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Needle Stick Injury Prevention and Occupational Exposure Preparedness among Healthcare Personnel in a Tertiary Care Hospital: A Cross-Sectional Study

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ABSTRACT

Background: Needle stick injury (NSI) is a major occupational hazard among healthcare personnel due to the risk of transmission of blood-borne infections such as Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), and Hepatitis C Virus (HCV). Adequate preventive practices and timely post-exposure management are essential to reduce occupational risk and assess occupational preparedness and preventive practices regarding needlestick injury prevention among healthcare personnel in a tertiary care hospital.

Methods: A hospital-based cross-sectional study was conducted among 202 healthcare personnel at Bhima Bhoi Medical College and Hospital, Balangir, Odisha, from September to November 2025. Participants included doctors, nurses, interns/students, laboratory technicians, and housekeeping staff. Data were collected using a pretested, semi-structured questionnaire that assessed NSI-related awareness, preventive practices, prevalence, and institutional support.

Results: Interns/students constituted 122 (60.4%) participants, while 106 (52.5%) had less than one year of work experience. Good knowledge regarding NSI prevention was observed among 51 (25.2%) participants, whereas 187 (92.6%) demonstrated positive attitudes and 162 (80.2%) reported good preventive practices. NSI prevalence was 37 (18.3%); among affected participants, 26 (70.3%) reported the incident and 23 (88.5%) received post-exposure prophylaxis. More than half [106 (52.5%)] had not received formal training.

Conclusion: Although preventive practices and attitudes were satisfactory, knowledge gaps and inadequate training persisted, highlighting the need for regular competency-based training and strengthened occupational safety measures.

Key-words: Needle stick injury; Healthcare personnel; Occupational exposure; Post-exposure prophylaxis; Preventive practices

INTRODUCTION

Sharp instruments contaminated with blood or body fluids during healthcare procedures are very common in clinical practice. NSI remains one of the most important occupational hazards among healthcare personnel worldwide, placing healthcare workers at risk of acquiring blood-borne infections such as Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), and Hepatitis C Virus (HCV) [1,2]. According to the World Health Organisation (WHO), nearly 3 million healthcare workers worldwide experience percutaneous exposure to blood-borne pathogens annually [3]. Sharps injuries contribute substantially to occupational morbidity, psychological stress, absenteeism, and reduced work efficiency among healthcare providers [4].

Globally, unsafe injection practices and improper disposal of sharps continue to contribute significantly to healthcare-associated infections. It has been estimated that approximately 37% of hepatitis B infections, 39% of hepatitis C infections, and 4.4% of HIV infections among

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healthcare workers are attributable to occupational exposure from contaminated sharps [4,5]. In developing countries, lack of safety devices, underreporting of injuries, inadequate infection control practices, and poor compliance with universal precautions further increase the risk of NSI [6].

In India, needle stick injuries are frequently reported among interns, nurses, laboratory technicians, and other healthcare personnel due to heavy workload, long duty hours, inadequate staffing, and improper biomedical waste disposal practices [7,8]. Several Indian studies have documented varying prevalence rates of NSI ranging from 10% to 80% among healthcare workers [9]. Despite the availability of post-exposure prophylaxis (PEP) guidelines and infection prevention protocols, underreporting and delayed management remain major concerns [10].

Knowledge of universal precautions, safe needle disposal, avoidance of recapping, and timely initiation of post-exposure prophylaxis plays a critical role in preventing occupational exposure [11,12]. Similarly, a positive attitude toward reporting and adherence to standard precautions are essential for reducing NSI-related morbidity. Assessment of knowledge, attitude, and practices (KAP) among healthcare personnel helps identify existing gaps and formulate targeted preventive strategies. Recent studies have shown that although awareness regarding NSI prevention is improving, unsafe practices such as recapping and inconsistent reporting persist among healthcare workers [13,14].

MATERIALS AND METHODS

Research Design- A hospital-based cross-sectional analytical study was conducted at Bhima Bhoi Medical College and Hospital, a tertiary care hospital, among healthcare personnel involved in patient care and clinical procedures. The study was carried out over a period of 3 months, from September to November 2025.

Study Population- The study population comprised healthcare personnel engaged in direct patient care activities at the institution, including doctors, staff nurses, interns, laboratory technicians, housekeeping personnel, and medical students.

Sample Size Estimation- The sample size was calculated using the standard formula for prevalence studies:

$$n = \frac{4pq}{d^2}$$

where n denotes the required sample size, p represents the prevalence of needle stick injury, $q = (100 - p)$, and d signifies the allowable error. The prevalence (p) was considered as 17%, based on a previous study conducted by Goel V et al. among healthcare workers in a tertiary care teaching hospital in North India, which reported a needle stick injury prevalence of 17%. The allowable error (d) was taken as 5.3%. The estimated sample size was 201, rounded to 202 participants for the present study.

Sampling Technique- A convenience sampling technique was employed to recruit eligible participants from various healthcare professional categories available during the study period.

Inclusion Criteria- Healthcare personnel directly involved in patient care, interventional procedures, and clinical services were included in the study. Individuals willing to participate and available during the data collection period were considered eligible.

Exclusion Criteria- Healthcare personnel who were on leave during the study period, administrative staff not directly engaged in clinical procedures, and individuals unwilling to provide informed consent were excluded from the study.

Study Instrument- Data were collected using a pretested semi-structured questionnaire developed through review of relevant literature and standard infection control guidelines. The questionnaire consisted of sections on socio-demographic details, knowledge regarding NSI, attitude toward NSI prevention, practices related to needle handling, prevalence of NSI, and institutional support. The knowledge assessment included questions on disease transmission, needle disposal, recapping, reporting, and post-exposure prophylaxis. Attitude was assessed using Likert-scale-based questions. Practice-related questions included glove use, recapping practices, and sharps disposal.

Data Collection method- Via WhatsApp groups, a Google Forms link was distributed with informed consent embedded (opt-in required). Anonymity was ensured (no

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identifiers). The form took ~5-7 minutes; one reminder was sent after 3 days. Those who could not fill out the Google Form were given a face-to-face interview using the same questionnaire by the investigator.

Scoring System- Knowledge scores were categorized as poor (0–3), average (4–6), and good (7–8). Attitude scores were categorized as negative (7–17), neutral (18–26), and positive (27–35). Practice scores were categorized as poor (0–4), moderate (5–8), and good (9–12).

Statistical Analysis- Data were entered and analysed using SPSS Version 24. Categorical variables expressed in frequency & percentage. Whereas Continuous variables are in terms of mean and standard deviation.

Ethical approval- Approval for the study was obtained from the institutional ethics committee of Bhima Bhoi Medical College & Hospital, Balangir, Odisha, India, before the commencement of the study. Informed consent was obtained from all participants and confidentiality of data was maintained throughout the study.

RESULTS

Table 1 shows that among the 202 healthcare personnel, the majority were interns/students [122 (60.4%)], followed by nurses [29 (14.4%)], doctors [25 (12.4%)], laboratory technicians [21 (10.4%)], and housekeeping staff [5 (2.5%)].

Table 1: Profession Distribution of study respondents (n=202)

Profession	Frequency	Percentage (%)
Intern/Student	122	60.4
Nurse	29	14.4
Doctor	25	12.4
Lab technician	21	10.4
Housekeeping staff	5	2.5

More than half of the participants [106 (52.5%)] had work experience of less than one year, whereas only 3 (1.5%) participants had experience ranging from 6–10 years (Fig. 1).

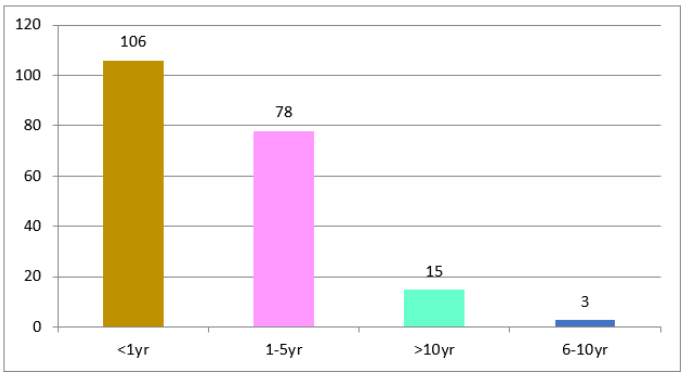

Fig. 1: Working experience of study respondents (n=202)

Table 2 represents knowledge about needle stick injury (NSI), a substantial proportion correctly identified disease transmission [188 (93.1%)], appropriate disposal methods [188 (93.1%)], the immediate first step following NSI [189 (93.6%)], and the importance of reporting incidents [194 (96.0%)]. However, comparatively lower awareness was observed regarding risks associated with needle recapping [114 (56.4%)] and the appropriate timing of post-exposure prophylaxis (PEP) [124 (61.4%)].

Table 2: Knowledge Regarding Needle Stick Injury among Respondents (n=202)

Question	Correct Responses n (%)	Incorrect Responses n (%)
NPI Transmissions	188 (93.1)	14 (6.9)
Highest Risk	143 (70.8)	59 (29.2)
Disposal	188 (93.1)	14 (6.9)
Recapping	114 (56.4)	88 (43.6)
First Step	189 (93.6)	13 (6.4)
Reporting	194 (96.0)	8 (4.0)
PEP Timing	124 (61.4%)	78 (38.6%)
Hepatitis B Protection	141 (69.8%)	61 (30.2%)

The mean knowledge score was 6.34 ± 1.42. Overall, 51 participants (25.2%) demonstrated good knowledge, while 134 (66.3%) exhibited average knowledge. Among professional categories, doctors demonstrated the highest proportion of good knowledge [14 of 25 (56.0%)], whereas housekeeping staff demonstrated comparatively poorer knowledge levels (Table 3).

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Table 3: Knowledge level among various health care professionals based on profession (n=202)

Profession	Level of Knowledge		
	Poor (0-3) N (%)	Average (4-6) N(%)	Good (7-8) N(%)
Intern/Student	12(9.8%)	87(71.3%)	23(18.80%)
Nurse	03(10.3%)	18(62.06%)	08(27.58%)
Doctor	00(0%)	11(44%)	14(56%)
Lab technician	01(4.76%)	15(71.42%)	06(28.57%)
Housekeeping staff	02(40%)	03(60%)	00(0%)
Total	18(8.91%)	134(66.33%)	51(25.24%)

Mean ± SD of knowledge score-6.34 ± 1.42
Minimum -2 and Maximum value -8.

Attitude assessment showed that most participants perceived NSI as a serious occupational hazard [192 (95.1%)] and acknowledged the importance of reporting injuries [197 (97.5%)]. Support for training programmes [196 (97.1%)] and adherence to universal precautions [177 (87.6%)] were also notably high. The mean attitude score was 31.03 ± 2.92, and an overall positive attitude was observed among 187 participants (92.6%), including all doctors [25 (100%)] (Table 4).

Table 4: Attitude Toward NPI Prevention among Health Care Providers (n=202)

Statement	SA	A	N	D	SD
Serious Hazard	149 (73.8%)	43 (21.3%)	8 (4.0%)	1 (0.5%)	1 (0.5%)
Feel at Risk	107 (53.0%)	78 (38.6%)	17 (8.4%)	0 (0.0%)	0 (0.0%)
Importance of Reporting	156 (77.2%)	41 (20.3%)	4 (2.0%)	0 (0.0%)	1 (0.5%)
Gloves Efficacy	63 (31.2%)	66 (32.7%)	34 (16.8%)	27 (13.4%)	12 (5.9%)
Comfort in Reporting	112 (55.4%)	72 (35.6%)	10 (5.0%)	8 (4.0%)	0 (0.0%)
Training Necessity	150 (74.3%)	46 (22.8%)	5 (2.5%)	1 (0.5%)	0 (0.0%)
Universal Precautions	101 (50.0%)	76 (37.6%)	20 (9.9%)	3 (1.5%)	2 (1.0%)

*** SA- Strongly Agree, A- Agree, N-Neutral, D-disagree, SD- Strongly Disagree*

Practice assessment revealed that 137 participants (67.8%) consistently wore gloves while handling needles, and 172 (85.1%) disposed of needles immediately into sharps containers. Although no participant reported always recapping needles, 56 (27.7%) admitted doing so often, while 30 (14.9%) reported doing so sometimes. Overall, 162 participants (80.2%) demonstrated good preventive practices. Doctors demonstrated the highest proportion of good practices [24 of 25 (96.0%)], followed by nurses [25 of 29 (86.2%)] and interns/students [97 of 122 (79.5%)] (Table 5).

Table 5: Practice assessment of the respondents: (n=202)

Practices	Always	Often	Sometimes	Never
Wear gloves during handling needles	137(67.8%)	37(18.3%)	19(9.4%)	09(4.5%)
Recap needles after use	00(0%)	56(27.7%)	30(14.9%)	85(42.1%)
Dispose immediately after use in sharp container	172(85.1%)	22(10.9%)	06(3%)	02(1%)

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The prevalence of NSI among healthcare personnel was 37 (18.3%). Among affected participants, 26 (70.3%) reported the incident to concerned authorities, while 23 (88.5%) received PEP following exposure (Table 6).

Tables 6: Prevalence of the Needle prick Injury among the respondents (n=202)

Variable	Category	Frequency n (%)
Ever had needle prick injury	Yes	37 (18.3%)
	No	165 (81.7%)
Reported the incident	Yes	26 (70.3%)
	No	11 (29.6%)
Received PEP	Yes	23 (88.5%)
	No	03 (11.5%)

Regarding institutional support, more than half of the participants [106 (52.5%)] reported not receiving formal training regarding NSI prevention. Sharps disposal containers were reported to be always accessible by 146 participants (72.3%), whereas 149 (73.8%) acknowledged clear reporting protocols, and 153 (75.7%) perceived adequate institutional support following exposure incidents (Table 7).

Table 7: Training and Institutional Support provider to respondents (n=202)

Variable	Category	Frequency (%)
Training received	Within last 1 year	71 (35.1%)
	>1 year ago	25 (12.4%)
	No training	106 (52.5%)
Sharps containers accessible	Always	146 (72.3%)
	Sometimes	41 (20.3%)
	Rarely	11 (5.4%)
	Never	4 (2.0%)
Clear reporting protocol exists	Yes	149 (73.8%)
	No	25 (12.4%)
	Not aware	28 (13.9%)
Know whom to contact	Yes	146 (72.3%)
	No	56 (27.7%)
Management support adequate	Yes	153 (75.7%)
	No	49(24.3%)

DISCUSSION

The present study assessed knowledge, attitudes, and practices (KAP) regarding needlestick injury prevention among healthcare workers (HCWs) at a tertiary care hospital. The findings demonstrated generally favourable attitudes and satisfactory preventive practices; however, important gaps persisted in knowledge and training coverage.

In the present study, a majority of participants were healthcare workers aged below 25 years [100 (49.5%)], and interns/students accounted for 122 (60.4%) of the study population, while 106 (52.5%) had less than 1 year of work experience.

Younger and less experienced HCWs are considered more vulnerable to occupational exposure because of inadequate procedural skills and limited clinical experience. Similar demographic findings were reported in recent Indian tertiary care studies, where junior healthcare workers constituted a substantial proportion of workers exposed to needle stick injuries [13,15].

The prevalence of NSI in the present study was 37 (18.3%), which is comparable to findings reported by Goel *et al.* [16]. However, Sharma *et al.* reported comparatively higher prevalence rates among healthcare workers in Delhi, possibly attributable to greater occupational exposure and higher workload among

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interns and nurses [7]. Similar studies from Ethiopia and Saudi Arabia have also documented considerable occupational exposure to sharps injuries among healthcare personnel [17,18].

A high proportion of participants correctly identified disease transmission through NSI [188 (93.1%)], safe disposal methods [188 (93.1%)], immediate first aid measures [189 (93.6%)], and the importance of incident reporting [194 (96.0%)], indicating satisfactory foundational awareness. Nevertheless, important knowledge gaps were observed regarding risks associated with needle recapping [114 (56.4%)] and the appropriate timing of post-exposure prophylaxis [124 (61.4%)]. Similar deficiencies have been documented in studies conducted in Central India and Ethiopia [6,17]. Recent studies among healthcare workers have also reported persistent misconceptions about recapping practices despite overall good awareness [13,14]. Delayed initiation of PEP significantly reduces its effectiveness; therefore, these deficiencies remain a major occupational health concern [19].

Professional category-wise differences were evident in the present study. Doctors demonstrated the highest levels of good knowledge [14 (56.0%)] and good preventive practices [24 (96.0%)], likely attributable to greater exposure to infection prevention training and institutional protocols. In contrast, housekeeping staff demonstrated comparatively poorer knowledge and practices, underscoring the vulnerability of ancillary workers who are frequently overlooked in occupational safety training programmes. Similar findings have been reported in previous studies among non-clinical healthcare personnel [20].

A highly favourable attitude toward NSI prevention was observed, with 187 (92.6%) participants demonstrating positive attitudes. Additionally, 197 (97.5%) participants acknowledged the importance of reporting injuries and 196 (97.1%) supported regular training programmes. Similar observations have been reported by Au *et al.* and Cullen *et al.,* emphasising the importance of institutional safety culture in promoting compliance with infection-prevention practices [21,22].

Preventive practices in the present study were generally satisfactory, with 162 (80.2%) participants demonstrating good practice scores. Immediate disposal of needles into sharps containers was practiced by 172 (85.1%) participants, reflecting adherence to biomedical waste management recommendations. However, unsafe recapping behaviour persisted, as 56 (27.7%) participants reported recapping needles often and 30 (14.9%) reported doing so sometimes. Such practices substantially increase the risk of accidental sharps injuries and occupational exposure [23]. A recent meta-analysis further demonstrated that recapping behaviour is significantly associated with increased NSI risk among healthcare workers [24].

More than half of the participants [106 (52.5%)] had not received formal training regarding NSI prevention, which may partly explain the observed knowledge and practice gaps. Similar findings have been reported in both Indian and African studies, where inadequate training was strongly associated with unsafe injection practices and underreporting [14,17]. These findings highlight the necessity for periodic competency-based training, reinforcement of universal precautions, accessible reporting systems, and continuous monitoring of compliance with infection prevention protocols.

LIMITATIONS

The study was conducted in a single tertiary care hospital; therefore, the findings may not be generalizable to other healthcare settings. Additionally, an equal representation of all categories of healthcare personnel could not be achieved because the institution is a newly established medical college with limited human resources.

CONCLUSIONS

The present study demonstrated that healthcare personnel generally had satisfactory knowledge, a positive attitude, and good practices regarding needlestick injury prevention. Doctors and nurses demonstrated greater awareness and safer practices than housekeeping staff and interns. The prevalence of needle stick injury was considerable, though reporting and post-exposure prophylaxis uptake were relatively satisfactory. Deficiencies were identified in areas such as knowledge of recapping risks, timing of post-exposure prophylaxis, and coverage of formal training. Regular training programs, strict adherence to universal precautions, accessible reporting mechanisms, and continuous monitoring are necessary to strengthen occupational safety and reduce needlestick injuries among healthcare personnel.

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