

ORIGINAL ARTICLE

# Factors Associated with Needle Stick and Sharp Injuries among Health Care Workers

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## ABSTRACT

Exposure to blood borne pathogens is considered as a common occupational hazard among health care workers all around the world. The aim of the current study was to investigate the factors associated with needle stick and sharp injuries among health care workers of an academic hospital. The current cross-sectional study of health care workers a teaching hospital designed based on a census sampling technique from 20 March to 20 April 2012. All personnel were required to fill out the forms they received from the investigators and fill them out on the occasion of any case of needle stick injury. All the obtained information was analyzed using SPSS software version 16. The results of our study demonstrated that the frequency of needle-stick injury was 18.8% (97 persons) the mean age of the affected individuals was  $30.49 \pm 7.04$  years. Significant relationship was observed between the risk of needle stick injury and age, gender, work experience less than 2 year and education. The majority of needle-stick injuries happened at the ICU and CCU. Personal protection devices (face masks, gloves, etc) were used by 67% of the affected individuals. Low frequency of needle stick injuries in our study can be attributed to the following factors: 1-the periodic preventive educational program for staff, especially the new freshmen nurses. 2-the existence of a comprehensive program followed by occupational health department and hospital infection control unit.

**Keywords:** Health care workers, Needle stick, Hospital

## INTRODUCTION

One of the occupational hazards among health care workers is exposure to blood born diseases [1]. Despite the advances in technology and increased awareness of medical staff, annually about 600 thousand to one million workers are affected by needle stick or sharp objects [2]. Health care workers are at increased risk of different disease in comparison with other occupations due to being exposed to various potentially hazardous

situations. Due to their professional and scientific skills, any issue regarding health and wellbeing of these professionals should be high on the agenda of policymakers and all measures need to be taken into account to ensure their safety.

In over 35 million health care professionals worldwide, about 3 million percutaneous exposures to blood borne pathogens occurs every 3 years; 2 millions of such exposures being related to HBV (Hepatitis B virus), 0.9 million to HCV (Hepatitis C virus), and 170,000 with HIV (Human immunodeficiency virus) [3]. In health care settings, needle stick injuries are

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**Table 1.** Demographic characteristics of needle stick injuries (n =97) during 2012-2013

Variables		Number (%)
Gender	Female	78 (80.4)
	Male	19 (19.6)
Marital status	Married	70.1 ( 68)
	Single	29 (29.9)
Occupation	Services	20 (20.7)
	Nurse	74 (76.3)
	MD*	3 (3)
Education	-BS**	25 (25.8)
	BS	67 (69.1)
	+MA	5 (5.2)
Job experience	< 2 years	41 ( 42.3 )
	2-5 years	23 ( 23.7 )
	5-10 years	18 ( 18.6 )
	+10 years	15 ( 15.5 )
Age	Mean±SD	30.49±7.04
Work hours in a week	Mean±SD	45.49±4.49

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common. Intramuscular or intravenous injection of drugs and use of sharp tools can expose an individual to blood borne pathogens which can occur while using the instrument, after the usage or when discarding the object into the sharp container (safety box) [4].

Injuries caused by surgical blades, knives during surgical operations and splashes of bloods and body fluids are also classified as a needle stick injuries. Needle stick injuries usually cause bleeding; minor surface scratches and minor visible skin injuries, although the main risk is transmission of viral infections. Scalpel-caused wounds need more attention in comparison with needle stick injuries [5]. Needle stick injuries are not limited only to health workers; and, in any environment with the risk of exposure to sharp instruments they can occur. These events are of concern principally because of the risk of transmission of infectious particles such as hepatitis B virus (HBV), hepatitis C virus (HCV), and Human Immunodeficiency Virus (HIV). Despite their importance, needle stick injuries are usually neglected and are often not reported [6].

This study was designed to determine the frequency of needle stick injuries and their influencing factors has been implemented in health care staff of a teaching hospitals affiliated in Tehran University of Medical Sciences.

## MATERIALS AND METHODS

In this cross sectional study, personnel of Baharloo Hospital from 20 March to 20 April 2012 were involved. Census method was used for the purpose of sampling. Special collection forms were distributed amongst the staff with needle injury. Total number of personnel and personnel injured from needle stick in the

hospitals were 515 and 97 (18.8%) respectively. Data collection forms were designed using appropriate internet resources and databases. Ultimately, all the variables included in previous studies, including new variables were designed in the form of a data collection forms which consisted of two parts: the first section included demographic information such as age, sex, marital status, education level, the place of accident, work experience, previous needle stick in the past 4 years, time of shift and injury.

The second part was related to the nature of the accident, sources, the process leading to the accident, type of the instrument, personal protective equipment, injury severity, the precise location of the injury and the person's immunization status. Completion of the data collection and confidentiality issues were in accordance with the ethical standards. Data were analyzed using SPSS 16 software, and in order to communicate two-state quantitative and qualitative statistical data, *t*-test and for comparison qualitative date, chi-square test were used.

## RESULTS

The overall incidence of needle stick injury of 515 hospital personnel in our study was 18.8%. Demographic variables and detailed information about the accidents are provided in Tables 1 and 2 respectively. The mean age of injured health care workers was 30.49±7.04 years.

Sixty eight injured personnel (70.1%) were married, 74 (76.3%) were in nursing occupation group. Sixty seven (69.1%) had a bachelor's degree and 76 (78.4%) participants in this study were working on a 44 hours per week basis. The most highly affected group was women (80.5%) and in 80 cases (82.5%) of needle stick inju-

**Table 2.** Information about the needle stick injured (n=97) during 2011-2012

Variable		Number (%)
Shift	Rotational	70 (72.2)
	Day shift	27 (27.8)
Shift of the accident	Morning	56 (57.7)
	Evening	29 (29.9)
	Night	12 (12.4)
Patient Status	Positive	24 (24.7)
	Negative	31 (32)
	Unknown	42 (43.3)
Accident resulting in injury	While using	47 (48.5)
	While capping	10 (10.3)
	After use	32 (33)
	Discarding in the Safety Box	8 (8.2)
Using protective equipment	Yes	65 (67)
	No	32 (33)
Intensity of injury	Low	45 (46.4)
	Medium	48 (49.5)
	High	4 (4.1)
Location of injury	Hand	80 (82.5)
	Face	15 (15.5)
	Other	2 (2.1)
Type of accident	Injection	63 (64.9)
	Cleaning	16 (16.5)
	Splashing	7 (7.2)
	Sharp injury	11 (11.3)
Hepatitis B vaccination	Incomplete	3 (3.1)
	Complete	94 (96.9)
Accepted antibody level	≥10µg/dl	96 (99)
	<10µg/dl	1 (1)
Number of incidents in the past year	1 time	56 (57.7)
	2 times	28 (28.9)
	3 times	3 (3.1)
	4 times	2 (2.1)
	5 times or more	8 (8.2)

ries, hand was involved. Most cases of needle stick injuries were in ICU (Intensive Care Unit) and CCU (Coronary Care Unit) (24.7% and 12.4% respectively, Table 3).

The total of 70 (72.2%) needle stick injured cases was working in rotatory shifts. In terms of type of needle stick injury 63 cases (64.9%) were due to injections. Fifty six subjects (57.7%) had needle stick in the morning shift. Based on our findings, 9 am (19 cases, 12.4%) and 10 am (12 cases, 19.6%) were the most high risk times.

The number of needle stick injured personnel who received full hepatitis B vaccination (three doses) was 94 (96.9%). Besides, 96 cases (99%) had protective antibody titers (greater than 10 micrograms per deciliter). About 56 (57.7 %) of affected individuals had experienced at least one needle stick injury in the past four years. In 24 patients (24.7%) the history for blood borne diseases was positive. Severity of injury was minor in 45 cases (46.4%) and moderate in 48 cases. In 65 cases (67%) of needle stick injuries, individuals were used protection devices. In terms of the situation leading to the injury, 47 cases (48.5%) were injured during

using a needle (Table 4). In our study, a significant relationship between the needle stick injuries and the age ( $P$  value: .000), sex ( $P$  value: 0.031 and odds ratio: 1.72), job experience less than 2 years ( $P$  value: 0.006 and odds ratio: 1.80), educational level ( $P$  value: 0.038) and occupation ( $P$  value: 0.033) was observed. In this study no significant relationship was found between marital status and the shift during which the injury had happened.

## DISCUSSION

CDC (Centers for Disease Control) estimated that 500-300 thousand cases of skin injuries occur annually among the health care professionals in United States although actual figures can be more [5]. OSHA (Occupational Safety and Health Administration) has stated that one million health care workers are damaged by sharp instruments [3]. Transmission of blood-borne diseases such as HCV, HBV and HIV is associated with skin injuries [7]. Such events imposes high psychological and financial burden on individuals, families and the society. Even in the case of infectious

**Table 3.** Frequency of needle stick injuries based on the hospital wards

Hospital ward	Number (%)
ICU	24 (24.7)
CCU	12 (12.4)
Internal	11 (11.3)
Emergency	11 (11.3)
Delivery	11 (11.3)
Emergency	8 (8.2)
Clinic	5 (5.2)
Surgery	4 (4.1)
Pediatrics	4 (4.1)
Lab	3 (3.1)
Yard	2 (2.1)
Official	2 (2.1)

diseases, personal and professional consequences of contaminated needles are costly [8-9].

In our study, 70.1% of needle stick injured cases were married and 61.9% had bachelor degrees. In Kordestan, 47.9% of cases had bachelor degrees [10]. The high prevalence of occupational exposure in workers with undergraduate educational level is due to two different factors: On one hand, based on the employment law of Iran, the minimum degree in nursing occupation is bachelor's degree, also nurses have to work immediately after obtaining their bachelors 'degrees as their compulsory government service period. Therefore, it can be argued that this leads to massive employment of low-skill nurses. Moreover, as health professionals with higher academic degrees tend to be employed in supervisory, administrative, and managerial levels, they are less exposed to needle stick injuries.

In our study, women were more affected (80.5%). In Poland the most common injuries occurred in female nurses [11]. In Hamadan the risk of injury was higher in women than men, 27.3% and 17.3%, respectively [12]. In South Korea, 54.4% needle stick injured cases were women [13]. This finding in our country is due to the fact that the majority of nursing graduates are female.

In our study, the mean age of injured staffs was  $30.49 \pm 7.04$  years. In a study, the age group of 34-30 years old had the highest risk of injury (33.3%) [12]. In Zahedan, mean age of needle stick injuries was  $34 \pm 8.1$  years old [14]. One of the reasons for the high prevalence of exposure in this age group is the young work force. In our study, the highest rate of needle stick injuries for nurses was 76.2%. In a study among the staff of Ardebil University of Medical Sciences, nurses (55%) were the most vulnerable group to such injuries [15]. In Norway, the most commonly exposed group to needle stick injuries were nurses 15% [16]. Among hospital staff in Washington in 1992, needle stick injuries in nurses were 45.8% more common in comparison with other staff of the hospital [17]. Therefore, the high prevalence of exposure in nursing

**Table 4.** Frequency of injured staff based on the situation of needle stick injury

Causes	Number (%)
While using	47 (48.5)
After using	32 (33)
While re capping the needle	10 (10.3)
While discarding in a safety box	8 (8.2)

staff might be due to the nature of the nursing profession and their more frequent presence in health care settings, the higher frequencies of injection, blood sampling, and clinical examination duties. In addition, large number of nurses and other members of the treatment team may be important factors affecting the high frequency of occupational exposure in this group.

Frequency of needle stick in our study was 18.8%. In Hamadan teaching hospitals, incidence of needles and sharp objects injury was 24.1% [15]. The rate of needle stick injury in Africa is 4.2 per person annually [18]. The prevalence of exposure to blood and other body fluids among health care workers in a hospital in Fars Province was 79% [19]. In Brazil, the average incidence of occupational exposures to biological health personnel per 100 fulltime person (subjects- years) was 11.9%, and the annual cumulative incidence was 7% [20]. In another study, the incidence of needle stick injuries was as follows: Nigeria, 31%, Turkey 62%, India (72%), Egypt, 35.6%, China (82%), Taiwan (93%) [21-26]. The incidence of needle stick injuries among nursing students has been reported as endemic in northern India, 48.1% [23], Taiwan (61.9%) [26], and Iran 71% [27]. The results of the present study are in contrast with the results of mentioned studies. It can be suggested that the lower incident of needle stick injuries in our study may be attributed to a number of factors, including the existence of a comprehensive program to pursue occupational health by occupational health clinic and providing periodic preventive education program for staff and as well as other factors.

Based on the results obtained, the needle stick injuries in most cases occurred in the ICU and CCU wards, 24.7% and 12.4% respectively. Afrasiabi's survey on 159 personnel of health care centers in Yasuj demonstrated that 39.3% of staff had cutaneous injury with the highest rate of 46.2% for nurses and 37.5% for operating room [28]. In Ardebil the maximum rate of needle stick injuries in nurses was in burn (90%), pediatric (73%), hematology (66.7%), cardiology (64.7%), ICU (57.9%) and emergency (61.9%) wards respectively. Operating room and anesthesia technicians and nurses had the highest rate of needle stick injuries, 45.8% and 15.9% respectively [29]. In ICU, due to special care need of patients with impaired level of consciousness, staff is more likely to be affected. In our

study, the highest rate of needle stick injuries occurred in the morning shift (58%). It was also demonstrated a rate of 55% of needle stick injuries occur in the morning shift [15]. In Hamadan most exposures had occurred in the morning shift [30]. Collection of safety boxed and garbage bags in the morning shifts, heavy load of catheterization jobs, educational sessions in the morning, and also noisy work environment which makes it difficult to focus may all be factors contributing to this higher incidence. Therefore, the issue of higher workload in the morning recalls the need to review the rational division of working shifts between staff in order to maintain their health.

Rate of needle stick injury in our study was 49.6% for injection, 16.4% for collecting and cleaning contaminated equipment, 11.3% for sharp tools, and 7.2% for splashing of blood and body fluids. 48.5% of the cases occurred during venipuncture or take blood samples from the patient [12]. Also, the incidence of needle stick and sharp objects injuries was 24.1% [12]. In a study, 58.2% of respondents were exposed to sharp objects, and 53.5% to splashing of body fluids [31]. Recapping of the needle was the most important risk factor (14.1%) [31]. The high frequency of exposure during venipuncture and blood sampling in this study on the one hand is due to lack of the knowledge that employees need about safe injection instructions as well as the frequency of medical procedures that can be done with needle is one reason of increasing prevalence of occupational exposure to this type of device. On the other hand the medical equipment is given to personnel by equipment provision divisions and the personnel are not involved in choosing the equipments. This is despite the fact that considering risks and injuries caused by such equipments in developed countries are demonstrated, safety equipments are now available in the market and their effectiveness is proved.

In our study, in 80 cases (82.5%) of needle stick injuries, the hands and in 15 cases (15.5%) the face were reported as the injured part. 90.9% needle stick injuries hands are listed as the damaged organ [13]. It seems that since hands are the most involved organ with sharp instruments and blood, and all injections are done by hand, therefore this is not an unexpected result. In our study, 93 cases (94.9%) of needle stick injuries completely were vaccinated against hepatitis B. 96 cases (99%) of needle stick injured had antibody titers (greater than 10 micrograms per deciliter). In Uganda, out of 6.2% subjects who had been vaccinated, only 34.8% had complete vaccination. In their study low vaccination coverage was attributed to low government facilities and lack of knowledge. Most of the cases were vaccinated on their personal expenses [32].

In Poland, 75.7% of personnel had full vaccination [33]. In the U.S., 72% of patients had complete vaccination and HBSAb (Antibody to hepatitis B surface antigen) had been controlled in 68% of cases [34]. In Syria, 76% were vaccinated [35]. In Gorgan

complete vaccination and HBSAb  $\geq 10\mu\text{g}/\text{dl}$  were 76.6% and 87.9% respectively [36]. In our study, 56 cases (57.7%) had needle stick injuries during the past four years. In Tehran, in 47% of participants, 65.6% had needle stick injuries once, 18.7% twice, 3.1% three times and 12.4%, more than three times [37]. In Ardabil 55% of those surveyed had needle stick during the past 5 years [38]. In Zahedan, 64.9% of subjects were injured during their work [14]. In Qazvin, 32% of participants mentioned the experience of injuries with sharp instruments in the period of one year [39].

## CONCLUSIONS

The prevalence of occupational exposure to sharp instrument injuries in the hospital is estimated 18.8%, which is lower than the results of similar studies in other countries is. This low frequency of needle stick injuries can be attributed to the following factors:

The existence of a comprehensive program followed by hospital infection control unit and occupational health clinic to receive feedback and new problems and provide solutions.

The analysis of needle sticks injuries and other sharp instruments to determine the nature of the injury (at risk group, type of device, time and place of accident, etc.)

The periodic preventive educational program for staff, especially the new freshmen nurses.

So we recommend that hospitals should reduce such injuries by establishing better work environments by providing sufficient human resource and safety-engineered equipment also hospitals should implement organizational strategies to prevent such injuries. It is also necessary to establish an occupational health clinic to monitor and record needle stick and sharp injuries in developing countries.

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