

Occupational Exposure to Blood and Other Body Fluids Among Healthcare Workers in Three Teaching Hospitals, Southeast Iran

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Abstract

Background: Healthcare workers (HCWs) regularly face the risk of exposure to sharp injuries and splashes as an occupational hazard, which presents a major risk for acquiring blood-borne infectious agents.

Objectives: This study aimed to determine the occurrence of needlestick injuries (NSIs) and other high-risk occupational exposures to blood and body fluids (BBFs) among HCWs in three teaching hospitals affiliated with the Zahedan University of Medical Sciences.

Patients and Methods: A cross-sectional study was carried out from March 2013 to December 2014. Information on self-reported incidents, circumstances surrounding occupational exposure, and post-exposure management were collected from an ongoing surveillance system. Descriptive statistics and chi square tests were used for data analysis.

Results: A total of 236 incidents of occupational exposure were registered during the study period. Nurses (82, 34.7%) were most frequently exposed to BBFs, followed by physicians (57, 24.2%). Two hundred and nineteen (92.8%) of the personnel sustained NSIs, and 17 (7.2%) had splashes to mucus membranes. The incidents were most frequently reported from the internal medicine ward (19.1%) followed by the operating theater (17.1%). Subjects with splashes to mucus membranes were more likely to postpone seeking medical advice following exposure, as compared with needlestick cases (23.5% versus 5%, $P < 0.016$). A significantly greater proportion of pediatric and emergency department staff were found to delay post-exposure measures ($P < 0.040$).

Conclusions: The relatively high prevalence of percutaneous injuries and splashes in this study emphasized the importance of improved prevention strategies, better hospital surveillance for occupational exposure, and enhanced training of healthcare workers.

Keywords: Needlestick Injuries, Sharp Injury, Occupational Exposure, Hospitals, Iran

1. Background

Accidental exposure to blood and other body fluids (BBFs) that expose healthcare workers (HCWs) to blood-borne infections is one of the major occupational hazards experienced by hospital staff (1). World Health Organization estimates have shown that needlestick injuries (NSIs) account for about 40% of hepatitis B and C infections and 2.5% of HIV infections in HCWs across the globe (2). These estimations also suggested that 1 in 10 HCWs worldwide sustain a needlestick injury (NSI) each year (3). Although the scope of the problem is not well known, estimates show that 600,000 to 800,000 such injuries occur annually (4), about half of which go unreported (5). A recent Centers for Disease Control and Prevention (CDC) report indicated that on average, 385,000 NSIs occur in U.S. hospitals each year (1). In other terms, approximately 30 NSIs per 100 beds per year are reported for an average hospital

(6).

Some factors that have been found to be independently associated with exposure to BBFs and NSIs include male gender, an age below 40 years (7), the recapping of needles (8), work experience of less than two years (9), and working at a surgical ward (10). Inadequate human and other resources and high emotional exhaustion significantly increase the risk of occupational exposure to BBFs (11). The presence of a health office for HCWs at a hospital, work at a university hospital, and previous training on infection control measures are associated with lower levels of NSIs and/or sharp injuries (7, 10).

The results of studies on the prevalence of occupational exposure to blood and other body fluids among healthcare workers in Iran have shown that more than half of HCWs have experienced some type of exposure during their professional lives (8, 12, 13). In general, more than

0.5 exposures per person-year have been reported among HCWs working in university hospitals (12, 14), and the proportion of HCWs suffering from NSIs during the previous year ranged between 20% and 40% (13, 15). However, it has been well documented that underreporting is a common public health problem related to the surveillance of sharp injuries and splashes to mucous membranes among hospital staff, and only one third of NSIs are officially reported by HCWs (12, 15). The major reasons for underreporting NSIs include dissatisfaction with consequent follow-up investigations by hospital officials after reporting the exposures and the fact that HCWs consider source patients as low risk (12).

The most common types of exposures are NSIs, followed by sharp instrument injuries and mucosal contact with potentially infectious fluids (16). The majority of the exposures take place during operative procedures and during or after sharp instrument disposal, especially recapping used syringes (8, 16). The operation room, emergency ward, and ICU have the highest prevalence of NSIs (13). In comparison with other health professionals, nurses have the highest rates of NSIs (14, 15). The prevalence of NSIs in medical students is similar to those figures reported for hospital staff (17). However, in this group, compliance with basic safety measures (using personal protective equipment, not recapping used needles, and properly disposing of sharp objects) is suboptimal.

Although the rate of occupational exposure in hospital settings is relatively high, post-exposure measures are not carried out in accordance with standard protocols. For instance, in one study, just over a quarter of injured HCWs received post-exposure prophylaxis against HIV (15). Similarly, in another study, post-exposure prophylaxis was administered to approximately one-fifth of the exposed personnel, and appropriate blood tests were performed for only one-third of the subjects (16).

2. Objectives

The objective of this study was to investigate the patterns and characteristics of occupational exposure to BBFs among HCWs in teaching hospitals affiliated with the Zahedan University of Medical Sciences.

3. Patients and Methods

This cross-sectional study reports a 20-month (between March 2013 and December 2014) experience of ongoing surveillance of HCW exposure to BBFs at three teaching hospitals in Zahedan, Sistan, and Baluchestan province. According to this surveillance system, HCWs are requested

to report BBF exposures immediately after each exposure. A detailed account of the exposure was then documented as per hospital guidelines. We collected reports of BBF exposures among HCWs and hospital orderlies who sustained accidental BBF exposure. We also investigated the time between the occupational exposure to blood and other body fluids and the use of a post-exposure prophylaxis (PEP), which involves the administration of antiretroviral therapy (ART) to reduce the risk of acquisition of HIV infection. Current guidelines recommend initiating PEP within 36 - 72 hours of exposure to HIV (18). The postponement of seeking counseling and preventive measures after this time was considered to be a delayed post-exposure prophylaxis.

The data included demographic characteristics, the HBV vaccination status of the personnel, the nature of the BBF exposures, common procedures resulting in NSIs, and instruments causing NSIs. We also asked about immediate post-exposure management after sustaining NSIs. Descriptive statistics and chi square tests were used for the data analysis, using the SPSS version 20 statistical software package (Chicago, IL). Categorical variables were presented as frequency numbers and percentages. Comparison among the categorical data was performed using a chi square test or Fisher's exact test as appropriate, and p values less than 0.05 were considered to be statistically significant.

4. Results

A total of 236 episodes of occupational exposure to BBFs were registered during the study period. Approximately 45 (19.1%) of the exposed personnel were men, and 191 (80.9%) were women (Table 1). The average age was 28.8 ± 6.2 years. Nurses constituted approximately one-third of the identified cases. Hepatitis B vaccination was incomplete in 22 (9.3%) of exposed HCWs, and the vaccination status was unknown in 4 (1.7%) of the investigated hospital staff.

The majority of BBF exposures were NSIs (92.8%), and the remaining cases were exposed to splashed blood and/or other body fluids. The BBF exposures were most frequently reported from internal medicine (19.1%), the operating room (17.8%), and the obstetrics/gynecology (16.1) wards. The least frequent occupational exposures were from the pediatrics (2.1%) and surgery (4.2%) wards (Tables 2 and 3).

Approximately one-fifth of the exposed hospital staff working in the pediatrics ward and the emergency department postponed seeking post-exposure measures, the highest proportion among all hospital wards. In contrast, only 2.2% and 2.6% of HCWs in the internal medicine and obstetrics/gynecology wards, respectively, were found to

Table 1. Demographics and Medical Characteristics of Healthcare Workers Exposed to Blood and Body Fluid, Zahedan, Iran, 2013 - 2014 (n = 236)

Variable	No. (%)
Gender	
Male	45 (19.1)
Female	191 (80.9)
Age group, y	
< 25	95 (40.3)
25 - 30	62 (26.3)
31 - 35	50 (21.2)
> 35	29 (12.3)
Occupation	
Physician	57 (24.2)
Nurse	82 (34.7)
Others	97 (41.1)
Hepatitis B vaccination	
Complete	210 (89.0)
Incomplete	22 (9.3)
Unknown	4 (1.7)
Type of exposure	
Needlestick	219 (92.8)
Splash	17 (7.2)

Table 2. The Distribution of Healthcare Workers' Occupational Exposure to Blood and Other Body Fluids by the Type of Exposure and Hospital Ward, Zahedan, Iran, 2013 - 2014 (n = 236)

Variables	No. (%)
Type of exposure	
Needlestick	219 (92.8)
Splash	17 (7.2)
Ward	
CCU/ICU	20 (8.5)
Emergency Department	26 (11.0)
Internal medicine	45 (19.1)
Obstetrics/Gynecology	38 (16.1)
Operation Room	42 (17.8)
Pediatrics	5 (2.1)
Surgery	10 (4.2)
Other wards	50 (21.2)

delay undertaking post-exposure measures following exposure to BBFs. The differences were statistically significant for the distribution of the delayed post-exposure mea-

Table 3. Factors Associated With Delayed Post-Exposure Measures Among Healthcare Workers Exposed to Blood and Other Body Fluids, Zahedan, Iran, 2013 - 2014 (n = 236)^a

Variables	Non-Delayed	Delayed	P Value ^b
Gender			
Male	40 (88.9)	5 (11.1)	0.172
Female	181 (94.8)	10 (5.2)	
Age group, y			
< 25	88 (92.6)	7 (7.4)	0.379
25 - 30	57 (91.9)	5 (8.1)	
31 - 35	48 (96.0)	2 (4.0)	
> 35 y	28 (96.6)	1 (3.4)	
Job category			
Physician	55 (96.5)	2 (3.5)	0.314
Nurse	77 (93.9)	5 (6.1)	
Others	89 (91.8)	8 (8.2)	
Ward			
CCU/ICU	19 (95.0)	1 (5.0)	0.040
Emergency Department	21 (80.8)	5 (19.2)	
Internal Medicine	44 (97.8)	1 (2.2)	
Obstetrics/Gynecology	37 (97.4)	1 (2.6)	
Operation Room	38 (90.5)	4 (9.5)	
Pediatrics	4 (80.0)	1 (20.0)	
Surgery	9 (90.0)	1 (10.0)	
Other wards	49 (98.0)	1 (2.0)	
Injury type			
Needlestick	208 (95.0)	11 (5.0)	0.016
Splash	13 (76.5)	4 (23.5)	
Hepatitis B vaccination			
Complete	197 (93.8)	13 (6.2)	0.999
Incomplete	20 (90.9)	2 (9.1)	
Unknown	4 (100.0)	0	
Season			
Spring	67 (97.1)	2 (2.9)	0.003
Summer	70 (93.3)	5 (6.7)	
Autumn	36 (81.8)	8 (18.2)	
Winter	45 (100.0)	0	

^aValues are expressed as No. (%).

^bP value for chi square tests.

asures across all hospital wards ($P < 0.040$). Healthcare workers sustaining NSIs were significantly less likely to delay post-exposure measures as compared with hospital staff exposed to splashed BBFs (5% versus 23.5%, $P < 0.016$).

In comparison with other seasons, the post-exposure measures for a significantly greater proportion of BBFs exposures that occurred during autumn were delayed.

5. Discussion

We found that NSIs were commonplace among hospital HCWs. In our study, injuries by sharp objects outnumbered those due to splashes, which is a frequent finding among HCWs working in pressing situations. Exposures to BBFs were most frequently reported from the internal medicine, operation room, and obstetrics/gynecology wards. Exposures to BBFs that occurred in the emergency department and the pediatric ward, NSIs that took place in the autumn, and splashes to mucus membranes were associated with delayed post-exposure prophylaxis measures.

The results of this study are comparable with the findings from similar studies conducted in Iran. For instance, a study on BBF exposure among HCWs in a hospital in Iran found that 82% of the hospital staff had NSIs and sharp instrument injuries, and 19% had mucosal contact with BBFs. Approximately one-third of these injuries occurred during or after sharp instrument disposal, and the rest occurred during operative procedures (16). A similar study that was carried out in hospitals in Tehran reported that more than 40% of HCWs had sustained NSIs in the previous year, and nurses accounted for the majority of the identified cases (15). A study on the epidemiological characteristics and risk factors of occupational exposure to BBFs among HCWs from three teaching hospitals in Tehran reported that housekeeping staff nurses and nurses were at the highest risk of exposure and that the events occurred most commonly in the medical wards (14). However, the analysis of the data on sharp injuries and splashes among HCWs of a trauma center showed that doctors but not nurses had the highest rate of exposure (19).

Our findings are also in accordance with similar study results from other developing countries. The data from four major hospitals in India showed that 243 NSIs and 22 incidents of BBF exposure were reported in the 50 months of the study period, and nurses constituted the occupational group with the highest proportion of exposure at 55% (20). A similar study on the frequency of sharp injuries among HCWs in the United Arab Emirates reported that approximately one-fifth of the HCWs had sustained an NSI in the one-year study period, and poor compliance with universal precautions nearly doubled the risk of suffering a sharp injury (21). The analysis of 17 years of data from surveillance of HCWs' exposure to BBFs at a tertiary care hospital in Lebanon showed that the average rate of BBF exposures was 0.57 per 100 admissions per year. The exposures were mostly related to procedural interventions,

the improper disposal of sharp objects, and recapping (22). A study of the prevalence and factors associated with NSIs and splash exposures among HCWs in a provincial hospital in Kenya showed that one-quarter of HCWs interviewed reported having been exposed to BBFs within the preceding year. Higher rates of percutaneous injuries were observed among nurses (50%), during stitching (30%), and in the obstetric and gynecologic department (22%) (7). Higher rates of occupational exposures to BBFs have been reported from less developed countries. For example, a study on nurses in Nigerian hospitals showed that the knowledge of injection safety was poor and that more than half of HCWs had sustained NSIs during the previous year. But only 0.6% of the respondents received post-exposure prophylaxis (23).

One of the major concerns with regard to BBF exposures is underreporting and delayed responses to the injuries sustained by HCWs. Such underreporting represents a missed opportunity for undertaking post-exposure measures and identifying hazardous procedures. Underreporting is prevalent among all HCWs, but it is more prevalent among hospital waste disposal staff (19). The major reasons for not reporting NSIs include dissatisfaction with the administrative response to reports (12), the estimation that the transmission risk is low (24), a perceived lack of time (24), personal fears, and hospital quality management (25). Factors contributing to the underreporting of NSIs need to be addressed through strong quality management processes and positive responses to reports of BBF exposure occurrences (25). These measures may in turn increase reporting and enhance HCWs' safety (25).

The results of this study showed that in comparison with sharp injuries, splashes to mucus membranes were associated with the postponement of post-exposure prophylaxis measures. Delayed measures in such cases could be partly explained by the underestimation by exposed HCWs of the transmission risk through splashes (24). The HCWs who experienced BBF exposures in autumn, as compared with other seasons, were more likely to postpone post-exposure prophylaxis measures. During autumn, as a result of increased seasonal admissions, most hospital wards would face a shortage of HCWs and an increased workload. A perceived lack of time is highly likely to result in delayed post-exposure measures (24). A greater proportion of the hospital staff who worked in emergency departments and pediatric wards and sustained NSIs had delayed prophylaxis responses to the incidents; these delays were possibly due to the relatively higher workload in these wards and to the HCWs' considering the hospitalized children as low risk. A staffing shortage, especially of nurses, that results in an increase in the workload is one of the main factors associated with hospitals' constrained

ability to comply with infection control measures including responses to NSIs (4).

We found that approximately 90% of the exposed hospital staff were fully immunized against hepatitis B. However, this level of immunization coverage is not sufficient to protect HCWs against occupationally acquired hepatitis B virus infections. This finding is in agreement with the results from another study that reported that proper hepatitis B vaccination was carried out by 81.4% of HCWs in Isfahan, Iran (26). The hepatitis B vaccination status in HCWs who are at an increased risk of exposure to blood-borne infections have also been found to be suboptimal. For instance, the results from a study on Iranian surgeons showed that hepatitis B vaccination was complete in about 76% of surgeons, but only 56.8% of them had checked their Hepatitis B surface antigen antibody (anti-HBs) levels (27). When planning infection control protocols, the long-term efficacy of the hepatitis B vaccination in HCWs should be considered. The results of a study conducted to evaluate the 16-year efficacy of the hepatitis B virus vaccine in hospital staff in Tehran, Iran, showed that only 80.7% of the HCWs had a protective level of anti-HBs antibody (28). The findings from a similar study on the immune response to the hepatitis B virus vaccine indicated that after an average of 63.4 months, only 68.2% had protective levels of anti-HBs antibody (29). This emphasizes the need for an improvement in the hepatitis B vaccination policy to ensure that HCWs receive proper protection against hepatitis B infection (30).

Several preventive measures have been proposed to reduce exposure to BBFs among HCWs. These exposure prevention measures include pre-exposure programs (such as HCW training, the development of standard precaution measures, the use of appropriate needle protective devices, and hepatitis B vaccinations) and post-exposure action plans (e.g., post-exposure prophylaxis and the early detection of disease) (31). Elimination of needle recapping and the use of safer needle devices, sharps collection boxes, gloves and personal protective gear, and universal precautions have been associated with a decrease in NSIs and other sharps injuries (32). Implementation of an enforceable policy to protect HCWs should also be considered (32). To prevent NSIs, hospital managers should establish safe systems of work and should promote compliance with standard infection control procedures (33). Although it has been proposed that the safety features of devices, such as shields or retractable needles, can possibly contribute to the prevention of NSIs, a comprehensive systematic review of the literature found that the results from different studies were inconsistent, and there was no clear evidence of a benefit (34). However, we cannot conclude that safety-engineered devices are not effective. Further

investigation is warranted to establish their effectiveness and cost-effectiveness, especially in developing countries.

One of the limitations of the current study is that we used administrative data to investigate the epidemiology of NSIs and other types of exposure to BBFs among HCWs. The quality of the data collected may differ from one hospital to another. Moreover, underreporting of the NSIs could not be ruled out.

In summary, the relatively high prevalence of occupational exposure in this study emphasizes the importance of promoting awareness, training, and education for HCWs as part of preventive strategies. It is also prudent to strengthen adherence to standard precautions as well as to improve the reporting of occupational exposure to blood and body secretions.

A determination of the prevalence, burden, and reasons for underreporting needlestick injuries by clinical nurses is required to establish a preventive strategy to decrease hospital infections.

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Footnotes

Authors' Contribution: Seyed Mehdi Tabatabaei planned the study design and coordinated the conduct of the study. He also carried out the statistical analysis and interpretation of the data and drafted this paper. Fateme Behmanesh Pour and Jamshid Ordoni Avval supervised the data collection process and participated in drafting the manuscript. Saeede Osmani, Sedighe Mokhtari, and Maryam Aghebat Bekheyr undertook the data collection during the study period. All authors approved the final draft of the paper.

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