which is consistent with the current study. Similarly, the study conducted in Nigeria had a study population that closely resembled the participants in the current research. Overall, these findings highlight the significant prevalence of COVID-19 vaccine hesitancy among PLHIV in southwest Ethiopia and underscore the importance of addressing the underlying determinants of vaccine hesitancy in this population.

According to various studies, the prevalence of COVID-19 vaccine hesitancy varies significantly. For instance, the prevalence was found to be higher among medical students at Mizan Tepi University Teaching Hospital (40.7%) [23], students at Wolkite University (41.2%) [27], and individuals in Urban Addis Ababa (37%) [26] and Egypt (41.9%) [47]. The possible justification could due to students and urban residence individuals were easily access the information on the importance of vaccination and high probability of getting arguments on the misinformation. This implies that information and awareness could be the powerful tool for the improvement of vaccine acceptance.

On the other hand, the prevalence was relatively much higher among individuals in Saudi Arabia (6%) [48], rural Ibadan (23%) [33], rural Nouna (31%) [33], and India (38%) [49]. This variation can be attributed to the differences in the study background characteristics of each specific study. For instance, the study conducted among medical students at Mizan Tepi University Teaching Hospital could have yielded better knowledge on the benefits of COVID-19 vaccination. Similarly, the study conducted among university students in Egypt could have been more informed about the benefits of vaccination compared to the general community. This highlights the importance of awareness and access to information in reducing vaccine hesitancy. Notably, the study conducted at Woldia Comprehensive Hospital found that 66.7% [31] of the participants had good knowledge on COVID-19 vaccination. Our finding lower in the study conducted in Debre tabor Comprehensive specialized hospital(57.7%) [36], Addis Ababa health worker(60.3%) [50], overall in Ethiopia(64.4%) [34], Nigeria(57.72%) [51], Democratic republic Congo(72.3%) [52], and Portugal(59%) [53].This variation in vaccination rates could be attributed to differences in the study population and the area of the study. For example, in the study conducted on people living with HIV, they may have had more frequent contact with healthcare providers who could have

**Table 3**
Factors associated with COVID-19 vaccine hesitancy among people living with HIV in Bench Sheko Zone, Southwest Ethiopia, 2023.

| Variables | Category | Binary logistic | p-value | Multivariable logistic | P-value |
|---|---|---|---|---|---|
| Age | ≤25 years | 0.55(0.23,1.34) | **0.190** | 2.30(1.15,4.57) | **0.02** |
| | 26–35 years | 1.21(0.56,2.63) | 0.622 | 1.01(0.59,1.73) | 0.95 |
| | 36–45 years | 0.99(0.46,2.15) | 0.993 | 1.24(0.75,2.06) | 0.41 |
| | ≥46 years | 1 | 1 | 1 | 1 |
| Educational status | No formal education | 1.93(0.91,4.08) | **0.086** | 0.84(0.41,1.73) | 0.63 |
| | Primary education | 1.52(0.66,3.48) | 0.326 | 0.90(0.40,2.05) | 0.80 |
| | Secondary education | 1.26(0.51,3.11) | 0.622 | 1.04(0.42,2.58) | 0.93 |
| | Tertiary and above | 1 | 1 | 1 | 1 |
| Residence | Rural | 1 | 1 | 1 | |
| | Urban | 0.75(0.5,1.11) | **0.150** | 0.61(0.42,0.91) | **0.006** |
| Occupation | Employed | 1 | 1 | 1 | 1 |
| | Farmer | 0.67(0.39,1.13) | 0.325 | 1.14(0.72,1.78) | 0.57 |
| | Unemployed | 0.80(0.52,1.24) | **0.135** | 1.33(0.76,2.33) | 0.31 |
| Monthly income | ≤3000Eth Birr | 2.12(1.16,3.89) | **0.015** | 0.57(0.31,0.92) | **0.04** |
| | 3001-5000 Eth Birr | 1.31(0.67,2.55) | 0.433 | 0.84(0.42,1.67) | 0.62 |
| | 5001-7000Eth Birr | 1.74(0.96,3.16) | **0.070** | 0.64(0.36,1.12) | 0.14 |
| | ≥7001 Eth birr | 1 | 1 | 1 | 1 |
| Community level educational status | Above the median | 1.21(0.85,1.71) | **0.151** | 0.81(0.57,1.15) | 0.24 |
| | Below the median | 1 | 1 | 1 | 1 |
| WHO clinical stage | Stage 1 | 2.13(0.52,1.24) | **0.003** | 0.44(0.27,0.73) | **0.001** |
| | Stage 2 | 1.57(1.0,2.41) | **0.041** | 0.60(0.39,0.93) | **0.02** |
| | Stage 3 | 1.03(0.64,1.64) | 0.910 | 0.93(0.58,1.49) | 0.75 |
| | Stage 4 | 1 | 1 | 1 | 1 |
| Past HIV related hospitality in last 6 months | Yes | 1.24(0.92,1.27) | **0.154** | 0.83(0.57,1.20) | 0.32 |
| | No | 1 | 1 | 1 | 1 |
| Perceived susceptibility | Low | 1.12(0.92,1.37) | **0.187** | 0.98(0.67,1.42) | 0.91 |
| | High | 1 | 1 | 1 | 1 |
| Perceived severity | Low | 1.05(0.86,1.28) | **0.19** | 1.28(0.89,1.84) | 0.18 |
| | High | 1 | 1 | 1 | |
| Perceived benefits | Low | 1.08(0.85,1.35) | **0.18** | 1.01(0.78,1.26) | 0.56 |
| | High | 1 | 1 | 1 | 1 |
| Cue to action | Low | 1.16(0.92,1.46) | **0.124** | 0.98(0.69,1.38) | 0.90 |
| | High | 1 | 1 | 1 | |
| Perceived self-efficacy | Low | 1.19(0.97,1.47) | **0.165** | 0.80(0.57,1.15) | 0.24 |
| | High | 1 | 1 | 1 | 1 |
| Perceived barrier | Low | 1.16(0.93,1.45) | **0.19** | 0.94(0.66,1.34) | 0.74 |
| | High | 1 | 1 | 1 | |
| Complacency | Disagree | 1.01(0.83,1.24) | 0.228 | 1.13(0.57,2.23) | 0.72 |
| | Neutral | 1.34(0.98,1.83) | **0.127** | 0.84(0.40,1.74) | 0.64 |
| | Agree | 1 | 1 | 1 | 1 |
| Collective responsibility | Not much | 1.68(1.25,2.25) | **0.044** | 0.67(0.40,1.14) | 0.14 |
| | Neutral | 0.88(0.71,1.09) | 0.961 | 1.34(0.80,2.22) | 0.26 |
| | Much | 1 | 1 | 1 | |

WHO=World health organization, HIV=Human immunodeficiency virus.

provided counseling on COVID-19 vaccination. Furthermore, during the vaccination campaign, priority was given to chronic care patients, and extensive mass advocacy efforts were undertaken at the national level. This implies continuous counseling and providing the information for targeted population may improve the vaccine acceptance of the individuals.

In our recent study conducted in southwest Ethiopia, we aimed to identify the determinants of COVID-19 vaccine hesitancy among people living with HIV. The findings revealed that age, residence, monthly income, and WHO clinical stage were identified as significant factors influencing vaccine hesitancy in this population. Age was found to play a role, suggesting that different age groups may have varying levels of vaccine hesitancy. In the current study younger age (age ≤ 25years) were 2.3 times more likely to hesitate for vaccination as compared to older age group. This finding comparable with the study finding in study conducted Wolkite [27],in study conducted in Mizan Tepi university teaching hospital medical students [23], study conducted in Addis Ababa [26] and Portugal [53]. This could be due to your age individuals may expose to misinformation on COVID-19 vaccine. The possible justification might be those students who were found ≤23 years old might consider themselves as healthy, young, and have immunity that could protect them from severe COVID-19 complications.

According to recent research, individuals living with HIV who reside in urban areas are 39% less likely to be hesitant about receiving the COVID-19 vaccine compared to those living in rural areas. This finding is consistent with similar studies conducted in Bangladesh [54] and among Wolkite medical students [27]. It is possible that those living in rural areas may not have access to current information about the safety and efficacy of the COVID-19 vaccine, leading to increased hesitancy compared to their urban counterparts. Additionally, monthly income was identified as a determinant, indicating that individuals with lower incomes may be more hesitant to receive the COVID-19 vaccine. The lower economic class individuals were less likely hesitate for COVID-19 vaccination as compared with higher income level individuals. This finding consistent with similar study conducted in Germany [55], in sub-saharan

Africa [33] and Southeast Asia [38].The possible justification for this finding is lower income individuals could access unpaid health services than higher income individuals.

Moreover, the research revealed a significant correlation between the WHO clinical stage of HIV and vaccine hesitancy. Specifically, individuals in the first and second stages of HIV were 56% and 40% less likely to exhibit COVID-19 vaccine hesitancy compared to those in the advanced stage of HIV according to the WHO classification. This discrepancy can potentially be explained by the fact that individuals in the advanced stage of HIV tend to perceive their overall health as being poorer. Consequently, individuals at different stages of HIV infection may possess varying levels of concern or uncertainty towards the COVID-19 vaccine. These findings underscore the importance of considering these factors when developing targeted interventions and communication strategies to address vaccine hesitancy among individuals living with HIV in southwest Ethiopia.

### *6.1. Strength and limitation of the study*

The study focused on individuals who are HIV-positive, marginalized, and have not been targeted by vaccination programs. It aimed to examine various factors that contribute to vaccine hesitancy among this specific population, making it highly relevant for designing effective interventions. By including both health centers and hospitals in the study, researchers were able to identify a wider range of determinants of vaccine hesitancy. The random selection of participants ensured that the findings could be applied to a broader population of people living with HIV. Moreover, the study participants were recruited from health centers and hospitals that catered to all clients receiving antiretroviral therapy, further enhancing the study's generalizability. The researchers also calculated the appropriate sample size, which was randomly assigned to different health facilities, ensuring that the findings could be generalized to the overall population of people living with HIV. However, it is important to note that the study had limitations as it did not cover the 3C component of vaccine hesitancy.

However, one limitation of the study is its cross-sectional nature, which does not establish a cause-effect relationship between the identified determinants. Another limitation is the lack of assessment of non-behavioral factors like CD4 count, community support, and stigma and discrimination among the study participants, which hinders a comprehensive understanding of the influencing factors. Lastly, the study did not assess PLHIV lost from care and treatment services, which could have resulted in different outcomes if included.

## 7. Conclusion

Despite the limitations, this study shed light on the COVID-19 vaccine hesitancy among participants living with HIV. It has been observed that there is a high level of COVID-19 vaccine hesitancy among people living with HIV as compared CDC estimate of hesitancy [56]. Younger individuals (age $\leq$25years), monthly income$\leq$3000 birr, urban residence, HIV stage one and HIV clinical stage two were the factors identified in this study.

Program designers and policymakers should prioritize addressing both vaccine-related and sociocultural issues faced by individuals living with HIV (PLHIV). This is crucial to ensure the success of vaccine campaigns. To effectively tackle vaccine hesitancy in the study area, policymakers and stakeholders could focus on identifying and addressing the specific factors contributing to hesitancy. One effective approach is to tailor interventions to target these identified factors, using positive messaging delivered by influential leaders. Public health interventions should address the reasons for hesitancy, alleviate concerns about safety and side effects, and emphasize the importance of vaccinations for this particular population. By adopting these strategies, we can effectively control the pandemic, increase vaccine acceptance, and reduce vaccine hesitancy.

## Ethical statement

The study received ethical clearance from the Institutional Review Board of Mizan Tepi University, College of Health Science. A support letter was also obtained from the Department of Public Health. The study was conducted in compliance with the Declaration of Helsinki. Necessary permission was obtained from the Bench Sheko Zone Health Department. To ensure anonymity, participants' names and personal information were not recorded, and no third party will have access to this information. Informed verbal consent was obtained from each study participant.

## Consent for publication

Not applicable.

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## Data availability statement

The data analyzed in their study is available upon reasonable request from the corresponding author.

## CRediT authorship contribution statement

**Melsew Setegn Alie:** Writing – review & editing, Writing – original draft, Validation, Supervision, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Gossa Fetene Abebe:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation. **Yilkal Negesse:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation. **Simegnew Gichew:** Writing – review & editing, Writing – original draft, Software, Formal analysis, Data curation, Conceptualization.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e27901.

## Acronyms/Abbreviations

| Acronyms/abbreviations | Full descriptions |
|---|---|
| ANOVA | Analysis of variance |
| ART | Antiretroviral treatments |
| CONSORT | Consolidated Standards of Reporting Trials |
| COVID-19 | Coronavirus disease 2019 |
| COVAX | COVID-19 Vaccines Global Access |
| HIV/AIDS | human immunodeficiency virus/Acquired immunodeficiency syndrome |
| PLHIV | People living with Human immunodeficiency virus |
| SPSS | Statistical Package for the Social Sciences |
| STROBE | Strengthening the Reporting of Observational Studies in Epidemiology |
| TB | Tuberculosis |
| WHO | World Health Organization |

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