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Burden of Occupational Exposure to Sharp Injuries among Nurses Working in Public Hospitals in South Gondar Zone, Northcentral Ethiopia: Multi-center cross-sectional study

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Abstract

Background: Sharp injuries are the most common and preventable occupational hazards that health care workers are exposed to the transmission of a variety of blood borne infections such as HBV, HCV, and HIV/AIDS. Most of these sharp injuries (90%) occur in developing countries, where the burden of blood borne infections in the general population is high and access to safety devices and personal protective equipments is limited. However, there is limited information in the study area that describes the burden of occupational exposure to sharp injuries and its predictors among nurses.

Objective: This study aimed to assess the burden of occupational exposure to sharp injuries and its predictors among nurses working in public hospitals in south Gondar.

Method: A multi-center cross-sectional study design was conducted among nurses from November 01-30/2022. A total of 376 nurses working in all public hospitals were included in the study. The collected data were checked for completeness, cleaned, coded manually, and entered into Epi-Data version 4.2; then, exported to Stata version 14 for analysis. Variables with a p-value of <0.05 at 95% CI were considered significantly associated with the outcome variable.

Results: Of the total respondents, 213 (56.65%) were between the age of 25-34 with the mean ± SD of age 30.22 ± 6.63 years. Similarly, 202 (53.72%) of the respondents were females. This study finding showed that the burden of occupational exposure to sharp injuries among nurses was 52.39% (95%CI: 47.92%, 56.37%).

Conclusions: Generally, this study finding reported that the burden of occupational exposure to sharp injuries among nurses was high. This study finding also showed that years of service, infection prevention training, job related stress, and the presence of

contaminated sharps at workplace were independent predictors of occupational exposure to sharp injuries among nurses.

Keywords: Occupational exposure to sharp injuries, nurses, and public hospitals.

Background

A sharp injury is defined as ″an accidental penetrating wound with an instrument that is potentially contaminated with the body fluid of another person. And, sharp injuries occur when health care providers perform their clinical activities in the health care facilities, such as hospitals, health centers and clinics″[1]. The majority of sharp injuries occur during administering injections, securing IV lines, drawing blood, checking blood sugar ,recapping needles, poor handling and disposing of needles, and transferring blood or body fluids from a syringe to a specimen container [2].

Globally, of the total of 35 million health care providers, it is estimated that 3 million experience sharp injuries every year; of these, nurses are at the greatest risk, with up to 50% of all sharp injuries being sustained by nurses [3]. Because nurses have the highest rate of encountering sharp injuries among health care providers due to their prolonged exposure to needles and other sharp devices [4]. The European Biosafety Network (EBN) reported that one million sharp injuries occur in European countries annually [5].

Most of these sharp injuries (90%) occur in developing countries, where the burden of blood borne infections in the general population is high and access to safety devices and personal protective equipments (PPEs) is limited, specifically more common in sub-Saharan African countries. On average, health care providers in Africa suffer 2 to 4 sharp injuries every year [6]. In Sub-Saharan Africa, the burden of sharp injuries and

their predictors are not clearly understood among health care providers [7]. In Ethiopia, a study conducted in Jimma University Specialized Teaching Hospital(JUSTH) reported that the burden of occupational exposure to sharp injuries among nurses was 61.76% [1, 8]. Sharp injuries are markedly the most common and preventable occupational hazards that health care providers are exposed to and become high risk for the transmission of a variety of blood borne infections such as hepatitis B virus(HBV), hepatitis C virus(HCV), and human immunodeficiency virus (AIDS) [3, 9].

Blood-borne infections following sharp injuries have serious consequences, including long-term illness, psychological stress to the victims ,colleagues and family, disability and death [10]. In addition to the potential risks for infectious diseases, they also suffer for direct costs required for laboratory tests, including tests for HIV antibodies, hepatitis B serology, and a baseline test for hepatitis C, as well as any treatments for these infections [11]. The implementation of education, universal precautions, elimination of needle recapping, and use of sharp containers for safe disposal have reduced the chance of getting sharp injuries by 80% [12]. Health care providers who followed universal precautions were 66% less likely to have needle sticks and sharp injuries than those who did not follow [13].

Training of handling objects, using instruments to grasp needles, reduction of the use of sharp devices, avoiding hand-to-hand passing of sharp instruments, decreasing of direct contact with needles, an appropriate disposal and using safety boxes properly can decrease the risk of getting sharp injuries [5].

In Ethiopia, where primary health care services are covered by nurses, it is important to develop their knowledge and practice on universal precautions since the risks of getting

infections following sharp injuries are high in their day to day activities [8]. However, there is limited information in the study area that describes the burden of sharp injuries and its predictors among nurses. Therefore, this study aimed to determine the burden of occupational exposure to sharp injuries and its predictors.

General objective

To assess the burden of occupational exposure to sharp injuries among nurses working in public hospitals in south Gondar zone, Northcentral Ethiopia, 2022

Specific objectives

- To determine the burden of occupational exposure to sharp injuries among nurses working in public hospitals in south Gondar zone, Northcentral Ethiopia, 2022
- To identify the predictors of occupational exposure to sharp injuries among nurses working in public hospitals in south Gondar zone, Northcentral Ethiopia, 2022

Methods

Study design, area, and Period

Muli-center cross-sectional study design was conducted among nurses working in public hospitals in south Gondar zone from November 01-30, 2022.

Study Population

All nurses working in all public hospitals in south Gondar zone.

Inclusion and exclusion criteria

All nurses working in all public hospitals in south Gondar zone at the time of the data collection period were included in the study; whereas, nurses who were on sick leave, maternity leave, annual leave, and training at the time of data collection period were also excluded from the study.

Sample size determination, and sampling procedure/technique

The sample size (n) was calculated by Computer-based Epi info7 software using a single population proportion at 95% CI, with a 5% margin of error, and by assuming the burden of occupational exposure to sharp injuries among nurses to be 61.76% [1].

$$n = \frac{(Z\alpha/2)^2 P (1-P)}{d^2}$$

Where: - n= the minimum sample size required for the study

Z= standard normal distribution (Z=1.96) with a 95% confidence interval

P= burden of occupational exposure to sharp injuries among nurses (61.76%=0.6176)

d=is a tolerable margin of error (d=5%=0.05)

$$n = \frac{(1.96)^2 0.6176(1-0.6176)}{(0.05)^2}$$

n=363. Then, by adding a 10% (0.1) non-response rate, the final sample size (n) was calculated to be 400. But, since it was the minimum sample size required, and the source population was only 402, the source population (402) was taken as a sample size for this study.

Dependent Variable

Occupational exposure to sharp injuries

Independent variables

- Socio-demographic characteristics: Age, sex, marital status, level of education, and years of service.
- Behavioral characteristics: Sleeping disturbance, following of standard precaution guide line, use of PPE, knowledge of standard precautions, and job-related stress.

- Work environment characteristics: Length of stay/shift, health and safety information access, infection prevention training, work load, availability of safety box, availability of standard precaution guidelines, and presence of contaminated sharps.

Operational Definitions

Occupational exposure to sharp injuries: Any kind of sharp injury which occurred among nurses in relation to his/her job in the health care facility [14].

Knowledge: Nurses who have scored ≥75% (9) of 12 knowledge related questions were considered to have adequate knowledge; whereas, nurses who have scored below 75% were also considered to have inadequate knowledge towards sharp injuries [15].

Job Stress: Nurses who scored above or equal to the mean score (32.78) of the Likert-scale questions that used to assess nurses' job-related stress were considered they have a job related stress, whereas, nurses who scored below the mean score were also considered they didn't have job-related stress [14].

Data collection tool and procedure

A structured and pre-tested self-administered English version questionnaire was used to collect the data. The questionnaire was prepared by reviewing different literatures and using standardized Likert-scale questions to assess job-related stress of the respondents, which were adopted from the Expanded Nursing Stress Scale (ENSS) [1, 8, 14].

The questionnaire contains nurses' socio-demographic, behavioral, environmental characteristics, knowledge questions related to standard precaution and standardized Likert-scale questions to assess job-related stress of the respondents. Reliability of the

tool was established with an overall Cronbach's alpha score (0.74 for knowledge questions related to standard precaution, and 0.79 for job stress Likert-scale questions. Before data collection, training was given to the data collectors. Before giving the questionnaire, the data collectors informed the nurses about the aims/purposes, risks and possible benefits of the study, the right and refusal to participate in the study and that the collected information would be kept confidential.

After all, those nurses who were willing and have signed the informed voluntary consent form were requested to fill out the questionnaire. The data collection was held for four consecutive weeks (from November 01-30/2022).

Data quality control, processing, and analysis

Five percent of the questionnaire was pre-tested in Koladiba primary hospital to assess the reliability, clarity, sequence, consistency, understandability and the total time that it will take to finish the questionnaire before the actual data collection. Then, the necessary comments and feedback were incorporated into the final tool to improve its quality. Training was given data collectors regarding the objective of the study, data collection tools, methods of data collection, checking the completeness of the collected data, and how to maintain confidentiality.

The collected data were checked for completeness, cleaned, edited, coded manually and entered into Epi data version 4.2. A double data entry was done for its validity and compared to the original data. Outliers were also checked & simple frequencies and cross tabulation were done for missing values and variables. Then, the data was exported to Stata version 14 for analysis. Descriptive analysis was done by computing proportions and summary statistics. Then, the information was presented using simple

frequencies, summary measures, tables and figures. Binary logistic regression was used to identify predictors of sharp injuries. Bivariate and multivariate analyses were used to see the association between the outcome variable and each independent variable.

The assumptions for binary logistic regression were checked. The goodness of fit was tested by Hosmer-Lemeshow statistics and Omnibus tests. All variables with P<0.2 in the bivariate analysis were included in the final model of multivariate analysis in order to control all the possible confounders and the variables were selected by using enter method. The adjusted odds ratio (AOR) along with a 95% CI was estimated to identify the predictors of occupational exposure to sharp injuries. In this study, variables with a P-value < 0.05 were considered significantly associated with occupational exposure to sharp injuries.

Ethical Considerations

Ethical clearance was obtained from Debre Tabor University, College of Health Sciences, ethical review board. All the respondents were informed about the purpose of the study, their right to refuse and written and signed voluntary consent was obtained from all the respondents prior to data collection. The respondents were told that the information obtained from them would be treated with complete confidentiality and would not cause any harm to them.

Result

Of the total of 402 respondents, 376 were included in the final analysis, giving a response rate of 93.53%.

Socio-demographic and working environment related attributes

Of the total respondents, 213 (56.65%) were between the age of 25-34 with the mean ± SD of age 30.22 ± 6.63 years. Similarly, 202 (53.72%) of the respondents were females. Additionally, only 89 (23.67%) of the respondents got infection prevention training. Moreover, 271 (72.07%) of them had safety boxes at workplace to dispose needles and other sharp materials after use, and 214 (56.91%) of respondents also stated that there were contaminated needles and sharp materials at workplace (Table 1).

Table1: Socio-demographic characteristics of the respondents working in public hospitals in south Gondar zone, Northcentral Ethiopia, 2022 (n=376).

Variables	Category	Frequency	Percentage (%)
Age	≤24	68	18.09
	25-34	213	56.65
	35-44	71	18.88
	≥45	24	6.38
Sex	Male	174	46.28
	Female	202	53.72
Marital status	Single	171	45.48
	Married	183	48.67
	Divorced	17	4.52
	Widowed	5	1.33
Educational level	Diploma	132	35.11
	BSc	244	64.89
Years of service	<5	136	36.17
	5-10	128	34.04
	>10	112	29.79
Sleeping disturbance problem	Yes	274	72.87
	No	102	27.13
Use of PPEs	All of the time	185	49.20
	Most of the time	102	27.13
	Sometimes	73	19.41
	Never use	16	4.26
Work load in the unit	Yes	212	56.38
	No	164	43.62
Length of stay/shift at work	≤8 hours	193	51.33

	9-14 hours	35	9.31
	≥15 hours	148	39.36
Health and safety information access	Yes	291	77.39
	No	85	22.61
Training on IP	Yes	89	23.67
	No	287	76.33
Availab. of safety box at work place	Yes	271	72.07
	No	105	27.93
Availab. of universal precaution guide line	Yes	212	56.38
	No	164	43.62
Following universal precaution guide line	Yes	93	43.87
	No	119	56.13
Presence of contaminated sharps at workplace	Yes	214	56.91
	No	162	43.09
Knowledge of standard precaution	Adequate knowledge	134	35.64
	Inadequate knowledge	242	64.36
Job related stress	Stressed	237	63.03
	Not stressed	139	36.97

*BSc, Bachelor of Science; *IP, infection prevention

Burden of occupational exposure to sharp injuries

This study finding showed that the burden of occupational exposure to sharp injuries among nurses was 52.39% (95%CI: 47.92%, 56.37%) (197).

The occurrence of occupational exposure to sharp injuries was the highest among respondents with the age of 45 years and above (62.50). Likewise, the majority of males, 108(62.07) also got occupational exposure to sharp injuries. Occupational exposure to sharp injuries was also the highest among diploma nurses, and nurses having more than 10 years of service (59.85% and 62.50%) respectively. Moreover, the occurrence of sharp injuries was also the highest among nurses working along with the presence of contaminated sharps at workplace (Table 2).

Table 2: Distribution of sharp injuries among nurses working in public hospitals in south Gondar zone, Northcentral Ethiopia, 2022 (n=376).

Variables	Categories	Occupational exposure to sharp injuries	
		Yes (%)	No (%)
Age	≤24	32(47.06)	36(52.94)
	25-34	111(52.11)	102(47.89)
	35-44	39(54.93)	32(45.07)
	≥45	15(62.50)	9(37.50)
Sex	Male	108(62.07)	66(37.93)
	Female	89(44.06)	113(55.94)
Marital status	Single	87(50.88)	84(49.12)
	Married	96(52.46)	87(47.54)
	Divorced	11(64.71)	6(32.29)
	Widowed	3(60.0)	2(40.0)
Educational level	Diploma	79(59.85)	53(40.15)
	BSc	118(48.36)	126(51.64)
Year of service	<5	59(43.38)	77(56.62)
	5-10	68(53.13)	60(46.87)
	>10	70(62.50)	42(37.50)
Sleeping disturbance problem	Yes	141(51.46)	133(48.54)
	No	56(54.90)	46(45.10)
Use of PPEs	All of the time	89(48.11)	96(51.89)
	Most of the time	56(54.90)	46(45.10)
	Sometimes	41(56.16)	32(43.84)
	Never use	11(58.75)	5(31.25)
Work load	Yes	125(58.96)	87(41.04)
	No	72(43.90)	92(56.10)
Length of stay/shift at work	≤8 hours	95(49.22)	98(50.78)
	9-14 hours	19(54.29)	16(45.71)
	≥15 hours	83(56.08)	65(43.92)
Health & safety information access	Yes	148(50.86)	143(49.14)
	No	49(57.65)	36(42.35)
Training on IP	Yes	38(42.70)	51(57.30)
	No	159(55.40)	128(44.60)
Availab. of safety box	Yes	129(47.60)	142(52.40)
	No	68(64.76)	37(35.24)
Availab. of universal	Yes	99(46.70)	113(53.30)

precaution guide line	No	98(59.76)	66(40.24)
Following universal precaution guide line	Yes	42 (45.16)	51(54.84)
	No	155 (54.77)	128 (45.23)
Presence of contaminated sharps at workplace	Yes	136(63.55)	78(36.45)
	No	61(37.65)	101(62.35)
Knowledge of standard precaution	Adequate knowledge	59(44.03)	75(55.97)
	Inadequate knowledge	138(57.02)	104(42.98)
Job related stress	Stressed	149(62.87)	88(37.13)
	Not stressed	48(34.53)	91(65.47)

**BSc, Bachelor of Science; PPEs, personal protective equipments; and *IP, infection prevention*

Occupational exposure to sharp injuries related Attributes

Of the respondents who encountered occupational exposure to sharp injuries, 114(57.87%) had encountered sharp injuries 1-2 times. Additionally, 69 (35.03%) of injuries occurred during abrupt movement of patients, and 86(43.65%) sharp injuries were slight skin penetration. Moreover, 93 (47.21%) of injuries were from the unknown status, and only 92 (46.70%) sharp injuries were reported to the concerned body (Table 3).

Table 3: Occupational exposure to sharp injuries related attributes among nurses working in public hospitals in south Gondar zone, Northcentral Ethiopia, 2022 (n=376).

Variables	Values	Frequency	Percentage (%)
Frequency of injuries occurred	1-2 times	114	57.87
	3-4 times	71	36.04
	≥5 times	12	6.09
Condition of sharps	Dirty needles/sharps	74	37.56
	Sterile needles/sharps	58	29.45
	Both dirty & sterile needles/sharps	65	32.99
How sustaining injuries	During abrupt movement	69	35.03

	of patients		
	During recapping needle after use	63	31.98
	During sharp collection	46	23.35
	Others	19	9.64
Type of injuries sustained	Deep injury	54	27.41
	Slight skin penetration	86	43.65
	Superficial injury	57	28.94
Health status of the source patients	Known HIV/AIDS positive	37	18.78
	Clinically suspected HIV/AIDS	40	20.30
	Clinically diagnosed hepatitis B patient	27	13.17
	Unknown status	93	47.21
Report of the injuries	Yes	92	46.70
	No	105	53.30

HIV/AIDS, Human immune deficiency virus/Acquired immune deficiency syndrome

Distribution of sharp injuries by their type

The major types of sharps that cause injuries to nurses were intravenous needles, 64(32.49%), intramuscular needles, 42(21.32%) and suturing needles, 36(18.27%) (Figure1).

Association between independent variables and occupational exposure to sharp injuries

Nurses having above 10 years of service were 2.35 times more likely to encounter occupational exposure to sharp injuries than nurses having less than 5 years of service ((AOR= 2.35, 95%CI: 1.21,4.57). On the other hand, nurses who got infection prevention training were 46% less likely to encounter occupational exposure to sharp injuries (AOR=0.54, 95%CI: 0.29,0.92). Additionally, nurses having job related stress were also 2.24 times more likely to be exposed for sharp injuries (AOR=2.24, 95%CI: 1.27, 3.89), and nurses who were working in the area with the presence of

contaminated sharps were 2.76 times more likely to get the chance of occupational exposure to sharp injuries (AOR=2.76, 95%CI: 1.67, 4.72) (Table 4).

Table 4: Showing the association between independent variables with occupational exposure to sharp injuries among nurses working in public hospitals in south Gondar zone, Northcentral Ethiopia, 2022 (n=376).

Variables	Categories	Sharp injuries		COR (95%CI)	AOR (95%CI)
		Yes (%)	No (%)		
Sex	Male	108 (54.82)	66 (36.87)	2.15 (1.32,3.07)	1.98 (0.91,4.21)
	Female	89 (45.18)	113 (63.13)	1.00	1.00
Year of service	<5	59 (29.95)	77 (43.02)	1.00	1.00
	5-10	68 (34.52)	60 (33.52)	1.46 (0.87,2.42)	1.38 (0.72,2.64)
	>10	70 (35.53)	42 (23.46)	2.12 (1.26,3.49)	2.35 (1.21,4.57)***
Work load in the unit	Yes	125 (63.45)	87 (48.60)	1.73 (1.15,2.52)	1.42 (0.83,2.45)
	No	72 (36.55)	92 (51.40)	1.00	1.00
Training	Yes	38 (19.29)	51 (28.49)	0.48 (0.32,0.67)	0.54(0.29,0.92)****
	No	159 (80.71)	128 (71.51)	1.00	1.00
Nurses' knowledge of standard precaution	Adequate knowledge	59 (29.95)	75 (41.90)	1.00	1.00
	Inadequate knowledge	138 (70.05)	104 (58.10)	1.96 (1.31,2.94)	1.42 (0.79,2.39)
Nurses' job stress level	Stressed	149 (75.63)	88 (49.16)	2.45 (1.62,3.67)	2.24 (1.27,3.89)**
	Not stressed	48 (24.37)	91 (50.84)	1.00	1.00
Presence of contaminated sharps at workplace	Yes	136 (69.04)	78 (43.58)	2.71 (1.79,4.09)	2.76 (1.67,4.72)*
	No	61 (30.96)	101 (56.42)	1.00	1.00

*Significant at P=0.000, **Significant at P=0.005, ***Significant at P=0.011, and ****Significant at P=0.018.

Discussion

This study finding showed that the burden of occupational exposure to sharp injuries among nurses was 52.39%. This study finding also reported that years of service,

infection prevention training, job related stress, and the presence of contaminated sharps at work place were significantly associated with the occurrence of occupational exposure to sharp injuries among nurses.

In this study, the burden of occupational exposure to sharp injuries among nurses was 52.39%. This finding is higher than a study conducted in three hospitals, Izmir, Turkey(44.3%) [9], but lower than studies conducted in Public Sector Tertiary Care Hospitals of Pakistan (67%) [16], and JUSH, Southwest Ethiopia (61.76%) [1]. This variation might be due to the difference in study setting and period, as well as due to the difference in infection prevention training and knowledge level of the respondents towards standard precaution across study settings.

In this study, year of service was significantly associated with the occurrence of occupational exposure to sharp injuries among nurses at $p< 0.05$. This finding is similar with studies conducted in three hospitals, Izmir, Turkey [9], and a secondary care hospital, Gaza Strip [17], which showed that year of service had shown significant association with the occurrence of occupational exposure to sharp injuries among nurses at $p< 0.05$. It is due to the fact that as year of service increases, the chance of getting occupational exposure to sharp injuries also increases.

This study finding also indicated that nurses who got infection prevention training were 46% less likely to get the chance of occupational exposure to sharp injuries as compared with nurses who didn't get the training. This finding is in line with a study conducted in public hospitals of Jimma Zone, South West Ethiopia(8),which showed that nurses who got infection prevention training were 88% less likely to get the chance of getting occupational exposure to sharp injuries as compared with nurses who didn't

get the training. It is due to the fact that getting infection prevention training helps to understand and practice the standard precaution guide line easily, which in turn reduces the chance of getting occupational exposure to sharp injuries.

Similarly, this study finding also showed that job related stress was significantly associated with the occurrence of occupational exposure to sharp injuries among nurses. This finding is comparable with a study conducted in JUSH; Southwest Ethiopia which reported that job-related stress had shown significant association with the occurrence of occupational exposure to sharp injuries among nurses [1]. It is due to the fact that job-related stress might make nurses to lose their concentration and practice their daily activities unsafely.

Moreover, this study finding also showed that the presence of contaminated needles and sharp materials at work was also significantly associated with the occurrence of occupational exposure to sharp injuries among nurses at $P<0.05$. This finding is in line with a study conducted in JUSH, Southwest Ethiopia which reported the presence of contaminated needles and sharp materials at the work place was significantly associated with the occurrence of occupational exposure to sharp injuries among nurses at $p< 0.05$ [1]. It is due to the fact that the presence of contaminated needles and sharp materials at workplace increases the chance of getting occupational exposure to sharp injuries among nurses in their day-to-day workplace activities.

Limitation of the Study

This study might be subjected to recall and social desirability biases.

The study also might not show cause and effect relationships while the study design was cross sectional.

Conclusion

Generally, this study finding reported that the burden of occupational exposure to sharp injuries among nurses was high. This study finding also showed that years of service, infection prevention training, job related stress, and the presence of contaminated sharps at workplace were independent predictors of occupational exposure to sharp injuries among nurses working in public hospitals in south Gondar zone.

Recommendations

1. The Ministry of health, Amhara regional health bureau, different NGOs, and hospital administrators in collaboration should strengthen regular provision of health & safety information and infection prevention training to nurses at all levels.
2. All stakeholders, including nursing staffs, should strengthen their efforts to work together to identify and manage those job-related stressors among nurses.
3. Safety boxes should be available in each working unit, and nurses should also practice proper use of safety box more than ever in order to avoid the presence of contaminated needles and other sharp materials at workplace.
4. Nurses should also use PPEs properly when handing and working with needles and other sharp materials in order to reduce the chance of getting occupational exposure to sharp injuries.

Abbreviations and acronyms

AIDS	Acquired Immune Deficiency Syndrome
AOR	Adjusted Odds Ratio
CI	Confidence Interval
EBN	European Biosafety Network

ENSS Expanded Nursing Stress Scale

HBV Hepatitis B Virus

HCV Hepatitis C Virus

HIV Human Immune deficiency Virus

NGOs Non-Governmental Organizations

PPEs Personal Protective Equipments

Consent for Publication

Not applicable

Funding

Not applicable

Data availability

All data used for the study were included in the manuscript.

Competing interests

We declared that we have no any conflicts of interests.

Authors' contributions

Tigabu Munye Aytenew: Wrote the research proposal, conducted the study, did data entry and analysis

Yohannes Tesfahun Kassie: Involved in data entry and analysis

Solomon Demis Kebede: Involved in proposal development, and data analysis.

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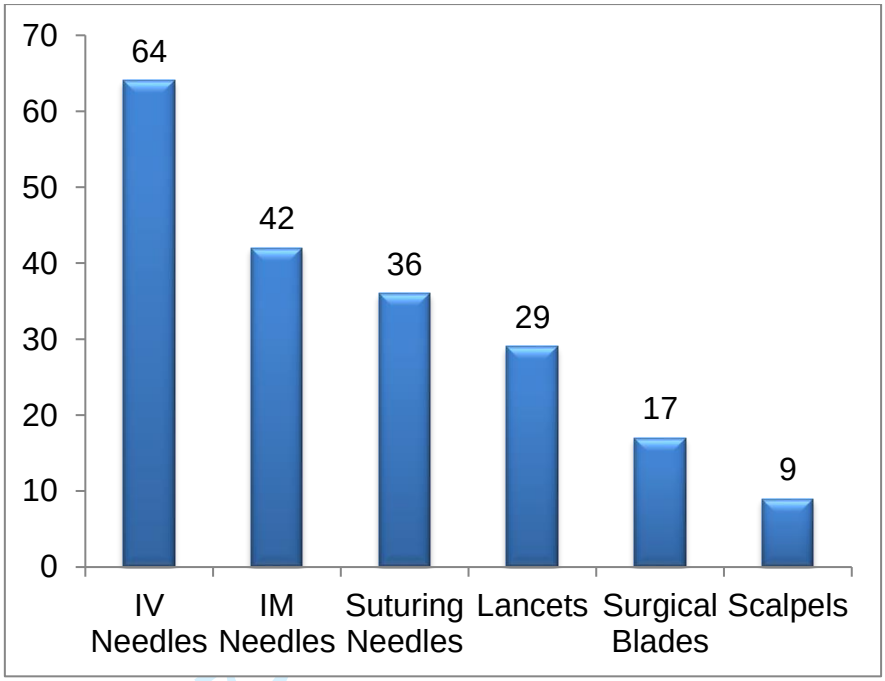

Figure 1: Distribution of sharp injuries by their type among nurses working in public hospitals in south Gondar zone, Northcentral Ethiopia, 2022 (n=376).

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

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		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	1-3
Objectives	#3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	#4	Present key elements of study design early in the paper	4
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4

Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	5
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-6
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	6-7
Bias	#9	Describe any efforts to address potential sources of bias	7
Study size	#10	Explain how the study size was arrived at	5
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	7-8
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	7-8
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	7-8
Statistical methods	#12c	Explain how missing data were addressed	7-8
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	7-8
Statistical methods	#12e	Describe any sensitivity analyses	7-8
Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	9
Participants	#13b	Give reasons for non-participation at each stage	9
Participants	#13c	Consider use of a flow diagram	10
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	10
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	10

Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	10-12
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	13-14
Main results	#16b	Report category boundaries when continuous variables were categorized	13-14
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	13-14
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	13-14
Discussion			
Key results	#18	Summarise key results with reference to study objectives	13-14
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	17
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	14-17
Generalisability	#21	Discuss the generalisability (external validity) of the study results	17
Other Information			
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

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Magnitude of occupational exposure to sharp injuries among Nurses working in South Gondar zone public hospitals, Northcentral Ethiopia: Institution-based cross-sectional study

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Magnitude of occupational exposure to sharp injuries among Nurses working in South Gondar zone public hospitals, Northcentral Ethiopia: Institution-based cross-sectional study

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ABSTRACT

Objective: The study aimed to determine the magnitude of occupational exposure to sharp injuries and identify its associated factors among nurses.

Design: Institution-based cross-sectional study design was conducted from November 01-30/2022.

Analysis: The collected data were entered into Epi-Data version 4.2; then, exported to Stata version 14 for analysis. Variables with a p-value of <0.05 at 95% CI were considered significantly associated with occupational exposure to sharp injuries.

Setting: The study was conducted in South Gondar zone public hospitals.

Participants: Nurses working in South Gondar zone public hospitals.

Results: Of the total respondents, 213 (56.65%) were between the age of 25-34 with the mean ± SD of age 30.22 ± 6.63 years. Similarly, 202 (53.72%) of the respondents were females. This study finding showed that the magnitude of occupational exposure to sharp injuries among nurses was 52.39% (95%CI: 47.92%, 56.37%). Moreover, this study finding showed that year of service >10 years (AOR=2.35, 95%CI: 1.21,4.57), lack of infection prevention training (AOR=1.85, 95%CI: 1.09, 3.45), job-related stress (AOR=2.24, 95%CI: 1.27, 3.89) and presence of contaminated sharps at workplace (AOR=2.76, 95%CI: 1.67, 4.72) were significantly associated with occupational exposure to sharp injuries among nurses.

Conclusions: Generally, this study finding reported that the magnitude of occupational exposure to sharp injuries among nurses was high. This study finding also showed that years of service >10 years, lack of infection prevention training, job-related stress and the presence of contaminated sharps at workplace were independent predictors of occupational exposure to sharp injuries among nurses. Hence, all the concerned bodies should strengthen regular provision of infection prevention training to nurses at all levels. Nurses should practice proper use of safety box more than ever in order to avoid the presence of contaminated needles and other sharp materials at workplace.

Keywords: Occupational exposure to sharp injuries, Nurses, Public hospitals.

Strengths and limitations of this study

- The findings could be strong evidence as a result of using census method.
- The study might be subjected to recall and social desirability biases.
- The study also might not show cause and effect relationships.

BACKGROUND

A sharp injury is ″an accidental penetrating wound with an instrument that is potentially contaminated with the body fluid of another person″ [1-10]. Sharp injuries occur when health care providers perform their clinical activities in the health care facilities, such as hospitals, health centers and clinics [3]. The majority of sharp injuries occur during administering injections, securing IV lines, drawing blood, checking blood sugar, recapping needles, poor handling and disposing of needles, and transferring blood or body fluids from a syringe to a specimen container [3, 4].

Globally, of the total of 35 million health care providers, it is estimated that 3 million experience sharp injuries every year; of these, nurses are at the greatest risk, with up to 50% of all sharp injuries being sustained by nurses [11, 12]. Because nurses have the highest rate of encountering sharp injuries among health care providers due to their prolonged exposure to needles and other sharp devices [13]. Most of these sharp injuries (90%) occur in developing countries, where the burden of blood borne infections in the general population is high and access to safety devices and personal protective equipments (PPEs) is limited, specifically more common in sub-Saharan African countries [14].

On average, health care providers in Africa suffer 2 to 4 sharp injuries every year [15]. In Sub-Saharan Africa, the magnitude of sharp injuries and their associated factors are not clearly understood among health care providers [16]. A study conducted in Jimma University Specialized Teaching Hospital (JUSTH), Ethiopia reported that the magnitude of occupational exposure to sharp injuries among nurses was 61.76% [3]. Sharp injuries are markedly the most common and preventable occupational hazards that health care

providers are exposed to and become high risk for the transmission of a variety of blood borne infections, such as hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (AIDS) [17, 18].

Blood-borne infections following sharp injuries have serious consequences, including long-term illness, psychological stress to the victims ,colleagues and family, disability and death [19]. In addition to the potential risks for infectious diseases, they also suffer for direct costs required for laboratory tests, including tests for HIV antibodies, hepatitis B serology and a baseline test for hepatitis C as well as any treatments for these infections [20]. The implementation of education, universal precautions, elimination of needle recapping, and use of sharp containers for safe disposal have reduced the chance of getting sharp injuries by 80% [6, 21].

Health care providers who followed universal precautions were 66% less likely to have needle sticks and sharp injuries than those who did not follow [22]. Training of handling objects, using instruments to grasp needles, reduction of the use of sharp devices, avoiding hand-to-hand passing of sharp instruments, decreasing of direct contact with needles, an appropriate disposal and using safety boxes properly can decrease the risk of getting sharp injuries [23].

In Ethiopia, where primary health care services are covered by nurses, it is important to develop their knowledge and practice on universal precautions since the risks of getting infections following sharp injuries are high in their day to day activities [4]. However, there is limited information in the study area that describes the magnitude of sharp injuries and its predictors among nurses. Therefore, this study aimed to determine the magnitude of occupational exposure to sharp injuries and identify its associated factors.

General objective

To assess the magnitude of occupational exposure to sharp injuries among nurses working in South Gondar zone public hospitals, Northcentral Ethiopia from November 01-30, 2022

Specific objectives

To determine the magnitude of occupational exposure to sharp injuries among nurses working in South Gondar zone public hospitals, Northcentral Ethiopia from November 01-30, 2022.

To identify the predictors of occupational exposure to sharp injuries among nurses working in South Gondar zone public hospitals, Northcentral Ethiopia from November 01-30, 2022.

METHODS

Study design, area and Period

Institution-based cross-sectional study design was conducted among nurses working in South Gondar zone public hospitals from November 01-30, 2022. South Gondar is one of the zonal administrations in Amhara region, Northern Ethiopia with an estimated area of 14,095.19 square kilometers. It is located by South and North Wollo zones in the East, Bahirdar Liyu zone and Lake Tana in the West, Central Gondar in the North, Waghimra zone in the Northeast and East and West Gojjam zones in the South (Figure 1). There are ten public hospitals in the zone, namely Debre Tabor comprehensive specialized hospital, Addis Zemen, Ebnat, Mekane-Eyesus, Andabet, Wogeda, Woreta, Nefas Mewucha, Dr. Ambachew Makonnen and Migbaru Kebede primary hospitals.

Source Population

All nurses working in all South Gondar zone public hospitals.

Study Population

All nurses working in all South Gondar zone public hospitals.

Inclusion and exclusion criteria

All nurses working in all South Gondar zone public hospitals at the time of the data collection period were included in the study; whereas nurses who were on sick leave, maternity leave, annual leave, and training at the time of data collection period were excluded from the study.

Patient and public involvement

None

Sample size determination

The sample size (n) was calculated by Computer-based Epi info7 software using a single population proportion at 95% CI, with a 5% margin of error, and by assuming the burden of occupational exposure to sharp injuries among nurses to be 61.76% [3].

$$n = \frac{(Z\alpha/2)^2 P (1-P)}{d^2}$$

Where: - n= the minimum sample size required for the study

Z= standard normal distribution (Z=1.96) with a 95% confidence interval

P= burden of occupational exposure to sharp injuries among nurses (61.76%=0.6176)

d=is a tolerable margin of error (d=5%=0.05)

$$n = \frac{(1.96)^2 0.6176(1-0.6176)}{(0.05)^2}$$

n=363. Then, by adding a 10% (0.1) non-response rate, the final sample size (n) was calculated to be 400. But, since it was the minimum sample size required, and the source population was only 402, the source population (402) was taken as a sample size for this study (census method was used).

Dependent Variable

Occupational exposure to sharp injuries

Independent variables

Socio-demographic characteristics: Age, sex, marital status, level of education and years of service.

Behavioral characteristics: Sleeping disturbance, following of standard precaution guide line, use of PPE, knowledge of standard precautions and job-related stress.

Work environment characteristics: Length of stay/shift, health and safety information access, infection prevention training, work load, availability of safety box, availability of standard precaution guidelines and presence of contaminated sharps.

Operational Definitions

Occupational exposure to sharp injuries: Any kind of needle stick and/or other sharp injury which occurred among nurses in relation to his/her job in the health care facility [4].

Knowledge: Nurses who have scored ≥75% (9) of 12 knowledge-related questions were considered to have adequate knowledge; whereas nurses who have scored below 75% were also considered to have inadequate knowledge towards sharp injuries [24].

Job-related stress: Nurses who scored above or equal to the mean score (32.78) of the Likert-scale questions that used to assess nurses' job-related stress were

considered they have a job-related stress, whereas nurses who scored below the mean score were also considered they didn't have job-related stress [25].

Workload: When one trained intensive care unit (ICU) nurse provides nursing care services for more than two patients in the ICU, and when one nurse provides nursing care services for more than 6 patients in inpatient departments per shift [25].

Sleeping disturbance: The presence of sleeping problems while the health care provider is at workplace [25].

Data collection tool and procedure

A structured and pre-tested self-administered English version questionnaire was used to collect the data. The questionnaire was prepared by reviewing different literatures [3, 4, 25], and using standardized Expanded Nursing Stress Scale (ENSS) Likert-scale questions to assess job-related stress of the respondents [3, 4, 25].

The questionnaire contains nurses' socio-demographic, behavioral, environmental characteristics, knowledge questions related to standard precaution and standardized Likert-scale questions to assess job-related stress of the respondents. Reliability of the tool was established with an overall Cronbach's alpha score (0.74 for knowledge questions related to standard precaution, and 0.79 for job-related stress Likert-scale questions). Training was given to the data collectors, and before giving the questionnaire, the data collectors informed the nurses about the aims/purposes, risks and possible benefits of the study, the right and refusal to participate in the study, and that the collected information would be kept confidential.

After all, those nurses who were willing and have signed the informed voluntary consent form were requested to fill out the questionnaire. The data collection was held for four consecutive weeks (from November 01-30/2022).

Data quality control

Five percent of the questionnaire was pre-tested from October 23-27/2022 in Koladiba primary hospital to assess the reliability, clarity, consistency, understandability and the total time that it would take to complete the questionnaire prior to the actual data collection. Then, the necessary comments and feedback were incorporated in the final tool to improve its quality. Training was given for the data collectors regarding the objective of the study, data collection tool, ways of data collection, checking the completeness of the collected data, and how to maintain confidentiality.

The collected data were checked for completeness, cleaned, edited, coded manually, and entered into Epi data version 4.2. Double data entry was done for its validity, and compared to the original data. Outliers were checked, and simple frequencies and cross tabulation were done for missing values and variables.

Data processing and analysis

Then after, the data were exported to Stata version 14 for analysis. Descriptive analysis was done by computing proportions and summary statistics. The information was presented using simple frequencies, summary measures, tables, and figures. Binary logistic regression was used to identify the associated factors of occupational exposure to sharp injuries. Bivariate and multivariate analyses were used to see the association between the outcome variable, and each independent variable. The assumptions for

binary logistic regression were checked. The goodness of fit was tested by Hosmer-Lemeshow statistics and Omnibus tests.

All variables with P<0.2 in the bivariate analysis were included in the final multivariable analysis model in order to control all the possible confounders, and the variables were selected using enter method. The adjusted odds ratio (AOR) along with a 95% CI was estimated to identify the associated factors of occupational exposure to sharp injuries. In this study, variables with a P-value of <0.05 were considered significantly associated with occupational exposure to sharp injuries.

RESULTS

Of the total of 402 respondents, 376 were included in the final analysis, giving a response rate of 93.53%.

Socio-demographic and working environment related attributes

Of the total respondents, 213 (56.65%) were between the age of 25-34 with the mean ± SD of age 30.22 ± 6.63 years. Similarly, 202 (53.72%) of the respondents were females. Additionally, only 89 (23.67%) of the respondents got infection prevention training. Moreover, 271 (72.07%) of them had safety boxes at workplace to dispose needles and other sharp materials after use, and 214 (56.91%) of respondents also stated that there were contaminated needles and sharp materials at workplace (Table 1).

Table 1: Socio-demographic characteristics of the respondents working in South Gondar zone public hospitals, Northcentral Ethiopia, 2022 (n=376).

Variables	Category	Frequency	Percentage (%)

Age	≤24	68	18.09
	25-34	213	56.65
	35-44	71	18.88
	≥45	24	6.38
Sex	Male	174	46.28
	Female	202	53.72
Marital status	Single	171	45.48
	Married	183	48.67
	Divorced	17	4.52
	Widowed	5	1.33
Educational level	Diploma	132	35.11
	BSc	244	64.89
Years of service	<5	136	36.17
	5-10	128	34.04
	>10	112	29.79
Sleeping disturbance problem	Yes	274	72.87
	No	102	27.13
Use of PPEs	All of the time	185	49.20
	Most of the time	102	27.13
	Sometimes	73	19.41
	Never use	16	4.26
Workload in the unit	Yes	212	56.38
	No	164	43.62
Length of stay/shift at work	≤8 hours	193	51.33
	9-14 hours	35	9.31
	≥15 hours	148	39.36
Health and safety information access	Yes	291	77.39
	No	85	22.61
Training on IP	Yes	89	23.67
	No	287	76.33

Availab. of safety box at workplace	Yes	271	72.07
	No	105	27.93
Availab. of universal precaution guide line	Yes	212	56.38
	No	164	43.62
Following universal precaution guide line	Yes	93	43.87
	No	119	56.13
Presence of contaminated sharps at workplace	Yes	214	56.91
	No	162	43.09
Knowledge of standard precaution	Adequate knowledge	134	35.64
	Inadequate knowledge	242	64.36
Job-related stress	Stressed	237	63.03
	Not stressed	139	36.97

*BSc, Bachelor of Science; *IP, infection prevention; PPEs, personal protective equipments

Magnitude of occupational exposure to sharp injuries

This study finding showed that the magnitude of occupational exposure to sharp injuries among nurses was 52.39% (95%CI: 47.92%, 56.37%) (197).

The occurrence of occupational exposure to sharp injuries was the highest among respondents with the age of 45 years and above (62.50). Likewise, the majority of males, 108(62.07) also got occupational exposure to sharp injuries. Occupational exposure to sharp injuries was also the highest among diploma nurses, and nurses having more than 10 years of service (59.85% and 62.50%) respectively. Moreover, the occurrence of sharp injuries was also the highest among nurses working along with the presence of contaminated sharps at workplace (63.55%) (Table 2).

Table 2: Distribution of sharp injuries among nurses working in South Gondar zone public hospitals, Northcentral Ethiopia, 2022 (n=376).

Variables	Categories	Occupational exposure to sharp injuries

		Yes (%)	No (%)
Age	≤24	32(47.06)	36(52.94)
	25-34	111(52.11)	102(47.89)
	35-44	39(54.93)	32(45.07)
	≥45	15(62.50)	9(37.50)
Sex	Male	108(62.07)	66(37.93)
	Female	89(44.06)	113(55.94)
Marital status	Single	87(50.88)	84(49.12)
	Married	96(52.46)	87(47.54)
	Divorced	11(64.71)	6(32.29)
	Widowed	3(60.0)	2(40.0)
Educational level	Diploma	79(59.85)	53(40.15)
	BSc	118(48.36)	126(51.64)
Year of service	<5	59(43.38)	77(56.62)
	5-10	68(53.13)	60(46.87)
	>10	70(62.50)	42(37.50)
Sleeping disturbance problem	Yes	141(51.46)	133(48.54)
	No	56(54.90)	46(45.10)
Use of PPEs	All of the time	89(48.11)	96(51.89)
	Most of the time	56(54.90)	46(45.10)
	Sometimes	41(56.16)	32(43.84)
	Never use	11(58.75)	5(31.25)
Workload	Yes	125(58.96)	87(41.04)
	No	72(43.90)	92(56.10)
Length of stay/shift at work	≤8 hours	95(49.22)	98(50.78)
	9-14 hours	19(54.29)	16(45.71)
	≥15 hours	83(56.08)	65(43.92)
Health & safety information access	Yes	148(50.86)	143(49.14)
	No	49(57.65)	36(42.35)
Training on IP	Yes	38(42.70)	51(57.30)
	No	159(55.40)	128(44.60)

Availab. of safety box	Yes	129(47.60)	142(52.40)
	No	68(64.76)	37(35.24)
Availab. of universal precaution guide line	Yes	99(46.70)	113(53.30)
	No	98(59.76)	66(40.24)
Following universal precaution guide line	Yes	42 (45.16)	51(54.84)
	No	155 (54.77)	128 (45.23)
Presence of contaminated sharps at workplace	Yes	136(63.55)	78(36.45)
	No	61(37.65)	101(62.35)
Knowledge of standard precaution	Adequate knowledge	59(44.03)	75(55.97)
	Inadequate knowledge	138(57.02)	104(42.98)
Job-related stress	Stressed	149(62.87)	88(37.13)
	Not stressed	48(34.53)	91(65.47)

**BSc, Bachelor of Science; PPEs, personal protective equipments; and IP, infection prevention*

Occupational exposure to sharp injuries related Attributes

Of the respondents who encountered occupational exposure to sharp injuries, 114(57.87%) had encountered sharp injuries 1-2 times. Additionally, 69 (35.03%) of injuries occurred during abrupt movement of patients, and 86(43.65%) sharp injuries were slight skin penetration. Moreover, 93 (47.21%) of injuries were from the unknown status, and only 92 (46.70%) sharp injuries were reported to the concerned body (Table 3).

Table 3: Occupational exposure to sharp injuries related attributes among nurses working in South Gondar zone public hospitals, Northcentral Ethiopia, 2022 (n=376).

Variables	Values	Frequency	Percentage (%)
Frequency of injuries occurred	1-2 times	114	57.87
	3-4 times	71	36.04
	≥5 times	12	6.09
Condition of sharps	Dirty needles/sharps	74	37.56

	Sterile needles/sharps	58	29.45
	Both dirty & sterile needles/sharps	65	32.99
How sustaining injuries	During abrupt movement of patients	69	35.03
	During recapping needle after use	63	31.98
	During sharp collection	46	23.35
	Others	19	9.64
Type of injuries sustained	Deep injury	54	27.41
	Slight skin penetration	86	43.65
	Superficial injury	57	28.94
Health status of the source patients	Known HIV/AIDS positive	37	18.78
	Clinically suspected HIV/AIDS	40	20.30
	Clinically diagnosed hepatitis B patient	27	13.17
	Unknown status	93	47.21
Report of the injuries	Yes	92	46.70
	No	105	53.30

HIV/AIDS, Human immune deficiency virus/Acquired immune deficiency syndrome

Distribution of sharp injuries by their type

The types of sharps that cause injuries to nurses were intravenous needles, 64(32.49%), intramuscular needles, 42(21.32%), suturing needles, 36(18.27%), lancets, 29 (14.72%), surgical blades, 17 (8.63%) and scalpels, 9 (4.57%).

Factors associated with occupational exposure to sharp injuries

Nurses having above 10 years of service were 2.35 times more likely to encounter occupational exposure to sharp injuries than nurses having less than 5 years of service (AOR=2.35, 95%CI: 1.21,4.57). On the other hand, nurses who didn't get infection prevention training were 1.85 times more likely to encounter occupational exposure to

sharp injuries (AOR=1.85, 95%CI: 1.09, 3.45). Additionally, nurses having job-related stress were also 2.24 times more likely to be exposed for sharp injuries (AOR=2.24, 95%CI: 1.27, 3.89), and nurses who were working in the area with the presence of contaminated sharps were 2.76 times more likely to get the chance of occupational exposure to sharp injuries (AOR=2.76, 95%CI: 1.67, 4.72) (Table 4).

Table 4: Showing the association between independent variables with occupational exposure to sharp injuries among nurses working in South Gondar zone public hospitals, Northcentral Ethiopia, 2022 (n=376).

Variables	Categories	Sharp injuries		COR (95%CI)	AOR (95%CI)
		Yes (%)	No (%)		
Sex	Male	108 (54.82)	66 (36.87)	2.15 (1.32,3.07)	1.98 (0.91,4.21)
	Female	89 (45.18)	113 (63.13)	1.00	1.00
Year of service	<5	59 (29.95)	77 (43.02)	1.00	1.00
	5-10	68 (34.52)	60 (33.52)	1.46 (0.87,2.42)	1.38 (0.72,2.64)
	>10	70 (35.53)	42 (23.46)	2.12 (1.26,3.49)	2.35 (1.21,4.57) ***
Workload in the unit	Yes	125 (63.45)	87 (48.60)	1.73 (1.15,2.52)	1.42 (0.83,2.45)
	No	72 (36.55)	92 (51.40)	1.00	1.00
Training	Yes	38 (19.29)	51 (28.49)	1.00	1.00
	No	159 (80.71)	128 (71.51)	2.08 (1.49, 3.13)	1.85(1.09, 3.45) ****
Nurses' knowledge of standard precaution	Adequate knowledge	59 (29.95)	75 (41.90)	1.00	1.00
	Inadequate knowledge	138 (70.05)	104 (58.10)	1.96 (1.31,2.94)	1.42 (0.79,2.39)
Nurses' job stress level	Stressed	149 (75.63)	88 (49.16)	2.45 (1.62,3.67)	2.24 (1.27,3.89) **
	Not stressed	48 (24.37)	91 (50.84)	1.00	1.00
Presence of contaminated sharps	Yes	136 (69.04)	78 (43.58)	2.71 (1.79,4.09)	2.76 (1.67,4.72) *
	No	61 (30.96)	101 (56.42)	1.00	1.00

*Significant at P=0.000, **Significant at P=0.005, ***Significant at P=0.011, and ****Significant at P=0.018.

DISCUSSION

This study finding showed that the magnitude of occupational exposure to sharp injuries among nurses was 52.39%. This study finding also reported that years of service >10 years, lack of infection prevention training, job-related stress, and the presence of contaminated sharps at workplace were significantly associated with the occurrence of occupational exposure to sharp injuries among nurses.

In this study, the magnitude of occupational exposure to sharp injuries among nurses was 52.39%. This finding was higher than a study conducted in three hospitals, Izmir, Turkey (44.3%) [18], but lower than studies conducted in Public Sector Tertiary Care Hospitals of Pakistan (67%) [26], and JUSH, Southwest Ethiopia (61.76%) [3]. This variation might be due to the difference in study setting and period, as well as due to the difference in infection prevention training and knowledge level of the respondents towards standard precaution across study settings.

In this study, year of service >10 years was significantly associated with the occurrence of occupational exposure to sharp injuries among nurses at $p < 0.05$. This finding was similar with studies conducted in three hospitals, Izmir, Turkey [18], and a secondary care hospital, Gaza Strip [27], which showed that year of service had shown significant association with the occurrence of occupational exposure to sharp injuries among nurses at $p < 0.05$. It might be due to the fact that as year of service increases, the chance of getting occupational exposure to sharp injuries also increases.

This study finding also indicated that nurses who didn't get infection prevention training were 1.85 times more likely to get the chance of occupational exposure to sharp injuries compared to nurses who got the training. This finding was in line with a study conducted in public hospitals of Jimma Zone, South West Ethiopia [4], which showed

that nurses who didn't get infection prevention training were 8.33 times more likely to get the chance of occupational exposure to sharp injuries compared to nurses who got the training. It is due to the fact that getting infection prevention training helps to understand and practice the standard precaution guide line easily, which in turn reduces the chance of getting occupational exposure to sharp injuries.

Similarly, this study finding also showed that job-related stress was significantly associated with the occurrence of occupational exposure to sharp injuries among nurses. This finding was comparable with a study conducted in JUSH, Southwest Ethiopia which reported that job-related stress had shown significant association with the occurrence of occupational exposure to sharp injuries among nurses [14]. It could be explained that job-related stress might make nurses to lose their concentration and practice their daily activities unsafely.

Moreover, this study finding also showed that the presence of contaminated needles and sharp materials at workplace was also significantly associated with the occurrence of occupational exposure to sharp injuries among nurses at P <0.05. This finding was congruent with a study conducted in JUSH, Southwest Ethiopia which reported that the presence of contaminated needles and sharp materials at the workplace was significantly associated with the occurrence of occupational exposure to sharp injuries among nurses at p <0.05 [3]. The presence of contaminated needles and sharp materials at workplace increases the chance of getting occupational exposure to sharp injuries among nurses in their day-to-day workplace activities.

Strengths and limitations of this study

The study used census method, as a result, the findings could be strong evidence for the problem. However, the study might be subjected to recall and social desirability biases. The study also might not show cause and effect relationships while the study design was cross sectional.

CONCLUSIONS

Generally, this study finding reported that the magnitude of occupational exposure to sharp injuries among nurses was high. Moreover, this study finding also showed that years of service >10 years, lack of infection prevention training, job-related stress, and the presence of contaminated sharps at workplace were independent predictors of occupational exposure to sharp injuries among nurses.

Prevention and control strategies

Continually educate the health care team: To achieve the desired infection prevention and control goals, training on infection prevention and control should be given to the staff on a continual basis covering the standard infection prevention and control precautions.

Conducting regular clinical audits: It used to ensure best practice of the standard infection prevention and control precautions such as proper use of personal protective equipments, disposal of used needles and other sharps and hand hygiene.

Creating a cleanliness culture: By building a clean culture, staff are aware of the benefits of infection prevention and control.

Recommendations

All the concerned bodies should strengthen regular provision of infection prevention training to the nurses at all levels. Stakeholders, including nursing staffs should also

strengthen their efforts to work together to identify and manage the possible job-related stressors among nurses. Furthermore, safety boxes should be available in each working unit, and nurses should also practice proper use of safety box more than ever in order to avoid the presence of contaminated needles and other sharp materials at workplace.

Abbreviations and acronyms

AIDS: Acquired Immune Deficiency Syndrome

AOR: Adjusted Odds Ratio

CI: Confidence Interval

EBN: European Biosafety Network

ENSS: Expanded Nursing Stress Scale

HBV: Hepatitis B Virus

HCV: Hepatitis C Virus

HIV: Human Immune deficiency Virus

ICU: Intensive Care Unit

PPEs: Personal Protective Equipments

Consent for Publication

Not applicable.

Funding

Not applicable.

Data availability

All data used for the study were included in the manuscript.

Competing interests

We declared that we have no any conflicts of interests.

Patient and public involvement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of the research.

Patient concent for publication

Consent was obtained from the respondents.

Ethical approval

The study involved human participants and was approved by Debre Tabor University, College of Health Sciences, ethical review board (Ref No.CHS/048/2022). All the respondents were informed about the purpose of the study, their right to refuse, and written and signed voluntary consent was obtained from all the respondents prior to data collection. The respondents were told that the information obtained from them would be treated with complete confidentiality, and would not cause any harm to them.

Provenance and peer review

Not commissioned; externally reviewed.

Contributors

Tigabu Munye Aytenew: Wrote the research proposal, conducted the study, did data entry and analysis.

Yohannes Tesfahun Kassie: Involved in data entry and analysis.

Solomon Demis Kebede: Involved in proposal development, and data analysis.

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Figure 1: Map of South Gondar Zone (Source; Ethio GIS, 1994).

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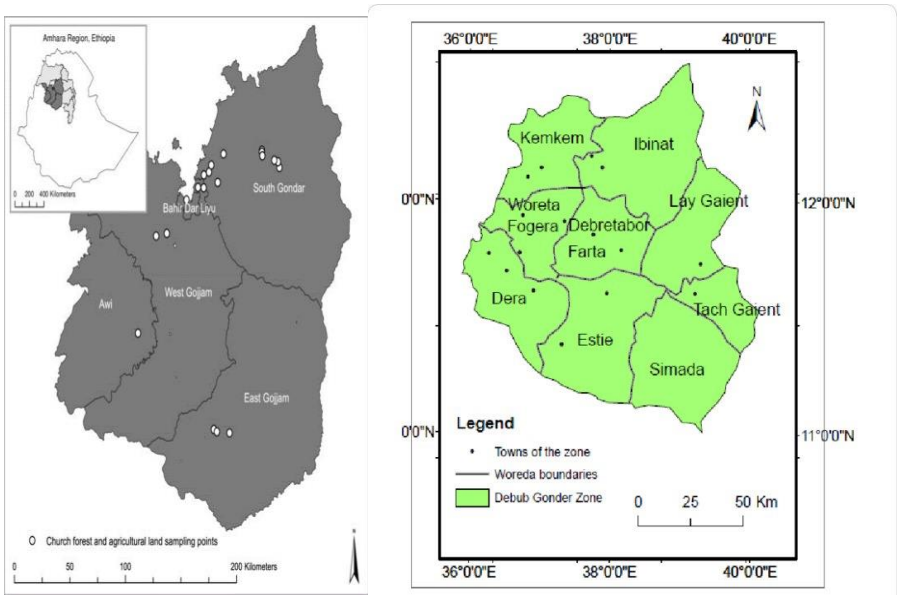

Figure 1: Map of South Gondar Zone (Source; Ethio GIS, 1994)

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

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		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	1-3
Objectives	#3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	#4	Present key elements of study design early in the paper	4
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4

Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	5
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-6
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	6-7
Bias	#9	Describe any efforts to address potential sources of bias	7
Study size	#10	Explain how the study size was arrived at	5
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	7-8
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	7-8
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	7-8
Statistical methods	#12c	Explain how missing data were addressed	7-8
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	7-8
Statistical methods	#12e	Describe any sensitivity analyses	7-8
Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	9
Participants	#13b	Give reasons for non-participation at each stage	9
Participants	#13c	Consider use of a flow diagram	10
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	10
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	10

Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	10-12
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	13-14
Main results	#16b	Report category boundaries when continuous variables were categorized	13-14
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	13-14
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	13-14
Discussion			
Key results	#18	Summarise key results with reference to study objectives	13-14
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	17
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	14-17
Generalisability	#21	Discuss the generalisability (external validity) of the study results	17
Other Information			
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

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Magnitude of occupational exposure to sharp injuries among Nurses working in South Gondar zone public hospitals, Northcentral Ethiopia: Institution-based cross-sectional study

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Magnitude of occupational exposure to sharp injuries among Nurses working in South Gondar zone public hospitals, Northcentral Ethiopia: Institution-based cross-sectional study

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ABSTRACT

Objective: The study aimed to determine the magnitude of occupational exposure to sharp injuries and identify its associated factors among nurses.

Design: Institution-based cross-sectional study design was conducted from November 01-30/2022.

Analysis: The collected data were entered into Epi-Data version 4.2; then, exported to Stata version 14 for analysis. Variables with a p-value of <0.05 at 95% CI were considered significantly associated with occupational exposure to sharp injuries.

Setting: The study was conducted in South Gondar zone public hospitals.

Participants: Nurses working in South Gondar zone public hospitals.

Results: Of the total respondents, 213 (56.65%) were between the age of 25-34 with the mean ± SD of age 30.22 ± 6.63 years. Similarly, 202 (53.72%) of the respondents were females. This study finding showed that the magnitude of occupational exposure to sharp injuries among nurses was 52.39% (95%CI: 47.92%, 56.37%). Moreover, this study finding showed that year of service >10 years (AOR=2.35, 95%CI: 1.21,4.57), lack of infection prevention training (AOR=1.85, 95%CI: 1.09, 3.45), job-related stress (AOR=2.24, 95%CI: 1.27, 3.89) and presence of contaminated sharps at workplace (AOR=2.76, 95%CI: 1.67, 4.72) were significantly associated with occupational exposure to sharp injuries among nurses.

Conclusions: Generally, this study finding reported that the magnitude of occupational exposure to sharp injuries among nurses was high. This study finding also showed that years of service >10 years, lack of infection prevention training, job-related stress and the presence of contaminated sharps at workplace were independent predictors of occupational exposure to sharp injuries among nurses. Hence, all the concerned bodies should strengthen regular provision of infection prevention training to nurses at all levels. Nurses should practice proper use of safety box more than ever in order to avoid the presence of contaminated needles and other sharp materials at workplace.

Keywords: Occupational exposure to sharp injuries, Nurses, Public hospitals.

Strengths and limitations of this study

- The findings could be strong evidence as a result of using census method.
- The study might be subjected to recall and social desirability biases.
- The study also might not show cause and effect relationships.

BACKGROUND

A sharp injury is ″an accidental penetrating wound with an instrument that is potentially contaminated with the body fluid of another person″ [1-10]. Sharp injuries occur when health care providers perform their clinical activities in the health care facilities, such as hospitals, health centers and clinics [3]. The majority of sharp injuries occur during administering injections, securing IV lines, drawing blood, checking blood sugar, recapping needles, poor handling and disposing of needles, and transferring blood or body fluids from a syringe to a specimen container [3, 4].

Globally, of the total of 35 million health care providers, it is estimated that 3 million experience sharp injuries every year; of these, nurses are at the greatest risk, with up to 50% of all sharp injuries being sustained by nurses [11, 12]. Because nurses have the highest rate of encountering sharp injuries among health care providers due to their prolonged exposure to needles and other sharp devices [13]. Most of these sharp injuries (90%) occur in developing countries, where the burden of blood borne infections in the general population is high and access to safety devices and personal protective equipments (PPEs) is limited, specifically more common in sub-Saharan African countries [14].

On average, health care providers in Africa suffer 2 to 4 sharp injuries every year [15]. In Sub-Saharan Africa, the magnitude of sharp injuries and their associated factors are not clearly understood among health care providers [16]. A study conducted in Jimma University Specialized Teaching Hospital (JUSTH), Ethiopia reported that the magnitude of occupational exposure to sharp injuries among nurses was 61.76% [3]. Sharp injuries are markedly the most common and preventable occupational hazards that health care

providers are exposed to and become high risk for the transmission of a variety of blood borne infections, such as hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (AIDS) [17, 18].

Blood-borne infections following sharp injuries have serious consequences, including long-term illness, psychological stress to the victims ,colleagues and family, disability and death [19]. In addition to the potential risks for infectious diseases, they also suffer for direct costs required for laboratory tests, including tests for HIV antibodies, hepatitis B serology and a baseline test for hepatitis C as well as any treatments for these infections [20]. The implementation of education, universal precautions, elimination of needle recapping, and use of sharp containers for safe disposal have reduced the chance of getting sharp injuries by 80% [6, 21].

Health care providers who followed universal precautions were 66% less likely to have needle sticks and sharp injuries than those who did not follow [22]. Training of handling objects, using instruments to grasp needles, reduction of the use of sharp devices, avoiding hand-to-hand passing of sharp instruments, decreasing of direct contact with needles, an appropriate disposal and using safety boxes properly can decrease the risk of getting sharp injuries [23].

In Ethiopia, where primary health care services are covered by nurses, it is important to develop their knowledge and practice on universal precautions since the risks of getting infections following sharp injuries are high in their day to day activities [4]. However, there is limited information in the study area that describes the magnitude of sharp injuries and its predictors among nurses. Therefore, this study aimed to determine the magnitude of occupational exposure to sharp injuries and identify its associated factors.

General objective

To assess the magnitude of occupational exposure to sharp injuries among nurses working in South Gondar zone public hospitals, Northcentral Ethiopia from November 01-30, 2022

Specific objectives

To determine the magnitude of occupational exposure to sharp injuries among nurses working in South Gondar zone public hospitals, Northcentral Ethiopia from November 01-30, 2022.

To identify the predictors of occupational exposure to sharp injuries among nurses working in South Gondar zone public hospitals, Northcentral Ethiopia from November 01-30, 2022.

METHODS

Study design, area and Period

Institution-based cross-sectional study design was conducted among nurses working in South Gondar zone public hospitals from November 01-30, 2022. South Gondar is one of the zonal administrations in Amhara region, Northern Ethiopia with an estimated area of 14,095.19 square kilometers. It is located by South and North Wollo zones in the East, Bahirdar Liyu zone and Lake Tana in the West, Central Gondar in the North, Waghimra zone in the Northeast and East and West Gojjam zones in the South (Figure 1). There are ten public hospitals in the zone, namely Debre Tabor comprehensive specialized hospital, Addis Zemen, Ebnat, Mekane-Eyesus, Andabet, Wogeda, Woreta, Nefas Mewucha, Dr. Ambachew Makonnen and Migbaru Kebede primary hospitals.

Source Population

All nurses working in all South Gondar zone public hospitals.

Study Population

All nurses working in all South Gondar zone public hospitals.

Inclusion and exclusion criteria

All nurses working in all South Gondar zone public hospitals at the time of the data collection period were included in the study; whereas nurses who were on sick leave, maternity leave, annual leave, and training at the time of data collection period were excluded from the study.

Patient and public involvement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of the research.

Sample size determination

The sample size (n) was calculated by Computer-based Epi info7 software using a single population proportion at 95% CI, with a 5% margin of error, and by assuming the burden of occupational exposure to sharp injuries among nurses to be 61.76% [3].

$$n = \frac{(Z\alpha/2)^2 P (1-P)}{d^2}$$

Where: - n= the minimum sample size required for the study

Z= standard normal distribution (Z=1.96) with a 95% confidence interval

P= burden of occupational exposure to sharp injuries among nurses (61.76%=0.6176)

d=is a tolerable margin of error (d=5%=0.05)

$$n = \frac{(1.96)^2 0.6176(1-0.6176)}{}$$

$(0.05)^2$

n=363. Then, by adding a 10% (0.1) non-response rate, the final sample size (n) was calculated to be 400. But, since it was the minimum sample size required, and the source population was only 402, the source population (402) was taken as a sample size for this study (census method was used).

Dependent Variable

Occupational exposure to sharp injuries

Independent variables

Socio-demographic characteristics: Age, sex, marital status, level of education and years of service.

Behavioral characteristics: Sleeping disturbance, following of standard precaution guide line, use of PPE, knowledge of standard precautions and job-related stress.

Work environment characteristics: Length of stay/shift, health and safety information access, infection prevention training, work load, availability of safety box, availability of standard precaution guidelines and presence of contaminated sharps.

Operational Definitions

Occupational exposure to sharp injuries: Any kind of needle stick and/or other sharp injury which occurred among nurses in relation to his/her job in the health care facility [4].

Knowledge: Nurses who have scored ≥75% (9) of 12 knowledge-related questions were considered to have adequate knowledge; whereas nurses who have scored below 75% were also considered to have inadequate knowledge towards sharp injuries [24].

Job-related stress: Nurses who scored above or equal to the mean score (32.78) of the Likert-scale questions that used to assess nurses' job-related stress were considered

they have a job-related stress, whereas nurses who scored below the mean score were also considered they didn't have job-related stress [25].

Workload: When one trained intensive care unit (ICU) nurse provides nursing care services for more than two patients in the ICU, and when one nurse provides nursing care services for more than 6 patients in inpatient departments per shift [25].

Sleeping disturbance: The presence of sleeping problems while the health care provider is at workplace [25].

Data collection tool and procedure

A structured and pre-tested self-administered English version questionnaire was used to collect the data. The questionnaire was prepared by reviewing different literatures [3, 4, 25], and using standardized Expanded Nursing Stress Scale (ENSS) Likert-scale questions to assess job-related stress of the respondents [3, 4, 25].

The questionnaire contains nurses' socio-demographic, behavioral, environmental characteristics, knowledge questions related to standard precaution and standardized Likert-scale questions to assess job-related stress of the respondents. Reliability of the tool was established with an overall Cronbach's alpha score (0.74 for knowledge questions related to standard precaution, and 0.79 for job-related stress Likert-scale questions). Training was given to the data collectors, and before giving the questionnaire, the data collectors informed the nurses about the aims/purposes, risks and possible benefits of the study, the right and refusal to participate in the study, and that the collected information would be kept confidential.

After all, those nurses who were willing and have signed the informed voluntary consent form were requested to fill out the questionnaire. The data collection was held for four consecutive weeks (from November 01-30/2022).

Data quality control

Five percent of the questionnaire was pre-tested from October 23-27/2022 in Koladiba primary hospital to assess the reliability, clarity, consistency, understandability and the total time that it would take to complete the questionnaire prior to the actual data collection. Then, the necessary comments and feedback were incorporated in the final tool to improve its quality. Training was given for the data collectors regarding the objective of the study, data collection tool, ways of data collection, checking the completeness of the collected data, and how to maintain confidentiality.

The collected data were checked for completeness, cleaned, edited, coded manually, and entered into Epi data version 4.2. Double data entry was done for its validity, and compared to the original data. Outliers were checked, and simple frequencies and cross tabulation were done for missing values and variables.

Data processing and analysis

Then after, the data were exported to Stata version 14 for analysis. Descriptive analysis was done by computing proportions and summary statistics. The information was presented using simple frequencies, summary measures, tables, and figures. Binary logistic regression was used to identify the associated factors of occupational exposure to sharp injuries. Bivariate and multivariate analyses were used to see the association between the outcome variable, and each independent variable. The assumptions for

binary logistic regression were checked. The goodness of fit was tested by Hosmer-Lemeshow statistics and Omnibus tests.

All variables with P<0.2 in the bivariate analysis were included in the final multivariable analysis model in order to control all the possible confounders, and the variables were selected using enter method. The adjusted odds ratio (AOR) along with a 95% CI was estimated to identify the associated factors of occupational exposure to sharp injuries. In this study, variables with a P-value of <0.05 were considered significantly associated with occupational exposure to sharp injuries.

RESULTS

Of the total of 402 respondents, 376 were included in the final analysis, giving a response rate of 93.53%.

Socio-demographic and working environment related attributes

Of the total respondents, 213 (56.65%) were between the age of 25-34 with the mean ± SD of age 30.22 ± 6.63 years. Similarly, 202 (53.72%) of the respondents were females. Additionally, only 89 (23.67%) of the respondents got infection prevention training. Moreover, 271 (72.07%) of them had safety boxes at workplace to dispose needles and other sharp materials after use, and 214 (56.91%) of respondents also stated that there were contaminated needles and sharp materials at workplace (Table 1).

Table 1: Socio-demographic characteristics of the respondents working in South Gondar zone public hospitals, Northcentral Ethiopia, 2022 (n=376).

Variables	Category	Frequency	Percentage (%)

Age	≤24	68	18.09
	25-34	213	56.65
	35-44	71	18.88
	≥45	24	6.38
Sex	Male	174	46.28
	Female	202	53.72
Marital status	Single	171	45.48
	Married	183	48.67
	Divorced	17	4.52
	Widowed	5	1.33
Educational level	Diploma	132	35.11
	BSc	244	64.89
Years of service	<5	136	36.17
	5-10	128	34.04
	>10	112	29.79
Sleeping disturbance problem	Yes	274	72.87
	No	102	27.13
Use of PPEs	All of the time	185	49.20
	Most of the time	102	27.13
	Sometimes	73	19.41
	Never use	16	4.26
Workload in the unit	Yes	212	56.38
	No	164	43.62
Length of stay/shift at work	≤8 hours	193	51.33
	9-14 hours	35	9.31
	≥15 hours	148	39.36
Health and safety information access	Yes	291	77.39
	No	85	22.61
Training on IP	Yes	89	23.67
	No	287	76.33

Availab. of safety box at workplace	Yes	271	72.07
	No	105	27.93
Availab. of universal precaution guide line	Yes	212	56.38
	No	164	43.62
Following universal precaution guide line	Yes	93	43.87
	No	119	56.13
Presence of contaminated sharps at workplace	Yes	214	56.91
	No	162	43.09
Knowledge of standard precaution	Adequate knowledge	134	35.64
	Inadequate knowledge	242	64.36
Job-related stress	Stressed	237	63.03
	Not stressed	139	36.97

*BSc, Bachelor of Science; *IP, infection prevention; PPEs, personal protective equipments

Magnitude of occupational exposure to sharp injuries

This study finding showed that the magnitude of occupational exposure to sharp injuries among nurses was 52.39% (95%CI: 47.92%, 56.37%) (197).

The occurrence of occupational exposure to sharp injuries was the highest among respondents with the age of 45 years and above (62.50). Likewise, the majority of males, 108(62.07) also got occupational exposure to sharp injuries. Occupational exposure to sharp injuries was also the highest among diploma nurses, and nurses having more than 10 years of service (59.85% and 62.50%) respectively. Moreover, the occurrence of sharp injuries was also the highest among nurses working along with the presence of contaminated sharps at workplace (63.55%) (Table 2).

Table 2: Distribution of sharp injuries among nurses working in South Gondar zone public hospitals, Northcentral Ethiopia, 2022 (n=376).

Variables	Categories	Occupational exposure to sharp injuries

		Yes (%)	No (%)
Age	≤24	32(47.06)	36(52.94)
	25-34	111(52.11)	102(47.89)
	35-44	39(54.93)	32(45.07)
	≥45	15(62.50)	9(37.50)
Sex	Male	108(62.07)	66(37.93)
	Female	89(44.06)	113(55.94)
Marital status	Single	87(50.88)	84(49.12)
	Married	96(52.46)	87(47.54)
	Divorced	11(64.71)	6(32.29)
	Widowed	3(60.0)	2(40.0)
Educational level	Diploma	79(59.85)	53(40.15)
	BSc	118(48.36)	126(51.64)
Year of service	<5	59(43.38)	77(56.62)
	5-10	68(53.13)	60(46.87)
	>10	70(62.50)	42(37.50)
Sleeping disturbance problem	Yes	141(51.46)	133(48.54)
	No	56(54.90)	46(45.10)
Use of PPEs	All of the time	89(48.11)	96(51.89)
	Most of the time	56(54.90)	46(45.10)
	Sometimes	41(56.16)	32(43.84)
	Never use	11(58.75)	5(31.25)
Workload	Yes	125(58.96)	87(41.04)
	No	72(43.90)	92(56.10)
Length of stay/shift at work	≤8 hours	95(49.22)	98(50.78)
	9-14 hours	19(54.29)	16(45.71)
	≥15 hours	83(56.08)	65(43.92)
Health & safety information access	Yes	148(50.86)	143(49.14)
	No	49(57.65)	36(42.35)
Training on IP	Yes	38(42.70)	51(57.30)
	No	159(55.40)	128(44.60)

Availab. of safety box	Yes	129(47.60)	142(52.40)
	No	68(64.76)	37(35.24)
Availab. of universal precaution guide line	Yes	99(46.70)	113(53.30)
	No	98(59.76)	66(40.24)
Following universal precaution guide line	Yes	42 (45.16)	51(54.84)
	No	155 (54.77)	128 (45.23)
Presence of contaminated sharps at workplace	Yes	136(63.55)	78(36.45)
	No	61(37.65)	101(62.35)
Knowledge of standard precaution	Adequate knowledge	59(44.03)	75(55.97)
	Inadequate knowledge	138(57.02)	104(42.98)
Job-related stress	Stressed	149(62.87)	88(37.13)
	Not stressed	48(34.53)	91(65.47)

**BSc, Bachelor of Science; PPEs, personal protective equipments; and IP, infection prevention*

Occupational exposure to sharp injuries related Attributes

Of the respondents who encountered occupational exposure to sharp injuries, 114(57.87%) had encountered sharp injuries 1-2 times. Additionally, 69 (35.03%) of injuries occurred during abrupt movement of patients, and 86(43.65%) sharp injuries were slight skin penetration. Moreover, 93 (47.21%) of injuries were from the unknown status, and only 92 (46.70%) sharp injuries were reported to the concerned body (Table 3).

Table 3: Occupational exposure to sharp injuries related attributes among nurses working in South Gondar zone public hospitals, Northcentral Ethiopia, 2022 (n=376).

Variables	Values	Frequency	Percentage (%)
Frequency of injuries occurred	1-2 times	114	57.87
	3-4 times	71	36.04
	≥5 times	12	6.09
Condition of sharps	Dirty needles/sharps	74	37.56
	Sterile needles/sharps	58	29.45

	Both dirty & sterile needles/sharps	65	32.99
How sustaining injuries	During abrupt movement of patients	69	35.03
	During recapping needle after use	63	31.98
	During sharp collection	46	23.35
	Others	19	9.64
Type of injuries sustained	Deep injury	54	27.41
	Slight skin penetration	86	43.65
	Superficial injury	57	28.94
Health status of the source patients	Known HIV/AIDS positive	37	18.78
	Clinically suspected HIV/AIDS	40	20.30
	Clinically diagnosed hepatitis B patient	27	13.17
	Unknown status	93	47.21
Report of the injuries	Yes	92	46.70
	No	105	53.30

HIV/AIDS, Human immune deficiency virus/Acquired immune deficiency syndrome

Distribution of sharp injuries by their type

The types of sharps that cause injuries to nurses were intravenous needles, 64(32.49%), intramuscular needles, 42(21.32%), suturing needles, 36(18.27%), lancets, 29 (14.72%), surgical blades, 17 (8.63%) and scalpels, 9 (4.57%).

Factors associated with occupational exposure to sharp injuries

Nurses having above 10 years of service were 2.35 times more likely to encounter occupational exposure to sharp injuries than nurses having less than 5 years of service (AOR=2.35, 95%CI: 1.21,4.57). On the other hand, nurses who didn't get infection prevention training were 1.85 times more likely to encounter occupational exposure to sharp injuries (AOR=1.85, 95%CI: 1.09, 3.45). Additionally, nurses having job-related

stress were also 2.24 times more likely to be exposed for sharp injuries (AOR=2.24, 95%CI: 1.27, 3.89), and nurses who were working in the area with the presence of contaminated sharps were 2.76 times more likely to get the chance of occupational exposure to sharp injuries (AOR=2.76, 95%CI: 1.67, 4.72) (Table 4).

Table 4: Showing the association between independent variables with occupational exposure to sharp injuries among nurses working in South Gondar zone public hospitals, Northcentral Ethiopia, 2022 (n=376).

Variables	Categories	Sharp injuries		COR (95%CI)	AOR (95%CI)
		Yes (%)	No (%)		
Sex	Male	108 (54.82)	66 (36.87)	2.15 (1.32,3.07)	1.98 (0.91,4.21)
	Female	89 (45.18)	113 (63.13)	1.00	1.00
Year of service	<5	59 (29.95)	77 (43.02)	1.00	1.00
	5-10	68 (34.52)	60 (33.52)	1.46 (0.87,2.42)	1.38 (0.72,2.64)
	>10	70 (35.53)	42 (23.46)	2.12 (1.26,3.49)	2.35 (1.21,4.57) ***
Workload in the unit	Yes	125 (63.45)	87 (48.60)	1.73 (1.15,2.52)	1.42 (0.83,2.45)
	No	72 (36.55)	92 (51.40)	1.00	1.00
Training	Yes	38 (19.29)	51 (28.49)	1.00	1.00
	No	159 (80.71)	128 (71.51)	2.08 (1.49, 3.13)	1.85(1.09, 3.45) ****
Nurses' knowledge of standard precaution	Adequate knowledge	59 (29.95)	75 (41.90)	1.00	1.00
	Inadequate knowledge	138 (70.05)	104 (58.10)	1.96 (1.31,2.94)	1.42 (0.79,2.39)
Nurses' job stress level	Stressed	149 (75.63)	88 (49.16)	2.45 (1.62,3.67)	2.24 (1.27,3.89) **
	Not stressed	48 (24.37)	91 (50.84)	1.00	1.00
Presence of contaminated sharps	Yes	136 (69.04)	78 (43.58)	2.71 (1.79,4.09)	2.76 (1.67,4.72) *
	No	61 (30.96)	101 (56.42)	1.00	1.00

*Significant at P=0.000, **Significant at P=0.005, ***Significant at P=0.011, and ****Significant at P=0.018.

DISCUSSION

This study finding showed that the magnitude of occupational exposure to sharp injuries among nurses was 52.39%. This study finding also reported that years of service >10 years, lack of infection prevention training, job-related stress, and the presence of contaminated sharps at workplace were significantly associated with the occurrence of occupational exposure to sharp injuries among nurses.

In this study, the magnitude of occupational exposure to sharp injuries among nurses was 52.39%. This finding was higher than a study conducted in three hospitals, Izmir, Turkey (44.3%) [18], but lower than studies conducted in Public Sector Tertiary Care Hospitals of Pakistan (67%) [26], and JUSH, Southwest Ethiopia (61.76%) [3]. This variation might be due to the difference in study setting and period, as well as due to the difference in infection prevention training and knowledge level of the respondents towards standard precaution across study settings.

In this study, year of service >10 years was significantly associated with the occurrence of occupational exposure to sharp injuries among nurses at $p < 0.05$. This finding was similar with studies conducted in three hospitals, Izmir, Turkey [18], and a secondary care hospital, Gaza Strip [27], which showed that year of service had shown significant association with the occurrence of occupational exposure to sharp injuries among nurses at $p < 0.05$. It might be due to the fact that as year of service increases, the chance of getting occupational exposure to sharp injuries also increases.

This study finding also indicated that nurses who didn't get infection prevention training were 1.85 times more likely to get the chance of occupational exposure to sharp injuries compared to nurses who got the training. This finding was in line with a study conducted in public hospitals of Jimma Zone, South West Ethiopia [4], which showed that nurses

who didn't get infection prevention training were 8.33 times more likely to get the chance of occupational exposure to sharp injuries compared to nurses who got the training. It is due to the fact that getting infection prevention training helps to understand and practice the standard precaution guide line easily, which in turn reduces the chance of getting occupational exposure to sharp injuries.

Similarly, this study finding also showed that job-related stress was significantly associated with the occurrence of occupational exposure to sharp injuries among nurses. This finding was comparable with a study conducted in JUSH, Southwest Ethiopia which reported that job-related stress had shown significant association with the occurrence of occupational exposure to sharp injuries among nurses [14]. It could be explained that job-related stress might make nurses to lose their concentration and practice their daily activities unsafely.

Moreover, this study finding also showed that the presence of contaminated needles and sharp materials at workplace was also significantly associated with the occurrence of occupational exposure to sharp injuries among nurses at P <0.05. This finding was congruent with a study conducted in JUSH, Southwest Ethiopia which reported that the presence of contaminated needles and sharp materials at the workplace was significantly associated with the occurrence of occupational exposure to sharp injuries among nurses at p <0.05 [3]. The presence of contaminated needles and sharp materials at workplace increases the chance of getting occupational exposure to sharp injuries among nurses in their day-to-day workplace activities.

Strengths and limitations of this study

The study used census method, as a result, the findings could be strong evidence for the problem. However, the study might be subjected to recall and social desirability biases. The study also might not show cause and effect relationships while the study design was cross sectional.

CONCLUSIONS

Generally, this study finding reported that the magnitude of occupational exposure to sharp injuries among nurses was high. Moreover, this study finding also showed that years of service >10 years, lack of infection prevention training, job-related stress, and the presence of contaminated sharps at workplace were independent predictors of occupational exposure to sharp injuries among nurses.

Prevention and control strategies

Continually educate the health care team: To achieve the desired infection prevention and control goals, training on infection prevention and control should be given to the staff on a continual basis covering the standard infection prevention and control precautions.

Conducting regular clinical audits: It used to ensure best practice of the standard infection prevention and control precautions such as proper use of personal protective equipment, disposal of used needles and other sharps and hand hygiene.

Creating a cleanliness culture: By building a clean culture, staff are aware of the benefits of infection prevention and control.

Recommendations

All the concerned bodies should strengthen regular provision of infection prevention training to the nurses at all levels. Stakeholders, including nursing staffs should also strengthen their efforts to work together to identify and manage the possible job-related

stressors among nurses. Furthermore, safety boxes should be available in each working unit, and nurses should also practice proper use of safety box more than ever in order to avoid the presence of contaminated needles and other sharp materials at workplace.

Abbreviations and acronyms

AIDS: Acquired Immune Deficiency Syndrome

AOR: Adjusted Odds Ratio

CI: Confidence Interval

EBN: European Biosafety Network

ENSS: Expanded Nursing Stress Scale

HBV: Hepatitis B Virus

HCV: Hepatitis C Virus

HIV: Human Immune deficiency Virus

ICU: Intensive Care Unit

PPEs: Personal Protective Equipments

Consent for Publication

Not applicable.

Funding

Not applicable.

Data availability

All data used for the study were included in the manuscript.

Competing interests

We declared that we have no any conflicts of interests.

Patient concent for publication

Consent was obtained from the respondents.

Ethical approval

The study involved human participants and was approved by Debre Tabor University, College of Health Sciences, ethical review board (Ref No.CHS/048/2022). All the respondents were informed about the purpose of the study, their right to refuse, and written and signed voluntary consent was obtained from all the respondents prior to data collection. The respondents were told that the information obtained from them would be treated with complete confidentiality, and would not cause any harm to them.

Provenance and peer review

Not commissioned; externally reviewed.

Author Contribution

TM conceptualized the study and was involved in the design, analysis, interpretation, report, and manuscript writing. TM and YT made a substantial contribution to the conception, analysis, and interpretation of data. SD contribute to critical revision of the manuscript. All the authors read and approved the final manuscript.

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Figure 1: Map of South Gondar Zone (Source; Ethio GIS, 1994).

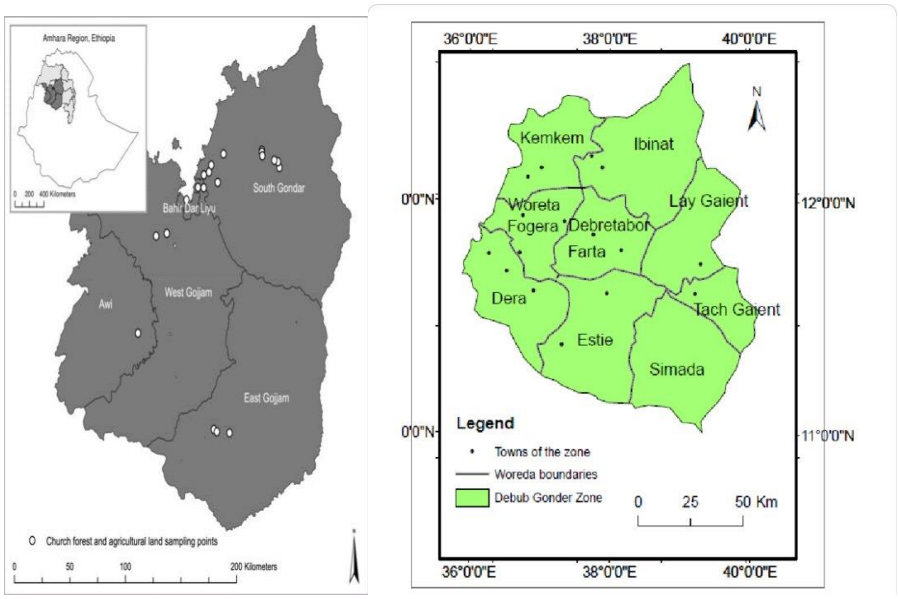

Figure 1: Map of South Gondar Zone (Source; Ethio GIS, 1994)

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the STROBE cross sectionalreporting guidelines, and cite them as:

von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.

		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	1-3
Objectives	#3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	#4	Present key elements of study design early in the paper	4
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4

Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	5
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-6
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	6-7
Bias	#9	Describe any efforts to address potential sources of bias	7
Study size	#10	Explain how the study size was arrived at	5
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	7-8
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	7-8
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	7-8
Statistical methods	#12c	Explain how missing data were addressed	7-8
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	7-8
Statistical methods	#12e	Describe any sensitivity analyses	7-8
Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	9
Participants	#13b	Give reasons for non-participation at each stage	9
Participants	#13c	Consider use of a flow diagram	10
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	10
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	10

Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	10-12
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	13-14
Main results	#16b	Report category boundaries when continuous variables were categorized	13-14
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	13-14
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	13-14
Discussion			
Key results	#18	Summarise key results with reference to study objectives	13-14
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	17
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	14-17
Generalisability	#21	Discuss the generalisability (external validity) of the study results	17
Other Information			
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18