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Professional paper

RISK FACTORS FOR PHLEBITIS ASSOCIATED WITH PERIPHERAL INTRAVENOUS CATHETERS: A SCOPING REVIEW OF THE LITERATURE

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Abstract

Introduction: Peripheral venous catheter placement is a quick and inexpensive procedure for short-term vascular access. This technique is widely used to administer fluids, drugs, blood products, and contrast media. However, their use is often associated with complications, the most common of which is phlebitis. To reduce the incidence of its occurrence, the implementation of effective preventive strategies is essential.
Aims: This review aims to evaluate and synthesize risk factors for the occurrence of phlebitis from peripheral venous catheters, focusing on factors related to the patient, catheters, infusions, and healthcare practices.
Methods: A scoping review was conducted to examine the relationship between risk factors and phlebitis associated with peripheral intravenous catheters. The search was performed in CINAHL, Cochrane Library, Embase, PubMed, Nursing Journal and Google Scholar focusing on studies published from 2003 to 2023. Only English-language, non-randomized studies on adults were included. Literature reviews, studies before 2003, pediatric studies, and those with sample sizes smaller than 100 were excluded. Keywords such as phlebitis, thrombophlebitis, and risk factors were used, and duplicates were removed.
Results: The electronic research strategy identified 1,408 papers, of which 30 were relevant to the aims of this review. The results of the study show a correlation between patient-related risk factors such as age, gender, vein quality, and the presence of chronic diseases. Catheter-related factors include the duration of catheterization, insertion site, catheter size, and emergency insertion. Infusions given as administration of antibiotics, high osmolarity drugs and potassium chloride (KCl) were also identified as risk factors. Factors related to the practice of health care nurses were assessed as low work experience, hand hygiene and missed nursing care.
Conclusions: The literature review assessed the impact of several risk factors for the occurrence of phlebitis. For its prevention and early detection, it is necessary to improve nurses' knowledge about the proper techniques for inserting a peripheral venous catheter, its maintenance and removal when necessary, as well as to identify factors that increase the risk of its development.

Keywords: Peripheral intravenous catheter, phlebitis, risk factors, nursing care

1. Introduction

Peripheral intravenous catheter (PIVC) insertion is the fastest, most direct, and least expensive technique to provide short-term intravascular access for the administration of fluids, medications, blood and blood products, and contrast media (Matthews et al., 2023). Approximately 70% of hospitalized patients have a peripheral venous catheter inserted (Webster et al. 2015).
Despite their ubiquity, PIVCs exhibit a high failure rate, with up to 69% removed prematurely due to mechanical complications (e.g., phlebitis, occlusion, infiltration) or infection before completion of prescribed therapy (Helm et al., 2019) Phlebitis remains the most frequent PIVC-related complication, with incidence estimates varying widely from 20% to 80% depending on patient populations and assessment criteria (Comparcini et al., 2017). Clinically, phlebitis manifests as pain, erythema, and palpable cord formation, often necessitating catheter replacement and thereby increasing patient discomfort, nursing workload, and overall treatment costs (Rickard et al., 2012). The persistence of phlebitis rates well above the ≤5% benchmark

recommended by the Infusion Nurses Society highlights the urgency of improved preventive measures (INS, 2021). The pathogenesis of phlebitis reflects a multifactorial interplay among patient-related factors (e.g., age, comorbidities), catheter characteristics (e.g., insertion site, gauge, dwell time), infusate properties (e.g., osmolality, pH), and nursing practices (e.g., insertion technique, site maintenance) (Urbanetto et al., 2017; Simin et al., 2019; Lee et al., 2019). Evidence-based guidelines emphasize selecting the smallest effective catheter, favoring proximal upper-limb sites, limiting dwell time to less than 72–96 hours, and adhering to strict aseptic technique (INS, 2021).
By using and strictly implementing appropriate protocols for the management of peripheral venous catheters and infusions, healthcare providers can reduce the incidence of phlebitis, improving patient well-being and reducing hospital costs.

2. Aims

This review aims to evaluate and synthesize risk factors for the occurrence of phlebitis from peripheral venous catheters, focusing on factors related to the patient, catheters, infusions, and healthcare practices.

3. Material and methods

This scoping review was conducted in accordance with the PRISMA-ScR checklist (Tricco et al., 2018) and applying the JBI scoping review methodology (Aromataris & Munn, 2020).
The research question used in this review was:
"What are the risk factors that influence the occurrence of phlebitis in patients with peripheral intravenous catheters?"
To answer this research question, the PCC framework (Population, Concept, and Context) was utilized:

- Population: Patients with peripheral intravenous catheters (PIVCs)
- Concept: Risk factors associated with the development of phlebitis
- Context: Healthcare settings (e.g., hospitals, clinics, long-term care facilities)

3.1 Data sources and search strategy: The literature search was systematically conducted across the following electronic databases: CINAHL, The Cochrane Library, Embase, PubMed, Nursing Journal, and Google Scholar. The primary aim of the search was to identify relevant studies published between January 2003 and December 2023, without applying restrictions related to geographical location. Although a publication date range was predetermined, no filters were applied within the databases regarding publication dates during the actual search process.
The search strategy utilized a combination of Medical Subject Headings (MeSH) and pertinent keywords related to *phlebitis* and *peripheral intravenous catheters*. Table 1 outlines the detailed search strings employed for each database. These search strategies incorporated key terms and their synonyms such as “phlebitis,” “peripheral intravenous catheter,” and “risk factors” in conjunction with Boolean operators (AND/OR) to optimize both the sensitivity and comprehensiveness of the search.
Following completion of the database searches, duplicate records were identified and removed. The remaining studies were screened through a review of their titles and abstracts to determine their eligibility for inclusion in the review.

3.2 Data extraction: According to the JBI scoping review methodology (Aromataris & Munn, 2020), data were extracted from the studies included in the review using a standardized results extraction table. The data extraction form was structured to capture the following key elements: author(s) and year of publication, main theme, geographical region, study design, population characteristics, and significant risk factors identified, and key gaps or limitations reported in each study.

Table 1: Search strategies used in each databases

PubMed	**("peripheral intravenous catheter"[Title/Abstract] OR PIVC[Title/Abstract]) AND phlebitis [Title/Abstract] AND ("risk factors"[Title/Abstract] OR predictors [Title/Abstract] OR "associated factors"[Title/Abstract])**	**76**
CINAHL	("peripheral intravenous catheter" OR PIVC) AND phlebitis AND ("risk factors" OR predictors OR "associated factors")	12
Embase	('peripheral intravenous catheter'/exp OR 'PIVC') AND 'phlebitis'/exp AND ('risk factor'/exp OR predictor* OR 'associated factor')	51
Cochrane Library	("peripheral intravenous catheter" OR PIVC): ti,ab,kw AND phlebitis: ti,ab,kw AND ("risk factors" OR predictors OR "associated factors"): ti,ab,kw	136
Nursing Journals	("peripheral intravenous catheter" OR PIVC) AND phlebitis AND ("risk factors" OR predictors OR "associated factors")	131
Google Scholar	("peripheral intravenous catheter" OR PIVC) AND phlebitis AND ("risk factors" OR predictors OR "associated factors") AND ("observational study" OR cohort OR case-control OR cross-sectional) AND -review AND adult patient	1080

3.3 Eligibility Criteria: Eligibility criteria were defined a priori using the Joanna Briggs Institute's Population -Concept - Context (PCC) framework.

Inclusion:

- ✓ Non-randomized designs (e.g., prospective cohorts, cross-sectional studies)
- ✓ Published January 2003 - December 2023
- ✓ Investigated phlebitis and its risk factors in adult PIVC users (≥18 years)
- ✓ English-language full-text articles with extractable phlebitis outcomes

Exclusion:

- ✓ Randomized controlled trials or pediatric-only (<18 years) studies
- ✓ Publications before 2003
- ✓ Non-peer-reviewed formats (e.g., letters, abstracts)
- ✓ Sample size <100
- ✓ Unclear methodology, imprecise results, or inaccessible full text

Studies with mixed adult/pediatric populations or multiple complications were included only if phlebitis-specific data were reported separately.

3.4 Screening process: The screening process was conducted in two distinct stages:

1. **Title and Abstract Screening:** Two independent reviewers assessed all retrieved records for relevance, based on the predefined inclusion and exclusion criteria.
2. **Full-Text Screening:** Full-text articles of studies deemed potentially relevant were retrieved and evaluated in detail to determine their eligibility for final inclusion.

Any discrepancies or disagreements between reviewers were resolved through discussion; if consensus could not be reached, a third reviewer was consulted to facilitate resolution. The

overall study selection process is depicted in the PRISMA-ScR flow diagram, as outlined by Tricco et al. (2018).

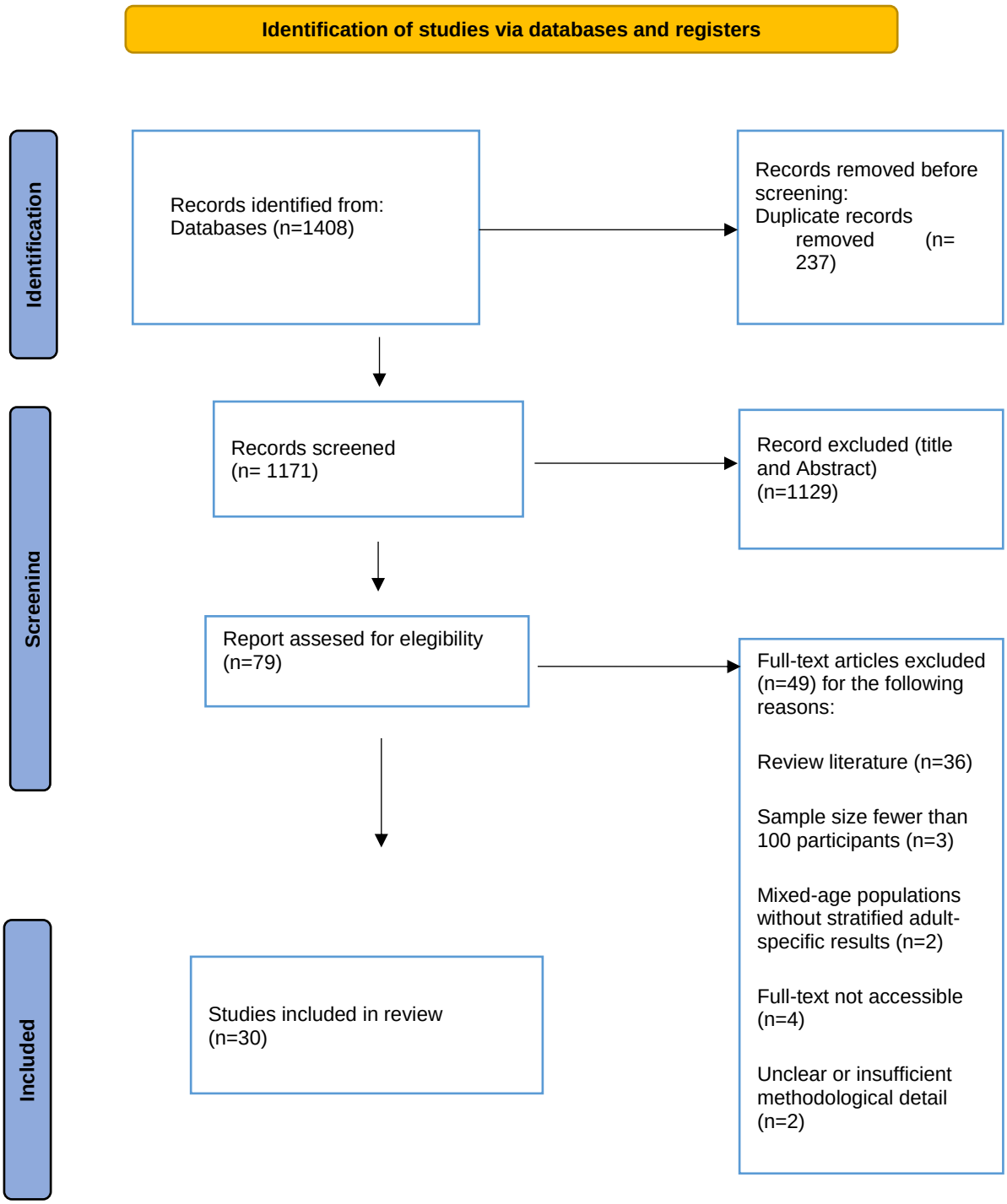

Figure 1: PRISMA 2020 flow diagram illustrating the study selection process

3.5 Quality Appraisal and Risk of Bias Assessment: In this scoping review, a formal appraisal of methodological quality and risk of bias was not undertaken. This decision is aligned with the primary purpose of scoping reviews, which is to map the existing body of literature and to identify the scope, range, and nature of available evidence, rather than to perform a critical evaluation of the quality of individual studies.

This was done based on and referring to the *JBI Manual for Evidence Synthesis* (Aromataris & Munn, 2020) and the *PRISMA-ScR describing* guidelines (Tricco et al., 2018) which determine that a critical appraisal is not mandatory for scoping review. Including studies even though they do not have a rigorous methodology allows us to evaluate all the data and evidence regarding risk factors leading to the occurrence of phlebitis from peripheral venous catheters.
However, during the evaluation process, basic criteria were applied for the articles acceptance inclusion in the study. The study excluded those articles that did not have a clear methodology or literature reviews, those articles where the study population was under 18 years of age or with a sample size of less than 100, and as well as where the full text was not available.
This pragmatic filtering aimed to maintain a minimum standard of reporting quality, thereby supporting the integrity and interpretability of the resulting synthesis.

Table 2: Summary of Included Studies on Risk Factors for Phlebitis Associated with Peripheral Intravenous Catheters (PIVCs)

Author (s)	**Main Theme**	**Geographical Region**	**Study Design**	**Population**	**Significant Risk Factors**	**Key Gaps/Limitations**
Daud et al. (2019)	To assess phlebitis incidence and associated risk factors to guide updates of PIVC guidelines	Malaysia	Observational/cohort	321 patients	Age ≥40, male, chronic disease	Need more evidence on phlebitis risk factors
Nassaji-Zavareh & Ghorbani (2007)	Investigate phlebitis incidence and related factors	Iran	Prospective study	300 patients	Female, <60 years old, lower extremities, diabetes, burns, infections**,** urgent catheter insertion	Need for future research to better understand risk factors
Salgueiro-Oliveira et al. (2012)	Identify incidence and risk factors for phlebitis in PIVC patients	Portugal	Prospective observational study	1,244 catheters	Antibiotics, KCl, upper limb	Randomized controlled trial is needed for better variable control
Simões, Vendramim & Pedreira (2022)	Identify risk factors for PIVC-related phlebitis and support nursing	Brazil	Post hoc analysis of RCT	1,319 adult patients	Reduced mobility, DVT family history, dorsal hand site, Amoxicillin-Potassium and	Secondary analysis; possible selection bias

	interventions				Omeprazole Sodium	
Yasuda et al. (2022)	Examine and identify risk factors for phlebitis in critically ill ICU patients	Japan	Secondary analysis of cohort	1,359 patients, 3,429 PIVCs	Upper arm insertion site, nitroglycerine Nicardipine, Noradrenaline, Amiodarone, Levetiracetam	"Using a priori variable selection instead of stepwise methods may have biased risk estimates and limited model accuracy."
Abolfotouh et al. (2014)	Assess pattern and complications of PIVCs in adults	Saudi Arabia	Observational prospective cohort	359 adult patients, 842 catheters	Females, forearm	Lack of prior regional studies
Salma et al. (2019)	Identify incidence and risk factors for PIVC complications	Bangladesh	Prospective study	300 patients, 420 PIVCs	Male,>45 years, Amoxicilline +clavulanic acid	Limitations not explicitly discussed
Atay et al. (2018)	Assess phlebitis rate and risk factors using a scale	Turkey	Prospective observational	317 patients, 532 catheters	Longer catheter duration, hypertonic fluid, blood product, chronic disease	Not explicitly stated in the provided excerpts
Arias-Fernández et al. (2017)	Determine incidence and risk factors of phlebitis from PVCs	Spain	Prospective cohort study	105 patients, 178 PVCs	Use of extension tube, size 18-20 G	Non-random sample
Braga et al. (2018)	Determine incidence and risk factors for phlebitis and infiltration	Brazil	Cohort study	110 patients	Length of hospital stay, catheter dwell time	Small, non-probabilistic sample; single unit
Wallis, et al. (2014)	Assessing independent risk factors for PIVC failure	Australia	Secondary data analysis from RCT	3283 patient, 5907 PIVCs	Female sex (HR 1.64 for phlebitis); younger,	The study highlighted that previous research had contradictory

	including phlebitis				infection, antibiotics	findings regarding risk factors, particularly gender
Usluso y & Mete (2008)	Predisposin g factors for phlebitis in peripheral IV catheter sites	Turkey	Descript ive compara tive	355 patients, 568 PIVCs	Catheter dwell time, antecubital fossa, hypertonic fluids, number of infused drugs > 4 or more time	Did not study dressing change frequency, diagnosis, catheter techniques; interrater variability possible
Urbane tto, Peixoto , May (2016)	Phlebitis incidence and risk factors with PIC and post-infusion phlebitis	Brazil	Cohort study	361 PIVCs	Dwell time >72 hrs. associated with higher incidence	Few studies on post-infusion phlebitis; wide incidence variability
Singh, et al. (2009)	Occurrence and factors of PIC-related phlebitis	Nepal	Prospect ive observat ional	230 ICU, medical, surgical, OBGYN pts.	Male sex, catheter gauge (20 gauge), forearm site, IV drug admin, blood transfusions	No explicit limitations listed
Simin, et al. (2019)	Incidence, severity, risk factors of PVC-induced complicatio ns	Serbia	Observa tional prospect ive	368 adult patients	Comorbidities, infection, catheter size, dwell time, number of infusions, hypertonic fluid	Single clinic; only IV antibiotic patients; limited antiseptic and stabilization resources; delayed catheter removal noted
Pasalio glu & Kaya (2014)	Effect of catheter indwell time on phlebitis developmen t	Turkey	Cross-sectional study	103 patients, 439 PIVCs	Catheter indwell time, antibiotic use, sex, hypertonic fluid	Descriptive design; did not explore dressing change frequency, diagnosis, catheter technique

Chen et al. (2021)	Risk factors and predictive model for PVC failure	China	Prospective multicenter cohort study	5,345 patients	Age >45 years, forearm site, , irritant infusions, long infusion time/volume, heparin saline	Did not consider venipuncture technique; no focus on irritant/vesicant infusions
Cicolini et al. (2009)	Optimal PVC insertion site to reduce thrombophlebitis	Italy	Observational survey	427 patients	Older, female gender, catheter size, insertion site, type of fluids	Limited generalizability
Cicolini et al. (2014)	Influence of insertion site on phlebitis and dwell time	Italy	Prospective cohort study	1,498 adults	Older age, female gender, urgent admission, antibiotic therapy, nurse insertion	Unclear anatomical site definitions, heterogeneity, observational design
Enes et al. (2016)	Phlebitis incidence and influencing factors	Brazil	Exploratory study	122 adults	concomitant continuous and intermittent infusion, chronic disease, infection	Small convenience sample
Furtado (2011)	Phlebitis in surgical patients	Portugal	Quantitative descriptive	171 patients, 286 catheters	Diabetes, tobacco use, KCl administration, cannula size 18 G,dwell time 72 h, antecubital fossa, Potassium chloride	No data on attempts or dressing type; phlebitis scale variability
Larsen et al. (2020)	Risk factors for catheter failure in oncology	Australia	Prospective observational	200 patients, 396 catheters	Age <45 years, inserted in dominant side, bruising due to insertion	Small size, single center, oncology population; no CVAD data
Lee, Kim, Kim (2019)	Predictive model for peripheral phlebitis in orthopedic patients	South Korea	Prospective survey	270 patients	Vein quality, use of contrast medium, shorter hand hygiene duration (<10	Single center; orthopedic only; no severity classification; mechanical/inf

					s) and nursing experience (<3 years)	ectious factors not uniformly assessed
Liu et al. (2020)	PVC complicatio n rates and costs	China	Prospect ive observat ional registry	1,069 patients	Catheter 22G, irritant drugs,	Observational; no drug frequency data; few catheters >4 days; scale properties modest
Lulie et al. (2021)	Incidence and associated factors of PIVC phlebitis	Ethiopia	Prospect ive observat ional/co hort	384 adult patients	Male, dwell time >96 hrs., used infuses, Age >60 years, malnutrition, immunosuppre ssion, comorbidity, large cannula size, poor aseptic technique, Improperly securing of cannula	No explicit limitations mentioned
Manda l and Raghu (2019)	Incidence and factors of PIVC-related phlebitis	India	Prospect ive observat ional	150 patients	Female, age <60, lower limb insertion, large catheter (18G), emergency insertion, IV drugs, transfusion	No explicit limitations mentioned
Marsh et al. (2018)	Risk factors for PIVC failure	Australia	Prospect ive cohort study	1,000 patients, 1,578 PIVCs	Larger catheter diameter, female sex, younger, antibiotics	Single center; missing data on dressing, flushing, meds; no BMI, mobility, cognition data
Mestre Roca et al. (2012)	Risk factors for PVP developmen t	Spain	Observa tional cohort	1201PI VCs	Emergency unit, forearm insertion, aminoglycosid es, amoxicillin clavulanate	Single center; post-intervention period; limited generalizability

Palese et al. (2016)	Phlebitis in ED-inserted PVCs and associated factors	Italy	Prospective explanatory	1,262 patients	PVC dwell time, Missed nursing care	No predefined sample size; missing variables; clinical diagnosis only; possible assessment inaccuracies
Agustiani E.V., Santosa A et.al 2020.	To predict the prevalence of phlebitis in patients based on causal factors.	Indonesia	Analytic survey with cohort approach	218 patients	Malnutrition, comorbidities, catheter size < 20G, distal insertion site, fluid type, injection therapy type	Limited predictive studies on phlebitis based on known risk factors.

3.6 Data synthesis: In this scoping review, the identified risk factors associated with peripheral intravenous catheters were narratively synthesized and categorized into four overarching domains: patient-related factors, catheter-related factors, infusion-related factors, and healthcare-related factors.

4. Result

A total of **1,408 studies** were initially identified through the database search. After the removal of duplicates and the application of inclusion and exclusion criteria, **24 studies** were included in the final synthesis.
Most of the included studies were **prospective observational studies**, followed by **prospective cohort studies**, **cross-sectional studies**, **secondary analyses** (including post hoc and secondary data analysis from randomized controlled trials), as well as other observational and exploratory designs. The methodological diversity reflects a predominance of quantitative and cohort-based approaches, with a strong focus on real-time data collection in clinical settings.

4.1 Patient-Related Factors: Patient characteristics have been identified as important determinants of phlebitis risk in peripheral intravenous catheter (PIVC) use. In some studies, age was assessed as a risk factor for the occurrence of phlebitis as >40 years (Daud et al., 2019), patients over 45 years (Salma et al., 2019, Chen et al., 2021), while in the study by Lulie et al., 2021 a higher incidence was seen in patients over 60 years. But in other studies a higher risk was assessed in patients younger than 45 years (Larsen et al., 2020, Mandal & Raghu, 2019).
Some studies show that women had a higher probability of developing phlebitis (Nassaji-Zavareh & Ghorbani et al.,2007, Mestre Roca et al., 2012, Mandal & Raghu et al.2019, Lulie et al., 2021,Cicolini et al. 2009). In contrast to these findings, other studies found that men had a higher probability of developing phlebitis in Daud & Mohamad, 2021, Salma et al., 2019; Singh et al., 2009). Personal factors, including vein quality, were identified by Lee et al., 2019, who established a significant relationship between vein quality and the occurrence of phlebitis. A family history of deep vein thrombosis, as studied by Simões et al., 2022, showed significant relationship with the occurrence of phlebitis.
Chronic pathologies such as diabetes mellitus or the presence of infections and other comorbidities, including immunosuppression and malnutrition, increased the risk of phlebitis

(Daud et al., 2019; Nassaji-Zavareh & Ghorbani, 2007; Enes et al., 2016; Simões et al., 2022; Agustiani & Santosa, 2020).
In the study conducted by Furtado et al.,2011, it was evidenced that smoking patients had a higher incidence of phlebitis.

4.2 Catheter-Related Factors: The catheter insertion area has been widely considered by various researchers to be a major risk factor for the occurrence of phlebitis. Nassaji-Zavareh & Ghorbani (2007) reported that patients receiving venous treatment through the lower extremities had a higher probability of developing phlebitis.
Bruised insertion sites were identified as a probability for the development of phlebitis (Marsh et al. 2018). Catheter insertion in the antecubital fossa increased the risk of phlebitis (Uslusoy & Mete et al 2008, Furtado et al.,2011), but in other studies an increased rate of phlebitis was seen in the dorsal area (Cicolini et al. 2009, Simões et al. 2022).
The size of the cannula is another important factor, larger caliber catheters such as 18 G have a higher probability of causing phlebitis (Mandal & Raghu et al., 2019, Simin et al., 2019, Arias-Fernández et al.,2017). The presence of an extension tube in the PVC was identified by Arias-Fernández et al. (2017) as a factor that increases the risk of phlebitis.
A significant relationship was found between catheter retention time >72 hours and the occurrence of phlebitis (Atay et al. 2018, Urbanetto et al. 2017) and >96 hours as a risk factor with higher probability (Lulie et al 2021). Also, poor peripheral venous catheter security was seen as a contributing factor to phlebitis (Lulie et al., 2021).

4.3 Infusion-Related Factors: Risk factors for the development of phlebitis were also identified by the characteristics of the infusions given through them. Medications with high osmolarity (Lee et al., 2019), hypertonic solutions (Uslusoy & Mete et al., 2008), antibiotic therapy (Salma et al 2019, **Atay et al., 2018; Uslusoy & Mete, 2008**). Infusions with irritating or hypertonic properties (Salgueiro-Oliveira et al., 2012; Furtado, 2011; Atay et al., 2018; Uslusoy & Mete, 2008; Lee et al., 2019; Chen et al., 2021) and specific drugs such as nicardipine, noradrenaline, amiodarone and levetiracetam are also implicated (Yasuda et al., 2022) or blood product (Atay et al.,2018,Singh et al., 2008). Such as the use of infusion pumps, multi-drug therapy, frequency of catheter use, and large infusion volumes were identified as factors (Uslusoy & Mete, 2008; Simin et al., 2019; Chen et al., 2021).

4.4. Healthcare-Related Factors Factors related to healthcare also contribute to the risk of phlebitis, a significant association was seen between the period of clinical nursing experience and the incidence of phlebitis (Lee et al., 2019). It was also evidenced that spending 10-20 or 20-30 seconds in hand hygiene solutions was associated with a significant reduction in the risk of phlebitis associated with PIVC (Lee et.al 2019). It was estimated that missed nursing care increased the incidence of phlebitis associated with PVC (Palese et al., 2016). This underscores the importance of nursing practices, such as hand hygiene and overall care, in influencing the occurrence of phlebitis associated with peripheral intravenous catheters.

5. Discussion

This scoping review found that the occurrence of peripheral venous catheter-related phlebitis results from the interaction of a number of factors, including patient, catheter-related, infusion therapy, and healthcare-related factors.
Age was found to be a complex risk factor for the occurrence of phlebitis. Some studies reported that younger patients were more predisposed, and this may be due to a higher sensitivity of the tunica intima of the vein and a greater inflammatory response to mechanical or chemical

phlebitis (Mandal & Raghu, 2019; Larsen et al., 2020). Other studies identified that older people had a higher risk of phlebitis because their veins were more fragile or due to the presence of chronic comorbidities such as diabetes or cardiovascular pathologies that affect perfusion and inflammation (Cicolini et al., 2009; Simões et al., 2022).

Gender was another risk factor for the development of phlebitis. Many studies reported that women were more predisposed, which could be explained by the fact that the diameter of the peripheral veins of women is smaller and increases the contact between the venous wall and the catheter, leading to endothelial damage. endothelial (Marsh et al., 2018; Cicolini et al., 2009). Hormonal changes, such as estrogen levels, may contribute to a higher degree of venous inflammation (Nassaji-Zavareh & Ghorbani, 2007; Mandal & Raghu, 2019). However, other studies assessed a higher risk for phlebitis in men, which could be due to the fact that their veins are deeper, increasing the difficulty in catheter insertion and the probability of trauma (Daud & Mohamad, 2021; Singh et al., 2009).

In many studies, it was assessed that the presence of concomitant pathologies was a risk factor for the occurrence of phlebitis in patients. Diabetes mellitus and hypertension favor microvascular damage and the patient's immunity, making the veins more susceptible to inflammation or infection (Cicolini et al., 2009; Singh et al., 2008). Diabetes causes microangiopathy, increasing the risk of phlebitis, while cardiovascular pathologies are often associated with decreased circulation and venous stasis (Mandal & Raghu, 2019). Immunosuppression has been identified as a factor that increases the risk of phlebitis, which results from decreased immunity, predisposing the patient to inflammation. Another influencing factor was found to be malnutrition, since in these patients the veins lack elasticity and have damage to the integrity of the blood vessels (Agustiani & Santosa et al., 2020).

Factors related to catheters: Cannula diameters ≤20G were found to increase the risk of phlebitis because they cause trauma to the internal area of the vein (Lulie et al.2021). Catheter insertion in the antecubital fossa (an area of high mobility) increased the risk of phlebitis or insertion on the dorsal side because the vein are smaller in diameter (Ciccolini et al 2009). Also, prolonged catheter retention time was noted as a risk factor and this may result from continuous mechanical damage to the vein, but today some authors suggest replacing it every 72 hours (Rickard et al., 2010), while INS 2021 suggest removing the catheter only when clinically indicated.

Infusion characteristics such as irritating or hypertonic solutions, antibiotic therapy, and other medications that can cause chemical irritation of the endothelium have been evaluated as a role for the occurrence of phlebitis. In cases of their infusion, central venous access can also be considered (Lee et al., 2019; Yasuda et al., 2022).

Healthcare factors have been shown to increase the risk of phlebitis, including poor hygiene, poor hand washing technique, and missed nursing care. Therefore, education and training may be a factor in reducing the incidence of phlebitis (Braga et al., 2018; Lee et al., 2019).

These findings highlight the importance of training, education and information of nursing staff to reduce the incidence of phlebitis. Knowledge of risk factors, selection of appropriate catheter and rigorous implementation of the peripheral venous catheter insertion and management protocol is essential in nursing practice. These measures will help prevent the development of phlebitis and will increase the well-being of patients with peripheral venous catheters.

6. **Conclusions**

This scoping review focused on identifying factors for the development of phlebitis related to the patient, peripheral venous catheter, infusions, and healthcare.

The literature overwhelmingly substantiates that vascular fragility modulated by age and comorbid conditions mechanical stressors such as catheter gauge, insertion site and indwelling

duration, chemical irritants inherent to hypertonic or high-osmolarity solutions, and healthcare system variables including aseptic technique and staffing adequacy each contribute materially to phlebitis risk.

From an educational standpoint, it is imperative to enhance nursing competencies in the systematic identification and appraisal of these risk dimensions. Incorporating structured training on comprehensive patient assessment, judicious catheter selection (favouring smaller-gauge cannulas and proximal insertion sites), optimal infusion protocols (including dilution strategies and consideration of central access for high-risk agents), and rigorous securement practices will enable nurses to preempt the emergence of phlebitis. Moreover, implementation of standardized phlebitis grading scales and vigilant site surveillance facilitates the early detection of incipient inflammation, thereby permitting timely intervention, such as catheter rotation, adjustment of infusion parameters, or escalation to alternative vascular access modalities.

Ultimately, the prevention of phlebitis necessitates an integrated "bundle" approach that synergizes evidence-based catheter management, infusion safeguards, and institutional support mechanisms, notably adequate nurse-to-patient ratios and ongoing competency evaluation. Future investigations should endeavour to harmonize phlebitis definitions, rigorously evaluate multifactorial intervention bundles in prospective trials, and adapt such strategies to heterogeneous clinical environments. Through these concerted efforts, the incidence and sequelae of phlebitis can be substantially attenuated, leading to improved patient safety, enhanced comfort, and overall optimisation of intravenous therapy outcomes.

Limitations of the study

This scoping review has several limitations. First, this review excluded randomized trials because of its focus on identifying the broad range of risk factors for the occurrence of phlebitis in clinical practice. Also, the exclusion of studies in non-English languages excluded some data from other countries.

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