

Assessment of sharps penetrating injury, mucosal exposure and compliance with standard precautions of health workers at a University Hospital in Turkey

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ABSTRACT

الأهداف: تقييم الالتزام بالاحتياطات القياسية للعاملين في مجال الرعاية الصحية الذين تعرضوا لإصابات اختراق الأدوات الحادة أو التعرض للغشاء المخاطي استناداً على مقياس الامتثال للاحتياطات المعيارية – النسخة التركية.

المنهجية: أُجريت دراسة مقطعية وصفية في مستشفى درجة ثالثة. تم فحص سجلات وحدة الصحة والسلامة المهنية للعاملين في الرعاية الصحية الذين أصيبوا باختراق الأدوات الحادة أو التعرض للغشاء المخاطي بين يناير 2018 ويوليو 2020. تم تقييم الامتثال لمقياس الاحتياطات المعيارية من خلال إجابة المشاركين على استبيان.

النتائج: من بين 100 مشارك كان 59% منهم رجال. من بين جميع العاملين في مجال الرعاية الصحية في المستشفى الجامعي أُصيب 4.5% (n=100) باختراق الأدوات الحادة أو التعرض للغشاء المخاطي. من بين المشاركين تعرض 95% لإصابة اختراق أدوات حادة و 5% تعرضوا للغشاء المخاطي. كان متوسط مقياس الامتثال للاحتياطات المعيارية للمشاركين الذين عانوا من إصابة اختراق أدوات حادة 16.36 ± 2.39 . بينما كان متوسط مقياس الامتثال لمن تعرضوا للغشاء المخاطي 16.80 ± 3.03 . لم يكن هناك فرق كبير بين متوسط درجات الامتثال لمقياس الاحتياطات المعيارية لإصابات اختراق الأدوات الحادة والمجموعات التي تعرضت للأغشية المخاطية، بغض النظر عن التدريب على الصحة والسلامة المهنية ($p=0.794$).

الخلاصة: في هذه الدراسة كان معدل تواتر إصابات اختراق الأدوات الحادة والتعرض للأغشية المخاطية للعاملين في مجال الرعاية الصحية مشابه للدراسات السابقة. كان مستوى التزام العاملين في الرعاية الصحية الذين تم قياسهم بمقياس الامتثال للاحتياطات المعيارية مرتفعاً.

Objectives: To evaluate the compliance with standard precautions in healthcare workers who experienced a sharps penetrating injury or mucosal exposure using the compliance with Standard Precautions Scale, Turkish version.

Methods: This descriptive cross-sectional study was conducted in a tertiary hospital. The occupational health and safety unit records of healthcare workers who were injured by a sharps penetrating injury or experienced mucosal exposure between January 2018 and July 2020 were examined. Compliance with the

Standard Precautions Scale was assessed by having participants answer a questionnaire.

Results: Of the 100 participants, 59% were men. Of all healthcare workers in the university hospital, 4.5% (n=100) were injured by sharps penetrating injuries or mucosal exposure. Of the participants, 95% were wounded by a sharps penetrating injury and 5% had mucosal exposure. The mean Compliance with Standard Precautions Scale score of participants with a sharps penetrating injury was 16.36 ± 2.39 and with mucosal exposure was 16.80 ± 3.03 . There was no significant difference between the mean Compliance with Standard Precautions Scale scores of the sharps penetrating injury and mucosal exposure groups regardless of training on occupational health and safety ($p=0.794$).

Conclusion: In conclusion, the frequency of a sharps penetrating injury and mucosal exposure in healthcare workers was similar to the literature. The compliance level of the healthcare workers measured with the Compliance with Standard Precautions Scale was high.

Keywords: health care worker, sharps penetrating injury, standard precautions

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Most occurrences of a sharps penetrating injury (SPI) (percutaneous injury) and mucosal exposure are preventable situations associated with workplace risks. Institutions providing health services contain health risks, which can lead to unfavorable health consequences for healthcare workers (HCWs). The joint International Labor Organization (ILO) and the World Health Organization (WHO) committee have declared that the improvement of work and working conditions can be conducive to workers' safety and health. Also, the implementation of preventive safety precautions and training policies for occupational health is recommended.¹ The WHO, within the scope of World Patient Safety Day in September 2020 promoted the slogan "Keep health workers safe to keep patients safe," and has among its goals to prevent sharps injuries and to report and analyze safety-related serious incidents.²

According to the 2015 estimates of the United States Centers for Disease Control and Prevention (CDC), HCWs have 385,000 sharps injury events each year. An SPI is related to the occupational transmission of pathogens such as hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV).³ Percutaneous (82%) and mucosal (14%) injuries have been reported by the CDC as major causes of exposure to blood and body fluids.⁴ According to the International Safety Center's Exposure Prevention Information Network (EPINet) 2019 report, 36.7% of SPIs occurred in nurse/nursing and 28.9% in physician/physician students. The incidence of exposure to blood or body fluids occurred in 55.9% of nurses/nursing and 11.5% of physicians/physician students.⁵

Standard precautions are protective measures taken by all health workers against microorganisms transmitted through blood and body fluids, secretions, feces, skin, or mucous membranes, regardless of whether patients have a known or suspected infection.⁶ The Compliance with Standard Precautions Scale (CSPS) was developed by Lam et al⁶ to measure standard precautions on the basis of the CDC and WHO's international preventive measures. Its validity and reliability have been tested in Turkey by Samur et al⁶ and the Cronbach's alpha internal consistency coefficient of the scale was 0.71.

In order to protect HCWs, patients, and patients' relatives from the risks of infection arising from the

working environment, HCWs are expected to comply with standard precautions such as hand hygiene, appropriate personal protective equipment (such as masks, gloves, aprons, and face shields), use of sharps, and proper waste disposal. The SPIs and mucosal exposure have been examined in current studies.³⁻⁵ However, SPIs and mucosal exposures have not been adequately addressed in terms of HCWs' compliance with standard precautions. The aim of this study was to evaluate SPIs and mucosal exposures of HCWs and the level of compliance with HCWs' standard precautions using the CSPS-Turkish version.

Methods. The study was carried out as a descriptive observational frequency study at Hospital of Dicle University, a tertiary medical faculty hospital, which has 2238 health workers and 1218 beds. In the study, the occupational health and safety unit records of health workers who were injured by an SPI or exposed to mucosal secretions between January 2018 and July 2020 were examined (101 individuals). As one employee had left his position with the organization, the remaining 100 were included. In total, 111 injuries were detected in the records of these individuals. A total of 11 repetitive injury records belonging to 5 men (8 SPI) and 3 women (3 SPI) with multiple injuries were not included in the study. In accordance with the Helsinki Declaration, ethics committee approval, institutional permission, and informed consent from participants were obtained before the study.

The injury records of the participants (occupation, the unit worked at the time of injury, and type and cause of injury) were recorded. In addition, sociodemographic information (age, gender, and marital status), duration of work in the profession, previous training on SPIs or mucosal exposure, time of injury, and the CSPS were assessed by participants answering a questionnaire.

The CSPS validity and reliability have been tested in Turkey by Samur et al⁶ and the Cronbach's alpha internal consistency coefficient of the scale was 0.716. The scale, which is evaluated with a 4-point Likert scale (never, rarely, sometimes, always), consists of 20 items. In the scale calculation, the 2nd, 4th, 6th, and 15th negative items are scored in reverse. While calculating the total score of the scale, positively scored items received one (1) point for "always" and zero (0) points for the others; negatively scored items were calculated as one (1) point to the 'never' answer and zero (0) to the others. Scale scores ranged from 1 to 20. The total scale scores of the participants were evaluated. As the scores obtained on the scale increase, compliance with standard measures increases.

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Statistical analysis. The data obtained from the study were analyzed using the Statistical Package for the Social Sciences, Windows version 24.0 (IBM Corp., Armonk, N.Y., USA). Descriptive statistics for the variables of the study were given. Means of continuous variables were shown with the standard deviation (SD). Kolmogorov-Smirnov tests and graphs were used to determine whether the continuous variables was normally distributed based on the number of participants in each group. Moreover, normality is assessed not only by normality tests, but also by skewness coefficients, kurtosis coefficients, histograms, q-q plots, and box plots. Since the parametric assumptions were not met in the analysis of the group averages, the Mann-Whitney U test was used to compare averages of 2 groups, and the Kruskal Wallis test was evaluated to compare the averages of more than 2 groups. A *p*-value <0.05 was considered statistically significant.

Results. Of the 100 participants, 59% were men. The mean age of the study participants was 33.3±7.8 (minimum 20, maximum 60), the mean age of the men was 35.0±7.7 (minimum 20, maximum 60), and the mean age of the women was 30.9±7.3 (minimum 22, maximum 50). The average occupational duration time of participants was 7.8±4.2 years (minimum 1, maximum 19). Overall, 4.5% (n=100) of all health workers at the university hospital were injured by SPIs or mucosal exposure.

Sociodemographic characteristics of the participants by type of injury are displayed in **Table 1**. As shown, 95% of participants were injured by an SPI and 5% by mucosal exposure. The SPIs were caused by a penetrating tool (90.5%) or a sharp tool (9.5%) in the participants. A review of the records showed that 52.6% of SPIs occurred in support staff/cleaning personnel, 34.7% in nurses/midwives/emergency medical technicians (EMTs), and 9.5% in physicians. In this study, 2 of the 5 participants with mucosal exposure were physicians, 2 were nurses/midwives/EMTs, and one was a support/cleaning staff. The units where the SPI incidence occurred were most frequently seen in internal wards (27.4%), surgery wards (18.9%), and emergency services (14.7%). Mucosal exposures were detected in the same order and with a similar frequency as the SPIs. Finally, 88.4% of participants with an SPI, all of the participants with mucosal exposure, and 89% of all participants had received training about these injuries.

The most common causes of SPIs in participants were the needle thrown into the garbage bag (24.2%), the needle being left exposed during cleaning (16.8%), and injury during closing the syringe needle cap (10.5%)

Table 1 - Sociodemographic characteristics of the participants by type of injury.

Characteristics	SPI		Mucosal		Total	
	n	(%)	n	(%)	n	(%)
<i>Age</i>						
20-29	30	(31.6)	2	(40.0)	32	(32.0)
30-39	45	(47.4)	3	(60.0)	48	(48.0)
40 and over	20	(21.1)	0	(0)	20	(20.0)
<i>Gender</i>						
Male	56	(58.9)	3	(60.0)	59	(59.0)
Female	39	(41.1)	2	(40.0)	41	(41.0)
<i>Education</i>						
High school and below	62	(65.2)	3	(60)	65	(65.0)
Associate's degree/bachelor's degree	27	(28.4)	0	(0)	27	(27.0)
Masters/doctorate	6	(6.4)	2	(40.0)	8	(8.0)
<i>Profession</i>						
Physician	9	(9.5)	2	(40.0)	11	(11.0)
Nurse/midwife/emergency medical technician	33	(34.7)	2	(40.0)	35	(35.0)
Support staff/cleaning staff	50	(52.6)	1	(20.0)	51	(51.0)
Other*	3	(3.2)	0	(0)	3	(3.0)
<i>Working unit</i>						
Internal wards	26	(27.4)	1	(20.0)	27	(27.0)
Surgical wards	18	(18.9)	1	(20.0)	19	(19.0)
Internal intensive care units	7	(7.4)	0	(0)	7	(7.0)
Surgical intensive care units	10	(10.5)	1	(20.0)	11	(11.0)
Emergency unit	14	(14.7)	0	(0)	14	(14.0)
Operating room	6	(6.3)	2	(40.0)	8	(8.0)
Medical waste	4	(4.2)	0	(0)	4	(4.0)
Other **	10	(10.5)	0	(0)	10	(10.0)
<i>Worked shift</i>						
Day (08:00 am-16:00 pm)	62	(65.3)	3	(60.0)	65	(65.0)
Night (16:00 pm-08:00 am)	14	(14.7)	1	(20.0)	15	(15.0)
24 hours	19	(20.0)	1	(20.0)	20	(20.0)
Total***	95	(95.0)	5	(5)	100	(100)

*Patient registration (1), radiology technician (1), laboratory (1) **
Emergency laboratory (1), biomedical (1), laundry (1), experimental
animals laboratory (1), radiology (4), sterilization unit (2)*** row %, SPI: sharps penetrating injury

(**Table 2**). Of these reasons, almost all of the first 2 were observed in support staff/cleaning staff, and half of the third was observed in nurses/midwives/EMTs.

It was observed that the participants agreed with the positive statement, "My mouth and nose are covered when I wear a mask," on the CSPS at the highest rate with 100%. Furthermore, 99% of the health workers stated that they agreed with the positive statement, "I put used sharps articles into sharps boxes." However, only 45% of the health workers stated, "I recap used needles after giving an injection." It was determined that 58% agreed with the negative statement, "The sharps box is discarded only when it is full" (**Table 3**).

The mean CSPS score of participants who received training on SPI and mucosal exposure was 16.39±2.42

Table 2 - Reasons for injury of participants.

Reasons	n	%
<i>Sharps penetrating injury</i>		
Injury with a needle thrown into a garbage bag	23	23.0
Injury from a needle left exposed during cleaning	16	16.0
Injury when capping the needle	10	10.0
Injury while connecting IV line/IV cannula to the patient	7	7.0
Injury when throwing a needle into the sharps boxes	7	7.0
Injury while checking blood sugar	6	6.0
Injury with surgical suture needle in the operating room	5	5.0
Injury while taking blood from the patient	4	4.0
Injury with scalpel	4	4.0
Injury while injecting	3	3.0
By accident while in my colleague's hands	1	1.0
Other*	9	9.0
<i>Mucosal exposure</i>		
The nose, eyes, oral mucosa exposure with blood or body fluids	5	5.0
Total	100	100

*glass incision (2), injury by the sharp edge of the device probe (1), ingrown nail (3), hand cut by the examination table (1), wire sinking (1), sinking of the cutter during load lowering (1)

CSPS of the subgroups was high. There was no significant difference between the mean CSPS of the subgroups according to sociodemographic characteristics ($p>0.05$, for each comparison) (Table 4).

Discussion. The SPIs and exposure to blood or other body fluids are biological risks in the work environment for HCWs. This risk can cause important health hazards that can be transmitted by a large number of pathogens. Both SPIs and mucosal exposure are accepted as important preventable health problems.^{3,4,6}

Rapisarda et al⁷ evaluated the risks of infection after occupational exposure to blood or body fluids among HCWs working at a university hospital in Southern Italy. In the 2-year period, the accident frequency was always below 5%. Mbaisi et al⁸ reported the frequency of percutaneous injury was 19.3% and mucosal exposure was 7.2% for HCWs in a state hospital in Kenya. In our study, the frequency of SPIs or mucosal exposure was 4.5%. This result is similar to the first 2 studies. It might have been lower than the third study due to the different development levels of the countries.

Table 3 - Scale of compliance with standard precautions.

Items	Never		Seldom		Sometimes		Always	
	n	%	n	%	n	%	n	%
I wash my hands between patient contacts.	2	(2.0)	2	(2.0)	5	(5.0)	91	(91.0)
I only use water for hand washing.	13	(13.0)	3	(3.0)	5	(5.0)	79	(79.0)
I use alcoholic hand rubs as an alternative if my hands are not visibly soiled.	30	(30.0)	15	(15.0)	11	(11.0)	44	(44.0)
I recap used needles after giving an injection.	55	(55.0)	6	(6.0)	4	(4.0)	35	(35.0)
I put used sharps articles into sharps boxes.	0	(0.0)	0	(0.0)	1	(1.0)	99	(99.0)
The sharps box is discarded only when it is full.	42	(42.0)	3	(3.0)	2	(2.0)	53	(53.0)
I remove personal protective equipment (PPE) in a designated area.	20	(20.0)	5	(5.0)	5	(5.0)	70	(70.0)
I take a shower in case of extensive splashing even after I have put on personal protective equipment (PPE).	5	(5.0)	7	(7.0)	4	(4.0)	84	(84.0)
I cover my wound(s) or lesion(s) with a waterproof dressing before patient contact.	6	(6.0)	6	(6.0)	6	(6.0)	82	(82.0)
I wear gloves when I am exposed to body fluids, blood products, and any excretion of patients.	1	(1.0)	0	(0.0)	0	(0.0)	99	(99.0)
I change gloves between patient contacts.	0	(0.0)	2	(2.0)	2	(2.0)	96	(96.0)
I decontaminate my hands immediately after removal of gloves.	0	(0.0)	1	(1.0)	0	(0.0)	99	(99.0)
I wear a surgical mask alone or in combination with goggles, face shield, and apron whenever there is a possibility of a splash or splatter.	8	(8.0)	10	(10.0)	7	(7.0)	75	(75.0)
My mouth and nose are covered when I wear a mask.	0	(0.0)	0	(0.0)	0	(0.0)	100	(100.0)
I reuse a surgical mask or disposable personal protective equipment (PPE).	14	(14.0)	4	(4.0)	6	(6.0)	76	(76.0)
I wear a gown or apron when exposed to blood, body fluids, or any patient excretions.	4	(4.0)	7	(7.0)	8	(8.0)	81	(81.0)
Waste contaminated with blood, body fluids, secretion, and excretion is placed in red plastic bags irrespective of the patient's infection status.	3	(3.0)	0	(0.0)	1	(1.0)	96	(96.0)
I decontaminate surfaces and equipment after use.	0	(0.0)	1	(1.0)	3	(3.0)	96	(96.0)
I wear gloves to decontaminate used equipment that is visibly soiled.	0	(0.0)	0	(0.0)	1	(1.0)	99	(99.0)
I clean up spillage of blood or other body fluids immediately with disinfectants.	10	(10.0)	3	(3.0)	3	(3.0)	84	(84.0)

Table 4 - The scale of compliance with standard precautions scores according to the sociodemographic characteristics of the participants.

Characteristics	mean±SD	P-value***
<i>Age</i>		
20-29	16.63±2.24	0.846
30-39	16.21±2.59	
40 and over	16.40±2.30	
<i>Gender</i>		
Male	16.15±2.44	0.227
Female	16.71±2.35	
<i>Marital status</i>		
Married	16.47±2.26	0.731
Single	16.19±2.74	
<i>Education</i>		
Under high school	15.96±2.50	0.240
High school	16.95±1.87	
University and above	16.09±2.7	
<i>Profession</i>		
Physician	16.09±2.80	0.961
Nurse/midwife/emergency medical technician	16.29±2.56	
Support staff/cleaning staff	16.51±2.24	
Other*	16.33±3.05	
<i>Working unit</i>		
Internal wards	15.67±2.32	0.082
Surgical wards	16.86±1.46	
Internal intensive care units	16.84±2.65	
Surgical intensive care units	17.82±1.53	
Emergency unit	15.86±2.34	
Operating room	17.13±3.52	
Medical waste	15.50±2.38	
Other **	16.00±2.16	
<i>Worked shift</i>		
Day (08:00 am-16:00 pm)	16.28±2.55	0.789
Night (16:00 pm-08:00 am)	16.80±2.07	
24 hours	16.40±2.21	
<i>Work experiences (year)</i>		
≤ 5	16.47±2.26	0.675
6≤10	16.58±2.36	
>10	15.87±2.74	

*Patient registration (1), radiology technician (1), laboratory (1)
 Emergency laboratory (1), biomedical (1), laundry (1), experimental animals laboratory (1), radiology (4), sterilization unit (2) *: $p > 0.05$ difference is not significant.

and 16.27 ± 2.45 for participants who did not receive it. The mean CSPS score of participants injured with SPI was 16.36 ± 2.39 and those injured with mucosal exposure was 16.80 ± 3.03 . In addition, there was no significant difference between the mean CSPS scores of SPI and mucosal exposure groups regardless of training on occupational health and safety ($p=0.794$).

The mean CSPS regarding demographic characteristics such as age, gender, marital status, education, occupation, unit of work, and duration of occupation were divided into subgroups. The mean

Chakravarthy et al⁹ reported 49.1% of sharps injuries occurred in nurses, 23.1% in cleaning personnel, and 10.8% in doctors. Cui et al¹⁰ found the incidence of sharps injury was in 31.2% of the nurses and 19.9% of the doctors in a teaching hospital in China. In the calculation we made using the data of Mbaisi et al,⁸ 49.2% of percutaneous injuries were in nurses, 18.6% clinical staff, 11.9% students, 8.5% support staff, 6.8% doctors, and 5.1% laboratory staff. Fadil et al¹¹ investigated the burden and risk factors of sharps injuries in HCWs in tertiary hospitals in Saudi Arabia. They showed that nurses (56.5%), doctors (17.6%), and housekeeping staff (13.7%) were the groups most affected by sharps injuries. Azap et al¹² looked at injuries in tertiary university hospitals and found 67% of the HCWs who had a sharps injury in the last 6 months were nurses and nurse assistants and 31% were doctors. Different from the literature, in our study, 52.6% of SPIs were observed in support staff/cleaning personnel, 34.7% in nurses/midwives/EMTs, and 9.5% in doctors.

Fadil et al¹¹ found the top 3 work sites for injuries were in the emergency room (19.8%), the surgical ward (15.3%), and the operating room (12.2%). Azap et al¹² reported that 42% of the injuries were in the surgical service, 28% in the internal service, and 11% in the intensive care unit. In our study, the 3 departments in which SPIs were most common were internal wards (27.4%), surgical wards (18.9%), and emergency services (14.7%). Mucosal exposures were detected at similar frequencies and in the same order. The reason why these results are different may be due to the study sample and the health service levels of the hospitals.

Sin et al¹³ reported 88.9% percutaneous and 3.3% mucosal injuries in public/private clinics, hospitals, and laboratory health workers. The injuries occurred during cleaning/collection after procedures (19.5%, most common), other bedside/treatment room procedures (16.5%), injection (including recapping of needles, 14.3%), and blood/intravenous catheter insertion (10.4%). Fadil et al¹¹ reported injuries were caused by needle sticks (79.4%) and penetrating injuries (11.5%). Injuries were reported to occur during surgery (17.6%), waste collection (11.5%), catheterization (9.2%), and injection (9.2%). Azap et al¹² found recapping of needles (45%) was the most common cause of sharps injuries. In our study, 95% of the participants were injured with an SPI and 5% experienced mucosal exposure. It was observed that 90.5% of SPIs occurred with a penetrating device and 9.5% with a sharp device. The 3 most common causes of SPIs were 24.2% from a needle thrown into the garbage bag, 16.8% from a needle left exposed during cleaning, and 10.5% from

recapping the injector needle. The frequency of injury type was similar to the literature, although differences were observed in the causes of injury.

Cui et al¹⁰ observed that 75.1% of the participants had standard infection prevention knowledge. Akagbo et al¹⁴ assessed health workers and found the highest frequency of compliance with the standard precautions of wearing gloves, cleaning all spilled blood immediately, and covering the cut skin at 61%. In addition, it was determined that 55% of the HCWs put used needles in the sharp boxes, 25% did not close the needles after use, and 48% received regular training on standard precautions. Pokorná et al¹⁵ reported the highest level of compliance with the individual hygiene precautions in healthcare facilities in the Czech Republic as, “I discard used sharps materials in the sharps containers,” with 99.4% of HCWs agreeing. In addition, 93% of the participants stated, “I avoid needle recapping”. In our study, we found that the participants who declared, “My mouth and nose are covered when I wear a mask” had the highest rate of 100%. It was determined that 45% of the workers agreed with, “I recap used needle after giving an injection,” whereas 58% agreed with the negative statement, “The sharps box is discarded only when it is full.” However, 99% of the HCWs stated that they agreed with the positive statement, “I put used sharps articles into sharps boxes.” We detected that the mean CSPS score of the participants was very high. The high compliance level of the HCWs might be related to a previous experience of SPI/mucosal exposure.

Study limitations. There are certain limitations to the present study. The main limitations are its retrospective design and including only reported injuries. This study covers a single institution, which limits its generalizability. The compliance level of HCWs was determined objectively using the CSPS and was found to be significantly high. However, further studies are required using the CSPS on HCWs who have not experienced SPI/mucosal exposure to determine the factors affecting the level of compliance with HCWs' standard precautions measured by the CSPS.

In conclusion, the frequency of SPI and mucosal exposure in HCWs was similar to the literature. The safety compliance level of the HCWs who had been injured by SPIs and mucosal exposure was measured with the CSPS and was high. The high compliance level of the HCWs might be related to the experience of SPI/mucosal exposure.

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