

## The incidence of needle stick injuries among medical students at Tabriz Imam Reza hospital in 2014

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### ABSTRACT

**Background and aims:** Needle stick injuries are a common and serious occupational hazard in the medical settings. So, this study was aimed to assess the incidence of needle stick injury among medical students at Tabriz Imam Reza Hospital in 2014.

**Methods:** This is a cross-sectional study which its data was collected from 211 medical students in Tabriz Imam Reza Hospital. The study was done using valid and reliable researcher's made questionnaire in December 2014 with getting inform consent from participants. The mentioned tool has two main parts; the first part studies the demographic and background variables and the second part focuses on the phenomenon of needle stick injuries and its relevant parameters. The data were firstly analyzed descriptively and the obtained results reported the qualitative variables in form of frequency (percentage) and for the quantitative variables the mean (standard deviation) was reported. Further on, the statistical relationship between demographic and background with Needle stick injuries parameters were assessed using Chi-square test. All these analyses were conducted using SPSS software and in all cases the significance of P was considered as less than 0.05.

**Results:** Obtained findings showed that 36% of the medical students have experienced needle stick injuries in the last year (with Confidence Interval of 95%) and the mean annual frequency is equal to 3.11 times per person. Moreover, the study findings indicated that there is a statistical relationship between needle stick exposure and age (P=0.019), educational level (P=0.001) and the hospital ward (P=0.004) which students older than 30, medical research fellows and students working in the surgery and pathology wards experience needle stick injuries more than others significantly.

**Conclusion:** This study showed the high incidence of needle stick injuries in medical students and highlighted the need for implementing precise interventions.

**Keywords:** Medical students, Safety, Needle stick injuries.

### INTRODUCTION

Occupational hazards are one of the main problems in both developed and

developing countries. The most important consequents of these accidents is the human

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cost.<sup>1</sup> Undoubtedly, one of the most dangerous occupational hazards in the healthcare environments is needle stick injuries.<sup>2</sup> Needle stick injuries can expose the health workers to blood-borne infections such as HIV, hepatitis B and C transmission is as one of the most important factor of such diseases.<sup>3,4</sup> Above all, if the medical staff infected with blood-borne diseases can act as potential vehicle for transmission of infectious agents to their patients.<sup>5</sup>

Injuries from needles and other sharp objects contaminated with blood can transmit at least 20 blood-borne pathogens to the health workers.<sup>6,7</sup> Health workers are faced with a 0.3% risk of HIV infection by HIV-infected objects, a 2.7 to 10% risk of infection with hepatitis C and a 4 to 45% risk of infection with hepatitis B.<sup>8</sup> A serious blood-borne case of infection can cost a million dollars for medical tests, treatment costs, disability costs and loss of work time whereas prevention costs are estimated to be about \$ 3000. Despite the emphasis on preventing needle stick injuries, they still remain as a major risk to health care workers.<sup>9,10</sup>

Annually throughout the world, more than 35 million health workers are exposed to constant risk of needle stick injuries with pointed objects and the amount of injuries that these people suffer from it, has been various from 0.2 to 4.7 million.<sup>11,12</sup> For example, studies have shown that annually 500,000 people in Germany, more than 100,000 people in the UK and 600-800 thousand people in the US are injured with needle sticks.<sup>13-15</sup> Authentic studies conducted about this issue reported that the number of needle stick injuries in nursing students in Australia is 13.9%, medical students in Iran is 71.1%, medical students in Malaysia is 14.1%, medical personnel in Taiwan is 87.3%, nursing students in Taiwan is 61.9% and health personnel in Venezuela is 30%.<sup>14,16-20</sup>

In Iran, needle stick injuries are not often registered and there is no precise statistics but a number of conducted studies indicated the existence of major problems. For example, the conducted studies in Shiraz city on dentistry, nursing and midwifery students showed 73% of them have experienced at least on needle stick injury in the last year.<sup>21</sup>

This study was conducted in order to investigate the status of needle stick injuries and identify the factors causing it among medical students of Tabriz Imam Reza Hospital because previously no study was carried out, taking into consideration the fact that different texts mention medical students to be one of the groups who did the great risk of exposure to such injuries. The researchers are hopeful that successful implementation of this research could take a fundamental step to promote the knowledge of nurses and the safety of patients through considerable reduction of ways to communicate infection through needle stick injuries.

## METHODS

This is a cross-sectional study which was conducted in August 2014 among 211 medical students of Imam Reza Hospital, Tabriz. The sample size was determined according to previous similar studies and the number of all students which was 465 using Morgan table (table to determine sample size).<sup>22</sup> The sample size was divided according to the number of students in each course and hospital wards on a proportionate basis and then getting randomly. The inclusion criteria were their educating in medicine fields, their presence in Imam Reza hospital in the past year and during their study period. The exclusion criteria were their insufficient time of students for responding to the questionnaire and their disagreement to participate in the study.

The used tool of the study was a researcher's made questionnaire which its validity and reliability was confirmed statistically. In the first step of preparing the tool, the researchers used the keyword of needle stick from data bases of Science Direct, Pub Med, Ovid Medline and Cochran as well as the Persian equivalent of keywords in Persian data bases of SID, Magiran and Irandoc. A vast amount of related texts were studied and sufficient information within theoretical grounds was obtained. Afterwards, the initial questionnaire was designed.

Then, all of obtained parameters from studying the texts were inserted into a questionnaire and to assess the content validity and face validity of the tools, it was studied taking the view of 15 experts into consideration.<sup>23</sup> The criteria to get the experts join the expert panel was having sufficient experience in this area as well as having an expert degree in one of the clinical courses or PhD courses of nursing or management of health care services. In this part of study, all the questions of the questionnaire were studied from the viewpoint of experts in five aspects of relevance, transparency, simplicity, necessity and measurability in a four-option scale on each aspect. According to statistical principles, firstly necessity aspect score was assessed (Content Validity Ratio or CVR) and if the question was confirmed in that aspect, the mean scores of the other four aspects were assessed (Content Validity Index or CVI). In all cases, the passing score for being valid will be 70%.<sup>24,25</sup> It is obvious that if a question not being able to pass this norm it will be excluded from the final tool.

All the above assessing was conducted and scores of 87% and 91% respectively were obtained for CVR and CVI and these scores confirmed the content validity of the questionnaire. Also, in order to confirm the face validity, the questionnaire was given to

the experts to be confirmed and their quality views were implemented in all parts of the questionnaire. In addition, to confirm the internal consistency (reliability) of the questionnaire, it was tested through an introductory study and doing test-retest with 50 samples. The Cronbach's Alpha of 0.87 was obtained and the questionnaire was confirmed in this regard too. Eventually the questionnaire with 8 demographic and basic questions and 7 questions about needle stick injuries and related stuff was prepared.

In developed questionnaire, the dependents variables are the parameters of needle stick injuries including NS exposure, NS rate, HBV vaccination, antibody test after vaccination, antibody test after NS exposure, HBV immunoglobulin and vaccination and NS cause; but the independent variables are the background and demographic variables including age, sex, educational level and hospital ward.

The data were firstly analyzed descriptively and the obtained results reported the qualitative variables in form of frequency (percentage) and for the quantitative variables, the mean (standard deviation) was reported. The statistical relationship between demographic and basic variables and the degree of needle stick injury were investigated. For this purpose the Chi-square statistical test was used and in all cases the significance of P was considered as less than 0.05. The analyses were conducted using SPSS software.

To observe the ethical principles, the participants were free to accept or refuse the cooperation and the participants were asked for their conscious consent. The results of the study were issued in a way to keep the respondents completely unknown and the privacy of the participants in the study was respected. The participants were also assured that the obtained data and results will only be used in line with the research goal.

## RESULTS

Participants of the study were mostly composed of male students in the age range between 30 and 40. About two-third of these participants were taking their full residency courses. Internal medicine, surgical and

neurosurgical wards accounted for the largest share of the participants, respectively (Table 1). The mean age of respondents is equal to 30.69 years with a standard deviation of 6.40 years.

**Table 1:** Demographic and background features of participants

Variable	Categories	Frequency	Percentages
Age	20-25	61	28.9
	25-30	49	23.2
	30-40	84	39.8
	Higher than 40	17	8.1
Sex	Male	133	63
	Female	78	37
Educational level	Residency	136	64.5
	General medicine	75	35.5
Hospital ward	Internal	79	37.4
	Surgery	50	23.7
	Neurology	23	10.9
	Emergency	17	8.1
	Infection disease	5	2.4
	Orthopedic	6	2.8
	Operation room	6	2.8
	ENT	16	7.6
	Pathology	9	4.3

Assessing the incidence of needle stick injury and its associated factors in the participants indicated that more than one-third of medical students experienced it in the past year. The highest frequency of incidence belongs to students with one time of exposure to needle stick injury. The mean annual frequency of the incidence of needle stick injury is equal to 3.11 times per person with a standard deviation of 3.27 times. In other words, each participant has had the experience of needle stick injury in the past year for averagely 3.11 times.

Most of the participants had a history of vaccination against hepatitis B, but only 40% of them took an antibody test to assess the vaccination effectiveness by checking the level of hepatitis B antibody (HBsAb) in their blood. The majority of respondents stated that they did not take an antibody test after the incidence of needle stick injury. Others admitted that even after learning of low levels of hepatitis B antibody, they did not receive an immediate injection of immunoglobulin or did not take steps for revaccination. Also,

our investigation showed that the following factors as among the most important reasons of exposure to needle stick injury: failure to cover syringes

appropriately by students, excessive workload, and inadequate training in relation to the prevention of needle stick injuries (Table 2).

**Table 2:** The needle stick and its related items in participants

Variable	Categories	Frequency	Percentage
NS exposure	Yes	76	36
	No	135	64
NS rate (time)	One	31	40.8
	Two	15	19.7
	Three or four	14	18.4
	Higher than four	16	21.1
HBV vaccination	Yes	199	94.3
	No	12	5.7
Antibody test after vaccination	Yes	85	40.3
	No	126	59.7
Antibody test after NS exposure	Yes	33	26.6
	No	91	73.4
HBV Immunoglobulin and vaccination	Yes	18	20.9
	No	68	79.1
NS cause	Unsafe self-recap	6	7.1
	Unsafe other recap	29	34.1
	Low safety of syringe container	3	3.5
	Unsafe transition of syringe	3	3.5
	High workload	23	27.1
	Inadequate education related to NS prevention	10	11.8
	Low safety of syringes	2	2.4
	Other causes	9	10.6

The statistical relationship between NS and its related items with demographic and background variable is indicated in Table 3. In examining the relationship between exposure to needle stick injury and demographic and background variables, we observed a significant relationship between age, educational level and the hospital ward in which the

students train and work. As, the exposure to needle stick injury on students which were older than 30, medical research fellows and students are working in the surgery and pathology wards is more than others significantly ( $P < 0.05$ ).

The analysis of the relationship between needle stick injury rate with the under study variables showed that exposure frequency is

significantly higher among men students in compared with women students. In addition, the needle stick rate among students training and working in the surgical ward is

significantly higher in compared with students in the other wards so that needle stick rate in this ward is more than 4 times per person annually ( $P < 0.05$ ).

**Table3:** The relationship between NS and its related items with assessed variable

	NS Exposure	NS rate	HBV vaccine	Antibody test after vaccine	Antibody test after NS	Immune and vaccine	NS cause
Age	0.019*	0.088	0.780	<0.001*	0.005*	0.088	0.369
Sex	0.978	0.003*	0.377	0.031*	0.483	0.632	0.355
Educational Level	0.001*	0.109	0.020*	<0.001*	0.412	0.404	0.060
Hospital ward	0.004*	0.001*	0.720	0.001*	0.052	0.042*	<0.001*

\* =significant relationship.

## DISCUSSION

The study findings showed that 36% of the medical students have experienced needle stick injuries in the last year. The mean annual frequency of exposure to needle stick injury is equal to 3.11 times per person. This exposure ratio is lower than that of the study by Askarian with 69% exposure and is higher than Koohestani results with 32.7% exposure.<sup>15,26</sup> However, the rate of exposure is higher in Askarian's study (1.87 times per person).<sup>15</sup> Furthermore, the ratio and rate of exposure in this study are lower than those of the study by Yao with 100% and 4.65 times per person.<sup>27</sup> Also, the ratio of exposure with NS is higher than studies which done by Bijani and Kazemi Gelogahi with 32% and 22.5% exposure in one year period, respectively.<sup>28,29</sup>

The study findings showed that more than 94% of the participants had a history of vaccination against hepatitis B which is similar to the presented results by Parsapili with 96.9%, but higher than the reported results by Serafinska with 75.7% and Mohammadi with 80.8% vaccination.<sup>30-32</sup>

After receiving vaccination, only 40.3% of the participants took an antibody

titer to test the effectiveness of the vaccination. This frequency is much higher than the reported results by Parsapili with 99% and Gershon with 68%.<sup>30,33</sup> Only 26.6% of the respondents reported that after the incidence of needle stick injury they took an antibody titer and only 20.9% of them with verified low levels of antibody in the blood received an immediate injection of immunoglobulin or took steps for re-vaccination. These findings are higher than those reported by Heidari according to which 16% of the participants took an antibody titer after exposure and 12% followed up and took steps for revaccination and receiving immunoglobulin of hepatitis B.<sup>34</sup>

Investigation on the reasons of exposure to needle stick injury showed that the students' failure to cover syringes appropriately, excessive workload, and inadequate training in relation to the prevention of needle stick injuries are the most important causes of exposure. Vahedi et al. introduced excessive workload as the most important cause of exposure although in most studies, as in this one, the students' failure to cover syringes appropriately is

considered as the most important cause of needle stick injuries.<sup>35-38</sup> In another study, the exposed health workers believed that the most important reason for NSIs was patients un precaution and crowdedness.<sup>32</sup>

There is a significant relationship between exposure ratio to needle stick injury and age, educational level and the ward of activity. There is also a significant relationship between rate of exposure with gender and hospital ward. Exposure ratio to needle stick injury is significantly higher among students older than 30, medical research fellows, and students working in the surgery and pathology wards in compared with the other groups. Besides, the rate of exposure is much higher among male participants compared with female participants and among students working in the surgery ward compared with the other groups. Various studies have pointed to the important role of these factors in the occurrence of needle stick injury. For example, these studies reported a higher level of exposure to needle stick injury among younger people and people with lower educational levels as well as among female health care workers compared with others.<sup>37,39</sup> In addition, some studies have pointed to the impact of the ward of activity on the incidence of needle stick injury. For instance, Ghasemi reported employment in the surgical ward as a main factor in the occurrence of needle stick injury.<sup>40</sup> In another study, the most injuries were occurred in the emergency department and Internal ward.<sup>32</sup>

With regard to the relationship between variables under study and vaccination against hepatitis B, we observed that vaccination rate is higher among medical research fellows. However, there is a relationship between taking an antibody titer and all the variables under study such that the rate of antibody test is higher in students older than 40, male students, medical

research fellows and students working in the surgical ward, in the ENT and in the emergency ward compared with other groups of participants ( $P < 0.05$ ). There is also a statistical relationship between taking an antibody titer after exposure and age as a demographic variable. Participants older than 40 are more likely to take an antibody titer after exposure compared with the other age groups. Also, there is a relationship between re-immunization in the case of low immunity and the ward of activity such that the rate of re-immunization is higher among students working in the pathology ward. Also, there is a statistically significant relationship between the causes of exposure and the ward of activity such that the rate of exposure is higher in the general internal medicine ward due to the failure to cover syringes appropriately and in the surgical ward due to excessive workload compared with the other wards.

Because the number of needle stick injuries are remarkably high among the nurses of Imam Reza Hospital, Tabriz, the researchers presented a suggestion to establish a precise reporting and registration system of this type of injury as well as preparation of a standard state protocol for its management and prevention because these injuries are not registered in developing countries in many areas and there is no standard model to manage this type of injuries.<sup>41</sup> This could be the biggest barrier to remove the relevant problems to it.

In terms of study limitations, we can point to the possibility of recall bias on the part of the respondents at least in relation to the number of cases in the last year. However, the possibility of bias in this study is relatively less than those studies that consider the employment of people in the course of five years or for longer periods of time. There is also the possibility of influence by demographic variables under study on the variable of

exposure and its associated variables since many of these variables can overlap with and distort the others in every situation. Another limitation of this study is the failure to assess the relationship between demographic variables and the variables associated with needle stick injuries such as vaccination and taking an antibody titer after vaccination, follow-up treatments after exposure and even the causes of exposure as reported by previous studies for comparison with the present study.

The current study is a confirmation that the incidence of needle stick injuries is not acceptable and requires the officials to pay attention to and remove the existing fundamental problems. So, the applied interventions such as the completing HBV vaccination for all students, procurement of antibody test equipment in hospital laboratories, procurement of HBV immunoglobulin for students, giving suitable and practical education related to NS causes and its prevention ways for students especially for more high risk groups including students older than 30, medical research fellows and students working in the surgery and pathology wards are needed. Undoubtedly, the results of the current study and its applied suggestions can pave the way for further studies and studies in similar areas.

## CONCLUSION

This study showed the high incidence of needle stick injuries in medical students and highlighted the need for implementing precise interventions.

## CONFLICT OF INTEREST

The authors declare that they have no conflict of interests.

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