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Evaluation of Preventive Interventions in Reporting Needle Stick Injuries among Health Care Workers

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Abstract

Background and Objectives: Needle Stick Injuries (NSIs) are a common potential risk for health care workers. The aim of this study was to evaluate preventive interventions against NSI incidents among the clinical staff of Chaharmahal-Va-Bakhtiari hospitals.

Methods: Seven hospitals in Chaharmahal-Va-Bakhtiari Province (Iran) were surveyed from March 2008 to March 2013. The NSI data of health care workers were extracted from their hospital documentations. Chi-square test and logistic regression were used for analyzing the data.

Findings: A total of 571 exposures (30.9%) to blood and other infected fluids were recorded. Three measures of preventive interventions against occupational exposures were found to be independently associated with the reporting time less than 72 hours; a positive history of training courses passed [P=0.012, OR=0. 440, 95% CI: 0.233-0.832], standard infection control procedures after NSI [P=0.000, OR=4. 905, 95% CL: 2.777 –8.663], and wearing personal protective equipment [P=0.000, OR=9. 313, 95% CL: 4.142 – 20.940].

Conclusions: Personnel protective equipment, training of employees, and use of standard infection control procedures after NSI incident are both essential and effective in preventing the viral transmission of blood-borne diseases among health care workers.

Keywords: Needle-stick injuries, Health care workers, Occupational exposure, Preventive interventions.

Background and Objectives

Needle Stick Injuries (NSIs) are a common and potential risk in medical centers for the Health Care Workers (HCWs). NSIs are defined as puncture wounds, which occur when the skin is accidentally punctured by the needles used such as suture needles [1-4]. During the clinical practices including injecting the intravenous drugs, the HCWs can accidentally expose to the blood and other fluids of the patient's body, which can lead to the potential risk of blood-borne diseases.

At least twenty infecting agents, specifically viral agents can be transmitted by NSIs [5]. Center for Disease Control (CDC) reports transmission rates of 5-45%, 2.7- 10%, and 0.3% for Hepatitis B virus (HBV), Hepatitis C virus and human immunodeficiency virus (HIV), respectively [6-8].

NSIs can be caused by psychological trauma [9], the heavy cost of therapy, and severity of infectious complications [10]. For protecting the employees against NSIs and their consequences [11], the hospital managers should apply preventive strategies, aimed at extending the HCWs' knowledge on the recognition, avoidance, and health hazards of NSIs.

The aim of this study was to survey the rate and causes of NSIs in Chaharmahal Va Bakhtiari Province (Iran), and also to analyze the impact of preventive measures on NSIs during a five-year period (March 2008 to March 2013).

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Methods

Study design and population

The study had a cross-sectional design. The information of NSIs of HCWs' was extracted from the clinical records filed during March 2008 to March 2013. NSIs were surveyed by the hospitals' infection control teams. The data were collected by census. The study population was considered as the HCWs with a positive history of NSI in seven selected hospitals of Chaharmahal Va Bakhtiari Province. The population included doctors, nurses, midwives, and laboratory technicians, as well as the supporting staff such as laundry workers and cleaners.

Data analysis

The prevalence rates were classified according to the characteristics of the injured persons (e.g. age, education, training courses, and job title), timing of injury during the device use (for example; during the needle recapping), and the devices involved. Mean and Standard Deviation (SD) was used for summarizing the data. Logistic regression was employed to determine the effect of preventive interventions on the health of the injured individuals who reported NSIs within 72 hours. $P<0.05$ was considered as the statistically significant. All statistical analyses were carried out using SPSS Software Version 18.

Results

By reviewing the records of 1848 HCWs, it was found that 571 (30.9%) exposures to blood and other infected fluids were reported to the supervisors, and registered in the HCWs' health file from March 2008 to March 2013.

Table 1 shows the demographic and professional characteristics of the hospital staff with NSIs history. Four hundred seventy one of the NSI-experiencing staff was female. The mean age of the population was 29.48 ± 7.42 years. The highest rate (65.8%) of occupational exposure was found among the nurses. 92.6% of NSIs were reported within the first 72 hours after injury.

Table 2 indicates the statistics of the NSI reports. The highest mean of reporting rate was 0.4 ± 0.8 with the interval of 5 days during March 2012-March 2013.

Table 3 illustrates the frequency of standard procedures against occupational exposures during the studied years. At the time of incident, 524 (91.8%) of NSI-experiencing staff had complete Hepatitis B vaccination, and their HBSAb titer was at a high level of 10. At exposure time with needles or sharp devices, 85.5% (490) wore personnel protective equipment and disinfected their hands. The majority of reported NSIs (87.7%) were related to the use of needles, and the most frequent incident was during the recapping of a used needle (76.7%).

All NSI-experiencing staff had consulted with an infectious disease specialist after the incidents. Out of the 571 NSI-experiencing staff, 123 washed the injury site with water and soap, 284 washed the injury site and sampled from the patient, 146 washed the injury site and sampled both from the patient and themselves, and 18 of them only sampled from themselves (Table 4).

Blood-borne diseases were identified in 34 of the sampled subjects including 23 Hepatitis B, 5 Hepatitis C and 6 HIV. Four of the NSI-experiencing staff exposed to HB patients' blood with a positive history of incomplete vaccination or a low level HBSAb titer of 10 received Immunoglobulin Hepatitis B (HBIG) and vaccine booster HB in the first 72 hours after exposure. Six NSI-experiencing staff exposed to the blood material of HCV patients underwent follow-up for 6 months as well as HCVAb test by Eliza method; 4-6 weeks, 3 and 6 months after exposure. Anti-retroviral drugs against HIV (Zidovudine plus Lamivudine) were prescribed for six of the NSI-experiencing staff for four weeks after the first 72 hours. They had a complete blood count and measurement of liver-enzyme levels at the second week of treatment. These subjects underwent follow-up for 6 months, and were tested with a HIVAb test by Eliza method; 4-6 weeks, 3 and 6 months after exposure. Eighteen NSI-experiencing staff did not determinate the source. They received standard infection control procedures against HCV, HBV, and HIV, were and followed up for six months.

Out of the 411 NSI-experiencing staff trained about adherence standard precautions in occupational exposures, 385 completed Hepatitis B vaccination, 365 wore personnel protective equipment, and all of them received the necessary standard infection control procedures. Significant differences were identified in completing the Hepatitis B vaccination ($P = 0.011$), using protective equipment ($P = 0.002$), and performing the standard infection control procedures ($P = 0.000$) before and after the preventive training courses.

Binary logistic regression analysis revealed that three variables of the preventive interventions against occupational exposures were independently associated with the reporting time within 72 hours; taking training courses [P=0.012, OR=0. 440, 95% CL: 0.233- 0.832], standard infection control procedures after injury [P=0.000, OR=4. 905, 95% CL: 2.777–8.663], and using protective equipment [P=0.000, OR=9. 313, 95% CL: 4.142 – 20.940]. None of other variables had a relationship with reporting time within 72 hours.

Discussion

Health care workers (HCWs) are susceptible to accidental exposure to the blood and other body fluids when performing clinical activities [2]. HCWs are at the potential risk of blood-borne diseases such as Hepatitis B virus (HBV), Hepatitis C virus (HCV) and HIV caused by NSI [13]. A study by Vaid et al. recommended for publication of National and International guidelines for beginning of post-exposure prophylaxis [14]. In Iran, these national guidelines have been codified and promoted to all health and treatment centers throughout the country. An infection control team of hospital has managed the occupational exposures based on the national guidelines. The results of our study showed an NSI prevalence of 30.9% during the past five years. This finding is similar to the several other studies in Iran, such as the NSIs rate of as 39.3% in Yasouj and 63.3% in Shahroud [15-16].

The best time for standard precaution procedures is within the first 72 hours after injury, especially for HIV infections [12]. The majority the NSI-experiencing staff were female with the age range of 19-28 years. Therefore, being young and lack of adequate experience can be considered as risk factors for NSIs [17-18]. None of the demographic or professional factors showed impact on reporting before 72 hours.

Clinical and laboratory tests of all cases were normal, and nobody was infected with HBV and HCV. This result indicates that care of post-exposure prophylaxis was effective in preventing HIV infections, a result consistent with previous studies [13, 21-23].

In line with previous studies, our study recommends that improving the awareness of clinical staff about standard precautions and ways of transmission of blood-borne diseases before the injury [11, 16, 25-26] should be considered as a crucial preventive strategy. Our results showed that 430 of the NSI-experiencing staff had passed the related training courses. These trainings were found to be an important factor in reducing the reporting time (P = 0.012). Although, the frequency of NSIs among the HCWs showed a growing trend, this can be due to the increasing rate of reports rather than the increasing rate of NSI incidents [27-28].

One of the protective strategies against NSI is to use individual personnel protection equipment (PPE) such as gloves and eye protection glasses in the therapeutic centers [11]. In this study, 490 of the NSI-experiencing staff had used personal PPE at the injury time. This practice had a significant relationship with reporting NSI within less than 72 hours and better care of NSIs. Kinlin et al. showed that gloving practice is an important factor in limiting the morbidity rate and the economic costs caused by NSIs in the health care system [4].

Table 1 Demographic and professional characteristics of NSI-experiencing staff

Variables	N	%
Sex (*n = 571*)		
Female	471	82.5
Male	100	17.5
Age (*n = 571*)		
19-28	337	59.0
29-38	179	31.3
39-48	48	8.4
> 49	7	1.2
Job title (*n = 571*)		
Nurse	376	65.8
Midwife	14	2.5
Laboratory technician	38	6.7
Doctor	25	4.4
Cleaning and technical personnel	118	20.7
University Education (*n = 571*)		
Medical university	457	80
Non-medical university	114	20

Table 2 Statistics of NSIs Incidents

Study year	N	Incidence rate (/1000/year)	Mean ± SD	95% CI	Min (day)	Max (day)
First year	1133	30.8	1.5 ± 1.9	0.90-2.2	0	7
Second year	1179	65.3	1.1 ± 3.5	0.3 -1.9	0	30
Third year	1304	79.7	2.4 ± 5.9	1.3-3.5	0	39
Fourth year	1848	68.7	1.6 ± 4.5	0.8 -2.4	0	31
Fifth year	1848	123.4	0.4 ± 0.8	0.3 -0.5	0	5

Table 3 Frequency of standard infection control procedures against occupational exposures

Study year	Frequency of Procedures				
	Washing the injury site with water and soap	Washing and sampling the patient	Washing and sampling the patient plus HCW	Only sampling the HCW	Total
2008	13	11	9	2	35
2009	22	41	7	7	77
2010	28	64	6	6	104
2011	55	61	8	3	127
2012	5	107	116	0	228
Total	123	177	144	18	571

Unfortunately, 269 NSI-experiencing staff had recapped a used needle. This practice was found to be the most frequent practice among the injured staff similar to the study of Askarian et al. [29]. Ribner et al. [30] showed that training programs could reduce the instances of this practice among the HCWs, when the disposal needles were used for vein puncture and percutaneous medication injections. Therefore, the managers should provide occupational safety facilities with excellent quality [31]. Ensuring that safety devices are in place and that the safety practices can help preventing the transmission of infection is greatly recommended [32].

The nosocomial infections surveillance instructions [11] and several studies [33-34] recommend vaccination of HCWs against Hepatitis B as an effective protective strategy against blood–borne diseases. In this study, 91.8% of NSI-experiencing staff had complete vaccination against Hepatitis B, which is similar to the study of Hashemi et al. [35] and Mirza et al. [27]. Vaccination was shown to have a significant correlation with reporting within 72 hours post-exposure (P = 0.001).

Study limitations

Our study has several strengths. Specifically, we used census sampling methods and all NSI-experiencing staff at risk of exposure to blood borne diseases were followed-up for 6 months. However, there was also limitation: in the first years of the study, the rate of reporting NSIs was so low.

Conclusions

Our study demonstrated the effectiveness of implementing training-based NSIs preventing interventional strategies

Table 4 Frequency distributions before and after implementing the standard procedures against occupational exposures

Variables	N	%
Hepatitis B vaccination status		
Complete	524	91.8
Incomplete	47	8.2
A positive history of training courses passed		
Yes	411	72
No	160	28
Standard infection control procedures after needle stick injury (NSI)		
Washing the injury site with water and soap	123	21.5
Washing and sampling the patient	284	49.7
Washing and sampling the patient plus HCW	146	25.6
Only sampling the HCW	18	3.2
To wear personnel protective equipment		
Yes	490	85.8
No	81	14.2

in improving the reporting of NSIs and reducing the rate of the related infections. Use of personal protective equipment, training of employees, and use of standard infection control procedures after NSI incident are both essential and effective in preventing the viral transmission of blood-borne diseases among the HCWs. At the same time, the increasing trend of NSIs during the last five years in the surveyed hospitals indicates the need for further training programs, and employing standard precaution procedures.

Abbreviations

(NSIs): Needle-stick injuries

Competing Interests

The authors declare that they have no competing interests.

Authors' Contributions

SHSH conceived the study, collected data, and made the major contribution to the statistical analysis and drafting of the manuscript. MBM was involved in data analysis and drafting of the manuscript. IR participated in designing the study and manuscript writing. All authors read and approved the final manuscript.

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