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Occupational exposure to sharps injury among healthcare providers in Ethiopia regional hospitals

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Abstract

Background: Sharps injury is a penetrating stab wound from a needle, scalpel, or another sharp object that may result in exposure to blood or other body fluids. According to World Health Organization pooled estimate, the annual incidence of sharps injury in Africa was ranged from 2.10 to 4.68 per person per year, but research data in Ethiopia is limited. The aim of the study was to investigate sharps injury prevalence and associated risk factors.

Methods: Institution based cross-sectional study was conducted with 200 healthcare providers (HCP) in Northeast Ethiopia. Proportionate stratified sampling was used to select HCP. Sharps injury during the last 12 months was an outcome variable whereas demographic characteristics, behavioral attributes, and job environment characteristics were independent variables. Data was collected from April to May 2016 using self-administered questionnaire; which was adapted from World Health Organization best practices for injections and related procedures toolkit. Bivariate and multivariate logistic regression analysis was carried out to identify sharps injury associated risk factors. Epi Info version 3.5.1 software package was used for data coding and entry whereas Statistical Package for Social Sciences (SPSS) version 20 software package was used for analysis.

Results: In total, 195 HCP participated with a response rate of 97.5%. The prevalence of sharps injury was 32.8%. Following adjustment for covariates, lack of in-service job training and previous exposure to sharps injury were statistically significant risk factors for sharps injury. HCP who had no in-service job training were 4.7 times more likely sustained sharps injury compared with those who had in-service job training (p < 0.001, OR = 4.7, 95% CI = 2.05–10.56). HCP who had previous exposure to sharps injury were 3.7 times more likely sustained sharps injury compared with those who were not exposed (p-value = 0.002, OR = 3.7, 95% CI = 1.62–8.27).

Conclusions: This study revealed 32.8% or at least three out of ten HCP exposed to sharps injury. This was found statistically significant among HCP who had no in-service job training and who had previous exposure to sharps injury. Thus, training HCP perhaps increase their skill and curiosity to reduce exposure to sharps injury.

Keywords: Sharps injury, Healthcare providers, Prevalence, Regional Hospital

Background

Sharps injury is a penetrating stab wound from a needle, scalpel, or another sharp object that may result in exposure to blood or other body fluids [1]. Infectious diseases potentially transmitted by sharps injury are constantly widespread and a significant cause of illness and death [2–4]. World Health Organization (WHO) global estimate showed that every unsafe injection and needle stick injury cause at least 8 to 12 million hepatitis B infections, 2.3 to 4.7 million hepatitis C infections and 160,000 HIV/AIDS infections [4, 5]. The Center for Disease Control and Prevention (CDC) estimated that each year 385,000 sharp injury was sustained by hospital-based health care personnel [6] during the course of their duty [7]. According to WHO pooled estimate, the annual incidence of sharps injury in Africa (Egypt, Senegal, and Mauritius) was ranged from 2.10 to 4.68 per person per year [8]. Specifically,
the prevalence of sharps injury was 38% in UK [9] and 19% in Kenya [10]. In addition, a cross-sectional study in Portuguese [11], South Korea [12], and Thailand [13] hospital found out the prevalence rate of sharps injury was 64.5%, 70.5% and 55.5% sharps injury respectively. Even though researchers argued decrements of sharps injury in Ethiopian hospitals [14], the incidence of sharps injury have been alarmingly increasing [15]. A cross-sectional study conducted in Bale [16] and North Shoa [17] zone, Ethiopia revealed that the prevalence of sharps injury was 19.1% and 31.5% respectively. The risk of sharps injury at the workplace was related to syringe recapping (56%), intramuscular or subcutaneous injection (22%), specimen collection or intravenous cannulation (20%), transfusion (35.5%), and inadequate waste disposal (74.8%) [1, 7, 18]. Furthermore, other studies identified suturing, removing the needle from syringes after injection, sharps disposal were risky procedures that expose to sharps injury [13, 19]. There were several factors associated with increased risk of sharps injury: lack of training, extended working hours, job dissatisfaction, work experience, and perception of risk [20]. Moreover, age, poor compliance with infection-control procedures, and inadequate knowledge of blood-borne pathogens were associated factors for sharps injury [21].

The persistence of preventable, life-threatening occupational hazard particularly sharps injury at the hospital is yet to be given attention in developing countries including Ethiopia [8]. Therefore, the aim of the study was to investigate sharps injury prevalence and associated risk factors.

Methods
Study setting
The study was conducted in Debre Berhan Town, Northeastern Ethiopia. Debre Berhan is the capital city of North Shoa zone and located 130 km North East from Addis Ababa, the capital city of Ethiopia. The city has nine kebeles with a total population of 94,829 (50.8% female). There are 22 health institutions: two hospitals, three health centers, and 17 private clinics [17]. The study was conducted at the two hospitals considering the magnitude of sharps injury is high.

Study design and population
Institution based cross-sectional study was conducted from April to May 2016. The total number of source population in the two Hospitals was 434 healthcare providers (HCP): 384 at Debre Berhan Referral Hospital and 50 at Ayu General Hospital. All HCP who were actively involved in the patient care, fully employed, and at least with one-year work experience were included. However, HCP and managers who were on holiday, sick leave, and maternal leave were excluded.

Sample size and sampling procedure
The sample size was calculated using single population proportion formula. Given the prevalence of sharps injury was 28% [22], 95% confidence level, 5% marginal error, and 10% non-response rate, the final sample size was 200. Systematic random sampling (sampling interval /k/=2) method was used for selecting HCP.

Study variables
Sharps injury during the last 12 months was an outcome variable. The explanatory variables were demographic characteristics, behavioral attributes, and job environment characteristics. 'Previous exposure to sharps injury' was defined as observing the incident of sustained sharps injury by someone or inflicting sharps injury to oneself during the last 12 months. Besides, 'previous exposure of needle recapping' was defined as observing someone recapping a needle or needle recapping by oneself during the last 12 months.

Data collection
Self-administered structured questionnaire, which was adapted from WHO best practices for injections and related procedures toolkit [23], was used for data collection. The questionnaire has three sections: section 1, demographic characteristics; section 2, sharps injury; and section 3, behavioral attributes and job environment characteristics. First, the questionnaire was developed in English. Next, it was translated using the forward-backward method from English to Amharic (local language) by professional fluent in both languages. Finally, it was pre-tested at Kebele 04 health center. Five nursing intern students collected the data.

Data analysis
Before data coding and entry, the supervisor and investigators reviewed and checked each questionnaire for completeness, accuracy, and consistency. Printed frequency was used for checking missingness and outlying values. To test the hypothesized association of each explanatory variable with the outcome variable, bivariate and multivariate logistic regression analysis was done. Variables reached a p-value ≤0.25 were included in the final model. Variables with p-value ≤0.05 in the final full model test were identified as independently associated risk factors. Odds ratio with 95% confidence interval was used to measure the strength of association. Numeric summary measures, tables, and figures were used to present the data. The study was adherent to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement [24]. Epi Info version 3.5.1 software package was used for data coding and entry whereas Statistical Package for Social Sciences (SPSS) version 20 software package was used for analysis.
Results

Demographic characteristics
In total, 195 HCP participated with a response rate of 97.5%. More than half (56.4%) of HCP were between the age of 25 and 30 years, 59.0% were female, 50.3% were married, 90.3% were working at Debre Berhan Referral hospital, and 43.6% were Nurse (Table 1).

Sharps injury
The prevalence of sharps injury was 32.8%. Table 2 presented, at least one out of five (21.5%) HCP sustained sharps injury once during the last 12 months. The most abundant type of sharps injury was needle stick injury (21.4%) followed by intravenous cannula (5.6%). Sudden movement of patients (20.5%) was the most frequent mechanism of sharps injury.

Table 1 Demographic characteristics of HCP

| Variables          | Categories | n = 195 | %   |
|--------------------|------------|---------|-----|
| Sex                | Male       | 80      | 41.0|
|                    | Female     | 115     | 59.0|
| Marital status     | Married    | 98      | 50.3|
|                    | Single     | 97      | 49.7|
| Age                | <25        | 31      | 15.9|
|                    | 25–30      | 110     | 56.4|
|                    | 31–40      | 42      | 21.5|
|                    | >40        | 12      | 6.2 |
| Experience year    | 1–5        | 109     | 55.9|
|                    | 5–9        | 57      | 29.2|
|                    | 10–14      | 18      | 9.2 |
|                    | ≥15        | 11      | 5.6 |
| Profession         | Nurse      | 85      | 43.6|
|                    | Midwife    | 21      | 10.8|
|                    | Medical laboratory science | 23 | 11.8|
|                    | Othersb    | 66      | 33.8|
| Name of hospital   | Debre Berhan Referral Hospital | 176 | 90.3|
|                    | Ayu hospital | 19  | 9.7 |
| Unit               | Emergency  | 22      | 11.3|
|                    | Outpatient department | 32 | 16.4|
|                    | Pediatrics | 23      | 11.8|
|                    | Medical    | 20      | 10.3|
|                    | Surgical   | 23      | 11.8|
|                    | Maternal and child health | 35 | 17.9|
|                    | Laboratory | 25      | 12.8|
|                    | Othersb    | 15      | 7.7 |
| HBV vaccination    | Yes        | 23      | 11.8|
|                    | No         | 172     | 88.2|

*Physicians, Porters, Health officers, Anesthetist, Emergency Surgeons
bOphthalmology, dental, psychiatry, anesthesia

Table 2 Sharps injury among HCP

| Variables                        | Categories | n = 64 | %   |
|----------------------------------|------------|--------|-----|
| Incident of sharps injury during the last 12 months | One times | 42 | 21.5 |
|                                  | Two times  | 18     | 9.2 |
|                                  | Three times| 3      | 1.5 |
| Incident of sharps injury during the last month | One times | 19 | 9.7  |
|                                  | Not injured| 45     | 23.1|
| Type of sharps injury            | Needle sticks | 42 | 21.4 |
|                                  | Glasses item | 4    | 2.1 |
|                                  | Intravenous cannula | 11 | 5.6 |
|                                  | Scalpel blade | 4    | 2.1 |
|                                  | Others      | 3      | 1.5 |
| Type of sharps injury            | Slight skin penetration | 15 | 7.7  |
|                                  | Superficial | 46     | 23.6|
| Mechanism of sharps injury       | During recapping | 8 | 4.1  |
|                                  | Sudden movement of patients | 40 | 20.5 |
| Part of body injured             | Hand       | 32     | 16.4|
|                                  | Finger     | 31     | 15.9|
| Mechanism of sharps injury inflicted | Self | 60     | 30.8|
|                                  | Non-compliant patient | 4 | 2.1  |

Behavioral attributes and job environment characteristics
Nearly three-fourth (69.7%) of HCP knew the department to report sharps injury. Half (50.3%) of HCP reported sharps material outside the sharps collection box. Seventy-five (38.5%) HCP reported the sharps collection box was available at distance of hand stretch (Table 3).

Association between demographic characteristics and sharps injury
As shown in Table 4, the profession was found significant risk factor for sharps injury. Midwifery professionals were 2.8 times more likely exposed to sharps injury compared with physicians, health officers, emergency surgeons, and anesthetist ($p$-value = 0.04, OR = 2.8, 95% CI = 1.02–7.92).

Association between behavioral attributes and job environment characteristics and sharps injury
As presented in Table 5, lack of in-service job training ($p < 0.001$, OR = 6.0, 95% CI = 2.95–12.03), previous exposure to sharps injury ($p < 0.001$, OR = 3.4, 95% CI = 1.82–6.48), unavailability of universal precaution guideline ($p$-value = 0.02, OR = 2.1, 95% CI = 1.14–3.90), and unavailability of sharps collection box at distance of hand stretch ($p$-value = 0.04, OR = 2.8, 95% CI = 1.02–7.92)
stretch (p-value = 0.02, OR = 2.1, 95% CI = 1.11–3.77) were statistically significant associated risk factors for sharps injury. Following adjustment for covariates, lack of in-service job training and previous exposure to sharps injury were statistically significant risk factors for sharps injury. HCP who had no in-service job training were 4.7 times more likely sustained sharps injury compared with those who had in-service job training (p < 0.001, OR = 4.7, 95% CI = 2.05–10.56). HCP who had previous exposure to sharps injury were 3.7 times more likely sustained sharps injury compared with those who were not exposed (p-value = 0.002, OR = 3.7, 95% CI = 1.62–8.27) (Table 6).

Discussion

At least twenty large occupational groups are exposed to biohazards [25]. The risk is greatest among healthcare and laboratory workers who are threatened by the transmission of human pathogens including Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), HIV/AIDS virus, malaria, syphilis, tuberculosis, brucellosis, herpes virus and diphtheria [7]. However, the World Health Organization (WHO) estimated 25–90% exposure to sharps injury remain unreported [7]. This study aimed to uncover the prevalence and associated risk factors of sharps injury among hospital HCP.

The prevalence of sharps injury among HCP during the last 12 months was 32.8%, which was in agreement with the prevalence rate reported in Ethiopia [17, 20] and United Kingdom [9]. However, the prevalence rate in our study was higher than the study report by Mbaisi et al. [10] in Kenya, Gessessew and Kahsu [26] and Bekele et al. [16] in Ethiopia. This inconsistency may be due to the difference in the operationalization of sharps injury, study population, the number of HCP in the facility, different work environment and culture and availability of resources [20]. In this study, the prevalence of sharps injury was highest in Midwifery professionals compared with nurses, physicians, health officers, emergency surgeons, and anesthetist. However, several earlier studies [16, 20] concluded sharps injury was highest in nurses.

In this study, the commonest mechanism of sharps injury was self-inflicted needle stick injury due to sudden movement of patients. Contrariwise, the Pakistani study indicated that the most commonly reported mechanisms for sharps injury were injection and two-handed recap- ping of the needle [19]. To avoid sudden movement, it is believed patients should be informed prior to any procedures that cause pain to prepare them psychologically. Agitated patients should be restrained manually or relevant medication should be given to calm them.
Table 4 Bivariate association of demographic characteristics and sharps injury

| Variables (reference category) | n = 195 | %    | p-value | OR (95% CI) |
|-------------------------------|---------|------|---------|-------------|
| Sex (female)                  | 80      | 41.0 | 0.40    | 1.3 (0.71, 2.38) |
| Marital status (single)       | 98      | 50.3 | 0.24    | 1.4 (0.78, 2.61) |
| Ayu hospital (Debre Berhan Referral Hospital) | 19     | 9.7  | 0.16    | 2.0 (0.76, 5.15) |
| No hospital infection prevention committee | 65    | 33.3 | 0.39    | 1.3 (0.70, 2.46) |
| HBV vaccinated                | 23      | 11.8 | 0.50    | 1.4 (0.56, 3.35) |
| Age (year) (>40 years)        |         |      |         |             |
| <25                           | 31      | 15.9 | 0.24    | 2.8 (0.51, 14.86) |
| 25–30                         | 110     | 56.4 | 0.24    | 2.5 (0.53, 12.17) |
| 31–40                         | 42      | 21.5 | 0.28    | 2.5 (0.48, 12.99) |
| Experience (year) (≥15 years) |         |      |         |             |
| <5                            | 109     | 55.9 | 0.22    | 2.7 (0.56, 13.18) |
| 5–9                           | 57      | 29.2 | 0.50    | 1.7 (0.34, 9.03)  |
| 10–14                         | 18      | 9.2  | 0.56    | 1.7 (0.27, 10.97) |
| Profession (Others\(^a\))     |         |      |         |             |
| Nurse                         | 85      | 43.6 | 0.14    | 1.7 (0.83, 3.49)  |
| Midwife                       | 21      | 10.8 | 0.04    | 2.8 (1.02, 7.92)  |
| Laboratory                    | 23      | 11.8 | 0.33    | 1.7 (0.60, 4.65)  |
| Unit (Others\(^b\))           |         |      |         |             |
| Emergency                     | 22      | 11.3 | 0.38    | 1.9 (0.46, 7.92)  |
| Outpatient department         | 32      | 16.4 | 0.54    | 0.6 (0.15, 2.70)  |
| Pediatrics                    | 23      | 11.8 | 0.60    | 1.5 (0.35, 6.13)  |
| Medical ward                  | 20      | 10.3 | 0.60    | 1.5 (0.34, 6.43)  |
| Surgical ward                 | 23      | 11.8 | 0.60    | 1.5 (0.35, 6.13)  |
| Maternal and child health     | 35      | 17.9 | 0.48    | 1.6 (0.43, 6.17)  |
| Laboratory                    | 25      | 12.8 | 0.54    | 1.5 (0.38, 6.31)  |

\(^a\)Physicians, Porters, Health officers, Anesthetist, Emergency Surgeons

\(^b\)Ophthalmology, dental, psychiatry, anesthesia

OR Odds ratio
CI Confidence interval

Table 5 Bivariate association of behavioral attributes and job environment characteristics and sharps injury

| Variables                                             | n = 195 | %    | p-value | OR (95% CI) |
|-------------------------------------------------------|---------|------|---------|-------------|
| Syringe with needle used free of charge from hospital  | 28      | 14.4 | 0.23    | 1.7 (0.73, 3.76) |
| No post-exposure management at the hospital           | 54      | 27.7 | 0.93    | 1.0 (0.53, 2.01) |
| No awareness on department to report sharps injury    | 59      | 30.3 | 0.38    | 1.3 (0.70, 2.53) |
| No privacy during counseling                          | 61      | 31.3 | 0.33    | 1.4 (0.73, 2.59) |
| Lack of in-service job training                       | 103     | 52.8 | <0.001 | 6.0 (2.95, 12.03) |
| Previous exposure of needle recapping (self or others) | 74     | 37.9 | 0.14    | 1.6 (0.68, 2.92) |
| Previous exposure to sharps injury (self or others)   | 64      | 32.8 | <0.001 | 3.4 (1.82, 6.48) |
| Dirty and contaminated injection environment           | 10      | 5.1  | 0.24    | 2.1 (0.59, 7.66) |
| Unavailability of sharps materials collection box     | 39      | 20.0 | 0.04    | 1.0 (0.49, 2.17) |
| Status of sharp materials collection box              | 144     | 73.8 | 0.80    | 1.1 (0.55, 2.17) |
| Previous exposure to sharps materials outside the collection box | 98     | 50.3 | 0.08    | 1.7 (0.94, 3.17) |
| Open dumping disposal of sharps materials             | 32      | 16.4 | 0.08    | 0.4 (0.11, 1.13) |
| Unavailability of universal precaution guideline       | 101     | 51.8 | 0.02    | 2.1 (1.14, 3.90) |
| Unavailability sharps collection box at distance of hand stretch | 75     | 38.5 | 0.02    | 2.1 (1.11, 3.77) |

OR Odds ratio
CI Confidence interval
In accordance with earlier finding [20], multivariate logistic regression analysis in this study showed that a lack of in-service job training and previous exposure to sharps injury were significant risk factors for sharps injury. Due to lack of training, HCP may not have sufficient knowledge and skill to prevent sharps injury and perhaps increased the risk of injury as a result. A study carried out in Sub-Saharan Africa also supported the importance of training among HCP [27]. Previous exposure to sharps injury may decreased HCP perceived risk of sharps injury and they did not take precaution. This was supported by a study done in Gonder, Ethiopia where HCP with low perceived risk of sharps injury might not take special care to avoid injury while performing different activities using sharp materials [20].

Opposite to the conclusion by Bekele et al. [16], our study revealed that there was no statistically significant association between HCP work experience and rate of sharps injury. Our finding also supported by a study conducted in Northern Ethiopia [20] where work experience did not affect the risk of sharps injury. HCP working in the emergency unit had a higher risk of sharps injury compared with ophthalmology, dental, psychiatry, anesthesia unit workers. The possible explanation was that critical and risky procedure executed in the emergency unit [16].

The strengths of this study include a high response rate and the inclusive nature of this research as HCP could participate from all profession. Including hospitals where risky procedures carried out was a further strength. Moreover, a reasonable sample size was used. However, this study had certain limitations. Since the study was self-administered and the last 12 months incident was evaluated, social desirability and recall bias might added. Due to cross-sectional nature of the study, only temporal association was assumed between sharps injury and identified risk factors.

Conclusions
This study revealed 32.8% or at least three out of ten HCP exposed to sharps injury. This was found significant among HCP who had no in-service job training and who had previous exposure to sharps injury. Thus, the training of HCP should always be undertaken for new employees and periodically for those already employed. Moreover, periodical assessment of HCP knowledge and skills and training about the use of new medical equipments helps to prevent exposure to sharps injury [7].

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Availability of data and materials
All the relevant data was available in the article.

Authors’ contributions
NT, GB, and KD conceived and designed the study. NT and TD analyzed the data. TD and GB wrote the manuscript. All the authors read the manuscript several times and have given final approval of the version to be published.

| Variables | n = 195 | %  | p-value | OR (95% CI) |
|-----------|--------|----|---------|-------------|
| Marital status, married | 98 | 50.3 | 0.22 | 1.7 (0.74, 3.67) |
| Age, 31–40 years | 42 | 21.5 | 0.10 | 5.4 (0.72, 40.04) |
| Work experience, <5 years | 109 | 55.9 | 0.30 | 3.0 (0.38, 23.50) |
| Profession, Midwifery | 21 | 10.8 | 0.76 | 1.3 (0.29, 5.52) |
| Hospital, Ayu general hospital | 19 | 9.7 | 0.56 | 1.4 (0.43, 4.76) |
| Syringe with needle used free of charge from hospital | 28 | 14.4 | 0.70 | 1.3 (0.39, 4.09) |
| Lack of in-service training | 103 | 52.8 | <0.001 | 4.7 (2.05, 10.56) |
| Previous exposure of needle recapping (self or others) | 74 | 37.9 | 0.83 | 1.1 (0.50, 2.44) |
| Previous exposure to needle stick injury (self or others) | 64 | 32.8 | 0.002 | 3.7 (1.62, 8.27) |
| Dirty and contaminated injection environment | 10 | 5.1 | 0.27 | 2.5 (0.50, 12.51) |
| Previous exposure to sharp materials outside the collection box | 98 | 50.3 | 0.58 | 1.2 (0.58, 2.68) |
| Open dumping disposal of sharps materials | 32 | 16.4 | 0.81 | 1.2 (0.25, 5.91) |
| Unavailability of universal precaution guideline | 101 | 51.8 | 0.24 | 1.6 (0.72, 3.67) |
| Unavailability sharps collection box at distance of hand stretch | 75 | 38.5 | 0.50 | 1.3 (0.58, 3.09) |

OR Odds ratio
CI Confidence interval
Competing interests
The first and second authors have an equal contribution and shared the first authorship. The other authors declare that they have no competing interests regarding the publication of this research article.

Consent for publication
Not applicable.

Ethics approval and consent to participate
In order to conform the Declaration of Helsinki (1964) and Population Screening Act (WHO), ethical clearance was obtained from Debre Berhan University, Institute of Medicine and Health Science. Additionally, an informed written consent was received from each study respondent. To ensure confidentiality of respondents, unique identifier number (ID) was used for each HCP.

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