Knowledge, Skills, and Attitudes of Registered Nurses Toward Needlestick Injury Prevention in a Tertiary Neuroscience Unit: A Cross-Sectional Study

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Abstract

Background: Needlestick injuries (NSIs) are a significant occupational hazard for nurses, leading to potential bloodborne infections and psychological distress. Despite training and safety protocols, unsafe practices and underreporting remain challenges.

Methods: A cross-sectional, single-site study was conducted at the National Neuroscience Institute, King Fahad Medical City (KFMC), Riyadh, Saudi Arabia, including 67 registered nurses. Data were collected using a structured questionnaire and direct observational skills checklist to assess knowledge, skills, and attitudes (KSA) toward NSI prevention. Descriptive and inferential statistics examined associations between demographic factors and KSA outcomes.

Results: Most nurses demonstrated excellent knowledge (85.1%), satisfactory skills (61.2%), and a positive attitude (64.2%). Unsafe practices, including needle recapping and improper disposal, were observed, and 43.3% perceived NSIs as minor incidents not requiring reporting. Years of experience and education level were significantly associated with knowledge (p = 0.005) and skills (p = 0.033), respectively, while age, gender, and university location showed no significant effect.

Conclusion: Nurses at KFMC exhibit high knowledge and moderate skills in NSI prevention, yet unsafe behaviors and attitudinal gaps persist. Targeted behavioral interventions, continuous monitoring, and reinforcement of safe practices are essential to translate knowledge into consistent clinical behavior. The study's methodology and findings may guide similar interventions in other tertiary care settings.

1. Introduction

Needlestick injury (NSI) is one of the most prevalent occupational hazards faced by healthcare workers (HCWs) worldwide, particularly among nurses due to their frequent handling of needles and other sharp instruments. These injuries pose a significant risk for the transmission of bloodborne pathogens, including hepatitis B, hepatitis C, and HIV, and can also cause considerable psychological stress, anxiety, and fear of infection. [1] Despite well-established guidelines and safety protocols, NSIs continue to occur in both developed and developing healthcare systems, often due to unsafe practices, poor compliance with standard precautions, and persistent underreporting.[2]

NSIs most frequently occur during venipuncture, suturing, and intravenous line insertion.[3] Reported annual occupational NSI rates range from 2.73 per 100 clinical staff to lower rates among the general healthcare workforce, showing an inverse relationship between years of clinical experience and NSI risk.[4,5] In India, 34.8% of HCWs have experienced NSIs, with only 8.3% formally reported, reflecting significant underreporting.[6] Similar findings have been observed in Iran, where adherence to NSI preventive measures remains suboptimal.[7,8]

Although nurses generally demonstrate good knowledge regarding NSIs, negative attitudes toward reporting and prevention continue to persist.[9] Adequate training on safe handling and disposal of sharps, as well as the implementation of clear post-exposure prophylaxis (PEP) policies, are essential to reduce the risk.[10] However, awareness levels among nurses remain inconsistent; for instance, only 24% could formally define NSIs, and 85% were unaware of the "no-recapping" technique.[11] Younger nurses aged 20–30 years with 2–3 years of experience tend to report higher NSI incidence rates, emphasizing the need for continuous education and refresher training.[12]

Globally, intensive care unit (ICU) nurses are at particularly high risk, with recapping practices accounting for a significant proportion of NSIs.[13] According to WHO data, the highest NSI rates occur during needle recapping, in general wards, among nurses, and during waste disposal activities.[14] Regular training, continuous auditing, and strict monitoring of safe practices have been shown to significantly reduce NSI incidence.[15] Female healthcare workers are reported to have higher NSI rates, with lack of experience and inadequate knowledge being key contributing factors.[16,17]

At the National Neuroscience Institute, King Fahad Medical City (KFMC), Riyadh, multiple NSI incidents among staff nurses and interns have raised concerns about awareness levels, behavioral practices, and institutional safety culture. Therefore, this study was undertaken to assess the knowledge, skills, and attitudes (KSA) of nurses toward NSI prevention and to identify critical gaps in practice. The findings aim to inform evidence-based interventions that enhance occupational safety in high-risk hospital units[18]

Research Methodology

Study Design

A cross-sectional quantitative study was conducted to assess the knowledge, skills, and attitudes (KSA) of registered nurses regarding needlestick injury (NSI) prevention. This design was appropriate to evaluate the current status of NSI-related competencies and identify gaps in practice within a specific nursing population.

Study Setting

The study was carried out at the National Neuroscience Institute, King Fahad Medical City (KFMC), Riyadh, Kingdom of Saudi Arabia. KFMC is a leading tertiary care facility providing specialized services, including advanced neuroscience care, where nurses are at high risk of occupational exposure to sharps.

Study Population

The target population included registered nurses classified under the SN1 clinical category, actively working 12-hour shifts, and providing informed consent. Nurses in administrative roles, interns, or those outside the SN1 category were excluded. The focus on SN1 nurses ensured inclusion of personnel directly involved in high-risk procedures, particularly intravenous and intramuscular medication administration.

Sampling Technique

Purposive sampling was employed to recruit eligible participants. This approach was justified due to the limited number of nurses administering intramuscular (IM) medications, which are primarily given during the 8:00 a.m. medication rounds. By targeting nurses with relevant exposure and experience, the study captured accurate representations of clinical practice.

Sample Size Calculation

The required sample size was estimated using the formula for prevalence studies: $n = \frac{Z^2 \cdot p \cdot (1-p)}{d^2}$, where $p = 0.5$ (a conservative estimate of adequate NSI knowledge, skills, and attitudes), $d = 0.1$ (allowable margin of error), and $Z = 1.96$ (95% confidence level), resulting in $n = 96$. Considering the finite population of 200 nurses, the sample size was adjusted using the finite population correction: $n_{adj} = \frac{n}{1 + (n-1)/N} \approx 67$. Therefore, a total of 67 registered nurses were included in the study after accounting for incomplete responses and non-participation.

Data Collection Tools

Data were collected using a structured, self-administered questionnaire complemented by a direct observational skills checklist:

- Questionnaire: Assessed demographic characteristics, knowledge of NSI prevention, and attitudes toward reporting and safe practices. Knowledge items were scored as Excellent (>80%), Good (50–79%), or Fair (<50%). Attitudes were measured using a 10-item Likert scale ranging from

Strongly Agree (+2) to Strongly Disagree (–2), categorized as Positive (>80%), Neutral (50–79%), or Negative (<50%).

- **Observational Checklist**: Evaluated practical skills related to NSI prevention using 10 items, scored as properly performed (2 points), partially performed (1 point), or not performed (0 points). Examples include: safe needle disposal, avoidance of recapping, and appropriate sharps handling. Observers were trained to standardize scoring, and inter-rater reliability was confirmed using Cohen's kappa (average measure = 0.85).

The tools were reviewed by five clinical nursing experts and two infection control academicians to ensure content validity. A pilot study confirmed feasibility and suitability in the clinical setting.

Reliability and Validity

- **Internal Consistency**: Cronbach's alpha values of 0.82 (knowledge) and 0.79 (attitude) indicated good reliability.

- **Inter-Rater Reliability**: Cohen's kappa of 0.85 demonstrated high agreement between observers.

Ethical Approval and Consent

Ethical approval was obtained from the Institutional Review Board of KFMC, and permissions were secured from hospital authorities. Participants were briefed on study objectives, assured of confidentiality, and provided written informed consent. Data collection was coordinated with nurses' shifts to minimize disruption, and completed questionnaires and checklists were immediately reviewed for completeness.

Statistical Analysis Plan

Data were analyzed using IBM SPSS Version 25. Descriptive statistics (frequencies, percentages, means, standard deviations) summarized demographic characteristics and KSA levels. Inferential statistics, including the Chi-square test and Kruskal-Wallis test, examined associations between demographic variables and KSA domains. A p-value <0.05 was considered statistically significant.

RESULTS:

A total of 67 registered nurses from the National Neuroscience Institute at King Fahad Medical City participated in this study. The majority were female (70.1%) and aged 31–40 years (52.2%). Educational qualifications were nearly evenly split between Diploma (49.3%) and BSN (49.3%) holders. Most participants (83.6%) had completed their nursing education outside the Kingdom of Saudi Arabia. Over half of the nurses (56.7%) had more than five years of overall nursing experience, while nearly half (49.3%) had less than two years of experience at KFMC. Regarding occupational health, all participants had received the Hepatitis B vaccine, with 88.1% vaccinated more than a year prior, and 31.3% reported receiving other vaccines related to occupational exposure. Notably, 34.3% of nurses reported experiencing a needlestick injury during their clinical practice.

Knowledge of NSI prevention was generally high, with 85.1% of nurses achieving an excellent score, 13.4% good, and only 1.5% fair. Nearly all participants (98.5%) were aware of universal precautions, and 100% understood the importance of immediate disposal of used sharps. Statistical analysis revealed that

years of experience as a registered nurse was significantly associated with knowledge (χ^2 = 9.13, H = 10.45, p = 0.005), with nurses having more than five years of experience demonstrating higher levels of excellent knowledge. No significant differences in knowledge were observed based on age (p = 0.130), gender (p = 0.201), or education level (p = 0.058), suggesting that institutional training effectively standardized knowledge across these demographic groups.

Skills performance, assessed via direct observation, indicated that 61.2% of nurses demonstrated excellent skills, 29.8% good, and 9% fair. Gender (p = 0.809) and age (p = 0.517) were not significantly associated with skill levels, while education level (p = 0.033) and years of experience (p = 0.065) influenced skill performance, with BSN-qualified nurses and those with more experience demonstrating higher proficiency. University location showed a trend toward higher skill scores for nurses trained outside KSA (p = 0.073), though this was not statistically significant. Observed gaps included improper disposal of needles and partial adherence to recommended safe practices, such as avoiding needle bending and using bedside trays for temporary sharps storage.

Attitudes toward NSI prevention were positive among 64.2% of nurses, neutral in 28.4%, and negative in 7.5%. No statistically significant associations were found between attitude and any demographic variable, including age (p = 0.139), gender (p = 0.976), education level (p = 0.338), years of experience (p = 0.575), or university location (p = 0.830). However, 43.3% of participants perceived NSIs as minor incidents that do not require reporting, highlighting a concerning attitudinal gap despite high knowledge and skill levels.

Overall, the combined assessment of knowledge, skills, and attitudes underscores a risk-to-practice disconnect. While 85% of nurses demonstrated strong knowledge of NSI prevention, unsafe practices such as recapping needles and inadequate post-exposure protocols persisted. Skill proficiency, though moderate at 61%, revealed continuing unsafe disposal behaviors, and attitudes, though generally positive at 64%, reflected that nearly half of the nurses underestimated the seriousness of NSIs, which may contribute to underreporting and inadequate responses. These findings highlight the critical need for targeted educational programs, reinforcement of safe clinical practices, and behavioral interventions to bridge the gap between theoretical knowledge and actual practice in NSI prevention.

Table:1: Demographic Characteristics of Participants

Sl: No	Variables	Category	Frequency(n)	Percentage (%)
1	Age	22-30 years	19	28.4
		31-40 years	35	52.2
		More than 41 years	13	19.4
2	Gender	Male	20	29.9
		Female	47	70.1
3	Education	Diploma	33	49.3
		BSN	33	49.3
		Others	1	1.5
4	University graduated from	Within KSA	11	16.4
		Outside KSA	56	83.6
5	Marital Status	Married	38	56.7

		Single	29	43.3
6	Years of experience as Registered Nurse	Less than 2years	8	11.9
		2-5 years	21	31.3
		More than 5 years	38	56.7
7	Years of experience in King Fahad Medical City	Less than 2years	33	49.3
		2-5 years	13	19.4
		More than 5 years	21	31.3
8	Years of experience in National Neuroscience Institute	Less than 2years	34	50.7
		2-5 years	14	20.9
		More than 5 years	19	28.4
9	Knowledge of universal precautions	Yes	66	98.5
		No	01	1.5
10	Knowledge of King Fahad Medical City policy	Yes	65	97.0
		No	2	3.0
11	Experienced Needle stick Injury	Yes	23	34.3
		No	44	65.7
12	Hepatitis B vaccination taken	Yes	67	100
		No	0	0
13	If vaccinated (Hep B)	Less than 1year	8	11.9
		More than 1 year	59	88.1
14	Other vaccines related to occupational exposure	Yes	21	31.3
		No	46	68.7

Interpretation:

Majority of participants were female (70.1%), aged 31–40 years (52.2%), Education was nearly split between Diploma (49.3%) and BSN (49.3%), Most nurses (83.6%) were trained outside KSA, over half (56.7%) had more than 5 years of overall nursing experience, but nearly half (49.3%) had less than 2 years at KFMC, regarding occupational health: all had Hepatitis B vaccination, and 34.3% reported a needle stick injury.

Table:2: Comparison of Knowledge Based on Demographic Characteristics

Sl: No	Variables	Category	n	Knowledge Level			Chi-square (χ²)	Kruskal-Wallis (H)	p-value
				Excellent	Good	Fair			
		22-30 years	19	16	3	0			0.130

1	Age	31-40 years	35	30	5	0			
		More than 41 years	13	11	2	0	4.12	5.67	
2	Gender	Male	20	15	5	0			0.201
		Female	47	42	5	0	2.04	3.19	
3	Education	Diploma	33	24	8	0			0.058
		BSN	33	30	3	0			
		Others	01	1	0	0	5.67	6.12	
4	Years of Experience as Registered Nurse	Less than 2years	08	4	40				0.005
		2-5 years	21	16	5	0			
		More than 5 years	38	37	1	0	9.13	10.45	

Interpretation: p < 0.05 → statistically significant difference, p ≥ 0.05 → no significant difference

Age: $\chi^2 = 4.12$, H = 5.67, p = 0.130 → No statistically significant difference in knowledge across age groups.

Gender: $\chi^2 = 2.04$, H = 3.19, p = 0.201 → No significant difference in knowledge between male and female nurses.

Education Level: $\chi^2 = 5.67$, H = 6.12, p = 0.058 → Trend toward higher knowledge in BSN nurses, but not statistically significant (p > 0.05).

Years of Experience as RN: $\chi^2 = 9.13$, H = 10.45, p = 0.005 → Statistically significant difference; nurses with >5 years of experience had higher knowledge scores.

Table:3: Comparison of Skills Based on Demographic Characteristics

Sl: No	Variables	Category	Knowledge Level		Total (n)	Median Score	Mean Score	(χ^2)	df	p-value	H (K-W)	p-value (K-W)
			Good	Poor								
1	Age	22-30 years	10	9	19	16	30.1	2.11	2	0.348	01.32	0.517
		31-40 years	23	12	35	17	34.9					

No	Variables	Category					χ^2	df	p-value	H (K-W)	p-value (K-W)
		More than 41 years	10	3	13	17	37.2				
2	Gender	Male	13	7	20	16	34.8	0.02	1	0.891	0.058	0.809
		Female	30	37	47	16	33.5					
3	Education	Diploma	15	18	33	15	30.2	8.64	2	0.013	6.82	0.033
		BSN	27	6	33	17	38.9					
		Others	1	0	1	17	44.0					
4	Years of Experience as Registered Nurse	Less than 2years	3	5	8	14	25.3	6.21	2	0.045	5.47	0.065
		2-5 years	11	10	21	15	31.6					
		More than 5 years	29	9	38	17	37.7					
5	University Location	KSA	4	7	11	15	28.0	2.96	1	0.085	3.21	0.073
		Outside KSA	39	17	56	17	35.2					

Interpretation: p < 0.05 → statistically significant difference, p ≥ 0.05 → no significant difference

Age: χ^2 = 2.11, p = 0.348 → No significant differences in skills across age groups. Gender: χ^2 = 0.02, p = 0.891 → No significant difference between males and females. Education Level: χ^2 = 8.64, p = 0.013 → Statistically significant; BSN nurses had better skills than Diploma or other nurses. Years of Experience: χ^2 = 6.21, p = 0.045 → Significant; more experienced nurses (>5 yrs) showed higher skill proficiency. University Location: χ^2 = 2.96, p = 0.085 → Trend toward higher skills for nurses trained outside KSA, but not significant.

Table:4: Comparison of Attitude Based on Demographic Characteristics

No	Variables	Category	Attitude Level		Total (n)	Median Score	Mean Score	(χ^2)	df	p-value	H (K-W)	p-value (K-W)
			Positive	Neutral								
1	Age	22-30 years	14	5	19	12	29.6	3.94	2	0.139	2.42	0.299

No	Category	Subcategory						χ²	df	p		
		31-40 years	27	8	35	13	34.1					
		More than 41 years	13	0	13	14	36.8					
2	Gender	Male	16	4	20	12	31.2	0.001	1	0.976	0.35	0.555
		Female	38	9	47	13	33.8					
3	Education	Diploma	24	9	33	12	29.8	2.17	2	0.338	1.20	0.549
		BSN	29	4	33	13	36.2					
		Others	1	0	1	14	37.0					
4	Years of Experience as Registered Nurse	Less than 2years	6	2	8	11	27.3	1.11	2	0.575	0.82	0.664
		2-5 years	16	5	21	12	31.4					
		More than 5 years	32	6	38	13	35.2					
5	University Location	KSA	9	2	11	12	30.8	0.05	1	0.830	0.41	0.523
		Outside KSA	45	11	56	13	33.6					

Interpretation: p < 0.05 → statistically significant difference, p ≥ 0.05 → no significant difference

Age: $\chi^2 = 3.94$, p = 0.139 → No significant difference in attitude across age groups. Gender: $\chi^2 = 0.001$, p = 0.976 → No difference between male and female nurses. Education Level: $\chi^2 = 2.17$, p = 0.338 → Education does not significantly influence attitude. Years of Experience: $\chi^2 = 1.11$, p = 0.575 → No significant differences in attitude across experience groups. University Location: $\chi^2 = 0.05$, p = 0.830 → Location of training does not affect attitude. Key point: Attitudes toward NSI prevention were generally positive, and demographic characteristics did not influence attitude significantly.

Table:5: Risk to Practice Disconnect in NSI Prevention

Domain	% (Percentage)	Behavioral /Attitudinal Gap
Knowledge	85%	Persistent gaps in recapping and Post exposure
Skills	61%	Unsafe disposal practices still common
Attitude	64%	43% Consider NSIs Minor and, may not report

Key Score:

- Knowledge (85%) indicates that most healthcare workers understand NSI risks and prevention, yet unsafe practices like recapping needles and neglecting post-exposure steps persist.

- Skills (61%) reflect a moderate proficiency, but unsafe behaviors, particularly in needle disposal, continue to pose risks.

- Attitude (64%) highlights a significant attitudinal barrier where nearly half underestimate the seriousness of NSIs, contributing to inadequate reporting and response.

DISCUSSION

This study assessed the knowledge, skills, and attitudes of registered nurses toward NSI prevention in a tertiary neuroscience unit. The findings reveal that while nurses possess high levels of knowledge (85.1% excellent) and satisfactory practical skills (61.2% excellent), gaps remain in certain behaviors and attitudes, particularly regarding reporting and safe needle handling. The significant association between years of experience and both knowledge ($p = 0.005$) and skill performance ($p = 0.065$) align with prior research suggesting that clinical exposure and professional maturity reinforce safe practices. [4],[9]

Despite high knowledge levels, unsafe practices such as recapping needles and temporary storage of sharps on bedside trays persisted. Education level significantly influenced skill performance ($p = 0.033$), with BSN-qualified nurses demonstrating superior competence compared to diploma holders, highlighting the importance of advanced education and continuous professional development. Other demographic variables, including age, gender, and university location, had minimal influence on knowledge, skills, or attitudes, suggesting that standardized training programs may equalize competency across diverse groups. [10]

Attitudinal gaps were evident, with nearly half of the nurses perceiving NSIs as minor incidents not requiring reporting. This disconnects between knowledge, skills, and attitudes poses risks for underreporting, delayed post-exposure management, and potential occupational transmission of bloodborne pathogens. [12],[7] Cultural and institutional barriers, such as fear of blame or hierarchical pressures, may further hinder proper reporting, underscoring that knowledge alone is insufficient to ensure safe practices.

Study Limitations

- Conducted at a single site, limiting generalizability.

- Use of self-administered questionnaires may introduce self-report bias.

- Observational assessments were constrained by timing and limited IM administration.

- Purposive sampling may not fully represent the broader nursing population.

Implications for Practice and Policy

- Implement periodic refresher training and behavioral reinforcement programs.

- Establish non-punitive, confidential reporting systems to encourage incident reporting.

- Engage leadership to model safe practices and reinforce accountability.

- Review and revise institutional protocols to address attitudinal barriers and ensure consistent safe needle handling.

Contributions to Nursing Education

- Emphasizes the need for integrating practical skills and attitude-focused training in nursing curricula.

- Highlights the importance of ongoing monitoring and targeted strategies for less experienced nurses to reduce NSI incidence.

Conclusion

Registered nurses at KFMC demonstrate strong knowledge and satisfactory skills in NSI prevention; however, persistent unsafe practices and attitudinal gaps remain. Bridging the knowledge-practice-attitude gap requires multi-faceted interventions, including behavioral change strategies, leadership engagement, and continuous evaluation of safety programs. Replicating this study in other tertiary care settings may provide further evidence to guide interventions and improve occupational safety.

Recommendations

1. Conduct ongoing NSI training and refresher courses.

2. Introduce attitude-focused workshops emphasizing reporting and post-exposure protocols.

3. Implement regular audits and provide real-time feedback on unsafe practices.

4. Establish a non-punitive, confidential incident reporting system.

5. Engage leadership to reinforce a culture of safety and accountability.

6. Continuously evaluate interventions to ensure closure of the knowledge-practice-attitude gap.

Statements and Declarations

Ethics Statement: This study was approved by the Institutional Review Board of King Fahad Medical City. Informed consent was obtained from all participants. Confidentiality and anonymity were strictly maintained.

Data Availability: The dataset supporting the conclusions of this article is available from the corresponding author upon reasonable request.

Consent for Publication: Not applicable

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