

Original Article

Body Fluid Exposure in Nurses of Fars Province, Southern Iran

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Background: Blood and body fluid exposures place healthcare workers at risk for blood-borne infections. To determine the extent of the problem in Iran, we assessed blood and body fluid exposure in healthcare workers in Fars Province hospitals.

Methods: We distributed 2,118 questionnaires using a stratified random sampling method among nurses of these hospitals. We used Chi-square test, Student's *t*-test, and multiple logistic regression analysis for determining risk factors for exposure.

Results: The overall prevalence of blood and body fluid exposures was 79% with a rate of exposure to sharps devices of 50%. Hypodermic needles were involved in most exposures (73%) with the most common source of injury being needle recapping (35%). Blood was the most frequent contaminant (87%) in mucocutaneous exposures, most commonly associated with inserting and removing intravenous lines (50%). Sharps injuries were independently associated with gender, professional level, and hospital location; mucocutaneous exposures were related to professional level and hospital location. Only 28% of nurses reported their exposures.

Conclusion: The high level of risk found among nurses in Fars Province highlights the urgent need for interventions to enhance their occupational safety and to prevent unnecessary transmission of blood-borne viruses.

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Keywords: Blood and body fluid exposure • Iran • needlestick • nurses • surveillance

Introduction

Needlestick injuries (NSIs) and blood and body fluid (BBF) exposures place healthcare workers (HCWs) at risk for numerous blood-borne infections, most importantly human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV).¹⁻² Approximately three million percutaneous exposures to blood-borne pathogens occur annually among 35 million HCWs worldwide. These injuries are estimated to result in approximately 16,000 HCV, 66,000 HBV, and

200 HIV infections. Over 90% of these infections occur in low-income countries and most are preventable.³

An European survey of NSIs, found that nurses are exposed more commonly (91%) than doctors (6%) or phlebotomists (3%).⁴ In a study by Askarian et al. conducted in Shiraz, southern Iran in 2003, 70% of medical, 74% of dental, and 72% of nursing students reported having had at least one sharps-related injury since beginning of their clinical education. Of note, 75 – 85% of these students did not report their injuries.⁵ This degree of under-reporting is important because in 2004 the estimated number of people in WHO Eastern Mediterranean region newly infected with HIV increased by 60% compared with 2003.⁶ Further complicating this situation in Iran is the inadequate supply of personal protective equipment and improper disposal of regulated medical wastes.⁶

The most effective approach for averting blood-borne infections in HCWs is the prevention of percutaneous injuries with contaminated medical

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devices.⁷ Such prevention requires implementation of safer devices and development of exposure control plans that detail which group of HCWs are at greater risk of exposure.⁸ Nurses generally are at high risk for NSIs with up to 50% of injuries being sustained by this group.⁴ However, risk to nurses has not yet been studied in Iran. Therefore, our objectives were 1) to estimate BBF exposure risk in nurses in Fars Province, southern Iran with regard to sociodemographic characteristics, and 2) to assess follow-up measures received by nurses.

Materials and Methods

Setting

A cross-sectional survey of nurses and midwives was conducted in hospitals of Fars Province, one of the 30 provinces in south of Iran. This location was selected since hospitals in Shiraz, the capital and largest city of Fars Province, serve as referral centers for approximately one-quarter of patients in Iran. There are 17 private and 35 governmental hospitals providing service under the supervision of Shiraz University of Medical Sciences (SUMS). Our study was conducted in these hospitals except for those in Jahrom and Fasa, which were excluded because they were not under the supervision of SUMS. Fifty-eight percent of the hospitals were located in Shiraz (n=30), the other 22 hospitals were in 14 other cities.

Study sample

The target population was nurses, auxiliary nurses, and midwives (n=4,576). This group was stratified by hospital; a 44% sample was randomly selected from within each hospital according to their population for a total sample of 2,118.

Instrument

A 32-item structured questionnaire was developed to ascertain exposures and risk factors for them. The final instrument was created and adapted from existing questionnaires used in surveys of North American HCWs⁹⁻¹³ and included information on demographics, exposures, follow-up measures, and hepatitis B immunization status. The questionnaire's content was reviewed and approved by infection control specialists and head nurses providing face validity to the questionnaire.

Data collection

In March 2005, we mailed 2,118 questionnaires

to hospitals. Designated infection control nurses distributed questionnaires to nurses selected for participation and collected the completed questionnaires. From April through September 2005, we received 1,555 questionnaires (73% response rate).

Data analysis

Data were analyzed with SPSS[®] for Windows[®] version 11.5 (SPSS, Chicago, IL). Standard descriptive statistical techniques were used to determine the number of annual NSI events and the prevalence of BBF contamination. χ^2 and independent-sample Student's *t*-tests were used to evaluate the association between independent variables and exposure. Variables which had a $P < 0.25$ in Wald χ^2 test were included in the multiple logistic regression equation. An alpha level (type I error) of 0.05 was used to determine statistical significance in the multiple logistic regression and other simple comparisons.

Ethical issues

Ethical considerations including privacy of personal data were considered during each step of the research process. Access to the data was restricted to the research team. Data were protected at all times including use of sealed envelopes and locked cabinets.

Results

Description of sample

The mean \pm SD age of respondents was 31 \pm 8.5 years; 71% of participants were females (Table 1). Approximately 79% of nurses (n=1,225) had been exposed to BBF at least once in the prior year. Exposures were primarily nonsharps-related BBF contamination (n=1,128; 73%), with the remainder from sharp devices (n=771; 50%). Some subjects reported more than one exposure.

Sharp injuries

The most frequently encountered source of injury was hypodermic needles (n=561; 73%), followed by intravenous (IV) catheters (n=232; 30%). The most common procedure involved in injury was needle recapping (n=273; 35%). The finger was the most commonly injured site (n=728; 94%).

In univariate analysis (Table 2), there was no statistically significant difference in the frequency of sharp injuries between male and female nurses.

Table 1. Demographic characteristics of participants (n=1555).

| Subject characteristics | Subjects (n=1555) |
|---|-------------------|
| Female gender (%) | 1197 (77%) |
| Mean (range) age, years | 31 (18 – 63) |
| Mean (range) years after graduation | 9.5 (0 – 40) |
| Mean (range) number of years at service | 7 (0 – 40) |
| Profession (%) | |
| Head nurse | 176 (11%) |
| Nurse | 901 (58%) |
| Midwife | 146 (9%) |
| Auxiliary nurse | 218 (14%) |
| Co-auxiliary nurse | 109 (7%) |
| Unknown | 5 (<1%) |
| Hospital location (%) | |
| Shiraz | 1104 (71%) |
| Cities of Fars Province except Shiraz | 451 (29%) |
| Hospital type (%) | |
| Private | 646 (42%) |
| Governmental | 909 (58%) |

However, differences were found between injured and noninjured employees with regard to age, years after graduation, years of service, profession, hospital location, and hospital type. In the multiple logistic regression analysis (Table 2), sharp injuries experienced during the preceding year were associated with male sex (OR=1.60; 95%CI: 1.17 – 2.21), working in any capacity other than head nurse, and employment in a hospital located outside of Shiraz (OR=2.27; 95%CI: 1.63 – 3.17).

Blood and body fluid mucocutaneous contamination

Approximately three-fourths of participants (n=1,128) reported experiencing a BBF contamination at least once during the prior year, with most being exposed to blood (n=982; 87%). The procedure most commonly associated with BBF contamination was IV line manipulation (n=562; 50%). The hand was the most often contaminated organ (n=1,007; 89%), while eye mucosa was the most frequently exposed mucous membrane (n=267; 24%).

In univariate analysis (Table 3), there were differences between exposed and nonexposed employees with regard to age, years after graduation, years of service, profession, hospital location, and hospital type. In multivariate analysis (Table 3), working as a midwife (OR=2.03; 95%CI: 1.07 – 3.85) and employment in a hospital

outside Shiraz (OR=1.53; 95%CI: 1.04–2.24) were significantly associated with BBF exposure. Of those reporting exposures, 175 (16%) had skin erosions or lesions and 429 (38%) employees were not using any protective equipment (e.g., gloves and goggles). BBF exposure occurred most frequently in surgical wards (n=507; 41%).

Postexposure follow-up

Fars Province hospitals do not have any official postexposure protocols to assist nurses in receiving appropriate postexposure care. Therefore, only 337 (28%) reported their exposure to an authority. Reasons cited for nonreporting are shown in Table 4.

Many BBF exposures occurred while performing procedures on patients whose infection status was not known. Only 60 (4.9%) of the exposed nurses confirmed that the source patient had one or more documented blood-borne infections. Nineteen exposures were from known cases with HIV, 40 with HBV, and 27 with HCV. Although documentation is limited, some source patients demonstrated notable risk factors for possible blood-borne infection such as IV drug use (n=121); multiple sexual partners (n=16); hemodialysis treatment (n=38); and multiple blood transfusions (n=61). Postexposure prophylaxis was provided for 123 (10%) nurses. Twelve exposed employees reported being treated with antiretroviral drugs; 19 received hepatitis immunoglobulin and 40 received hepatitis B vaccine. Only 65% of participants had completely been vaccinated against HBV; of these, only 194 (12%) had a documented adequate antibody titer.

Discussion

The level of exposure to BBF among nurses in Fars Province hospitals is unacceptably high and in need of urgent solutions. The proportion of nurses experiencing BBF exposure in Iran is comparable to that found in other developing countries. Fifty-five percent of HCWs in Uganda,³ 72% of Indian nurses,³ and 82% of Chinese nurses¹⁴ experienced at least one percutaneous injury in the prior year, compared to only 9% of nurses in the United States in one study.³ The high prevalence of BBF exposure in developing countries may be due to 1) inadequate supply of personal protective equipment; 2) lack of availability of safer sharp devices; 3) inadequate information about exposure risks; 4) lack of adherence to standard isolation precautions;

Table 2. Univariate and multivariate analysis of variables associated with nurses reporting at least one sharp injury in the previous year.

| Characteristic | ≥1 sharp injury | No sharp injury | Univariate analysis (n=747) | | Multivariate analysis (n=747) | |
|----------------------------------|-----------------|-----------------|-----------------------------|---------|-------------------------------|---------|
| | | | OR (95%CI) | P value | OR (95% CI) | P value |
| Gender | | | | 0.188* | | 0.004 |
| Female | 580 (48%) | 617 (52%) | 1 | | 1 | |
| Male | 167 (53%) | 148 (47%) | 1.20 (0.94 – 1.54) | | 1.60 (1.17 – 2.21) | 0.004 |
| Mean (SD) age | 32.14 (8.44) | 33.45(8.65) | — | 0.004** | 0.98 (0.95 – 1.02) | 0.296 |
| Mean (SD) years after graduation | 8.8 (7.5) | 10.16 (7.7) | — | 0.001** | — | — |
| Mean (SD) years of service | 9.05 (7.8) | 10.62 (8.5) | — | 0.001** | 1.02 (0.98 – 1.06) | 0.404 |
| Profession | | | | <0.001* | — | <0.001 |
| Head nurse | 62 (35%) | 114 (65%) | 1 | | 1 | 1 |
| Nurse | 457 (51%) | 444 (49%) | 1.89 (1.35 – 2.6) | | 1.98 (1.33 – 2.95) | 0.001 |
| Midwife | 104 (71%) | 42 (29%) | 4.55 (2.83 – 7.3) | | 4.72 (2.69 – 8.26) | <0.001 |
| Auxiliary nurse | 102 (47%) | 116(53%) | 1.67 (1.11 – 2.52) | | 1.57 (0.95 – 2.61) | 0.08 |
| Co-auxiliary nurse | 43 (40%) | 66 (60%) | 1.21 (0.74 – 1.99) | | 1.73 (0.88 – 3.40) | 0.114 |
| Hospital location | | | | <0.001* | | <0.001 |
| Shiraz | 482 (44%) | 622 (56%) | 1 | | 1 | |
| Other cities of Fars Province | 292 (65%) | 159 (35%) | 2.36 (1.88 – 2.96) | | 2.27 (1.63 – 3.17) | |
| Type of hospital | | | | <0.001* | | 0.537 |
| Private | 282 (44%) | 364 (56%) | 1 | | 1 | — |
| Governmental | 492 (54%) | 417 (46%) | 1.52 (1.24 – 1.86) | | 1.10 (0.82 – 1.47) | — |

5) insufficient number of nurses and use of temporary nursing staff; and 6) improper disposal of regulated medical wastes, especially needle disposal systems.

In our study, certain groups were at higher risk for exposure than others. For example, male nurses had higher odds of experiencing an injury than female nurses. This outcome was also reported in studies conducted in France,⁸ Australia,⁸ and the United States.¹ Possible explanations could be that men are assigned more risky tasks or are less likely to use universal precautions. Further studies are warranted to identify exposure differences, especially in nursing staff who perform similar jobs. In addition, midwives, who perform numerous high-risk procedures, experienced more BBF exposures than other groups.

Hospital location was also an independent factor; nurses in Shiraz hospitals had lower levels of BBF contamination than those working elsewhere. An Indian study also found that hospital location was an independent predictor in sharp injuries, as did a study from the United States where rural hospitals had higher rates of exposures than did urban hospitals.¹⁵ Within hospitals, BBF

exposure was more common in surgical wards confirming findings reported by other authors,^{1,8,14,16,17} a finding most probably due to the number/type of procedures conducted in these settings.

In our study, needle recapping was the most common procedure associated with injury (35%) although Iranian nurses are trained not to recap any needle. Forty-three percent of sharp injuries occurred during recapping in China,¹⁴ 45% in Turkey,¹⁶ and 16.4% in Korea.¹⁸ In a US study, however, only 9% of the nurses' sharp injuries were caused by recapping.¹² At least one study has determined that sharp injuries could be reduced by 70% if recapping was avoided and needles were disposed promptly into puncture resistant containers.¹⁶ Therefore, HCWs should be encouraged to discontinue this practice and to dispose used needles immediately. Furthermore, safety enhanced devices, (e.g., shielding, sheathing, or retracting) should be made available to Iranian HCWs.

Although personal protective equipment is available, participants' hands/eyes were contaminated frequently. Of the exposed workers, only 46% were able to confirm that their skin was free of

Table 3. Univariate and multivariate analysis of variables associated with nurses reporting at least one mucocutaneous contamination with BBF in the previous year.

| Characteristics | ≥1 report of mucocutaneous contamination | No report of mucocutaneous contamination | Univariate analysis (n=1100) | | Multivariate analysis (n=1100) | |
|----------------------------------|--|--|------------------------------|----------|--------------------------------|---------|
| | | | OR (95%CI) | P value | OR (95%CI) | P value |
| Gender | | | | 0.112* | — | 0.106 |
| Female | 882 (74%) | 315 (26%) | 1 | | 1 | — |
| Male | 218 (69%) | 97 (31%) | 1.1(.95 – 1.49) | | 1.35 (0.94 – 1.95) | — |
| Mean (SD) age | 32.18 (8.03%) | 34.41(9.71) | | <0.001** | 0.99 (0.95 – 1.02) | 0.466 |
| Mean (SD) years after graduation | 9.16 (7.34) | 10.49(8.5) | | 0.007** | 1.04 (1.00 – 1.08) | 0.07 |
| Mean (SD) duration of service | 9.067 (7.61) | 12.028(9.46) | | <0.001** | 0.96 (0.91 – 1.00) | 0.07 |
| Profession | | | | <0.001* | | 0.002* |
| Head nurse | 120 (68%) | 56 (32%) | 1.45 (0.95 – 2.2) | | 1 | 1 |
| Nurse | 687 (76%) | 214 (24%) | 2.18 (1.6 – 2.98) | | 1.41 (0.93 – 2.15) | 0.109 |
| Midwife | 119 (82%) | 27 (18%) | 2.98 (1.81 – 4.9) | | 2.03 (1.07 – 3.85) | 0.030 |
| Axillary nurse | 130 (60%) | 88 (40%) | 1 | | 0.61 (0.36 – 1.02) | 0.062 |
| Co-auxiliary nurse | 68 (62%) | 41 (38%) | 1.16 (0.72 – 1.87) | | 0.96 (0.47 – 1.95) | 0.902 |
| Hospital location | | | | <0.001* | | 0.032* |
| Shiraz | 770 (70%) | 334 (30%) | 1 | | 1 | |
| Other cities of Fars Province | 360 (80%) | 91 (20%) | 1.72 (1.32 – 2.23) | | 1.53 (1.04 – 2.24) | |
| Type of hospital | | | | 0.025* | — | 0.682* |
| Private | 450 (70%) | 196 (30%) | 1 | | 1 | — |
| Governmental | 680 (75%) | 229 (25%) | 1.29 (1.03 – 1.62) | | 0.93 (0.68 – 1.29) | — |

lesions. These results stress the importance of using personal protective equipment during all procedures involving BBF exposures.

Postexposure follow-up

In Iran, no consistent protocols exist for reporting exposures. In our study, only 29% of the exposed nurses reported their BBF exposures. This proportion is well comparable with that found in other developing countries (8 – 30%).^{14,16,18,19} Moreover, 33% of the exposed nurses were even unaware of the need to report their exposures. Likewise, in studies in China and Turkey, the most common reason for failure to report was that the affected persons did not think it is important to report at all.^{4,14,16} This suggests that nurses require a targeted prevention program addressing the importance of reporting all exposures, whether or not they perceive the exposures to be high risk. The fact that 14% of nurses reported not knowing to whom to report their injury underscores the need for standardized reporting mechanisms. Furthermore, few exposed HCWs received appropriate follow-up treatment.

Vaccination

Only 65% of participants reported receiving

three or more doses of hepatitis B vaccine, an important step in reducing the risk of HBV infection.²⁰ Of these, only 194 (12.4%) were confirmed to be immune against HBV (antibody titer >10 mIU/mL). In China, 71% of HCWs reported receiving HBV vaccination,¹⁴ compared with 68% in Turkey¹⁶ and 40% in Africa.¹⁹ Because there are convincing data for the efficacy of hepatitis B vaccine in protecting against infection,¹⁴ vaccination programs should be universally implemented.

In this study, we demonstrated that exposure to BBF in Iranian nurses is unacceptably high and that reporting of exposures and follow-up procedures do not conform to accepted practices of care elsewhere. In addition, safer sharp devices are not available in Iran. Given these results, it is clear that there is an urgent need for interventions to enhance the occupational safety of workers. The following recommendations are made so that a higher level of protection can be afforded to these HCWs:

- Development of sharps injury registries in Iran. This is important because there is no organization responsible for postexposure follow-up, nor is there a consistent protocol for evaluation

Table 4. Nurses stated reasons for not reporting an exposure (n=762).

| Stated reason for non-reporting | Number of nurses citing this reason | Percentage |
|---|-------------------------------------|------------|
| Reporting was not regarded as necessary | 250 | 33% |
| Forgetting, too busy | 233 | 31% |
| Not having their case followed if reported | 210 | 28% |
| Not knowing to whom the injury should be reported | 104 | 14% |
| The outcome would not have been affected if reported or not | 63 | 8% |

Note: Respondents able to choose more than one reason for non-reporting.

and treatment of exposed HCWs.

- Provision of a structured educational program about universal precautions and blood-borne pathogen exposure for HCWs.
- Implementation of safety engineered devices where practical and feasible. Given the financial hardship that this may impose, a structured implementation program should be developed so that, in time, all HCWs are provided greater protection through engineering controls.
- Provision of an adequate number of properly positioned, safely constructed, puncture-resistant disposal containers in patients' rooms.
- Universal administration of hepatitis B vaccine to HCWs at risk of exposure to blood-borne pathogens.
- Identifying specific prevention priorities for workers at highest risk of exposure, keeping in mind that all HCWs deserve to be offered adequate protection as well. Determining relative exposure risks helps health authorities to increase prevention and training measures necessary for the protection of all HCWs, especially groups at highest risk of exposure such as midwives, male nurses, and those who work in surgical settings.

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