HAYDARPAŞA NUMUNE MEDICAL JOURNAL

DOI: 10.14744/hnhj.2024.22230
Haydarpasa Numune Med J 2025;65(1):32–37

hnhtipdergisi.com

ORIGINAL ARTICLE

Exposure of Healthcare Workers to Blood and Bodily Fluids: A 10-Year Retrospective Analysis at a Single Center

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Abstract

Introduction: Due to the nature of their profession, healthcare workers are frequently exposed to blood and bodily fluids, placing them at risk for various infections. Among the main causes of infection risk are blood-borne pathogens such as hepatitis B, hepatitis C, and HIV. This study aims to evaluate the exposure of healthcare workers to blood and bodily fluids and develop strategies to prevent injuries.

Methods: This study is a retrospective cross-sectional analysis conducted at Health Sciences University Izmir Tepecik Training and Research Hospital between 2014 and 2023. Data were retrospectively collected from the hospital's occupational health and safety unit. Variables analyzed include age, gender, occupation, years of experience, time of injury, and type of exposure. SPSS software was used for data analysis, with continuous variables expressed as medians and categorical data presented as percentages.

Results: The study examined 1,100 healthcare workers. A total of 32.8% of injuries occurred among nurses, while 26.4% involved doctors. Employees with 0–1 years of experience constituted the highest risk group (54.9%). Additionally, 65.2% of injuries occurred during daytime shifts. Among those exposed to known sources, the HBsAg positivity rate was 11.5%, the Anti-HCV positivity rate was 1.5%, and the Anti-HIV positivity rate was 1.4%. A notable increase was observed in annual data during 2018 and 2019, followed by a declining trend after 2020, after which the increase resumed.

Discussion and Conclusion: Preventive measures such as the use of safe needle technologies, continuous infection control training, and the regulation of working hours are recommended to reduce the risk of injuries among healthcare workers. These measures can improve the quality of healthcare services, ensuring the safety of workers and preventing occupational injuries.

Keywords: Blood-Borne Pathogens; Health Personnel; Infection Control; Needlestick Injuries; Occupational Exposure

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Submitted Date: 26.09.2024 **Revised Date:** 26.09.2024 **Accepted Date:** 10.10.2024
Haydarpaşa Numune Medical Journal

Healthcare workers are a significant professional group frequently exposed to blood and bodily fluids as a result of their job, placing them at risk for various infections. One of the most common sources of these risks is injuries caused by sharp and piercing objects. According to reports by the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC), blood-borne pathogens that healthcare workers are exposed to include the hepatitis B virus (HBV), hepatitis C virus (HCV), and the human immunodeficiency virus (HIV). These risks do not only threaten the health of healthcare workers but also affect the sustainability of healthcare services[1,2].

Injuries from sharp and piercing objects are considered a significant health issue among healthcare workers. Prüss-Üstün et al.[3] reported that approximately 3 million healthcare workers worldwide are exposed to sharp and piercing object injuries annually, resulting in a significant risk of infection. Additionally, many studies have highlighted that such injuries are more common in low- and middle-income countries, largely as a result of insufficient infection control measures[4,5].

The exposure rates of healthcare workers to blood and bodily fluids can vary depending on their occupation and years of experience. Particularly, groups such as nurses, doctors, laboratory technicians, and cleaning staff, who are directly involved in patient care and laboratory procedures, are at higher risk. A study on nurses, who form the most densely populated group involved in patient care, found that this group was the most frequently exposed to such injuries, attributing this to a lack of education and experience[6]. Similarly, recent literature indicates that doctors, especially those working in emergency departments, carry a high risk as a result of the intense working conditions[7,8].

The existing literature suggests several strategies to reduce the exposure risks of healthcare workers. These strategies include the use of safe needle technologies, regular training programs, and the diligent implementation of infection control measures[9]. Lee et al.[10] demonstrated that the use of safe needle technologies could reduce sharp and piercing object injuries by 30%. Additionally, Makeen et al.[11] reported that infection control training increased healthcare workers' awareness and reduced injury rates.

However, for these preventive measures to be effectively implemented, it is necessary to systematically examine injury cases and identify specific risk factors. In this context, the objective of this study is to comprehensively evaluate the exposure of healthcare workers to blood and bodily fluids and contribute to the development of strategies to prevent such injuries.

Materials and Methods

This study is a retrospective cross-sectional study conducted at Health Sciences University Izmir Tepecik Training and Research Hospital. Health Sciences University Izmir Tepecik Training and Research Hospital is a tertiary healthcare institution with 910 beds, approximately 4,000 healthcare workers, and 1,200 intern students. The study period spans from January 1, 2014, to December 31, 2023.

The study covers all healthcare workers at Health Sciences University Izmir Tepecik Training and Research Hospital who were documented in the occupational health and safety unit (OHSU) records between January 1, 2014, and December 31, 2023. Data were retrospectively collected from the OHSU's monitoring forms. The variables in the study include age, gender, occupation, department worked, years of experience, date and location of exposure, activity during which the exposure occurred, and, if the source patient was known, their HBsAg, Anti-HCV, and Anti-HIV serology.

Statistical Analysis

The patient data collected for the study were analyzed using IBM Statistical Package for the Social Sciences (SPSS) for macOS 29.0 (IBM Corp., Armonk, NY). Frequencies and percentages were used for categorical data, while the median (interquartile range) was provided for continuous variables.

Ethical Approval

The study was approved by the Health Sciences University Izmir Tepecik Training and Research Hospital Ethics Committee with decision number 2024/08-18 on September 2, 2024. All procedures were performed in accordance with the ethical standards of the Human Experimentation Committee of our institution and the Declaration of Helsinki.

Results

In this study, data from 1,100 healthcare workers exposed to blood and bodily fluids at Health Sciences University

Table 1. Demographic Characteristics of Healthcare Workers Exposed to Injuries

Variables	Total Cases (n=1110)	Number	Percentage (%)
Gender			
	Female	490	44.1
	Male	620	55.9
Age (years)*		21 (18-59)	
Occupational Group			
	Intern	115	10.3
	Nurse	365	32.8
	Doctor	294	26.4
	Cleaning Staff	217	19.5
	Laboratory Technician	119	10.7
Years of Experience			
	0-1 year	610	54.9
	1-5 years	242	21.8
	5-10 years	258	23.2
Department			
	Emergency Room	222	20.0
	Operating Room	266	23.9
	Wards	356	32.0
	Outpatient Clinic	24	2.1
	Intensive Care Unit	156	14.0
	Laboratory	86	7.7
Injury Type			
	Percutaneous	1011	91.0
	Mucosal	99	8.9
Injury Site			
	Hand	949	85.4
	Eye	82	7.3
	Foot	57	5.1
	Oral Mucosa	17	1.5
	Other**	5	0.4
Exposed Bodily Fluid			
	Blood	1097	99.5
	Urine	13	1.1
	Other***	4	0.3
Source of Exposure			
	Known	691	62.2
	Unknown	419	37.7
Hepatitis B Vaccination			
	Not Vaccinated	145	13.0
	Vaccinated	965	86.9
Tetanus Vaccination			
	Not Vaccinated	674	60.7
	Vaccinated	436	39.2
Injury Time			
	Daytime (08:00-17:00)	724	65.2
	Evening (17:00-00:00)	249	22.4
	Night (00:00-08:00)	137	12.3

* Median (IQR) (min-max); ** Other body parts with sharp and penetrating object injuries; *** Peritoneum, pleura, cyst contents.

Izmir Tepecik Training and Research Hospital over the past 10 years were analyzed. The median age of the healthcare workers included in the study was 21 years, with 490 females (44.1%) and 620 males (55.9%). When injury rates were examined according to occupational groups, nurses (32.8%), doctors (26.4%), cleaning staff (19.5%), laboratory technicians (10.7%), and interns (10.3%) were identified as the most affected groups.

Regarding years of experience, most injuries occurred among healthcare workers with 0–1 years of professional experience (610 cases, 54.9%). Injuries occurring in wards and percutaneous injuries (91%) were the most common types. The most frequent causes of risky exposures varied over the years, with the highest percentages occurring during surgeries (31.9%) and invasive procedures (24.9%). Among the healthcare workers who experienced injuries, 86.9% had received the hepatitis B vaccine, and 39.2% had received the tetanus vaccine. Additionally, 65.2% of injuries occurred during daytime working hours (08:00–17:00).

When evaluating the source of the exposure, it was found that exposures with a known source (62.2%) were more frequent than those with an unknown source, and the majority of exposure incidents involved blood (99.5%) (Table 1).

The seropositivity rates for HBsAg, Anti-HCV, and Anti-HIV were 11.5%, 1.5%, and 1.4%, respectively, among those exposed to known sources (Table 2).

Table 3 presents an analysis of the distribution of risky exposure causes among healthcare workers over the years. These causes have been classified into categories such as exposure during invasive procedures, capping a needle, waste collection or transportation, surgeries, cleaning activities, and other reasons. Over the years, the most frequently reported cause of risky exposure was during surgeries, accounting for a total of 355 cases (31.9%). The second most common cause was exposure during invasive procedures, with 277 cases (24.9%) reported.

A significant increase in the number of exposures was observed in 2018 and 2019, with this rising trend continuing after a decline in 2020. Total exposures during these years were recorded as 152 cases (13.6%) and 161 cases (14.5%), respectively. A detailed breakdown of the distribution of risky exposure causes across the years is provided in Table 3.

Table 2. Seropositivity of HBV, HCV, and HIV in Known Sources of Risky Exposures

Source Serology	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total Cases (n=691)
HBsAg Positive, n (%)	4 (28.5)	1 (2.5)	2 (21)	11 (10.4)	25 (22.7)	10 (7.8)	9 (27.2)	12 (6.31)	2 (2.2)	4 (6.3)	80 (11.5)
Anti-HCV Positive, n (%)	0 (0)	2 (5.1)	3 (3.2)	2 (1.9)	1 (0.9)	0 (0)	0 (0)	1 (5.2)	1 (1.1)	1 (1.5)	11 (1.5)
Anti-HIV Positive, n (%)	0 (0)	1 (2.5)	0 (0)	0 (0)	1 (0.9)	1 (0.7)	0 (0)	0 (0)	3 (3.4)	4 (6.3)	10 (1.4)

Table 3. Distribution of Risky Exposure Causes Over the Years Among Healthcare Workers

Characteristics	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total Cases (n=1110)
Invasive Procedure	9	13	18	14	55	20	12	32	55	49	277 (24.9%)
Capping Needle	14	7	12	15	38	59	39	17	5	4	210 (18.9%)
Waste Collection/Transport	6	14	9	17	6	26	7	23	16	9	133 (11.9%)
Surgery	31	34	41	50	43	34	2	16	53	51	355 (31.9%)
Cleaning	20	13	6	7	8	16	19	7	3	2	101 (9.0%)
Other	1	3	3	0	2	6	2	3	9	5	34 (3.0%)
Total Exposures, n (%)	81 (7.2)	84 (7.5)	89 (8.0)	103 (9.2)	152 (13.6)	161 (14.5)	81 (7.2)	98 (8.8)	141 (12.7)	120 (10.8)	1110

Discussion

Our study found that male healthcare workers were more frequently exposed to injuries. This may be attributed to the fact that males are often more engaged in invasive procedures and surgical interventions, which inherently carry higher risk. Similar findings have been reported in the literature[12]. Additionally, our study identified that nurses and emergency room doctors were more frequently exposed to needlestick and sharp object injuries compared to other healthcare workers. This is consistent with a systematic review by Azak et al.,[13] which reported that nurses have a higher incidence of needlestick injuries than other healthcare professionals. The elevated risk among nurses is likely due to the demands of their role, which expose them to greater risks of needlestick and other percutaneous injuries. Furthermore, a study by Verbeek and colleagues demonstrated that emergency room doctors are at an elevated risk of injury, primarily due to the inherently unpredictable and high-risk nature of emergency medical practice[14]. Studies in Türkiye have also highlighted that nurses and emergency room workers are at higher risk[15].

When analyzed by years of professional experience, our findings revealed that healthcare workers with 0–1 years of experience exhibited a significantly higher injury rate (54.9%) compared to other experience groups. This result indicates that less experienced workers may require additional support and training in occupational safety. A study by Erturk Sengel et al.[16] similarly emphasized the pivotal role of education in mitigating injury risks. Likewise, a study conducted in Germany corroborated these findings, showing that workers with limited experience are at greater risk of injury[17]. These results underscore the importance of comprehensive and ongoing training programs for newly employed healthcare professionals.

Regarding the nature of injuries and the departments in which they occurred, our study found that percutaneous injuries (91%) and injuries to the hand (85.4%) were the most prevalent. This aligns with findings from the study by Grimmond and Good, which reported that percutaneous injuries are the most common type of injury among healthcare workers[18]. The predominance of hand injuries further highlights the vulnerability of this area, particularly during invasive procedures.

A significant portion of the injuries occurred during surgeries (31.9%) and invasive procedures (24.9%). Jahic et al.[19] similarly observed an increased risk of exposure to blood and bodily fluids during such high-risk procedures. Moreover, a notable percentage of injuries occurred while capping needles (18.9%), underscoring the urgent need for more widespread implementation of safe injection practices. Elseviers et al.[20] attributed this trend to the insufficient adoption of safe injection practices. These findings emphasize the need for enhanced training programs focused on the utilization of safe devices and injection techniques.

In our study, 86.9% of healthcare workers were found to have been vaccinated against hepatitis B. This reflects a high level of awareness regarding the importance of vaccination among healthcare workers. However, the

lower tetanus vaccination rate (39.2%) signals a gap in education and suggests the need for further advocacy and reinforcement in this area. Particularly in developing countries, increasing vaccination rates among healthcare professionals is crucial for providing adequate protection against blood-borne infections[21]. Expanding vaccination programs could significantly reduce the risk of infection transmission.

Most injuries occurred during daytime working hours (65.2%), suggesting that factors such as distraction and fatigue, exacerbated by increased work intensity during these hours, may contribute to a higher risk of injury. Cooke and Stephens similarly highlighted the role of work intensity and distraction in elevating the risk of injury during peak working hours[22]. Adjusting work schedules and managing workloads could be effective strategies for reducing injury risks.

A significant finding in the annual data was the noticeable increase in exposure rates in 2018 and 2019, with total exposure rates recorded as 13.6% and 14.5%, respectively. This upward trend may be linked to the growing demand for healthcare services during these years, which likely intensified the risk for healthcare workers. The marked decrease in exposure rates in 2020 (7.2%) during the onset of the COVID-19 pandemic may be attributable to the reduction in elective procedures, stricter safety protocols, and the widespread implementation of personal protective equipment. However, the subsequent rise in exposure rates in 2021 and later suggests that as healthcare services were restructured in the post-pandemic era, healthcare workers faced renewed risks[23]. These findings demonstrate the complex interplay between workload, safety protocols, and occupational risk, underscoring the necessity for ongoing evaluation and improvement of safety measures to protect healthcare workers, especially during public health crises.

Limitations

This study has several limitations. First, the retrospective design may increase the risk of missing or inaccurate information during data collection. Additionally, the study was conducted only at Health Sciences University Izmir Tepecik Training and Research Hospital, which limits the generalizability of the findings to other healthcare institutions. The fact that the sample group is limited to this hospital may not adequately represent the exposure risks of healthcare workers in different geographical regions. Furthermore, since the data were obtained from the hospital's occupational health and safety unit, some risk factors may have been overlooked or insufficiently detailed. Lastly, as this study includes only healthcare workers from a specific hospital, it may not fully reflect the exposure risks in other healthcare settings. Future studies should include larger sample groups and encompass multiple healthcare institutions to support these findings.

Conclusion

This study highlights the importance of increased education, safety measures, and the use of protective devices to prevent healthcare workers' exposure to blood and bodily fluids. Expanding training programs, particularly for young and inexperienced healthcare workers, and ensuring safe working environments will play a critical role in reducing occupational injuries. Additionally, regulating working hours and workload appears to be an effective strategy for minimizing injury risk. Improving healthcare workers' safety not only enhances the quality of healthcare services but also protects the well-being of the workers themselves.

Ethics Committee Approval: The study was approved by Health Sciences University Izmir Tepecik Training and Research Hospital Ethics Committee (No: 2024/08-18, Date: 02/09/2024).

Peer-review: Externally referees.

Use of AI for Writing Assistance: Not declared.

Authorship Contributions: Concept – A.I., D.F.; Design – A.I., D.F.; Supervision – D.F.; Fundings – A.I., D.F.; Materials – A.I.; Data collection &/or processing – A.I.; Analysis and/or interpretation – A.I., D.F.; Literature search – A.I., D.F.; Writing – A.I., D.F.; Critical review – A.I., D.F.

Conflict of Interest: The authors declare that there is no conflict of interest.

Financial Disclosure: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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