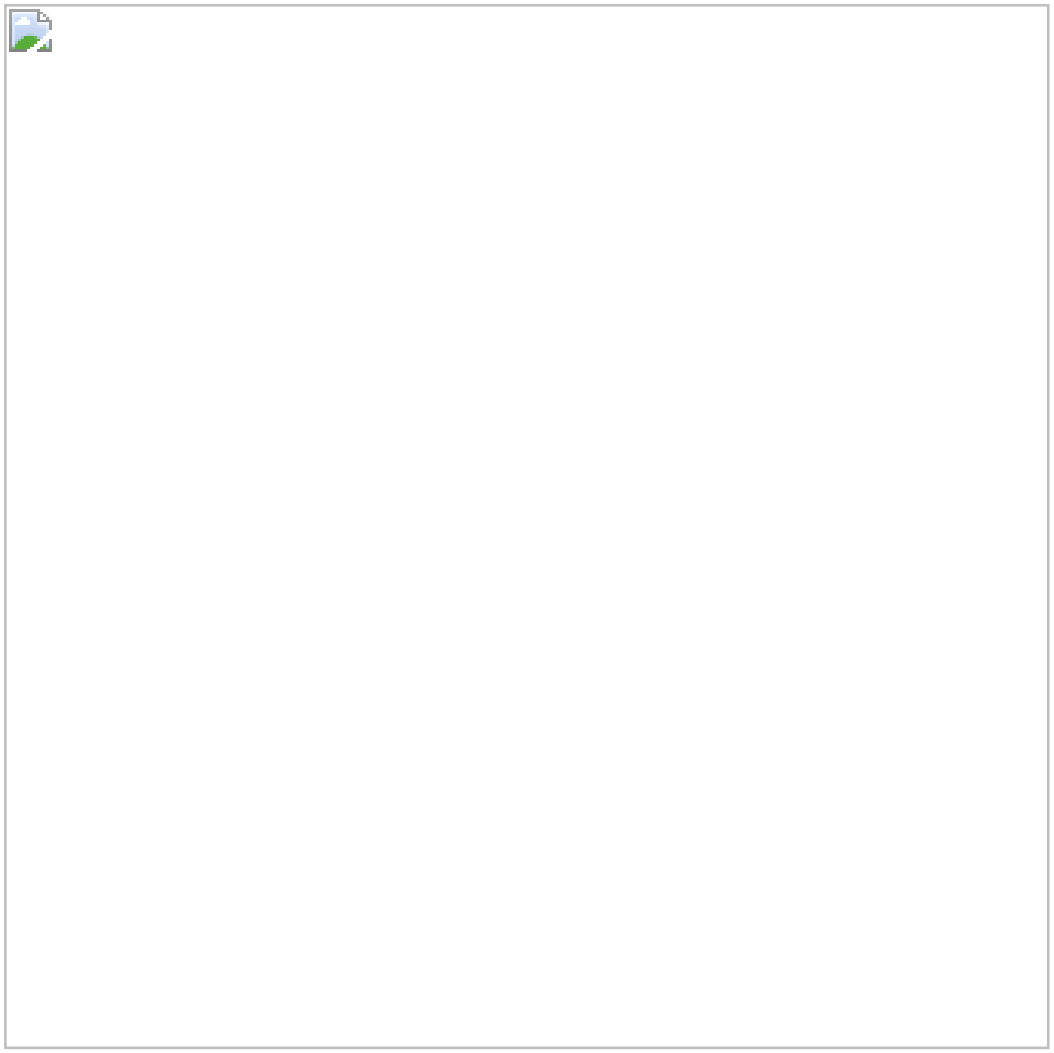

Occupational Exposure to Blood and Body Fluids Among Nurses in the Emergency Department and Intensive Care Units of Public Hospitals in Addis Ababa City: Cross-sectional Study

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Occupational Exposure to Blood and Body Fluids Among Nurses in the Emergency Department and Intensive Care Units of Public Hospitals in Addis Ababa City: Cross-sectional Study

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ABSTRACT

AIMS AND OBJECTIVES: This study investigated occupational exposure to blood and body fluids among nurses at the emergency department and intensive care units of public hospitals in Addis Ababa city.

METHODS: A cross-sectional study was conducted from June 18, 2021 to September 20, 2021. A simple random sampling method and semi-structured, self-administered questionnaires were used to collect the data, which were analyzed using SPSS version 25. A binary logistic regression model was used to identify factors associated with exposure to blood and body fluids on the AOR with a 95% confidence interval at a *P*-value of <.05.

PATIENT AND PUBLIC INVOLVEMENT: No patients were involved in this study.

RESULTS: Of the total study participants (260), 198 (76%) nurses had been exposed to blood and body fluids in their professional live, and 167 (64%) were exposed to blood and body fluids in the last 12 months. Being male (AOR = 2.88, 95% CI: (1.35, 6.12), lacking access to handwashing facilities (AOR = 5.02, 95% CI: (3.73, 14.51)), not consistently wearing all the required types of personal protective equipment (AOR = 6.21, 95% CI: (2.39, 9.55)), and the lack of the required personal protective equipment (AOR = 5.53, 95% CI: (1.87, 10.38)) were all significant factors that were positively associated with exposure to blood and body fluids.

CONCLUSION: This study showed that a higher proportion of nurses in the emergency department and intensive care unit were exposed to blood and body fluids in the study setting. Most nurses do not consistently wear all the required types of personal protective equipment, putting them at a higher risk of acquiring blood-borne pathogens. The authors recommended that there is a need to implement and strengthen appropriate and consistent use of all required personal protective equipment during any procedure, and patient care to reduce exposure to blood and body fluids.

RELEVANCE TO CLINICAL PRACTICE: This study provides baseline information for other action-based studies to assess exposure to blood and body fluids among nurses in emergency and intensive care units.

STROBE CHECKLIST: This manuscript was prepared based on the strobe checklist guidelines.

IMPACT STATEMENT: The study's findings and recommendations might be used for healthcare providers, non-governmental organizations, and policymakers for appropriate planning and interventions to minimize or safeguard nurses' exposure to blood and body fluids.

KEYWORDS: Occupational exposure, blood and body fluids, emergency, intensive care unit, Ethiopia

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Introduction

When a person is exposed to potentially infectious blood and body fluids through non-intact or intact skin, percutaneous, and per mucosal routes while providing professional activities, this is referred to as blood and body fluid exposure. Nurses, as a staff group, particularly in the emergency department (ED) and intensive care unit (ICU), 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.[1,2] Recent research showed that exposure to blood and body fluids (BBFs) is mostly caused by needle-stick injuries. Thus, approximately 1000 infectious diseases occur per year.[3]

The consequences of BBFs include the transmission of various types of pathogens such as, hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV), and other blood-borne pathogens that result in systemic and localized site infections.[4,5] Additionally, significant anxiety and depression may occur following an event related to a fear of infections.[6] The prevalence of BBFs is increasing among nurses.[7-9] For instance, a study conducted in the United States of America (USA) showed that the prevalence of exposure to

BBFs among nurses was 31.3%.[10] In a similar study conducted in Iran, The highest rates of exposure were among young nurses with less than 3 years of experience (47 of 63), young and recently employed orderlies (21 of 25), and medical and nursing students. Of those nurses, 3 had needle-stick injuries from known HIV-infected patients. Among the 171 exposures, 23 (13%) were to HBSAG-positive patients and 3 (2%) to HCV-positive patients. But the study was not specific to nurses, and nurses in the ICU were excluded.[11] The frequency and annual rate of exposure to BBFs among nurses are higher in the ED. For instance, the research conducted by Gourni et al[7] reported that 39.5% of nurses were exposed to BBFs at EDs, which was higher than the 27% of nurses who were exposed to BBFs at inpatient wards (IPDs).

A systematic review and meta-analysis conducted in 2017 in 21 African countries disclosed that 65.5% of heath care workers (HCWs) were exposed to BBFs.[12] High patient flow leading to overloaded work, a lower ratio of HCWs to patients, limited awareness of the risks associated with exposure to BBFs, failure to implement standard precautions, an inadequate supply of basic safety equipment, a lack of training, and an inadequate supply of personal protective equipment (PPE) are factors that increase the burden.[12,13]

Moreover, the epidemiology of blood-borne infections in Ethiopia has been on the rise and dynamically changing over the past decades, along with poor compliance with standard precautions.[3] According to a recent study, more than half (58.5%) of HCWs are exposed to BBFs during their professional live.[3] Aside from the studies available on overall HCWs in Ethiopia, no specific study was conducted on occupational exposure to BBFs among nurses. And there is no published study yet, particularly in the ED and ICU, regarding occupational exposure to BBFs. Nurses who work in emergency rooms and intensive care units are the healthcare workers with the highest probability of contact with BBFs. The study might provide evidence-based information to improve their safety and avoid accidental injuries and infections. Therefore, this study aimed to investigate occupational exposure to BBFs among nurses working in EDs and ICUs.

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 occupational exposure to BBFs among nurses in the ED and ICU. This is because this study is limited to the ED and ICU and has not yet been conducted across the country. The findings also, serve as a baseline for future longitudinal and action-based studies.

Methods

Study design, setting, and population

A cross-sectional study was conducted among nurses in the ED and ICU, public hospitals in Addis Ababa city from June 18, 2021 to September 20, 2021. Addis Ababa is the capital city of Ethiopia, and is located in the central part of the country. Also, 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.[14,15] All nurses at randomly selected public hospitals who were involved (participated) in the patient care at ED and ICU were enrolled in this study.

Sample size, sampling procedure, and technique

The actual sample size for the study was determined using a single population proportion formula: $\{n = [(z\alpha/2)2p(1-p)]/d2\}$, n = sample size, $z\alpha/2$ = 95% confidence level, p = the proportion of exposure to BBFs in the previous study (41.2%),[16] d = margin of error (0.05). By considering 10% of non-response rate, the final sample size of the study was 266. To determine the representativeness of the sample, by using a lottery method, the principal investigators were randomly selected two-third of the total hospitals (3 from 5). The sample size for each hospital was proportionally allocated based on the number of nurses in each ED and ICU.

Inclusion criteria

All nurses who directly participated in patients' care were selected using systematic random sampling at 2 intervals from their list in the offices of the ED and ICU. Then, consent was obtained from each study participant.

Exclusion criteria

Nurses who did not directly care for patients, such as nurse managers, were excluded.

Data collection tools

The English version of the self-administered questionnaire was used to collect the data. The tools were divided into 4 sections: participant sociodemographic (7 items), participant behavioral characteristics (5 items), institutional factors (4 items), and exposure to blood and body fluids (12 items) obtained from a modified version in the previous study.[3]

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 other than this study setting. In the previous study, the tools were validated and the Cronbach alpha was .813.[3] However, the tools were modified on the basis of the study setting and characteristics of the study population; therefore, 2 professional experts

(1 from the English language and 1 from the medical field) validated the tool and confirmed its reliability (Cronbach alpha of .766) from the pre-tested questioners before 2 weeks of data collection.

Patient and public involvement

All randomly selected nurses in the ED and ICU of Addis Ababa public hospitals were enrolled in this study. No patients were involved in this study.

Operational definitions and terms

Occupational exposure. It can occur through Needlestick or cuts from other sharp instruments contaminated with an infected patient's blood (including blood contaminated saliva) or through contact of the eye, nose, mouth, or skin with a patient's blood or other potentially hazardous bodily fluids.[17]

Exposure to blood and body fluids. Indicates mucocutaneous and percutaneous exposure. Mucocutaneous exposure is defined as any exposure to blood or body fluid splashed into the eyes, nose, or mouth, or blood contact with non-intact skin. We appended studies that reported the lifetime or 12-month prevalence of occupational exposure through blood and body fluid contacts from at least 1 of these routes (eye, mouth, mucous membrane, and non-intact skin).[3]

The favorite type of PPE is the frequently used or mostly available clothing or equipment in the health facilities of developing countries, and it is worn with healthcare professionals for all patients' care. Those include gowns, face masks, and gloves.[4]

The required personal protective equipments (PPE). All medical clothing or equipment worn by healthcare professionals, and intended to protect against health and safety hazards in health care facilities. Those include the gown, face mask, face shield, apron, and gloves.[1]

Statistical analysis

The data were cleaned, verified for completeness, coded, and entered EPI-Data version 4.6.0.4, and then exported to SPSS version 25 for further analysis. The results were presented in narration, graphs, and tabulations. A binary logistic regression analysis model was used to identify factors that determine exposure to BBFs. The model fitness of the variable was tested using Hosmer and Lemon's method, which yielded a *P*-value of .76. Using linear regression, the multicollinearity of the independent variables revealed that all variables had tolerances greater than 0.1 and variance inflation factors greater than 4. All independent variables with a *P*-value of <.25 from a bivariate logistic regression analysis were fitted into a multivariable logistic regression analysis to control for the possible effect of confounders. Finally, the variables that were independently associated with exposure to BBFs were identified using an adjusted odd ratio (AOR) with a 95% confidence interval (CI) and a *P*-value of <.05.

Table 1. Sociodemographic characteristics of the study participants in the ED and ICU of Addis Ababa public hospitals, September 2021.

VARIABLES	NO (%), N=260
Sex	
Male	121 (46.5)
Female	139 (53.5)
Age	
20–29	164 (63.1)
30–39	88 (33.8)
40–49	8 (3.1)
Educational status	
Diploma	26 (10.0)
BSc degree	216 (83.1)
MSc degree	18 (6.9)
Work experience (years)	
1–9	189 (72.7)
10–19	70 (26.9)
20–29	1 (0.4)
Working institution	
Tikur Anbessa specialized hospital	66 (25.4)
St. Paulo's specialized hospital	105 (40.4)
Alert specialized hospital	28 (10.8)
Yekatit 12 hospital	28 (10.8)
Zewditu memorial hospital	33 (12.6)
Working unit	
Emergency	169 (65)
ICU	91 (35)

Results

Sociodemographic characteristics of the study participants

A total of 260 nurses participated in this study, with a response rate of 97.7%. One hundred thirty-nine (53.5%) of nurses were female, and 63.1% of nurses were aged in the range between 22 and 46 years, with a median age of 29 years. The majority (83.1%) of nurses had a BSc degree (Table 1).

Behavioral characteristics of nurses

Most nurses (88.5%) had used at least the most widely available PPE (a glove, gown, and face mask) consistently during patient care in the last 12 months (Table 2).

Table 2. Behavioral characteristics of study participants in the emergency and intensive care units of Addis Ababa public hospitals, September 2021.

VARIABLES (N = 260)	FREQUENCY (%)
Did you use at least the most available PPE (a glove, gown, and face mask) consistently during any patient care or procedures but exclude the prone and face shield?	
Yes	230 (88.5)
No	30 (11.5)
Did you use all the required PPE (glove, gown, face mask, a face shield, and apron) consistently during any invasive procedures?	
Yes	74 (28.5)
No	186 (71.5)
Did you usually chew khat in the last 12 months at least 3 times per week?	
Yes	66 (25.4)
No	194 (74.6)
Did you drink alcohol in the last 12 months at least 3 times per week?	
Yes	61 (23.5)
No	199 (76.5)
Are you concerned about exposure to BBFs and the impact of its outcome?	
Yes	218 (83.8)
No	42 (16.2)

Institutional factors of occupational exposure to blood and body fluids

More than half, (66.5%) of the study participants were fully vaccinated against HBV as health professionals. One hundred seventy-six (67.7%) respondents said that there was not enough PPE available throughout the year (Table 3).

Prevalence of occupational exposure to blood and body fluids among nurses

Most (76.2%) nurses were exposed to BBFs in their professional lifetime. Among the exposed nurses, 79.8% of them were exposed more than once a year. Approximately 73% of the study participants identified the status of the source patients, and of those tested, nearly 19.3%, 8.2%, and 6.9% of them were positive for HIV, HBV, and HCV, respectively (Table 4).

Factors associated with occupational exposure to blood and body fluids

In binary logistic regression analysis, sex, wearing of the required types of PPE, accessibility of handwashing facilities,

Table 3. Institutional factors of occupational exposure to BBFs among nurses in the emergency and intensive care units of Addis Ababa public hospitals, September 2021.

VARIABLES	FREQUENCY (%), N = 260
Have you ever taken hepatitis B virus vaccination as a health professional?	
Yes	173 (66.5)
No	87 (33.5)
Have you ever received training on infection prevention?	
Yes	159 (61.2)
No	101 (38.8)
Was PPE available throughout the year at your hospital?	
Yes	84 (32.3)
No	176 (67.7)
Are there enough handwashing facilities in the department?	
Yes	107 (41.2)
No	153 (58.8)

and availability of all required types of PPE in their hospital was significantly associated with occupational exposure to BBFs at a *P*-value of <0.05. Males had approximately 3 times the odds of being exposed to BBFs than females (AOR = 2.88, 95% CI: (1.35, 6.12)). Nurses who complained about the lack of handwashing facilities in their hospital had approximately 5 times more odds of exposure to BBFs compared to those who had not complained (AOR = 5.02, 95% CI: (3.73, 14.51)). Nurses who did not wear all the required PPE consistently had approximately 6 times higher risk of exposure to BBFs than those who did (AOR = 6.21, 95% CI: (2.39, 9.55)). Nurses who reported the lack of PPE in their hospital had approximately 6 times higher odds of exposure to BBFs compared to those who reported that PPE was available in their hospital throughout the year (AOR = 5.53, 95% CI: (1.87, 10.38)) (Table 5).

Discussion

In this finding, the prevalence of exposure to BBFs among nurses in the ED and ICU showed that 76% and 64% of nurses were exposed to BBFs during their professional lives and in the past 12 months, respectively. The finding of this study is much higher than the studies conducted in Turkey (13.7%),[18] Iran (34.7%),[19] and South Africa (21.9%).[12] This discrepancy may be due to variations in the study settings, a lack of PPE, a higher patient load, and the infrequent use of PPE among nurses in this study setting. For instance, in this study, participants were only nurses working in the ED and ICU. Although the above-mentioned study was conducted in all HCWs and departments.[12]

Table 4. Occupational exposure to blood and body fluids among nurses in the ED and ICU of Addis Ababa public hospitals, the last 12 months, September 2021.

VARIABLES	FREQUENCY (%), N = 198
Frequency of exposure per year	
1 time	40 (20.2)
More than 1	158 (79.8)
Exposure to BBFs in the emergency department	130 (78)
Resuscitation	65 (50)
Triage	21 (16)
Procedure	8 (6)
Both procedure and resuscitation	36 (28)
Exposure to BBFs at ICU	68 (73)
Parts of the body exposed to BBFs	
Hands	89 (44.9)
Eye splash	36 (18.2)
Legs	17 (8.6)
Both hands and eyes splash	56 (28.3)
The type of procedure leading exposure to BBFs	
Needle disposal	27 (13.6)
IV setup	60 (30.3)
Blood collection	39 (19.7)
Both blood collection and IV setup	67 (33.8)
Bed bath and other procedures	5 (2.6)
Did you follow the status of the source patients?	
Yes	145 (73.8)
No	53 (26.2)
Sero-status of the source patients	
HIV seropositive	28 (19.3)
HBV seropositive	12 (8.2)
HCV seropositive	10 (6.9)
Negative for the above listed viruses	95 (65.5)
Did you take antiretroviral prophylaxis if the source patient was seropositive for HIV (started, but un complete 28 days)?	
Yes	42 (84)
No	8 (16)
Did you complete the prophylaxis (the right dose for 28 days)?	
Yes	41 (97.6)
No	1 (2.4)

The findings of this study showed that 79.8% of nurses were exposed to BBFs more than once a year, which is higher than the figure observed in a study by Belachew et al (38.5%).[20] The observed difference could be a result of the inadequacy of PPE and the nurses' infrequent use of it in this study setting.[21] This revealed that the blood/body fluid splash (46%) was the most common mode of exposure. This is consistent with the findings of a study conducted in Turkey (40.6%),[22] but differs from findings in Iran (92.8%),[19] Australia (57%),[23] Tanzania (71.1%),[13] and Ethiopia (26.5%) and (78.8%), which were conducted by Belachew et al[20] and Alemayehu et al,[24] respectively, and in which NSI was the most common mode of exposure. The discrepancy might be due to the variation in the study period, population, and setting. For instance, this study was particularly conducted in the ED and ICU, whereas the previous study was conducted in all working units.[20,24]

According to the findings, most exposure to BBFs occurs on the hands (44.9%). This is supported by a study conducted in Tanzania and Haramaya University, which found that exposure to BBFs on hands accounted for 45.5% and 46.6%, respectively.[13,24] In this finding, half (50%) of nurses were exposed in the resuscitation area, and 33.8% of them were exposed during both IV setup and blood collection. This is similar to a study conducted in Turkey (26.5%).[22] In this study, 96% of nurses took action immediately after exposure by washing the exposed site. This is consistent with the study conducted in India (100%),[25] and Tunisia (92.8%).[26]

Approximately 74% of nurses have identified the status of the source patients, and from those tested patients, 19.3%, 8.2%, and 6.9% were positive for HIV, HBV, and HCV, respectively. Moreover, the findings of this study showed that the risk for transmission of a blood-borne pathogen among nurses exposed to BBFs was higher than in the study conducted in Tunisia,[26] in which 1.1%, 1.6%, and 5.25% of source patients were HIV, HCV, and HBV positive, respectively.

According to this study, 28.5% of nurses wore all the required PPE during the procedure, which is lower than the study conducted in Kenia (98%) and Jimma University (99%).[20,27] This difference may be a result of the lack of PPE caused by increased demand, the limited budget to provide PPE because of the COVID-19 era, and the low attention given by healthcare administrators.[4,21]

Approximately two-third of the nurses in this study (66.5%) were fully vaccinated against HBV, which is lower than the studies in Iran (89%) and Turkey (77.5%),[22,28] and higher than the study in Tanzania (8%).[13] The inconsistency might result from the low accessibility and irregular distribution of the vaccine in developing countries like Ethiopia and Tanzania because of the vaccine's high cost.[13] More than half (61.2%) of them had received infection prevention training, indicating that nurses in this study setting had received more training than those in Gondar town (39.36%) and Bahir Dar town (22%).[6,29] The reason might be the relatively better budget and

Table 5. Factors associated with occupational exposure to blood and body fluids among nurses in the ED and ICU of Addis Ababa public hospitals, September 2021.

	OCCUPATIONAL EXPOSURE TO BLOOD AND BODY FLUIDS			
VARIABLES	YES	NO	COR (95% CI)	AOR (95% CI)
Sex				
Male	102	19	2.40 (1.31, 4.41)*	2.88 (1.35, 6.12)*
Female	96	43	1.00	1.00
Educational status				
Diploma	17	9	0.23 (0.04, 1.26)	0.53 (0.06, 4.05)
BSc degree	165	51	0.40 (0.09, 1.81)	0.57 (0.09, 3.51)
MSc degree	16	2	1.00	1.00
Use of the required types of PPE				
Yes	38	36	1.00	1.00
No	160	26	5.83 (3.15, 10.79)**	6.21 (2.39, 9.55)**
Concerned exposure to BBF				
Yes	163	55	1.00	1.00
No	35	7	1.68 (0.70, 4.02)	1.63 (0.53, 4.96)
Vaccinated for HBV				
Yes	136	37	1.00	1.00
No	62	25	0.67 (0.37, 1.21)	0.62 (0.29, 1.36)
Availability of the required types of PPE				
Yes	36	48	1.00	1.00
No	162	14	15.42 (7.69, 24.95)**	5.53 (1.87, 10.38)**
Handwashing facility				
Yes	54	53	1.00	1.00
No	144	9	15.70 (7.25, 34.00)**	5.02 (3.73, 14.51)**

Abbreviations: AOR, adjusted odd ratio; CI, confidence interval; COR, crude odd ratio.
1.00: reference.
*Significant at P-value <.05.
**Significant at *P*-value <.005.

attention-seeking given by the government and hospital administrators in this study setting.[4]

In this finding, the sex of the respondents, the accessibility of handwashing facilities, the wearing of all of the required types of PPE consistently during the procedure, and the constant availability of the required types of PPE throughout the year in their hospital were found to be factors associated with occupational exposure to BBFs. Being male had a higher risk of exposure to BBFs than females. This is congruent with the studies reported in Turkey,[18] but disagrees with the study in Tanzania.[13] The possible explanation is that male nurses underestimated the facts, paying no attention to the burden and consequences of exposure to BBFs.[13]

Nurses who had complained about the shortage of handwashing facilities in their hospital had a higher risk of exposure to BBFs compared to those who hadn't complained. Wearing all the required types of PPE consistently during the procedure decreased the odds of exposure to BBFs. Nurses who reported a lack of PPE in their hospital had a higher risk of exposure to BBFs than those who did not. This is further supported by the studies conducted in Tanzania, and Ethiopia, which was conducted by Yasin et al.[29] and Mabwe et al.[30] The reason could be described as the availability of PPE in healthcare facilities influencing nurses' habits of using PPE during patient care and procedures, thereby reducing exposure to contaminated BBFs and its impact on the outcome of exposure. Giving patients

care without PPE can also reduce nurses' concentration during activities, which can lead to anxiety and further exposure to BBFs.[3,29,31]

Strengths and Limitations

As its strength, this study was conducted in 5 randomly selected public hospitals; thus, it could be generalized to all nurses working at the ED and ICU of public hospitals in Addis Ababa city. This study shared the limitation of a cross-sectional study design; hence, it is difficult to determine the causal relationships between variables. It might have had a recall bias among the study participants.

Conclusion

This study showed that a high proportion of nurses at the ED and ICU were exposed to BBFs in the study setting. Exposure to BBFs was positively associated with a lack of personal protective equipment, inconsistent use of the required personal protective equipment, the inaccessibility of handwashing facilities, and being male. The authors suggested that health care facility managers, as well as government and non-government organizations, ensure the accessibility and availability of personal protective equipment for its implementation. Healthcare professionals, including nurses, could use the required personal protective equipment during any procedure and patient care in a consistent manner.

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Author Contributions

Ousman Adal developed the proposal, analyzed the data, interpreted the results, and drafted the manuscript. Asmamaw Abebe and Yohannes Feleke 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.

Consent for Publication

Not applicable

Ethical Approval and Consent for Participants

The ethical review board of Addis Ababa University's College of Health Sciences approved this study (ChM 199 edu.net for ethical approval). Certify that, the study was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

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