



Factors associated with peripheral intravenous catheter loss as documented in nursing records: a retrospective study^a

Fatores associados à perda de cateter venoso periférico segundo registros de enfermagem: estudo retrospectivo

Factores asociados a la pérdida del catéter venoso periférico según registros de enfermería: estudio retrospectivo

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ABSTRACT

Objective: to analyze factors associated with peripheral intravenous catheter loss as documented in nursing records. **Method:** retrospective quantitative study based on medical record review, conducted at a general hospital in Campos dos Goytacazes, Rio de Janeiro, Brazil. The initial sample comprised 743 medical records from January to October 2023, of which 209 contained complete data on these variables: event date, catheter type, event description, interventions performed, and immediate outcome. The chi-square test was used, with a 5% significance level ($p < 0.05$) and 95% confidence intervals. **Results:** accidental peripheral intravenous catheter losses were the most frequent (30.6%) and accounted for 44.6% among patients aged 18 to 64 years; phlebitis predominated among older patients. Infiltration was associated with saline flushing used to maintain catheter patency, and occlusion was associated with medication infusion. Catheter dwell time was associated with the causes of loss, with occlusion occurring more often in recently inserted catheters (<24 hours) and phlebitis in catheters in place for more than 96 hours. **Conclusion and implications for practice:** a high incidence of accidental peripheral intravenous catheter loss was observed, associated with risk factors amenable to nursing intervention or monitoring. Technical protocols, staff training, and improved nursing documentation are recommended.

Keywords: Catheters; Observational Study; Hospitalization; Nursing Records; Patient Safety.

RESUMO

Objetivo: analisar os fatores associados à perda de cateter venoso periférico segundo registros de enfermagem. **Método:** estudo retrospectivo, documental e quantitativo, realizado em hospital geral de Campos dos Goytacazes, Rio de Janeiro, Brasil. A amostra inicial foi composta por 743 prontuários de janeiro a outubro de 2023, dos quais 209 continham variáveis completas: data do evento, tipo de cateter, descrição do ocorrido, intervenções realizadas e desfecho imediato. Utilizou-se teste qui-quadrado, com significância de 5% ($p < 0,05$) e intervalo de confiança de 95%. **Resultados:** as perdas acidentais foram as mais frequentes (30,6%) e, entre pacientes de 18 a 64 anos, representaram 44,6%; a flebite predominou em idosos. A infiltração esteve associada à permeabilização do cateter com flush de solução salina e a obstrução, à infusão de medicamentos. O tempo de punção associou-se às causas da perda, com maior ocorrência de obstruções em punções recentes, inferiores a 24 horas, e de flebite em acessos com mais de 96 horas. **Conclusão e implicações para a prática:** houve alta incidência de perdas acidentais de cateteres venosos periféricos associadas a fatores de risco passíveis de intervenção ou acompanhamento pela enfermagem. Recomenda-se adotar protocolos técnicos, capacitar a equipe e qualificar os registros de enfermagem.

Palavras-chave: Cateter Venoso Periférico; Estudo Observacional; Hospitalização; Registros de Enfermagem; Segurança do Paciente.

RESUMEN

Objetivo: analizar factores asociados a la pérdida del catéter venoso periférico documentada en registros de enfermería. **Método:** estudio cuantitativo retrospectivo basado en revisión de registros de enfermería en un hospital general municipal de Campos dos Goytacazes, Río de Janeiro, Brasil. De 743 historias clínicas revisadas entre enero y octubre de 2023, 209 contenían datos completos sobre fecha, tipo, descripción del evento, intervenciones y desenlace inmediato. Se aplicó la prueba de chi cuadrado, con significación del 5% ($p < 0,05$) e intervalos de confianza del 95%. **Resultados:** las pérdidas accidentales fueron las más frecuentes (30,6%) y representaron el 44,6% en pacientes de 18 a 64 años; la flebitis predominó en adultos mayores. La infiltración se asoció con lavado con solución salina para mantener la permeabilidad, y la obstrucción, con infusión de medicamentos. El tiempo de permanencia se asoció con las causas de pérdida, con obstrucción más frecuente en catéteres recién insertados (<24 horas) y flebitis en aquellos con más de 96 horas. **Conclusión:** la pérdida del catéter venoso periférico se asoció con factores prevenibles mediante intervención o monitoreo de enfermería. Se recomiendan protocolos técnicos, capacitación del equipo y mejora de los registros de enfermería.

Palabras clave: Catéteres; Estudio Observacional; Hospitalización; Registros de Enfermería; Seguridad del Paciente.

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INTRODUCTION

The peripheral intravenous catheter (PIVC) is a device used to access the vascular system and is a fundamental component of intravenous therapy (IV therapy). Its use enables the administration of fluids, medications, blood products, and nutrients, thereby supporting therapeutic interventions.¹ The device is commercially available in short- and long-dwell versions.

PIVC insertion is a common procedure across different care settings.² A cross-sectional study conducted in five Latin American countries found that approximately 70% of hospitalized patients undergo peripheral intravenous catheterization.³

PIVC use can lead to complications that prolong hospital stay, increase hospital costs, and compromise patient recovery.^{4,5} Between June 2021 and May 2022, 39,994 complications resulting from PIVC use were reported in Brazilian healthcare services, corresponding to an estimated occurrence in 50% to 75% of patients who used the device in the country during the same period.⁶

Procedures related to PIVC use, from device selection to insertion, maintenance, and removal, as well as IV therapy management, are nursing responsibilities.^{1,7-9} Safe, high-quality care requires the adoption of protocols based on guidelines recognized by the Infusion Nurses Society,¹ including continuing education for nursing professionals.^{8,9}

Nursing care practices during IV therapy are influenced by endogenous and exogenous factors, which may compromise intravenous access maintenance and patient safety. Endogenous factors, related to patient conditions, include extremes of age, clinical and metabolic status, physiological conditions, the condition of the venous network, psychomotor agitation, movement while in bed, and diaphoresis. Exogenous factors include technical failures during venipuncture, inappropriate choice of the PIVC and insertion site, insufficient catheter securement, lack of monitoring of the puncture area, and inadequate patient transport. They also include material- and equipment-related factors, such as the quality of the securement adhesive, the use of shortextension tubing, and the absence of catheter stabilization devices.^{5,10,11}

It is the nursing team's responsibility to document activities related to peripheral intravenous catheterization, the care provided, patient reactions, possible complications, and outcomes.¹⁰ In this context, PIVC loss is frequently documented in patients' medical records.¹¹⁻¹⁴

The term "PIVC loss" is defined as unplanned device removal before completion of IV therapy, resulting from complications or accidental removal.¹ This event may compromise treatment continuity, increase the need for new venipunctures, and raise patients' risk of complications. The removal process and insertion of another PIVC cause discomfort for patients, their companions, and the nursing team.⁶

Studies on unplanned PIVC loss are scarce.⁷ The scientific literature indicates that guideline- and evidence-based recommendations are not fully adopted in health services, reinforcing the need for technical updates and the incorporation of technologies to improve the safety of PIVC use.¹⁵⁻²³

Flushing with preservative-free 0.9% sodium chloride solution is recommended to maintain PIVC patency when devices are used intermittently or for bolus medication administration, clearing the catheter between administrations. In addition, PIVCs are kept patent during continuous infusion of normal saline or medications.^{1,6,24,25}

Therefore, PIVC management is related to patient safety, because device loss may cause preventable harm, making it essential to identify the causes of PIVC loss to support preventive measures.^{1,6,14} Thus, this study aimed to analyze factors associated with peripheral intravenous catheter loss as documented in nursing records.

METHOD

This retrospective, descriptive study with a quantitative approach was based on a medical record review and reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

Data were collected between December 2023 and February 2024 in the Departmental Records Archive of a municipal general hospital in Campos dos Goytacazes, in the state of Rio de Janeiro, Brazil. This department, the study setting, stores medical records and other documents from patients admitted to the medical ward.

The institution had general protocols for controlling healthcare-associated infections; however, it had no specific protocol for intravenous therapy or systematic monitoring of PIVC loss. Practices related to device selection, venipuncture technique, catheter securement, and medical record documentation were guided by the nursing service's care routines, based on Brazilian Ministry of Health guidelines and best practices recommended by the Brazilian Health Regulatory Agency (ANVISA).²⁴

During data collection, the institution did not have a specialized IV therapy team; PIVC insertion, maintenance, and removal were the responsibility of each department's direct-care nursing team.

To characterize PIVC loss events in hospitalized patients, 743 medical records were analyzed, corresponding to the same number of admissions to the medical ward between January 1 and October 10, 2023. Of these, 487 contained records of PIVC loss, constituting the study population.

The inclusion criteria were medical records documenting the cause of PIVC loss and information on the following variables: patient age, method used to maintain catheter patency, and catheter dwell time. No exclusion criteria were defined a priori. Of these medical records, 258 met the inclusion criteria, and 49 were classified as sample losses because illegibility or erasures prevented data extraction. Thus, the final study sample consisted of 209 nursing records.

Data were obtained using forms completed manually by the researcher, who, at the time, served as the nurse responsible for the Continuing Education department at the institution where the study was conducted. This position enabled access to the records archive and identification of the medical records of interest, as well as selection of those that met the study criteria and scope.

The data collection instrument was a form developed by the authors and composed of the following variables: sex, patient age group, cause of PIVC loss, method used to maintain PIVC

patency, and catheter dwell time. The conceptual and operational definitions of the variables used in the analysis are described in Chart 1.

Chart 1. Definition of the variables analyzed to characterize peripheral intravenous catheter loss. Campos dos Goytacazes, state of Rio de Janeiro, Brazil, 2024.

Variable	Conceptual definition	Operational definition
Patient age group	Patient's chronological age at the time of hospital admission.	Age was stratified into three groups: 18 to 64 years; 65 to 85 years; and over 85 years. Clinical and epidemiological criteria related to vulnerability and risk of vascular complications were considered. ⁴
PIVC loss	Loss or removal of the peripheral intravenous catheter.	Nursing records documenting PIVC loss or removal.
Causes of PIVC loss	The causes of PIVC loss were identified from the descriptions documented in nursing records, considering the clinical signs and manifestations recorded by nursing professionals.	Phlebitis was considered present when records described local pain, edema, erythema, and/or the presence of a palpable venous cord. ¹⁴
		Infiltration was defined as the inadvertent administration of a nonvesicant solution into adjacent tissues, identified by notes describing edema, cool skin, pallor, slow infusion flow, and absence of blood return. ¹⁴
		Catheter occlusion was characterized by interruption of fluid flow through the PIVC, with records mentioning resistance to flushing, interrupted drip flow, infusion pump alarms indicating occlusion or high pressure, and absence of blood return. ¹⁴
		Extravasation was considered present when records indicated inadvertent administration of a vesicant solution into surrounding tissues, with descriptions of severe pain; erythema, possibly progressing to pallor or cyanosis; edema; stiffness; blisters or vesicles; and, in some cases, tissue necrosis. ¹⁴
		Accidental loss was defined as the unintentional or unscheduled removal of previously functioning PIVCs. ¹ Events resulting in PIVC removal were attributed in the medical records to sudden patient movement during bathing, repositioning, or ambulation.
Method used to maintain PIVC patency	Mechanism used to keep the peripheral intravenous catheter functional and unobstructed. ¹	Categorized as: flushing with 0.9% saline; continuous infusion of normal saline; and continuous infusion of prescribed medication. ^{5,6}
Catheter dwell time	Time interval between PIVC insertion and loss, considering the recommended dwell time for the device. ⁶	Classified as: PIVC loss within 24 hours of insertion; between 24 and 96 hours; and more than 96 hours after insertion. ^{1,2}

Thus, the variable “method used to maintain intravenous access patency” was categorized according to the mechanisms used to keep the PIVC and infusion set lines patent at the time PIVC loss was identified. Accordingly, in this study, the following methods of maintaining PIVC patency were considered: flushing with 0.9% saline, continuous infusion of normal saline, and continuous infusion of prescribed medication. These categories were defined to investigate whether the PIVC use regimen (continuous or intermittent) or the flushing regimen influenced the outcome under investigation.

Given that PIVCs should not be replaced before 96 hours,⁶ the variable “catheter dwell time” was categorized by how long the venous access had been in place at the time of PIVC loss. Thus, in this study, PIVC losses were classified as occurring within 24 hours of insertion, between 24 and 96 hours, or more than 96 hours after insertion.

Measurement bias was identified in this study because characterizing the causes of PIVC loss required interpreting nursing records, introducing potential subjectivity in categorization (e.g., distinguishing between infiltration and phlebitis). As a mitigation strategy, objective and standardized criteria were defined for each PIVC loss category. In addition, nursing records were reviewed by two reviewers.

Data were organized in Microsoft Excel 2019, and statistical analysis was performed using Minitab®, version 17.1.0. Variables were characterized using absolute and relative frequencies (%). For bivariate inferential analysis, Pearson’s chi-square test was used, with a 5% significance level ($p < 0.05$) and 95% confidence intervals (95% CI).

The study complied with the ethical principles for research involving human participants. It was approved by the Research Ethics Committee of Universidade Federal Fluminense on December 16, 2022, under Opinion No. 5,822,212 and Certificate of Presentation for Ethical Review (CAAE) No. 65455722.3.0000.8160.

RESULTS

A total of 209 nursing records describing PIVC loss events were analyzed. Table 1 shows the distribution of the causes recorded for these events.

Accidental loss was the most frequent cause (30.6%), followed by phlebitis (26.3%), catheter occlusion (23.0%), infiltration (11.5%), and patient-specific factors (8.6%). The categories with the largest number of cases, accidental loss and phlebitis, had narrower confidence intervals, indicating greater precision of the estimates compared with less prevalent events, such as infiltration and patient-specific factors.

The associations between the variable “cause of PIVC loss” and the variables “age group,” “method used to maintain patency,” and “catheter dwell time” are described in Table 2.

There was no statistically significant association between age group and the cause of PIVC loss ($p = 0.0629$), although patients aged 65 to 85 years had the largest absolute number of events across all causes analyzed.

A significant association was observed between the cause of PIVC loss and the method used to maintain patency ($p = 0.0001$). When the PIVC was used for continuous normal saline infusion, accidental loss predominated (45.2%), followed by phlebitis (30.1%). Catheter occlusions were most frequently associated with continuous medication administration (41.1%). When the catheter was maintained with flushing alone, a higher relative frequency of infiltration was observed (28.6%).

There was a significant association between the cause of PIVC loss and catheter dwell time ($p = 0.0001$). Accidental losses occurred mainly between 24 and 96 hours after insertion (41.1%), whereas phlebitis was more frequent after more than 96 hours of dwell time (34.4%), indicating a relationship between prolonged use and inflammatory deterioration of the venous access. Catheter occlusions, in turn, were concentrated among catheters inserted less than 24 hours earlier and used for medication infusion, suggesting suboptimal or absent flushing in clinical practice.

Table 1. Causes attributed to peripheral intravenous catheter loss events in hospitalized patients at a municipal general hospital in Campos dos Goytacazes, state of Rio de Janeiro, Brazil, 2024 (n = 209).

Causes	N	%	95% CI	
			LL	UL
Accidental loss	64	30.6	24.4	36.9
Phlebitis	55	26.3	20.3	32.3
Catheter occlusion	48	23.0	17.3	28.7
Infiltration	24	11.5	7.2	15.8
Patient-specific factors	18	8.6	4.8	12.4

CI: confidence interval; LL: lower limit; UL: upper limit.

Table 2. Association between causes of peripheral intravenous catheter loss by age group, method used to maintain patency, and catheter dwell time. Campos dos Goytacazes, state of Rio de Janeiro, Brazil, 2024 (n = 209).

Variable	Causes n (%)					p-value
	Accidental loss	Phlebitis	Catheter occlusion	Infiltration	Patient-specific factors	
Age group						
18 to 64 years	25 (44.6)	11 (19.6)	15 (26.8)	2 (3.6)	3 (5.4)	0.0629
65 to 85 years	30 (25)	32 (26.7)	28 (23.3)	19 (15.8)	11 (9.2)	
Over 85 years	9 (27.3)	12 (36.4)	5 (15.2)	3 (9.1)	4 (12.1)	
Method used to maintain patency						
Flushing with 0.9% saline	5 (23.8)	4 (19.0)	5 (23.8)	6 (28.6)	1 (4.8)	0.0001
Continuous infusion of normal saline	42 (45.2)	28 (30.1)	4 (4.3)	8 (8.6)	11 (11.8)	
Infusion of prescribed medication	17 (17.9)	23 (24.2)	39 (41.1)	10 (10.5)	6 (6.3)	
Catheter dwell time						
Up to 24 hours	18 (75.0)	0 (0)	3 (12.5)	1 (4.2)	2 (8.4)	0.0001
Between 24 and 96 hours	39 (41.1)	13 (13.7)	16 (16.8)	19 (20.0)	8 (8.4)	
More than 96 hours	18 (20.0)	31 (34.4)	29 (32.2)	4 (4.4)	8 (8.9)	

DISCUSSION

This study found “Accidental loss” to be the predominant category, differing from other studies that reported complications, such as phlebitis and occlusion, as the most frequent causes.^{10,25-28} The high incidence of accidental PIVC removal requiring subsequent intravenous cannulation causes physical and emotional harm to patients, increases the nursing team’s workload, and raises hospital costs.⁵

Another complication commonly observed in hospitalized patients with PIVCs in place is phlebitis, which in this study had an incidence rate of 5.26%, exceeding the 5% threshold recommended by the Infusion Nurses Society.^{1,29} The high incidence of phlebitis among patients receiving IV therapy is a challenge faced by hospitals worldwide; studies have reported rates ranging from 16.7% to 54.5%, identifying phlebitis as the most frequent cause of PIVC loss.³⁰⁻³⁶ Thus, implementing training on catheter insertion and maintenance, in accordance with guidelines issued by scientific societies and ANVISA, may help improve procedural success.^{6,37,38}

In this study, the incidence rate of phlebitis among older patients was 61.3%. This finding may be explained by aging-related factors, such as immobility or limited mobility, skin and tissue fragility, reduced blood vessel elasticity, a higher prevalence of chronic diseases, immune system impairment, and lower vascular reserve. To prevent phlebitis, the nursing team should consider these factors and patient safety measures when performing safe, high-quality PIVC insertion, including skin antisepsis, selection of an insertion site away from joints, use of over-the-needle catheters, hand hygiene, and insertion-site monitoring.^{11,25,37} Alternative routes indicated for frail older adults, such as hypodermoclysis, should also be considered.³⁷

Here, the proportion of infiltration was similar to those reported in other studies that identified infiltration as a reason for PIVC removal: 11.1%, 11.83%, 13%, 0.5%, and 35.5%.^{12,36,37,39-42} Infiltration involves injury to the venous wall, with vessel perforation and leakage of nonvesicant solutions into the tissues surrounding the PIVC insertion site. Risk factors for infiltration are associated with the type of intravenous medication infused.¹ Thus, infiltration may involve circulatory impairment adjacent to the intravenous insertion site and, in more severe cases, tissue necrosis, reinforcing the importance of nursing care.²⁸

Infiltration adverse events were more frequent (28.6%) in PIVCs managed under a saline flushing protocol to maintain vascular access patency than in those managed with other methods. This finding may be associated with excessive pressure during flushing, vascular fragility, catheter gauge, or the administered solution’s osmolality, all of which may cause endothelial injury. When saline flushing is used, regular monitoring and proper flushing with 0.9% saline are required to prevent possible occlusions and infiltration.^{5,6}

Despite this incidence, saline flushing and positive-pressure flushing to maintain the patency of vascular devices used in IV therapy are considered safe and economically viable practices and provide patients with greater freedom of movement during therapy. In this regard, ongoing training for the nursing team helps ensure these procedures are performed as recommended.^{6,25}

In this study, catheter occlusion occurred mainly during medication administration, when drug crystallization and blood clot formation may occur, resulting in interruption of IV therapy.⁴ A Spanish study identified occlusion as the main reason for PIVC loss in 74.2% of cases.³⁹ This complication prevents catheter flushing or fluid infusion, leading to access removal and subsequent intravenous recannulation to continue IV therapy.^{32,34}

Using 0.9% saline to maintain and flush intravenous access, guided by clinical judgment and each patient's individual needs, can be considered a versatile and safe option because it is compatible with a wide range of medications and fluids. Other practices include following recommendations from the Centers for Disease Control and Prevention (CDC) and ANVISA on a 72- to 96-hour PIVC dwell time, which may be extended when clinically indicated and consistent with institutional best practices.^{6,43}

Implementing safety bundles developed by the Institute for Healthcare Improvement (IHI) is another strategy that may help reduce PIVC loss. Examples include bundles for central venous catheter care, which are designed to reduce risks and prevent infections based on scientific evidence, thereby improving care quality and patient safety.³²⁻³⁴

Bundles are sets of actions implemented during catheter insertion or maintenance. They include recommendations on hand hygiene, maximal barrier precautions, skin antisepsis, and insertion-site selection; disinfection of connectors and catheter hubs by scrubbing with 70% alcohol for 30 seconds; dressing care; and daily review of the continued need for the catheter, with immediate removal when it is no longer indicated.³²⁻³⁴

Finally, patient-specific factors warrant attention. These factors refer to patient-related characteristics, such as patient-reported pain without inflammatory signs, and accounted for 8.6% of the causes of PIVC loss in this study. Other studies have reported this category in 3.8% of device loss justifications, followed by accidental removal without a description of the accidental event, at 5.3%.^{7,28}

The incidence of PIVC loss is an indicator for monitoring related care processes and points to shortcomings in procedure standardization and staff training. Accordingly, institutional protocols based on Infusion Nurses Society guidelines should be implemented to guide nursing care and best practices for preventing adverse events, including appropriate catheter insertion and maintenance techniques; monitoring and early risk identification; health education for patients, family members, and caregivers; and ongoing staff training.^{1,9,14,41,44,45}

Beyond the procedure itself, professional training should also address documentation of the nursing procedure and individualized care. Nursing notes are legally recognized as professional acts and are essential to ethical, safe care.^{10,19}

CONCLUSION AND IMPLICATIONS FOR PRACTICE

This study identified accidental loss, phlebitis, catheter occlusion, and infiltration as the main causes of PIVC loss documented in nursing records. Accidental loss predominated in cases involving continuous normal saline infusion; phlebitis was associated with prolonged catheter dwell time; and occlusions were concentrated in catheters used for medication administration, suggesting weaknesses in monitoring, flushing technique, and ongoing assessment of venous access.

Associations were observed between causes of loss and the method used to maintain patency and between these causes and catheter dwell time, indicating that care practices related to PIVC management may directly affect catheter maintenance.

These findings suggest that PIVC loss may be associated with preventable factors in nursing practice.

The factors associated with PIVC loss identified in this study indicate that nursing practices related to device insertion, maintenance, and monitoring need strengthening.

Limitations include the lack of control for clinical and care-related variables that may have influenced PIVC loss, such as patients' health status, the prescribed treatment, and the quality of catheter securement. In addition, the single-hospital setting limits the generalizability of the results. Therefore, longitudinal, multicenter studies that consider clinical variables, securement techniques, and different care practices are recommended to deepen understanding of the factors associated with PIVC loss.

Continuing education for the team is essential, particularly regarding proper PIVC securement; systematic assessment of the insertion site, with early risk identification to support preventive decision-making; correct flushing technique; and adherence to catheter dwell time based on clinical criteria. Thus, adopting evidence-based institutional protocols and investing in catheter stabilization technologies may help reduce PIVC losses, promote patient safety, and optimize care resources.

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DATA AVAILABILITY RESEARCH

The data used in this study are included in the article.

CONFLICT OF INTEREST

None.

REFERENCES

1. Nickel B, Gorski L, Kleidon T, Kyes A, DeVries M, Keogh S et al. Infusion therapy standards of practice. *J Infus Nurs.* 2024;47(Suppl 1):S1-285. <https://doi.org/10.1097/NAN.0000000000000532>. PMID:38211609.
2. Braga LM, Salgueiro-Oliveira AS, Henriques MAP, Arreguy-Sena C, Albergaria VMP, Parreira PMSD. Peripheral venipuncture: comprehension and evaluation of nursing practices. *Texto Contexto Enferm.* 2019;28:e20180018. <https://doi.org/10.1590/1980-265x-tce-2018-0018>.
3. Walker RM, Pires MPO, Ray-Barruel G, Cooke M, Mihala G, Azevedo SS et al. Peripheral vascular catheter use in Latin America (the vascular study): a multinational cross-sectional study. *Front Med.* 2023;9:1039232. <https://doi.org/10.3389/fmed.2022.1039232>. PMID:36687407.
4. 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>. PMID:33016412.
5. Lima AFC, Saba A, Neves Filho AG, Couto KA, Silva LO. Peripheral venous access using devices over needles with and without extension: costs and outcomes. *Rev Bras Enferm.* 2020;73(5):e20180921. <https://doi.org/10.1590/0034-7167-2018-0921>. PMID:32609202.

6. Ministério da Saúde (BR). Práticas seguras para a prevenção de incidentes envolvendo cateter intravenoso periférico em serviços de saúde [Internet]. Brasília: ANVISA; 2022 [cited 2025 Aug 11]. Available from: <https://portaldeboaspraticas.iff.fiocruz.br/atencao-recem-nascido/nt4-cateter-intravenoso-anvisa-2022/>
7. Cooke M, Ullman AJ, Ray-Barruel G, Wallis M, Corley A, Rickard CM. Not "just" an intravenous line: consumer perspectives on peripheral intravenous cannulation (PIVC): an international cross-sectional survey of 25 countries. *PLoS One*. 2018;13(2):e0193436. <https://doi.org/10.1371/journal.pone.0193436>. PMID:29489908.
8. Santos LM, Conceição TB, Silva CSG, Tavares SS, Rocha PK, Avelar AFM. Care related to peripheral intravenous catheterism in pediatrics performed by nursing technicians. *Rev Bras Enferm*. 2021;75(2):e20200611. <https://doi.org/10.1590/0034-7167-2020-0611>. PMID:34669898.
9. Gorski LA, Hadaway L, Hagle ME, Broadhurst D, Clare S, Kleidon T et al. Infusion therapy standards of practice, 8th edition. *J Infus Nurs*. 2021;44(Suppl 1):S1-224. <https://doi.org/10.1097/NAN.0000000000000396>. PMID:33394637.
10. Ministério da Saúde (BR). Recomendações para registros de enfermagem no exercício da profissão [Internet]. Brasília: Conselho Federal de Enfermagem; 2023 [cited 2025 July 11]. Available from: <https://www.cofen.gov.br/wp-content/uploads/2024/02/Registros-de-Enfermagem-no-Exercicio-da-Profissao.pdf>
11. Teixeira PC, Almeida PF, Vieira RPC, Oliveira LS, Pinto JGM, Mesquita LF et al. Peripheral venous catheterization: the quality of nursing care in peripheral venous catheter insertion. *Glob Acad Nurs*. 2021;2(Suppl 3):e180.
12. Bezerra ABC, Medeiros LNB, Neves AD, Barbosa MMB, Silva RGS, Siqueira RM. Nursing technicians and peripheral venous catheterization in pediatrics. *Rev Enferm UFPE on line*. 2020;14:e244663.
13. Lima NO, Sousa MOF, Peres EM, Gomes HF, Pires BMFB, Leite DC et al. Caracterização da utilização de cateteres venosos periféricos em unidade clínica de um hospital universitário. *J Nurs Health*. 2020;10(3):e20103003. <https://doi.org/10.15210/jonah.v10i3.18367>.
14. Organização Mundial de Saúde. Estrutura conceitual da classificação internacional de segurança do paciente. [Internet]. Lisboa; 2011 [cited 2025 May 11]. Available from: <https://proqualis.fiocruz.br/sites/proqualis.fiocruz.br/files/Estrutura%20Conceitual%20da%20Classifica%C3%A7%C3%A3o%20Int%20Seguran%C3%A7a%20do%20Paciente.pdf>
15. Ministério da Saúde (BR). Documento referência para o programa nacional de segurança do paciente [Internet]. Brasília; 2014 [cited 2025 Jan 11]. Available from: https://bvsms.saude.gov.br/bvs/publicacoes/documento_referencia_programa_nacional_seguranca.pdf
16. Silva BSM, Santos LM, Rocha PK, Mota ANB, Avelar AFM, Kusahara DM. National practice of nursing professionals in the insertion of peripheral vascular access devices. *Rev Latino-Am Enfermagem*. 2024;32:e4314. PMID:39319889.
17. Costa SPD, Silveira RED, Monteiro DAT, Contim D, Toffano SEM. Quality of care in peripheral venous catheterization: a scoping review. *Rev Bras Enferm*. 2023;76(6):e20220578. <https://doi.org/10.1590/0034-7167-2022-0578pt>. PMID:38055472.
18. Prado NCC, Silva RAR, Menezes HF, Santos IS, Santos RSC, Juraci SDSL et al. Clinical validation of the diagnosis adverse location of peripherally inserted central catheter in neonatology. *Rev Esc Enferm USP*. 2025;59:e20250117. <https://doi.org/10.1590/1980-220x-reeusp-2025-0117en>. PMID:40762992.
19. Messias LFDS, Cesar VF, Crespo JCL, Andrade IDS, Fedrigo JC, Menezes NM et al. Infusion therapy nursing team: implementation and effectiveness of initial results. *J Infus Nurs*. 2025 Jul-Aug;48(4):261-7. <https://doi.org/10.1097/NAN.0000000000000596>. PMID:40626773.
20. Cerqueira EAC, Bittencourt IS, Caldas MOL, Silva BSM, Manzo BF, Rocha PK et al. Knowledge of pediatric nursing professionals about infiltration and extravasation in newborns and children. *Rev Rene*. 2025;26:e94280. <https://doi.org/10.15253/2175-6783.20252694280>.
21. Soares HRB, Pereira RR, Pitombeira MGV, Araújo PF, Moreira DP, Veras RN Fo. Elaboração de cartilha educativa para paciente adulto em uso do cateter central de inserção periférica. *Rev Enfer Atual Derme*. 2024;98(2):e024315. <https://doi.org/10.31011/reaid-2024-v.98-n.2-art.2116>.
22. Ferreira MG, Peres EM, Leite DC, Peixoto IC, Pires BMFB, Gomes HF. Characterization of peripheral venous catheter use in a unit specialized in adolescent health. *Rev Enferm Aten Saude*. 2023;12(1):202366. <https://doi.org/10.18554/reas.v12i1.5825>.
23. Gorski LA. Update: the 2024 infusion therapy standards of practice. *Home Healthc Now*. 2024;42(4):198-205. <https://doi.org/10.1097/HHH.0000000000001270>. PMID:38975817.
24. Chroinin DN, Ray-Barruel G, Carr PJ, Frost AS, Rickard CM, Mifflin N et al. The burden of peripheral intravenous catheters in older hospital inpatients: a national cross-sectional study part of the one million global peripheral intravenous catheters collaboration. *Australas J Ageing*. 2023;42(1):98-107. <https://doi.org/10.1111/ajag.13068>. PMID:35384222.
25. Costa SP, Silveira RE, Monteiro DAT, Contim D, Toffano SEM. Quality of care in peripheral venous catheterization: a scoping review. *Rev Bras Enferm*. 2023;76(6):e20220578. <https://doi.org/10.1590/0034-7167-2022-0578pt>. PMID:38055472.
26. Azevedo GN, Monteiro DAT, Torres LN, Santos LA, Gir E, Toffano SEM. Safety with engineering control and treatment to standard precaution in peripheral venous catheterization: observational study. *Rev Baiana Enferm*. 2021;36:e45618.
27. Simões AMV, Vendramim P, Pedreira MLG. Risk factors for peripheral intravenous catheter-related phlebitis in adult patients. *Rev Esc Enferm USP*. 2022;56:e20210398. <https://doi.org/10.1590/1980-220x-reeusp-2021-0398en>. PMID:35724261.
28. López-López C, Collados-Gómez L, García-Manzanares ME, Segura-Paz AM, López-Gutierrez AM, Pérez-García S. Prospective cohort study on the management and complications of peripheral venous catheter in patients hospitalized in Internal Medicine. *Rev Clin Española*. 2021;221(3):151-6.
29. Bourgault AM, Penoyer DA, Upvall MJ. It depends: decision-making for insertion and removal of short peripheral catheters. *J Infus Nurs*. 2021;44(2):103-12. <https://doi.org/10.1097/NAN.0000000000000418>.
30. Estequi JG, Roseira CE, Jesus JB, Figueiredo RM. Boas práticas na manutenção do cateter intravenoso periférico. *Enf Foco*. 2020;11(1):10-4. <https://doi.org/10.21675/2357-707X.2020.v11.n1.2246>.
31. Costa CAB, Araújo FL, Costa ACL, Corrêa AR, Kusahara DM, Manzo BF. Central venous catheter bundle: professional knowledge and behavior in adult intensive care units. *Rev Esc Enferm USP*. 2020;54:e03629. <https://doi.org/10.1590/s1980-220x2019011203629>. PMID:33084798.
32. Vicente APR, Contrin LM, Werneck AL. Nursing professionals' adherence to the blood stream infection prevention bundle. *Rev Enf Contemp*. 2023;17(1):103-11.
33. Lima KMS, Souza CS, Rocha HMN, dos Santos IRA. Nursing professionals' adherence to the blood stream infection prevention bundle. *Rev Enf Contemp*. 2023;12:e4757. <https://doi.org/10.17267/2317-3378rec.2023e4757>.
34. O'Grady NP, Alexander M, Burns LA, Dellinger EP, Garland J, Heard SO et al. Guidelines for the prevention of intravascular catheter-related infections. *Clin Infect Dis*. 2011;52(9):162-93. <https://doi.org/10.1093/cid/cir257>.
35. Massante CC, Peres EM, Gomes HF, Andrade PCS, Costa IO, Pires BMF. Conhecimento dos enfermeiros sobre boas práticas em cateteres venosos periféricos. *Rev Enferm Atual Derme*. 2021;95(35):e021106.
36. Souza RS, Oliveira PP, Dias AAL, Simão DAS, Pelizari AEB, Figueiredo RM. Prevention of infections associated with peripheral catheters: construction and validation of clinical scenario. *Rev Bras Enferm*. 2020;73(5):e20190390. <https://doi.org/10.1590/0034-7167-2019-0390>. PMID:32638931.
37. Evangelista ACS, Costa BHC, Santos TBR, Alvim ALS. Prevenção de flebites: conhecimento dos profissionais de enfermagem. *J Health NPEPS*. 2021 Jan-Jun;6(1):205-17. <https://doi.org/10.30681/252610105219>.
38. Mota RS, Silva VA, Mendes AS, Barros AS, Santos OMB, Gomes BP. Incidence and characterization of electronically notified phlebitis in a teaching hospital. *Rev Baiana Enferm*. 2020;34:e35971.
39. Indarwati F, Munday J, Keogh S. Peripheral intravenous catheter insertion, maintenance and outcomes in Indonesian pediatric hospital settings: a point prevalence study. *J Pediatr Nurs*. 2023 Nov-Dec;73:106-12. <https://doi.org/10.1016/j.pedn.2023.08.009>. PMID:37659338.

40. Rocha DMA, Brito EAW, Souza TTL, Mota RO, Miranda MC, Lima FET. Administração de medicamento endovenoso em pacientes de hospital de doenças infectocontagiosas: atuação da enfermagem. *Enferm Foco*. 2020;11(2):98-104. <https://doi.org/10.21675/2357-707X.2020.v11.n2.2643>.
41. Silva MCM. Atuação da enfermagem no controle de infecção da corrente sanguínea relacionada aos cateteres venosos periféricos. *Rev Enferm UFPE on line*. 2021;15(2):e247901. <https://doi.org/10.5205/1981-8963.2021.247901>.
42. Ribeiro DL, Barbieri A, Uema RTB, Shibukawa BMC, Higashihashi IH, Dias J. Use of virtual reality during venipuncture procedures in hospitalized children: a descriptive study. *Online Braz J Nurs*. 2022;21:e20226588.
43. Monteiro NCA, Pereira ER, Oliveira FA, Pinto CMI, Paes GO. Eventos adversos relacionados ao uso de cateteres venosos periféricos: revisão integrativa. *Rev Recien*. 2021;11(33):280-9.
44. Silveira DD, Marinho NMV, Silva IMF, Ferreira MS, Lima FS, Simplicio IOB. O papel da enfermagem na prevenção e controle das infecções na corrente sanguínea por cateter venoso periférico: uma revisão da literatura. *Cad Pedag*. 2025;22(6):e15260. <https://doi.org/10.54033/cadpedv22n6-012>.
45. Tendeiro PISN, Diniz AM, Mendes C, Bordalo IMSVL, Chainho M C, Ramos SMSV et al. Flebite associada a cateter venoso periférico e a administração de medicamentos: análise retrospectiva de incidentes. *Rev Enferm Ref*. 2023;serVI(2):e22069.

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