Original Article

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Evaluation of Sharp and Needle-stick Injuries in A Tertiary Care Hospital: A Two-year Analytical Cross-sectional Study

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Abstract

Aim: Healthcare workers are at risk of infections due to needle-stick and sharp injuries (NSSIs) and through contact with blood and contaminated body fluids. This study aimed to investigate NSSIs and associated factors in healthcare workers.

Methods: This single-center analytical cross-sectional study included healthcare workers who were admitted to "the Hospital Infections Control Committee" following NSSIs at University of Health Sciences Turkey, Istanbul Haseki Training and Research Hospital, between January 1, 2020, and December 31, 2021. Demographic and epidemiological data, serological tests, and routine follow-up results were retrospectively collected from NSSI surveillance. Healthcare workers were divided into two groups according to the occurrence of stab wounds (injury or no injury). The age, sex, occupation, and working area of healthcare workers were compared.

Results: A total of 232 (7%) experienced NSSIs among 3,312 healthcare workers. The NSSI was 35.0 [confidence interval (CI)=34.9-35.2] per 1000 person-years. Needle-stick and sharp injuries were most frequently observed in nurses (n=148, 63.8%). Nurses [odds ratio (OR)=5.97, CI=4.51-7.90, p<0.001], cleaning staff (OR=1.64, CI=1.13-2.37, p=0.009), medical waste personnel (OR=10.79, CI=2.88-40.46, p<0.001), and medical technicians/technologists (OR=1.92, CI=1.03-3.57, p=0.039) were at increased risk for NSSIs.

Conclusion: This study highlights the need for assigning sufficient healthcare workers, prioritizing vaccination programs for high-risk groups, and providing regular hands-on training as crucial measures to prevent injuries.

Keywords: Sharp injuries, needle-stick injuries, healthcare workers

Introduction

Healthcare workers are at risk of infections due to contact with blood and contaminated body fluids during service provision. The main risk of infections transmitted through blood is injuries from needle-stick and sharp injuries (NSSIs). The Centers for Disease Control and Prevention (CDC) estimate that approximately 385,000 injuries occur among healthcare workers each year (1). According to the World Health Organization, more than two million professional NSSIs occur among 35 million healthcare workers annually (2). Factors leading to infection because of injury include major viruses such as hepatitis B, hepatitis C, and the human immunodeficiency virus (3). A systematic review on NSSIs among healthcare workers has shown that in developed countries, the incidence of injury is lower because of appropriate budget programs and the supply of preventive equipment (4).

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However, inadequate information on the prevention and management of professional exposure increases the risk of injury. Despite regular training for healthcare professionals on professional exposure and measures to be taken from the onset, NSSIs continue to be a significant problem. In addition, the CDC emphasizes the importance of a lack of notification after injury among healthcare workers (5).

Needle-stick and sharp injuries are common problems among healthcare professionals (6). Following occupational exposure, the exposed individual should promptly report the incident, and necessary follow-up and treatment should be planned. Hospitals should establish appropriate emergency intervention mechanisms to ensure timely reporting and treatment of exposures, as well as regular monitoring and follow-up (6,7). Therefore, it is critical to conduct regular NSSI surveillance and identify risky groups and situations that increase risk. This study aimed to investigate NSSIs and associated factors in healthcare workers.

Methods

Compliance with Ethical Standards

This study was approved by the University of Health Sciences Turkey, Istanbul Haseki Training and Research Hospital Clinical Research Ethics Committee (approval no.: 159-2022, date: 10.08.2022).

Study Design

This single-center analytical cross-sectional study included healthcare workers who were admitted to "the Hospital Infections Control Committee (HICC)" following NSSIs at Haseki Training and Research Hospital between January 1, 2020, and December 31, 2021. 232 (7%) healthcare workers with NSSIs were included in the study. The study excluded 45 (1.4%) healthcare workers who were injured by contaminated body fluids (Figure 1). Demographic and epidemiological data (age and sex) and routine follow-up results were retrospectively collected from medical data sheets for NSSI surveillance. Healthcare workers were routinely monitored for six months following the injury. They were divided into two groups according to the occurrence of stab wounds (injury or no injury) during the 2-year period. The gender and age characteristics of these two groups were compared. Healthcare workers who were injured were evaluated according to their professional group, the unit in which they worked, and the type of injury. In addition, injured healthcare workers were divided into 3 groups: 18-30 years old, 30-45 years old, and >45 years old, and the frequency of injuries was compared between age groups.

Statistical Analysis

The statistical software IBM SPSS-21 (Statistical Package for Social Sciences, Chicago, IL, USA) facilitated the execution of these analyses. Quantitative variables were delineated through the calculation of the median (minimum-maximum) in the context of continuous data, whereas categorical data were articulated in terms of percentages (%) and frequencies (n). The Pearson chi-squared test was employed to compare qualitative characteristics. The odds ratio (OR) was calculated, and risk values were given. The Student's t-test was applied to analyze continuous data among more than two independent non-parametric groups. Results were provided within a 95% confidence interval (CI), with the predetermined level of statistical significance set at a p-value of <0.05.

Results

A total of 232 (7%) experienced NSSIs among 3,312 healthcare workers. Of the 232 healthcare workers

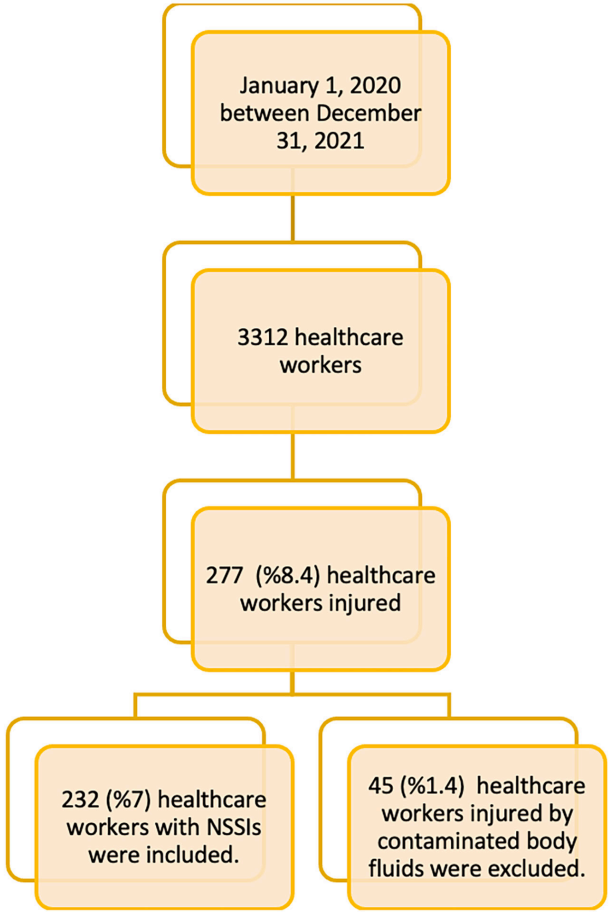

Figure 1. The flow chart regarding the study design

included in the study, 155 (66.8%) were female, with a median age of 27 (18-62) years. The demographic data of healthcare workers in our hospital, their distribution according to occupational groups, and the clinics where they worked are presented in Table 1. When injuries were grouped by age, the highest incidence occurred in the 18-30 age group (n=159, 68.5%) (Table 2). The NSSI was 35.0 (CI=34.9-35.2) per 1000 person-years.

The NSSIs were most frequently observed in nurses (n=148, 63.8%), followed by cleaning staff (n=37, 15.9%), and physicians (n=15, 6.5%) (Table 3). Working in general wards (OR=2.08, CI=1.58-2.72, p<0.001) and working in the intensive care unit (ICU) (OR=3.71, CI=2.69-5.10, p<0.001) were associated with an increased risk of NSSIs (Table 4). When injuries were evaluated by region, the hand was the most frequently injured area (n=230, 99.1%). Needlestick injuries accounted for 82.8% of cases (n=192). Six healthcare workers were injured during the breakage of a drug ampule. The material causing the injury was contaminated in 89.6% of cases (n=208), whereas in 14 cases (6.03%), the contacted material was not contaminated. In eleven cases, it was unknown whether the material was contaminated. No cases of infection transmitted through blood were recorded during the 2-year study period associated with the injury.

Table 1. Demographic characteristics of healthcare workers

		n	%
In total		3312	100
Sex	Female	1977	59.7
	Male	1335	40.3
Median age, years (min.-max.)		30 (18-69)	
Distribution by Professions			
Nurse		850	25.7
Doctor		672	20.3
Patient receptionist		440	13.3
Cleaning staff		357	10.8
Medical secretary		323	9.8
Administrative staff		180	5.4
Laboratory technician		170	5.1
Security guard		150	4.5
Medical technician		97	2.9
Dining hall staff		64	1.9
Medical waste personnel		9	0.3
Distribution by Units/Departments			
Clinics		982	29.7
Intensive care unit		325	9.8
Emergency department		292	8.8
Outpatient clinics		283	8.5
Operating room		207	6.3
Laboratory		170	5.1
Other departments		**1053**	**31.8**

Discussion

This single-center analytical cross-sectional study was designed to assess the prevalence of NSSIs and associated factors among healthcare workers in our hospital. We found that the NSSI was 35.0 (CI=34.9-35.2) per 1000 person-years. Factors significantly associated with NSSIs were occupation (being a nurse) and working area (working in general wards and the ICU).

In the study by Erturk Sengel et al. (8), the incidence of occupation-related injuries was 34.1 (CI=33.1-37.5). In the study by Yunihastuti et al. (9), the NSSI incidence rate was 13.3 per 1000 people per year. In our study, the NSSI was 35.0 (CI=34.9-35.2) per 1000 person-years. Injury rates among different centers varied. In addition, the extent to which injuries are reported or followed up for treatment and testing may vary among healthcare professionals. There are problems with reporting among healthcare professionals, probably because of a lack of time, a lack of belief in the infection transmitted through NSSIs, and several other reasons (10). In a questionnaire, at least one-third of health workers had at least one reported injury, and the most common reason for not being notified was time-consuming (11). Although the relatively low ratio seen in physicians in our center is required, it may be thought that they may not be notified for various reasons.

Table 2. Comparison of injured and uninjured healthcare workers in terms of sex and age

In total (n=3,312)	**Injured (n=232)**		**Uninjured (n=3,080)**		**OR**	**CI**	**p-value**
	n	**%**	**n**	**%**			
Sex							
Female (n=1,977)	155	66.8	1822	59.2	1.39	1.05-1.84	0.022*
Male (n=1,335)	77	33.2	1258	40.8			
Age							
Median age, years (min.-max.)	27 (18-62)		31 (18-69)		-	-	0.186**

OR: Odds ratio, CI: Confidence interval, min.-max.: Minimum-maximum, *: Pearson chi-quare test, **: Student's t-test

In our study, 82.8% of NSSIs were caused by needlestick injuries. In the study of Aiken et al. (12), it was found that 36.9% of NSSIs occurred through needlestick injuries during drug preparation, injection, and blood collection. Karabay et al. (13) showed that 85% of the tools that caused NSSIs were contaminated. In our study, it was determined that nurses, medical technicians, and cleaning personnel constituted approximately 85% of penetrating injuries. Kaya et al. (14) reported that NSSIs were distributed as follows: 48% are nurses, 22% are servants, 14.5% are technicians, 8.5% are health officers, and 7% are doctors. Güngör Özdemir and Şengöz (15) demonstrated that nurses constituted the most frequent occupational group exposed to NSSIs, accounting for 57.5%.

In a retrospective study conducted by HICC in a hospital in India over a period of 9 years, 78 NSSIs were reported, with nurses constituting 61.5% of these incidents. This study revealed a higher incidence of injuries among females (1.6:1). The higher proportion of female healthcare workers overall and in the nursing profession can both help to explain this situation (16). In another study, Alshehri et al. (17) showed that the NSSI rate was 2.05. Also, they found that 68.8% of the cases were female and 66.6% were under 39 years old (17). In our study, the rate of women's health workers in our hospital was higher, and more injuries were seen in females.

In numerous studies in the literature, it has been shown that NSSIs most frequently occur among nurses (9,16-19). In our study, the most commonly injured occupational group was also found to be nurses. This situation can be explained by the fact that nurses constitute the highest proportion in terms of the number of employees, coupled with their frequent and direct patient contact and the relatively high patient load per nurse. Another retrospective study by Stallard et al. (20) included 47 injuries, and the most common injuries were seen in nurses.

Saadeh et al. (19) demonstrated that two-thirds of the injuries were among health workers under 30 years of age. Alshehri et al. (17) reported that 66.6% of the injuries

Table 3. Comparison of injured and uninjured healthcare workers terms of occupation

In total (n=3,312)	Injured (n=232)		Uninjured (n=3,080)		OR	CI	p-value*
	n	%	n	%			
Doctor (n=672)	15	6.5	657	21.3	0.25	0.15-0.43	<0.001
Nurse (n=850)	148	63.8	702	22.8	5.97	4.51-7.90	<0.001
Cleaning staff (n=357)	37	15.9	320	10.4	1.64	1.13-2.37	0.009
Medical waste personnel (n=9)	4	1.7	5	1.5	10.79	2.88-40.46	<0.001
Patient receptionist (n=440)	4	1.7	436	14.2	0.11	0.04-0.29	<0.001
Medical technician (n=97)	12	5.2	85	2.8	1.92	1.03-3.57	0.039
Dining hall staff (n=64)	0	0	64	2.1	0.10	0.01-1.63	0.106
Security guard (n=150)	1	0.4	149	4.8	0.09	0.01-0.61	0.014
Administrative staff (n=180)	0	0	180	5.8	0.03	0.002-0.56	0.018
Medical secretary (n=323)	1	0.4	322	10.5	0.04	0.01-0.26	0.001
Laboratory technician (n=170)	10	4.3	160	5.2	0.82	0.43-1.58	0.557

OR: Odds ratio, CI: Confidence interval, *: Pearson chi-quare test

Table 4. Comparison of of injured and uninjured healthcare workers terms in terms of working area

In total (n=3,312)	Injured (n=232)		Uninjured (n=3,080)		OR	CI	p-value*
	n	%	n	%			
Emergency department (n=292)	24	10.3	268	8.7	1.21	0.78-1.88	0.395
Operating room (n=207)	16	6.9	191	6.2	1.12	0.67-1.90	0.673
Clinics (n=283+478+221)	105	45.3	877	28.5	2.08	1.58-2.72	<0.001
Intensive care unit (n=325)	60	25.9	265	8.6	3.71	2.69-5.10	<0.001
Laboratory (n=170)	10	4.3	160	5.2	0.82	0.43-1.58	0.557
Outpatient clinics (n=283)	3	1.3	280	9.1	0.13	0.04-0.41	<0.001
Other departments (n=1,053)	14	6.0	1039	33.7	0.13	0.07-0.22	<0.001

OR: Odds ratio, CI: Confidence interval, *: Pearson chi-quare test

were among health workers under 39 years of age. In our study, 68.5% of injuries occurred in health workers aged 30 years. In another study evaluating NSSIs over 19 years in Japan, 58.5% of the injuries occurred in people with less than 5 years of experience (21). The median age of healthcare workers in our hospital is 30 (range: 18-69) years, suggesting a relatively young healthcare workforce. It is also thought that the work experience of the cases can be a factor. Contrary to these studies, in a single-center cross-sectional study conducted in Ethiopia, it was found that being older (>40 years) increased the risk of NSSI by three times. The reason for this has been suggested as loss of muscle strength and sensory nerve endings, loss of concentration, loss of attention, and increasing structural and functional changes due to chronological age in elderly caregivers (22).

In Saadeh et al. (19), 91.1% of NSSIs occurred in the hand. Another study by Sharma et al. (16) also found that hand injuries were the most common location for NSSIs. In another retrospective cross-sectional study, hand injuries were observed in 94.3% of cases (18). In the study by Iwamatsu-Kobayashi et al. (21), the most frequently injured area was the hand. In our study, 99.1% of injuries occurred in the hand, which is consistent with the existing literature.

Study Limitations

There are some limitations to our study. This study was conducted in a single center and cannot be generalized to the entire population. However, the fact that injury hours were not evaluated in the study was insufficient to elucidate the relationship between injuries and shifts. Additionally, the number of cases was found to be lower in our study than in some studies in the literature. Despite this limitation, there was a hospital infection control committee that strictly monitored NSSIs.

Conclusion

This study highlights the need for assigning sufficient healthcare workers, prioritizing vaccination programs for high-risk groups, and providing regular hands-on training as crucial measures to prevent injuries. Needle-stick and sharp injuries among healthcare workers remain an important problem. Efforts should be made to raise awareness among healthcare professionals and increase reporting rates.

Ethics

Ethics Committee Approval: This study was approved by the University of Health Sciences Turkey, Istanbul Haseki Training and Research Hospital Clinical Research Ethics Committee (approval no.: 159-2022, date: 10.08.2022).

Informed Consent: Written informed consent was waived because of the retrospective nature of this study.

Authorship Contributions

Concept: G.T., S.S., A.A, M.T, S.U.A, Design: S.S., G.T., A.A., C.G.G., O.F.B., Data Collection or Processing: A.A., M.T., S.U.A., C.G.G, Analysis or Interpretation: G.T., S.S., O.F.B., C.G.G., G.S., M.T., Literature Search: G.S., G.T., S.U.A., M.T., S.S., Writing: S.S., O.F.B., G.T., C.G.G., G.S, A.A.

Conflict of Interest: No conflicts of interest were declared by the authors.

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