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Prevalence of Needle Stick Injuries and Its Associated Factors Among Nursing Staff-A Retro Prospective Study

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ABSTRACT

Background: Needle stick injuries (NSIs) are accidental percutaneous injuries caused by needles and other sharp medical devices and represent one of the most significant occupational hazards for healthcare workers. In developing countries, NSIs are strongly associated with transmission of blood-borne infections such as Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), and Hepatitis C Virus (HCV). Nurses are particularly vulnerable due to their frequent exposure to invasive procedures.

Aim & Objectives: To determine the prevalence of needle stick injuries among nursing staff
To identify the factors associated with the occurrence of needle stick injuries
To assess knowledge and practices regarding prevention of needle stick injuries among nursing staff

Material & Methods: A retro-prospective study was conducted among 415 nursing staff at a tertiary care hospital in Hyderabad, India. Retrospective NSI data were collected for a three-year period (January 2023 to December 2025) from incident reports and NSI logs. Prospective data were collected using a pre-designed, validated, self-administered questionnaire assessing socio-demographic characteristics, exposure details, and knowledge and practices related to NSI prevention. Data were analyzed using SPSS software. Descriptive statistics and chi-square tests were applied, with logistic regression used to identify independent predictors.

Results: During the **retrospective period**, a total of **41 needle stick injuries (NSIs)** were reported. The annual prevalence demonstrated a **declining trend**, decreasing from **64% in 2023** to **33% in 2025**. This reduction coincided with the implementation of a **30-day NSI awareness campaign conducted in June 2025 as a part of the Infection Control Nursing Council (ICNC) Activity** . As part of this initiative, **educational videos demonstrating correct techniques for removing needles from insulin pens** were shared through staff communication groups. The temporal association between this focused awareness

intervention and the subsequent decline in NSI incidence suggests a **potential positive impact of targeted education and reinforcement of safe practices**, particularly in relation to insulin pen handling.

Common circumstances associated with NSIs during the retrospective period included **patient movement during insulin administration**, **blood sample collection**, **improper waste segregation**, and **removal of needles from pen devices**.

In the **prospective analysis**, the overall prevalence of NSI was **7.7% (32/415)**. The majority of affected nurses were aged **20–29 years (84.4%)**, **female (90.6%)**, **junior staff nurses (53.1%)**, **unmarried (90.6%)**, and **degree-qualified (68.8%)**. **Fingers** were the most common site of injury (**84.4%**), and **conventional syringe needles** accounted for **59.4%** of reported injuries.

Statistical analysis revealed that **age group** was the only variable significantly associated with NSI occurrence ($\chi^2 = 13.51$, $p = 0.0037$), although the effect size was small. No statistically significant associations were observed with **gender, designation, marital status, educational qualification, or years of experience**

Conclusion: The prevalence of NSIs among nursing staff was moderate, with younger nurses being more vulnerable. Strengthening training programs, improving adherence to safe injection practices, and reinforcing reporting mechanisms are essential to reduce occupational exposure.

Recommendations: Based on the findings of the present study, which demonstrate a modest but significant association between younger age and needle stick injury (NSI) occurrence, alongside the limited predictive value of socio-demographic factors overall, the following recommendations are proposed Strengthen Orientation and Induction Programs for Newly Appointed Nurses and Enhance Supervision during High-Risk Procedures There is a need for on-going training activities regarding safe injection practices and protective device usage among the nursing staff in the hospital. Information, education, and communication materials should be exhibited prominently at the places of every worksite. Self-reporting of NSI should be emphasized in all the nursing staff in the hospital.

Keywords: Prevalence Awareness, Exposures, Needle stick injuries, Nursing staff, Percutaneous.

INTRODUCTION

Needle Stick Injuries (NSIs) are defined as an accidental skin penetrating injury caused by needles such as hypodermic needles, blood-collection needles, intra venous (IV) catheter styles, and needles of IV delivery system.(1) Needle stick injuries (NSIs) are one of the key factors for blood-borne infections. It is the single greatest occupational hazard to medical personnel.(2) Health care personnel who are exposed to needles in their clinical activities are at risk of getting needle stick injuries which may lead to serious and fatal infections with blood-borne pathogens such as human immunodeficiency virus (HIV), hepatitis B virus, hepatitis C virus.(3) Worldwide, there is gross underreporting of NSIs with the actual incidence of NSIs being much higher than that reported.(4) Centre for Disease Control (CDC), Atlanta, United States of America estimated that exposure to blood and body fluids by sharp objects and NSIs affect around three million health care personnel annually with an estimated occurrence of six million NSIs each year.(5)

The average risk of transmission of HIV, Hepatitis B, and Hepatitis C to health care workers after percutaneous exposure is 0.1% to 0.3%, 10% to 30%, and 3% to 10% respectively.(6) Needle stick injury is associated with the highest global prevalence of HIV, Hepatitis B, and Hepatitis C in

developing countries.(7) Staff nurses have the highest rate of NSIs among other health care workers due to their maximum exposure to the needles and other sharp items.(8) The psychological consequences of NSIs can result in anxiety, depression and emotional stress. This needs intensive programmes regarding awareness and knowledge to educate nurses on various aspects of needle stick injury preventive measures. It is anticipated that about three-fourth (75%) of the NSIs in developing countries are not reported.(9) However, several studies consistently found that a very high proportion of health care workers receive NSIs while performing their work, both in India and globally and factors associated with an increased risk of occupational exposure to NSIs differ from place to place.(10)

Globally, needle stick injuries contribute significantly to occupational morbidity among healthcare workers. In developing countries the burden is higher due to increased patient load, limited resources, and inadequate use of safety devices.Inderreporting of NSIs further complicates prevention efforts. Therefore, assessing the prevalence and associated factors of NSIs is essential for improving occupational safety among nursing staff our research aims to know the prevalence of needle stick injuries among nursing staff at the Apollo hospital, Hyderabad. By determining the frequency of NSIs and examining the associated factors, we intend to identify the most susceptible groups within the nursing staff, understand the reasons behind these incidents, and propose evidence-based interventions to prevent and mitigate the risks of needle stick injuries effectively.

MATERIALS & METHODS

Study Type, study population, study area and duration: A Retro prospective study was conducted at Apollo hospital in Hyderabad India during January 2023 to March 2026 retrospectively collected NSI Incidents from incident forms and NSI Log and Prospectively Knowledge & practice was observed through Pre-designed, pre-tested, structured, close-ended, self-administered questionnaire about needle stick injury and observational checklist. Questionnaire consists of 3 parts .The first part (6) questions about socio demographic profile of staff nurses (Age,Gender,Designation,Marital status, Educational status& Years of experiences) , 2nd part (7) questions about Environmental and circumstances features of nurses exposed to NSIs (Frequency of injury/Exposed to NSI,Site of injury, sharp associated with NSI,Circumstances of injury, Reporting after injury, Intervention required and post exposure prophylaxis) and third part (14) questions about Knowledge and practice regarding NSI Prevention by using Google sheet. Before the start of study, validation of questionnaire was ensured, by in-depth discussion with experts regarding various correlates and lastly by conducting a pilot study a score of one for a correct answer and zero for incorrect answers was awarded

Working Definition: Needle Stick Injury (NSI) was operationally defined as any cut or prick to the respondents by a needle used on a patient which was work-related and sustained within the hospital premises.(11) We had considered any episode of NSI encountered at the present working place

Ethical Approval and Consent: The study commenced after taking prior approval from institutional ethics committee. The nursing staffs were explained about the purpose of the research and anonymity was maintained at all levels

Sample size: Used convenient sampling method to include the participants. 50% (415 n) of the nursing staff working at ICUs, Wards, OTs, and Emergency & OPDs included in the study

Strategy for data collection: 3 years NSI Exposure history collected from incident reporting forms and After obtaining their informed consent, the questionnaire was distributed to all nursing staff who were working in various areas of the hospital departments, intensive care units, Wards operation theatre,

emergency ward and outpatient department, excluding Nurses on long term leave during study period. On the same day questionnaire was collected. Total nursing staff 830 Out of 50% sample included in the study all 415 samples completed 3 parts. From February 15th to March 7th 2026 for quality assurance of data, on each survey day in evening, the questionnaire was checked for completeness. If any information was missing or there was any confusion regarding any particulars, the respective participants were revisited again on the next day.

Inclusion criteria: The study includes the staff nurses who were actively involved in patient care, willing to participate in the study, available at the time of data collection

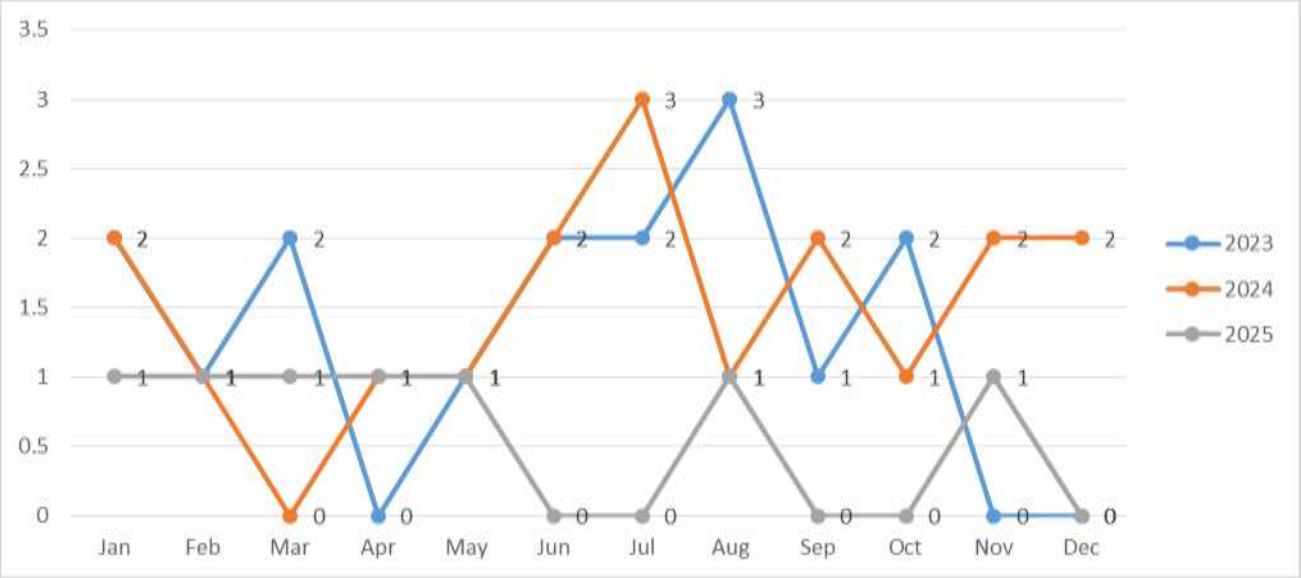
Exclusion criteria: The study excludes nursing staff on long leave during study period

Statistical analysis: The data collected was entered in the Microsoft excel spreadsheet and later analysed using SPSS software. Frequency and percentages were used to describe the variables. Chi square test was applied for determination of any significant association between the variables. Odds ratios with 95% confidence intervals was also calculated for association with the factors related to NSI. To determine independent predictors of NSI in the study population, p values

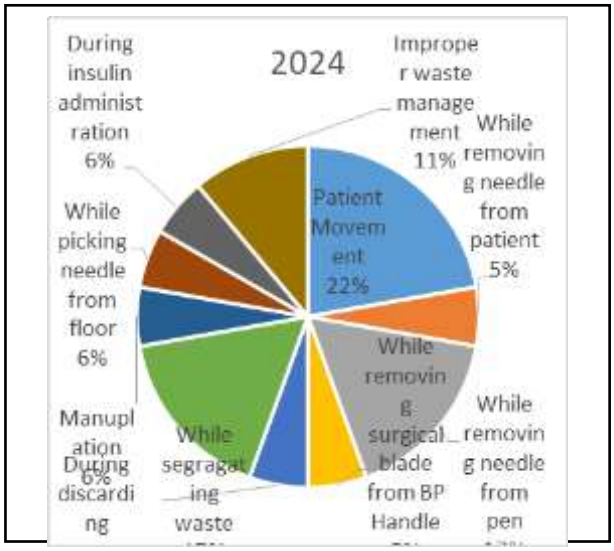
RESULTS

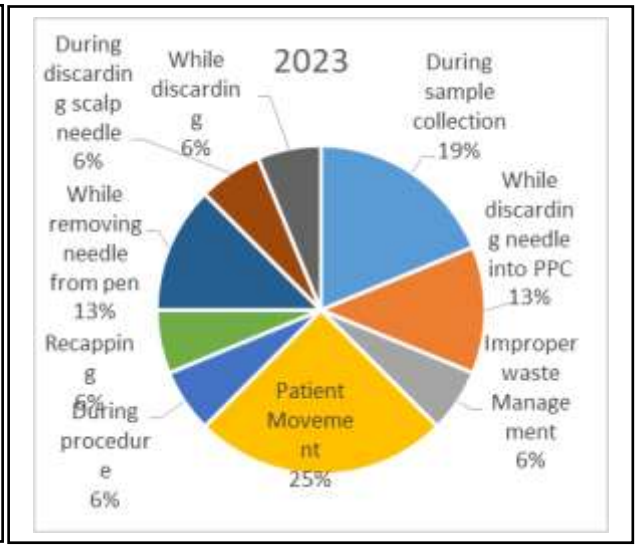
During the three-year study period (January 2023 to December 2025), a total of 41 needle stick injury (NSI) cases were reported among nursing staff.

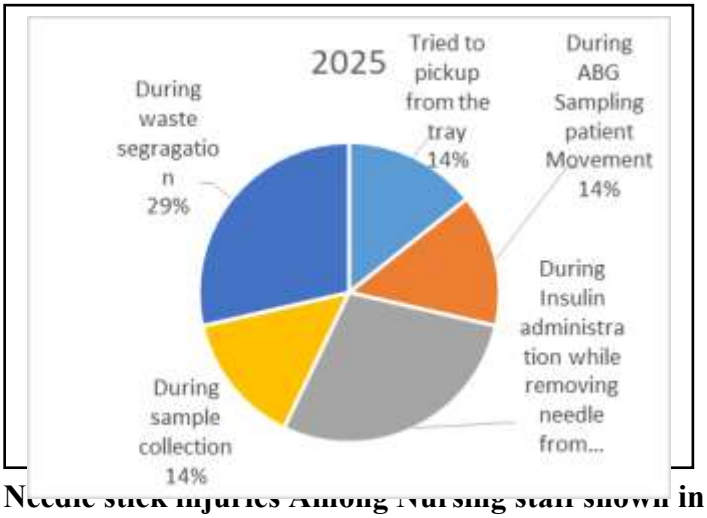
The month wise reporting of the NSIs with the annual trend is shown in Figure -1



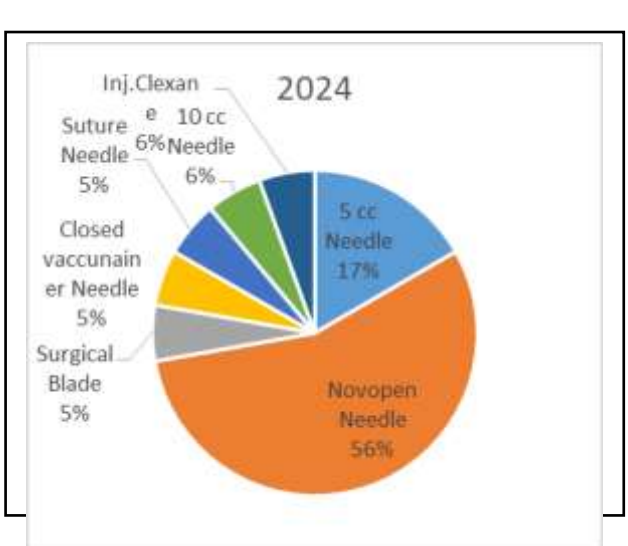
Reasons Associated with Needle stick injuries Among Nursing staff shown in Figure-II

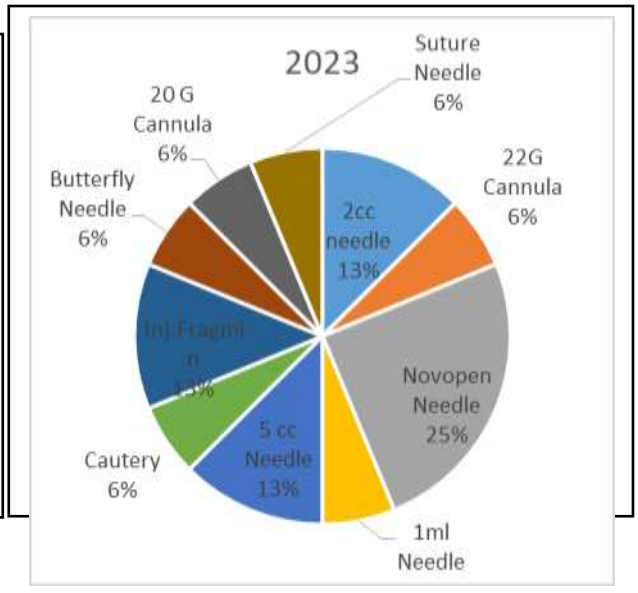


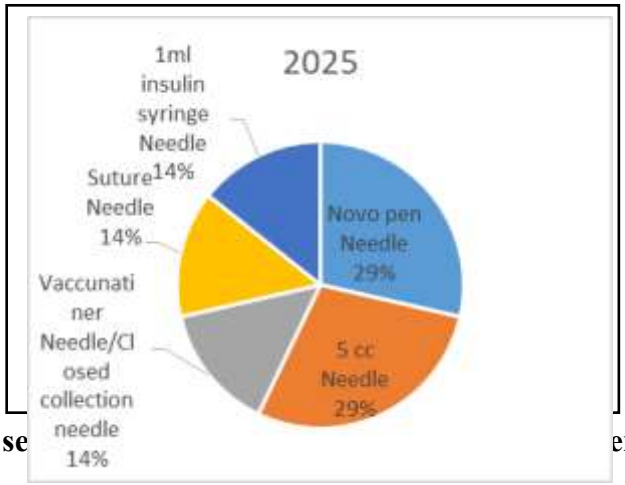




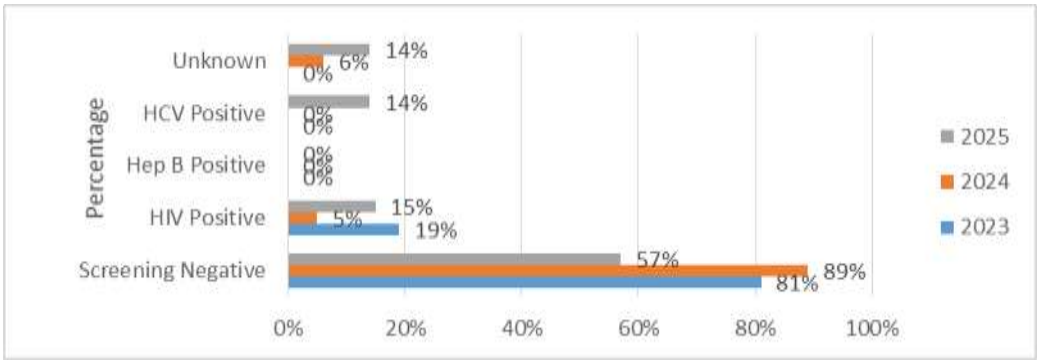
Sharps Associated with Needle stick injuries Among Nursing staff shown in Figure-III







The data of the se **entage Figure IV**



During the three-year retrospective period, a total of 41 needle stick injuries (NSIs) were reported among nursing staff. In **2023**, out of 16 NSIs, **three nurses (19%)** were exposed to sources confirmed to be **HIV-positive**. All exposed nurses had **protective hepatitis B surface antibody titers** at the time of exposure. Appropriate **post-exposure prophylaxis (PEP)** for HIV was initiated as per institutional protocol.

In **2024**, among 18 reported NSIs, **one staff nurse (5%)** sustained an exposure from an **HIV-positive source**, and **one case (6%)** involved an **unknown source**. PEP was administered for both HIV-positive and unknown source exposures in accordance with hospital guidelines.

In **2025**, out of 7 NSIs, **one nurse (15%)** was exposed to an **HIV-positive source**, **one nurse (14%)** to an **HCV-positive source**, and **one case (14%)** involved an **unknown source**. HIV PEP was provided for exposures involving HIV-positive and unknown sources. The healthcare worker exposed to an HCV-positive source received counseling as per hospital protocol and was advised serological follow-up at **3 months and 6 months**.

TABLE 1. SOCIO-DEMOGRAPHIC PROFILE OF STAFF NURSES (N = 415)

S. No	Variables	Category	Frequency (n)	Percentage (%)
1	Age Groups	20-29 years	370	89.2
	Age Groups	30-39 years	32	7.7
	Age Groups	40-49 years	12	2.9
	Age Groups	50 years above	1	0.2
2	Gender	Female	380	91.6
	Gender	Male	35	8.4

3	Designation	Junior Staff Nurse	247	59.5
	Designation	Senior staff nurse	168	40.5
4	Marital Status	Unmarried	367	88.4
	Marital Status	Married	48	11.6
5	Educational Status	Degree	293	70.6
	Educational Status	Diploma	122	29.4
6	Years of Experience	< 1 Year	143	34.5
	Years of Experience	<1 Year	0	0
	Years of Experience	1-2 Years	128	30.8
	Years of Experience	1–2 Years	0	0
	Years of Experience	2-3 Years	72	17.3
	Years of Experience	2–3 Years	0	0
	Years of Experience	Above 3 years	72	17.3
	Years of Experience	>3 Years	0	0

TABLE-11. ASSOCIATION OF NEEDLE STICK INJURY WITH VARIOUS FACTORS AMONG STAFF NURSES

Variable	Subgroup	Yes n (%)	No n (%)	Chi-square p	Exp(β)	95% CI
Duration of service	>3 years	6 (8.3%)	66 (91.7%)	p=1.000	1	
Duration of service	≤3 years	26 (7.6%)	317 (92.4%)	p=1.000	0.9	0.357-2.279
Marital status	Married	3 (6.2%)	45 (93.8%)	p=0.908	1	
Marital status	Unmarried	29 (7.9%)	338 (92.1%)	p=0.908	1.3	0.377-4.397
Education	Degree	22 (7.5%)	271 (92.5%)	p=0.970	1	
Education	Diploma	10 (8.2%)	112 (91.8%)	p=0.970	1.1	0.505-2.397

TABLE III.DISTRIBUTION OF STAFF NURSES WHO EXPERIENCED NEEDLE STICK INJURY (NSI = YES) — COMBINED TABLE (N = 32)

Variable	**Subgroup**	**Frequency (n)**	**Percentage (%)**
Age Group	20–29 years	27	84.4
			1
			2
	30–39 years	2	6.2
			1
			2

	40–49 years	2	6.2 1 2
	50 years above	1	3.1 1 2
Gender	Female	29	90.6 1 2
	Male	3	9.4 1 2
Designation	Junior Staff Nurse	17	53.1 1 2
	Senior Staff Nurse	15	46.9 1 2
Marital Status	Unmarried	29	90.6 1 2
	Married	3	9.4 1 2
Educational Status	Degree (B.Sc/M.Sc)	22	68.8 1 2
	Diploma (GNM)	10	31.2 1 2
Years of Experience	< 1 Year	9	28.1 1 2
	1–2 Years	10	31.2 1 2
	2–3 Years	6	18.8 1 2
	Above 3 years	7	21.9 1

			2

TABLE IV.DISTRIBUTION OF STAFF NURSES WHO EXPERIENCED NEEDLE STICK INJURY ACCORDING TO VARIOUS CHARACTERISTICS. (N = 32)

Variable	Category	Frequency (n)	Percentage %
Age Group	20-29 yrs	27	84.4
	30-39 yrs	2	6.2
	40-49 yrs	2	6.2
	50+ yrs	1	3.1
Gender	Female	29	90.6
	Male	3	9.4
Designation	Junior Staff Nurse	17	53.1
	Senior Staff Nurse	15	46.9
Years of Experience	<1 year	8	25
	1-2 years	12	37.5
	2-3 years	6	18.8
	>3 years	6	18.8
Department	ER/EMERGENCY	5	15.6
	OPD	5	15.6
	REG-2	4	12.5
	MICU 1	4	12.5
	TRACHEOSTOMY	3	9.4
	NURSING	2	6.2
	T WARD	2	6.2
	MICU	2	6.2
	PICU	1	3.1
	Micu2	1	3.1
	CATHLAB	1	3.1
	DIALYSIS	1	3.1
	KTU	1	3.1
Site of Injury	Fingers	26	81.2
	Other parts	2	6.2
	Not applicable	2	6.2
	Palms	2	6.2
Sharp Involved	Conventional syringe needle (2/5/10cc)	19	59.4
	Insulin/pen needle	8	25
	Other/NA	3	9.4
	IV stylet	2	6.2
Circumstances of Injury	While removing needle from pen/removing needle from patient	16	50

	During blood sampling/cannulation	9	28.1
	During cleaning	9	28.1
	During needle disposal	6	18.8
	During cannulation/injections	4	12.5
	Improper waste management	4	12.5
	During insulin administration/removing pen needle	4	12.5
	During waste segregation	3	9.4
	During patient movement	3	9.4
	Not applicable	2	6.2
Reporting of Injury	Yes	27	84.4
	No	5	15.6
Intervention Required	Yes	6	18.8
	No	26	81.2

In the prospective phase of the study, a total of **415 staff nurses** were included in the analysis. The overall **prevalence of needle stick injury (NSI)** was **7.7% (32/415)**, while **92.3% (383/415)** of nurses reported no history of NSI during the study period.

Descriptive analysis revealed that among nurses who sustained NSIs (**N = 32**), the majority belonged to the **20–29-year age group (84.4%)**, were **female (90.6%)**, **junior staff nurses (53.1%)**, **unmarried (90.6%)**, and **degree-qualified (68.8%)**. With respect to work experience, most NSI-positive nurses had **1–2 years of service (31.2%)**, followed by those with **less than one year of experience (28.1%)**.

Chi-square analysis was performed to assess the association between NSI occurrence and selected socio-demographic variables. A **statistically significant association** was observed only with **age group** ($\chi^2 = 13.51$, $p = 0.0037$), indicating that **younger nurses were more frequently affected**. The effect size was small but notable (Cramér's V = 0.18). No statistically significant associations were identified between NSI occurrence and **gender, designation, marital status, educational qualification, or years of experience** ($p > 0.05$ for all).

Further, a multivariable **logistic regression model**, including age, gender, designation, educational status, and experience (>3 years), did not identify any strong independent predictors of NSI occurrence. The model demonstrated **low explanatory power** (pseudo-R^2 = 0.018), suggesting that socio-demographic factors alone accounted for minimal variation in NSI risk.

Overall, the findings indicate that while **age—particularly the 20–29-year group—was associated with higher NSI occurrence**, other socio-demographic variables did not show meaningful statistical associations.

DISCUSSION

The present study assessed the socio-demographic profile of staff nurses and examined factors associated with needle stick injuries (NSIs) among **415 nurses** working in a tertiary care hospital. The overall prevalence of NSIs was **7.7%**, which is consistent with reported global estimates ranging from **4% to 14%** among nursing personnel, although higher rates have been documented in high-risk clinical settings. This finding indicates that NSIs remain a persistent occupational hazard despite established preventive guidelines.

In the present dataset, NSI occurrence was disproportionately higher among **younger nurses aged 20–29 years**, who accounted for **84.4%** of all NSI-positive cases. This observation aligns with previous studies suggesting that younger or early-career nurses are more vulnerable to occupational exposures due to factors such as limited procedural experience, unfamiliarity with complex clinical workflows, adaptation to high workload demands, and challenges associated with the transition into professional practice.

Despite the higher burden of NSIs among younger nurses, chi-square analysis demonstrated that **age group was the only socio-demographic variable significantly associated with NSI occurrence** ($\chi^2 = 13.51$, $p = 0.0037$). However, the effect size was small (Cramér's V = 0.180), indicating that although age is statistically relevant, it explains only a modest proportion of the variation in injury occurrence. Other variables—including **gender, marital status, designation, educational qualification, and years of experience**—did not show statistically significant associations with NSI risk ($p > 0.05$ for all). These findings suggest that NSI occurrence in this setting is more strongly influenced by **workflow characteristics, task-related exposures, and procedural environments** rather than inherent personal or demographic factors.

The absence of a significant association between **designation** and NSI risk is noteworthy. Although senior nurses are expected to possess greater procedural expertise, both **junior (53.1%) and senior nurses (46.9%)** contributed comparably to NSI cases. This may reflect similar exposure frequencies to invasive procedures, patient turnover, and environmental hazards across designations. Likewise, no significant association was observed between **years of experience** and NSI occurrence ($\chi^2 = 1.48$, $p = 0.688$), despite a higher proportion of NSIs among nurses with **less than one year or 1–2 years of service**. This finding may indicate that exposure opportunities and procedural responsibilities are distributed relatively evenly across experience levels within the institution.

The lack of association between **educational qualification** and NSI risk further suggests that theoretical knowledge alone does not ensure safe needle-handling practices. Instead, consistent adherence to safety protocols, reinforcement through hands-on training, supervision, and institutional safety culture are likely to play a more critical role. This interpretation is supported by the multivariable logistic regression analysis, in which none of the examined predictors—including age, gender, designation, education, and experience—emerged as strong independent determinants of NSI occurrence. The regression model demonstrated **minimal explanatory power (pseudo-$R^2 = 0.018$)**, underscoring the limited contribution of socio-demographic factors alone in predicting NSI risk.

Regarding injury characteristics, **fingers** were the most common site of NSI, reported by **27 nurses (84.4%)**, consistent with the mechanics of needle handling during clinical procedures. **Conventional syringe needles (2/5/10 cc)** were the most frequently involved sharps (**59.4%**). The most common circumstances leading to injury included **removal of needles from pen devices (50%)**, followed by **blood sampling (28.1%)**. A high proportion of injuries (**84.4%**) were reported, reflecting satisfactory

reporting practices within the institution, although continued emphasis on complete and timely reporting remains essential.

Collectively, these findings highlight the importance of **targeted preventive strategies**, particularly for **younger and newly inducted nurses**, who represent the most vulnerable group in this study. Interventions such as **enhanced onboarding programs, simulation-based competency training, periodic refresher sessions, and structured supervision during high-risk procedures** may help reduce early-career vulnerability to NSIs.

Furthermore, the study underscores the need for **strengthened occupational surveillance systems**, including standardized reporting mechanisms, real-time monitoring, and incorporation**,** Finally, the findings suggest that NSI risk is **widely distributed across demographic groups** rather than confined to a single category, reinforcing the importance of a **hospital-wide safety culture**, strict compliance with **standard precautions**, and consistent adherence to **safe injection and sharps disposal practices** among all nursing staff.

CONCLUSION

In this tertiary care setting (**N = 415**), the prevalence of needle stick injury (NSI) among nursing staff was **7.7% (32/415)**. **Age group** was the only factor showing a statistically significant—though small—association with NSI occurrence (χ^2 = 13.51, p = 0.0037; Cramér's V = 0.18), with a higher concentration of injuries observed among nurses aged **20–29 years**. No meaningful associations were identified between NSI occurrence and **gender, designation, marital status, educational qualification, or years of experience**. Multivariable logistic regression analysis demonstrated **no strong independent predictors**, with **very low explanatory power** (pseudo-$R^2 \approx 0.018$). Collectively, these findings suggest that NSI risk in this setting is **broadly distributed across socio-demographic groups**, while younger age may represent a **modestly elevated vulnerability** rather than a dominant determinant.

From a practical perspective, the findings support a **hospital-wide occupational safety approach**, with **targeted reinforcement for younger and early-tenure nurses**. Strategies such as enhanced onboarding programs, simulation-based skills training, refresher micro-learning modules, and closer supervision during high-risk procedures may help mitigate early-career exposure. Strengthening routine NSI reporting and systematic incident follow-up—along with incorporation of **department- and shift-specific variables** in future surveillance systems—would enable more granular risk assessment and targeted interventions, such as unit-specific coaching where environmental risks are identified. These measures, combined with continued emphasis on **non-recapping practices, safe sharps disposal, and timely post-exposure management**, are likely to contribute to a sustained reduction in NSIs among the nursing workforce.

RECOMMENDATIONS:

Based on the findings of the present study, which demonstrate a modest but significant association between younger age and needle stick injury (NSI) occurrence, alongside the limited predictive value of socio-demographic factors overall, the following recommendations are proposed:

1. Strengthen Orientation and Induction Programs for Newly Appointed Nurses

Given the disproportionately higher occurrence of NSIs among nurses aged 20–29 years, targeted induction programs should be implemented for newly recruited and early-career nurses. These programs should emphasize:

- Safe needle handling techniques
- Proper use of personal protective equipment (PPE)
- Standard precautions and post-exposure protocols
- Familiarization with institutional workflows and high-risk procedures

Structured onboarding may help reduce vulnerability during the transition from training to independent clinical practice.

2. Implement Simulation-Based and Hands-On Training

The lack of association between educational qualification and NSI occurrence highlights that theoretical knowledge alone is insufficient. Regular simulation-based training and supervised hands-on practice should be incorporated to reinforce safe practices, particularly for procedures such as blood sampling, injections, and pen device handling, which were commonly associated with injuries.

3. Enhance Supervision during High-Risk Procedures

Close supervision and mentoring by senior nursing staff during high-risk clinical procedures should be encouraged, especially for junior nurses. A structured mentorship system may improve procedural confidence, reduce errors, and promote adherence to safety protocols.

4. Promote Standard Preventive Strategies Across All Designations

As NSI risk was observed across both junior and senior nurses, preventive interventions should be hospital-wide rather than limited to specific demographic groups. All nursing staff should receive periodic refresher training irrespective of designation or years of experience to ensure consistent compliance with safe injection and sharps disposal practices.

5. Improve Sharps Safety and Engineering Controls

Considering that conventional syringe needles were the most commonly implicated sharps, the institution should:

- Gradually introduce safety-engineered devices where feasible
- Ensure availability of puncture-proof sharps containers at point of use
- Reinforce policies against recapping and unsafe needle manipulation

Engineering controls can significantly reduce reliance on individual behavior alone.

6. Strengthen Occupational Surveillance and Reporting Systems

Although reporting rates were relatively high in this study, continued efforts are needed to maintain and improve reporting compliance. The hospital should:

- Maintain standardized and user-friendly NSI reporting mechanisms
- Encourage non-punitive reporting cultures
- Conduct periodic audits and feedback sessions to identify trends and risk areas

Robust surveillance will enable timely preventive action and institutional learning.

7. Foster a Strong Institutional Safety Culture

The minimal explanatory power of socio-demographic variables underscores the importance of organizational and environmental factors. Hospital leadership should actively promote a safety-first culture by:

- Reinforcing accountability for adherence to standard precautions
- Integrating NSI prevention into quality improvement initiatives
- Supporting continuous education and staff engagement

8. Recommendations for Future Research

Future studies should explore non-demographic determinants of NSI risk, including:

- Workload intensity and staffing ratios
- Shift patterns and fatigue
- Compliance with standard precautions
- Availability and use of safety devices

Longitudinal and interventional studies may provide deeper insights into causal factors and effectiveness of preventive strategies.

Key numbers to carry forward: The prevalence of needle stick injury (NSI) was 7.7%. Age group was the only factor significantly associated with NSI occurrence, although the effect size was small. All other examined variables were not statistically significant. The multivariable model demonstrated minimal explanatory power (pseudo-$R^2 \approx 0.018$).

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