ISSN-e [2675-5602]

Global Academic Nursing Journal

ORIGINAL ARTICLE

Prevention of peripheral venous catheter-related bloodstream infection: validation of a skills training script

Prevención de la infección del torrente sanguíneo relacionada con el catéter venoso periférico: validación de un guión de capacitación en habilidades

Prevenção de infecção de corrente sanguínea relacionada ao cateter venoso periférico: validação de roteiro de treinamento de habilidades

Raquel Calado da Silva Gonçalves[1*]
ORCID: 0000-0003-0158-5031
Aline Coutinho Sento Sé[2]
ORCID: 0000-0001-9301-0379
Nébia Maria Almeida de Figueiredo[1]
ORCID: 0000-0003-0880-687X
Teresa Tonini[1]
ORCID: 0000-0002-5253-2485

[1]Universidade Federal do Estado do Rio de Janeiro. Rio de Janeiro, Brazil.
[2]Ministério da Saúde. Rio de Janeiro, Brazil.

How to cite this article:
Gonçalves RCS, Sento Sé AC, Figueiredo NMA, Tonini T. Prevention of peripheral venous catheter-related bloodstream infection: validation of a skills training script. Glob Acad Nurs. 2026;7(2):e547. https://dx.doi.org/10.5935/2675-5602.20200547

***Corresponding author:**
raquelcalado@yahoo.com.br

Submission: 03-14-2026
Approval: 05-02-2026

Abstract

The aim was to develop and validate the content of an instructional guide for training nursing undergraduates in skills focused on preventing bloodstream infections associated with peripheral venous catheterization. This was a methodological study structured into development and validation phases. The sample consisted of ten expert nurses selected via the Lattes Platform. The content was evaluated by the experts using an agreement scale, with a Content Validity Index (CVI) > 0.90 set as the acceptability threshold. Analysis of the experts' input resulted in the "Skills Training Guide: Peripheral Venous Puncture with Needleless Intravenous Catheter." As a monitoring strategy, the use of validated instruments to measure specific preventive care measures for peripheral venous catheterization is recommended. The guide achieved an overall Content Validity Index of 0.96, confirming its theoretical and technical robustness. The instrument is suitable for teaching nursing assessment and clinical procedures, and it also serves as a professional development tool for nursing personnel at various levels of training.

Descriptors: Simulation Training; Catheterization, Peripheral; Education, Nursing; Nursing Students; Nursing.

Resumén

El objetivo fue construir y validar el contenido de un guion didáctico dirigido a estudiantes de enfermería de pregrado en habilidades para prevenir infecciones del torrente sanguíneo asociadas con la cateterización venosa periférica. Este estudio metodológico se estructuró en etapas de construcción y validación. La muestra estuvo compuesta por diez enfermeras expertas seleccionadas a través de la plataforma Lattes. El contenido se sometió a evaluación experta utilizando una escala de concordancia, con un Índice de Validez de Contenido > 0,90 como parámetro de aceptabilidad. El análisis de las contribuciones dio como resultado el "Guion de Entrenamiento de Habilidades: Punción Venosa Periférica con Catéter Intravenoso Sin Aguja". Como estrategia de seguimiento, se recomienda la aplicación de instrumentos validados que midan la atención preventiva específica para la cateterización venosa periférica. El guion obtuvo un Índice de Validez de Contenido total de 0,96, lo que confirma su solidez teórica y técnica. El instrumento demuestra ser adecuado para la enseñanza de Semiología y Semiótica, así como para servir como herramienta de actualización para profesionales de enfermería en diferentes niveles de formación.

Descriptores: Entrenamiento Simulado; Cateterismo Periférico; Educaciónen Enfermeira; Estudiantes de Enfermería; Enfermería.

Resumo

Objetivou-se construir e validar o conteúdo de um roteiro instrucional voltado ao treinamento de habilidades de graduandos de enfermagem, focando na prevenção de infecções da corrente sanguínea associadas ao cateterismo venoso periférico. Estudo metodológico estruturado em etapas de construção e validação. A amostra foi composta por dez enfermeiros peritos selecionados via Plataforma Lattes. O conteúdo foi submetido à avaliação dos especialistas por meio de uma escala de concordância, sendo o índice de Validade de Conteúdo > 0,90 o parâmetro de aceitabilidade. A análise das contribuições resultou no "Roteiro de treinamento de habilidades: punção venosa periférica com cateter intravenoso não agulhado". Como estratégia de monitoramento, recomenda-se a aplicação de instrumentos validados que mensurem os cuidados preventivos específicos ao cateterismo venoso periférico. O roteiro obteve um Índice de Validação de Conteúdo total de 0,96, confirmando sua robustez teórica e técnica. O instrumento demonstra-se apto para o ensino de Semiologia e Semiotécnica, além de servir como ferramenta de atualização para profissionais de enfermagem em diferentes níveis de formação.

Descritores: Treinamento por Simulação; Cateterismo Periférico; Educação em Enfermagem; Estudantes de Enfermagem; Enfermagem.

Introduction

The starting point for the development of patient safety initiatives was 1999, with the publication of the report on healthcare-related errors among U.S. patients: "To Err Is Human: Building a Safer Health System". In this context, error ceased to be a matter for individual punishment and came to be understood as an opportunity for guidance, viewed through a systemic lens that identifies structural flaws[1].

The concern with preventing harm arising from healthcare is grounded in the Hippocratic principle (460-360 BC), "primum non nocere" (first, do no harm), and in the research of Florence Nightingale (19th century AC); during the Crimean War, she observed a causal link between the quality of environmental care and soldier mortality. The care she advocated focuses on the individual and their surrounding environment[1-3].

In this context, preventing harm to healthcare service users resulting from care processes or structures is becoming increasingly necessary. Healthcare-associated infections (HAIs) drive up care costs and increase the length of hospital stays, morbidity, and mortality[4]. In 2011, bloodstream infections accounted for 40% of mortality among Brazilian patients[5].

Although bloodstream infections have a low incidence compared to other healthcare-associated infections, their significance lies in the resulting increase in hospital costs and morbidity and mortality. Furthermore, the World Health Organization (WHO) defines healthcare-associated infection as a key indicator of the quality of healthcare provided; indeed, reducing the risk of infection is one of the six international patient safety goals[6].

Peripheral venous catheters (PVCs) are the most used invasive devices in hospitals, utilized in up to 90% of hospitalized patients. For a long time, these devices were considered safe; however, complications occur in approximately 50% of patients, leading to premature PVC removal, the suspension of therapy administration, and catheter replacement[7].

The most frequently observed complications are phlebitis (19%), extravasation (14%), occlusion (8%), leakage (7%), pain (6%), and catheter displacement (6%)[8]. Infectious complications are rare, yet their consequences are potentially serious. The occurrence of peripheral venous catheter (PVC)-related bloodstream infections has been associated with increased hospital length of stay, mortality, and costs[7].

The literature reports severe cases of bloodstream infection requiring intensive care and prolonged antibiotic therapy due to infection-related complications, with some cases resulting in death. Staphylococcus aureus bacteremia is a significant issue that can affect prognosis; catheter removal is indicated to prevent bloodstream infection and death[9].

Hand hygiene stands out as the single most effective measure for reducing the transmission of pathogens and infections in healthcare settings[10]. However, it is also recommended to provide training for healthcare professionals responsible for catheter insertion and handling, implement continuing education programs, periodically assess team knowledge, and ensure adherence to recommended measures for catheter insertion and maintenance[11].

In the context of health education, clinical simulation enables learners to experience simple or complex situations within environments considered safe and controlled. It is a teaching-learning strategy guided by theoretical models that direct the facilitator in planning, implementing, and evaluating the activities[12].

Studies highlight the importance of simulation as a key teaching and learning strategy in nursing education, at both undergraduate and postgraduate levels, yielding clear benefits for students[13].

Active learning methodologies offer a way to enhance the qualifications of professionals and students by fostering autonomy in the construction of knowledge. They involve critical reflection on the part of the student through the resolution of problem-based scenarios and facilitate the development of competencies, critical reasoning, self-confidence, and teamwork skills[14].

Thus, the guiding question emerges: "How can a standardized protocol be developed and validated for skills training for undergraduate nursing students, focusing on best practices for preventing peripheral venous catheter-related bloodstream infections?".

Considering the foregoing, the objectives are to develop and validate the content of a training guide for undergraduate nursing students regarding the prevention of peripheral venous catheter-related bloodstream infections.

Methodology

This is a methodological study regarding the development and validation of a skills training guide for a semiology and semiotechnique laboratory, grounded in the stages proposed by Guilbert and Adamson[15] and based on the International Nursing Association for Clinical Simulation and Learning (INACSL) recommendations for simulated scenarios.

Skills training focuses on acquiring isolated technical competencies, whereas clinical simulation integrates technical and behavioral skills with clinical reasoning within complex scenarios. Training focuses on the "how-to" of a task, while clinical simulation focuses on "what to do, why to do it, and how to behave" when dealing with a patient in a specific scenario[15].

Content validation of the protocol was conducted through an assessment by nurses selected based on pre-defined criteria. The sample consisted of nurses who met the definition of an expert, adapted from the Fehring model, as described in Chart 1.

A sociodemographic and professional profiling questionnaire was used, as well as a skills training protocol. During the expert profiling stage, any individual declaring a lack of experience in clinical simulation and/or skills training was automatically excluded from the study. A specific score was assigned to each defining criterion; consequently, experts scoring below five points were excluded[16].

Chart 1. Definition of expert adapted from the Fehring model. Rio de Janeiro, RJ, Brazil, 2025

Definition of expert[16]	Score	Adapted definition of an expert	Score
Master's degree in Nursing	4	Master's degree	4
Master's degree in Nursing with a thesis containing content relevant to the diagnosis of interest	1	Master's degree with a thesis related to education, clinical simulation and/or skills training, patient safety, and/or infection control	1
Publication of research on the diagnostic data or relevant content	2	Publication of research related to education, clinical simulation and/or skills training, patient safety, and/or infection control	2
Publication of an article on the diagnosis in a reputable journal	2	Publication of an article related to education, clinical simulation and/or skills training, patient safety, and/or infection control	2
Doctoral thesis on the diagnosis	2	Doctoral degree	2
Current clinical practice of at least one year in an area relevant to the diagnosis of interest	1	At least one year of professional practice in education, clinical simulation and/or skills training, patient safety, and/or infection control	1
Clinical practice certification in an area relevant to the diagnosis of interest	2	Specialization certificate in education, patient safety, and/or infection control	2

To select the experts, their curricula available on the Lattes Platform of the National Council for Scientific and Technological Development (CNPq) were consulted, and an invitation letter was sent to them via the CNPq platform; this letter outlined the reasons for their selection, inquired about their interest and availability to participate, and explained the concepts involved in the study[17].

Participants were asked to nominate other participants using the "virtual snowball" strategy[18]. A period of 15 calendar days was provided for agreeing to participate in the study; failure to express interest within the stipulated timeframe would result in exclusion from the study. Upon agreeing to participate, a link to a Google Forms® questionnaire was sent for the completion of the Informed Consent Form (ICF), collection of sociodemographic data, and validation of the training protocol.

Given the lack of consensus regarding the ideal number of experts for validation and considering that data quality takes precedence over sample size[19], recruitment concluded once 10 experts who met the proposed criteria[17] had completed their evaluations.

The experts evaluated the script by responding to an agreement scale regarding its appearance and content. Each topic in the script featured a Likert scale ranging from one to five, representing the degree of agreement for each item. Responses could thus be classified as: (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, or (5) strongly agree, regarding its suitability, relevance, clarity of language, accuracy, and objectivity[17].

The questionnaires returned by the experts were analyzed, and each item was assigned a weight: (1) strongly agree; (0.75) agree; (0.50) neutral; (0.25) disagree; (0) strongly disagree. Subsequently, weighted averages were calculated to classify the items: a weighted average of 0.80 or higher indicated primary items; averages between 0.50 and 0.79 indicated secondary items; and an average below 0.50 indicated irrelevant items. Finally, the total Content Validity Index (CVI) was calculated by dividing the sum of the weighted averages by the total number of items analyzed[16]. Items with a total CVI greater than or equal to 0.90 were defined as valid[20].

The collected data were categorized and stored in an Excel® spreadsheet. The professional profile of the sample was described using absolute and relative frequencies of the categorical variables. Research participants were coded with the letter "E" (experts) and numbered from 1 to 10 (E1, E2, E3, … E10).

The study was approved by the Research Ethics Committee of the Cardoso Fontes Federal Hospital (HFCF); Certificate of Presentation for Ethical Appreciation (CAAE): 82516424.3.0000.8066; Opinion: 7.079.251. Expert participation took place upon the signing of the Informed Consent Form (TCLE) sent to their email addresses.

Results and Discussion

The first 100 Lattes curricula resulting from a subject search using the terms "clinical nursing simulation" were analyzed. Of these, 50 curricula were pre-selected for email contact.

Twelve completed forms were received; two participants were automatically excluded for stating they lacked experience in technical skills training and/or simulated scenarios. The final sample consisted of ten experts, all with over 10 years of professional experience. Of these, six (60%) held a master's degree, and four (40%) held a doctorate, with publications of interest. Regarding sociodemographic characteristics, five (50%) were aged between 30 and 39, and six (60%) were female. Although experts from other regions of Brazil were contacted, only nurses from the Southeast and South regions responded to the survey, as shown in Table 1. Most of the experts were from the Southeast region, specifically the state of Rio de Janeiro (60%).

Table 2 presents an overview of the items analyzed by the experts. Regarding the classification of the items, all were categorized as primary items, having a weighted mean greater than or equal to 0.80. The total CVI was 0.96, resulting in the validation of the skills training protocol by the experts.

Table 1. Sociodemographic characteristics of the experts. Rio de Janeiro, RJ, Brazil, 2025 (n=10)

Age	**n**	**%**
[30,39[	05	50
[40,49[	04	30
[50,59[	01	10
Total	**10**	**100**
Sex	**n**	**%**
Female	06	60
Male	04	40
Total	10	100
Regions/State		
Southeast	**n**	**%**
Rio de Janeiro	06	60
São Paulo	01	10
South	**n**	**%**
Paraná	02	20
Rio Grande do Sul	01	10
Total	**10**	**100**

Table 2. Item validation index. Rio de Janeiro, RJ, Brazil 2025

	Suitability	**Relevance**	**Clarity**	**Precision**	**Objectivity**	**Weighted average**
Objectives	1	1	1	0.97	1	0.99
Clinical case	0.95	0.95	0.91	0.91	0.95	0.94
Materials	0.97	0.97	0.95	0.97	0.95	0.97
Expected sequence	0.97	0.95	0.97	0.95	0.97	0.96
Evaluation and feedback	0.96	1	0.96	1	0.94	0.97
Total CVI						0.96

Note: CVI – Content Validity Index.

In accordance with the recommendation of expert 6, the “Briefing” item was incorporated into the script.

> *“I also suggest outlining the skills training briefing: informing the student of the procedure to be performed at the station, the training objective, evaluation criteria (if applicable), the time available, and how feedback will be provided. This briefing ensures the student's psychological safety during the skills training” (E6).*

A variety of terms are used in the literature to describe pre-skills-training activities aimed at preparing students to meet scenario objectives, establishing psychological safety, and providing a general orientation to the simulation process. For this guide, the term "Briefing" was adopted[21]. During the briefing, specific guidelines regarding the simulated scenario are provided, such as an outline of the problem and the steps to be carried out. This informational meeting aims to ensure the student feels at ease and emotionally secure. Rules and boundaries must be established, and a "fiction contract" agreed upon with the participants, alongside an explanation of the roles played by the training facilitators and evaluators[22]. The inclusion of the “Briefing” item, suggested by Expert 6, transcends the mere transmission of technical information; it underpins the psychological safety of the learning environment. According to Edmondson[23], Psychological safety is the shared belief that the environment is safe for taking interpersonal risks, where errors are treated as phenomenological and pedagogical data rather than grounds for punishment. In the context of venipuncture, the briefing establishes a "fiction contract," allowing the student to direct their attentional resources toward the motor skill and thereby reduce the anxiety that often acts as paralyzing cognitive noise during invasive procedures. Two experts suggested including the preparation method and information regarding the medication presented in the clinical case.

> *“Add the preparation instructions for Tenoxicam® 20 mg IV. Is it a bolus? Diluted? Infusion over what duration?” (E1).*

> *“Include information about the medication: presentation, reconstitution method, and route of administration. Skills training doesn't involve actual medication administration, right? However, I think it is important to include this information in the medical order so that students can start familiarizing themselves with the pharmacological therapy” (E8).*

Although Experts 1 and 8 suggested including details on medication preparation, the decision was made to maintain an exclusive focus on the puncture technique. This decision is grounded in Sweller’s Cognitive Load Theory[24], which posits that working memory has a limited capacity. For

undergraduate students in the early stages of training, superimposing pharmacological complexity (dilution, stability, and interactions) onto the psychomotor complexity of the puncture could generate excessive extraneous cognitive load, thereby compromising the consolidation of the mental schema required to safely perform venous access. Thus, the protocol prioritizes "task fidelity" over "total scenario fidelity" at this stage of training. Regarding the nursing diagnosis used in the clinical case, the inclusion of a diagnosis related to venipuncture was suggested.

> *"Enter the nursing diagnosis, expected outcome, and intervention related to venipuncture" (E4).*

The decision not to include a specific risk diagnosis for vascular trauma, despite the suggestion by Expert 4, reflects alignment with the 13th edition of NANDA-I (2024–2026), which discontinued that nomenclature. The discontinuation of the "Risk for vascular trauma" diagnosis is explained by the fact that its risk factors do not reflect current best practices[25]. However, this taxonomic gap reinforces the importance of this validated protocol as a nursing surveillance tool. In the absence of a specific preventive diagnostic label in the current taxonomy, the rigorous standardization of the care sequence, from centrifugal antisepsis to the securing technique, acts as an evidence-based nursing intervention, mitigating risks not addressed by current nomenclature. Regarding the "Evaluation and feedback" item, the experts' suggestion was adopted, with the information being incorporated into the training outline.

> *"I suggest adding specific details regarding the feedback: which items met the requirements and which did not, thereby providing an opportunity for learning from both successes and errors. The feedback must be clear and fulfill the purpose of providing a response to the participants. I recommend including a section that allows for this feedback, along with a score indicating whether the learning objectives were met" (E1).*

> *"It would be beneficial, after the simulation, to provide feedback to the participating employee regarding any non-conformities in their performance" (E4).*

Information or dialogue exchanged among participants, the facilitator, or peers, aimed at enhancing understanding of the concepts covered in the training or addressing aspects of student performance, is known as feedback. Feedback on participant performance is a crucial component of training, as it taps into both individual and group intrinsic motivation. It is important to note that the facilitator should avoid being harsh or negative yet also steer clear of being insincerely polite or refraining entirely from offering an opinion or assessment. Feedback should be delivered directly and respectfully to address identified shortcomings and evaluate the participant's performance. The facilitator-participant relationship must be grounded in ethical and professional standards, fostering a positive, proactive dynamic focused on ensuring learning and satisfaction, thereby promoting participant engagement[26].

Regarding the "Expected sequence" item, the suggestion from expert E7 was adopted, as follows:

> *"It could be better described, for example, as the entry angle of the puncture" (E7).*

At the time of puncture, the needle should be positioned at an angle of 10 to 30 degrees relative to the vein, with the bevel facing upward. Superficial veins require a shallower angle, whereas deeper veins require a steeper angle. This positioning reduces the risk of puncturing the posterior wall of the vein[27].

Expert E9 suggested describing the volume required to saline-flush the peripheral venous access:

> *"My suggestion would be to include the specific volume (in mL) required to flush the access line in the salinization order. The key point is to always specify the volume of saline to be used" (E9).*

The volume of 0.9% sodium chloride required to flush a peripheral venous access device is defined as "the minimum volume equivalent to twice the internal lumen volume of the catheter plus the extension set." For peripheral catheters, a volume of 5 mL is recommended to "reduce fibrin deposits, precipitated drugs, and other debris within the lumen." Factors to consider when selecting the volume include the catheter type and size, patient age, fluid restrictions, and the type of infusion therapy. Viscous solutions may require the infusion of larger volumes. Standardizing the flush volume at 5 mL aligns with ANVISA guidelines for maintaining patency and preventing biofilm formation. However, the importance of this step lies not only in the volume used but also in the use of the pulsatile flushing technique[28]. Specialized literature indicates that creating turbulent flow within the catheter lumen is superior to laminar flow for removing debris and fibrin deposits, representing a critical component of health surveillance for drastically reducing bloodstream infection (BSI) rates in hospital settings. This recommendation has been incorporated into the protocol. Following an analysis of the suggestions provided by the experts, the "Skills training guide: peripheral venipuncture with a needle-free intravenous catheter", presented in full in Chart 2, was developed. Regarding student assessment criteria, it is suggested to adopt the instrument "Assessment of nursing professionals' and students' knowledge regarding measures to prevent bloodstream infections associated with peripheral venous catheters"[29] or another validated instrument addressing preventive care for infections associated with peripheral catheterization. Achieving the technical proficiency required for the training of a nursing professional necessitates the student's use of cognitive and motivational resources when facing a new care-related challenge. Skill training must be premised on attaining a specific level of mastery to ensure the delivery of high-quality, safe patient care[33].

Study limitations include the small number of experts, the lack of representation from other geographic regions of Brazil, and the choice of search terms used to identify experts on the Lattes Platform. Further studies addressing the proposed topic are suggested, considering the limitations presented.

Chart 2. Validated skills training protocol. Rio de Janeiro, RJ, Brazil 2025

Skills training guide: peripheral venipuncture with a needleless intravenous catheter
Briefing Inform the student about the procedure to be performed at the station (peripheral venipuncture using a needle-free intravenous catheter), the training objectives, evaluation criteria (Pelizari instrument), time available (15 minutes), and how feedback will be provided.
Objectives 1. Create hands-on experiences so that students can execute the technique with knowledge, competence, and safety. 2. Evaluate students' skills in performing the peripheral venipuncture technique using a needleless intravenous catheter.
Clinical case A.B.S., a 45-year-old female, was admitted to the observation room for the administration of an analgesic. She denies drug allergies. She reports lower back pain resulting from physical trauma (a fall). Imaging results showed no abnormalities; the attending physician prescribed a medication and ordered that the patient remain in the observation room for two hours following its administration. Medical prescription Tenoxicam® 20 mg IV now. Maintain a saline-locked IV access. Nursing diagnosis: Acute pain[25]. Expected outcome: Pain control: reports changes in pain symptoms to healthcare professional[30]. Nursing intervention: Pain management: acute[31] Activities: Ensure appropriate analgesic care for the patient; provide relief using prescribed analgesics; notify the physician if measures are unsuccessful or if the current complaint represents a significant change from the patient's previous pain experience[31].
Material - venipuncture using a needleless intravenous catheter • 01 venipuncture arm simulator. • 01 Mayo stand. • 01 sharps container. • 01 venous access identification label. • 01 vial simulating medication. • 01 pair of procedure gloves. • 01 dispenser bottle of 70% alcohol. • 01 tray. • 01 transparent dressing. • 02 packages of sterile gauze. • 01 roll of hypoallergenic microporous tape. • 02 10 ml syringes. • 01 5 ml syringe. • 02 10 ml ampoules of 0.9% sodium chloride. • 01 multi-way IV tubing set. • 01 cap/occluder for multi-way IV tubing. • Needleless intravenous catheters sizes 24, 22, and 20 (01 unit of each). • 03 needles (40 x 12). • 01 tourniquet. • Printed prescription with patient's name. • Personal items: pen and stamp. * The quantity of supplies will be determined by the instructor based on the number of participants. The described materials are intended for use by a single student.
Expected sequence of activities 1. Identify the patient's medical record (prescription). 2. Gather the necessary materials. 3. Perform hand hygiene. 4. Introduce yourself to the patient. 5. Verify the patient's identity using a double-check method (full name and medical record number). 6. Explain the procedure. 7. Prepare the environment and materials appropriately, ensuring privacy. 8. Select the best site for the puncture. 9. Perform hand hygiene before the puncture. 10. Put on procedure gloves. 11. Open the materials using the correct technique. 12. Prime the multi-lumen extension set with 0.9% sodium chloride. 13. Set aside a syringe containing 0.9% sodium chloride to flush the access line. 14. Perform antisepsis of the puncture site using gauze and 70% alcohol. Skin antisepsis with gauze and 70% alcohol must be performed using a centrifugal spiral motion, three times. 15. Allow the antiseptic to air-dry before proceeding with the puncture. 16. Apply the tourniquet to the patient's limb correctly. 17. Perform the puncture.

18. Press down on the base of the intravenous catheter and remove the stylet from the catheter.
19. Connect the multi-lumen extension set to the intravenous catheter.
20. Mechanically scrub the connector with gauze moistened with 70% alcohol three times before inserting the syringe containing 0.9% sodium chloride.
21. Flush the peripheral access line with 5 mL of 0.9% sodium chloride using a pulsatile flushing technique.
22. Observe for signs of infiltration.
23. Secure the intravenous catheter using transparent dressing or sterile gauze and microporous tape; 24. Remove the empty syringe and apply a new dressing.
25. Label the puncture site (date, time, healthcare professional's name, gauge).
26. Tidy the area and position the patient comfortably.
27. Transport contaminated materials correctly.
28. Dispose of contaminated materials in the appropriate receptacle.
29. Remove procedure gloves.
30. Perform hand hygiene.
31. Store materials in the appropriate place.
32. Document the nursing procedure performed in the patient's medical record[4,26-27,32-34].
Evaluation and feedback
Congratulate the participants on their experience during the skills training.
Acknowledge any questions, emotions, or feelings regarding the scenario presented.
Reinforce that skills training is a safe space for learning and that mistakes are part of the training process.
Encourage critical reflection on theory and practice. Objectively outline the points to be explored, such as: "What were you able to accomplish as planned?"; "What difficulties did you encounter?"; or "What would you do differently in a real-life situation?".
Highlight which items met the criteria and which did not, providing an opportunity to learn from both successes and mistakes.

Final Considerations

This study successfully developed and validated the content of the instructional guide, achieving a total CVI of 0.96. This index lends the instrument technical and theoretical robustness, qualifying it as a reliable tool for teaching semiology and semiotechnique, as well as for continuing nursing education. Beyond technical standardization, the integration of briefing and structured feedback into the guide establishes an essential environment of psychological safety. This approach ensures that the skills laboratory functions as a space for ethical experimentation, where errors are transformed into learning opportunities without compromising the student's integrity. By focusing exclusively on venipuncture, the guide respects the cognitive load limits of students in training, ensuring that mastery of the psychomotor skill precedes the complexities of pharmacological therapy. As a primary contribution, this study addresses the lack of validated guidelines for the use of needleless intravenous catheters. Implementing this protocol has the potential to enhance nursing surveillance and patient safety, directly contributing to risk mitigation and the prevention of bloodstream infections associated with peripheral catheterization. Despite limitations regarding the regional representativeness of the expert panel, the protocol is ready for clinical and academic application, serving as a foundation for future impact studies to measure knowledge retention and the reduction of adverse outcomes in clinical practice.

References

1. Conselho Regional de Enfermagem do Estado de São Paulo (COREN-SP). Segurança do paciente: guia para a prática [Internet]. São Paulo: COREN-SP; 2022 [citado em 1 jun 2025]. Disponível em: https://portal.coren-sp.gov.br/wp-content/uploads/2022/05/Seguranca-do-Paciente-WEB.pdf
2. Miranda CML. O risco e o bordado – um estudo sobre a formação da identidade profissional. Rio de Janeiro: Escola de Enfermagem Anna Nery/UFRJ; 1996.
3. Ferreira MA, Machado PS, Sauthier M, Silva RC. Fundamentos nightingaleanos, cuidado humano e políticas de saúde no Século XXI. Rev Enferm UERJ. 2020;28:e50353. https://doi.org/10.12957/reuerj.2020.50353
4. Brasil. Agência Nacional de Vigilância Sanitária (ANVISA). Segurança do paciente e qualidade em serviços de saúde: medidas de prevenção de infecção relacionada à assistência à saúde [Internet]. Brasília: ANVISA; 2017 [citado em 1 jun 2025]. Disponível em: https://www.gov.br/anvisa/pt-br/centraisdeconteudo/publicacoes/servicosdesaude/publicacoes/publicacoes/caderno-4-medidas-de-prevencao-de-infeccao-relacionada-a-assistencia-a-saude.pdf/view
5. Marra AR, Camargo LF, Pignatari AC, Sukiennik T, Behar PRP, Medeiros EAS, et al. Nosocomial bloodstream infections in Brazilian hospitals: analysis of 2,563 cases from a prospective nationwide surveillance study. J Clin Microbiol. 2011;49(5):1866-71. https://doi.org/10.1128/JCM.00376-11
6. Oliveira KRD, Liberal MMCD. A enfermagem frente às infecções de corrente sanguínea relacionadas ao cateter venoso central. REAS. 2024;24(11):e17582. https://doi.org/10.25248/reas.e17582.2024
7. Drugeon B, Guenezan J, Pichon M, Devos A, Fouassin X, Neveu A, et al. Incidence, complications, and costs of peripheral venous catheter-related bacteraemia: a retrospective, single-centre study. J Hosp Infect. 2023;135:67-73. https://doi.org/10.1016/j.jhin.2023.02.012

8. Marsh N, Webster J, Ullman AJ, Mihala G, Cooke M, Chopra V, et al. Peripheral intravenous catheter non-infectious complications in adults: a systematic review and meta-analysis. J Adv Nurs. 2020;76(12):3346-62. https://doi.org/10.1111/jan.14565
9. Sato A, Nakamura I, Fujita H, Tsukimori A, Kobayashi T, Fukushima S, et al. Peripheral venous catheter-related bloodstream infection is associated with severe complications and potential death: a retrospective observational study. BMC Infect Dis. 2017;17:434. https://doi.org/10.1186/s12879-017-2536-0
10. World Health Organization (WHO). Proposed members of the WHO global guidelines for the prevention of bloodstream infections and other infections associated with the use of intravascular catheters. Part 1 – peripheral catheters [Internet]. Geneva: WHO; 2023 [citado em 1 jun 2025]. Disponível em: https://www.who.int/news-room/articles-detail/proposed-members-of-the-who-global-guidelines-for-the-prevention-of-bloodstream-infections-and-other-infections-associated-with-the-use-of-intravascular-catheters
11. Silva AG, Oliveira AC. Conhecimento autorreferido das equipes médica e de enfermagem quanto às medidas de prevenção de infecção da corrente sanguínea. Texto Contexto Enferm. 2018;27(3):e3480017. https://doi.org/10.1590/0104-070720180003480017
12. Bortolato-Major C, Mantovani MF, Felix JVC, Boostel R, Silva ATM, Caravaca-Morera JA. Debriefing evaluation in nursing clinical simulation: a cross-sectional study. Rev Bras Enferm. 2019;72(3):788-94. https://doi.org/10.1590/0034-7167-2018-0103
13. Fonseca AS, Reis F, Melaragno ALP. Habilidades para as melhores práticas clínicas. In: Melaragno ALP, Fonseca AS, Assoni MAS, Mandelbaum MHS, organizadoras. Educação permanente em saúde. Brasília: Editora ABEn; 2023. p. 37-46. https://doi.org/10.51234/aben.23.e25.c04
14. Brito AR, Melo MN, Leon CGRMP, Ribeiro LM. Cenário simulado com brinquedo terapêutico: uma ferramenta para educação em saúde. Rev Recien. 2022;12(40):200-9. https://doi.org/10.24276/rrecien2022.12.40.200-209
15. Guilbert M, Adamson KA. Making sense of methods and measurement: validation part II. Clin Simul Nurs. 2016;12(7):275-6. https://doi.org/10.1016/j.ecns.2016.02.006
16. Fehring R. Methods to validate nursing diagnoses. Heart Lung. 1987;16(6):625-9.
17. Coluci MZO, Alexandre NMC, Milani D. Construção de instrumentos de medida na área da saúde. Cienc Saude Colet. 2015;20(3):925-36. https://doi.org/10.1590/1413-81232015203.04332013
18. Portella JR, Maliszewski LS, Martins ESL. Técnica de amostragem "bola de neve virtual" na captação de participantes em pesquisas científicas. J Nurs Health. 2024;14(1):e1426636. https://doi.org/10.15210/jonah.v14i1.26636
19. Fernandes CS, Magalhães BMB. Uma reflexão sobre a utilização da técnica de Delphi em enfermagem. Texto Contexto Enferm. 2024;33:e20230227. https://doi.org/10.1590/1980-265X-TCE-2023-0227pt
20. Gonçalves RCS, Sé ACS, Cardoso RB, Silva CPG, Vianna ECC, Figueiredo NMA, et al. Elaboração e validação de conteúdo de um protocolo assistencial para cuidados de enfermagem com materiais utilizados em suporte ventilatório de paciente suspeito ou com COVID-19 confirmada. Glob Acad Nurs. 2022;3(Ed. Esp. 1):e228. https://doi.org/10.5935/2675-5602.20200228
21. INACSL Standards Committee, McDermott DS, Ludlow J, Horsley E, Meakim C. Healthcare simulation standards of best practiceTM prebriefing: preparation and briefing. Clin Simul Nurs. 2021;58:9-13. https://doi.org/10.1016/j.ecns.2021.08.008
22. Pereira Júnior GA, Guedes HTV. Simulação clínica: ensino e avaliação nas diferentes áreas da Medicina e Enfermagem [Internet]. Brasília: Associação Brasileira de Educação Médica; 2022 [citado em 1 jun 2025]. Disponível em: https://website.abem-educmed.org.br/wp-content/uploads/2022/09/livro-completo_digital-1.pdf
23. Edmondson AC. A organização sem medo: criando segurança psicológica no local de trabalho para aprendizado, inovação e crescimento. 1ª ed. Rio de Janeiro: Alta Books; 2020.
24. Sweller J. Cognitive load theory, learning difficulty, and instructional design. Learn Instr. 1994;4(4):295-312. https://doi.org/10.1016/0959-4752(94)90003-5
25. Herdman TH, Kamitsuru S, Lopes CT, organizadores. Diagnósticos de enfermagem da NANDA-I: definições e classificação 2024-2026. 13ª ed. Porto Alegre: Artmed; 2024.
26. Conselho Regional de Enfermagem do Estado de São Paulo (COREN-SP). Manual de simulação clínica para profissionais de enfermagem [Internet]. São Paulo: COREN-SP; 2020 [citado em 20 jun 2024]. Disponível em: https://biblioteca.cofen.gov.br/wp-content/uploads/2022/01/manual-simulacao-clinica-profissionais-enfermagem.pdf
27. Perry AG, Potter PA. Guia completo de procedimentos e competências de enfermagem. 9ª ed. Rio de Janeiro: Elsevier; 2021.
28. Ribeiro GSR, Campos JF, Silva RC. What do we know about flushing for intravenous catheter maintenance in hospitalized adults? Rev Bras Enferm. 2022;75(5):e20210418. https://doi.org/10.1590/0034-7167-2021-0418
29. Pelizari AEB, Silva RS, Couto DS, Fittipaldi TRM, Perinoti LCSC, Figueiredo RM. Prevenção de infecções associadas a cateteres periféricos: elaboração e validação de instrumento. Rev Eletr Enferm. 2021;23:67583. https://doi.org/10.5216/ree.v23.67583
30. Moorhead S, Johnson M, Maas ML, Swanson E. NOC: classificação dos resultados de enfermagem. 6ª ed. Rio de Janeiro: Guanabara Koogan; 2020.
31. Bulechek GM, Butcher HK, Dochterman JM, Wagner CMC. NIC: classificação das intervenções de enfermagem. 7ª ed. Rio de Janeiro: Guanabara Koogan; 2020.
32. Brasil. Agência Nacional de Vigilância Sanitária (ANVISA). Nota Técnica GVIMS/GGTES/DIRE3/ANVISA nº 04/2022. Práticas seguras para a prevenção de incidentes envolvendo cateter intravenoso periférico em serviços de saúde [Internet]. Brasília: ANVISA; 2022 [citado em 23 jun 2024]. Disponível em: https://portaldeboaspraticas.iff.fiocruz.br/atencao-recem-nascido/nt4-cateter-intravenoso-anvisa-2022/
33. Rolim GAM. O uso do Instrumento de Avaliação da Reprodutibilidade de Procedimento de Enfermagem (IARPE) como estratégia para análise da eficácia na capacitação em punção venosa periférica [dissertação]. São Paulo: Pontifícia Universidade Católica de São Paulo; 2015. Disponível em: https://tede2.pucsp.br/bitstream/handle/18803/2/Gisele%20Aparecida%20Mendes%20Rolim.pdf
34. Fonseca AS, Reis F, Melaragno ALP. Habilidades para as melhores práticas clínicas. In: Melaragno ALP, Fonseca AS, Assoni MAS, Mandelbaum MHS, organizadoras. Educação permanente em saúde. Brasília: Editora ABEn; 2023. p. 31-6. https://doi.org/10.51234/aben.23.e25.c03