

# Risk Factors of Needlestick and Sharps Injuries among Healthcare Workers

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## Abstract

**Background and Objectives:** Exposure to contaminated needlesticks and sharp devices is an important occupational hazard among healthcare workers. The objective of this study was to gain further insight into prevalence and risk factors of needlestick and sharps injuries among healthcare workers.

**Methods:** A cross-sectional survey was carried out among 384 healthcare workers of two hospitals in Neyshabur, a northeastern city of Iran. A self-administered questionnaire was designed and distributed among participants. Data were summarized using descriptive statistical methods. Chi-square test and multivariate logistic regression were used to examine the association between respondents' demographic characteristics and occurrence of needlestick and sharps injuries.

**Findings:** More than 32% of healthcare workers reported experiencing at least one needlestick and sharps injury during the study period, 54.8% reported having sustained one injury, and 45.2% reported more than one injury. The highest prevalence of injuries was observed among nurses (39.7%). Syringe needle was responsible for the majority of incidental injuries (35.71%). Age (OR=0.551, 95% CI: (0.325, 0.934)) and number of shifts per month (OR=2.404, 95% CI: (1.389, 4.160)) were found to be significantly associated with occurrence of needlestick and sharps injuries.

**Conclusions:** In total, our findings indicate a relatively high prevalence of needlestick and sharps injuries among healthcare workers. Our results highlight the need for targeted training programs for young nurses to decrease risk of needlestick and sharps injury incidents. In addition, adequate healthcare staffing and appropriate number of shifts per month are prerequisites to preventing a high risk of needlestick and sharps injuries in hospitals.

**Keywords:** Needlestick and Sharp Injury, Healthcare Workers, Risk Factor, Prevalence

## Background and Objectives

Healthcare workers (HCWs) are exposed to various occupational risks [1]. Exposure to blood and other body fluids via contaminated needlesticks and sharp devices is a significant occupational hazard potentially leading to infection with blood-borne pathogens among HCWs [2, 3]. Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), and Hepatitis C Virus (HCV) are among the important blood-borne pathogens that can be transmitted through needlestick and sharps include. The World Health Organization (WHO) estimates that exposure to sharp devices in the workplace is responsible for 2-3% of HIV infections and 40% of HBV and HCV infections among healthcare workers

(HCWs) [4]. Globally, 12% of all working people are HCWs [5] and nearly all those performing invasive procedures with sharp devices are at risk of needlestick and sharps injuries (NSSIs) [6]. Each year, more than three million of these HCWs are exposed to HBV, HCV, and HIV due to NSSIs [7]. Previous studies in different countries have revealed that prevalence of NSSIs vary among HCWs [8-14]. This type of injury can result in substantial health consequences such as psychological stress among different HCWs and their families [8-10]. NSSIs incidents are associated with a number of different factors, including heavy workload, working in surgical or intensive care units, insufficient work experience and young age [14]. Regarding the importance of this health problem in medical centers, it is necessary to develop effective measures for reducing related incidents. For this purpose, first, prevalence and risk factors of this injury type should be identified. The objective of this study was to provide further relevant data by evaluating prevalence of NSSIs and the associated factors.

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## Methods

### Study Design and Settings

A cross-sectional design was adopted for conducting this study. The data on incidence of NSSI was collected within six months from March 21, 2011 to September 22, 2011. The data were collected from two general hospitals in Neyshabur, a city situated in the northeast of Iran. Three hundred and eighty four HCWs were randomly selected and surveyed.

### Ethics

An approval for conducting the study was obtained from the Ethical Committee of the Neyshabur University of Medical Sciences. Informed consent of all target participants was obtained. The participants were assured of the confidentiality of their responses.

### Measurement Tool

A draft questionnaire on NSSI incidences was developed. The questionnaire was further modified by consulting an epidemiologist and an infectious diseases expert. This questionnaire included 16 questions related to four sections, including *Background information*, *Occurrence of NSSIs*, *Circumstances under which NSSIs occurred*, and *Devices related to injury*.

### Pilot Study

A pilot study was carried out among 20 HCWs who were excluded from the main survey, and their comments on the relevance and appropriateness of the questions were obtained. These comments were used to provide the final version of the questionnaire.

### Analysis

Frequency of injury incidences due to the use of sharp devices was considered as the dependent variable. On the other hand, variables including sex, age, level of education, employment status, work experience, number of shifts per month, history of Hepatitis B vaccination, immunization status, and history of being trained on NSSIs were considered as independent variables.

Data was summarized using descriptive statistical methods. T-test was used to compare the mean values. Association between independent variables and occurrence of NSSIs was examined using Chi-square test. Multivariate Logistic Regression (backward method) was used to estimate the odd ratios, where confounding factors were controlled for (OR).

A P value < 0.05 was considered to represent statistical significance. All statistical analyses were carried out using SPSS Version 16 Software.

## Results

Table 1 presents demographic characteristics of the respondents. The average age of the respondents was 32.6 years ranging from 21-55 years. Of all participants who completed the questionnaire, 70.3% (270) were female with a mean age of 30.63 years, and 29.7% (114) were male with a mean age of 37.26 years. Among the participants, 32.3% (124) reported having experienced at least one NSSI incident during the study period, while 54.8% reported having sustained one injury, and 45.2% reported more than one injury.

The mean age of injured HCWs (30.06) was significantly lower than the age of those not injured (33.82) ( $P < 0.01$ ). Fifty-four percent (67) of the reported injuries occurred by contaminated devices.

Table 2 compares frequency of NSSIs incidents in the study period based on different demographic variables. As seen, there is a significant relationship between incidence of NSSIs and factors including age, level of education, and number of shifts per month, immunization status, and history of related training. However, no significant relationship was found between NSSIs incidents and sex, employment status, work experience, and history of Hepatitis B vaccination.

Table 3 represents the results of backward multivariate logistic regression analysis. Age and number of shifts per month are significantly associated with NSSI incidents. NSSI incidents are negatively associated with age, and positively associated with number of shifts.

Table 4 shows distribution of the NSSI incidents over different medical devices. The highest frequency of incidents was related to syringe (35.71%), followed by Ampule and Angiocath needles.

Table 5 compares frequency of NSSI incidents among different HCW groups. Nurses reported the highest frequency of NSSI incidents, followed by technicians and midwives.

Figure 1 compares frequency of NSSI incidents based on medical practices. Over 20% of the NSSI incidents are related to instrument preparation, followed by injection and recapping of used needles (13.21%).

## Discussion

In this study, a relatively high prevalence of NSSI incidents was observed among the study group. Nearly one-third of the study group had experienced at least one

**Table 1 Demographic and Professional Characteristics of the Participants**

Variables	Number	%
Sex ( <i>n</i> = 384)		
Male	114	29.7
Female	270	70.3
Age ( <i>n</i> = 384)		
< 35 years	254	66.1
≥ 35 years	130	33.9
Level of Education ( <i>n</i> = 384)		
< Bachelor	137	35.7
≥ Graduate	247	64.3
Employment Status ( <i>n</i> = 384)		
Official	78	20.3
Contractual	306	79.7
Work experience ( <i>n</i> = 381)		
< 10	250	65.6
≥ 10	131	34.4
Number of Shifts ( <i>n</i> = 384)		
≤ 30 per month	112	29.2
> 30 per month	272	70.8
Hepatitis B Vaccination ( <i>n</i> = 384)		
No	30	7.8
Yes	354	92.2
Immunization Status ( <i>n</i> = 347)		
Incomplete	82	23.6
Complete (3 doses)	265	76.4
History of received training on NSSIs ( <i>n</i> = 384)		
No	198	51.6
Yes	186	48.4

NSSI incident during the study period. This observation is comparable with the results of a previous study where 35.6% of the respondents reported at least one needlestick injury (NSI) during the study period [9]. However, the incidents of NSSI in our survey were considerably higher than those reported by Gholami *et al.* (26.8%) [8], Moro (22.3%) [10], and Rampal (27.9%) [11].

This study identified nurses to be at highest risk of NSSIs among other HCW groups (39.7%). This observation is in agreement with the findings of Gholami *et al.* [8] and Martins *et al.* [9]. However, the incidents of NSSI reported by nurses in our survey was

considerably lower than those in Askarian's study in the Fars province of Iran (49.6%) [16], Smith's study in Japan (46%) [17], and Smith's study in Korea (79.7%) [18].

We identified age as an important risk factor in NSSI incidents. This result is consistent with previous studies having identified relationship between age and needle stick injuries [8, 14, 17]. In addition, Smith *et al.* [18] reported a 4.5 times higher risk of NSI incidents among nurses aged lower than 27 years.

There are also studies that have not found any relationship between age and NSI incidents. Fredrich *et al.*

**Table 2 The Relationship between Incidents of NSSIs and Demographic Characteristics**

Variables	At least one NSSI during studied period		Odd Ratio	Confidence Interval	Significance
	No (n = 260)	Yes (n = 124)			
	N (%)	N (%)			
Sex					
Male	83 (72.8)	31 (27.2)	1.41	(-0.87 , 2.28 )	0.165
Female	177 (65.6)	93 (34.4)			
Age					
< 35 years	157 (61.8)	97 (38.2)	0.42	(0.26 , 0.70)	0.001
≥ 35 years	103 (79.2)	27 (20.8)			
Level of Education					
< Bachelor	103 (75.2)	34 (24.8)	1.74	(1.09 , 2.77)	0.02
≥ Graduate	157 (63.6)	90 (36.4)			
Employment Status					
Official	59 (75.6)	19 (24.4)	1.62	(-0.92 , 2.86)	0.093
Contractual	201 (65.7)	105 (34.3)			
Work experience (years) <sup>a</sup>					
< 10	163 (65.2)	87 (34.8)	0.71	(-0.45 , 1.13)	0.147
≥ 10	95 (72.5)	36 (27.5)			
Number of Shifts (per month)					
≤ 30	89 (79.5)	23 (20.5)	2.29	(1.36 , 3.85)	0.002
> 30	171 (62.9)	101 (37.1)			
Hepatitis B vaccination					
No	25 (83.3)	5 (16.7)	2.53	(-0.95 , 6.78)	0.057
Yes	235 (66.4)	119 (33.6)			
Immunization Status <sup>a</sup>					
Incomplete	62 (75.6)	20 (24.4)	1.85	(1.05 , 3.24)	0.031
Complete (3 doses)	166 (62.6)	99 (37.4)			
History of received training on NSSI					
No	125 (63.1)	73 (36.9)	0.65	(0.42 , 0.997)	0.048
Yes	135 (72.6)	51 (27.4)			

<sup>a</sup> Some data were missing.

**Table 3 Odds Ratio Estimates of NSSIs**

Variables	$\beta$	OR <sup>a</sup>	95% CI <sup>b</sup>	Significance
Age	- 0.596	0.551	(0.325 , 0.934)	0.027
Number of Shift (per month)	0.877	2.404	(1.389 , 4.160)	0.002

<sup>a</sup> Odd Ration, <sup>b</sup> Confidence Interval

**Table 4 Distribution of Medical Device Injuries**

Device	Number	%
Syringe needle	65	35.71
Angiocath needle	19	10.44
butterfly needle	4	2.20
Suture needle	18	9.90
Lancet	9	4.95
Bisturi Blade	12	6.59
Ampoule	36	19.78
Vial	11	6.04
Other devices	8	4.40

in an assessment of the frequency and NSI risk factors among nurses and midwives in sub-Saharan Africa identified no significant relationship between age and NSI incidents [20]. In addition, Honda [13] and Kazemi's [21] reported no significant association between age and sharp devices injuries. The inconsistency between the results requires further investigation using

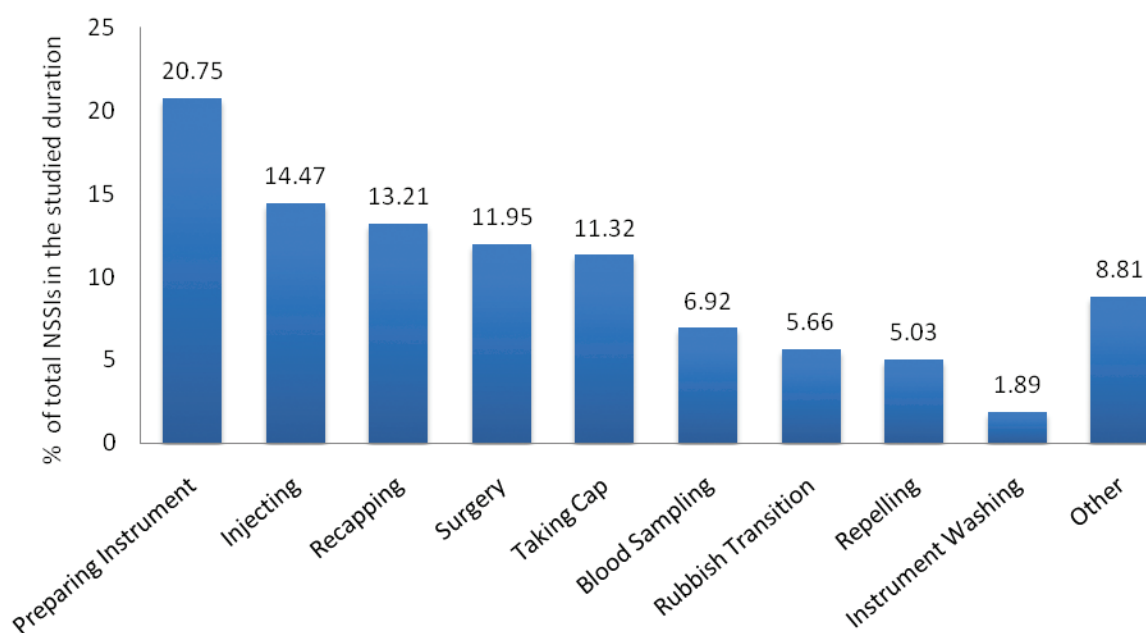
larger study groups.

Our results also found number shifts per month as a risk factor of NSSI incidents. HCWs who worked more than 30 shifts in a month were about 2.4 times more likely to encounter NSSIs than those who worked 30 shifts or lower in a month. Kakizaki also reported higher NSSIs incidents in HCWs working

**Table 5 Distribution of NSSIs Incidents over Professions**

Profession	HCWs	Number of Injured Individuals	%
Nurse	184	73	39.7
Auxiliary Nurse <sup>a</sup>	54	11	20.4
Midwife	22	6	27.3
Physician	30	7	23.3
Cleaner	59	14	23.7
Technician	35	13	37.1
Total	384	124	32.3

<sup>a</sup> Including auxiliary nurses and assistance auxiliary nurses



**Figure 1** Distribution of NSSIs Incidents in Medical Procedures

over 35 hours per week [22]. Similarly, Honda [13], Ilhan [14], and Fredrich [20] emphasized the importance of long working hours per week in the risk of NSI incidents.

Absence of relationship between NSSI occurrence and sex, level of education, employment status, work experience, history of Hepatitis B vaccination, immunization status, and history of NSSIs training, is partially supported by a number of previous studies. Honda *et al.* (2011) identified no significant association between gender and sharp devices injuries [13]. In a survey of nursing workers of Khanevadeh Hospital in Tehran, no significant association was observed between NSIs and gender, professional experience, and level of education [21]. In addition, Fredrich did not observe a significant association between gender and NSIs [20].

Identifying the prevalence and risk factors of NSIs in HCWs is important in implementing preventive strategies. Study of this kind can help rank the major unsafe practices leading to NSSIs. In addition, our study showed that almost half of the injuries occurred during preparation of instruments, injection, and recapping. Fredrich [20], Jahan [24], Memish [26], and Cheng [27] showed that recapping of used syringes is responsible for 13%, 29%, 6.6%, and 28% of injuries, respectively. Although HCWs are advised not to recap the needles, it is still a common practice calling for targeted training. Healthcare workers must avoid

unsafe practices such as recapping needles, and must dispose of used needles in safety boxes.

## Conclusions

This study demonstrated a relatively high prevalence of NSSIs among HCWs of a number of Iranian hospitals. In addition, nurses were found to be at the highest risk of NSSIs. Age and number of shifts per month are the two major risk factors for NSSIs incidents. The high prevalence of NSSIs highlights the need for developing effective preventing strategies. According to our results, for the effective prevention of NSSIs incidents, training of young nurses should be emphasized. In addition, adequate healthcare staffing and appropriate number of shifts per month are essential in preventing high NSSIs risk in hospitals.

## Abbreviations

(HCWs): HealthCare Workers; (NSSIs): NeedleStick and Sharps Injuries; (NSI): NeedleStick Injury  
(HIV): Human Immunodeficiency Virus; (HBV): Hepatitis B Virus;  
(HCV): Hepatitis C Virus; (WHO): World Health Organization.

## Competing Interests

The authors declare no competing interests.

## Authors' Contributions

AG carried out the study design, coordinated the study, and



participated in preparing the manuscript. AB was involved in data analysis. PL prepared the draft manuscript and participated in data analysis. AA participated in data collection and interpretation of the results. All authors read and approved the final manuscript.

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