

Full length research paper

# Investigating the use of safe injection guidelines after needle stick and sharp instruments injuries in Nursing & Midwifery students of Hamadan University of Iran

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Unsafe injection threatens patients, medical students and healthcare providers; so this study was conducted to determine the rate of application of safe injection guidelines after needle stick and sharp instruments injuries (NSIs/Sis) by Nursing & Midwifery students of Hamadan University. In this cross-sectional study 234 students of nursing, midwifery and medical emergencies were selected by stratified random sampling. Data were collected by questionnaires that included demographic data, history of injuries and preventive guidelines of safe injection. Data analysis was done using the software SPSS21. The average age was  $22.71 \pm 2.94$ . 38% of the students had a history of NSIs/SIs. The most of the NSIs/SIs had occurred in the emergency room among final year students (21.2%) after vein puncturing (29.2%) and before discarding the needle (64.2%). 77.8% of all the students were vaccinated against hepatitis B. The average score of incorporating preventive measures was  $32.01 \pm 7.14$ ; 53% of the students' scores were at the average levels (28-37/40) and only 21.8% of the students were at the good levels (>38/40). A significant relationship was observed between taking preventive measures and field of study, history of injury and between history of vaccination ( $P \leq 0.005$ ). Regarding the high rate of NSIs/SIs, we suggest designing certain training courses based on the guidelines of safe injection to increase the awareness and performance of students about safe injections.

**Keywords:** Injection, Needle stick injuries, Students

## Introduction

In health care settings, injected medicines are regularly used for prevention, diagnosis, and treatment of different illnesses. Unsafe injection techniques threaten patients and healthcare providers with infectious and non-infectious adverse events (CDC, 2014). Percutaneous damages caused by needle sticks pose the major risk of work-related transmission of blood borne pathogens such as

human immunodeficiency virus (HIV), hepatitis B virus (HBV) and hepatitis C virus (HCV) to healthcare workers (HCWs). According to the Centers for Disease Control and Prevention, 384,000 percutaneous injuries happen annually in US hospitals from which about 236,000 are related to hollow-bore needles (Jayanth S *et al.*, 2009). EPINet (The Exposure Prevention Information Network) reported in 2003 that about 27 needle stick injuries occur (NSIs) per every 100 beds in teaching hospitals (Mehta A *et al.*, 2005).

The annual expected proportion of health-care workers (HCW) exposed to blood-borne pathogens globally are

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2.6% for HCV, 5.9% for HBV, and 0.5% for HIV, According to the studies of WHO. This means that nearly 16,000 HCV infections and 66,000 HBV infections happen to HCW worldwide (Rampal L *et al.*, 2010).

In a report from UK, 37% of nurses stated that they had needle-stick injuries constantly at some stage during their occupation. In Australia, the rate of reported needle-stick injuries is 1 in every 5 occupied beds each year which leads to an annual sharps-related injury rate of 47,000 (Yang L, Mullan B, 2011). The risk of needle stick injuries is believed to be greater for medical students because of their lack of experience, poor knowledge about preventative measures and right post-exposure behaviors. Numerous authors have assessed the prevalence of needle stick injuries among medical students in a single year of training. Their results varied from 14.6% to 61.3% ( Deisenhammer S *et al.* , 2006). In the SalzerH *et al.* (2011) online survey regarding NSI(2011), results showed that the vast majority (75%) of students experienced at least one NSI. An Improved performance in injections is highly recommended internationally to guarantee safe usage of sharp instruments during injections. A safe injection is an injection that does not injure the recipient, does not expose the staff to any unnecessary risks and the remaining of injected substances do not pose a threat to the community. The duty of emphasizing on safe injections rests with national governments, prescribers, employers, managers, receivers of injections and the community as a whole. It is the health care organizations' responsibility to inhibit any injection-related disease transmission from patients to health care workers and the community, via the rational and safe use of injections by following the WHO Injection Safety program and the Safe Injection Global Network (SIGN)( WHO, 2010). In this regard, Ministry of Health and Medical Education of Iran ( 2009) translated a directive for practicing safe injections which is based on the guidelines of WHO and SIGN. It contains two basic parts A) Preventive measures toward injuries caused by needles and sharp instruments in health care workers B) management of exposure to blood (i.e. emergency first aid, risk assessment,). According to high prevalence of injections, what is more the high risk of unsafe injections like transmission of infections such as HBV, HCV, HIV, especially for medical students, researchers decided to undertake this study with the aim of determining the rate of application of guidelines of safe injection after needle stick and sharp instruments injuries by Nursing & Midwifery students of Hamadan university in 2013.

## Methods

In this cross-sectional study we selected 234 undergraduates from nursing, midwifery and emergency

medicine, out of the 600 students of the faculty of Nursing and Midwifery of Hamadan University of Medical Sciences in 2013 by the method of stratified random sampling. Data were gathered by a self-administered questionnaire which contained three parts. The first part was about demographic data such as age, sex, educational level and field of study, semester and the name of the training departments. In the second part of the questionnaire the history of injuries from needles and sharp instruments (NSIs/Sis) was questioned, which included questions such as the history of NSIs/SIs, the frequency of exposure to needles and sharp instruments during the education, causes of NSIs/SIs (taking blood samples, venipuncture, intramuscular, intravenous and subcutaneous,), the situation which caused the NSI/SI (after injection and before throwing away the needle, during the act of discarding the needle and after discarding) and the history of vaccination against hepatitis B. The third part of the questionnaire was based on the students' practices about guidelines of safe injection after NSI/SI. These five-point liker scale questions (never, rarely, sometimes, often and always) were adjusted based on the guidelines of WHO (2010) and the center of Monitoring and Accreditation of Treatment affairs of Ministry of Health and Medical Education of Iran (2009). The questionnaire was comprised of eight items and answer to each item ranged from 1 "never" to 5 "always". Scores from each item are summed for a total possible score of 8 to 40. The content validity was established by ten faculty members. Validity of the questionnaire was confirmed by test-retest reliability (Pearson correlation coefficient=0.78). Questionnaires were distributed among the students who had passed at least one course of training in a hospital during their education period (from 2-3 semesters) and were collected within 2-3 weeks. All the students signed the consent form and declared their willingness for participation in this research. The Ethics Committee of the Department of Research and Technology Studies of Hamadan University approved this research and all ethical principles were ensured during all the steps of the project. After gathering data and extracting the required information, data were analyzed using the software SPSS version 22. In the descriptive analysis, the mean and standard deviation and percentages of variables were computed. Statistical associations were assessed using the chi-square, Fisher's exact test and Mann-Whitney test. P-values of  $\leq 0.05$  were considered statistically significant.

## RESULTS

In this study, 234 nursing, midwifery and medical emergencies students participated. A great proportion of the students (43.6%) were in the age group of 21-22

**Table 1-** Demographic data of the subjects

Characteristics	n	%
<b>Age: (mean <math>\pm</math> SD): 22.71<math>\pm</math>2.94</b>		
19-21	45	19.2
21-22	102	43.6
>23	87	37.2
<b>Gender:</b>		
Male	90	38.5
Female	144	61.5
<b>Field of study:</b>		
Nursing	133	56.8
Midwifery	77	32.9
Medical emergency	24	10.3
<b>The semester of students:</b>		
Third	38	16.2
Fourth	63	26.9
Fifth	20	8.5
Sixth	40	17.1
Seventh	20	8.5
eighth	53	22.6

years. 61.5% were female; 56.8% , 32.9% and 10.3% of the students were studying nursing, midwifery and emergency medicine, respectively. Most of them (26.9%) were in the fourth semester (Table 1). The most of the students had a history of being injured in the emergency (30.8%), Gynecology & Obstetrics (27%) and medical department (21.2%). 11.1% of them had a student work in the emergency ward (57%) of about 3-6 months. 38% (89 persons) of the students had a history of needle stick injury. 43.8% of the students (89) had only one experience of NSI/SI. Most of the NSIs/SIs occurred in the emergency room among final year students (21.2%) after vein puncturing (29.2%) and before discarding the needle (64.2%). The most of the students (77.8%) were vaccinated against hepatitis B over the past 2-4 years (37.2%) but the level of vaccine-induced hepatitis B surface antibody of only 7.7% of the students was 10 mIU/mL or more (Table 2). This means that the average score of applying the guidelines of safe injection after NSIs/SIs by the students was  $32.017 \pm 7.14$  (Table 4). The majority of the students' (46.2%) scores were in the average level (Table 3). The most of the students answered properly to these questions: "I wash the wounds and affected mucous membrane (mouth, nose,....) with great amounts of water" (62%), "I wash the affected area with soap and water immediately" (56%) and "I follow up the results of the blood sample taken from the patient who is a known case of HIV, HBV and HCV" ( 55.6%). Although answers to this question: "I

report a needle stick injury immediately to medical authorities" was not appropriate and only 41.9% of the students answered correctly to this question. Finally the relationship between the score of applying the guidelines of NSIs/Sis, demographic data and history of NISs/SIs were assessed. There was a significant relationship between applying the guidelines of safe injection and field of study ( $p=0.002$ ); that is to say that the scores of applying the guidelines of safe injection by nursing, midwifery and emergency medicine students were different from each other ( Mann- Whitney  $p=0.002$  ,  $z=-3.109$ ). There was also a significant relationship between applying the guidelines of safe injection and having a history of injury ( $p=0/000$ ) and history of vaccination against hepatitis B ( $P=0.005$ ) (Table 5).

## Discussion

This study aimed for determining the rate of application of guidelines of safe injection after NSIs/SIS by Nursing & Midwifery students of Hamadan University in 2013. According to our findings, more than one third of the students in this study (38%) had experienced NSIs and SIs. This rate was higher than the results of the study carried out by Irmak Z and Baybuga MS (2011) in Turkey (19.4%) but was lower than the SHIAO's *et al.*(2002) study in Taiwan (61.9%). It is possible to argue that nursing students in Shiao's study were at the final year

**Table 2-** The frequency and status of NSIs/SIs of the subjects

Variable	Number	Percent
<b>Status of injuries</b>		
Yes	89	38%
No	145	62%
<b>Number of injuries</b>		
Once	39	43.0%
Twice	27	30.0%
More than twice	33	25.0%
<b>Department of NSI/SI</b>		
Emergency	27	30.0%
Obstetrics and Gynecology	24	27.0%
Medicine	19	21.0%
Surgery	14	15.0%
Others	5	5.5%
<b>The semester of injuries</b>		
Before fourth semester	32	36.0%
fourth semester	19	21.2%
After fourth semester	38	42.0%
<b>Causes of NSI/SI</b>		
Vein puncture	26	29.0%
Blood sampling	25	28.0%
Injections( IM, ID, SC)	16	18.0%
Suturing	11	12.0%
Others	11	12.0%
<b>The time of NSI/SI</b>		
Before injection	19	21.3%
<b>After injection and before disposing of needles and sharp instruments</b>	<b>57</b>	<b>64.0%</b>
During disposing of needles and sharp instruments	11	12.0%
After disposing of needles and sharp instruments	2	2.2%
<b>Immunization against hepatitis B</b>		
Yes	182	77.8%
No	52	22.0%
<b>Assessment the level of vaccine-induced hepatitis B surface antibody(n=182)</b>		
+10	14	7.7%
-10	1	.6%
I don't know	167	91.0%

**Table 3-** The level of application of guidelines of safe injection after NSIs<sup>1</sup>/SIs<sup>2</sup>

Applying guidelines	Number	Percent
Good	70	29.9%
Average	108	46.2%
Poor	56	23.9%
Total	234	100%

<sup>1</sup>-Needle stick injuries; <sup>2</sup>-Sharp injuries

**Table 4**-The scores of applying the guidelines of safe injection after needle stick and sharp instruments injuries (N=234)

Post exposure measures of safe injection	Minimum	Maximum	Mean±SD
1- Immediately washed the affected area with soap and water.	1	5	4.27±1.03
2- Immediately washed eyes with running water or saline with opening eyes.	1	5	4.22±1.06
3- if blood and infected secretions splashed, not rubbed my eyes.	1	5	4.43±0.87
4- Washed the wounds and affected mucous membrane (mouth, nose,) with a great of water.	1	5	3.79±1.26
5- Ensured only a suitably person performed medical evaluation, risk assessment and prescription of PEP.	1	5	3.63±1.31
6- Sought advice on the need for PEP for HIV and HBV.	1	5	3.66±1.35
7- Followed up getting blood sample from the patient who were known the case of HIV, HBV and HCV.	1	5	3.88±1.30
8- Followed up the results of blood sample from the patient who were known the case of HIV, HBV and HCV.	1	5	4.10±1.24
<b>Total Score</b>	<b>8</b>	<b>40</b>	<b>32.017±7.14</b>

**Table 5** - Relationship between application of guidelines of safe injection after NSIs<sup>1</sup>/Sis<sup>2</sup> and demographic data

Preventive measures	Chi-square value (χ <sup>2</sup> )	P value
<b>Demographic data</b>		
Age	6.97	0.539
Sex	2.33	0.311
Field of Study	17.01	0.002*
Term of study	16.09	0.936
Student's work	1.57	0.097
History of injury	17.38	0.000*
Number of injury	5.32	0.514
History of vaccination	10.69	0.005*

<sup>1</sup>-Needlestick injuries; <sup>2</sup>-Sharp injuries; \* p<0.05

and at the stage of internship in which they had experienced working at different hospitals but the samples of our study were from second to fourth year students. The curriculum of these students is designed in a way that novice students perform simple and non-invasive procedures but the final year students must do a variety of procedures that among them, a lot can be invasive and therefore the risk of NSIs/Sis is higher for them. There was a significant difference between the year of study and NSI/SI (p=0.000). The highest rate of needle stick injury was observed among the final year students. Our findings about the relationship between years of study and NSI and SI are similar to reports from Australia (Smith DR, Leggat PA, 2005) but not to the findings from Italy (Petrucci C *et al.* 2009). In Australia, NSIs increased with progression in the year of study but in Italy the number of NSIs/Sis decreased with that. It can be concluded that students in the Internship period (final year) have more responsibility and have to do a variety of tasks but if their knowledge about biosafety increases,

they might be able to protect themselves from risks like NSIs/Sis.

The highest rate of NSIs/Sis occurred in the emergency (30.8%), and then Gynecology and Obstetrics (27%) and after that in medical (21.2%) departments. In the study of Yao *et al.* (2013) in China, NSIs frequently occurred in medical and Gynecology & Obstetrics wards by the students. Cheung's *et al.* (2010) study in Hong Kong also showed the majority of NSIs were in medical (18%) and surgical (13%) wards. These high rates in these divisions are due to this fact that these are training environments for interns. The fields of training of the most of the nursing and medical emergencies students were the medical and surgical wards and for midwifery students were Gynecology & Obstetrics ward so the probability of NSIs/Sis in these environments is higher than the other wards because of high frequency and variety of diagnostics and curative procedures like blood sampling, vein puncturing, injecting, etc. Venipuncture (29.2%) and taking the blood sample (28.2%) were the most frequent

causes of NSIs and SIs. Our findings about causes of NSIs and SIs are consistent with Kohestani's *et al.* study (2010) that showed NSIs occurred for the majority of medical emergency students during Venipuncture (40%) and taking blood samples (21%). In this study 64.2% of NSIs occurred after the procedure and before throwing away the sharp object. Kohestani *et al.* (2010) also showed that 62.5% of medical emergency students were injured from needles at this stage. In this study 77.8% of the students had a history of vaccination against hepatitis B. Our findings about vaccination was different from other studies conducted in Iran (medical, dental, nursing and midwifery students) (Askarian M, Malekmakan L, 2006) and in Australia (nursing students) (Smith and Leggat, 2005). The hepatitis B immunization rates of our study were lower and higher than the rates of Iranian's (86.2%) and Australian's studies (72.3%) respectively. This disparity may be related to directors' approach about preventive measures or to the different knowledge and practices of students about ways of preventing NSIs/Sis.

The results of this study showed that the scores of applying the guidelines of safe injection after NSIs/SIs of 29.9%, 46.2% and 23.9% of the students were good, moderate and poor, respectively. The most of the students (62%) said that they washed the wounds and affected mucous membrane (mouth, nose,) with great amounts of water after NSIs and SIs. 56% of the students claimed that they washed the affected area with soap and water immediately. While in the study of Saleem T *et al.* (2010) 50%, 26.7% and 62.5% of third year, fourth year and final year students had washed the affected area respectively. In the Hadadi *et al.* study (2009), 91.38% of health care workers had washed the affected area with soap and water. It is possible that health care workers had observed the preventive measures via systematic and continuing education but students had a little training in preventive measures of NSIs/Sis or their experiences were too limited to manage the situation( NSIs/Sis) properly. In this study 41.9% of the students noted that they had reported their needle stick injury immediately to the medical services. In studies conducted by Irmak Z and Baybuga MS (2011) and Shiao *et al.*(2002)31.7%and 13.1%of the nursing students had reported their NSI respectively which are different from our study. Saleem's T *et al.* study (2010) also showed that 25% of third year, 13.3% of fourth year and 16.7% of final year students, reported the incidence. The disparity between these studies may be related to factors such as being ashamed or afraid of reporting NSIs/SIs or lack of knowledge about the importance of reporting. 55.6% of the students in this study said that they followed up the results of blood sample from the patients. Saleem T *et al.* (2010) showed that 25% of third year, 60% of fourth year and 87.5% of final year students, enquired about their patient and his/her disease history. This means that by increase in year of education, the performance will be bettered. In

these two studies, results showed that students had relatively good health seeking behaviors and knowledge about preventive measures of NSIs.

In this study we assessed the relationship between the scores of applying the guidelines of NSIs/SIs and demographic data and history of NISs/SIs. There was a significant relationship between applying the guidelines of safe injection and field of study ( $p=0.002$ ). The midwifery students applied the guidelines of safe injection more than nursing students but there was no differences between midwifery and medical emergency students. There were few studies about comparison of NSIs/Sis in medical students. In Hashemi's *et al.* study (2011), 700 health workers were assessed for NSIs/Sis and results showed that 44.6% of nurses and 2.9% of midwiferies had a needle stick injury during past year. The preventive measures like vaccination against HBV were 100% for midwiferies and 89.7% for nurses. It can be concluded that preventive measures were more observed in midwiferies in the two studies.

In the present study we assessed the relationship between applying the guidelines of safe injection and past history of injury. Results showed that the scores of applying the guidelines of safe injection were improved in the students that had a history of NSIs/Sis ( $p=0/000$ ). Similarly, in Yao's *et al.* study (2013) 87.8% of educated nursing students (on occupational safety training) that have never had a history of needle stick, had experienced NSIs after finishing their education; meanwhile the number of injuries in students that had a history of needle stick(26.02%) decreased to %10.2 after finishing education( $p<0.005$ ). It can be concluded that the experience of having NSIs/Sis besides increasing the students' knowledge may improve their acts of management over conditions such as NSI/SI.

Finally after assessing the relationship between applying the guidelines of safe injection and history of vaccination against hepatitis B, we found that students, who had the history of vaccination, had a higher score in applying the guidelines of safe injection. The results of this study are not exactly similar to Saleem's *et al.* study (2010) in which by increase in years of study, preventive practices were improved, but vaccination status lessened from 95% to 93% when comparing third year students to fifth year medical students. It can be concluded that vaccination is a part of preventive guidelines and by applying the guidelines, the prevalence of NSIs/Sis may be decreased. The emphasis on the program of vaccination against HBV, is different from one country to another, especially for the medical students and this difference may change the statistic of vaccination.

## Conclusion

This cross-sectional study was done to observe the

preventive measures of students about NSI/SI. It was found that the students were at the risk of blood-borne pathogens through NSI/SI and less than 30% of them applied the guidelines of safe injection at an appropriate level. Gately and Bromwich (2007) recommended that the main control measures of NSIs are utilizing the principles of engineering, administration and code of conduct. In several hospitals, safety-engineered devices such as retracted lancets and needleless heparin blocks are being used. Furthermore managerial acts such as identifying needleless products and setting aside budgets to purchase them and also educating the healthcare workers and students are crucial. Lecturers should emphasize on the evaluation and prevention of NSIs/Sis and supervise and encourage the preventive behaviors.

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