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Prevalence of Needle Stick Injury and Hepatitis B Vaccination Status Among Medical Interns: A Cross-Sectional Study from a Tertiary Care Teaching Hospital in North Karnataka, India

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ABSTRACT

Background: Needle stick injury (NSI) is among the commonest occupational hazards faced by healthcare workers and carries a risk of transmitting Hepatitis B virus (HBV), Hepatitis C virus, and HIV. Interns perform many invasive procedures while still consolidating clinical skills and are disproportionately affected, and incomplete HBV vaccination compounds this risk. This study assessed the prevalence of NSI and HBV vaccination status among interns at a tertiary care teaching hospital in North Karnataka, India.

Methods: A cross-sectional study was conducted over ten days among 53 interns of the 2020 batch at Raichur Institute of Medical Sciences (RIMS), Raichur, using a pre-tested, self-administered questionnaire covering NSI history, HBV vaccination status, knowledge/awareness of standard precautions, and safety practices. Descriptive statistics were used; because several items were conditional on a prior "yes" response and the form permitted item-level non-response, valid responses ranged from 25 to 46 per item and are reported against the item-specific denominator.

Results: Of 44 respondents, 81% reported at least one NSI during internship. Of 28 who specified frequency, 46.4% had one injury and 14.3% more than three. Suturing (31.4% of 35) and blood sampling (22.9%) were the commonest activities. Only 55.9% of 34 respondents reported their most recent injury, and only 37.1% of 35 took post-exposure prophylaxis. HBV vaccination was reported by 70% of 40 respondents, but only 47.8% of 46 had checked their anti-HBs titre. Awareness of standard precautions (71.7% of 46) and of the post-NSI protocol (63% of 46) were incomplete, and recapping was practiced "always"/"sometimes" by 73.4% of 45 respondents.

Conclusion: NSI affects a substantial proportion of interns, and knowledge of preventive measures has not fully translated into safe practice or complete HBV protection. Mandatory pre-posting vaccination with antibody verification, reinforced sharps-handling training, and a supportive, non-punitive reporting culture are needed to close these gaps.

Keywords: *Needlestick Injuries; Occupational Exposure; Hepatitis B Vaccines; Internship and Residency; Universal Precautions; Post-Exposure Prophylaxis; Cross-Sectional Studies; Medical Waste Disposal.*

INTRODUCTION

Needle stick injury (NSI) — a percutaneous puncture wound caused by a needle or other sharp instrument contaminated with blood or body fluid — remains among the most frequent occupational hazards encountered by healthcare workers

(HCWs) worldwide.1 The World Health Organization's global burden-of-disease modelling estimated that percutaneous exposures accounted for approximately 16,000 hepatitis C virus (HCV), 66,000 hepatitis B virus (HBV), and 1,000 human immunodeficiency virus (HIV) infections among HCWs in a single reference year, with HBV and HCV together responsible for more than a third of all occupationally acquired bloodborne infections in this group.1 More than two decades later, HBV continues to disproportionately affect HCWs in low- and middle-income settings, where vaccination coverage and post-exposure care remain uneven.2

Medical interns occupy a uniquely hazardous position within this workforce. As the most junior members of the clinical team, they perform a disproportionate share of invasive bedside procedures — venepuncture, intravenous cannulation, suturing, and parenteral injections — precisely while they are still consolidating the manual skills and safety habits that reduce injury risk.3 Cross-sectional surveys from India and neighbouring South Asian countries have repeatedly shown that interns sustain NSI at higher rates than their nursing and faculty colleagues: an incidence of 75.6% among interns compared with 24.4% among nurses in a Kerala tertiary centre,3 a pooled prevalence of 25.2% among health-profession students with intern subgroups around a quarter,4 and rates as high as 79.5% among a mixed cadre of resident doctors, interns, nurses, and technicians in Delhi.5 Comparable patterns are reported outside South Asia, among junior doctors in Singapore,6 otolaryngology residents in North America,7 surgical trainees in the United States,8 and hospital staff in China,9 and continue to be documented in recent record-based surveillance from a sub-Himalayan Indian teaching hospital,10 confirming that the internship/trainee period is a consistent, internationally reproducible window of elevated risk rather than a local anomaly.

Among the bloodborne pathogens transmissible through NSI, HBV is of particular public health concern because of its high infectivity relative to HIV and the long-standing availability of a safe, effective vaccine.2 Full HBV vaccination — and, ideally, post-vaccination confirmation of an adequate anti-HBs antibody titre — is recommended for all HCWs before they begin activities that expose them to blood and body fluids, since a meaningful minority of vaccine recipients mount a hyporesponsive or non-responsive antibody titre and remain susceptible despite completing the schedule.11 In practice, vaccination coverage among HCWs and trainees is far from universal: willingness-to-pay and access barriers limit uptake in several low-resource settings,12 and even where a course has been completed, anti-HBs titres are seldom checked to confirm protection.11

A second, closely related gap is behavioural rather than logistical. Even where knowledge of standard (universal) precautions is reported as satisfactory, translating that knowledge into consistent safe practice — avoiding needle recapping, disposing of sharps immediately, and reporting every exposure — remains inconsistent across cadres and countries.13,14 Under-reporting of NSI is itself a well-described and persistent phenomenon, driven by time pressure, fear of blame or stigma, low perceived risk, and unfamiliarity with the reporting pathway, and has been documented among junior doctors,6 surgical trainees,8 otolaryngology residents,7 and hospital staff in resource-limited settings alike.15 Because under-reported injuries do not trigger post-exposure prophylaxis (PEP), the true protective value of an institution's occupational-health system depends as much on reporting behaviour as on the availability of PEP itself — a dependency that is especially fragile where PEP protocols and trainee risk-assessment pathways are not standardised.16 Unsafe final disposal of sharps compounds the hazard further: a recent systematic review linked inadequate healthcare-waste segregation and disposal practices in resource-limited settings to more than four-fold higher odds of NSI and more than three-fold higher odds of HBV infection among exposed workers.17

Despite this substantial body of international and Indian evidence, data specific to interns training in smaller tertiary care teaching hospitals of North Karnataka — where infrastructure for injury reporting, occupational-health services, and vaccination documentation may differ from larger metropolitan centres — remain limited; regional reports from Assam18 and Nepal19 suggest considerable heterogeneity in both NSI prevalence and vaccination completeness even within similar training contexts. Locally generated data are therefore necessary to identify institution-specific gaps in prevention, reporting, and vaccination coverage, and to inform targeted infection-control policy for this vulnerable, high-turnover trainee population. This study was undertaken to determine the prevalence of NSI among interns at Raichur Institute of Medical Sciences (RIMS), Raichur, and to assess their HBV vaccination status together with the practices and awareness factors associated with NSI.

MATERIALS AND METHODS

This report follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for cross-sectional studies.

Study design and setting

This descriptive cross-sectional study was conducted in the Department of Community Medicine, Raichur Institute of Medical Sciences (RIMS), Raichur, Karnataka, India, a state-run tertiary care teaching hospital that hosts a compulsory one-year rotatory internship across major clinical and para-clinical departments. Data were collected over a ten-day period [INSERT exact start and end dates of data collection].

Study population and sampling
The study population comprised all interns of the 2020 admission batch posted at RIMS during the study period. Given the small, well-defined size of this batch, a complete-enumeration (census) approach was used: all 53 eligible interns were approached, and no separate sample-size formula was applied. [INSERT sample-size calculation, if the investigators wish to justify n=53 by a formula rather than a census approach].

Eligibility criteria
Inclusion criteria were (i) interns undergoing compulsory rotatory internship at RIMS, (ii) presence during the study period, and (iii) provision of written informed consent. Interns who declined participation, submitted incompletely filled questionnaires, or were absent during data collection were excluded. [INSERT the number of interns excluded, by reason, for the participant flow diagram (Figure 1)].

Data collection instrument
Data were collected using a pre-tested, semi-structured, self-administered questionnaire (Annexure 1) developed by the investigators after review of instruments used in comparable knowledge-attitude-practice surveys of NSI among healthcare workers and students.3,19 [INSERT details of the pre-testing process — number and setting of pilot respondents and any resulting modifications]. The instrument comprised four sections: (A) history and circumstances of NSI during internship (occurrence, frequency, timing of the most recent episode, activity at the time of injury, glove use, reporting behaviour and reasons for non-reporting, and receipt of post-exposure prophylaxis); (B) HBV vaccination status and whether the post-vaccination anti-HBs antibody titre had been checked; (C) knowledge and awareness of standard precautions, the institutional protocol to be followed after an NSI, transmissibility of HBV through NSI, and receipt of formal training in biomedical waste (BMW) management; and (D) safety practices, namely needle-recapping behaviour and perceived adequacy of sharps-disposal containers at the workplace. The questionnaire was administered electronically; items concerning the number, timing, circumstances, and consequences of NSI were displayed only to interns who answered "yes" to having ever sustained an NSI, while the remaining items were presented to all respondents.

Variables and operational definitions
NSI was defined as an accidental percutaneous injury from a needle or sharp instrument contaminated with blood or body fluid. HBV vaccination status, anti-HBs titre testing, awareness of standard precautions, awareness of the post-NSI protocol, BMW training, and needle-recapping practice were all recorded as reported by the respondent (self-report); no biological or documentary verification (e.g., vaccination card review or serological testing) was performed as part of this study.

Data management and statistical analysis
Responses were compiled and summarised using descriptive statistics — frequencies and percentages — presented as figures for each item [INSERT the name and version of the statistical/tabulation software used]. Because the electronic form combined conditional (skip-logic) branching for the NSI-history items with permissible item-level non-response elsewhere, the number of valid responses differed across questions (range 25–46 of 53 eligible interns); each result is therefore reported against its own item-specific denominator rather than the full sample size, consistent with STROBE recommendations for the transparent reporting of missing data in cross-sectional studies. No inferential statistical tests, confounder adjustment, or subgroup comparisons were performed in the present analysis.

Ethical considerations
The study was conducted after obtaining approval from the Institutional Ethics Committee of Raichur Institute of Medical Sciences. Written informed consent was obtained from all participants before data collection. Confidentiality and anonymity of respondents were maintained throughout the study, and the data collected were used solely for research purposes.

RESULTS
Of the 53 eligible interns of the 2020 batch posted at RIMS during the study period, item-level responses to the electronic questionnaire ranged from 25 to 46, reflecting both the conditional (skip-logic) structure of the needle-stick-injury history section and permissible non-response elsewhere; participation and response counts for every item are summarised in Table 1.

Table 1. Item-level participation in the survey (N = 53 eligible interns)

Questionnaire item	Section	Respondents, n	Response rate, % (n/53)
Ever sustained NSI during internship	A	44	83.0
Number of NSI episodes (among those reporting NSI)*	A	28	52.8

Questionnaire item	Section	Respondents, n	Response rate, % (n/53)
Timing of most recent NSI*	A	33	62.3
Activity during NSI*	A	35	66.0
Gloves worn at time of injury*	A	36	67.9
Reported the NSI*	A	34	64.2
Reason for not reporting*	A	25	47.2
Post-exposure prophylaxis taken*	A	35	66.0
Hepatitis B vaccination status	B	40	75.5
Anti-HBs antibody titre checked	B	46	86.8
Awareness of standard precautions	C	46	86.8
Awareness of post-NSI protocol	C	46	86.8
Knowledge that HBV is transmissible via NSI	C	45	84.9
Formal training received on BMW management	C	46	86.8
Needle-recapping practice	D	45	84.9
Sharps-disposal container availability	D	45	84.9

NSI, needle stick injury; HBV, hepatitis B virus; BMW, biomedical waste. *Items 2–8 were displayed only to respondents who reported having sustained an NSI (skip-logic branching); their denominators are therefore smaller than, and not directly comparable to, the "ever sustained NSI" item. Response rates for items 9–16 are calculated against the full eligible sample (n=53).

Needle stick injury history (Section A)

Among 44 respondents, 81% reported having experienced at least one NSI at some point during their internship, while 18% reported none (Table 2). Of the 28 respondents who specified how many injuries they had sustained, 46.4% reported a single episode, 39.3% reported two to three episodes, and 14.3% reported more than three episodes. Among the 33 respondents who indicated the timing of their most recent injury, 18.2% had been injured within the preceding month, 39.4% within the preceding one to six months, and 42.4% more than six months previously.

The activity being performed at the time of injury was recorded by 35 respondents (Table 2): suturing accounted for the largest share (31.4%), followed by blood sampling (22.9%), injection administration (14.3%), sharps disposal (11.4%), and other unspecified activities (11.4%), with needle recapping accounting for the smallest share (8.6%). Of 36 respondents who reported on glove use at the time of injury, 63.9% were wearing gloves, 27.8% were not, and 8.3% gave an unspecified response.

Table 2. Needle stick injury history and circumstances among interns

Variable	Category	n	%
Ever sustained NSI during internship	Yes	44	81
	No	44	18
Number of NSI episodes	1	28	46.4
	2–3	28	39.3
	>3	28	14.3
Timing of most recent NSI	Within last 1 month	33	18.2
	1–6 months ago	33	39.4
	>6 months ago	33	42.4
Activity during NSI	Suturing	35	31.4
	Blood sampling	35	22.9

Variable	Category	n	%
	Injection	35	14.3
	Sharps disposal	35	11.4
	Other	35	11.4
	Needle recapping	35	8.6
Gloves worn at time of injury	Yes	36	63.9
	No	36	27.8
	Unspecified	36	8.3
Reported the NSI	Yes	34	55.9
	No	34	44.1
Reason for not reporting†	Other/unspecified	25	48
	Lack of time	25	28
	Did not think it was important	25	12
	Fear/stigma	25	8
	Did not know reporting protocol	25	4
Post-exposure prophylaxis taken‡	Yes	35	37.1
	No	35	48.6
	Not applicable	35	11.4

NSI, needle stick injury. Percentages for "ever sustained NSI" sum to 99% in the source data because of rounding. †Asked only of respondents who did not report their NSI. ‡The remaining approximately 2.9% of respondents selected an unspecified response option.

Of 34 respondents, 55.9% reported their most recent NSI to the appropriate authority, while 44.1% did not (Table 2). Among the 25 respondents who gave a reason for not reporting, the largest share (48%) selected "other" unspecified reasons, followed by lack of time (28%), the perception that reporting was not important (12%), fear or stigma (8%), and unfamiliarity with the reporting protocol (4%). Of 35 respondents, only 37.1% reported having taken post-exposure prophylaxis after their injury, 48.6% had not, 11.4% considered it not applicable, and the remainder gave an unspecified response.

Hepatitis B vaccination status (Section B)

Of 40 respondents, 70% reported having received HBV vaccination, while 30% reported not being vaccinated (Table 3). Of 46 respondents, only 47.8% had ever checked their anti-HBs antibody titre after vaccination, while 52.2% had not.

Table 3. Hepatitis B vaccination status and knowledge/awareness among interns

Variable	Category	n	%
Hepatitis B vaccination status	Vaccinated	40	70
	Not vaccinated	40	30
Anti-HBs antibody titre checked	Yes	46	47.8
	No	46	52.2
Awareness of standard precautions	Yes	46	71.7
	No	46	28.3
Awareness of protocol to follow after NSI	Yes	46	63
	No	46	37

Variable	Category	n	%
Knowledge that HBV is transmissible via NSI	Yes	45	86.7
	No	45	13.3
Formal training received on BMW management	Yes	46	78.3
	No	46	21.7

HBV, hepatitis B virus; NSI, needle stick injury; BMW, biomedical waste.

Table 4. Safety practices related to sharps handling among interns

Variable	Category	n	%
Needle-recapping practice	Always	45	46.7
	Sometimes	45	26.7
	Never	45	26.7
Sharps-disposal container availability	Adequate	45	77.8
	Inadequate	45	15.6
	Other	45	6.7

Knowledge and awareness (Section C)

Of 46 respondents, 71.7% reported awareness of standard precautions for preventing NSI, while 28.3% did not (Table 3). Of 46 respondents, 63% were aware of the institutional protocol to be followed after an NSI, while 37% were not. Knowledge that HBV can be transmitted through NSI was high: of 45 respondents, 86.7% answered affirmatively, while 13.3% did not. Of 46 respondents, 78.3% reported having received formal training in biomedical waste (BMW) management, while 21.7% had not.

Safety practices (Section D)

Of 45 respondents, needle recapping was practiced "always" by 46.7%, "sometimes" by 26.7%, and "never" by 26.7% (Table 4) — that is, some degree of recapping was practiced by 73.4% of respondents. Regarding the availability of sharps-disposal containers at the workplace, of 45 respondents, 77.8% considered availability adequate, 15.6% considered it inadequate, and 6.7% selected another response option.

DISCUSSION

This cross-sectional survey found that a large majority of interns at RIMS Raichur (81% of 44 respondents) had sustained at least one NSI during their internship, that reporting of injuries and uptake of post-exposure prophylaxis remained incomplete, and that although most interns reported HBV vaccination (70% of 40 respondents), fewer than half had ever verified a protective anti-HBs antibody titre.

The prevalence observed here is broadly consistent with, and toward the upper end of, prevalence figures reported among interns elsewhere in India. Madhavan et al. found an NSI incidence of 75.6% among interns in a Kerala tertiary hospital, considerably higher than the 24.4% observed among nurses in the same study,3 a pattern consistent with our finding that interns are among the highest-risk cadres. Sharma et al. reported an even higher prevalence of 79.5% among a mixed cadre of resident doctors, interns, nurses, and technicians in Delhi,5 while lower figures were reported by Datar et al. (25.2% across nursing, medical, and dental trainees, with interns at 24.5%)4 and Bhattarai et al. (42.8% among Nepalese medical, dental, and nursing students).19 Gogoi et al. reported a lower prevalence of 21.1% among healthcare workers in Assam.18 This wide range — from roughly one-fifth to four-fifths of respondents — likely reflects genuine differences in recall period, denominator (all HCWs versus interns specifically), procedural volume, and institutional reporting culture, rather than a single "true" prevalence of NSI in Indian teaching hospitals. Internationally, comparably elevated rates among junior trainees have been reported in Singapore (52% among junior doctors),6 China (27.5% among hospital staff generally, concentrated in junior staff),9 and the United States (55% among medical students, residents, and operating-room staff at a single academic centre, with students and residents citing fear of reporting significantly more often than attending surgeons).8 Suturing and blood sampling were the two commonest activities associated with injury in our sample, echoing the emphasis on recapping- and blood-withdrawal-related injury reported by Madhavan et al.3 and the recapping-related injuries reported by Sharma et al.5

Under-reporting was substantial in our sample (44.1% of injuries unreported), comparable to the 31% non-reporting rate among junior doctors in Singapore6 and to the low reporting rates documented among otolaryngology residents,7 surgical trainees,8 and hospital workers in China,9 where the leading reasons cited — perceived low risk, lack of time, and fear of consequences — mirror the "lack of time" and "did not think it was important" responses recorded in our survey. That only 37.1% of injured interns took post-exposure prophylaxis is concerning, given that PEP is time-critical and that occupational-health systems in resource-limited settings are frequently reported as inadequately standardised or accessible.16 Together, low reporting and low PEP uptake suggest that the protective potential of existing occupational-health infrastructure at our centre is not being fully realised, a gap also highlighted by calls for standardised, accessible PEP pathways in low-resource training environments.16

The 70% vaccination coverage observed here is lower than the near-universal coverage recommended for HCWs, and lower than the 86.5% reported among Nepalese healthcare students,19 though still an improvement over settings where access and willingness to pay constrain uptake.12 More striking is that only 47.8% of respondents had ever checked their anti-HBs titre — a gap that matters clinically because a meaningful minority of vaccine recipients remain hyporesponsive or non-responsive despite completing the full schedule, a status that cannot be identified without post-vaccination serological testing.11 Without titre verification, a vaccinated intern may nonetheless remain susceptible to occupationally acquired HBV, a possibility our data cannot exclude for the interns surveyed. This finding aligns with the broader literature describing HBV as continuing to affect HCWs disproportionately in settings where vaccination programmes exist on paper but post-vaccination confirmation is not systematically pursued.2

Knowledge that HBV is transmissible through NSI was high (86.7%), and awareness of standard precautions was reasonably high (71.7%), yet this knowledge did not consistently translate into safe practice: 73.4% of respondents practiced needle recapping at least "sometimes," a behaviour identified as an avoidable and preventable cause of injury in multiple settings, including Sharma et al.'s Delhi cohort (recapping implicated in 34.0% of injuries)5 and dental professionals in Bangalore (recapping implicated in 41.8% of injuries).20 This disconnect between knowledge and practice mirrors reviews of standard-precaution compliance, which consistently find that knowledge alone is insufficient without reinforcement through training, supervision, and consistent equipment availability.13,14 Similar knowledge-practice gaps, including continued recapping and low awareness of blood-exposure protocols, have been documented in resource-limited hospital settings in Mali.15 The 77.8% reporting adequate sharps-disposal container availability in our study is reassuring, but the remaining 15.6–22.2% reporting inadequate access or lacking BMW training is consistent with evidence that inadequate healthcare-waste management infrastructure independently raises the odds of both NSI and occupationally acquired HBV infection.17 Clear, written occupational-exposure protocols and accessible post-exposure pathways are recommended even in smaller or resource-constrained facilities.21

Several, non-mutually-exclusive mechanisms could plausibly explain these findings: high procedural workload and fatigue during the internship year, incomplete direct supervision during high-risk procedures such as suturing, a reporting culture that discourages disclosure of minor exposures, and gaps in a structured, mandatory pre-posting occupational-health orientation that would otherwise ensure vaccination completion, titre verification, and protocol familiarity before interns begin clinical duties.

STRENGTHS

This study provides institution-specific, intern-focused data on NSI and HBV vaccination status from a tertiary care teaching hospital in North Karnataka, a setting under-represented in the published literature relative to larger metropolitan centres, and captures multiple relevant domains — injury history, vaccination, knowledge, and practice — within a single instrument.

LIMITATIONS

The cross-sectional design does not establish a cause-and-effect relationship between the factors assessed and NSI occurrence. Data were collected using a self-administered questionnaire; recall and reporting bias may therefore have influenced responses, and some interns may have under-reported NSI due to fear, stigma, or forgetfulness. This was a single-centre study conducted among interns at RIMS, Raichur, and the findings cannot be generalised to other institutions or cadres of healthcare workers. HBV vaccination status and anti-HBs titre status were based entirely on self-report; vaccination records and antibody titres were not independently verified. No sociodemographic or departmental-posting data were collected, precluding subgroup comparisons. Finally, the number of valid responses varied across items (25–46 of 53 eligible interns), which limits precision for items with the smallest denominators, such as the reasons cited for not reporting an NSI (n=25).

CLINICAL IMPLICATIONS

These findings support several institutional measures: mandatory, documented HBV vaccination with anti-HBs titre confirmation before interns commence clinical postings; reinforced, hands-on training in safe injection, suturing, and sharps-handling technique; discouragement of needle recapping other than by the one-handed scoop technique when recapping is unavoidable; immediate disposal of used needles into puncture-proof sharps containers at the point of use; a

non-punitive, simplified NSI reporting pathway paired with a readily accessible post-exposure prophylaxis protocol and occupational-health service; adequate supervision and duty scheduling to limit fatigue-related risk; and periodic audits of biomedical waste segregation and disposal infrastructure.

FUTURE RESEARCH

Larger, multi-centre studies incorporating demographic and departmental stratification, independently verified vaccination and antibody-titre records, and longitudinal follow-up of reporting behaviour would help determine whether the gaps identified here are institution-specific or reflect a broader pattern among Indian medical interns.

CONCLUSION

Needle stick injury affects a substantial proportion of interns at this institution, and existing knowledge of standard precautions and HBV transmission has not translated fully into safe practice or complete HBV protection. Institutional measures — mandatory pre-posting vaccination with titre verification, reinforced training, immediate and correct sharps disposal, and a supportive, non-punitive reporting culture — are needed to close these gaps and protect this vulnerable trainee workforce.

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CONFLICTS OF INTEREST

The authors declare no competing interests.

DATA AVAILABILITY

The datasets generated and analysed during the current study are available from the corresponding author on reasonable request.

ETHICS STATEMENT

The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Ethics Committee of Raichur Institute of Medical Sciences. Written informed consent was obtained from all participants prior to enrolment.

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