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A Study of Needle-Stick Injury Incidence amongst Healthcare Workers and its Root Cause Analysis in a Tertiary Care Hospital

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Abstract: ***Introduction: Needle-stick injuries (NSIs) are a significant occupational hazard among healthcare workers, especially in high-risk areas such as operation theatres and dialysis units. These injuries increase the risk of transmission of blood-borne infections such as Hepatitis B, Hepatitis C, and Human Immunodeficiency Virus (HIV). Factors such as improper sharps disposal, heavy workload, fatigue, and non-adherence to standard precautions contribute to the occurrence of NSIs. Aim: To assess the incidence of needle-stick injuries among healthcare workers and to identify the root causes contributing to these injuries in a tertiary care hospital. Methods: A descriptive study design will be used. Data will be collected from Infection Control Nurse (ICN) records of reported NSI cases. The data will be analyzed using descriptive statistics such as frequency and percentage, and the prevalence of NSIs will be calculated. The findings will be presented using tables and graphical representations. Results: A total of 15 needle-stick injury (NSI) cases were reported among 355 healthcare workers, with a prevalence of 4.22%. Most cases occurred among females (64%) and nurses (50%), mainly in the operation theatre (36%) and dialysis unit (21%). Injuries commonly occurred during procedures (64%), especially surgical procedures (50%), and were primarily caused by hollow-bore needles (64%). Unsafe practices were the leading cause (87%). A rising trend was observed from January to September (14 cases), followed by a significant reduction after implementation of preventive measures, with only one case in October and none thereafter. Conclusion: NSIs remain an occupational risk primarily due to unsafe practices. The significant reduction following targeted interventions highlights the effectiveness of preventive strategies and the need for sustained adherence to safety protocols.***

Keywords: Needle-Stick Injury (NSI), Healthcare Worker (HCW), Root Cause Analysis (RCA), Preventive Measures, Prevalence, Disease, Infection, Standard precautions

1. Introduction

Needle-stick injuries (NSIs) are a significant occupational hazard among healthcare workers (HCWs) worldwide. An NSI is defined as a penetrating wound caused by needles or other sharp medical instruments that may result in exposure to blood and body fluids. These injuries pose a serious risk of transmission of blood-borne infections such as Hepatitis B, Hepatitis C, and Human Immunodeficiency Virus (HIV), leading to substantial physical, psychological, and economic burden on affected individuals.

Healthcare workers, including nurses, doctors, laboratory personnel, and housekeeping staff, are particularly vulnerable due to frequent handling of needles, sharps, and exposure to high-risk procedures. The incidence of NSIs is often underreported due to factors such as lack of awareness, fear of stigma, and inadequate reporting systems. This underreporting further complicates the implementation of effective preventive strategies.

In a tertiary care hospital setting, where patient load and procedural complexity are high, the risk of NSIs is considerably increased. Factors contributing to NSIs include improper handling and disposal of sharps, lack of adherence to standard precautions, inadequate training, fatigue, high workload, and unsafe practices such as recapping of needles.

Understanding the incidence and identifying the root causes of needle-stick injuries are crucial steps toward improving occupational safety. Root cause analysis (RCA) helps in systematically identifying underlying factors contributing to such incidents, rather than focusing only on immediate causes. This approach enables healthcare institutions to design targeted interventions, implement safer practices, and strengthen policies aimed at reducing NSIs.

Therefore, this study aims to assess the incidence of needle-stick injuries among healthcare workers in a tertiary care hospital and to analyse the root causes contributing to these events, with the ultimate goal of enhancing workplace safety and minimizing the risk of occupational exposure to infectious diseases.

Operational definition:

1) **Needle-Stick Injury (NSI):** A needle-stick injury is defined as a percutaneous penetrating wound caused by a needle or other sharp medical instrument that may result in exposure to blood or other potentially infectious body fluids, posing a risk of transmission of infections

such as Hepatitis B, Hepatitis C, and Human Immunodeficiency Virus (HIV).

2) **Healthcare Worker (HCW):** A healthcare worker is any individual engaged in activities aimed at improving health, including doctors, nurses, technicians, laboratory personnel, and support staff, who may be directly or indirectly exposed to patients and healthcare environments.
3) **Root Cause Analysis (RCA):** Root Cause Analysis is a systematic process used to identify the fundamental underlying causes of an event or problem, rather than focusing only on its immediate or superficial causes, in order to develop effective corrective and preventive strategies.
4) **Preventive Measures:** Preventive measures refer to actions, strategies, and interventions implemented to reduce or eliminate the risk of occurrence of a particular problem or hazard, such as adherence to standard precautions, safe handling of sharps, use of protective equipment, and proper training.
5) **Prevalence:** According to epidemiological standards often adopted by the WHO, prevalence is the total proportion of a population affected by a specific disease, condition, or risk factor at a given time.
6) **Disease:** A disease is a pathological condition, either communicable or non-communicable, that causes structural or functional dysfunction in an organism.
7) **Infection:** Infection is the invasion, growth, and replication of pathogenic microorganisms (such as viruses, bacteria, fungi, or parasites) inside the body, which may or may not lead to disease.
8) **Standard precautions:** Standard precautions are the minimum infection prevention and control (IPC) practices that must be applied to all patient care, in all healthcare settings, at all times, regardless of a patient's suspected or confirmed infection status.

2. Need of the Study

1) **For reduction** - Increasing incidences of Needle Stick Injuries among HCWs in the institution.
2) **For prevention** – NSIs expose healthcare workers to serious blood-borne infections such as Hepatitis B, Hepatitis C, and Human Immunodeficiency Virus (HIV). Prevention of these infections among HCWs.
3) **Awareness among staff** - The study will help in developing targeted interventions, improving training programs, and strengthening safety protocols.
4) **Fact** - Average Needle Stick Injuries for the year 2025 is ≥1.25.

3. Objectives

1) To find out the prevalence of Needle Stick Injuries (NSIs) among healthcare workers.
2) To find out the causes of Needle Stick Injuries (NSIs) among healthcare workers.
3) To develop strategies to prevent Needle Stick Injuries (NSIs) among healthcare workers.

4. Assumptions/Hypothesis

1) It is assumed that mostly nurses are prone to NSIs among healthcare workers.
2) It is assumed that lack of adherence to standard precautions increases the risk of exposure to blood-borne infections such as Hepatitis B, Hepatitis C, and Human Immunodeficiency Virus (HIV).
3) It is assumed that inadequate availability or accessibility of sharps disposal containers contributes to unsafe practices.
4) It is assumed that proper training and awareness can reduce the incidence of NSIs among healthcare workers.

5. Methodology

The present study will adopt a quantitative research approach with a retrospective observational design to assess the incidence of needle-stick injuries (NSIs) and analyse their root causes among healthcare workers. The study will be conducted at Apollo Hospital, Noida, over a period of twelve months from January to December 2025. A retrospective design is chosen as the study will utilize already recorded data of NSI incidents rather than collecting real-time data.

Data will be collected from the emergency log book, where incidents of needle-stick injuries are routinely documented. Additional relevant information regarding the affected healthcare workers, such as their designation, department, and cause of injury, will be obtained from records maintained by the Infection Control Nurse (ICN). This will ensure that the data is accurate, reliable, and systematically recorded.

The target population of the study will include all categories of healthcare workers who are at risk of exposure to needle-stick injuries. This includes nurses, doctors (interns, residents, and consultants), laboratory technicians, operation theatre personnel, dialysis technicians, phlebotomists, and housekeeping and waste-handling staff involved in biomedical waste management.

The sample will consist of all healthcare workers who have reported a needle-stick injury during the defined study period. A purposive sampling technique will be used, as only those individuals who meet the specific criteria (i.e., reported NSI cases) will be included in the study.

The collected data will be organized and analysed using appropriate statistical methods to determine the incidence and distribution of NSIs and to identify the contributing factors. Ethical considerations such as maintaining confidentiality and using the data strictly for research purposes will be ensured throughout the study.

Inclusion Criteria:

- Healthcare workers employed in the selected tertiary care hospital during the study period
- Healthcare workers who are directly or indirectly involved in handling needles or sharp instruments
- Healthcare workers who have experienced a needle-stick injury during the study period

6. Data Analysis

Data will be analyzed section-wise according to the structured questionnaire. Descriptive statistics such as frequency and percentage will be used to summarize demographic variables, incidence of needle-stick injuries, reporting practices, risk factors, and preventive measures. The prevalence of NSIs will be calculated. Data will be presented using tables, bar graphs, and pie charts to identify patterns and contributing factors.

7. Data Interpretation

Section A: Demographic Details

Table 1: Gender, n = 15

Parameter	Frequency	Percentage
Female	10	67%
Male	5	33%

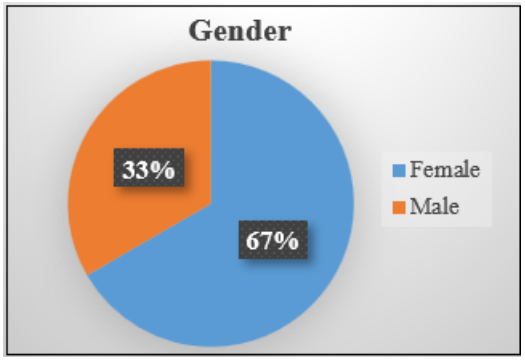


Chart 1: Gender

The results of the study [Table 1] showed that the gender-wise distribution of healthcare workers who experienced needle-stick injuries were females in majority, accounting for 67% (n=10), while males constituted 33% (n=5) of the total cases. This indicates a higher occurrence of NSIs among female healthcare workers in the present study, which may be attributed to their greater representation in nursing roles and more frequent involvement in direct patient care and needle-related procedures.

Table 2: Designation

Parameter	Frequency	Percentage
Doctor	4	27%
Nurse	8	53%
Technician	1	7%
Housekeeping staff	2	13%
Others	0	0%

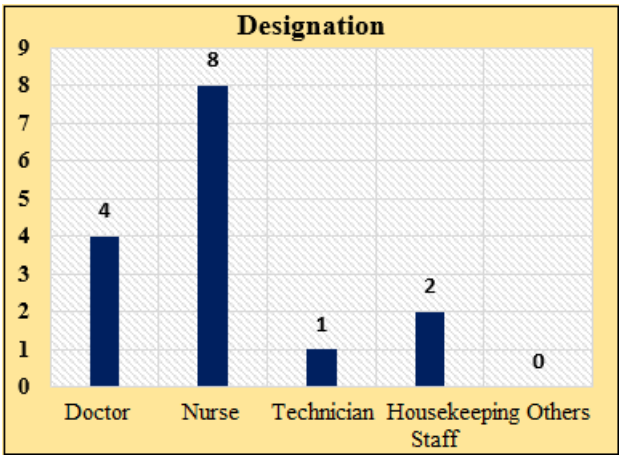


Chart 2: Designation, n = 15

The distribution of needle-stick injuries according to designation revealed that nurses accounted for the highest proportion at 53% (n=8), followed by doctors at 27% (n=4). Housekeeping staff contributed to 13% (n=2) of the cases, while technicians accounted for 7% (n=1). No cases were reported under the "others" category. This finding indicates that nurses are the most affected group, likely due to their frequent involvement in direct patient care and handling of needles and sharps, thereby increasing their risk of exposure. [Table 2]

Table 3: Department, n = 15

Parameter	Frequency	Percentage
ICU	2	13%
OT	6	40%
Dialysis	3	20%
Ward	0	0%
EMR	0	0%
Lab	1	7%
Others	3	20%

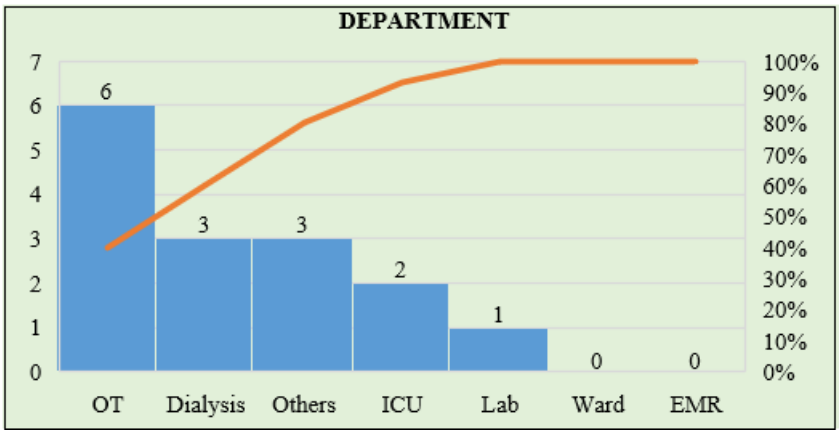


Chart 3: Department

The department-wise distribution of needle-stick injuries showed that the highest incidence occurred in the operation theatre, accounting for 40% (n=6) of cases. This was followed by dialysis and other departments, each contributing 20%

(n=3) of the cases. The ICU accounted for 13% (n=2), while the laboratory contributed 7% (n=1). No cases were reported from the ward or emergency (EMR) departments. This indicates that high-risk areas involving frequent invasive procedures, such as operation theatres and dialysis units, have a greater occurrence of needle-stick injuries. [Table 3]

Section B: Incidence of Needle-Stick Injury

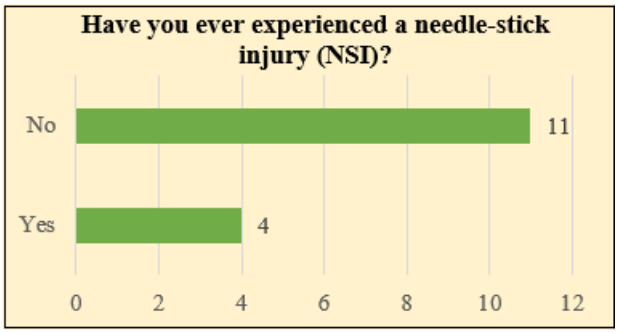


Chart 4: Experienced a Needle Stick Injury

Table 4: Have you ever experienced a needle-stick injury (NSI)? n = 15

Parameter	Frequency	Percentage
Yes	4	26%
No	11	73%

The findings in Table 4 show that out of the total participants (n=15), 26% (n=4) reported having experienced a needle-stick injury before, while the majority, 73% (n=11), reported no such experience.

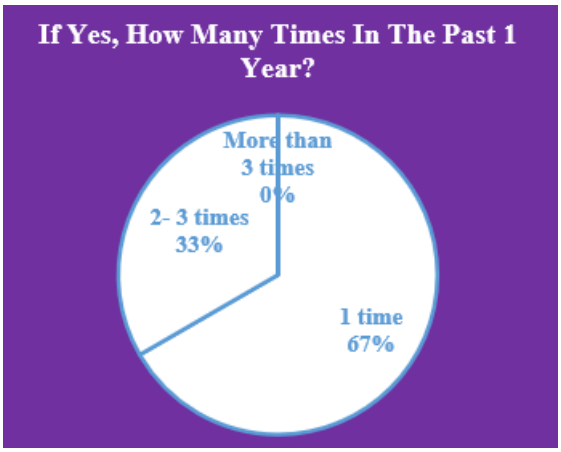


Chart 5: Number of times in past 1 year

Table 5: If yes, how many times in the past 1 year? n = 15

Parameter	Frequency	Percentage
1 time	2	13%
2- 3 times	1	7%
More than 3 times	0	0%

The findings in Table 5 show that among the participants (n=15), 13% (n=2) experienced needle-stick injury once in the past one year, while 7% (n=1) experienced it 2–3 times. No participant reported more than three occurrences. This indicates that most NSI cases were isolated incidents; however, the presence of repeated injuries among some healthcare workers highlights the need for continuous monitoring and reinforcement of safe practices.

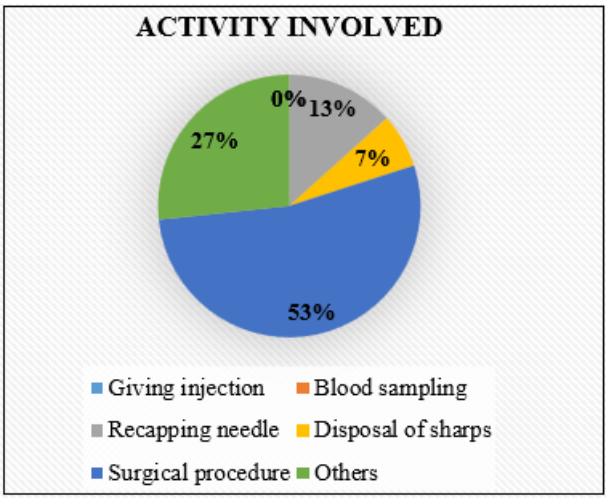


Chart 6: Activity Involved

Table 6: Activity Involved, n = 15

Parameter	Frequency	Percentage
Giving injection	0	0%
Blood sampling	0	0%
Recapping needle	2	13%
Disposal of sharps	1	7%
Surgical procedure	8	53%
Others	4	27%

The distribution of needle-stick injuries based on the activity performed at the time of injury showed that the majority occurred during surgical procedures, accounting for 53% (n=8) of the cases. This was followed by other activities at 27% (n=4). Injuries due to recapping of needles contributed to 13% (n=2), while disposal of sharps accounted for 7% (n=1). No injuries were reported during giving injections or blood sampling. These findings suggest that high-risk procedures, particularly surgical interventions, are the most common situations associated with needle-stick injuries, highlighting the need for strict adherence to safety protocols in such settings. [Table 6]

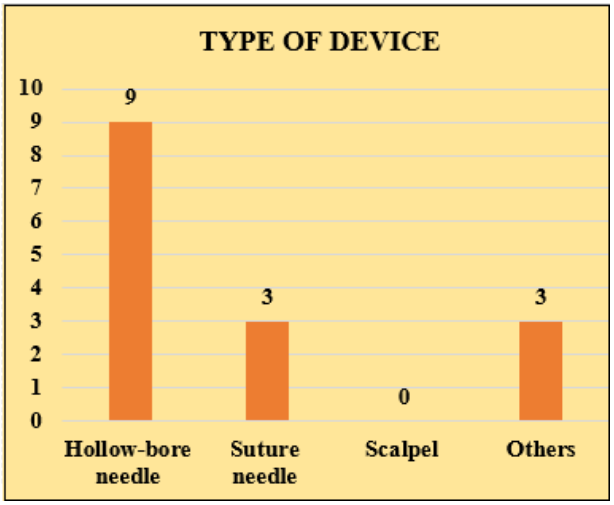


Chart 7: Type of Device

Table 7: Type of Device, n = 15

Parameter	Frequency	Percentage
Hollow-bore needle	9	60%
Suture needle	3	20%
Scalpel	0	0%
Others	3	20%

The distribution of needle-stick injuries based on the type of device revealed that the majority were caused by hollow-bore needles, accounting for 60% (n=9) of the cases. This was followed by suture needles at 20% (n=3), while other devices contributed to 20% (n=3). No injuries were reported due to scalpels. These findings indicate that hollow-bore needles are the most common source of NSIs, likely due to their frequent use in clinical procedures and their higher potential for blood exposure. [Table 7]

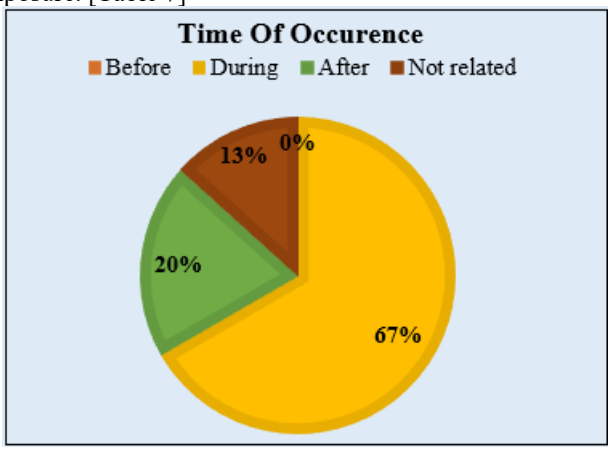


Chart 8: Time of Occurrence

Table 8: Time of Occurrence, n = 15

Parameter	Frequency	Percentage
Before	0	0%
During	10	67%
After	3	20%
Not related	2	13%

The distribution of needle-stick injuries based on the time of occurrence showed that the majority of incidents occurred during procedures, accounting for 67% (n=10) of the cases. This was followed by injuries occurring after procedures at 20% (n=3), while 13% (n=2) were not directly related to procedural timing. No injuries were reported before procedures. These findings indicate that the active phase of clinical procedures carries the highest risk for needle-stick injuries, emphasizing the need for heightened caution and adherence to safety practices during this period. [Table 8]

Section C: Reporting and Post-Exposure Practices

Table 9: Post-exposure prophylaxis (PEP)? n = 15

Parameter	Frequency	Percentage
Yes	0	0%
No	15	100%

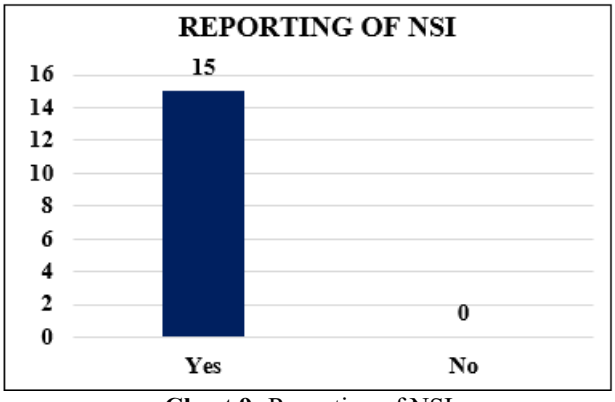


Chart 9: Reporting of NSI

The findings in Table 9 reveal that none of the participants (0%, n=0) received post-exposure prophylaxis (PEP), while all participants (100%, n=15) did not require PEP. This is because, as per the Infection Control Nurse (ICN) records, the source patients involved in the needle-stick injuries were not tested positive for blood-borne infections such as Hepatitis B, Hepatitis C, and Human Immunodeficiency Virus (HIV). Therefore, PEP was not indicated in these cases. This finding reflects appropriate clinical decision-making based on risk assessment; however, it remains important to ensure timely evaluation and adherence to post-exposure protocols in all NSI cases.

Table 10: Awareness, n = 15

Parameter	Frequency	Percentage
Yes	15	100%
No	0	0%

The findings revealed that all participants (100%, n=15) were aware of the hospital protocol for reporting needle-stick injuries, while none reported lack of awareness. This indicates a high level of awareness regarding reporting procedures among healthcare workers; however, the continued occurrence of NSIs suggests that awareness alone may not be sufficient, and emphasis on proper implementation and adherence to protocols is equally important. [Table 10]

Section D: Availability of Resources

Table 11: Accessibility of sharps disposal containers, n = 15

Parameter	Frequency	Percentage
Yes	15	100%
No	0	0%

Table 12: Do you have to walk a distance to dispose of sharps? n = 15

Parameter	Frequency	Percentage
Yes	0	0%
No	15	100%

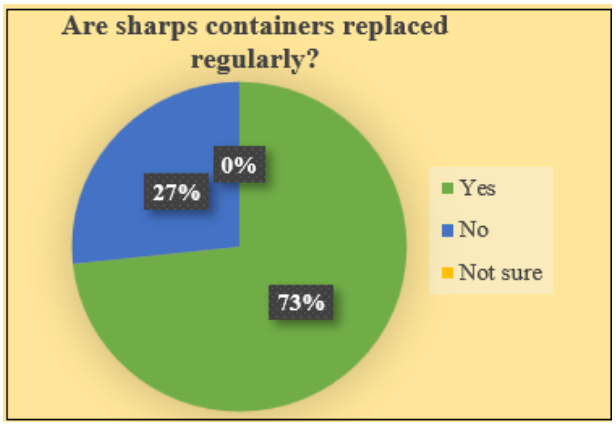


Chart 10: Replacement of sharp containers

Table 13: Are sharps containers replaced regularly? n = 15

Parameter	Frequency	Percentage
Yes	11	73%
No	4	27%
Not sure	0	0%

The findings from Tables 11, 12, and 13 indicate that all participants (100%, n=15) reported that sharps disposal

containers were easily accessible in their work areas, and none of the participants had to walk a distance to dispose of sharps. This suggests that the hospital has adequate infrastructure and proper placement of disposal containers, which supports safe practices.

Regarding the maintenance of these containers, the majority of participants (73%, n=11) reported that sharps containers are replaced regularly, while 27% (n=4) indicated otherwise. This highlights that although accessibility is well maintained, there may be occasional gaps in the timely replacement of containers. Overall, the availability and accessibility of sharps disposal systems appear satisfactory; however, consistent maintenance and monitoring are essential to further reduce the risk of needle-stick injuries.

Section E: Knowledge and Awareness

Table 14: Training of infection control, n = 15

Parameter	Frequency	Percentage
Yes	15	100%
No	0	0%

Table 15: Are you aware that NSIs can transmit infections like Hepatitis B, Hepatitis C, and Human Immunodeficiency Virus (HIV)? n = 15

Parameter	Frequency	Percentage
Yes	15	100%
No	0	0%

Table 16: Following standard precautions, n = 15

Parameter	Frequency	Percentage
Always	15	100%
Sometimes	0	0%
Never	0	0%

The findings from Tables 14, 15, and 16 indicate a high level of awareness and compliance among healthcare workers regarding infection control practices. All participants (100%, n=15) reported receiving training in infection control and were aware that needle-stick injuries can transmit infections such as Hepatitis B, Hepatitis C, and Human Immunodeficiency Virus (HIV). Additionally, all participants (100%, n=15) stated that they always follow standard precautions during clinical practice.

Section F: Root Cause Analysis

Chart 11: Causes of NSI

Table 17: Main causes of NSI, n = 15

Parameter	Frequency	Percentage
Work overload	0	0%
Lack of training	0	0%
Inadequate equipment	0	0%
Unsafe practices	13	87%
Poor supervision	2	13%
Others	0	0%

The findings in Table 17 indicate that the majority of needle-stick injuries were attributed to unsafe practices, accounting for 87% (n=13) of the cases. Poor supervision contributed to 13% (n=2) of the incidents, while factors such as work overload, lack of training, inadequate equipment, and other causes were not reported. This suggests that behavioral factors, particularly unsafe handling of sharps, play a predominant role in the occurrence of NSIs, highlighting the need for stricter adherence to safe practices and improved supervision in clinical settings.

Calculation of Prevalence:

Prevalence of NSI=

$$\frac{Number\ of\ healthcare\ workers\ with\ NSI}{Total\ number\ of\ healthcare\ workers}\ x\ 100$$

NSI cases = 15
Total Healthcare workers = 355
Prevalence = 15/355 x 100 = 4.22%

The **prevalence of needle-stick injuries is 4.22%**, indicating a relatively low but important occupational risk among healthcare workers. While this may suggest the presence of safety measures in the hospital, it still reflects ongoing exposure to potential hazards. Moreover, since the data is based on reported cases, the actual prevalence may be higher due to underreporting. Therefore, continuous efforts are needed to strengthen safety practices and ensure better compliance with infection control protocols.

Table 18: Total Number of NSIs

Months	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NUMBERS	2	2	0	3	1	0	3	0	3	1	0	0

Before Implementation of Preventive Measures

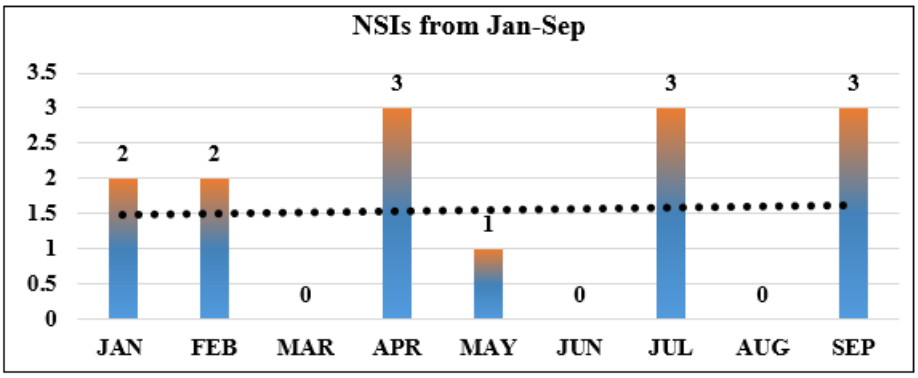


Chart 12: NSIs from Jan-Sep (14)

A total of 14 needle-stick injury (NSI) cases were reported from January to September, with a noticeable rising trend observed over this period, as evident from the data. These cases were recorded prior to the implementation of preventive measures. The increasing pattern highlighted a growing concern, particularly in high-risk areas such as the operation theatre and dialysis unit, thereby necessitating targeted interventions and strengthened safety practices.

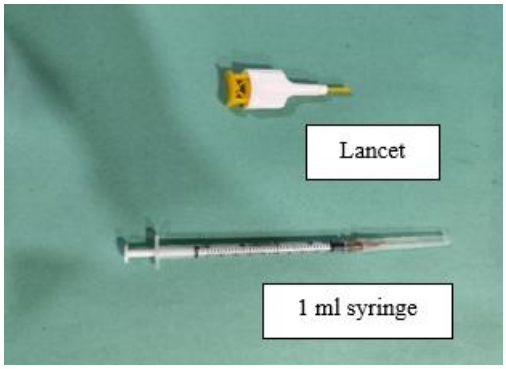
8. Implementation of Preventive Measures

A rising trend in needle-stick injuries (NSIs) was observed from January to September, with a total of 14 reported cases, as evident from the data. The majority of these incidents were recorded in high-risk areas such as the operation theatre and dialysis unit. In response to this increasing trend, preventive measures were introduced towards the end of September, with focused efforts directed at reducing NSIs in these departments, along with the implementation of comprehensive safety interventions across all work areas, as outlined below:

- **Kidney Tray implementation:** One of the key interventions was the introduction of kidney tray/bowl at the point of care for the immediate disposal of used needles and sharps, thereby minimizing unnecessary handling and movement. In the operation theatre, an additional kidney tray was placed within the surgical tray setup specifically to safely receive local injection needles and scalp vein needles, reducing the chance of accidental contact during procedures.

Picture 1: Additional kidney tray implementation in operation theatre

- **One-hand recapping technique:** For insulin administration, safer practices were emphasized by initiating the one-hand recapping technique and replacing insulin syringes with lancets wherever feasible (specially in dialysis department), significantly lowering the risk of needle stick injuries.



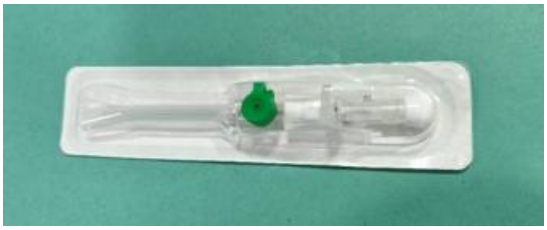
Picture 2: 1ml syringe has been replaced with lancet in dialysis

- **Strict Adherence to Standard precautions:** Strict adherence to standard precautions related to needle-stick injury (NSI) prevention was implemented as a key intervention to minimize occupational exposure among healthcare workers. This included consistent use of:
1) Personal protective equipment
2) Safe handling and disposal of sharps
3) Avoidance of needle recapping
4) And compliance with established infection control protocols.

Emphasis was placed on ensuring that all healthcare personnel followed these precautions during every clinical procedure, thereby reducing the risk of accidental injuries and promoting a culture of safety within the healthcare setting.

Picture 3: Training by ICN regarding strict adherence of standard precautions

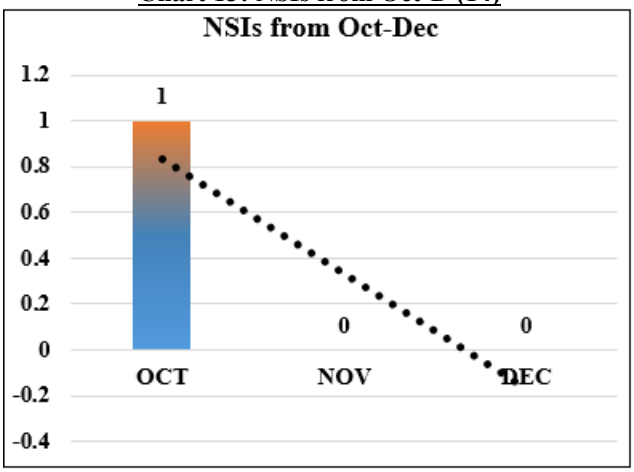
- **Single-use safety engineered device:** Single-use safety-engineered devices (Safety cannula) were introduced by replacing conventional IV cannulas with safety-engineered IV cannulas to reduce the risk of needle-stick injuries. These devices incorporate built-in safety mechanisms that minimize direct handling of sharps and prevent accidental exposure, thereby enhancing occupational safety among healthcare workers.



Picture 4: Safety cannula

- **After Implementation Of Preventive Measures**

Chart 13: NSIs from Oct-D (14)



Following the implementation of preventive measures, a marked reduction in needle-stick injuries was observed. Only one NSI was reported in the month of October, and no further cases were recorded thereafter. This significant decline indicates the effectiveness of the interventions in reducing the incidence of NSIs and improving overall safety practices within the healthcare setting.

Hypothesis Testing:

S. No.	Assumption (Hypothesis)	Result	Interpretation
1	It is assumed that mostly nurses are prone to NSIs among healthcare workers.	Accepted	Nurses accounted for the highest proportion of NSIs (50%), indicating they are the most affected group.
2	It is assumed that lack of adherence to standard precautions increases the risk of exposure to blood-borne infections.	Rejected	All participants reported adherence to standard precautions, yet NSIs still occurred, suggesting other contributing factors.
3	It is assumed that inadequate availability or accessibility of sharps disposal containers contributes to unsafe practices.	Rejected	Sharps disposal containers were fully accessible (100%), indicating no infrastructural limitation.
4	It is assumed that proper training and awareness can reduce the incidence of NSIs among healthcare workers.	Partially Accepted	Although all participants were trained and aware, NSIs occurred; however, a significant reduction was observed after implementation of preventive measures.

Overall, the findings suggest that behavioral factors, particularly unsafe practices, play a more significant role than lack of awareness or infrastructure in the occurrence of NSIs.

9. Discussion

The present study aimed to assess the incidence of needle-stick injuries (NSIs) among healthcare workers and to identify the contributing factors associated with these injuries. The prevalence of NSIs in this study was found to be 4.22%, indicating a relatively low but significant occupational risk. However, as the data was obtained from Infection Control Nurse (ICN) records, the findings may represent only reported cases, and the actual incidence could be higher due to possible underreporting.

A rising trend in NSIs was observed from January to September, with a total of 14 reported cases, as evident from the data. The majority of these incidents were recorded in high-risk areas such as the operation theatre and dialysis unit. This increasing trend highlighted a growing concern and indicated the need for targeted interventions in these departments. In response, preventive measures were introduced towards the end of September, focusing on reducing NSIs in high-risk areas while also strengthening safety practices across all work areas.

Following the implementation of these interventions, a significant reduction in NSIs was observed. Only one case was reported in October, and no further cases were recorded during the subsequent months (November and December). This marked decline suggests the effectiveness of the implemented measures in controlling and preventing needle-stick injuries within the healthcare setting.

The gender-wise distribution showed that females accounted for the majority of NSI cases (64%), which may be attributed to their higher representation in nursing roles and increased involvement in direct patient care. In terms of designation, nurses were the most affected group (50%), followed by doctors (29%), housekeeping staff (14%), and technicians (7%). This aligns with the nature of clinical responsibilities, where nurses and doctors are more frequently exposed to sharps.

Department-wise analysis revealed that the highest number of NSIs occurred in the operation theatre (36%), followed by dialysis units and other departments (21% each), and ICU (14%). No cases were reported from wards or emergency departments. This further supports that high-risk areas involving invasive and surgical procedures have a greater likelihood of NSI occurrence.

The majority of injuries occurred during surgical procedures (50%), followed by other activities (29%). Recapping of needles (14%) and improper disposal of sharps (7%) were also identified as contributing factors. With regard to the type of device, hollow-bore needles were responsible for most injuries (64%), followed by suture needles (21%) and other devices (14%). These findings indicate that high-risk procedures and commonly used sharp devices significantly contribute to NSIs.

All participants (100%) were aware of the hospital protocol for reporting NSIs and had received infection control training. They also reported consistent adherence to standard precautions. Despite this high level of awareness and compliance, NSIs still occurred, suggesting that knowledge alone is insufficient and that behavioural and environmental factors also play a critical role.

The root cause analysis revealed that unsafe practices were the predominant contributing factor (87%), followed by poor supervision (13%). Factors such as lack of training, inadequate equipment, and work overload were not reported, indicating that behavioural aspects were the primary drivers of NSIs in this setting.

In response to these findings, several targeted interventions were implemented. The introduction of kidney trays at the point of care facilitated immediate disposal of sharps, reducing unnecessary handling. In the operation theatre, additional kidney trays were incorporated into surgical setups to safely collect used needles. Safer practices for insulin administration were also promoted by encouraging the one-hand recapping technique and replacing insulin syringes with lancets wherever feasible, particularly in the dialysis unit.

Furthermore, strict adherence to standard precautions was reinforced, including the use of personal protective equipment, safe handling and disposal of sharps, avoidance of needle recapping, and compliance with infection control protocols. These interventions were aimed at addressing the behavioural and procedural gaps identified in the study.

Overall, the findings demonstrate that while awareness, training, and infrastructure were satisfactory, needle-stick injuries were primarily driven by unsafe practices and procedural risks. The significant reduction in NSIs following the implementation of targeted interventions highlights the importance of continuous monitoring, reinforcement of safe practices, and system-level improvements in ensuring occupational safety among healthcare workers.

10. Recommendations

- Standardization of point-of-care sharps disposal practices, including the use of kidney trays, should Adoption of safety-engineered devices (e.g., retractable needles, needle safety systems, and lancets) should be prioritized, particularly in high-risk departments such as operation theatre and dialysis units be ensured across all clinical areas to minimize handling and reduce exposure risk.
- Regular competency-based training and skill reinforcement programs should be conducted, with a focus on high-risk procedures and safe sharps handling techniques.
- Implementation of a behavioral safety approach through continuous monitoring, visual reminders, and supervisory checks to address unsafe practices, which were identified as the primary root cause.
- Strengthening of a non-punitive and transparent incident reporting system to improve reporting rates and enable timely corrective actions.
- Periodic clinical audits and compliance assessments should be conducted by the Infection Control Committee to ensure adherence to established protocols.
- Enhanced supervision and accountability mechanisms should be established in high-risk areas to ensure real-time adherence to safety practices during procedures.
- Establishment of continuous surveillance and trend analysis of NSIs to evaluate the effectiveness of interventions and guide data-driven decision-making.
- Institutional emphasis on fostering a culture of safety, integrating infection control practices into routine clinical workflows and organizational policies.

11. Conclusion

The present study highlights that needle-stick injuries (NSIs) remain a significant occupational hazard among healthcare workers, with a prevalence of 4.22% observed during the study period. The majority of incidents were reported from high-risk areas such as the operation theatre and dialysis unit and were primarily associated with unsafe practices. Despite high levels of awareness, training, and availability of infrastructure, the occurrence of NSIs indicates a gap between knowledge and actual practice.

The observed rising trend in NSIs from January to September underscored the need for timely intervention. Following the

implementation of targeted preventive measures- including point-of-care disposal systems, reinforcement of standard precautions, adoption of safer techniques, and introduction of safety-engineered devices- a substantial reduction in NSIs was achieved, with only one case reported in October and none thereafter. This demonstrates the effectiveness of structured, evidence-based interventions in minimizing occupational risks.

Overall, the study emphasizes that a combination of behavioural modification, system-level improvements, and continuous monitoring is essential for the prevention of NSIs. Strengthening a culture of safety, ensuring sustained compliance with protocols, and integrating preventive strategies into routine clinical practice are critical to safeguarding healthcare workers and enhancing the quality of patient care.

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Annexure

Questionnaire

Title: *A Study of Needle-Stick Injury Incidence amongst Healthcare Workers and its Root Cause Analysis in a Tertiary Care Hospital*

Instructions:

- Please tick (✓) the appropriate option.
- All information will be kept confidential and used only for research purposes.

Section A: Demographic Details

1) Gender:
   ☐ Male ☐ Female ☐ Other
2) Designation:
   ☐ Doctor ☐ Nurse ☐ Technician ☐ Housekeeping staff ☐ Others: _____
3) Department:
   ☐ ICU ☐ Operation Theatre ☐ Dialysis Unit ☐ Ward ☐ Emergency ☐ Others: _____

Section B: Incidence of Needle-Stick Injury

4) Have you ever experienced a needle-stick injury (NSI)?
☐ Yes ☐ No

5) If yes, how many times in the past 1 year?
☐ 1 ☐ 2–3 ☐ >3

6) During which activity did the injury occur?
☐ Giving injection
☐ Blood sampling
☐ Recapping needle
☐ Disposal of sharps
☐ Surgical procedure
☐ Others: _____

7) Type of device involved:
☐ Hollow-bore needle ☐ Suture needle ☐ Scalpel ☐ Others: _____

8) Time of occurrence of needle stick injuries
☐ Before procedure ☐ During procedure ☐ After procedure ☐ Not related to any procedure

Section C: Reporting and Post-Exposure Practices

9) Did you take any post-exposure prophylaxis (PEP)?
☐ Yes ☐ No

10) Are you aware of the hospital protocol for reporting NSI?
☐ Yes ☐ No

Section D: Availability of Resources

11) Are sharps disposal containers easily accessible in your work area?
☐ Yes ☐ No

12) Do you have to walk a distance to dispose of sharps?
☐ Yes ☐ No

13) Are sharps containers replaced regularly?
☐ Yes ☐ No ☐ Not sure

Section E: Knowledge and Awareness

14) Have you received training on infection control?
☐ Yes ☐ No

15) Are you aware that NSIs can transmit infections like Hepatitis B, Hepatitis C, and Human Immunodeficiency Virus (HIV)?
☐ Yes ☐ No

16) Do you follow standard precautions regularly?
☐ Always ☐ Sometimes ☐ Never

Section F: Root Cause Analysis

17) In your opinion, what are the main causes of NSI? (Tick all that apply)
☐ Work overload
☐ Lack of training
☐ Inadequate equipment
☐ Unsafe practices
☐ Poor supervision
☐ Others: _____