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Original Article

Frequency of Needlestick and Sharp Injuries, Their Associated Risk Factors and Safety Measures among Healthcare Workers of Fauji Foundation Hospital, Rawalpindi

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ABSTRACT

Background: Needlestick and sharp injuries (NSSIs) are significant occupational hazards for healthcare workers (HCWs), facilitating the transmission of bloodborne pathogens such as HIV, hepatitis B, and C viruses. Despite known risks, the frequency and associated factors contributing to these injuries in healthcare settings, particularly in developing countries, are not well-documented.

Objective: This study aimed to determine the frequency of NSSIs, identify their associated risk factors, and evaluate the safety measures adopted by HCWs in a tertiary care hospital in Rawalpindi, Pakistan.

Methods: A cross-sectional study was conducted from May to September 2022 at Fauji Foundation Hospital, Rawalpindi. A total of 250 HCWs, including paramedical staff, doctors, nurses, and allied health professionals, participated in the study. Ethical approval was obtained from the Center of Advanced Studies in Health and Technology research committee and the Head of the Department of Pathology. A structured questionnaire was developed to collect data on demographic characteristics, history of NSSIs, risk factors, and safety measures adopted post-injury. Data were analyzed using SPSS version 25, employing non-parametric tests due to the non-normal distribution of data.

Results: Among the participants, 76.8% (n=192) reported experiencing NSSIs at least once during their employment. The highest incidence of NSSIs was observed among HCWs aged 26-30 years (31.6%, n=79) and those with 2-7 years of work experience (50.4%, n=126). The most common risk factors for NSSIs were heavy workload (40%) and recapping of needles (22%). Only 38% (n=95) of HCWs reported the incident, and 44% (n=111) were vaccinated against hepatitis B following exposure. Moreover, 58% (n=145) used personal protective equipment, and 73.6% (n=184) utilized safety boxes for sharp waste disposal post-injury.

Conclusion: The study highlights a high prevalence of NSSIs among HCWs, with inadequate reporting and post-exposure prophylaxis. There is a critical need for enhanced training on safe handling of sharps and increased adherence to universal precautions to mitigate the risk of NSSIs in healthcare settings.

Keywords: Needlestick injuries, healthcare workers, occupational hazards, bloodborne pathogens, safety measures, Pakistan.

INTRODUCTION

Needlestick and sharp injuries (NSSIs) pose a significant occupational hazard to healthcare workers (HCWs), arising from unintentional contact with sharp objects such as needles, blades, or contaminated broken glass. These incidents are critical pathways for the transmission of blood-borne pathogens, notably HIV, hepatitis B virus (HBV), and hepatitis C virus (HCV), which significantly endanger the health and safety of HCWs. It has been reported that sharp objects contaminated with HIV, HBV, and HCV are responsible for injuries to 327,000, 2.1 million, and 926,000 healthcare workers annually, respectively (5-7). The prevalence of NSSIs is notably high, with rates of 58% in Pakistan and 35% in Egypt, underscoring a global health concern (8). Unsafe injection practices, including improper gloving and recapping of needles, have been linked to approximately 33% of hepatitis B infections, 42% of hepatitis C infections, and 2% of HIV infections among HCWs (9), highlighting the imperative for improved safety protocols and practices within healthcare settings.

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The risk of NSSIs is compounded by factors such as the physical design of needles, improper handling or disposal of sharps, and workplace conditions like increased workload and administrative negligence. These elements elevate the likelihood of injuries through various clinical activities, including injections, blood collection, needle disposal, and the transfer of bodily fluids (5). Developing countries report a higher incidence of HIV and NSSIs, attributing to the urgent need for comprehensive strategies to mitigate these risks (4, 11). Key factors contributing to NSSIs include the reuse of needles, excessive use of sharps, lack of safety devices, inadequate personnel training, poor disposal practices, and patient reactions (12-16). Furthermore, the introduction of post-exposure prophylaxis (PEP) has reduced the prevalence of infections and treatment costs, with PEP showing a 75-90% success rate in preventing HBV infection (17). Antiretroviral therapy for HIV further reduces the risk of acute wound infections, emphasizing prevention as a cornerstone in combating these diseases (17). Vaccination against hepatitis B and comprehensive infection prevention programs are crucial for occupational safety (18). Prior research has primarily focused on estimating the incidence, causes, knowledge, and attitudes towards NSSIs among HCWs, leading to this study's aim to determine the frequency of NSSIs, their associated risk factors, and safety measures among HCWs in a tertiary care hospital in Rawalpindi.

MATERIAL AND METHODS

The study received ethical approval from the Center of Advanced Studies in Health and Technology (CASHT) research committee and the Head of the Department of Pathology at Fauji Foundation Hospital, Rawalpindi, ensuring adherence to ethical standards in line with the Declaration of Helsinki. Conducted from May 2022 to September 2022, this cross-sectional study aimed to assess the frequency of needlestick and sharp injuries (NSSIs), their associated risk factors, and the implementation of safety measures among healthcare workers (HCWs) at Fauji Foundation Hospital, Rawalpindi. The target population included a broad spectrum of HCWs, encompassing paramedical staff (such as laboratory and radiology staff), doctors, nurses, and allied health professionals specializing in Molecular Biology and Microbiology.

Employing a quantitative research approach, a meticulously structured questionnaire was developed for data collection. Although the questionnaire was provided in English, assistance was offered to participants as necessary to ensure clarity and comprehensiveness in responses. The objectives and other pertinent details of the study were communicated to the HCWs during the questionnaire distribution phase to ensure informed participation. Oral informed consent was obtained from all participants, with a total of 250 HCWs contributing to the study. Confidentiality of the responses was guaranteed to participants to maintain privacy and encourage candidness in their answers.

Data collected from the completed questionnaires were subsequently digitized and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25. Preliminary analysis involved conducting a reliability assessment of the questionnaire items, achieving a Cronbach's alpha (α) value of ≥ 0.07, indicative of satisfactory internal consistency among the items. Given the non-normal distribution of the data, as determined by normality tests, non-parametric tests were applied for statistical analysis. This methodological approach facilitated a comprehensive evaluation of the study objectives, ensuring rigorous data analysis and interpretation in line with established research standards.

RESULTS

The demographic characteristics of healthcare workers (HCWs) in this study highlight a nearly balanced gender distribution among the participants, with males representing 52.8% (n=132) and females 47.2% (n=118) of the total 250 respondents (Table 1). The age distribution indicates a young workforce, predominantly between 26 to 30 years (31.6%, n=79), followed closely by those in the 31 to 35-year range (29.2%, n=73). Educational background varied, with the majority holding Bachelor's degrees (43.2%, n=108), underscoring a well-educated cohort. Paramedical staff and nursing staff constituted the largest professional groups, 36.8% (n=92) and 52.4% (n=131) respectively, illustrating the study's encompassing of a diverse range of healthcare professionals. Work experience among participants was notably varied, with half (50.4%, n=126) having 2-7 years of experience. A significant 76.8% (n=192) of HCWs reported having experienced needlestick and sharp injuries (NSIs), emphasizing the prevalent risk within this setting (Table 1).

The analysis of risk factors associated with NSIs revealed that used needles were responsible for 47.6% (n=119) of the injuries, while 29.2% (n=73) were caused by sterilized ones, indicating lapses in safety practices (Table 2). Duty timing played a critical role, with the majority of injuries occurring during morning shifts (49.6%, n=124), suggesting that the start of the workday might be the most vulnerable period for such incidents. The frequency of NSIs varied, with most HCWs experiencing 1-2 injuries (48%, n=120), pointing to a significant exposure to hazardous incidents. Surprisingly, 42.4% (n=106) of the participants were unsure about the disease transmission risk associated with their injuries, highlighting a gap in awareness or post-injury follow-up procedures.

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Table 1 Demographic Characteristics of Healthcare Workers (N=250)

Characteristic	Frequency (f)	Percentage (%)
Gender		
Male	132	52.8%
Female	118	47.2%
Age Group (years)		
20-25	37	14.8%
26-30	79	31.6%
31-35	73	29.2%
36-40	61	24.4%
Education		
Metric	5	2.0%
Intermediate	83	33.2%
Bachelor	108	43.2%
Diploma	34	13.6%
Masters	20	8.0%
Designation		
Paramedical staff	92	36.8%
Nursing staff	131	52.4%
Doctor	11	4.4%
Allied health professional	16	6.4%
Work Experience (years)		
2-7	126	50.4%
8-13	87	34.8%
14-19	27	10.8%
20-26	10	4.0%
History of NSIs		
Yes	192	76.8%
No	58	23.2%

Table 2 Risk Factors Associated With Needle Stick Injuries

Risk Factor	Frequency (f)	Percentage (%)
Needle		
Used	119	47.6%
Sterilized	73	29.2%
Duty Timing		
Morning	124	49.6%
Evening	56	22.4%
Night	12	4.8%
Number of NSIs		
1-2	120	48.0%
3-4	47	18.8%
More than 5	15	6.0%
Don’t know	10	4.0%
Disease Transmission Risk		
Not infectious disease	68	27.2%
Hepatitis B & C	18	7.2%
Don’t know	106	42.4%

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Risk Factor	Frequency (f)	Percentage (%)
Reason for NSIs		
Workload	100	40.0%
Recapping	55	22.0%
Quickness	27	10.8%
Drawing blood	10	4.0%
Location of NSI		
Phlebotomy	32	12.8%
Within lab	43	17.2%
ICU	8	3.2%
Emergency	69	27.6%
Operation theatre	10	4.0%
Ward	30	12.0%

Table 3 Safety Measures Taken After Needle Stick Injury Occurrence

Safety Measure	Frequency (f)	Percentage (%)
Using sterilized needle	192	76.8%
Using PPE	145	58.0%
Using safety box	184	73.6%
Discharging safety box	174	69.6%
Sealing sharp waste containers	169	67.6%
Avoid breaking of needle	178	71.2%
Using gloves after injury	135	54.0%
Reporting NSI	95	38.0%
Blood test after injury	123	49.2%
Preventive training	92	36.8%
Hepatitis B vaccine	110	44.0%

Table 4 Chi-Square Test Results for Variables Associated with Needle Stick Injuries

Variable	Chi-Square Value	Degrees of Freedom (Df)	Asymptotic Significance (Asymp Sig)
Needle	11.021	1	0.001
Duty Timing	99.500	2	<0.001
Number of NSIs	160.792	3	<0.001
Disease Transmission Risk	60.875	2	<0.001
Reason for NSIs	96.625	3	<0.001
Location of NSIs	79.813	5	<0.001
Wearing Gloves	11.021	1	0.001
Sharp Devices	337.125	3	<0.001
Treatment	5.469	2	0.065
Vaccinated	4.688	1	0.030
Reporting of NSI	2.083	1	0.149

Regarding safety measures post-NSI occurrence, a considerable proportion of HCWs (76.8%, n=192) reported using sterilized needles, reflecting a high adherence to safety protocols. However, the use of personal protective equipment (PPE) and safety boxes was reported at 58% (n=145) and 73.6% (n=184) respectively, indicating room for improvement in comprehensive protective measures adoption (Table 3). Post-injury, 38% (n=95) of the HCWs reported the incident, while 49.2% (n=123) underwent a blood test, suggesting a proactive approach by some but not all affected individuals.

The chi-square test results further elucidated the significant associations between various factors and the occurrence of NSIs. Notably, sharp devices showed the highest chi-square value (337.125, df=3, $p<0.001$), underscoring their critical role in injury

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incidents. Duty timing, reasons for NSIs, and locations of NSIs also showed strong statistical significance ($p<0.001$), indicating that these factors are crucial in understanding and mitigating the risk of NSIs among HCWs (Table 4).

These findings underscore the critical need for targeted interventions and enhanced safety protocols within healthcare settings to mitigate the risk of NSIs. The high prevalence of NSIs, combined with identified risk factors and safety measures, provides a comprehensive overview of the challenges and necessary actions required to protect healthcare workers from these preventable injuries.

DISCUSSION

In this investigation, a significant proportion of healthcare workers (76.8%) reported experiencing needlestick and sharp injuries (NSSIs) during their tenure, highlighting an endemic occupational hazard within the healthcare setting. This prevalence underscores the persistent risk faced by healthcare professionals, particularly among nursing and paramedical staff, who were identified as the groups most vulnerable to such injuries. The demographic breakdown revealed a young, predominantly educated workforce, with a significant number holding bachelor's degrees, suggesting that educational attainment does not necessarily correlate with a reduced incidence of NSSIs.

The distribution of NSSIs across different age groups and job designations provides insight into the occupational dynamics contributing to these incidents. Notably, the highest incidence of NSSIs was reported among healthcare workers aged 26-30 years and those with 2-7 years of work experience, indicating that younger, less experienced staff may be at greater risk. This could be attributed to factors such as insufficient training, higher workloads, or a lack of familiarity with safety protocols.

The study's findings align with broader trends observed in developing countries, where occupational health and safety practices in medical settings often fail to meet the necessary standards to protect healthcare workers from bloodborne pathogens (3, 19). The frequent contact with blood and other potentially infectious materials elevates the risk of transmission of diseases such as hepatitis B, hepatitis C, and HIV, making the implementation of effective safety measures crucial.

A comparison with previous research indicates that the major causes of NSSIs, such as heavy workloads and the practice of recapping needles, are consistent with factors identified by the Centers for Disease Control (CDC) as contributing to sharps-related injuries (20). The study further highlights the emergency department and laboratory settings as high-risk environments, corroborating the understanding that areas with increased exposure to needles and sharp objects pose a greater danger to healthcare workers.

Despite the known risks, the study observed that a significant gap remains in the adherence to post-exposure safety measures. While a majority of the injured healthcare workers reported using sterilized needles and personal protective equipment following an injury, less than half underwent a blood test or received hepatitis B vaccination post-exposure. This discrepancy points to a need for more robust enforcement of safety protocols and access to post-exposure prophylaxis.

Comparatively, awareness and adherence to safety measures, such as the use of gloves during phlebotomy procedures, were lower than expected, underscoring a critical area for improvement. The introduction of universal precautions by the CDC and the Occupational Safety and Health Administration (OSHA) has been a significant advancement in protecting healthcare workers from sharps injuries and bloodborne pathogen transmission. However, the effectiveness of these measures is contingent upon their consistent application in clinical practice (24, 25).

The study's limitations, including its focus on a single healthcare facility and the reliance on self-reported data, suggest that the findings may not be generalizable across different settings or regions. Future research should aim to explore the knowledge, attitudes, and practices related to NSSIs in more diverse healthcare environments, particularly in underprivileged areas with limited access to healthcare facilities.

To mitigate the risk of NSSIs and their consequent bloodborne infections, healthcare settings must prioritize the reduction of injection overuse, promote safer working conditions, and adhere strictly to universal precautions. Encouragingly, the study's identification of specific risk factors and safety measures provides a foundation for targeted interventions to enhance occupational safety for healthcare workers.

CONCLUSION

In conclusion, this study elucidates the significant challenge posed by NSSIs to healthcare workers, particularly those in nursing and paramedical roles. The findings highlight the critical need for comprehensive strategies that encompass training, adherence to safety protocols, and the provision of post-exposure care to mitigate the risk of occupational bloodborne infections.

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