# HIV Sero-Status of Health Care Workers in Addis Ababa Public Hospitals After Post-Exposure Blood and Body Fluids: A Cross-Sectional Study, October 2022

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**ABSTRACT**

**OBJECTIVES:** The study investigated the sero-status of human immunodeficiency virus among healthcare workers in Addis Ababa public hospitals.

**METHODS:** A multi-centered, institutional-based cross-sectional study was conducted from September 18, 2022, to October 30, 2022. A simple random sampling method and semi-structured, self-administered questionnaires were used to collect the data, which were analyzed using statistical package for social science version 25. A binary logistic regression model was used to identify factors associated with the sero-status of healthcare workers' post-exposure blood and body fluids for the human immunodeficiency virus.

**RESULTS:** Of the 420 study participants who were exposed to blood and body fluids, 403 (96%) were non-reactive. Healthcare workers who had 20 to 29 years of work experience had approximately 6 times higher odds of testing positive for human immunodeficiency virus (AOR = 6.21, 95% CI: (2.39, 9.55). Healthcare workers who did not use personal protective equipment properly had 5 times higher odds of testing positive for human immunodeficiency virus (AOR = 5.02, CI: 3.73, 9.51).

**CONCLUSION:** This study showed that a higher proportion of healthcare workers at the emergency department were positive for human immunodeficiency virus infection among healthcare workers who were exposed to blood and body fluids and tested immediately. Healthcare workers who did not use personal protective equipment properly had higher odds of testing positive for human immune-deficiency virus.

**KEYWORDS:** Post exposure, blood and body fluids, emergency, HIV, Ethiopia

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## Introduction

In every clinical setting, healthcare professionals often face numerous occupational hazards, such as the human immunodeficiency virus (HIV), because they work at health facilities whose activities involve direct contact with their patients.[1] Healthcare workers (HCWs) are always in contact with their patients to provide immediate care. Because of the highest patient flow, nurses are overloaded, so they are at the highest risk of such exposure at emergency department.[2]

Recent research showed that exposure to HIV is mostly caused by sexual intercourse (62.6%), and developing countries account for more than 90% of these events.[3] However, exposure among HCWs in the health sector is sometimes caused by exposure to blood and body fluids (BBFs).[2] Every year, approximately 15 000 healthcare workers become infected with this preventable infection.[4,5]

The consequences of BBF exposure include not only the risk of HIV transmission, but also the transmission of various pathogens such as hepatitis B virus (HBV), hepatitis C virus (HCV), and other blood-borne pathogens that result in systemic and localized site infection.[6,7] Furthermore, significant anxiety and depression may occur following an event related to a fear of infection.[8,9]

In a study conducted in Iran among healthcare workers (HCWs), the highest rates of exposure were among nurses with less than 3 years of experience (74.6%) who were young and recently employed. Of those HCWs, 3% of them had gotten an infection from known HIV-positive patients, 13% were known hepatitis B serum antigen (HBs-Ag) positive, and 2% were HCV-positive patients.[10]

The frequency and annual rate of HIV prevalence among HCWs are higher in the emergency department. For instance, according to the research conducted by Mengistu et al and Yasin et al of the exposed HCWs, 22.3% were HIV positive.[2,9]

A systematic review and meta-analysis conducted in 2017 in 21 African countries showed that, of 65.5% of exposed HCWs, 25% were positive for human immunodeficiency virus.[11] Higher patient flow, a lower ratio of HCWs to patients, failure to implement standard precautions, inadequate supply of basic safety equipment, a lack of training, and inadequate supply of personal protective equipments (PPE) are factors that increase the burden.[11,12]

Currently, in Ethiopia, a lack of reports exists that quantify the pooled prevalence of HIV among healthcare workers (HCWs). Moreover, the epidemiology of HIV in Ethiopia has been on the rise and has been dynamically changing over the

past 2 decades, along with poor compliance with standard precautions among HCWs.[13-15]

## Methods

### *Study design and setting*

A multi-centered, institutional-based, cross-sectional study was conducted among HCWs in public hospitals in Addis Ababa city from September 18, 2022, to October 30, 2022. Addis Ababa is the capital city of Ethiopia, which is located in the central part of the country. Additionally, it is the seat of the African Union and the United Nations' World Economic Commission for Africa. In Addis Ababa city, there are more than 53 hospitals, of which 13 are public hospitals and more than 40 are private hospitals.[16-18] The study population contained all nurses who were working in 5 randomly selected public hospitals in Addis Ababa city.

### *Sample size, sampling procedure, and technique*

The actual sample size for the study was determined using a single population proportion formula $\{n = [(z\alpha/2)^2 p(1-p)]/d^2\}$, n = sample size, $z\alpha/2$ = 95% confidence level, P = the proportion of HIV-positive HCWs among post exposure to BBFs in the previous study (48.2%),[19] $d$ = margin of error (0.05). By considering 10% of non-response rate, the final sample size of the study was 422. To determine the representativeness of the sample, by using the lottery method, the principal investigators were randomly selected from two-thirds of the total hospitals (3 from 5). The sample size for each hospital was proportionally allocated based on the number of HCWs in each hospital. Individuals who fulfilled the inclusion criteria were selected using systematic random sampling at 2 intervals from their list. Their lists were obtained from the office of the chief clinical director of each hospital. Then, consent was obtained from each study participant.

### *Inclusion criteria*

All nurses who were exposed to BBFs in the current 12 months of their professional lives and tested positive for HIV after exposure using a rapid diagnostic test (HIV serum-antibody test kit) were included.

### *Exclusion criteria*

Nurses who did not know their HIV sero-status, meaning they had not been exposed or tested after exposure in the previous 12 months, were excluded.

### *Data collection tools*

The English version of the self-administered questionnaire was used to collect the data. The tools were divided into 2 sections: participant sociodemographic information and HIV sero-status data from a modified version of the study conducted in Cape Town, South Africa.[20] The supervisors were given the questioner for each study participant. Then, the participants themselves fill out the questionnaire, as directed by the supervisors and the principal investigators.

### *Data quality control*

Training was provided to supervisors, and appropriate supervision was provided. A pre-test was conducted 2 weeks before the actual data collection using 5% of the sample size. The internal consistency of instruments in the pretest data (questioners) was confirmed (Cronbach's alpha = 0.86). Two professional experts (one from the English language and one from medicine) validated the tool. After the pretest, some explanations were modified and re-edited. The collected data were checked for completeness, and some unclear statements were corrected.

### *Patient and public involvement*

No patients were involved in this study.

### *Data processing and analysis*

Before analyzing the data, it was cleaned up and cross-checked. The data were entered into Epi Data version 4.6.0.4 and exported to SPSS (Statistical Packages for Social Science) version 26 for further analysis. A binary logistic regression model was used to estimate the associated factors of all independent variables with a $P$-value of $<.05$. The model fitness of the variable was tested using Hosmer's and Lemons' show test. All independent variables with a $P$-value of $<.05$ from a bivariate logistic regression analysis were considered for fitting into a multivariable logistic regression analysis to control for the possible effect of confounders. Descriptive statistics such as percentage, mean, median, and standard deviation were used. Tables, graph, and narrations were used for data presentation.

## Results

### *Sociodemographic characteristics of study participants*

Of the 420 HCWs who participated in the study, which had a response rate of 99.5%, most of the 236 HCWs (56%) were female. Two hundred fifty-five (62%) of the HCWs were between the ages of 20 and 29, with a mean age of 30.18 ± 4.37. Most study participants, 301 (72%), were nurses, and 278 (66%) had 1 to 9 years of work experience. More than half of the HCWs (246, or 58.5%) used personal protective equipment correctly (Table 1).

### *Human immune deficiency virus sero-status of healthcare workers*

Of the 420 study participants who were exposed to blood and body fluids in the current 12 months of their professional live, 403 (96%) were non-reactive (Figure 1).

**Table 1.** Sociodemographic characteristics of study participants, October 2022.

| VARIABLES | | NO (%), N – 420 |
|---|---|---|
| Sex | | |
| | Male | 185 (44) |
| | Female | 235 (56) |
| Age | | |
| | 20–29 | 255 (62) |
| | 30–39 | 130 (31) |
| | 40–49 | 35 (7) |
| Educational status | | |
| | Physician | 72 (17) |
| | Nurse | 301 (72) |
| | Midwifery | 47 (11) |
| Work experience | | |
| | 1-9 years | 278 (66 |
| | 10-19 years | 121 (29) |
| | 20-29 years | 21 (5) |
| Working institution | | |
| | Tikur Anbessa specialized hospital | 117 (28) |
| | St. Paulo's specialized hospital | 124 (30) |
| | Alert specialized hospital | 65 (15) |
| | Yekatit 12 hospital | 65 (15) |
| | Zewditu memorial hospital | 49 (12) |
| Proper use of personal protective equipments | Yes | 246 (58.5) |
| | No | 174 (41.5) |

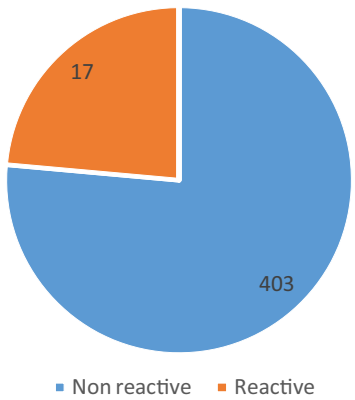


**Figure 1.** HIV sero-status of healthcare workers.

### *HIV sero-status of HCWs with their sociodemographic characteristics*

In a chi-square test analysis with a *P*-value of <.05, proper use of personal protective equipment, educational status, and work experience were significantly associated with post-exposure HIV sero-status of healthcare workers (Table 2).

### *Factors associated with post exposure HIV sero-status of healthcare workers*

The goodness of fit of the variable using the Hosmer and Lemeshow test displayed that the dependent variable was explained by the independent variables by 89.6%. In a binary logistic regression analysis with a *P*-value of <.05, proper use of personal protective equipment, educational status, and work experience were significantly associated with post-exposure HIV sero-status of healthcare workers. Healthcare workers who had 20 to 29 years of work experience had approximately 6 times higher odds of testing positive for HIV (AOR = 6.21, 95% CI: (2.39, 9.55). HCWs who were not using PPE properly had approximately 5 times more odds of being positive for HIV (AOR = 5.02, 95% CI: (3.73, 9.51). HCWs who were midwives had approximately 4 times higher

**Table 2.** HIV sero-status of HCWs with their sociodemographic characteristics.

| SEX | N = 420 | NON-REACTIVE (N = 403) | REACTIVE (N = 17) | $X^2$ | *P*-VALUE |
|---|---|---|---|---|---|
| | Male | 178 (96.2) | 7 (3.8) | 2.343 | .123 |
| | Female | 225 (95.7) | 10 (4.3) | | |
| Age | | | | | |
| | 20-29 | 246 (96.5) | 9 (3.5) | 1.134 | .152 |
| | 30-39 | 125 (96) | 5 (4) | | |
| | 40-49 | 32 (91.4) | 3 (8.6) | | |
| Educational status | | | | | |
| | Physician | 71 (98.6) | 1 (1.4) | 3.162 | .042* |
| | Nurse | 289 (96) | 12 (4) | | |
| | Midwifery | 43 (91.5) | 4 (8.5) | | |
| Work experience | | | | | |
| | 1-9 years | 266 (95.7) | 12 (4.3) | 1.657 | .012* |
| | 10-19 years | 117 (96.7) | 4 (3.3) | | |
| | 20-29 years | 2 0 (95.2) | 1 (4.8) | | |
| Proper use of personal protective equipments | Yes | 245 (99.6) | 1 (0.4) | 3.345 | .001* |
| | No | 158 (90.8) | 16 (9.2) | | |

*Significant at *P*-value < .05.

odds of testing positive for HIV (AOR = 4.2, 95% CI: (3.17, 8.21) (Table 3).

## Discussion

In this study, the prevalence of HIV among post-exposure HCWs in the current 12 monthsof professional life was 17 (4%). This means that despite the fact that various technologies and prevention methods have been developed, HCWs are still at risk of contracting HIV in their workplaces. This is comparable with the study that was reported from South Africa (4%),[20] Tanzania (3%),[21] and Nigeria (4.2%).[22]

However, the result is much higher than the studies conducted in Iran (1.7%),[23] Australia (2.1%),[24] Kenya (1.5%),[25] and Tunisia (1.7%).[26] This discrepancy may be due to variation among the study participants, a lack of PPE, a higher patient load, and the infrequent use of PPE among participants in this study setting. For instance, in this study, HCWs infrequently used PPE due to its shortage in the COVID era.[23-25] Additionally, there is a high patient flow along with greater consumption of PPE in this study setting and the country as a whole, which subsequently can lead to exposure to HIV.

In this study, healthcare workers who had 20 to 29 years of work experience had 6 times higher odds of testing positive for HIV (AOR = 6.21, 95% CI: (2.39, 9.55). HCWS who were not using PPE properly had 5 times more odds of being positive for HIV (AOR = 5.02, 95% CI: (3.73, 9.51). HCWs who were midwives had 4 times higher odds of testing positive for HIV (AOR = 4.2, 95% CI: 3.17, 8.21). This is supported by many studies, such as those in Tunisia,[26] South Africa,[20] and Kenya.[25] The reason could be described as the availability of PPE in healthcare facilities influencing HCWs' habits of using PPE during patient care and procedures, thereby reducing exposure to HIV and its impact on the outcome of exposure. Furthermore, the infrequent availability of PPE reduced HCWs' compliance to wear PPE such as a glove, face mask, face shield, and apron, potentially amplifying their exposure to HIV infection; and finally, increasing the transmission of blood-borne pathogens. Giving patients care without PPE can also increase the risk of HIV exposure with contaminated BBFs and can lead to anxiety and further exposure to HIV infection.[9,13,27]

### *Implications of the study*

This study will be used to provide information to healthcare providers, non-governmental organizations, and policymakers for appropriate planning and interventions regarding HCWs' exposure to HIV infection.

This study also provides new knowledge regarding occupational exposure to HIV infection among healthcare workers. Moreover, the results of this study serve as baseline data for further longitudinal and action-based studies.

**Table 3.** Factors associated with the HIV sero-status of healthcare workers, November 2022.

| VARIABLES | HIV SERO-STATUS OF HEALTHCARE WORKERS | | | |
|---|---|---|---|---|
| | NR | R | COR (95% CI) | AOR (95% CI) |
| Sex | | | | |
| Male | 178 | 7 | 1.00 | 1.00 |
| Female | 225 | 10 | 0.32 (0.61, 4.3) | 13.8 (0.45, 25.12) |
| Age | | | | |
| 20-29 | 246 | 9 | 1.00 | 1.00 |
| 30-39 | 125 | 5 | 0.75 (0.34, 2.43) | 4.23 (0.71, 14.05) |
| 40-49 | 32 | 3 | 3.40 (0.29, 64) | 4.57 (0.19, 2.51) |
| Educational status | | | | |
| Physician | 71 | 1 | 1.00 | 1.00 |
| Nurse | 289 | 12 | 0.17 (0.25, 3.08) | 4.8 (0.24, 4.21) |
| Midwifery | 43 | 4 | 3.10 (1.12, 6.23)** | 4.2 (3.17, 8.21)** |
| Work experience | | | | |
| 1-9 years | 266 | 12 | 1.00 | 1.00 |
| 10-19 years | 117 | 4 | 4.73 (2.15, 9.71) | 3.11 (0.26, 7.34) |
| 20-29 years | 20 | 1 | 6.75 (0.57, 9.267)** | 6.21 (2.39, 9.55)** |
| Proper use of personal protective equipments | | | | |
| Yes | 245 | 1 | 1.00 | 1.00 |
| No | 158 | 16 | 5.70 (3.25, 8.00)** | 5.02 (3.73, 9.51)** |

Abbreviations: COR: crude odd ratio, AOR: adjusted odd ratio, R: reactive, NR: non-reactive.
1:00: reference, **significant at *P*-value < .005.

### *Strength and limitations*

As its strength, this study was conducted in 5 randomly selected public hospitals; thus, it could be generalized to all HCWs working in public hospitals. The data was collected using self-administered questioners by asking each participant; hence, it is susceptible to recall bias.

## Conclusion

This study showed that a higher proportion of HCWs in the emergency department were positive for HIV infection than HCWs who were exposed to BBFs and tested immediately. In a binary logistic regression analysis with a *P*-value of .05, proper use of personal protective equipment, educational status, and work experience were significantly associated with post-exposure HIV sero-status of healthcare workers.

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## Author Contributions

Ousman Adal developed the proposal, analyzed the data, and interpreted the results. Asmamaw Abebe drafted the manuscript, revised the proposal, checked the data, and revised the manuscript. The authors have read and approved the final manuscript.

## Availability of Data and Materials

The data that support the findings of this study are available upon reasonable request from the corresponding authors.

## Ethical Approval and Consent to Participants

The ethical review board of the College of Health Sciences at Addis Ababa University approved this study. No. 1239 edu.net for ethical approval). Certify that the study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

## Consent for Publication

Not applicable.

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