Sharp Injury and Exposure to Blood and Body Fluids among Health Care Workers in Health Care Centers of Eastern Ethiopia

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Abstract

Background: Health care workers are facing certain occupational hazards because of sharp injury and exposure to human blood and body fluids as a result of handling wastes. Though much attention is paid for the protection of these workers, the number of exposures and injuries do not show a sign of decline from time to time.

Objective: To examine the occurrence of sharp injury and exposure to blood and body fluids in health care workers in health care centers in Ethiopia.

Methods: In a case-control study, a randomly selected sample of 65 health facilities with 391 cases and 429 controls were studied. Data were collected through a self-administered questionnaire. Detailed analysis of exposure among the health care workers was done by logistic regression analysis with generalized estimating equations model to control correlation effects of responses within the cluster of health facilities.

Results: The number of health care workers who got sharp injury was 217 (26.5%). 296 (36.1%) had exposure to blood and body fluids. Working at Harari region (adjusted OR 0.44, 95% CI 0.26 to 0.75) and East Hararghea (adjusted OR 0.61, 95% CI 0.40 to 0.94), being male (adjusted OR 0.56, 95% CI 0.44 to 0.91), and a being nurse (adjusted OR 0.188, 95% CI 0.06 to 0.63) were independent risk factors of the exposure.

Conclusion: Regardless of the anticipated low self-reporting for exposure status, the number of health care workers reported having sharp injury and exposure to blood and body fluids was high. Such high exposures indicate that health care workers are at high risk of acquiring blood-borne viral infections such as hepatitis B, hepatitis C, and HIV.

Keywords: Health personnel; Waste management; Health facilities; Needlestick injuries; Blood; Body fluid; Hospitals; Occupational exposure; Ethiopia

Introduction

Health care workers (HCWs) are facing certain occupational hazards because of exposure to sharp injury (SI) and human blood and body fluids (BBFs) as a result of handling wastes.¹,² They all are at risk of developing blood-borne infections including human immunodeficiency virus (HIV), hepatitis B and hepatitis C viruses.³ In 2000, WHO estimated that injections with contaminated...
syringes caused 21 million hepatitis B virus (HBV) infections (32% of all new infections), two million hepatitis C virus (HCV) infections (40% of all new infections) and 260 000 HIV infections (5% of all new infections).4 Some investigators suggest that unsafe injections, a component of which is unsafe waste disposal, may be more responsible for the spread of HIV in Africa than sexual behavior.5,6

The prevalence of SI was assessed by various authors in different countries. Pandit and colleague in India have shown that needle stick injury (NSI) among service providers was 52.2% with annual incidence of 19%.7 In Serbia, there were reports of 50.7% NSIs in 38.4% health care personnel within one year only.8 Colombo in Switzerland also found a cumulative incidence rate of NSIs of 31.9 per 100 occupied beds for all hospitals studied.9 Exposure to BBFs is another source for HCWs to contract blood-borne infection from workplace. In Serbia, over one year, 59.1% of HCWs had dermal contact with patients' blood, 34.4% of whom had conjunctival or other mucosal contact.8 A study conducted in Australia revealed that 42% of HCWs had body fluid exposures during one year.10 Another study from India showed that 65.4% of health care service providers had exposure to body fluids.7

In low-income countries like Ethiopia, exposure to SI and BBFs is common, placing both patients and HCWs at risk of acquiring infections. Though much attention is paid to the safety of HCWs and their protection from exposure to SI and BBFs, the number of exposures and injuries reported has not shown any signs of decline from time to time. In particular in Ethiopia, no report exists to quantify the extent of exposures to SI and BBFs. Furthermore, no incident reporting systems, testing, and medication and post-exposure prophylaxis have been organized yet. We therefore conducted this study to assess factors determining the exposure status of HCWs to SI and BBFs.

Materials and Methods

This case-control study was conducted from August 2013 to February 2014 in Harari region, Dire Dawa administration, and East and West Hararghea zones in the eastern part of Ethiopia. According to the data obtained from the respective health offices, there were a total of 195 public health facilities (9 hospitals and 186 health centers) in the study area, of which 65 (9 hospital and 56 health centers) were included in this study.

To calculate the minimum sample size, a 40% proportion of controls with exposure, controls:cases ratio of 1:1 and an odds ratio of 1.58 was assumed.8 Using OpenEpi® software, the calculated minimum sample size was 820. For the selection of health centers, a two-stage sampling was considered. First, 30% (n=56) of the centres were considered sufficient to evaluate the impacts of health care wastes on HCWs.11,12 Second, the sample size taken from each center was proportional to population size of the center; data were taken from 820 HCWs.

During interviewing HCWs, those who reported exposure to either SI or BBFs in the last one year prior to data collection

TAKE-HOME MESSAGE

- The impact of improper health care waste management on the health of health care workers is high.
- Over one year, more than a quarter of health care workers had sharp injury; more than a third had exposure to human blood and body fluids.
- The independent determinants of the exposure were place of the work, sex of the health care worker, and being a nurse.
A total of 820 HCWs participated in this study; 391 had exposure to SI or BBFs during the last 12 months; 429 did not. Of 820 participants, 468 (57.3%) were male. The mean age of respondent was 28 (SD 7.1) years. HCWs involved in this study had a mean age of 28 (SD 7.1) years. The majority (n=496, 60.7%) of participants were nurses; 524 (64.2%) had diploma (Table 1).

### Table 1: Socio-demographic characteristics of HCWs in the eastern Ethiopia, 2014

| Variables          | Cases, n (%) | Controls, n (%) | p value |
|--------------------|--------------|-----------------|---------|
| Sex                |              |                 |         |
| Male               | 243 (51.9)   | 225 (48.1)      | 0.004   |
| Female             | 148 (24.2)   | 201 (57.6)      |         |
| Educational status |              |                 |         |
| Diploma            | 258 (49.2)   | 266 (50.8)      |         |
| First degree       | 123 (44.9)   | 151 (55.1)      | 0.27    |
| Others             | 10 (45)      | 12 (55)         |         |
| Professional category |            |                 | 0.68    |
| Medical doctors    | 8 (38)       | 13 (62)         |         |
| Health officers    | 42 (52)      | 39 (48)         |         |
| Nurse              | 240 (48.4)   | 256 (51.6)      |         |
| Midwife            | 45 (49)      | 47 (51)         |         |
| Medical lab        | 38 (37.6)    | 63 (62.4)       |         |
| Others             | 18 (62)      | 11 (38)         |         |
| Region             |              |                 |         |
| Harari             | 72 (37.7)    | 119 (62.3)      | <0.001  |
| East Hararghae     | 130 (46.1)   | 152 (53.9)      |         |
| West Hararghae     | 63 (48.1)    | 68 (51.9)       |         |
| Dire Dawa          | 126 (58.3)   | 90 (41.4)       |         |
| Health facility type |             |                 | 0.004   |
| Hospital           | 179 (43)     | 237 (57)        |         |
| Health center      | 212 (52.5)   | 192 (47.5)      |         |
| Age (yrs)          |              |                 | 0.52    |
| 20–29              | 257 (46.4)   | 297 (53.6)      |         |
| 30–39              | 54 (50)      | 54 (50)         |         |
| 40–49              | 17 (44)      | 22 (56)         |         |
| 50–60              | 8 (35)       | 15 (65)         |         |
| Service length (yrs) |            |                 | 0.52    |
| 1–9                | 310 (47.2)   | 347 (52.8)      |         |
| 10–19              | 38 (50)      | 38 (50)         |         |
| 20–29              | 13 (42)      | 18 (58)         |         |
| 30–39              | 7 (39)       | 11 (61)         |         |

were considered “cases” and those who had exposure to neither SI nor BBFs were considered “controls.” Using a questionnaire, further information were obtained from cases. Using the sampling technique described, 391 cases were identified. To reach the required minimum sample size of 820, we therefore recruited 429 controls.

A questionnaire was prepared by adopting few questions from the standard materials of WHO’s rapid assessment tool,13 Exposure Prevention Information Network,14 and others similar studies. The questionnaire was self-administered and distributed to the respondents by data collection facilitators. Ethical clearance was secured from IRB of the College of Health and Medical Sciences of Haramaya University.

### Statistical Analysis

Bivariate and multivariable analyses were carried out as per the objective of this study. The Mantel-Haenszel method was used to calculate the pooled odds ratio (OR) and its 95% confidence interval (CIs). Generalized Estimations Equation (GEE) model was used to identify factors associated with the occurrence of SI and exposure to BBFs. Clustering effects of the health facilities were controlled during analysis using GEE. A p value <0.05 was considered statistically significant.

### Result

**Socio-demographic characteristics**

A total of 820 HCWs participated in this study; 391 had exposure to SI or BBFs during the last 12 months; 429 did not. Of 820 participants, 468 (57.3%) were male. The mean age of respondent was 28 (SD 7.1) years. HCWs involved in this study had a median service length of 4.0 (IQR 4.0) years. The majority (n=496, 60.7%) of participants were nurses; 524 (64.2%) had di-
ploma (Table 1).

Work Units and Health Status

Around one-third (n=239, 31.5%) of HCWs reported working at outpatient department (OPD); only 19 (2.4%) were working at injection and dressing rooms. To assess the self-reported health problems, out of 774 HCWs who responded to this question, 202 (26.1%) complained that they had at least one health problem, out of whom 154 (21.6%) had a known health problem. When they were asked to list the type of health problem they had, the most frequently reported problem was “common cold” (n=91, 22.1%); the least problems were those of arm and throat, reported by 13 (3.2%) HCWs.

Exposure to SI

Out of 820 HCWs studied, 217 (26.5%, 95% CI 23.4% to 29.5%) had SIs in the last 12 months. NSI was the highest SI incident reported by 108 (58.7%) HCWs. Hands were the dominant site of injury (n=158, 86.8%). HCWs reported the incident happened when they were using sharp objects (n=69, 37.3%). Many HCWs injured with the used sharp objects, say by objects left on the floor, table, and bed (n=24, 13.1%), near disposal container (n=15, 8.2%) and after disposal because of inappropriate storage container and poor disposal practices (n=40, 21.9%).

About half of the HCWs with exposure (n=99, 48.1%) reported they could identify the patient whom the sharp object was in contact with. None of the health facilities studied had a system of rehabilitating workers who had injury while performing their activities. Actions taken by HCWs after an exposure included seeking medical checkups in 96 (43.2%) HCWs. Out of those who underwent checkups, 17 (33%) had a positive result. However, all of them failed to mention what “a positive result” does mean (Table 2).

| Variables                                           | n (%)          |
|-----------------------------------------------------|----------------|
| **Variables**                                       | **n (%)**      |
| Sharp material*                                      |                |
| Needle stick                                        | 108 (58.7)     |
| Lancet                                              | 28 (15.2)      |
| Glass                                                | 43 (23.4)      |
| Others                                               | 26 (14.1)      |
| Body part injured*                                   |                |
| Hand                                                 | 158 (86.8)     |
| Foot                                                 | 19 (10.4)      |
| Other parts                                          | 12 (6.6)       |
| When did the injury occur?*                          |                |
| Before use of the item                               | 35 (19.1)      |
| During use of the item                               | 69 (37.3)      |
| Restraining patient                                  | 21 (11.5)      |
| Between steps of a multi-step procedure              | 31 (16.9)      |
| Disassembling device or equipment                    | 15 (8.1)       |
| In preparation for reuse                             | 18 (9.8)       |
| While recapping used needle                          | 33 (18.0)      |
| Withdrawing a needle from rubber or other resistant material | 26 (14.2)   |
| Device left on the floor, table or bed               | 24 (13.1)      |
| After use before disposal                            | 24 (13.1)      |
| Item left on/near disposal container                 | 15 (8.2)       |
| Putting item into a disposal container               | 12 (6.6)       |
| After disposal, stuck by item protruding from opening of disposal container | 12 (6.6)  |
| Item piercing side of disposal container             | 9 (4.9)        |
| After disposal, item protruded from trash bag or inappropriate waste container | 19 (10.4)  |
| Other                                                | 10 (5.5)       |
| Measures taken after injury                          |                |
| Seek advice from health professional                 | 62 (27.9)      |
| Medical checkup                                      | 96 (43.2)      |
| I did nothing                                        | 52 (23.4)      |
| Other measures                                       | 12 (5.5)       |
| Outcome of medical checkup                           |                |
| Positive                                             | 17 (33)        |
| Negative                                             | 32 (63)        |
| I do not know                                        | 2 (4)          |

*Percentages may not add up to 100 due to multiple responses
Exposure to BBFs

Of 820 HCWs studied, 296 (36.1%, 95% CI 32.8% to 39.4%) had exposure to BBFs. Hands were the dominant site exposed (n=196, 64.1%) as reported by 306 HCWs who responded to this question. Few exposed HCWs made any efforts after the exposure; only 99 (33%) had medical check-ups. Blood and blood products followed by amniotic fluid are the most common fluids workers were exposed to (Table 3). The number of HCWs with exposure to both SI and BBFs were 122 (14.9%, 95% CI 12.4% to 17.3%).

Determinants of Exposure to SI and BBFs

Using a logistic regression analysis for our data would be misleading as the basic assumption of independent of observations might be violated as the data from a group of HCWs would have some sort of correlations. We therefore used the GEE to take into account the correlations. The result from the final analysis showed that the study region, sex of the respondents, and professional category of HCWs were statistically associated with exposure to SI and BBFs. More specifically, working in Harari region and East Hararghea reduced the odds of having exposure to SI and BBFs by 54% (adjusted OR 0.44, 95% CI 0.26 to 0.75) and 39% (adjusted OR 0.61, 95% CI 0.40 to 0.94) compared to those working in West Hararghea. Being male HCW also reduced the odds by 44% (adjusted OR 0.56, 95% CI 0.44 to 0.91). Being a nurse also decreased the odds by 81% compared to other professional categories (adjusted OR 0.19, 95% CI 0.06 to 0.64) (Table 4).

Discussion

More than a quarter of studied HCWs had exposure to either SI or BBFs. The incidence of SI was nearly the same as that reported in a study from Malaysia (27.9%)15.
Table 4: Factors determining SI and BBFs exposure of HCWs in eastern Ethiopia, 2014

| Parameter               | Adjusted OR (95% CI) |
|-------------------------|----------------------|
| **Working area (region)** |                      |
| Harari                  | 0.44 (0.26 to 0.75)  |
| East Harargae           | 0.61 (0.40 to 0.94)  |
| Dire Dawa               | 0.75 (0.45 to 1.26)  |
| West Hararghae          | 1                    |
| **Sex**                 |                      |
| Male                    | 0.56 (0.44 to 0.91)  |
| Female                  | 1                    |
| **Educational level**   |                      |
| Diploma                 | 3.60 (0.80 to 16.18) |
| First degree            | 2.86 (0.63 to 12.88) |
| Others                  | 1                    |
| **Professional category** |                    |
| Medical Doctor          | 0.24 (0.05 to 1.09)  |
| HO                      | 0.30 (0.09 to 1.03)  |
| Nurse                   | 0.19 (0.06 to 0.64)  |
| Midwifery               | 0.28 (0.07 to 1.12)  |
| Medical Lab             | 0.57 (0.03 to 12.96) |
| Others                  | 1                    |
| **Work Unit**           |                      |
| OPD                     | 0.69 (0.32 to 1.48)  |
| Inpatient               | 1.19 (0.54 to 2.62)  |
| Lab                     | 0.16 (0.01 to 3.30)  |
| Injection and dressing  | 1.77 (0.54 to 5.81)  |
| Emergency               | 1.16 (0.52 to 2.61)  |
| MCH                     | 0.69 (0.32 to 1.48)  |
| Other units             | 1                    |
| **Age (yrs)**           |                      |
| 20–29                   | 1.80 (0.34 to 9.47)  |
| 30–39                   | 1.79 (0.34 to 9.38)  |
| 40–49                   | 1.39 (0.35 to 5.54)  |
| 50–60                   | 1                    |
| **Service length (yrs)** |                    |
| 1–4                     | 0.99 (0.17 to 5.83)  |
| 5–9                     | 1.24 (0.22 to 7.04)  |
| 10–19                   | 1.52 (0.27 to 8.52)  |
| 20–29                   | 1.15 (0.26 to 5.09)  |
| 30–39                   | 1                    |

and Nigeria (24.5%); the rate was higher than another study in Ethiopia, and United Arab Emirates, but was lower than in Thailand (55.5%). In another study done in Australia, the rate of both SI (58%) and exposure to BBFs (42%) were high. The current study anticipated under-reporting of exposures, which might be due to fear of being stigmatized by their coworkers. One study estimated the rate of under-reporting to be between 40% and 75%. Another reason could be the lack of post-exposure services in the studied facilities that did not encourage the exposed HCWs to report the incidents.

HCWs participated in our study had a service length ranging from 1 to 39 years. We found that neither age nor service length was determinant of exposure to SI and BBFs. However, some previous studies showed these two variables are. A study from sub-Saharan Africa also showed that less experienced nurses were 1.67 times more likely to develop SI compared to those with higher experience. Experienced HCWs are more likely to improve their competence in using sharp instruments and waste handling over time, both of which are important in preventing the exposure.

NSI is the most common SI incidents reported. In India, NSI among health service providers was 52.2%. Injuries with sharp objects occurred during several activities. In the current study, 75 (41%) injuries occurred by either a sharp object placed in a wrong place or while inserting the object in the container; 40 (21.9%) HCWs were injured after disposal of sharps because of inappropriate storage container and poor disposal practices. Similar results were reported in a study by Alamgir, et al, where 14.6%, and 20.1% of HCWs were injured by sharp objects during and after disposal, respectively. In another study 58% of incidents occurred after the use and before disposal of sharps.
Recapping of used needles remains a cause of SI; despite the national guideline recommendations that used needles should not be recapped, 33 (18%) HCWs injured while recapping used needle. Similar injury reports by recapping needle are reported in a study from Ethiopia on the assessment of injection safety of HCWs. Studies in other countries also show that recapping needle or sharp objects is the most common cause of SI. For example, 28% of HCWs get injured while recapping needle in Saudi Arabia, 27.2% in Malaysian, and 5.6% in China.

In our study, nurses were more often (28.8%) exposed to SI, and followed by midwives (23.9%) and health officers (21.0%). Medical doctors had the least reporting rate (19%). However, for BBFs exposure, medical doctors had the highest reported rate (42.0%), followed by midwives (41.3%) and nurses (34.9%). In another study, the highest rate (40.3%) of SI occurred among nurses followed by 22.6% in care aides (CAs), and 14.5% in medical technologists. Similarly, for BBFs exposure, nurses had the highest proportion (57.9%), followed by CAs (13.2%) and medical technologists (7.9%). The difference observed might be due to safety practices exercised by different professional categories.

The most common site of SI and BBFs exposure was hands. This is in line with another study where the most commonly affected sites were the thumb, index finger, and middle finger.

Risks of SI and BBFs exposure varied between different units. In this study, 110 (33.1%) of 332 of the SI and BBFs exposures occurred in the OPD, whereas only 62 (18.7%) occurred in inpatient wards. In another study, 45% of all SIs and BBFs exposures occurred in inpatient wards. The differences may be attributed to high number of respondents from OPD (31.5%) and more senior (experienced) staff members working in inpatient wards.

After HCWs got exposed to SI, only 96 (46.2%) went for medical checkups; the number of HCWs who sought medical attention after BBFs exposure was 99 (33%). In another study, 93% of those reporting a blood or sharps exposure were followed for HBV and HIV; 94% were followed for HCV. The observed difference could be due to the variance in the culture of report of the exposure by HCWs and set up of the health facility that enables workers to report such incidences.

We found that study region, sex of the respondent, and being a nurse were independent determinants for having SI or BBFs exposure. This is in agreement with the findings of another study from Serbia that showed after adjustment for age, exposure to sharp instruments and skin contact with BBFs occur most frequently in nurses and less frequently in doctors. Exposure also differs with sex; female HCWs had a higher injury rate compared with their male counterparts. This is consistent with other studies.

This study had some limitations. First, the number of HCWs who were at risk was likely to be underestimated. Second, estimating the incidence of SI and BBFs exposure based on self-reports over the past 12 months might be subjected to recall bias. Third, quantifying the risk based on the number of SIs and BBFs exposure in the area would be misleading; the study sample was limited to public health facilities, excluding the associated risks resulting from private health sectors. This would also have the potential to underestimate the risk the HCWs face in the study area.

Despite the anticipated under-reporting of exposure to SI and BBFs, the incidence of SI and BBFs exposure was high. Therefore, HCWs might be at high risk of acquiring blood-borne viral infections. Only few HCWs who had an incident sought medical attention. Therefore, efforts should be
made to increase the awareness of HCWs about what should be done soon after the exposure. Proper management of wastes plays a significant role in reducing SI. Training in injection safety, prevention of SI, avoiding exposure to BBFs and considering the universal precautions must be incorporated into the curriculum of all health care professionals in Ethiopia.

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