

# Prevalence of occupational exposure to blood and body secretions and its related effective factors among health care workers of three Emergency Departments in Tehran

Davood Farsi, Mohammad A. Zare, Sayed A. Hassani, Saeed Abbasi, Afsoon Emaminaini<sup>1</sup>, Peyman Hafezimoghadam, Mahdi Rezaei

Department of Emergency Medicine, Tehran University of Medical Sciences, Tehran, <sup>1</sup>Department of Nephrology, Research Center of Kidney and Urinary Tract Diseases, Isfahan University of Medical Sciences, Isfahan, Iran

**Background:** Accidental exposure to blood and body secretions is frequent among health care workers (HCWs). They are at risk of acquiring blood-borne diseases. In this study, we have investigated the prevalence and risk factors of occupational exposure among the HCWs of the Emergency Departments (ED) at three teaching hospitals in Tehran. **Materials and Methods:** We conducted this observational, descriptive, cross-sectional study using a self-reporting 25-question survey, related to occupational exposures, in February 2010. It was carried out among 200 HCWs (specialist physicians, residents, medical interns, nurses, laboratory personnel, housekeepers, cleaners, and others), who were working in the EDs of the three teaching hospitals of the Tehran University of Medical Sciences. The age, sex, and job category of the HCWs suffering from the injury were determined, as also the risk factors responsible for the exposure of the HCWs. **Results:** One hundred and fifteen (57.5%) of the 200 HCWs had had at least one episode of blood or body fluid exposure in their professional life. Hollow-bore needles accounted for the highest amount of injuries, with 41.5%, followed by suture needles (18.5%). The most prevalent procedures associated with injuries were suturing (17.5%) and recapping used syringes (16.5%), respectively. All the specialist doctors in this study reported at least one exposure. The percentage of exposure in the other participants of our study was 74.3% for ED residents, 61.1% for laboratory technicians, 51.9% for nurses, and 51% for medical interns. Binary logistic regression analysis revealed that male gender, recapping needles, and job profession were independently associated with exposure to blood or body fluids. **Conclusion:** High prevalence of occupational exposure in this study emphasized the importance of promoting awareness, training, and education for the HCWs, for preventive strategies, and also reporting of occupational exposure to blood and body secretions.

**Key words:** Emergency Department, health care workers, Iran, occupational exposure


## INTRODUCTION

Healthcare workers (HCWs) especially emergency physicians, nurses, and workers are at increased risk of blood and body fluid exposure, and it may lead to various infectious transmissions.<sup>[1,2]</sup> Transmission of at least 20 different pathogens by needle stick and sharp injuries has been reported, and hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) are the most significant and frequent blood-borne pathogens.<sup>[3,4]</sup> Infection by these viruses can lead to serious and even fatal illnesses.<sup>[5]</sup>

With increase in the proportion of HIV-positive, hepatitis B surface antigen (HBSAg)-positive, and HCV-positive patients, due to an increase in the prevalence of intravenous drug abusers' population, there will be a great interest to determine the risk of exposures and improve precautions.<sup>[6]</sup>

Prevalence of exposure to blood and body secretions has been studied in many countries, for example, in the United Kingdom, 100,000 exposures annually and in the United States about 600,000 exposures annually have been reported.<sup>[7,8]</sup> Results of a study on the epidemiology of needle stick injuries (NSIs) among HCWs in two German hospitals, indicate that 500,000 injuries occur annually in Germany.<sup>[9]</sup>

Some recent studies reported occupational injuries in special medical providers. Vanhille and co-workers evaluated 231 otolaryngology residents and discovered that 72.2% of them had at least one sharp exposure during residency.<sup>[10]</sup> In Taiwan, 23.0% of the

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**Address for correspondence:** Mr. Peyman Hafezimoghadam, Department of Emergency, Hazrat-e-Rasoul Akram Hospital, Niyayesh Ave., Sattarkhan Street, Tehran, Iran. E-mail: Hafezimoghadam@yahoo.com

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enrolled dentists reported that they had experienced more than one NSI per week.<sup>[11]</sup> Kazemi *et al.* showed that 56.96% of their participants had a history of at least one NSI. In this study, ED was one of the two wards that had more reports of needle injurers. Victims believed that the most important and basic reason for needle stick injuries was crowding of the patients and hospital chaos (37.8%).<sup>[12]</sup>

One of the most important problems in occupational exposure is that about one-third of the victims do not report their exposures.<sup>[13,14]</sup> Underreporting this hazard may result in insufficient attention to this problem and inadequate preventive planning to reduce it.

To our knowledge, there is no study about the prevalence of occupational exposure and its related risk factors in EDs from. The purpose of this study was to evaluate the prevalence of occupational exposure to blood and body secretions among HCWs who worked in the EDs of our city, and we hope it creates a more standard precautionary behavior among HCWs who are working in EDs. This study was also conducted to find out the factors that might be associated with the occurrence of this problem.

## MATERIALS AND METHODS

This observational, cross-sectional, descriptive study was carried out among 200 HCWs, who worked in three EDs of the teaching hospitals of Tehran University of Medical Sciences. (Research Project Number: 20104755). It was conducted in the EDs that had more than 100,000 admissions annually. Data for this study were gathered through a self-administered, 25-question survey that contained six series of questions relating to sociodemographic factors (age, gender, job category, length of working in the ED), safety measurements (use of gloves or other safety instruments, recapping, use of safety box), immunization status of hepatitis B and hepatitis B antibody titration, kind of instrument that was responsible for the injury (hollow-bore needles, suture needles, scalpel blades, etc.), and follow-up after injury (only use of irrigation with water and antiseptic, referred to infection control center of the hospital, no intervention). Occupational exposure was defined as any percutaneous (needle stick injury, scalpel cut, etc.) or mucocutaneous (splash to mucosa, eyes, or damaged skin) exposure to blood or body fluids. We asked the participants to inform us of the number of exposures to blood and body fluids of the patients, during their working hours in the ED.

We enrolled all the HCWs (specialist physicians, ED residents, medical interns, nurses, laboratory personnel, housekeepers, cleaners, and others) who were working in the EDs of the studied hospitals in February 2011, and they responded to our questions.

The data was processed with the Statistical Package for Social Sciences version 16 (SPSS Inc, Chicago, IL, USA). Data were expressed in frequencies, mean, and standard deviation (SD). The chi-square test was applied to compare qualitative variables. The Fisher exact test was used instead of the chi-square test when the sample size was small. An independent *t* test was used to compare the mean of the quantitative variables between the injured and non-injured HCWs. Binary logistic regression analysis was performed to predict the risk of occupational exposure to blood and body fluids. The level  $P < 0.05$  was considered as the cut-off value for significance.

## RESULTS

A self-administered, 25-question survey was filled out by 200 HCWs. Most of the participants were nurses (26%), followed by medical interns (24.5%). The mean of the age was similar in exposed and unexposed HCWs ( $P=0.3$ ). A bivariate analysis revealed that two factors were markedly associated with a higher occurrence of blood or body fluid exposure. We found that the male gender and profession of the subjects were meaningfully related to higher occupational exposure. (Chi<sup>2</sup>,  $P = 0.013$  and Fisher exact,  $P = 0.018$ , respectively). Even as half of the females were exposed to blood or body fluids, two-thirds of the males had a history of at least one episode of exposure. All the specialist physicians (100%) in our study had a history of occupational exposure. The percentages of occupational exposure in the other participants were 74.3% for ED residents, 61.1% for laboratory technicians, 51.9% for nurses, and 51% for interns. Years of job experience and ED experience did not relate to occupational exposure ( $P = 0.5$  and  $P = 0.7$ , respectively). The characteristics of the study subjects by history of exposure are shown in Table 1.

In total, 115 (57.5%) of the 200 health care workers had at least one episode of blood or sharp instrument exposure, when working in the ED. Twenty-eight participants (14%) reported two to five injuries during their professional life in the ED. Details of the exposure route and frequency have been summarized in Table 2.

As shown in Table 3, 84.5% of the HCWs had completed the hepatitis B vaccination course. Also we found that in 70.5% of the participants, the hepatitis antibody titer was unknown or unsatisfactory. Neither hepatitis B vaccination status nor hepatitis B antibody titer differed between the exposed and unexposed HCWs ( $P = 0.6$  and  $P = 0.8$ , respectively). Details are demonstrated in Table 3.

Hollow-bore needles were responsible for the highest number of injuries (41.5%), followed by suture needles. The most prevalent procedures associated with injuries

**Table 1: Sociodemographic characteristic of participants**

Variables	Total population (n = 200) (%)	Not exposed (n = 85) (%)	Exposed at least once (n = 115) (%)	P value
Age (years)	30 ± 6.3(23 – 54 years)	29.4 ± 6.3	30.4 ± 6.3	0.30
Gender				0.013
Male	91 (45.5)	30 (35.3)	61 (53)	
Female	109 (54.5)	55 (64.7)	54 (47)	
Profession				0.015
Specialist (Attending)	10 (5)	-	10 (100)	
ED Resident	35 (17.5)	9 (25.7)	26 (74.3)	
Intern	49 (24.5)	24 (49)	25 (51)	
Nurse	52 (26)	25 (48.1)	27 (51.9)	
Laboratory technician	18 (9)	7 (38.9)	11 (61.1)	
Housekeeper	8 (4)	5 (62.5)	3 (37.5)	
Miscellaneous	28 (14)	15 (53.6)	13 (46.4)	
Job experience (years)				0.50
< 5	126 (63)	57 (67.1)	69 (60)	
5 – 10	39 (19.5)	14 (16.5)	25 (21.7)	
> 10	35 (17.5)	14 (16.5)	21 (18.3)	
Emergency ward experience (years)				0.70
< 5	160 (80)	70(82.4)	90(78.3)	
5 – 10	23 (11.5)	11 (12.9)	18 (15.7)	
> 10	17 (8.5)	4 (4.7)	7 (6.1)	

**Table 2: Frequency and exposure routes in our ED personnel**

Route of injury	One episode	Two episodes	Three or more episodes
Percutaneous injury	42 (21)	22 (11)	36 (18)
Mucus membrane contact with blood and body fluids	26 (13)	14 (7)	60 (30)
Non-intact skin contact with blood and body fluids	14 (7)	8 (4)	78 (39)

were suturing (17.5%), recapping used syringes (16.5%), and phlebotomy (13%), respectively.

Among the HCWs behavior, recapping needles and not using protective gloves were markedly related to more occupational exposure ( $P=0.023$ ,  $P=0.005$ ). The rate of using protective gloves by the ED personnel, use of other safety measures (such as mask, goggles, etc), recapping needles, and use of safety box for disposal of sharp instruments are demonstrated in Table 4. The most common reasons for health care workers not using the safety measures were, the rush in the work (40%), unavailability of protective facilities and safe devices (29.5%), and neglecting to consider standard precautions (16.5%).

Post-exposure management of occupational exposure was as follows: Seventy-two percent washed with water and povidone-iodine or alcohol, 29.5% referred to the infection control center, 23.5% took a blood sample to the laboratory, and 13% did not do anything after the exposure. Actually,

**Table 3: History of Hepatitis B virus vaccination and antibody titration in HCWs**

Variables	Total population (n = 200) (%)	Not exposed (n = 85) (%)	Exposed at least once (n = 115) (%)	P value
Hepatitis B vaccination status				0.6
Never vaccinated	12 (6)	7 (8.2)	5 (4.35)	
One dose	8 (4)	3 (3.5)	5 (4.35)	
Two doses	11 (5.5)	4 (4.7)	7 (6.1)	
Three doses	169 (84.5)	71 (83.5)	98 (85.2)	
Hepatitis B Antibody titer				0.8
Satisfactory	59 (29.5)	25 (29.4)	34 (29.6)	
Unsatisfactory	31 (15.5)	19 (16.5)	19 (16.5)	
Unknown	110 (55)	62 (53.9)	62 (53.9)	

**Table 4: Diversity of HCWs behavior**

HCWs Behavior	Always	Often	Sometimes	Rarely	Never
Use of protective gloves	52	31	11.5	4.50	1
Use of mask, goggles, and so on	10	15	23	32	20
Recapping needles after use	51	23	12	6	8
Use of safety box for sharp instruments	62	23	10	3	2

only 59 HCWs reported their exposures. We found that specialist and ED residents reported their occupational injury significantly less than other groups (Fisher exact,  $P=0.04$ ) (Table 5).

We conducted a binary logistic regression analysis to predict the independent factors of blood or body fluid exposure. This multivariate analysis revealed that male gender (OR = 2.07; 95%CI, 1.16 – 3.68) and recapping needles (OR = 1.88; 95%CI, 1.56 – 4.01) increased the odds of occupational exposure. The most powerful predictors of exposure to blood and body fluids were the emergency physicians (OR = 8.66; 95%CI, 2.57 – 27.57), laboratory technician (OR = 4.78, 95%CI, 2.25 – 23.54) and nursing staff (OR = 3.98; 95%CI, 1.82 – 17.94) (Table 6).

## DISCUSSION

Exposure to blood and other potentially infectious body fluids has, for a long time, been recognized as a potential health hazard in HCWs. In previous studies, injuries from contaminated needles or other sharp objects in healthcare settings have been associated with transmission of 20 different pathogens to the personnel,<sup>[15]</sup> especially as these injuries can lead to infections with HBV, HCV, or HIV.<sup>[16]</sup> The preventive strategies are of vital importance. They state that HCWs who come in contact with sharp instruments suffer from significant anxiety and emotional distress, before knowing if it was a healthy or unhealthy exposure.<sup>[17]</sup>

In this study, among 200 cases who worked in EDs, exposure to blood or body fluids, at least once, was detected in 115 (57.5%) of them. The high prevalence of exposure may be due to, (1) inadequate supply of protective equipments in the EDs; (2) unavailability of safer sharp devices; (3) inadequate training of the personnel about the risks of exposure; (4) not adhering to standard isolation precautions; (5) insufficient number of nurses and use of temporary nurse staff; and (6) improper disposal of regulated medical wastes, especially used needle wastes. In one study, the nursing staff claimed that crowding of patients and hospital chaos were the most important reasons for sharp injuries.<sup>[12]</sup> Most of our participants claimed that rushing was the most

important reason for not using protective equipment, such as, gloves and masks.

There is a wide variation in the number of occupational exposure occurrences reported in our study, ranging from 100% among specialist physicians to 37.5% among housekeepers. The plausible explanation of the high prevalence of exposure in specialist physicians is that, in the three hospitals that we selected, the emergency medicine specialists were overworked. In contrast to other groups (nursing staff or workers), the emergency medicine attending specialists passed the entire duration of their professional lives in EDs, and always encountered unsafe situations in emergency procedures.

Hepatitis B vaccination coverage in this study was 84.5%, while this ranged between 18 and 85% in other studies.<sup>[18]</sup> Jahan reported 82% coverage in Saudi Arabia.<sup>[19]</sup> We discovered that 15.5% of HCWs had not completed the vaccination course at the time of study, and moreover, 14.8% of the HCWs who had a history of exposure had neglected HBV vaccination. This could be due to the lack of knowledge on the hazards of exposure to blood or body fluids.

Shah and coworkers showed that of the total studied subjects (1022), 214 studied subjects (20.9%) were victims of needle stick injuries and 89.1% from the total had been vaccinated against HBV. One hundred and ninety-five of the 214 HCWs (91.1%) who had sharp injuries had taken HBV vaccination. However, the rest of the 19 HCWs (8.9%) had neglected the HBV vaccination.<sup>[20]</sup> Ghorbani assessed 112 HCWs who had experienced sharp injury. In this study, the nursing staff were the most injured category (70.5%); 85.7% had completed three doses of HBV vaccination.<sup>[21]</sup> Aghadoost *et al.* who studied 678 students and staff of the Educational–Medical Centers in Kashiand, showed that 94% of the participants and 100% of the emergency nurses, operation room technicians, and laboratory technicians reported at least one episode of blood

**Table 5: Post-exposure management**

Type of Injury	Washing with Water, Alcohol or Bethedine (%)	Referring to Infection Control Center (%)	Sending a blood sample to the laboratory (%)	No follow-up
Percutaneous injury	28 (24.3)	16 (13.9)	14 (12.2)	3 (2.6)
Mucous membrane	12 (10.4)	9 (7.8)	6 (5.2)	1 (0.9)
Non-intact skin	9 (7.8)	6 (5.2)	6 (5.2)	1 (0.9)

**Table 6: Details of multiple binary logistic regression analysis for prediction of occupational exposures in HCW**

Variables	B	S.E.	OR	95% CI for OR	P value
Male gender	0.728	0.294	2.07	1.16 – 3.68	0.013
Recapping needles	0.581	0.32	1.88	1.56 – 4.01	0.04
Emergency physicians	2.16	0.871	8.66	2.57 – 27.57	0.013
Nursing staff	1.01	0.763	3.98	1.82 – 17.94	0.033
Laboratory technicians	1.6	0.51	4.78	2.25 – 23.54	0.012
Constant	0.302	0.143	1.353		0.035

exposure in their professional life.<sup>[22]</sup> There is a report from southern Iran, Bandar Abbas, which states that, of the 137 medical students who were asked about needle stick injury, 54 cases (39.4%) had experienced it in the previous year.<sup>[23]</sup>

In our study, the prevalence of exposure in males (53%) was higher than in females (47%), which was similar to the finding of the study by Shariati *et al.* (73.1 vs. 26.9%).<sup>[24]</sup> In contrast Shah and coworkers reported a higher percentage of sharp injuries among female HCWs (69.2%) than males (30.8%).<sup>[20]</sup>

There is a big concern about occupational exposure in medical students and interns. We think that they are not sufficiently prepared and do not get enough information about the hazards of occupational injuries and preventive precautions. As we mentioned the prevalence of occupational injury in medical interns was 51%. Koenig and Chu reported that 48% of the graduating medical students recalled at least one exposure to a blood-borne pathogen during their last two years of medical school.<sup>[25]</sup> They should be educated with regard to what they should do if they encounter occupational injuries, and it should be made mandatory that they complete three doses of hepatitis B vaccination before they start working in hospitals.

Compared to the reported prevalence of occupational exposures in literature, the prevalence was rather high in our study and other studies in our country. It seems that educational programs are necessary for reducing the rate of exposure in our personnel. We can reduce occupational injuries by applying safer devices related to the situation. However, invasive emergency procedures should be restricted to the ones that are really indicated in textbooks or evidence-based literatures. Renschler recommended one solution to the problem. He suggested installing disposable needle containers on all gurneys, mounted right underneath the patient on both sides and at the head of the gurney.<sup>[26]</sup> Some believed that only providing safety devices is not enough to decrease the occupational exposures. Edmond *et al.* have reported that the installation of bedside needle disposal units achieved no significant reduction in the frequency of recapping or in the number of reported needle stick injuries acquired by various mechanisms of injury.<sup>[27]</sup> Other authors have advised that bending, recapping, or breaking of needles should be prohibited.<sup>[28]</sup>

It is obvious that not reporting occupational injury can delay diagnostic and therapeutic procedures. Some of victims may need chemoprophylaxis or starting of vaccination or even immunoglobulin. Appropriate post-exposure management is thus an important aspect of workplace safety, with which all EDs should be familiar.<sup>1</sup> In the event of an injury with a potential for transmission of a blood-borne pathogen, the employer is required to implement an immediate evaluation of the occurrence.<sup>[29]</sup> In the present study 13% of the victims

did nothing when exposed to blood or body fluids. The data from another study in our county was disappointing, where 75% of the HCWs who experienced sharp injuries did nothing and three of them became infected with HBV.<sup>[22]</sup> McCormic and Maki had the same finding and believed that physicians rarely report needle-stick injuries.<sup>[30]</sup> Reports from Germany and United States showed that only 28.7 and 35.5% of the injured HCWs had reported a needle stick injury and had seen a physician after the incident.<sup>[16,31]</sup> The probable explanation for physicians not reporting may be that they believe they know what to do after occupational exposure and neglect to report it.

Kazemi mentioned that from his study population, 44.3% recapped needles in spite of the existence of a safety box and the recapping process was responsible for 21.57% of all needle stick injuries.<sup>[12]</sup> Also recapping of the needle was the most frequent cause of exposure in the studies by Shariati *et al.*, with the rate of 66%.<sup>[25]</sup> We found the same devastating result and only 8% of the ED personnel never recap needles and recapping needles was responsible for 16.5% of the occupational injuries.

### Limitation

Our study suffers from some limitations. The sample size was small and it was better to investigate and compare occupational injuries in EDs with different patient loads and also in academic and non-academic hospitals. Another source of error is the recall bias that could not be prevented because of the nature of this study.

In conclusion, multivariate analysis showed that ED physicians, nursing staff, and laboratory technicians were more likely to be exposed to blood or body secretions and recapping used needles caused increased susceptibility to occupational injury. We demonstrated that 57.5% of the HCWs who worked in ED, had at least one episode of exposure. An attempt should be made to decrease occupational exposure to blood-borne diseases among HCWs, through available and cost-effective interventions. Educational lectures and seminars, providing pamphlets and posters, applying appropriate sedation and analgesia to patients, to reduce unexpected patient movement, hepatitis B vaccination, and avoiding a rush in doing procedures, are the leading interventions.

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