

ORIGINAL ARTICLE

Factors associated with needle-stick injuries among healthcare workers in tertiary care hospital: A cross-sectional analytical study.

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ABSTRACT... Objective: To determine the 12-month frequency of self-reported needle-stick injuries (NSIs) among healthcare workers, identify associated demographic and occupational risk factors, and evaluate post-exposure care and management practices. **Study Design:** Analytical Cross-sectional study. **Period:** January to June 2025. **Setting:** Shahida Islam Teaching Hospital. **Methods:** Using stratified random sampling, 379 eligible clinical staff members were recruited. Data were collected via structured, WHO/CDC-adapted questionnaires assessing demographics, injury circumstances, and safety protocols. Bivariate analyses and multivariable binary logistic regression were performed to isolate independent predictors of NSIs while controlling for confounding variables. **Results:** The 12-month NSI prevalence was 46.2% (n=175). Hollow-bore needles were the most frequently implicated devices (52.6%), primarily during blood withdrawal. Formal incident reporting was suboptimal at 54.3%, with fear of reprimand and heavy clinical duties cited as primary barriers. Multivariable analysis demonstrated that working night or rotating shifts (aOR=2.14), high perceived workload (aOR=1.89), and lacking safety training within the preceding year (aOR=2.85) significantly elevated injury risk. Conversely, possessing five or more years of clinical experience emerged as a strong protective factor (aOR=0.45). **Conclusion:** NSIs remain a substantial occupational hazard in tertiary care environments, predominantly driven by inadequate safety training, night-shift fatigue, and heavy workloads. Implementing mandatory, hands-on safety reinforcement alongside non-punitive, simplified reporting mechanisms is urgently required to mitigate risks and improve overall post-exposure management.

Key words: Needlestick Injuries, Occupational Exposure, Post-Exposure Prophylaxis, Risk Factors.

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INTRODUCTION

Occupational exposure to sharp instruments remains a persistent vulnerability for healthcare workers (HCWs) globally. A needle-stick injury (NSI) is defined as a penetrating stab wound from a needle or similar sharp device that results in potential exposure to blood or other infectious body fluids.¹ Recent meta-analyses estimate the global pooled prevalence of NSIs among HCWs to be approximately 43.8%, with nurses, physicians, phlebotomists, and laboratory technicians facing the highest cumulative risk.² The consequences of these incidents extend well beyond immediate physical trauma. NSIs serve as the primary occupational transmission route for bloodborne pathogens, carrying a percutaneous transmission risk of up to 30% for Hepatitis B (HBV), 1.8% for Hepatitis C (HCV), and 0.3% for Human Immunodeficiency Virus (HIV).³ Beyond the physical risk, surviving

an NSI frequently triggers profound psychological distress; recent cohort data indicate that over 65% of affected HCWs experience acute anxiety and sleep disturbances, alongside substantial financial burdens related to mandatory serological testing, post-exposure prophylaxis (PEP), and potential lost workdays.⁴

Although international health bodies have established rigorous safety protocols and actively promoted the adoption of safety-engineered devices, NSI rates remain unacceptably high, particularly within high-volume, high-stress tertiary care environments where incidence rates can reach 5.2 to 7.4 injuries per 100 HCWs annually.⁵ Existing literature frequently highlights a disconnect between institutional policy and daily clinical practice.

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While many studies broadly document NSI prevalence, a critical gap remains in understanding the context specific, modifiable determinants such as specific shift patterns, procedural haste, or localized departmental workflows that actively drive these incidents in tertiary hospitals.⁶ Compounding this issue, a pervasive culture of under-reporting obscures the true magnitude of the problem. Surveillance data suggest that between 50% and 75% of all NSI events are never formally reported, preventing effective institutional accountability and masking the real barriers to post-exposure care.⁷

Identifying the precise demographic, occupational, and behavioral factors associated with NSIs is a prerequisite for designing targeted, evidence-based interventions. Modifiable occupational factors, such as inadequate rest and improper disposal practices, are estimated to contribute to nearly 45% of all preventable sharps injuries.⁸ Hospital wide safety campaigns often fail because they do not address the localized realities of specific clinical workflows. By isolating the independent predictors of NSIs within this specific tertiary care setting, hospital administration can allocate resources more effectively. This includes mandating department-specific retraining, optimizing staffing ratios during peak operational hours, and improving the physical accessibility of sharps disposal units at the point of care.⁹

OBJECTIVE

To determine the 12 month frequency of self-reported needle stick injuries among healthcare workers in a tertiary care hospital, identify the demographic, occupational, and behavioral factors independently associated with these incidents, and evaluate subsequent post-exposure management practices, including formal incident reporting and post-exposure prophylaxis (PEP) uptake.

METHODS

This analytical cross-sectional study was conducted at Shahida Islam Teaching Hospital in Lodhran from January 2025 to June 2025 after taking approval from Institutional Ethical Review Committee (Reference No: SIMC/ H.R/1914/25 DATED: 03/01/2025) and informed consent from each participant. Based on a previously reported needle stick injury (NSI)

prevalence of 43.8%², 95% confidence level and 5% margin of error, the calculated sample size was 379 participants. The target population comprised healthcare workers (HCWs) directly involved in patient care. Eligible participants included physicians, nurses, phlebotomists, laboratory technicians and surgical staff who had been continuously employed at the facility for minimum of six months. Administrative personnel, non-clinical support staff and individuals on extended medical or administrative leave during the study period were excluded. To ensure proportional representation across different clinical roles and mitigate selection bias, stratified random sampling technique was used. The HCW population was first divided into distinct strata based on their profession and primary department. Participants were then randomly selected from each stratum in proportion to its size within the overall hospital workforce.

Data were gathered using structured questionnaire adapted from established World Health Organization (WHO) and Centers for Disease Control and Prevention (CDC) needle-stick injury surveillance instruments. The instrument was organized into four primary sections. The first captured socio-demographic details and occupational characteristics, including age, gender, profession, department, years of experience, typical shift type and perceived workload. The second section assessed NSI history over the preceding 12 months, documenting injury frequency, specific circumstances and the type of device involved. The final sections evaluated prior safety training, the availability of safety engineered devices, Hepatitis B vaccination status, and post-exposure actions, specifically formal incident reporting and the uptake of post-exposure prophylaxis (PEP). The dependent variable was defined as the occurrence of at least one NSI in the past 12 months (Yes/No), while the occupational and demographic factors served as the independent variables.

Statistical analyses were performed using SPSS version 25.0. Categorical variables were summarized as frequencies and percentages, while continuous variables were presented as means with standard deviations or medians with interquartile ranges, depending on their distribution normality. Bivariate

associations between the independent variables and the occurrence of NSIs were initially examined using the Chi-square test or Fisher's exact test, as appropriate. Variables demonstrating p-value of <0.20 in the bivariate analysis were subsequently entered into a multivariable binary logistic regression model to control for potential confounding. This final model identified the independent predictors of needle-stick injuries, with results expressed as Adjusted Odds Ratios (aOR) alongside their corresponding 95% Confidence Intervals (CI). Statistical significance was established at p-value of <0.05 .

RESULTS

The mean age of the participants was 31.4 years (standard deviation [SD] = 6.8). The cohort was predominantly female (62.5%, $n=237$). Nurses constituted the largest professional group (44.6%, $n=169$), followed by physicians (26.1%, $n=99$), laboratory technicians (15.3%, $n=58$), surgical staff (9.5%, $n=36$), and phlebotomists (4.5%, $n=17$). More than half of the respondents (56.2%, $n=213$) reported working regular night shifts, and 41.2% ($n=156$) perceived their daily clinical workload as high (Table-I).

The overall 12-month frequency of self-reported needle stick injuries (NSIs) was 46.2% ($n=175$). Among the injured HCWs, 38.3% ($n=67$) experienced multiple incidents during the study period. Hollow-bore needles were the most frequently implicated devices 52.6% ($n=92$), followed by suture needles 24.0% ($n=42$) and scalp vein sets 16.6% ($n=29$). Blood withdrawal (41.1%) and intravenous cannulation (33.7%) accounted for the majority of injury-causing procedures. Recapping needles was reported as the primary mechanism of injury in 28.0% of cases, while accidental punctures during active procedures accounted for 45.7% (Table-II).

Post-exposure management practices revealed significant gaps in institutional protocol adherence. Only 54.3% ($n=95$) of the injured HCWs formally reported their incidents to the hospital infection control department. The most commonly cited reasons for non-reporting included the perception that the injury was minor (42.5%, $n=34$), lack of time due to heavy clinical duties (31.2%, $n=25$), and fear

of professional reprimand (18.7%, $n=15$). Regarding prophylactic measures, 61.1% ($n=107$) initiated or updated their Hepatitis B vaccination series, while only 22.3% ($n=39$) received post-exposure prophylaxis (PEP) for HIV (Table-III).

Bivariate analysis identified several variables significantly associated with the occurrence of NSIs ($p < 0.05$). HCWs who worked night shifts, perceived their workload as high, lacked formal safety training in the preceding 12 months, and had less than five years of clinical experience demonstrated a significantly higher incidence of injuries. Additionally, profession and department were strongly linked to injury rates, with nurses and laboratory technicians showing the highest crude odds of sustaining an NSI compared to physicians. Variables such as age, gender, and Hepatitis B vaccination status did not show a statistically significant association with NSI occurrence in the unadjusted models (Table-IV).

Variables achieving p-value of <0.20 in the bivariate stage (profession, clinical experience, shift type, perceived workload, and safety training) were incorporated into a multivariable binary logistic regression model to isolate independent predictors. After adjusting for potential confounders, working night or rotating shifts remained a strong predictor of NSIs (Adjusted Odds Ratio [aOR] = 2.14, 95% CI: 1.32–3.48, $p = 0.002$). The absence of safety training within the last year more than doubled the risk of injury (aOR = 2.85, 95% CI: 1.65–4.92, $p < 0.001$). High perceived workload was also independently associated with increased injury risk (aOR = 1.89, 95% CI: 1.15–3.10, $p = 0.012$). Conversely, having five or more years of clinical experience was protective against NSIs (aOR = 0.45, 95% CI: 0.26–0.78, $p = 0.004$) (Table-V).

DISCUSSION

The findings of this study reveal a substantial 12-month prevalence of needle-stick injuries (NSIs) at 46.2% among healthcare workers in a tertiary care setting in Pakistan. This rate aligns closely with recent multicenter data from the region, which report prevalence figures ranging between 40% and 52% in similar high-volume public hospitals.¹⁰

TABLE-I

Socio-demographic and Occupational Characteristics of Healthcare Workers (n=379)

Characteristic	Category	Frequency (n)	Percentage (%)
Age (years)	18–25	84	22.2
	26–35	192	50.6
	> 35	103	27.2
Gender	Male	142	37.5
	Female	237	62.5
Profession	Nurses	169	44.6
	Physicians	99	26.1
	Laboratory Technicians	58	15.3
	Surgical Staff	36	9.5
	Phlebotomists	17	4.5
Clinical Experience	< 5 years	188	49.6
	≥ 5 years	191	50.4
Typical Shift Type	Day shifts only	166	43.8
	Night shifts / Rotating	213	56.2
Perceived Workload	Low to Moderate	223	58.8
	High	156	41.2

TABLE-II

Characteristics and Circumstances of Needle-Stick Injuries (n=175)

Variable	Category	Frequency (n)	Percentage (%)
Injury Frequency (past 12 months)	1 time	108	61.7
	2–3 times	45	25.7
	> 3 times	22	12.6
Device Involved	Hollow-bore needle	92	52.6
	Suture needle	42	24.0
	Scalp vein set	29	16.6
	Other / Unknown	12	6.8
Procedure During Injury	Blood withdrawal	72	41.1
	Intravenous cannulation	59	33.7
	Injections / Medication administration	26	14.9
	Surgical / Suturing	18	10.3
Mechanism of Injury	Puncture during active procedure	80	45.7
	Recapping a used needle	49	28.0
	Improper disposal in sharps container	28	16.0
	Handling contaminated waste	18	10.3

TABLE-III

Post-Exposure management and reporting behaviors among injured HCWs (n=175)

Action / Behavior	Yes n (%)	No n (%)
Washed wound immediately with soap/water	158 (90.3)	17 (9.7)
Formally reported incident to administration	95 (54.3)	80 (45.7)
Source patient tested for bloodborne pathogens	82 (46.9)	93 (53.1)
Initiated / Updated Hepatitis B vaccination	107 (61.1)	68 (38.9)
Received HIV Post-Exposure Prophylaxis (PEP)	39 (22.3)	136 (77.7)
Reasons for Non-Reporting (n=80)		
Perceived injury as minor / low risk	34 (42.5)	-
Lack of time / heavy clinical duties	25 (31.2)	-
Fear of professional reprimand / stigma	15 (18.7)	-
Unaware of reporting protocol	6 (7.5)	-

TABLE-IV

Bivariate Analysis of Factors Associated with Needle-Stick Injuries (n=379)

Variable	Category	NSI Yes (n=175) n (%)	NSI No (n=204) n (%)	P-Value	Crude OR (95% CI)
Age (years)	18–25	42 (50.0)	42 (50.0)	0.412	1.00 (Ref)
	26–35	91 (47.4)	101 (52.6)		0.90 (0.54–1.50)
	> 35	42 (40.8)	61 (59.2)		0.69 (0.39–1.21)
Gender	Male	62 (43.7)	80 (56.3)	0.385	0.82 (0.53–1.28)
	Female	113 (47.7)	124 (52.3)		1.00 (Ref)
Profession	Physicians	28 (28.3)	71 (71.7)	<0.001	1.00 (Ref)
	Nurses	94 (55.6)	75 (44.4)		3.18 (1.84–5.49)
	Lab Techs / Others	53 (56.4)	41 (43.6)		3.28 (1.82–5.91)
Clinical Experience	< 5 years	104 (55.3)	84 (44.7)	0.003	1.85 (1.22–2.80)
	≥ 5 years	71 (37.2)	120 (62.8)		1.00 (Ref)
Shift Type	Day shifts only	58 (34.9)	108 (65.1)	<0.001	1.00 (Ref)
	Night / Rotating	117 (54.9)	96 (45.1)		2.27 (1.48–3.48)
Perceived Workload	Low to Moderate	76 (34.1)	147 (65.9)	<0.001	1.00 (Ref)
	High	99 (63.5)	57 (36.5)		3.36 (2.16–5.22)
Safety Training (past year)	No	112 (58.0)	81 (42.0)	<0.001	3.45 (2.22–5.36)
	Yes	63 (33.5)	125 (66.5)		1.00 (Ref)

TABLE-V

Multivariable Logistic Regression Analysis for Independent Predictors of Needle-Stick Injuries (n=379)

Independent Variable	Category	Adjusted OR (aOR)	95% Confidence Interval	P-Value
Clinical Experience	< 5 years	0.45	0.26 – 0.78	0.004
	≥ 5 years	1.00 (Ref)		
Shift Type	Day shifts only	1.00 (Ref)	1.32 – 3.48	0.002
	Night / Rotating shifts	2.14		
Perceived Workload	Low to Moderate	1.00 (Ref)	1.15 – 3.10	0.012
	High	1.89		
Safety Training (past year)	Yes	1.00 (Ref)	1.65 – 4.92	<0.001
	No	2.85		

The predominance of hollow-bore needles (52.6%) and injuries occurring during blood withdrawal or intravenous cannulation reflects global patterns, where these high-risk procedures are performed most frequently.¹¹ Notably, recapping remained a primary mechanism of injury in over a quarter of cases. Despite decades of explicit guidelines prohibiting this practice, it persists as a deeply ingrained habit, particularly in resource-constrained environments where immediate access to point-of-care sharps disposal containers may be inconsistent.¹²

A critical concern highlighted by this study is the profound gap in post-exposure management. Nearly half of the injured workers (45.7%) failed to formally report their incidents. This under reporting mirrors findings from recent Pakistani cohorts, where fear of professional stigma, perceived triviality of the injury, and overwhelming clinical duties serve as primary deterrents.¹³ Consequently, the uptake of HIV post-exposure prophylaxis (PEP) was alarmingly low at 22.3%. When incidents go unreported, institutional infection control teams cannot assess source patient status or initiate timely prophylactic protocols, leaving workers unnecessarily vulnerable to bloodborne pathogen transmission.¹⁴

The multivariable analysis successfully isolated several modifiable occupational predictors of NSIs. Working night or rotating shifts more than doubled the risk of injury (aOR = 2.14). Fatigue and disrupted circadian rhythms during night shifts are well-documented contributors to procedural errors and diminished situational awareness.^{15,16} Similarly, high perceived workload independently increased injury risk (aOR = 1.89), suggesting that procedural haste in understaffed departments directly compromises sharps safety. Conversely, having five or more years of clinical experience emerged as a protective factor (aOR = 0.45). This likely reflects the development of refined motor skills, better hazard recognition, and established safe habits over time. Most alarmingly, the absence of safety training within the preceding year more than doubled the odds of sustaining an NSI (aOR = 2.85), underscoring that theoretical knowledge of safety protocols degrades rapidly without regular, hands-on reinforcement.^{17,18,19}

This study possesses several methodological strengths, including the use of stratified random sampling, which ensured proportional representation across diverse clinical professions. The application of a validated WHO/CDC surveillance tool and multivariable logistic regression further strengthens the reliability of the identified predictors by controlling for potential confounding variables. However, certain limitations must be acknowledged. The cross-sectional design precludes the establishment of causal relationships between the identified risk factors and NSI occurrence. Furthermore, reliance on self-reported data introduces the potential for recall bias, particularly regarding the exact circumstances of injuries over 12-month period. Finally, as single center study conducted in one tertiary hospital, the findings may not be generalizable to primary care facilities.

Based on these findings, several targeted recommendations are proposed for hospital administration. First, the institution must mandate annual, hands-on safety training that specifically addresses high-risk scenarios like night shift procedures and proper sharps disposal, moving beyond passive, lecture-based formats. Second, simplified digital reporting system should be implemented to remove the bureaucratic friction and fear of reprimand that currently deter incident reporting. Third, hospital management should conduct a workflow audit to ensure adequate staffing ratios during night shifts and peak hours, thereby reducing the procedural haste associated with high workloads. Finally, strict enforcement of the “no recapping” policy, coupled with the guaranteed availability of safety engineered devices and point of care sharps containers, is essential to mitigate preventable injuries.

CONCLUSION

Needle-stick injuries remain a highly prevalent occupational hazard in this tertiary care setting, driven primarily by inadequate safety training, high workloads, and night-shift fatigue. Implementing non-punitive reporting systems and mandatory, hands-on safety reinforcement is urgently required to protect healthcare workers and improve post-exposure management.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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2	Rabia Abbas: Data collection.
3	Ali Altaf: Data analysis.
4	Ayesha Muzaffar: Data interpretation.
5	Saba Muazzam: Data entry.
6	Hafiza Naima Anwar: Proof reading.