



## Original Research Article

# IMPACT OF STRUCTURED POLICY IMPLEMENTATION ON NEEDLE STICK INJURY REPORTING AND FOLLOW-UP COMPLIANCE IN A 700-BED TERTIARY CARE HOSPITAL: A QUASI-EXPERIMENTAL BEFORE AND AFTER STUDY

Syed Abdul Bari<sup>1</sup>, Trupthi M<sup>2</sup>, Saranya Y<sup>3</sup>, Quader Ahmed Jalily<sup>4</sup>

<sup>1</sup>Associate Professor, Department of Microbiology, Mahavir Institute of Medical Sciences, Vikarabad, Telangana, India.

<sup>2</sup>Tutor, Department of Microbiology, Mahavir Institute of Medical Sciences, Vikarabad, Telangana, India.

<sup>3</sup>Tutor, Department of Microbiology, Saphagiri Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India.

<sup>4</sup>Professor and HOD, Department of Microbiology, Nova Institute of Medical Sciences, Jaffarguda, Hyderabad, Telangana, India.

Received : 12/01/2026  
Received in revised form : 25/02/2026  
Accepted : 12/03/2026

**Corresponding Author:**

**Dr. Syed Abdul Bari,**  
Associate Professor, Department of  
Microbiology, Mahavir Institute of  
Medical Sciences, Vikarabad,  
Telangana, India.  
Email: drsabari7may@gmail.com

DOI: 10.70034/ijmedph.2026.1.457

Source of Support: Nil,  
Conflict of Interest: None declared

**Int J Med Pub Health**  
2026; 16 (1); 2656-2663

**ABSTRACT**

**Background:** Needlestick injuries (NSIs) remain a significant occupational hazard among healthcare workers (HCWs), with risk of transmission of blood-borne pathogens such as hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV).<sup>[1]</sup> Despite established guidelines, under-reporting of NSIs and poor follow-up compliance continue to be major concerns in healthcare settings.<sup>[2]</sup> Evidence suggests that structured policy implementation combined with education and institutional reinforcement improves reporting behaviour and compliance.<sup>[3,4]</sup> Additionally, hepatitis B vaccination awareness plays a critical role in preventing occupational transmission.<sup>[5]</sup> **Objective: Primary Objective:** To assess the impact of structured NSI policy implementation, education, and hepatitis B vaccination awareness on NSI reporting rates and follow-up compliance in a 700-bed tertiary care hospital.

**Material and Methods:** A quasi-experimental before–after study was conducted in a 700-bed tertiary care hospital involving 450 healthcare workers. Baseline NSI data from 2024 were compared with post-intervention data from 2025 following implementation of a structured NSI policy, staff education programs, hepatitis B vaccination promotion, and a simplified reporting system. Changes in NSI reporting rates and follow-up compliance were analyzed.<sup>[3,7,8]</sup>

**Results:** During the pre-intervention period (2024), NSI reporting was 8.9 per 1,000 HCWs. Following the implementation of a structured policy, staff education, hepatitis B vaccination promotion, and a simplified reporting system in (2025), reporting increased to 20 per 1,000 HCWs, representing a 125% increase. In addition, follow-up compliance for post-exposure management improved, with more HCWs completing recommended evaluations, and documentation of hepatitis B vaccination status increased, indicating greater adherence to occupational safety measures.

**Conclusion:** Structured NSI policy implementation, reinforced by education, vaccination awareness, and simplified reporting, significantly increased NSI reporting and follow-up compliance among healthcare workers. Institutional commitment to continuous training and clear protocols is essential to improve occupational safety and reduce under-reporting of blood-borne exposures.<sup>[9-10]</sup>

**Keywords:** Needlestick injury, Sharps injury, Healthcare workers, Occupational safety, Infection control, Policy implementation, Post-exposure compliance, Hepatitis B vaccination, Staff education, Reporting systems.

## INTRODUCTION

Healthcare workers (HCWs) are consistently at risk of occupational injuries due to the invasive nature of clinical procedures, with needlestick injuries (NSIs) being among the most significant hazards. NSIs occur when needles or other sharps accidentally penetrate the skin, exposing HCWs to blood-borne pathogens such as hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV).<sup>[11]</sup> These injuries not only endanger individual health but also have broader implications for healthcare systems, including costs related to post-exposure management, potential workforce absenteeism, and long-term psychological impact.<sup>[12]</sup> Despite the availability of internationally recommended preventive guidelines and safety-engineered devices, NSI reporting remains suboptimal worldwide. A multicenter study among nurses reported that although more than half had experienced an NSI, only about 10% formally reported the event, citing time constraints, workload, and perceived low risk as key barriers.<sup>[11]</sup> Under-reporting hinders the ability of institutions to accurately monitor occupational hazards, delays initiation of post-exposure prophylaxis (PEP), and limits evaluation of preventive strategies.<sup>[12,13]</sup>

Multiple factors contribute to the persistent under-reporting of NSIs. Limited awareness of institutional reporting protocols, lack of reinforcement of safety policies, fear of blame, and procedural inconvenience are commonly cited barriers.<sup>[13,8]</sup> For instance, a cross-sectional study in India demonstrated that although most nurses were aware of the potential risks associated with NSIs and supported timely reporting, unsafe practices such as recapping needles and inconsistent reporting of exposures were prevalent.<sup>[8]</sup> This disconnect between knowledge and practice emphasizes the need for interventions that not only provide information but also change behaviour and institutional culture.

Structured educational interventions have been shown to improve awareness, knowledge, and compliance related to NSIs. Targeted education, combined with clinical audits and feedback cycles, significantly enhances HCWs' understanding of NSI risks, reporting procedures, and preventive practices.<sup>[15]</sup> Similarly, implementation of best-practice strategies, including proper handling and disposal of sharps, has been associated with improved adherence to safety standards among nursing staff and a reduction in risky behaviours.<sup>[15]</sup> These findings highlight the importance of continuous training and systematic reinforcement of institutional policies.

Hepatitis B vaccination is a key preventive measure against HBV infection among HCWs. Although the vaccine is highly effective, coverage rates and completion of the recommended three-dose series remain suboptimal in many healthcare settings.<sup>[16,17]</sup> Studies have shown that while many HCWs initiate

vaccination, follow-up for subsequent doses is often inconsistent, reducing overall protective immunity.<sup>[16]</sup> These gaps reflect deficiencies in institutional policies, occupational health services, and ongoing awareness campaigns.

The combination of structured policies, educational programs, and vaccination initiatives has the potential to significantly enhance NSI reporting and follow-up compliance. Evidence suggests that facilities that integrate formal reporting systems with regular training and vaccination monitoring achieve higher reporting rates and better adherence to preventive practices.<sup>[15,17]</sup> Continuous evaluation and reinforcement of these strategies are crucial for minimizing occupational exposure risks and improving the overall safety of healthcare environments.

Given the persistent global burden of NSIs, their health and economic consequences, and the demonstrated impact of education, policy enforcement, and vaccination programs, this study aims to evaluate the effect of structured NSI policy implementation, targeted educational interventions, and hepatitis B vaccination awareness on NSI reporting rates and follow-up compliance among HCWs in a 700-bed tertiary care hospital using a quasi-experimental design. This research will provide evidence for practical strategies to improve occupational safety and promote a culture of reporting and prevention in healthcare institutions.

### Objective

#### Primary Objective

To assess the impact of structured NSI policy implementation, education, and hepatitis B vaccination awareness on:

1. NSI reporting rates
2. Follow-up compliance (including post-exposure protocols and vaccination completion).

### Review of Literature

#### Introduction

Needle stick injury (NSI) is defined as a percutaneous injury caused by needles or other sharp medical instruments that accidentally puncture the skin. It is considered one of the most common occupational hazards among healthcare workers. These injuries expose healthcare personnel to blood-borne pathogens such as hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV).<sup>[18]</sup> Healthcare workers including doctors, nurses, laboratory technicians, and housekeeping staff are particularly vulnerable because of their frequent contact with needles and sharp instruments during patient care.<sup>[19]</sup>

Needle stick injuries represent a significant public health problem in healthcare settings worldwide. Occupational exposure to contaminated sharps can lead to serious infections, emotional stress, and economic burden among healthcare workers.<sup>[20]</sup>

#### Global Prevalence of Needle Stick Injuries

Studies conducted in different parts of the world have reported a high prevalence of needle stick injuries among healthcare workers. A systematic review

found that a large proportion of healthcare workers experience at least one needle stick injury during their professional career.<sup>[21]</sup> The prevalence of needle stick injuries is particularly higher in developing countries due to inadequate resources, lack of training, and insufficient safety devices.<sup>[22]</sup>

### **Risk Factors Associated with Needle Stick Injuries**

Several risk factors contribute to needle stick injuries among healthcare workers. Common factors include recapping of needles, improper disposal of sharps, lack of training, and heavy workload.<sup>[23]</sup> Younger healthcare workers and trainees are more likely to experience such injuries due to limited experience and inadequate awareness of infection control practices.<sup>[24]</sup>

### **Occupational Exposure to Blood-Borne Infections**

Needle stick injuries can result in transmission of serious infections such as hepatitis B, hepatitis C, and HIV. Among these, hepatitis B has the highest risk of transmission if the healthcare worker is not vaccinated.<sup>[25]</sup> Studies have highlighted the importance of vaccination and early post-exposure prophylaxis in reducing the risk of infection after occupational exposure.<sup>[26]</sup>

### **Under-Reporting of Needle Stick Injuries**

Under-reporting of needle stick injuries is a major concern in healthcare settings. Many healthcare workers fail to report injuries due to lack of awareness about reporting systems, fear of stigma, and busy work schedules.<sup>[27]</sup> Failure to report such incidents can delay treatment and increase the risk of infection.

### **Prevention and Control Measures**

Prevention strategies play a crucial role in reducing needle stick injuries among healthcare workers. These strategies include the use of safety-engineered devices, proper disposal of sharps, adherence to universal precautions, and regular training programs.<sup>[28]</sup> Healthcare institutions are encouraged to implement strict infection control policies to minimize occupational hazards.

### **Impact of Training Programs**

Training and educational programs have been shown to significantly improve knowledge and safe practices among healthcare workers. Studies indicate that healthcare workers who receive regular training demonstrate better compliance with safety guidelines and reduced incidence of needle stick injuries.<sup>[22]</sup>

### **Hepatitis B Vaccination and Post-Exposure Management**

Vaccination against hepatitis B is one of the most effective preventive measures for healthcare workers. Institutions should ensure that all healthcare workers receive complete vaccination and have access to post-exposure prophylaxis when necessary.<sup>[26]</sup>

## **MATERIALS AND METHODS**

**Design and Setting:** A quasi-experimental before–after study was conducted in a 700-bed tertiary care

hospital to assess the impact of structured NSI policy, education, vaccination awareness, and simplified reporting on NSI reporting and follow-up compliance.

### **Study Setting and Population**

The study was carried out in a 700-bed tertiary care teaching hospital providing multispecialty services. The study population included 450 HCWs comprising physicians, nursing staff, laboratory personnel, interns, and housekeeping staff who were at risk of occupational exposure to blood and body fluids. Inclusion criteria consisted of all HCWs with direct or indirect exposure to sharps handling. Administrative staff without exposure risk were excluded.

Healthcare workers are recognized as a high-risk group for occupational blood-borne infections due to frequent exposure to needles, sharps, and contaminated instruments.<sup>[12,18]</sup> Nurses and junior doctors have been shown to experience a disproportionately higher incidence of NSIs because of frequent procedural involvement.<sup>[8,19]</sup>

### **Study Duration**

The study was conducted over a period of two years:

- **Pre-intervention phase:** January 2024 to December 2024
- **Post-intervention phase:** January 2025 to December 2025

Baseline NSI data from 2024 were compared with post-intervention data from 2025 to determine the effectiveness of implemented measures. Similar annual comparative approaches have been adopted in infection control intervention studies.<sup>[4,20]</sup>

### **Baseline Assessment**

During the pre-intervention phase, retrospective data on NSIs were obtained from hospital infection control records and occupational health registers. Data extracted included:

- Total number of NSIs
- Category of HCW involved
- Type of device causing injury
- Location and clinical department
- Hepatitis B vaccination status
- Time interval between exposure and reporting
- Initiation and completion of post-exposure prophylaxis (PEP)
- Follow-up serological testing compliance

Under-reporting of NSIs is a recognized challenge globally, often due to fear of blame, lack of awareness, or complex reporting procedures.<sup>[11,13,22]</sup> Therefore, baseline assessment also evaluated reporting trends and barriers.

A structured, pre-validated questionnaire was administered to assess knowledge, attitudes, and practices (KAP) related to NSI prevention and management. The questionnaire framework was adapted from previously published KAP and audit-based studies evaluating healthcare workers' awareness and preventive practices.<sup>[3,9,8,16]</sup>

## Intervention Components

The interventional strategy, implemented in January 2025, consisted of a multi-component institutional program based on international guidelines and evidence-based recommendations.<sup>[10,12]</sup>

### 1. Development and Implementation of a Structured NSI Prevention Policy

A comprehensive NSI prevention and management policy was introduced, detailing safe handling of sharps, immediate first aid measures, mandatory reporting procedures, risk assessment protocols, and PEP guidelines. The policy was aligned with international occupational safety standards to reduce transmission of hepatitis B, hepatitis C, and HIV.<sup>[10,12]</sup>

### 2. Education and Training Programs

Regular training sessions, workshops, and simulation-based demonstrations were conducted for all HCWs. The sessions emphasized standard precautions, safe injection practices, proper disposal of sharps, avoidance of needle recapping, and early reporting. Educational interventions have been shown to significantly improve compliance and reduce NSI incidence (6,8,20). Periodic reinforcement sessions were conducted quarterly to ensure sustainability of behavioral change, as continuous education has been associated with sustained reduction in occupational injuries.<sup>[4,21]</sup>

### 3. Hepatitis B Vaccination Drive

A hospital-wide hepatitis B vaccination campaign was organized to ensure full immunization coverage among HCWs. Vaccination coverage among HCWs has been reported as suboptimal in several regions, increasing occupational risk (16,17,18). Strengthening immunization coverage is a critical component of NSI prevention programs.<sup>[12,19]</sup>

### 4. Simplified and Confidential Reporting System

To address barriers related to under-reporting, the reporting system was simplified through introduction of a standardized one-page reporting form and direct notification to the Infection Control Committee. Confidentiality and non-punitive policies were emphasized to encourage voluntary reporting, as fear of stigma and administrative burden are key reasons for non-reporting.<sup>[11,13,22]</sup>

### 5. Strengthening Surveillance and Feedback Mechanisms

Active surveillance of NSIs was carried out by the Infection Control Committee. Monthly review meetings were conducted to analyze trends and provide departmental feedback. Continuous surveillance and audit-based feedback mechanisms have demonstrated effectiveness in reducing occupational injuries.<sup>[4,20]</sup>

## 6. Promotion of Safety Culture

Administrative support was strengthened to foster a culture of occupational safety. Studies have shown that workload, staffing shortages, and lack of safety culture significantly contribute to NSI occurrence.<sup>[21]</sup> Therefore, departmental heads were sensitized to ensure compliance with safety protocols.

### Outcome Measures

#### Primary Outcomes:

- NSI incidence rate (per 100 HCWs per year)
- Proportion of NSIs reported within 24 hours
- Compliance with recommended PEP
- Completion of follow-up serological testing
- Hepatitis B vaccination coverage rate

#### Secondary Outcomes:

- Improvement in knowledge scores
- Reduction in under-reporting trends
- Change in high-risk practices (e.g. needle recapping)

Global meta-analyses have emphasized that reduction in incidence rates and improvement in reporting compliance are key indicators of successful NSI prevention programs.<sup>[18,19,20]</sup>

### Statistical Analysis

Data were entered and analyzed by statistician. Descriptive statistics were used to summarize demographic variables and NSI characteristics. Categorical variables were expressed as frequencies and percentages.

Comparative analysis between pre- and post-intervention phases was performed using the Chi-square test for categorical variables. A p-value <0.05 was considered statistically significant. Incidence rate ratios were calculated to quantify reduction in NSI occurrence. Similar statistical approaches have been utilized in occupational injury intervention studies.<sup>[4,20]</sup>

### Ethical Considerations

Institutional Ethics Committee approval was obtained prior to study commencement. Written informed consent was obtained from participants involved in the **questionnaire survey**. Confidentiality of occupational exposure data was strictly maintained. The study adhered to principles of occupational health safety and ethical research conduct as recommended by international health authorities.<sup>[12]</sup>

## RESULTS

### 1. Study Population Characteristics

A total of 450 healthcare workers (HCWs) were included in the study during both the pre-intervention (2024) and post-intervention (2025) periods. The professional distribution of participants remained comparable across both study phases.

**Table 1: Distribution of Healthcare Workers by Category (N = 450)**

Category of HCWs	Number (n)	Percentage (%)
Doctors	114	25.3%
Interns	108	24.0%
Nurses	145	32.2%
Laboratory Personnel	46	10.2%
Housekeeping Staff	37	8.2%
<b>Total</b>	<b>450</b>	<b>100%</b>

## 2. Comparison of NSI Reporting Rates

During the pre-intervention period (January–December 2024), the NSI reporting rate was 8.9 per 1,000 HCWs per year. Following implementation of the structured NSI prevention program in 2025, the

reporting rate increased to 20 per 1,000 HCWs per year.

This represents a 125% increase in reporting rate during the post-intervention period.

**Table 2: Comparison of NSI Reporting Rates Before and After Intervention**

Study Period	NSI Rate (per 1,000 HCWs)	Percentage Change	p-value
2024 (Pre)	8.9		
2025 (Post)	20.0	+125%	<0.05

Statistically significant at  $p < 0.05$ , The increase in reporting indicates improved awareness, enhanced accessibility of reporting mechanisms, and greater adherence to institutional policy following intervention.

## 3. Timeliness of Reporting

Post-intervention data demonstrated improvement in early reporting (within 24 hours of exposure). A higher proportion of HCWs reported injuries promptly in 2025 compared to 2024.

**Table 3: Timeliness of NSI Reporting**

Reporting Time for Needle-Stick Injury	2024 (Pre) n	2024 (Pre) %	2025 (Post) n	2025 (Post) %
Within 2 hours	-	-	3	15.8%
Within 24 hours	1	25%	16	84.2%
Within 48 hours	2	50%	-	-
Within 72 hours	1	25%	-	-
<b>Total</b>	<b>4</b>	<b>100%</b>	<b>19</b>	<b>100%</b>

Early reporting improved significantly in the post-intervention phase, facilitating timely risk assessment and post-exposure prophylaxis.

## 4. Post-Exposure Prophylaxis (PEP) and Follow-up Compliance

Follow-up compliance improved considerably in 2025. A greater proportion of exposed HCWs completed recommended serological evaluation and follow-up testing.

**Table 4: Compliance with Post-Exposure Follow-up**

Parameter	2024 (Pre) n	2024 (Pre) %	2025 (Post) n	2025 (Post) %	p-value
Initiated PEP	1	25%	19	100%	<0.05
Completed Follow-up Testing	1	25%	19	100%	<0.05

The structured intervention contributed to improved adherence to recommended follow-up protocols.

## 5. Distribution of Healthcare Workers by Hepatitis B Vaccination Category

Among the 234 healthcare workers, Hepatitis B vaccination was highest among nurses (35%), followed by doctors (23.1%) and interns (21.8%), while laboratory and housekeeping staff had lower coverage.

**Table 5: Distribution of Healthcare Workers by Hepatitis B Vaccination Category**

Category of HCWs	Number (n)	Percentage (%)
Doctors	54	23.1%
Interns	51	21.8%
Nurses	82	35.0%
Laboratory Personnel	26	11.1%
Housekeeping Staff	21	9.0%
<b>Total</b>	<b>234</b>	<b>100%</b>

## 6. Hepatitis B Vaccination Coverage

Documentation of hepatitis B vaccination status improved substantially during the post-intervention

period. The vaccination promotion campaign resulted in increased immunization coverage and better documentation practices.

**Table 6: Hepatitis B Vaccination Coverage Among HCWs**

Vaccination Status	Pre (2024)	Post (2025)
Fully Vaccinated	216	450
Partially Vaccinated	4	0
Unvaccinated	230	0
Total	450	450

In 2024, out of 450 individuals, 216 were fully vaccinated, 4 were partially vaccinated, and 230 were unvaccinated, while in 2025 all partially vaccinated and unvaccinated individuals became fully vaccinated, resulting in 100% full vaccination.

### 7. Distribution of Needle-Stick Injury Exposure by Category of Healthcare Workers (Pre-

### intervention, 2024 and post-intervention, 2025)

This table shows the distribution of needle-stick injury cases among different categories of healthcare workers before the intervention in 2024. A total of four cases were reported, with nurses accounting for the highest proportion, followed by doctors and laboratory technicians.

**Table 7a: Distribution of Needle-Stick Injury Exposure by Category of Healthcare Workers-2024**

Category of HCWs 2024	Number of Cases (n)	Percentage (%)
Doctors	1	25%
Nurses	2	50%
Laboratory Technicians	1	25%
Housekeeping Staff	0	0%
Total	4	100%

**Table 7b: Distribution of Needle-Stick Injury Exposure by Category of Healthcare Workers-2025**

Category of HCWs 2025	Number of Cases (n)	Percentage (%)
Nurses	6	31.6%
Doctors	5	26.3%
Laboratory Technicians	5	26.3%
Housekeeping Staff	3	15.8%
Total	19	100%

Among the 19 reported needle-stick injury cases, nurses accounted for the highest proportion (31.6%), followed by doctors and laboratory technicians (26.3% each), and housekeeping staff (15.8%)

### 8. Comparison of Circumstances Leading to Needle-Stick Injury Among Healthcare Workers (2024 vs 2025)

This table compares the circumstances leading to needle-stick injuries among healthcare workers before and after the intervention. Recapping of needles was the most common cause of injury in both years, followed by injuries during suturing and scalpel use.

**Table 8: Comparison of Circumstances Leading to Needle-Stick Injury Among Healthcare Workers (2024 vs 2025)**

Circumstance of Injury	2024 (Pre) n	2024 (Pre) %	2025 (Post) n	2025 (Post) %
Recapping of needles	2	50%	9	47.4%
During suturing	1	25%	4	21.1%
Handling/cleaning sharps	0	0%	3	15.8%
Scalpel injury	1	25%	1	5.3%
Total cases	4	100%	19	100%

### Blood-Borne Infection Status Following Needle-Stick Injury

This table shows the infection status of healthcare workers following needle-stick injury exposure.

Among the 19 reported cases, only one case tested positive for a blood-borne infection, while the majority tested negative.

**Table 9: Blood-Borne Infection Status Following Needle-Stick Injury**

Infection Status	Number of Cases (n)	Percentage (%)
Positive for blood-borne infection	1	5.3%
Negative	18	94.7%
Total	19	100%

## DISCUSSION

The present quasi-experimental before-after study demonstrated a substantial increase in reported NSI rates following implementation of a structured institutional policy, comprehensive education

programs, hepatitis B vaccination promotion, and a simplified reporting mechanism. The 125% increase in reporting observed during the post-intervention phase likely reflects improved awareness and enhanced compliance with reporting protocols rather than a true rise in injury incidence. Similar

improvements in reporting behavior following structured audits and educational interventions have been documented in previous clinical audit studies and structured intervention programs.<sup>[3,8]</sup>

Under-reporting of NSIs remains a persistent occupational health challenge globally. Multiple studies have identified lack of awareness, fear of blame, perceived low risk, and cumbersome reporting systems as major barriers to timely notification.<sup>[11,13]</sup> In the present study, simplification of the reporting process and reinforcement of confidentiality were associated with improved early reporting and follow-up compliance. Comparable findings have been reported in tertiary care centers where system-level modifications led to significant improvements in voluntary reporting trends.<sup>[9,15]</sup>

The strengthening of infection control surveillance and regular feedback mechanisms likely contributed to sustained compliance in the post-intervention period. Institutional infection control activities, including structured monitoring and periodic audits, have previously been shown to reduce occupational exposures and improve safety practices.<sup>[4,20]</sup> Furthermore, best-practice recommendations emphasize that standardized post-exposure protocols and accessible occupational health services are central to minimizing transmission of blood-borne pathogens.<sup>[10,12]</sup>

Improvement in hepatitis B vaccination documentation and coverage in the current study aligns with prior evidence demonstrating suboptimal vaccination uptake among HCWs in many settings.<sup>[16,17]</sup> Vaccination remains the most effective preventive measure against occupational hepatitis B transmission, and institutional vaccination drives have been shown to enhance coverage and seroprotection rates.<sup>[12,18]</sup> Increased documentation in the present study suggests improved adherence to occupational health policies and better monitoring systems.

The enhanced compliance with post-exposure prophylaxis (PEP) and follow-up evaluation observed in 2025 is particularly important from a clinical safety perspective. Delayed or incomplete follow-up increases the risk of undetected seroconversion and psychological distress among exposed workers.<sup>[20]</sup> Structured education and protocol reinforcement have been shown to improve PEP adherence and timely risk assessment.<sup>[8,20]</sup>

Global meta-analyses report that lifetime prevalence of NSIs among HCWs ranges between 30% and 60%, with nurses and junior doctors being disproportionately affected.<sup>[18,19]</sup> These findings highlight the necessity of sustained institutional strategies targeting high-risk groups. Additionally, workplace factors such as heavy workload, extended duty hours, and inadequate staffing have been associated with increased injury risk.<sup>[21]</sup> Addressing these systemic contributors, alongside policy implementation, is essential for long-term prevention.

The results of this study support the effectiveness of multifaceted interventions in strengthening occupational safety culture. Evidence suggests that single-component interventions are less effective compared to integrated strategies combining education, policy enforcement, vaccination, surveillance, and administrative commitment.<sup>[4,20]</sup> The observed improvements in reporting rates and follow-up compliance in the present study underscore the importance of organizational leadership and continuous reinforcement.

However, the increase in reported NSIs should be interpreted cautiously. As documented in prior studies, improved surveillance systems often reveal previously under-reported injuries.<sup>[11,13]</sup> Therefore, higher reporting rates may represent enhanced transparency rather than increased hazard exposure. Long-term monitoring is necessary to determine whether true incidence rates decline over time with sustained intervention.<sup>[4,20]</sup>

## CONCLUSION

The implementation of a structured Needle-Stick Injury prevention and management program resulted in a marked improvement in NSI reporting rates, early notification, follow-up compliance, and hepatitis B vaccination documentation among healthcare workers. The 125% increase in reporting observed post-intervention reflects strengthened awareness, improved accessibility of reporting systems, and enhanced adherence to institutional protocols.<sup>[3,8,9]</sup>

The findings reaffirm that under-reporting remains a significant barrier to effective occupational exposure management and that simplifying reporting systems, ensuring confidentiality, and promoting non-punitive policies are critical to improving compliance.<sup>[11,13]</sup> Furthermore, sustained education, vaccination promotion, and active infection control surveillance are essential components of comprehensive occupational safety programs.<sup>[4,10,12,20]</sup>

Institutional commitment, administrative support, and reinforcement of safety culture play a decisive role in reducing occupational risk and strengthening adherence to post-exposure protocols.<sup>[21]</sup> Continuous monitoring and periodic evaluation of safety practices are recommended to ensure long-term sustainability of intervention outcomes.

Overall, a multifaceted, policy-driven approach integrating education, immunization, surveillance, and streamlined reporting systems is fundamental to improving occupational safety and minimizing the risk of blood-borne pathogen transmission among healthcare workers.

### Limitations of the Study

One of the limitations of this study was that Anti-HBs antibody testing was not performed to assess the post-vaccination immune status of the participants. Therefore, the level of protective immunity among the vaccinated healthcare workers could not be

confirmed. Additionally, a considerable number of interns rotate or complete their training and leave the hospital or college during the study period, which made follow-up and continuous monitoring difficult. Another limitation was the limited availability of Anti-HBs antibody testing facilities in the study setting. Furthermore, some participants showed reluctance to undergo additional testing or participate in further follow-up procedures, which may have affected the completeness of the data. These factors should be considered when interpreting the results of the study.

## REFERENCES

- Prüss-Üstün A, Rapiti E, Hutin Y. Estimation of the global burden of disease attributable to contaminated sharps injuries among healthcare workers. *Am J Ind Med.* 2005;48(6):482-490.
- Tabak N, Shiaabana A, Shasha S. The health beliefs of hospital staff and the reporting of needlestick injury. *J Clin Nurs.* 2006;15(10):1228-1239.
- Alfulayw KH, Al-Otaibi ST, Alqahtani HA. Improving doctors' knowledge and practices on needle-stick injury prevention and management: a clinical audit. *Cureus.* 2021;13(5):e14880.
- Shiao JSC, et al. Prevention of needle-stick injuries among nurses through structured intervention programs. *JBHI Evid Implement.* 2022;20(1):45-52.
- Singhal V, Bora D, Singh S. Hepatitis B vaccination status among healthcare workers and its impact on post-exposure management. *J Lab Physicians.* 2009;1(2):53-55.
- Mujeeb SA, et al. Impact of infection control activities on the rate of needle stick injuries at a tertiary care hospital. *BMC Infect Dis.* 2009;9:78.
- Thiyagarajan M, Ranganathan U, Shivekar S, Rangasamy G. Trends of voluntary reporting of needlestick injuries and hepatitis B vaccination status among healthcare workers of a tertiary health care center in Puducherry. *J Lab Physicians.* 2019;11(4):352-355.
- Wicker S, Walcher F, Wutzler S, Stephan C, Marzi I. Best practice for needlestick injuries. *Eur J Trauma Emerg Surg.* 2014;40(2):151-158.
- Joukar F, Mansour-Ghanaei F, Naghipour MR, Asgharnezhad M. Needlestick injuries among healthcare workers: why they do not report their incidence? *Iran J Nurs Midwifery Res.* 2018;23(5):382-387.
- World Health Organization. Health worker occupational safety: needlestick and sharps injuries. Geneva: WHO; 2020.
- Pandey A, Verma R, Choudhary N, et al. Factors influencing under-reporting of needlestick injuries among healthcare workers in India. *Int J Occup Saf Health.* 2019;9(3):45-52.
- Sain S, et al. Knowledge, attitudes, and practices of nurses regarding needle-stick injuries and prevention in a tertiary care center in Nagpur: a cross-sectional study. *Cureus.* 2024.
- Harsha Kumar HN, Bairy KL, Ramakrishna BS. Hepatitis B vaccination status and post-exposure prophylaxis practices among healthcare workers in Mangalore. *Ann Glob Health.* 2015;81(5):664-668.
- Rupak KC, KC B, Karki S, et al. Prevalence of exposure to needlestick and sharp-related injury and hepatitis B vaccination status among healthcare workers. *Health Sci Rep.* 2023;6(7):e1399.
- Bouya S, et al. Global prevalence and device-related causes of needlestick injuries among healthcare workers: a systematic review and meta-analysis. *Ann Glob Health.* 2020;86(1):35.
- Mengistu DA, Tolera ST, Demmu YM. Worldwide prevalence of occupational exposure to needlestick injury among healthcare workers: a meta-analysis. *Can J Infect Dis Med Microbiol.* 2021;2021:9019534.
- Schuurmans J, et al. Effectiveness of safety-engineered devices in reducing needlestick injuries: a systematic review. *J Hosp Infect.* 2018;100(4):451-458.
- Smith DR, et al. Workload and occupational sharps injuries among healthcare workers: a multicenter study. *Occup Med (Lond).* 2016;66(5):350-356.
- Tarigan LH, Cifuentes M, Quinn M, Kriebel D. Prevention of needle-stick injuries in healthcare facilities: a meta-analysis. *Infect Control Hosp Epidemiol.* 2015;36(7):823-829.
- HosseiniPalangi Z, et al. Global, regional and national incidence and causes of needlestick injuries: a systematic review and meta-analysis. *East Mediterr Health J.* 2022;28(3):200-210.
- Rapiti E, Prüss-Üstün A, Hutin Y. Sharps injuries: assessing the burden of disease from sharps injuries to health-care workers at national and local levels. Geneva: World Health Organization; 2005.
- Smith DR, Mihashi M, Adachi Y, et al. Organizational climate and its relationship with needlestick injuries among nurses. *Occup Med (Lond).* 2009;59(3):165-170.
- Beltrami EM, Williams IT, Shapiro CN, Chamberland ME. Risk and management of blood-borne infections in healthcare workers. *Clin Microbiol Rev.* 2000;13(3):385-407.
- Centers for Disease Control and Prevention. Updated U.S. Public Health Service guidelines for management of occupational exposures to HBV, HCV, and HIV. *MMWR Recomm Rep.* 2001;50(RR-11):1-52.
- Adams D, Elliott TS. Impact of safety needle devices on occupationally acquired needlestick injuries: a four-year prospective study. *J Hosp Infect.* 2006;64(1):50-55.
- Voide C, Darling KE, Kenfak-Foguena A, et al. Underreporting of needlestick and sharps injuries among healthcare workers. *Am J Infect Control.* 2012;40(9):e195-e197.
- Simonsen L, Kane A, Lloyd J, Zaffran M, Kane M. Unsafe injections in the developing world and transmission of bloodborne pathogens: a review. *Bull World Health Organ.* 1999;77(10):789-800.
- Sohn JW, et al. Compliance with post-exposure management guidelines following occupational exposure to blood-borne pathogens. *Am J Infect Control.* 2006;34(7):407-412.
- Deisenhammer S, et al. Needlestick injuries during medical training and the protective effect of safety programs. *J Hosp Infect.* 2016;94(2):161-166.