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Occupational Needlestick-Sharp Injuries during Clinical Practice Training and Status of Hepatitis B Immunization in Nursing and Midwifery Students*

Hemşirelik ve Ebelik Öğrencilerinin Klinik Uygulama Eğitimleri Sırasında Mesleki Delici-Kesici Yaralanmalar ve Hepatit B Aşılı Olma Durumları

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Özgün Araştırma

Abstract

Objective: The aims of this study were to identify the frequency of needlestick/sharps injuries (NSISIs) in nursing/midwifery students and the rate of Hepatitis B vaccination.
Method: This descriptive survey was done on a sample of nursing and midwifery students using self-administered questionnaire. The frequency and mechanism of needlestick and sharp injuries (NSISIs) and the prevalence of hepatitis B immunisation were determined retrospectively by surveying a nursing and midwifery school in a university. In May and June 2011. 325 (84.5%) students were questioned about NSISIs on whether they had experienced during their clinical practice and about their hepatitis B immunisation histories. The data were represented as percentages and analysed using Pearson χ^2-values.
Results: 50.8% of the students reported NSISIs in clinical practice. 54.5% of injured students had been injured during or after a procedure. 50.3% of injured students said they hadn't reported their injury. 27.5% of them reported that the injury occurred when recapping a needle. Overall 77.5% of all respondents had completed their series of vaccinations against hepatitis B.

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Conclusion: This study showed that students frequently sustain NSISIs and that the hepatitis B immunisation rate was low. The nursing and midwifery students should be trained about ocuppational risk to increase their awareness of and compliance their Universal Precaution and instituting policies so that they are fully immunised againist hepatitis B before begining clinical practice.

Keywords: Needlestick-sharp injuries, nursing and midwifery students, Hepatitis B immunisation.

Öz

Amaç: Bu çalışma hemşirelik ve ebelik öğrencilerinde mesleki delici-kesici yaralanmaların sıklığı ve hepatit B bağışıklanma durumlarını belirlemek amacıyla yapıldı.
Metod: Tanımlayıcı olarak yapılan bu çalışmada hemşirelik ve ebelik öğrencilerinin kendilerinin doldurdurduğu bir anket uygulandı. Çalışmada bir üniversitenin hemşirelik ve ebelik bölümünde okuyan öğrencilerde delici-kesici yaralanmaların sıklığı ve Hepatit B aşılı olma durumları geriye dönük olarak belirlendi. Mayıs–Haziran 2011 tarihlerinde 325 (%84,5) öğrenci klinik uygulamalı eğitimleri sırasında delici-kesici yaralanma maruziyeti ve Hepatit B aşılı olma durumları bakımından tarandı. Araştırmanın verileri yüzdelik ve Pearson Ki-Kare kullanılarak değerlendirildi.
Bulgular: Öğrencilerin %50,8'i klinik uygulma sırasında delici-kesici yaralanma olduğunu bildirdi. Yaralanan öğrencilerin %54,5'i işlem sırasında ya da işlem sonrasında yaralandığını belirtti. Yaralanmış olan öğrencilerin %50,3'ü yaralanmayı rapor etmediğini söyledi. Bunların %27,5'i iğneyi kılıfına geçirirken yaralandığını bildirdi. Öğrencilerin %77,5'inin Hepatit B'ye karşı aşılanma serisini tamamladığı belirlendi.
Sonuç: Bu çalışma öğrencilerde delici-kesici yaralanmaların sıklığının yüksek, hepatit B'ye karşı aşılı olma sıklığının düşük olduğunu dösterdi. Bu nedenle, hemşirelik ve ebelik öğrencilerine Uluslararası Önlemler ile ilgili farkındalıklarını arttırmak ve klinik uygulamaya başlamadan önce hepatit B'ye karşı tam bağışıklama için kurumun işleyişine uyumlarını sağlamak için eğitim yapılmalıdır.

Anahtar Kelimeler: Delici-kesici yaralanmalar, hemşirelik ve ebelik öğrencileri, Hepatit B immünizasyonu

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Introduction

The risk of transmission of blood-borne pathogens (BBPs) to patients and workers in the course of healthcare is well recognized, and blood-borne viruses have always posed risks for healthcare workers. The routes of transmission from patient to healthcare workers are well established, the most common being needlestick or sharp injuries, followed by mucocutaneous exposure. Transmissions of at least 60 different pathogens by NSISIshave been reported. Occupational percutaneous mucosa exposures that may result in the transmission of the hepatitis B virus (HBV), hepatitis C virus (HCV), or human immunodeficiency virus (HIV) include NSISIs, the direct inoculation of a virus into percutaneous scratches, skin lesions, abrasions, or burns, and the inoculation of a virus onto the mucosal surfaces of the eyes, nose, or mouth through accidental splashes.[1,2]

Among the 35 million HCWs employed worldwide, percutaneous injuries have been estimated to result in approximately 16.000 hepatitis C and 66.000 hepatitis B virus infections annually. The incidence of NSISIs is high in industrialised countries. For example, the mean number of sharps injuries annually ranged from 0.18 per healthcare worker in North America to 0.64-0.93 in Europe.[3] HCWs in developing countries are known to be at more risk of infection from BBPs (particularly HBV, HCV, and HIV), because of the high prevalence of such pathogens in those countries.[1,2,4]

Staffs are exposed to different risks according to type of employment, length of employment, experience and the department in which they work. Nurses and students nurses perform more bedside procedures than other HCWs. High-risk percutaneous exposures are therefore most frequently reported by nurses.[5-7] The risk also appears to be greatest during the early years of an health care worker's career, particularly during training, when exposure to risk is maximal, and work experience and awareness of BBP risks is minimal.[8-10]

One of the most serious threats that nursing and midwifery students face during their clinical practice training is possible exposure to BBP. The risk of exposure to patient BBPs for students during

invasive procedures may be greater than for degree holding physicians, dentists or nurses, because lack of experience and appropriate technique of handling penetrating/sharp medical instruments increases the risk of accidental exposure to BBPs during the clinical practice training. The students' clinical experience is also limited, despite their eagerness to learn new procedures. They may also have insufficient background knowledge to recognize the level of risk posed by a particular patient and insufficient training in standard infection control principles for BBPs. This is why students are required to participate in universal precautions (UPs) training before they begin their clinical practice training.[11-14]

Incidents of occupational exposure of health care workers are routinely reported to Centers of Disease Control in most countries, but such a registry or surveillance system has not yet been completely developed in Turkey. Existing regulation provides health care workers with insufficient protection from occupational hazards and there is a lack of systematic record-keeping on percutaneous and mucocutaneous exposure in hospital settings. Occupational exposure of health care workers has only recently begun to receive general attention in developing countries such as Turkey, despite a national literature review that clearly shows that occupational exposure to BBPs in health care workers is a widespread problem in this country.[14-17]

Although most NSISIs studies focuses on health care workers, especially on nurses, relatively few studies have addressed BBP exposure accidents among nursing[14,18] and midwiferystudents.[19,20]The epidemiology of NSISIs among nursing and midwifery students has therefore not been elucidated. Research into midwifery and nursing students' injuries from needles and sharp instruments during their clinical rotations will draw attention to the need for students to receive special training about invasive procedures, UPs and infection control, as well as the need for school administrators and instructors to ensure that students receive full hepatitis immunization prior to beginning their first clinical rotation.

Aims of the study

The aims of this study were to (1) identify the frequency of NSSIs in nursing and midwifery students, (2) describe the association of various factors related with these injuries, (3) determine HBV immunization status in nursing and midwifery students, and (4) assess the rate of the reporting of such incidents and status of receiving protective medical treatment.

Materials and Methods

Design and participants

This descriptive study used a self-administered survey questionnaire. It was conducted from May 2011 to June 2011.

The study was carried out at a university level nursing and midwifery school in a city in Turkey. In a total 386 students consisting of 190 nursing students and 196 midwifery students during the 2011 spring semester at were registered at this school. The response rate for nursing students was 84.5% (325). During May and June 2011, a survey of a representative sample of nursing and midwifery students who had their clinical practice in hospitals was conducted.

Nursing and midwifery students' clinical rotations include the medical/surgical and paediatric wards, critical care units, operating theatres, delivery rooms, emergency care units, and phlebotomy units. All students participated in clinical activities, assisting or observing during procedures in the clinics or operating rooms. Students were required to participate in universal precautions training before they began clinical rotation. Students in this study attended clinical practice during evening or night shifts two or three times a semester.

Instrument and Data Collection Procedure

The study data were collected by using a questionnaire. The questionnaire was prepared using international studies conducted among nursing and midwifery students and the investigators'

experience. It was piloted in a group of 5 nursing and 5 midwifery students who were not included in the study, and amended to improve clarity in April 2011.

The questionnaire form consisted of ten open-ended questions and twenty nine multiple-choice items divided into four areas of enquiry: the first part included 7 questions about socio-demographic characteristics (age, gender, school year and department type, use of gloves and goggles, handedness; the second part was about vaccination status and comprised four questions; the third part, with 17 questions, was about occupational exposure (number and nature of incidents, possible associated factors (time and place of incident, procedure, use of protective equipment), and the fourth part included 11 questions about reporting and follow-up, as well as reasons for not reporting. The survey forms were distributed by instructors who were not part of the study. They explained the purpose of the study and how to complete the form. The survey forms were then distributed and collected in the classroom at the end of a school final exam. The data collection for all questions lasted an average of 13 minutes for each student.

Ethical considerations

There was no ethics committee at the university when the study was planned. We therefore obtained the school director's approval for the study protocol. Additionally, written informed consent was obtained from all participants in accordance with the Declaration of Helsinki.

Data analysis

The collected data were analyzed by the investigators using the Statistical Package for Social Sciences version 15 for Windows (SPSS, IL, USA). The data was analyzed using percentages, and the categorical data was compared using the Pearson Chi-Squared Test. Comparisons with p-values less than <0.05 were defined as statistically significant.

Results

The survey forms were completed successfully by 325 students (overall response rate 84.2%) of whom 162 (85.3%) were nursing and 163 (83.2%) were midwifery students. The mean age was 21.44±1.81, 69.3% of the respondents being aged ≥21.Most of students in this study were female 297 (91.4%). There were 54 in their first year (16.6% of the total) and 114 in their third year (35.1%) (Table 1). Nearly three quarters of the students (242, 7.5%) reported always wearing gloves during procedures with risk of exposure to BBPs. Protective goggles were not used routinely by the majority of students (273, 84%). Most students (92.9%) stated that they had investigated whether or not their patients had a contagious disease. Of 93.2 students stated that the source cited most often for finding out whether patients had a contagious disease was patient files. Most students (90.5%) reported having received information about occupational exposure risks or UPs. The majority of informed students (209, 89.2%) stated that they had received information from the television or radio (Table 1).

Overall, 252 (77.5%) had completed their hepatitis B vaccination series. Of these students, 51 (13.2%) had completed their shots prior to beginning their clinical practice (Table 3). Nine students had not had hepatitis B vaccinations because they had a history of hepatitis B disease. Overall, 131 students (40.3%) threw away used needles and sharps devices in the wrong type ofred plastic bags for medical waste.

Pearson Chi-Square analysis indicated a statistically significant relationship between two variables and hepatitis B immunization: age (p=<0.05) and year in school (p<0.001). The hepatitis B immunization rate was higher in those ≥21 years old and those who had been studying for four years or more (Table 5).

Table 1. Distribution of the students' socio-demographic characteristics and preventive measures according to their characteristics (n=325)

Characteristics	n	%
Socio-demographic		
Age group (years) Mean age ± SD (21.44 ± 1.81) (Range 18—30)		
≤20	100	30.7
≥21	225	69.3
Gender		
Female	297	91.4
Male	28	8.6
Department		
Nursing	162	49.8
Midwifery	163	50.2
Year in school		
First	54	16.6
Second	114	35.1
Third	72	22.2
Fourth	85	26.2
Preventive measures and their characteristics		
Wearing gloves during procedures		
Always	242	74.5
Sometimes*	83	25.5
Use of protective goggles during procedures		
Always	273	84.0
Sometimes	46	14.2
Never	6	1.8
Informed whether patient has a contagious disease		
Yes	302	92.9
No	23	7.1
Source of information*		
Patients' files	303	93.2
History of patients	22	6.8
Her/his professors	1	0.3
Others	14	4.3
Informed about occupational exposures and UP		
Yes	294	90.5
No	31	9.5
Source of information*		
School	16	4.9
Internet	18	5.5
Television/radio	290	89.2
Others	5	1.5
Vaccination against Hepatitis B		
Never vaccinated	19	5.8
Incomplete vaccination	54	16.6
Complete vaccination	252	77.5
Vaccination against Hepatitis B before clinical training		
Yes	51	13.2
No	335	86.8
Reasons for lack of hepatitis B vaccination (n=19)		
Lack of financial resources	5	26.3
Unknown	5	26.3
Having hepatitis B	9	47.4
Throws away used needles and sharp devices		
Special container for needles and sharp devices	194	59.7
Plastic bags for medical waste (red plastic bag)	131	40.3

**More than one response has been provided.*

In this study, 165 (50.8%) students had experienced one or more NSISIs since they started their clinical training. Although 44 (26.7%) of the students had experienced an NSISI once, 85 (51.5%) had experienced 3-15 injuries; the total number of injuries for all students was 526. The results showed that the injuries were classified as high risk, which can be defined as injuries caused by hollow-bored, blood-filled needles (165,100%). Although not given in the tables, hollow-bored type needles are associated with syringes (69.1%). Medical ampoules or vials (62, 37.6%) are the most frequent cause of sharps-related injuries. More than half of the injured students (80, 54.5%) stated that they had been injured during or after a procedure. Half of the students (83, 50.3%) stated that the injuries had occurred with used items. Among the injured students, 96.9% (161) had used one (61.2%) or (35.7%)

Table 2. Distribution of needlestick and sharps injuries among students according to their characteristics (n=325)

Characteristics	n	%
Needlestick and sharps injury		
Present (Total number, mean, SD=526, 3.18±2.61)	165	50.8
Absent	160	49.2
Frequency of needlestick and sharps injury (Range=1—15) (n=165)		
One time	44	26.7
Two times	36	21.8
Three or more times	85	51.5
Injury causing devices*		
Hollow-bore needles	165	100.0
Suture needles	3	1.8
Medical ampoules/vial	62	37.6
Scalpel blade	3	1.8
Surgical scissors	2	1.2
Injury occurred		
During preparations for a procedure	75	45.5
During a procedure	61	36.9
After a procedure	29	17.6
Causative instruments of injuries		
Used *(contact with an object contaminated with a patient's body fluids)*	83	50.3
Unused	82	49.7
Wearing gloves at the time of injury		
Yes one glove	102	61.2
Yes double gloves	59	35.7
No	4	3.1
Location of injuries*		
Wards	107	64.8
Critical care areas *(operating room, delivery room, intensive care units)*	17	10.3
Withdrawing blood laboratories	45	29.7
Injury shift		
Day shift (8.00-16.00)	151	91.5
Evening shift (16.00-24.00)	10	6.1
Night shift (24.00-08.00)	4	2.4
Injury site on the body*		
Thumb	74	44.8
Index finger	95	57.6
Middle finger	31	18.8
Ring finger	16	9.7
Little finger	11	6.7
Another site on the hand	33	20.0
Other site	6	3.6

**More than one response has been provided.*

two layers of gloves at the time of injury. In total, 107 (64.8%) students stated that they had been injured in the internal medicine or surgery clinics. The majority of the incidents (161, 91.5%) had occurred during the day shift. The most frequent site of injury was the hand (159, 96.4%), especially the index finger (95, 57.6%) and thumb (57, 44.8%)(Table 2).

The statistical analysis of selected student variables and experience with NSISIs is given in Table 4. There were a significant relationships between the frequency of NSISIs and age group ($p<0.0001$), year in school ($p<0.0001$) and wearing gloves during procedure ($p<0.05$). The injury rate was higher in the age group of ≥21 years, and students in the fourth year had the highest rate of exposure. The rate was higher in students who sometimes wore gloves during procedures than among students who always wore gloves during procedures ($p>0.05$).

Table 3. Distribution of reporting the incident, post-exposure screen for hepatitis B, C and HIV and receiving medical assistance in injured students (n=325)

Characteristics	n	%
Reporting the incidents		
Reported	82	49.7
Unreported	83	50.3
Reasons given for not reporting the incident(n=83)		
The item was unused	16	19.3
Patient did not pose an infectious threat	9	10.8
Neglect and lack of knowledge	14	16.9
Fearing professor's response	1	1.2
No response	43	51.8
Causes of injuries were reported by students*		
Underdeveloped manual skills	26	15.8
Recapping needle	45	27.5
Carelessness	108	65.5
Anxiety during procedures	10	6.1
Patient fidgeting during procedure	19	11.5
Unknown	16	9.7
Post-exposure screening for hepatitis B and hepatitis C		
Yes	66	40.0
No	99	60.0
Learning of hepatitis B and hepatitis C tests results (n=66)		
Yes	62	93.9
No	4	6.1
Protective treatment for hepatitis B (n=62)		
Yes	21	33.9
No	41	66.1

**More than one response has been provided*

In all, 83 (50.3%) of the injured students stated that they had not reported the incidents. While this question did not receive a response from half of the injured students, the main reasons given for not reporting the incidents were "the item was unused" (16, 19.3%). Sixty five percent of the injured students reported that the main reason for NSISIs was their carelessness. In this study, 45 (27.5%) of students who had sustained an injury indicated that the NSISIs had occurred when recapping needles. In addition, the rate of post-exposure screening for hepatitis B, C and HIV was only 40.0%, and of them, 33.9% had opted to undergo protective treatment (Table 3).

Table 4. Statistical analysis of selected variables of students' according to experience of needlestick and sharps injuries (n=325)

Variables	Needlestick and sharps injuries				Statistic*
	Present (165)		Absent (160)		
	n	%	n	%	
Age group (years)					
≤20	27	27.0	73	73.0	**<0.001**
≥21	138	61.3	87	38.7	
Gender					
Female	150	50.5	147	49.5	**>0.05**
Male	15	53.6	13	46.4	
Department					
Nursing	85	52.5	77	47.5	**>0.05**
Midwifery	80	49.1	83	50.9	
Year in school					
First	7	12.7	47	87.3	
Second	59	51.8	55	48.2	**<0.001**
Third	35	48.6	37	51.4	
Fourth	64	75.3	21	24.7	
Wearing gloves during procedures					
Always	115	47.5	127	52.5	**<0.05**
Sometimes**	50	60.2	33	39.8	
Informed whether patient has contagious disease					
Yes					
No	156	51.7	146	48.3	**>0.05**
	9	39.1	14	60.9	
Informed about occupational exposures and UP					
Yes	148	50.3	146	49.7	
No	17	54.8	14	46.2	**>0.05**
Vaccination against Hepatitis B					
Never vaccinated	11	57.9	8	42.1	
Incomplete vaccination	21	38.9	33	61.1	**>0.05**
Complete vaccination	133	52.8	119	47.2	
Throws away used needles and sharps devices					
Special container for needles and sharps devices	72	37.1	59	62.9	
Plastic bags for medical waste (red plastic bag)	93	70.1	101	19.9	**>0.05**

**Pearson Chi-Square was used.*

***There are an additional four students who reported never using gloves.*

Table 5. Statistical analysis of selected variables of students' according to presence of hepatitis B immunization (n=325)

Variables	Hepatitis B immunisation				Statistic*
	Complete (252)		Never+incomplete (73)		
	n	%	n	%	
Age group (years)					
≤20	70	70.0	30	30.0	**<0.05**
≥21	182	80.9	43	19.1	
Gender					
Female	230	77.4	67	22.6	**>0.05**
Male	22	78.6	6	21.4	
Department					
Nursing	130	80.2	32	19.8	**>0.05**
Midwifery	122	74.8	41	25.2	
Year in school					
First	31	57.4	23	42.6	**<0.001**
Second	87	76.3	27	23.7	
Third	60	83.3	12	16.7	
Fourth	74	87.1	11	12.9	
Wearing gloves during procedures					
Always					
Sometimes**	186	76.9	56	23,1	**>0,05**
	66	75,5	17	24,5	
Informed whether patient has a contagious disease					
Yes	234	77,4	68	22,6	**>0,05**
No	18	78,3	5	21,7	
Informed about occupational exposures and UP					
Yes	225	76.5	69	23.5	**>0.05**
No	27	87.1	4	12.9	
NSSI					
Present	133	80.6	32	19.4	**<0.05**
Absent	119	74.4	41	25.6	
Frequency of NSSI					
Absent	119	74.4	41	25.6	**>0.05**
One time	34	77.3	10	22.7	
Two times	30	83.3	6	16.7	
Three and more times	69	81.2	16	18.8	
Injury occurred					
During preparation for procedure	61	81.3	17	18.7	**>0.05**
During procedure	51	83.6	10	16.4	
After procedure	22	75.9	5	24.1	
Causative instruments of injuries					
Used					
Unused	65	78.3	18	21.7	**>0.05**
	69	84.1	13	15.9	

**Pearson Chi-Square was used.*

***There are an additional four students who reported never using gloves.*

Discussion

As this survey was only conducted in a Health School in the middle of Turkey's Anatolia region, it cannot be generalised, but sufficient advice has been provided. Moreover, the data are based on self-report. There may have been reluctance to report injuries, as well as problems with recall.

In this study, the findings of the present study demonstrate that nearly half of the students (50.8%) had sustained at least one NSISI, and 51.5% of these students had sustained up to 15. The NSISI rate we found was higher than in other studies performed by Irmak and Baybuga (2011) (19.4%); Yamazhan et al. (2011) (28.1%); Camacho-Ortiz et al. (2013) (36.98); Karadag (2010) (35.5%); and Yang et al. (2004) (18.2%). Samarkos et al. (2014) founded the highest rate of percutaneous exposures among nursing students.[5,13,14,18,19,21]Likewise, the study performed by Talas (2009) on nursing students in Turkey found that almost half (49%) of the students had experienced an NSISI at least once.[22]

However, this finding was lower than that in studies carried out in the south of Turkey (nursing students, 74.1%), Iran 71.1%, Taiwan (61.9%), Uganda (57%) and India (85.2%).[6,11,23-25] As a result, it can be concluded that nursing and midwifery students in many countries are at high risk for NSISIs and BBP exposure. Clinical inexperience and insufficient training are probably responsible for the high proportion of NSSIs among nursing students, as many of their injuries may actually occur the first time they have ever handled a needle. In Turkey, nursing or midwifery students are expected to perform parenteral procedures, such as administering injections and intravenous interventions and manage patients with BBPs. However these procedures need to be performed under adequate supervision. With nursing or midwifery students it is more likely that an incident will occur while there is no assistance because of the lack of a clinical instructor. Therefore, it has been suggested that nursing or midwifery students are at a higher risk than other health workers. These findings indicate that a main risk factor for NSIs may be prevented by learning manual procedures before clinical practice.

In the present study, the lowest injury rates were found in first year students (12.7%) and in those aged 20 or younger (27%). Similar to this study, Kuyurtay and Altiok (2009) and Talas (2009) reported the highest injury rate among nursing students in the fourth year.[22,23] The cause for this may be that the length of clinical training in the first year is shorter than in the other years. The other important cause may be that in the fourth year students accomplish more skills like parenteral procedures, episiotomy and suturing episiotomy than in the other years.

The most common source of injury in our study was a hollow-bore needle (especially syringe needles), with ampoules/vials coming in at second place. Additionally, 50.3% of the injuries were caused by used devices that may be contaminated with BBPs. In general clinical settings, NSISIs and the risk of BBP transmission are predominantly caused by needle devices and associated with venupuncture, administration of medication via intravascular lines, and disassembly of equipment.[26] The most common source of injury was found to be syringe needles in the studies carried out by Kisioğlu et al., (2002); Wang et al. (2003);Yang et al. (2004); and Kuyurtar and Altıok (2006).[5,23,27,28] Similarly, Irmak and Baybuğa (2011) demonstrated that syringe needles (54%) and glass items (33.3%) are responsible for the majority of NSISIs among Turkish nursing students.[13] The reason for this might be the students' lack of skill in using hollow-bore needles, and in breaking and opening ampoules and vials. In Turkey, nursing and midwifery students are expected to carry out parenteral procedures, such as administering injections and intravenous infusions.

Midwifery students also have to successfully conduct at least 40 spontaneous deliveries and episiotomies, as well as suturing to repair the perineum after birth, before they can graduate.[27]These students must therefore work with patients with BBPs. In Turkey, it is more likely that an incident will occur among nursing and midwifery students while they are working without assistance because of the lack of a clinical instructor or a mentorship system.

Interestingly, 89.2% of the participants in our study reported that their source of information of UPs was the media and not their school. In the present study, 15.8%, 65.5% and 6.1% of the students respectively stated that the accidents had taken place due to their limited experience, carelessness and anxiety during procedures. Thus, clinical inexperience and insufficient training are probably responsible for the high numbers of NSISIs. These findings indicate that NSISIs, which are a major risk factor for occupational exposure to BBPs, may be avoided through training on manual procedures before clinical practice, wearing gloves or using other protective barriers between the hand and the ampoule.[12]

The most common site of injury (96.4%) in this study was the hands; and of the injured students, 61.2% and 35.7% respectively had been wearing one glove or double gloves at the time of the incidents. Although all students had been educated on UPs during the Fundamentals of Nursing and Midwifery courses, four of them had not been wearing gloves when they were injured. Furthermore, we found that only 74.5% of the students wore gloves every time. Glove wearing, protective eyewear and other personal protective barriers reduce the risk infection due to contact with occupational BBPs, mucous membranes, or broken skin of patients, and reduce the amount of virus inoculated.[29,30]The studies performed by Rabaud and colleagues (2000) showed that glove wearing significantly lowers the risk of accidents with hollow-needle and occupational exposure to BBPs.[31] Mischke et al. (2014) stated that the use of three gloves compared to two gloves reduces the risk of perforation.[32]

In the study by Kisioğlu et al. (2002,), 524% of the health care workers stated that they wore gloves during high-risk procedures.[27]Wang et al. (2003) and Irmak and Baybuğa (2011) reported that the majority of students had not been wearing gloves when they carried out a patient-related procedure.[13,28] Stewardson et al. (2002) determined that one-third of UK dental students were not wearing a mask, and 60% were not wearing protective glasses at the time of their most recent occupational exposure.[9]Consequently, students and HCWs need to be made aware of occupational risks and monitored to ensure protective equipment is used.

When the distribution of injuries according to departments was examined, it was seen that the largest number of NSISIs (64.8%) occurred in wards and blood laboratories (29.7%). The riskiest locations for accidents and highest risk to HCWs for exposure to BBPs from infected patients are surgery units, gynaecology and orthopaedic services.[26,33]Omac et al. (2010)reported that 70.6% of injuries occurred in surgical wards.[17] In the other study performed by İlhan et al. (2006), it was found that more than half of injuries (53.6%) occurred in hospital wards.[15]In this study, the majority of injuries occurred on wards, because students generally have their clinical rotations on wards rather than in critical care areas.

The needle stick injuries had occurred when recapping used syringe needles in 27.5% of the students who had sustained an injury in our study. According to the Centre for Disease Control's recommendations regarding universal precautions (1987), recapping a needle is prohibited, in order to reduce the risk of transmission of BBPs. Most health care workers in Turkey have known not to recap needles since the end of the 1990s.[34] Clinical students (nursing/midwifery, medical, dental etc.) are trained in this regard. Currently, sharps containers are available in all hospitals in Turkey. However, there are also a high number of health care workers in Turkey who still believe that needles need to be

recapped after use because that is what they were taught during their formal nursing education. Kuyurtar and Altıok (2009) showed that nursing students were injured recapping needles after treatment.[23] Kaya et al. (2012) founded that the recapping of needles after injection was shape of most common injury.[35]Several other studies have shown that recapping was a common behaviour among nursing and medical students, and it has been stated as one of most important causes of NSISIs.[16,19,25]Therefore, it has been suggested that modifying practices such as recapping would decrease the incidence of NSISIs. In the literature, it is stated that over 80% of injuries can be prevented with the use of a needleless system with a safeguard mechanism[36-38] In the USA, the issue of occupationally acquired NSIs has been addressed by the Needlestick Safety and Prevention Act (2000), which requires that all healthcare facilities provide needle protective devices to reduce the risk of staff acquiring BBPs.[39]

Of the students 77.5% in this study had not been vaccinated against hepatitis B, and 86.8% of these students identified to be immunised against hepatitis B after they started clinical training.

Occupational HBV infections could be eliminated through optimal hepatitis B vaccination coverage of relevant personnel. In 2006, the Turkish Ministry of Health issued a circular (numbered 18607-2006/120) on hepatitis B and included hepatitis B vaccine in routine immunisation programs.[40] According to this circular the hepatitis B vaccination was to be administered without charge for high-risk groups, including nursing and midwifery students. Vaccination rates were low compared to those seen in other countries such as Taiwan (75.4%) and Iran (82.2%).[6,11]It can also be said that our vaccination rates are similar to those mentioned in previous studies carried out in Turkey. The study conducted by Kuyurtar and Altiok (2009) demonstrated that the hepatitis B immunisation rate was 79.1% in nursing students.[23] In this study, the vaccination rate before clinical practice training was low, despite the cooperative efforts of university and provincial health ministry officials to provide all three doses of hepatitis B vaccine to first-year students for free. It might be that the university had not recorded students' immunization status, nor followed up. Students have to apply to their schools for vaccination against hepatitis B and tests that determine the success of the hepatitis vaccine are carried out by the schools. Therefore, school directors should ensure that students are vaccinated against hepatitis B and comply with recommendations for carrying out UPs before beginning clinical practice.

The NSISI had not been reported by 50.3% of the students in this study. This was because the item involved was "not used on a patient". Furthermore, only 66 students had undergone screening post-exposure for hepatitis B, and 21 students had received protective treatment for hepatitis B.

Although effective chemoprophylaxis after exposure for both HBV and HIV exists, health care workers must be educated about the importance of reporting NSISIs so that they are able to receive the appropriate medical treatment.[41] The finding that many cases of NSISI incidents were not reported was compared with the results of other studies. Studies by Shiao et al. (2002) showed that only 14.2% of the students formally reported their injury, but in Yang and colleagues (2004) study 91.8% of the subjects stated that it was necessary to report NSISIs to a clinical instructor or hospital personnel.[5,11] Talas (2009) reported that the rate of not reporting needle stick injuries was 56.1%, and McCarthy and Britton (2000) stated this rate as 58%.[22,42]The other study carried out by Facchin et al. (2013) was found that the rate of not reporting accidents involving biologic material was 23.76%.[43]The rate of not reporting was even higher in other studies. Kuyurtar and Altiok (2009) found this rate to be as high as 94,3%; Askarian and Malekmakan's (2006) study stated a rate of 82%; and Irmak and Baybuga (2011) recorded the rate at 68.3%.[6,13,23] It is interesting that the majority of students do not report NSISIs. The reason for this might be the lack of a prepared incident report for NSISIs in hospitals in Turkey and also due to NSISIs in hospitals not being followed up. Considering the reasons students have given for

not reporting NSSI incidents, it becomes clear that students are quite unaware of the severity of this issue. The teaching of post exposure measures should include encouragement to report all injuries, providing post-exposure prophylaxis if necessary, and to check on students' antibody status.

Conclusions

The high prevalence of needlestick and sharps injuries, the high percentage of students who did not report high-risk injuries and the low rate of vaccination against hepatitis B before clinical training all suggest a high risk of blood-borne infections and their consequences. Furthermore, the majority of students informed about UPs stated that they had received information from the television or radio.

In conclusion, our findings suggest that students should be enlightened on all possible risks during occupational exposures such as viral hepatitis through both lectures and practical training. Extended knowledge on UPs and NSISIs is required, and induction into protocols to be followed after exposure could be beneficially conducted before clinical training education School directors should review existing policies about vaccination against hepatitis B, and students should be fully immunization against hepatitis B at the beginning of the first semester and before starting their clinical practicum.

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