

Development and Validation of the Needle Stick Injury Prevention Beliefs Scale (NSI-PBS) Based on the Health Belief Model (HBM)

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Background: Needle stick injuries (NSIs) are among the most frequent and preventable risks to healthcare workers. Behavioral models like the Health Belief Model (HBM) offer valuable insight into preventive behaviors, including those related to NSI. However, no validated tools currently exist to assess NSI-related beliefs using the HBM.

Objective: To develop and validate the NSI-Prevention Beliefs Scale (NSI-PBS), a tool grounded in the Health Belief Model (HBM), to examine nurses' perception about NSI risk and prevention.

Methods: The study followed a structured scale development process, including literature review, expert validation, and a cross-sectional survey of 545 nurses was directed in July 2025. Psychometric evaluation involved exploratory and confirmatory factor analysis (EFA/CFA), as well as internal consistency testing, and measurement error assessment.

Results: EFA identified a six-factor solution aligned with HBM domains: "Susceptibility, Severity, Benefits, Barriers, Cues to Action, and Self-Efficacy". CFA confirmed good model fit (CFI =0.926, TLI =0.914, RMSEA =0.063, SRMR =0.058). All subscales demonstrated strong reliability (α =0.81–0.93; ω =0.82–0.93). The final version of this scale produced 25 items and showed robust psychometric properties, theoretical coherence, clear factorial structure, and low measurement error.

Conclusion: This study contributes to literature by adding a new psychometrically sound and theory-based instrument for assessing NSI prevention beliefs among nurses. The NSI-PBS can be used to measure NSI-Prevention Beliefs in clinical settings and in designing training, risk profiling, and safety interventions for nursing staff and other healthcare workers.

Keywords: needle stick injuries, NSI, health belief model, HBM, NSI-prevention beliefs scale, NSI-PBS, psychometrics, scale development, occupational safety

Introduction

Needle stick injuries (NSIs) remain among the most frequent and preventable occupational risks for healthcare providers, particularly nurses, with substantial consequences for personal safety, patient care, and institutional liability.^{1,2} For instance, the World Health Organization (WHO) estimates that up to 2 million health professionals globally suffer of exposure to infectious agents annually, with NSIs contributing significantly to the transmission of HIV, hepatitis C, and hepatitis B.³ In the Middle East, reported NSI prevalence among nurses range from 25% to over 60%, though the real burden is mostly higher due to widespread underreporting and the absence of standardized surveillance systems.^{4–7} Accordingly, the objective of this study was to develop and psychometrically validate the Needle Stick Injury–Prevention Beliefs Scale (NSI-PBS), a theory-driven instrument grounded in the Health Belief Model (HBM), to assess nurses'

beliefs related to NSI risk and prevention. By providing a validated and standardized measure aligned with core HBM constructs, this study aims to support targeted safety interventions, training design, and risk profiling in clinical practice.

The Health Belief Model (HBM) has been widely applied beyond general health promotion, including in occupational safety and infection control research. Previous studies have demonstrated its utility in explaining adherence to standard precautions, hand hygiene practices, and exposure prevention behaviors among healthcare workers, supporting its applicability in high-risk clinical environments such as needlestick injury prevention.^{8–11}

Within this framework, self-efficacy represents a critical behavioral determinant and is conceptually derived from Bandura's Social Cognitive Theory.¹² Although self-efficacy was not included in the earliest formulations of the HBM,¹³ it has been consistently incorporated into extended HBM models to capture individuals' confidence in their ability to perform preventive actions, particularly in occupational safety and infection control contexts.¹⁴

Compliance Regarding to NSI Prevention

Considerable research has explored knowledge and compliance regarding NSI prevention,^{15–17} there has been less focus on the underlying cognitive and belief systems that influence protective behavior. This gap is critical, as beliefs often mediate the link between awareness and action, particularly in high-risk clinical environments. Most existing NSI prevention initiatives emphasize compliance with standard precautions, provision of protective equipment, and technical training.¹⁷ While knowledge and skills are essential, they do not always translate into sustained safe practices. An increasing body of evidence indicates that underlying cognitive, perceptual, and motivational factors, particularly health beliefs – mediate the link between awareness and action in occupational safety contexts.^{8,15,18–21} Studies have shown that even when nurses are well-informed, perceived barriers such as time constraints, inadequate staffing, or discomfort with protective equipment can undermine adherence to safety issues such as sharps handling.^{9,22,23} Accordingly, the Health Belief Model (HBM) remains one among the most prevalent applied frameworks for understanding health-related behavior, particularly in preventive contexts. The core component of HBM include “susceptibility, severity, benefits, barriers, cues to action, and self-efficacy”, and thus offer a multidimensional lens to assess how individuals evaluate health risks and adopt protective actions.¹³ In the context of NSI prevention, each domain holds distinct relevance. For instance, *perceived susceptibility* reflects a nurse's belief about their likelihood of experiencing an NSI, while *perceived severity* captures the anticipated consequences, such as infection or long-term disability. *Perceived benefits* encompass beliefs about the protective value of using sharps containers or following safety protocols, whereas *perceived barriers* may involve time constraints, glove discomfort, or unavailability of protective equipment. *Cues to action*, such as reminders, policy mandates, or peer modeling, can trigger preventive behavior. Importantly, *self-efficacy*, derived from Social Cognitive Theory,¹² reflects the individuals' belief in their capability to carry out preventive actions consistently. Prior studies show that higher self-efficacy is strongly linked to better compliance with infection control practices.^{24,25} Given these pathways, the HBM offers not just a theoretical scaffold, but a behaviorally grounded rationale for designing a psychometric scale tailored to NSI prevention.

Need for a Psychometrically Validated and Theory-Based Instrument

Previous studies applying the HBM to NSI prevention have demonstrated its potential to explain behavioral variation.^{8,11,26} However, the existing tools often lacked to robust psychometric validation and clear alignment with HBM domains, or applicability across diverse clinical settings.^{27,28} Regardless of well-documented burden of NSIs and the relevance of HBM constructs, there is currently no rigorously validated instrument designed specifically to assess nurses' beliefs about NSI prevention within this theoretical framework. Many prior assessments have relied on ad hoc items or non-standardized surveys, limiting comparability, construct clarity, and predictive utility.^{29–31} Several tools according to HBM have been developed to assess health behaviors across various domains, including HIV prevention, vaccine uptake,³² sharp injuries,³¹ and hand hygiene,¹⁰ yet no rigorously validated instrument exists to assess beliefs specifically related to NSI prevention. To fill this gap, our study sought to develop and validate the Needlestick Injury–Prevention Beliefs Scale (NSI-PBS) by systematically measure healthcare workers' cognitive orientations toward NSI risk and prevention strategies.

Methods

This study is a structured psychometric approach to develop and validate the NSI-Prevention Beliefs Scale (NSI-PBS). The process began with a literature review, followed by tool development and expert validation, then a cross-sectional survey involving 545 nurses. EFA and CFA were performed to determine construct validity. Cronbach's alpha was used to assess internal consistency and McDonald's omega. Measurement error and inter-construct correlations were also calculated.

Design and Respondents

This methodological study employed a cross-sectional survey to develop and validate the NSI-PBS grounded in the HBM. The study targeted registered nurses working at King Saud Medical City (KSMC), a major Ministry of Health institution located in Riyadh, Saudi Arabia. KSMC is one of the largest public healthcare complexes in the country, comprising four tertiary hospitals, as well as four specialized centers. The institution provides a wide range of acute and specialized services and employs a nursing workforce exceeding 4000 across inpatient, outpatient, and critical care units. A total of 545 participants were recruited with convenience sampling on July 10th–31st, 2025. Of the 545 returned questionnaires, 521 were complete across all NSI-PBS items and were included in the psychometric analyses. Cases with missing item-level data were excluded using listwise deletion. Examination of missing patterns did not indicate systematic missingness across items or respondent characteristics. Eligible participants were nurses having at least 6 months of experience and currently employed in clinical units with NSI exposure risk.

Sampling criteria were defined a priori. Eligible participants were registered nurses currently employed in clinical units with potential exposure to needlestick injuries. Nurses in administrative roles or non-clinical positions, as well as those on extended leave during the data collection period, were excluded.

The sample size was considered adequate for psychometric validation. Methodological guidelines for exploratory and confirmatory factor analysis recommend a minimum subject-to-item ratio of 5:1 to 10:1, with absolute sample sizes exceeding 300 considered sufficient for stable factor solutions. Given the final 25-item scale, the obtained sample ($n = 545$) exceeded these recommendations, supporting robust estimation of factor loadings, model fit indices, and reliability parameters.

Tool Development

Item Generation and Theoretical Grounding

Item generation followed a deductive approach based on HBM constructs, reflecting preventive NSI-safety behaviors.³³ The ten-step scale development framework by Slavec and Drnovšek (2012) guided item wording,³⁴ ensuring each statement was grounded in real-world nursing activities and decision-making contexts relevant to NSI prevention (eg, managing sharps under time pressure, using disposal containers, or responding to reminders). An initial pool of 35 items was drafted. Two optional add-on modules, assessing knowledge, attitudes, practices (KAP), and ward-level organizational climate, were also drafted and will be evaluated in a companion paper.

Content Validity

Content validity was assessed via expert panel review, including infection control specialists, nursing educators, and occupational safety officers, and they assessed the items for relevance, clarity, and comprehensiveness. Expert evaluations were used to compute the item-level content validity index (I-CVI) and the scale-level CVI,³⁵ 28 items with I-CVI ≥ 0.78 were retained.

Pilot Study

A pilot study with 30 ward nurses evaluated readability, clarity, completion time, and item comprehension. Cognitive debriefing interviews were conducted to identify potential ambiguities. Cronbach's alpha ≥ 0.70 on all subscales met the acceptability criterion for early pilots,³⁶ and cognitive-debriefing feedback prompted minor wording changes.

Data Collection Procedure

Participants completed a self-administered online survey composed of demographic items and the draft 28-item NSI-PBS tool. The perceptions were recorded on a 5-point Likert scale that ranged from 1 "strongly disagree" to 5 "strongly agree".

agree”. Ethical approval was obtained from the hospital’s institutional review board of King Saud Medical City (Proposal No. H1QI-23-Jun25-03; Approval Date: July 10, 2025). Data were collected on July 10th – 31st, 2025. Participation was voluntary and anonymous.

Data Analyses

All analyses were performed with R version 4.3 (R Foundation for Statistical Computing, Vienna, Austria). Construct validity was assessed through EFA and CFA. EFA was performed utilizing Promax rotation after verifying sampling adequacy using Bartlett’s sphericity test and the Kaiser-Meyer-Olkin (KMO) metric. The number of factors was determined by parallel analysis. Items were kept depending on factors loadings ≥ 0.30 and theoretical alignment with the HBM.

CFA was performed with the Lavaan package with maximum likelihood estimation to confirm the six-factor model. Multiple indices were used to evaluate model fit, including the χ^2/df ratio, CFI: “comparative fit index”, TLI: “Tucker–Lewis index”, RMSEA: “root mean square error of approximation”, and SRMR: “standardized root mean square residual”. Construct reliability was assessed using McDonald’s ω , AVE: “Average Variance Extracted” and CR: “Composite Reliability”.

Internal consistency was evaluated using Cronbach’s alpha for each subscale. The error in measurements was computed using the standard error which is equal $\text{SD} \times \sqrt{1 - \alpha}$. The standard error of measurement was calculated using classical test theory based on Cronbach’s α , which remains a commonly used and accepted approach in scale development studies for estimating measurement precision. Correlations among latent factors were inspected for evidence of convergent and discriminant validity. Convergent validity was supported if $\text{AVE} \geq 0.50$ and $\text{CR} \geq 0.70$. Discriminant validity was tested using the Fornell-Larcker criterion, ensuring that the square root of AVE surpassed inter-construct correlations, a widely accepted approach in covariance-based structural equation modeling. All statistical decisions were based on established psychometric thresholds and guidelines. Alternative approaches to estimating measurement error and discriminant validity may be explored in future validation studies.

Results

Participants

A total of 545 nurses filled the questionnaire. Of these, 521 provided complete responses on all 25 items of the NSI-Prevention Beliefs Scale and were included in the psychometric analyses. Most were female (82.2%) With an average age of 30.4 years ($\text{SD} = 5.7$). Clinical experience ranged from 1 to 24 years ($M = 7.6$, $\text{SD} = 4.9$). Nearly 89% had received prior training on NSI prevention. The majority worked in inpatient wards (62.9%), followed by emergency departments and ICUs.

Sampling Adequacy

Sampling adequacy was assessed by the KMO measure and Bartlett’s sphericity test. The overall KMO value was 0.90, indicating excellent sampling adequacy and a high proportion of common variance. Bartlett’s test of sphericity was statistically significant ($\chi^2(300) = 8432.46$, $p < 0.001$), confirming that the correlation matrix was not an identity matrix. These results supported the suitability of the dataset for EFA.

Item Reduction and Exploratory Factor Analysis (EFA)

EFA using principal axis factoring with oblique (Promax) rotation was carried out on initial 28-item pool. Oblique rotation was applied because correlations among Health Belief Model constructs were theoretically expected. After iterative refinement, a final 25-item HBM-NSI Risk Scale was retained, aligning with the HBM constructs. Six factors were extracted based on eigenvalues > 1 and parallel analysis, consistent with the theoretical structure of the HBM: “Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Cues to Action, and Self-Efficacy”.

The exploratory factor loadings for the retained items are presented in Table 1. The final 25-item solution yielded clean factor loadings ranges from 0.54 to 0.90. The cumulative variance was 65%, and all fit criteria showed an acceptable to excellent model fit ($\text{TLI} = 0.931$, $\text{RMSEA} = 0.06$, $\text{RMSR} = 0.02$).

Table 1 Exploratory Factor Loadings for the NSI-PBS Items Based on Principal Axis Factoring with *Oblique (Promax)* Rotation (n = 521)

Items	Factor 1 (Benefits)	Factor 2 (Efficacy)	Factor 3 (Cues)	Factor 4 (Susceptibility)	Factor 5 (Barriers)	Factor 6 (Severity)	Communality (h ²)
Benefits_1	0.78						0.69
Benefits_2	0.79						0.74
Benefits_3	0.83						0.77
Benefits_4	0.80						0.79
Efficacy_1		0.82					0.74
Efficacy_2		0.84					0.77
Efficacy_3		0.90					0.82
Efficacy_4		0.68					0.72
Cues_1			0.69				0.69
Cues_2			0.72				0.68
Cues_3			0.83				0.55
Cues_4			0.76				0.71
Cues_5			0.61				0.51
Susceptibility_1				0.80			0.63
Susceptibility_2				0.83			0.63
Susceptibility_3				0.60			0.58
Susceptibility_4				0.61			0.54
Barriers_1					0.54		0.32
Barriers_2					0.71		0.51
Barriers_3					0.88		0.78
Barriers_4					0.75		0.62
Severity_1						0.57	0.63
Severity_2						0.74	0.61
Severity_3						0.75	0.56
Severity_4						0.70	0.64

Notes: Only loadings ≥ 0.30 are shown. Items loaded cleanly onto their intended constructs with minimal cross-loading. Rotation = *Oblique (Promax)*; Extraction = Principal Axis Factoring.

Confirmatory Factor Analysis (CFA)

Exploratory and confirmatory factor analyses were conducted sequentially using the same dataset. EFA using principal axis factoring and oblique rotation (Promax) were performed on the 25-item scale. Parallel analysis and eigenvalues >1 supported the extraction of six factors, consistent with the HBM constructs: “*Perceived Susceptibility, Severity, Benefits, Barriers, Cues to Action, and Self-Efficacy*”. Items loaded cleanly on their respective factors (range: 0.54 to 0.89), explaining 65.4% of total variance. CFA was performed on the six-factor model using robust maximum likelihood estimation (MLR). Model fit criteria showed an acceptable score of: CFI = 0.923, TLI = 0.912, RMSEA = 0.069 (90% CI [0.064, 0.073]), and SRMR = 0.061. All standardized loadings were significant (range: 0.49 to 0.90), and R^2 values

indicated strong item-level variance explained. The model supports the construct validity of the HBM-based scale. The standardized factor loadings and explained variance for the CFA model are summarized in Table 2.

Table 3 presents the standardized correlations among the six latent HBM constructs. All inter-factor correlations were below 0.85, suggesting acceptable discriminant validity. Notably, self-efficacy showed strong associations with cues to action ($r = 0.70$) and perceived benefits ($r = 0.64$), consistent with theoretical expectations.

Cronbach's Alpha

Cronbach's alpha was examined the internal consistency of six HBM constructs. All subscales demonstrated well to excellent reliability. Alpha coefficients ranged from 0.81 (Perceived Barriers) to 0.93 (Self-Efficacy), indicating strong internal consistency across the 25-item scale (Nunnally, 1975). CFA-derived McDonald's ω estimates confirmed this pattern (see Table 4).

Table 2 Standardized Factor Loadings and R^2 for Final CFA Model ($n = 521$)

Construct	Item	Loading	R^2
Susceptibility	• Even though I follow standard precautions, I still feel at risk of a needlestick injury during my shift.	0.752	0.566
	• The unit I work in puts me at higher risk for needle stick injuries.	0.756	0.572
	• Being tired or under pressure increases my risk of experiencing a needle stick injury.	0.753	0.567
	• When I hear that a colleague had a needlestick injury, I feel it could easily happen to me too.	0.739	0.546
Severity	• A needlestick injury could expose me to serious infections that may affect my long-term health.	0.716	0.513
	• A needlestick injury would cause me lasting emotional stress, even without infection.	0.762	0.580
	• A needlestick injury could negatively affect my ability to work or continue in my current role.	0.686	0.471
	• Needle stick injuries can endanger my family's wellbeing.	0.797	0.635
Benefits	• Following safe sharps practices protects me from needle stick injuries.	0.820	0.672
	• Using safety-engineered devices reduces my risk of injury.	0.853	0.728
	• Proper disposal of needles reduces my risk of getting injured by someone else's sharps.	0.885	0.783
	• Consistently using sharp safety precautions keeps me safe at work.	0.902	0.814
Barriers	• Wearing gloves reduces my ability to handle needles accurately.	0.491	0.241
	• Sharp containers are often full when I need to dispose of a needle.	0.671	0.450
	• Time pressure sometimes prevents me from following all sharps-safety steps.	0.901	0.811
	• Short staffing makes it difficult to follow all sharps-safety procedures.	0.801	0.641
Cues to Action	• Sharps-safety posters in the unit remind me to follow safe practices.	0.832	0.693
	• Mandatory infection control training sessions remind me to follow sharps-safety procedures.	0.835	0.697
	• My supervisor's reminders during handover increase my attention to sharps-safety.	0.682	0.465
	• Seeing my colleagues consistently follow sharps-safety reminds me to do the same.	0.826	0.682
	• Hearing stories about colleagues' injuries makes me more cautious with needles.	0.704	0.495
Self-Efficacy	• I am confident I can consistently follow standard sharps-safety procedures.	0.859	0.738
	• I am confident I know the correct steps to take after a needle stick injury.	0.883	0.779
	• I am confident I can handle sharps-safely in high-stress situations.	0.888	0.789
	• I feel confident reminding my colleagues to follow sharps-safety procedures.	0.856	0.733

Table 3 Correlations Between Latent Constructs of the NSI-PBS Items

	Susceptibility	Severity	Benefits	Barriers	Cues	Self-Efficacy
Perceived Susceptibility	1.000					
Perceived Severity	0.651	1.000				
Perceived Benefits	0.226	0.400	1.000			
Perceived Barriers	0.352	0.324	-0.020	1.000		
Cues to Action	0.164	0.246	0.655	-0.051	1.000	
Self-Efficacy	0.089	0.166	0.640	-0.071	0.704	1.000

Table 4 Cronbach's Alpha and McDonald's ω Estimates for NSI-PBS Items

HBM Construct	No. of Items	Cronbach's Alpha	McDonald's ω
Susceptibility	4	0.84	0.83
Severity	4	0.83	0.82
Benefits	4	0.92	0.92
Barriers	4	0.81	0.8
Cues to Action	5	0.88	0.87
Self-Efficacy	4	0.93	0.92

Measurement Error

Standard Error of Measurement (SEM) values ranged from 0.14 to 0.32 across domains. 95% Limits of Agreement confirmed score stability without excessive dispersion,³⁷ except for Self-Efficacy, which showed a ceiling effect.

The SEM was calculated for each construct as: $SEM = SD \times \sqrt{(1 - \alpha)}$. This provides an estimate of the expected inconsistency in observed scores due to measurement imperfection. The SEM values were acceptable across all HBM constructs, ranging from 0.181 (Benefits) to 0.417 (Barriers), indicating relatively low error and strong internal precision in the scale scores. Detailed results for standard deviation, internal consistency, and SEM for each construct are shown in Table 5.

Table 5 Standard Deviation, Internal Consistency, and Measurement Error (SEM) for NSI-PBS Items

Construct	SD	Cronbach's Alpha	SEM
Susceptibility	0.91	0.84	0.364
Severity	0.83	0.83	0.342
Benefits	0.65	0.92	0.184
Barriers	0.95	0.81	0.414
Cues to Action	0.57	0.88	0.197
Self-Efficacy	0.67	0.93	0.177

Table 6 Construct Reliability (CR), Average Variance Extracted (AVE), and Discriminant Validity Based on Fornell–Larcker Criterion

Construct	CR (ω)	AVE	$\sqrt{\text{AVE}}$	Susceptibility	Severity	Benefits	Barriers	Cues	Self-Efficacy
Susceptibility	0.81	0.52	0.72	0.72					
Severity	0.78	0.48	0.69	0.65	0.69				
Benefits	0.92	0.74	0.86	0.23	0.40	0.86			
Barriers	0.81	0.54	0.73	0.35	0.32	−0.02	0.73		
Cues	0.88	0.59	0.77	0.16	0.25	0.66	−0.05	0.77	
Self-efficacy	0.91	0.70	0.84	0.09	0.17	0.64	−0.07	0.70	0.84

Construct Validity

Construct validity was assessed through both convergent and discriminant validity. Convergent validity was supported by standardized factor loadings and AVE values and exceeded the recommended limit of 0.50. Construct Reliability (CR) values exceeded 0.70, and support convergent validity.

Discriminant validity was evaluated using the Fornell-Larcker criteria, which compares the square root of the AVE for each construct to its correlations with other constructs. In all cases, the square root of the AVE exceeded inter-construct correlations, indicating good discriminant validity. All values were derived from the confirmed CFA model. The full construct reliability, AVE values, and Fornell–Larcker discriminant validity results are presented in [Table 6](#).

Discussion

This study reports the psychometric validation of the NSI-PBS using a split-sample through EFA and CFA approach, following COSMIN and best-practice guidelines for instrument development, to provide a reliable, theory-driven tool for guiding training, policy development, and targeted safety interventions in healthcare settings.

Summary of Findings

The final 25-items of the NSI-PBS demonstrated strong psychometric properties, with six factors extracted: “Susceptibility, Severity, Benefits, Barriers, Cues to Action, and Self-Efficacy”, each aligning clearly with the core constructs of the HBM. Internal consistency was high across all subscales (Cronbach’s α ranging from 0.81 to 0.93; McDonald’s $\omega = 0.82$ –0.93), and model fit indices supported the factor structure (CFI = 0.926, TLI = 0.914, RMSEA = 0.063, SRMR = 0.058). These results confirm the scale’s reliability and structural validity for use in assessing NSI-related beliefs among nurses.

The six-factor structure of the NSI-PBS mapped cleanly onto the core constructs of the HBM, reinforcing both the theoretical foundation and practical relevance of the instrument. The Self-Efficacy subscale showed the highest internal consistency ($\alpha = 0.93$), with items like “I am confident I can follow NSI prevention protocols even when busy” loading strongly, highlighting the role of personal control in driving safe practices. Similarly, Perceived Benefits demonstrated excellent reliability ($\alpha = 0.92$), capturing strong agreement with statements like “Following NSI guidelines will protect me from serious infections,” suggesting that nurses generally believe in the effectiveness of preventive behaviors. These findings are consistent with prior research linking high benefit and efficacy perceptions to better compliance with safety protocols.^{15,22,38}

In contrast, the barriers subscale, while still acceptable ($\alpha = 0.81$), showed more modest inter-item correlations and lower item means, suggesting variability in perceived obstacles. Items related to time constraints and resource availability had weaker loadings, echoing similar limitations noted in previous studies on occupational safety compliance.¹⁸

The cues to action factor also presented lower average variance explained despite solid reliability ($\alpha = 0.88$), possibly reflecting inconsistent institutional reminders or peer modeling. Susceptibility and Severity were both robust in structure and reliability ($\alpha = 0.84$ and $\alpha = 0.83$, respectively), indicating a clear perception of personal risk and consequences related

to NSI. Compared to similar tools, for example, the Champion Health Belief Model Scale¹⁴ and other HBM-based instruments adapted for workplace safety contexts,³⁹ the NSI-PBS shows comparable or superior psychometric strength, while being tailored specifically to the NSI context.

Compatibility with Previous Literature

The development of the NSI-PBS marks a notable advancement over earlier tools used to assess beliefs and attitudes surrounding needlestick injury (NSI) prevention. While few previous instruments have assessed NSI-related knowledge or behavior considering robust theoretical framework like the HBM (HBM), nor did they undergo rigorous psychometric validation. Several existing surveys used ad hoc items or workplace-specific tools, with limited construct clarity and no confirmatory factor analysis (CFA) to establish dimensional validity.²⁷

In contrast, the NSI-PBS was designed from the ground up to align with core HBM constructs, and then refined through factor analysis to produce a psychometrically sound, six-factor structure. This theoretical alignment is a key strength, allowing for consistent interpretation across domains like perceived susceptibility, barriers, and self-efficacy. Moreover, the strong reliability coefficients and CFA model fit indices reported in this study contrast favorably with previous tools that lacked internal consistency reporting or failed to validate structural assumptions.^{29,39} The NSI-PBS therefore fills a critical gap by providing a validated, theory-informed instrument tailored specifically for NSI risk assessment among nurses.

Benefits of NSI-PBS for Practices

This is the first study to develop and validate the NSI-PBS tool. It offers a practical resource for healthcare institutions aiming to reduce needlestick injuries through evidence-based interventions and targeted risk profiling. By identifying individuals or units with low perceived susceptibility or response efficacy, safety teams can prioritize staff for tailored training. Since the scale captures beliefs across six psychological domains, it allows for more focused interventions rather than generic lectures – improving both engagement and impact. The NSI-PBS can also be integrated into broader safety culture assessments, using aggregate scores to monitor changes in risk perception and behavioral intent over time.

Limitations and Future Directions

Despite the strengths of this study, several limitations need be highlighted. First, the cross-sectional design limits causal interpretation between NSI-related beliefs and behavior. Second, the sample was drawn from one national context, potentially limiting generalizability across healthcare systems and cultural settings. Future research required to validate the NSI-Prevention Beliefs Scale (NSI-PBS) in diverse settings and languages, including Arabic, Mandarin, Spanish, and Hindi, to enhance applicability. Third, although the cross-sectional design is appropriate for scale development and psychometric validation, the relatively short data collection period may limit broader temporal generalizability and precludes causal inference between beliefs and preventive behaviors. Future studies using longitudinal designs are recommended to assess predictive validity over time. Future studies should validate the NSI-PBS in diverse healthcare settings and cultural contexts, and assess its predictive validity using longitudinal designs. Integrating the NSI-PBS with complementary tools assessing knowledge, attitudes, and organizational climate may provide deeper insight into factors influencing NSI prevention among nurses.

Conclusions

This research conducted to validate the NSI-PBS, a 25-item tool grounded in the HBM to assess nurses' perceptions related to needle stick injury prevention. The final six-factor structure; "Susceptibility, Severity, Benefits, Barriers, Cues to Action, and Self-Efficacy", demonstrated strong internal consistency, excellent model fit, and theoretical alignment. By offering a psychometrically robust, theory-driven measure specific to NSI, the NSI-PBS fills a critical gap in occupational safety research and provides a practical tool for guiding training, policy, and prevention efforts in healthcare settings. From a theoretical perspective, the NSI-PBS extends the application of the Health Belief Model by operationalizing its core constructs within the context of occupational safety and needlestick injury prevention.

Data Sharing Statement

Data are accessible upon reasonable request from the corresponding author.

Institutional Review Board Statement

The study was approved by the King Saud Medical City Institutional Review Board (IRB Log No. H-01-R-053, dated July 2025). All ethical standards concerning the protection of study participants were upheld, in line with the World Medical Association's Declaration of Helsinki.

Informed Consent Statement

Informed consent was obtained from all participants prior to data collection.

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Disclosure

The authors declare no conflicts of interest in this work.

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