

BMJ Open Quality appraisal of clinical guidelines for peripherally inserted central catheter-related thrombosis prophylaxis in patients: a systematic review

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ABSTRACT

Objectives To evaluate and analyse the quality of clinical practice guidelines for Peripherally Inserted Central Catheter-related thrombosis (PICC-related thrombosis) to identify the most current and effective prophylactic measures recommended in the guidelines.

Design Scoring and analysis of the guidelines using the Appraisal of Guidelines for Research and Evaluation II (AGREE II).

Data sources Cochrane Library, PubMed, EMBASE, Cumulative Index of Nursing and Allied Health Literature (CINAHL), Chinese databases (China National Knowledge Infrastructure and Wan Fang) and the relevant websites of the guideline were searched through 8 August 2024.

Eligibility criteria for selecting studies Studies that primarily clinical practice guidelines on the prevention of PICC-related thrombosis were included.

Data extraction and synthesis Two reviewers independently screened the searched items and extracted data and scored documents using AGREE II. Findings were summarised in Grading of Recommendation, Assessment, Development and Evaluation (GRADE) evidence profiles and synthesised qualitatively.

Results The analysis incorporated a total of nine guidelines, all rated as 'recommended' or 'recommended with modifications'. Standardised scores revealed elevated performance in the domains of Scope and Purpose, Clarity of Presentation and Editorial Independence. Conversely, the Stakeholder Involvement and Applicability domains yielded the lowest average standardised scores. Disparities in standardised scores across guidelines were particularly evident in the domains of Rigour of Development, Stakeholder Involvement and Applicability. The agreement between the two appraisers was almost perfect (intraclass correlation coefficients higher than 0.80). A considerable proportion of recommendations relied on evidence of low-quality, in certain instances, were derived from expert opinions within working groups.

Conclusions The review reveals that a significant portion of recommendations relies on low-quality evidence. Guideline developers are urged to prioritise methodological quality, with a specific focus on refining Stakeholder Involvement and Applicability domains. Addressing these aspects will enhance the overall quality and reliability of PICC-related thrombosis prevention guidelines. One potential way to mitigate these challenges is to endorse

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This systematic review used a comprehensive search for Clinical Practice Guidelines on the prevention of Peripherally Inserted Central Catheter-related thrombosis.
- ⇒ Two appraisers used Appraisal of Guidelines for Research and Evaluation II (AGREE II), an assessment with methodological rigour and reliability, to appraise the quality of included guidelines and resolved any discrepancies by discussion.
- ⇒ Caution is warranted in interpreting the AGREE II results, as the AGREE framework assigns equal weighting to all six domains, irrespective of their individual significance.
- ⇒ We used the Grading of Recommendation, Assessment, Development and Evaluation approach to evaluate and summarise the strength and quality of the evidence.

a standardised approach to guideline development and to synthesise reliable clinical evidence to reduce variation in recommendations.

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INTRODUCTION

Peripherally Inserted Central Catheter (PICC) has obtained widespread use in clinical practice owing to the manoeuvrability, minimal trauma and heightened safety attributes.^{1–3} However, PICC-related thrombosis is prone to occur, stemming from factors such as unavoidable puncture injuries, toxic medication effects and patient-specific conditions, underscores its incidence. The incidence of PICC-related thrombosis varied between 2.3% and 71.9% due to differences in study population, testing modality and threshold for diagnosis, of which 94.5% were asymptomatic.^{4,5} In recent years, a steady rise in the incidence rate of PICC-related thrombosis has been attributed to the escalating utilisation of PICC lines, augmented awareness among medical

professionals regarding PICC-related complications and an elevated detection rate of asymptomatic thrombosis.⁶ This not only jeopardises patient safety but also begets prolonged or interrupted treatment, unplanned extubation of the PICC, extended hospital stays and increased burden on society.^{7–9}

It is important to emphasise that some interventions can reduce the occurrence of PICC-related thrombosis.¹⁰ One study effectively forestalled the occurrence of PICC-related thrombosis by implementing a graded nursing intervention based on risk assessment for 560 patients.¹¹ Similarly, Liu *et al* executed ball-holding exercise training for PICC-catheterised patients, significantly reducing the incidence of PICC-related thrombosis.¹⁰ However, the current landscape lacks clarity on the latest and most efficacious preventive measures recommended in guidelines.

Using evidence-based programmes for PICC-related thrombosis can improve practice outcomes while reducing the physical, psychological, social and economic burden on individuals, families and societies. Clinical Practice Guidelines (CPGs) facilitate optimal decision-making by healthcare professionals and patients, minimising wastage. Nonetheless, the efficacy of a CPG is contingent on the robustness of its evidence base.¹² Therefore, an imperative exists to systematically evaluate CPGs to gauge their quality. This systematic review aims to critically appraise the quality of PICC-related thrombosis prevention guidelines and assess the strength of their recommendations.

METHODS

Registry

The review followed Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines¹³ and used the recommended Grading of Recommendation, Assessment, Development and Evaluation (GRADE) process¹⁴ to summarise findings.

Objectives

The purpose of this systematic review is to critically appraise the quality of PICC-related thrombosis prevention guidelines specific to patients. The Appraisal of Guidelines for Research and Evaluation II (AGREE II) tool was used.

Data sources and search strategy

Academic databases, encompassing Cochrane Library, PubMed, EMBASE, Cumulative Index of Nursing and Allied Health Literature (CINAHL), and Chinese databases (China National Knowledge Infrastructure and Wan Fang) were systematically searched from inception until 8 August 2024. The search strategy was tailored to the requirements of each database. Searching of reference lists from identified papers were scrutinised, and forward citation searches were performed using Google Scholar. All searches were saved in each database and imported into EndNote (V.20; Clarivate Analytics),

Table 1 Inclusion and exclusion criteria

No.	Items
Inclusion criteria	
1	Published international and national guidelines on the management and/or prevention of PICC-related thrombosis
2	Most recent complete guideline (from a single working group, ie, ACCP) and any partial revisions for the guideline published thereafter
3	Include an explicit statement identifying the document as a 'guideline'
Exclusion criteria	
1	Guidelines under development
2	Guidelines were specific to one institution
3	Complete guidelines with publication dates that have been superseded by more recent complete guidelines
4	Clinical practice standards, defined as a statement reached through consensus, which identifies the desired outcome. Usually used in audit as a measure of success
5	Guidelines inclusive of only one phase of care, for example, Ginzburg <i>et al</i> ⁴² (ie, during rehabilitative therapy)
ACCP, American College of Chest Physicians; PICC-related thrombosis, Peripherally Inserted Central Catheter-related thrombosis.	

where duplicates were removed. To supplement our database searches, we also searched guidelines repositories, including CPG Infobase: CPGs (Canadian Medical Association), the Guidelines International Network (GIN), the National Health and Medical Research Council—Australian CPGs, the National Institute for Health and Care Excellence (NICE), the National Guideline Clearinghouse (NGC), Scottish Intercollegiate Guideline Network (SIGN), New Zealand Guidelines Group (NZGG) and BMJ Best Practice and Chinese guidelines repository (Yi Mai Tong). Search details are available in online supplemental appendix 1.

Eligibility criteria

A complete list of inclusion and exclusion criteria is detailed in [table 1](#).

Data screening and extraction

Two reviewers screened titles and abstracts based on predetermined eligibility criteria. Articles that met the above inclusion and exclusion criteria were included for a second full-text screen. Conflicts were resolved through discussion or the involvement of a third reviewer. Reasons for exclusion were documented in a tabular format (online supplemental appendix 2). Data extraction was independently performed using a standardised data extraction form developed based on AGREE II.¹⁵

Quality assessment of CPGs

To evaluate the quality of pre-existing guidelines selected for guideline adaptation, two reviewers graded each guideline according to AGREE II. This instrument consists of 23 items organised into six domains. AGREE II also includes two overall assessment items for overall judgements of the practice guideline. Online supplemental appendix 3 provides a brief description of each domain.¹⁶

The 23-item AGREE II tool uses a seven-point agreement scale from 1 (strongly disagree) to 7 (strongly agree).¹⁵ Standardised scores for each domain were computed as $(X/Y) \times 100\%$, where X=obtained score–minimum possible score and Y=maximum possible score–minimum possible score.¹⁵ As defined by AGREE II, we considered a CPG as ‘recommended’ if most items score 6 or 7 points and multidimensional evaluation is >60%, as ‘recommended with modifications’ if the items scoring 6 or 7 points are similar to the items scoring 1 or 2 points, and the multidimensional evaluation is 30%–60% and as ‘not recommended’ if most items score 1 or 2 points and the multidimensional evaluation is <30%.

Before the quality appraisal using AGREE II, two reviewers completed an Online Training Tool¹⁷ and performed calibration exercises to clarify the eligibility criteria. Following training, the two reviewers independently applied AGREE II criteria to eligible CPGs using the My AGREE PLUS online platform.¹⁸ Our team met regularly to resolve any discrepancies in the quality appraisal. We used intraclass correlation coefficients (ICCs) to measure the agreement between the two assessors’ assessment of quality (AGREE II) of included CPGs. The results were interpreted as follows: 0.00, poor agreement; 0.00–0.20, slight agreement; 0.21–0.40, fair agreement; 0.41–0.60, moderate agreement; 0.61–0.80, substantial agreement and 0.81–1.00, almost perfect agreement.¹⁹

Patient and public involvement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

RESULTS

After removal of duplicates, 272 citations were screened for the electronic database, with 13 full-text reports assessed and five included (figure 1). Guidelines repository searches retrieved 151 citations, with 16 evaluated and four included (figure 2). Ultimately, nine guidelines were included in the final analysis, and the detailed characteristics are shown in table 2. These CPGs were published between 2013 and 2024. Most of the CPGs were developed in the USA (n=3),^{20–22} with the remaining coming from China (n=3),^{23–25} France (n=1),²⁶ Europe (n=1)²⁷ or India (n=1).²⁸ Information sources regarding where CPGs were obtained are shown in online supplemental appendix 4.

Two assessors appraised each CPG. The AGREE II domain scores of each guideline are presented in table 3. Detailed scoring of each AGREE II item under each domain is presented in online supplemental appendix 5. Online supplemental figure 1 shows a radar chart of the results of the guideline appraisal. The quality of the evaluated guidelines showed significant variability. The standardised scores ranged from 86% to 100% in the Scope and Purpose domain, and all CPGs scored above 80%. The standardised scores in the Stakeholder Involvement domain ranged from 58% to 92%, with all CPGs scoring above 50%. The standardised scores in the Rigour of Development domain ranged from 49% to 94%, with only one CPG scoring below 50%. The standardised scores in the Clarity of Presentation domain ranged from 89% to 97%. The standardised scores in the Applicability domain ranged from 42% to 94%, with only one CPGs scoring below 50%. The standardised scores in the Editorial Independence domain ranged from 88% to 100%. As per the quality assessment tool used in this review, six of the nine included CPGs were judged to be ‘recommended’. There is an almost perfect agreement between two appraisers, with the ICC ranging from 0.876 to 0.968 ($p < 0.001$).

Table 4 shows the levels of evidence for recommendations of PICC-related thrombosis prevention in patients, as reported in the included CPGs. The Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach²⁹ was used to rank recommendations. Despite unanimous agreement in the recommendations for identifying and assessing risk factors, monitoring for signs and symptoms, providing non-pharmacological preventative measures, diagnose, remove the PICC against, treatment after diagnosis and medical personnel training, details disagree on the risk assessment tools and pharmacological choice. The Infusion Nursing Society (INS) 2024 guidelines²² recommended the Caprini Risk Assessment Model and the Michigan risk score for patients with PICC, but the China Medical Association (CMA) 2018 guidelines²⁴ recommended the Khorana score model for outpatient patients with malignancies receiving chemotherapy. The American Society of Clinical Oncology (ASCO) 2013 guidelines,²⁰ American Society of Haematology (ASH) 2021 guidelines²¹ and International Initiative on Thrombosis and Cancer (ITAC-CME) 2022 guidelines²⁶ did not recommend pharmacologic prophylaxis and the INS 2024 guidelines²² notes that recommendations for pharmacologic prophylaxis have not been established for all patient populations but should be guided by individual patient risk. However, the CMA 2018 guidelines²⁴ recommended using low molecular weight heparin (LMWH) or Low-Dose Unfractionated Heparin (LDUH) for medium and high-risk patients. In terms of risk assessment, pharmacologic preventative measures, diagnose and confirm PICC-related thrombosis, remove the PICC against and medical personnel training, we observed little recommendations with relatively low quality. The recommendations from each CPG that are informed in table 4 are detailed in online supplemental

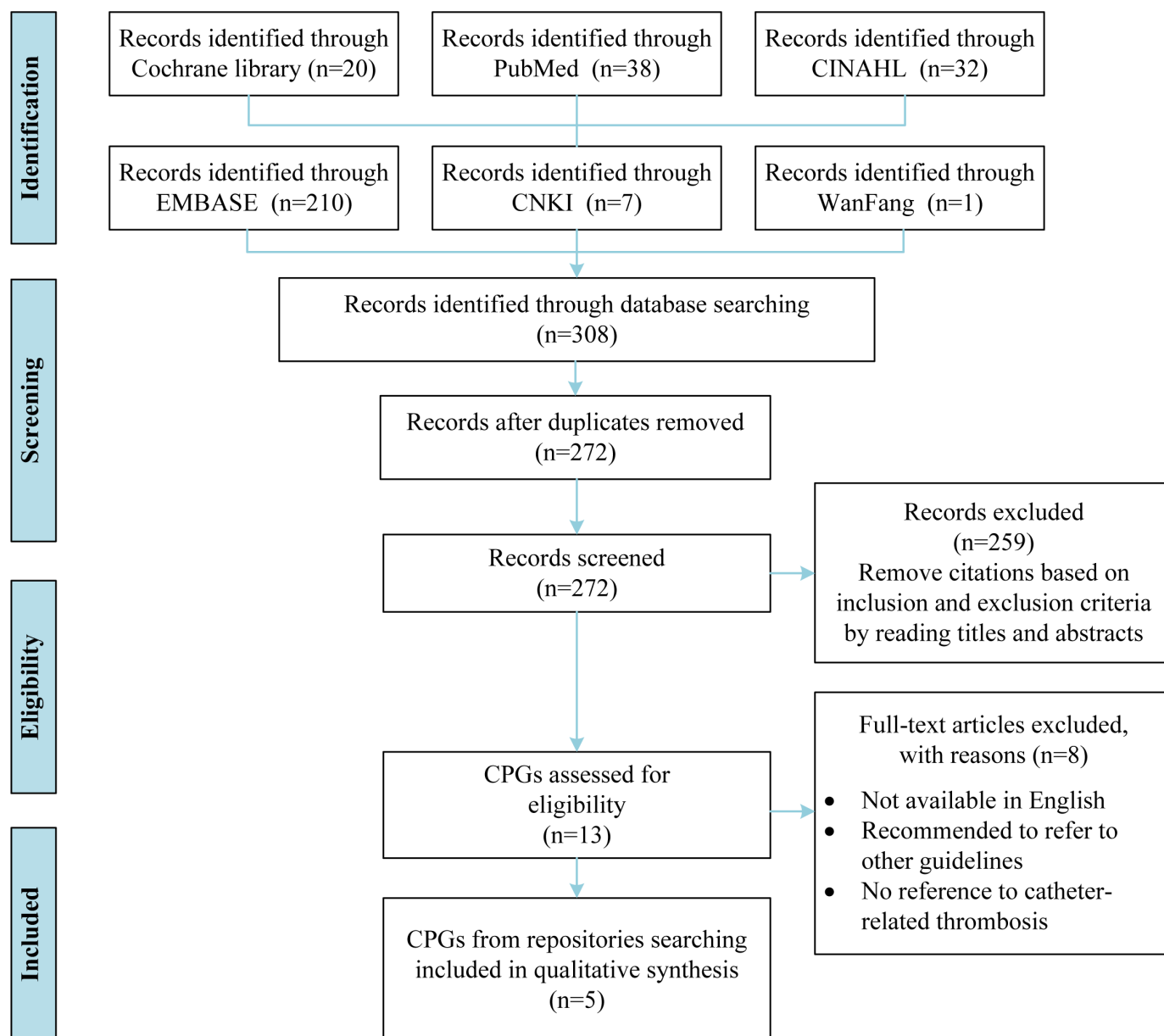


Figure 1 Search strategy for library databases (final search undertaken on 8 August 2024). CPGs, clinical practice guidelines; CINAHL, Cumulative Index of Nursing and Allied Health Literature; CNKI, China National Knowledge Infrastructure.

appendix 6. Online supplemental appendix 7 shows an explanation of the different evidence levels used across included CPGs.

DISCUSSION

To the best of our knowledge, this is the first systematic quality appraisal of CPGs for PICC-related thrombosis prevention in patients, with recognition of nine guidelines. Overall, the quality of all incorporated guidelines was deemed acceptable, evaluated as either 'recommended' or 'recommended with modifications'. We summarised all key recommendations about PICC-related thrombosis prophylaxis, and compared and visualised the difference among them, providing a concise but informative overview for clinicians and researchers.

Most of the guidelines included in the study tend not to recommend the routine use of pharmacological prophylaxis of PICC-related thrombosis. Despite consistency in recommendations across the included CPGs, they employed diverse classification systems to indicate levels of evidence. Discrepancies in preferred pharmacological prophylaxis (such as LMWH, direct oral anticoagulants or no drug prophylaxis) could be attributed to variations in data availability from trials and the timing of approval by regulatory agencies. The latest guidelines state that prophylactic anticoagulation for catheter-related thrombosis prevention have not been established for all patient populations but should be guided by individual patient risk.²² This may indicate that the choice of whether or not to use pharmacological prophylaxis for PICC-related

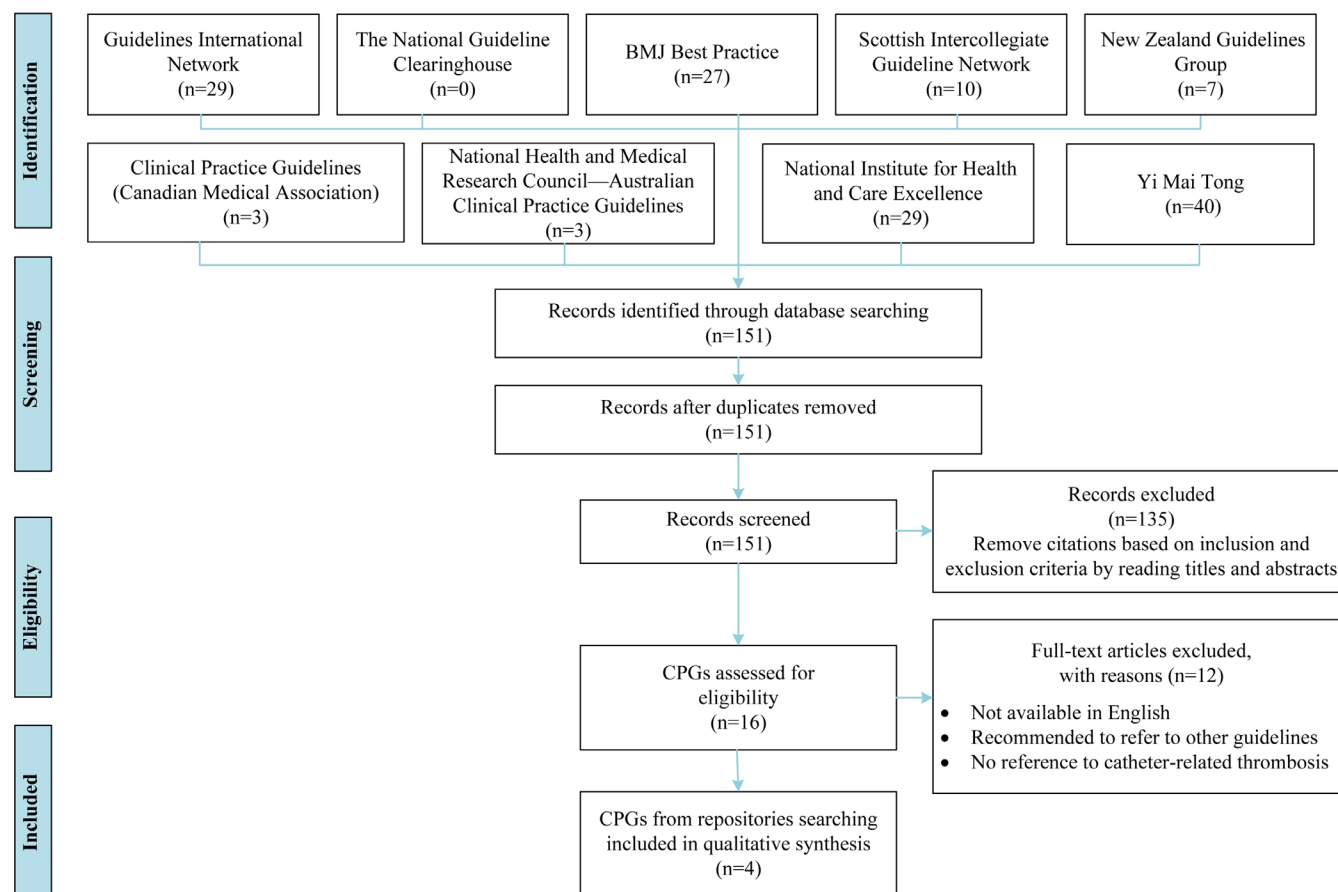


Figure 2 Search strategy for guideline repositories (final search undertaken on 8 August 2024). CPGs, clinical practice guidelines.

thrombosis based on risk assessment in the future.³⁰ It may be a trend for future research. It is noteworthy that a substantial proportion of recommendations relied on low-quality or very-low-quality evidence, or even on expert opinions from working groups, suggesting uncertain clinical significance. Therefore, advocating for high-quality randomised controlled trials is imperative to reinforce the evidence base and potentially enhance the cost-effectiveness of treatment.³¹

Additionally, regarding non-pharmacological prevention, only a very limited number of strong recommendations could be found, which implies the absence of solid evidence. It was worth noting that current updated guidelines were more inclined to recommend non-pharmacological prophylaxis, such as INS 2024, which specifies the frequency and duration of handgrip exercises (three or six times per day for 3 weeks).^{22 23 25} These findings would account for the fact that prophylaxis for PICC-related thrombosis is still not routinely implemented as per guideline recommendations in most hospitals.^{32 33} However, there were no clear criteria for the number and the duration of each set of handgrip exercises. Therefore, a large randomised controlled trial could be conducted in the future to develop a standardised content of handgrip

exercises. It was also worth noting that as the first line of defence in the prevention of PICC-related thrombosis, dynamic and accurate risk assessment is crucial. However, current guidelines did not provide detailed descriptions of the timing of risk assessment and specialised assessment tools for PICC-related thrombosis prevention.^{22–24} Therefore, future research should delve into these aspects to refine risk assessment specificity, facilitating clinical prevention and enhancing assessment accuracy.

We found that standardised scores for different domains varied across the nine guidelines included. The Scope and Purpose, Clarity of Presentation and Editorial Independence domains exhibited relatively high standardised scores. In contrast, the Stakeholder Involvement, Rigour of Development, and Applicability domains demonstrated considerable variations among the CPGs. Our results are consistent with the results of CPG quality evaluations for other clinical topics.^{34 35} This suggests that improvements in these areas may improve the consistency of the guidance provided. With significant improvements in CPG development methods over the past decade, differences between existing CPGs can be explained in part by guideline development methodology. Therefore, guideline development should be based on developed standards

Table 2 Characteristics of CPGs regarding PICC-related thrombosis prevention in patients

	ASCO 2013	ASH 2021	INS 2024
Original CPG title	Central Venous Catheter Care for the Patient With Cancer: American Society of Clinical Oncology Clinical Practice Guideline	American Society of Hematology 2021 guidelines for management of venous thromboembolism: prevention and treatment in patients with cancer	Infusion Therapy Standards of Practice, ninth Edition
Date published	2013	2021	2024
Country of origin	USA	USA	USA
Objective of CPG	Guide prophylaxis and management of central venous catheter (CVC) care for patients with cancer	Guide prevention and treatment of VTE in patients with cancer	Guide patient-centred infusion care
Methods used to collect/select the evidence	A targeted systematic using two databases	Systematic evidence reviews of topic areas	A targeted systematic using more than nine databases
Methods used to analyse the evidence	Not stated	The hierarchical system used to strong and conditional recommendations	The hierarchical system used to grade levels of evidence
Ranking scheme to determine the strength of the evidence and recommendation	Not stated	Strong, conditional	I, II, III, IV, V, A/P, Committee Consensus
Methods used to formulate the recommendations	Expert consensus	Expert consensus	Expert consensus
Number of recommendations	12	34	46 recommendations in catheter-associated thrombosis
Method of CPG validation	External and internal peer review	External and internal peer review	External and internal peer review
Intended users	Medical oncologists haematologist, nurses, interventional radiologists, surgeons, infectious disease specialists and specialised CVC care teams	Patients, clinicians and other healthcare professionals	All healthcare settings and all populations
Composition of CPG working group	Two groups: 1. 15-panel members from ASCO CVC care expert 2. The external peer-review group	Three groups: 1. 16-panel members from ASH 2. McMaster GRADE centre 3. The external peer review group	Two groups: 1. Healthcare specialties from 12 countries around the globe 2. 144 international reviewers
Number of documents included in the appraisal	2 CPG (1360 pages); online data supplement (1359 pages)	2 CPG (928 pages); online data supplement (933 pages)	1 CPG (180 pages)
	CCC-IUA 2020	CMA 2018	IITC-CNA 2022
Original CPG title	Infusion catheter-related venous thrombosis prevention and control China expert consensus (2020 edition)	Chinese guidelines for the prevention and treatment of thrombotic diseases	Clinical Nursing Practice Guidelines for Common Complications of Intravenous Catheters
Date published	2020	2018	2022
Country of origin	China	China	China
Objective of CPG	Guide the clinical work of preventing catheter-related thrombosis	Guide the diagnosis, treatment, and nursing of venous thrombosis	Guide patient-centred infusion care

Continued

Table 2 Continued

	CCC-IUA 2020	CMA 2018	IITC-CNA 2022
Methods used to collect/select the evidence	Not stated	A targeted systematic using 10 databases	A targeted systematic using 14 databases
Methods used to analyse the evidence	Not stated	The hierarchical system used to grade levels of evidence	The hierarchical system used to grade levels of evidence
Ranking scheme to determine the strength of the evidence and recommendation	Not stated	Grades A, B, C, D; 1, 2	I, II, III, IV, V; grades A, B, C, D
Methods used to formulate the recommendations	Expert consensus	Expert consensus	Expert consensus
Number of recommendations	37	19 recommendations in prevention	57
Method of CPG validation	External and internal peer review	External and internal peer review	External and internal peer review
Intended users	Clinicians and nurses	Clinicians	Clinicians and nurses
Composition of CPG working group	Two groups: 1. 47-panel members from CCC-IUA 2. The external peer-review group	Three groups: 1. Guideline development group 2. Review committee 3. External reviewer group	Two groups: 1. 23-panel members from IITC-CAN 2. External reviewer group
Number of documents included in the appraisal	1 CPG (337 pages)	1 CPG (2861 pages)	1 CPG (2381 pages)
	ITAC-CME 2022	ESMO 2015	ISCCM 2020
Original CPG title	2022 international clinical practice guidelines for the treatment and prophylaxis of venous thromboembolism in patients with cancer, including patients with COVID-19	Central venous access in oncology: ESMO Clinical Practice Guidelines	Indian Society of Critical Care Medicine Position Statement for Central Venous Catheterisation and Management 2020
Date published	2022	2015	2020
Country of origin	France	Europe	India
Objective of CPG	Guide management of catheter-related thrombosis (CRT) in cancer patients	Guide management of central venous access in adult cancer patients	Guide critical care physicians and allied professionals
Methods used to collect/select the evidence	A targeted systematic using more than three databases	Not stated	A targeted systematic using three databases
Methods used to analyse the evidence	The hierarchical system used to grade levels of evidence	The hierarchical system used to grade levels of evidence	The hierarchical system used to grade levels of evidence
Ranking scheme to determine the strength of the evidence and recommendation	Grades A, B, C, D; strong, weak, best clinical practice (guidance)	I, II, III, IV, V; A, B, C, D, E	1, 2, 3; Useful Practice Point (UPP), grade A, grade B
Methods used to formulate the recommendations	Expert consensus	Expert consensus	Expert consensus
Number of recommendations	41	67	54
Method of CPG validation	External and internal peer review	External and internal peer review	External and internal peer review

Continued

Table 2 Continued

	ITAC-CME 2022	ESMO 2015	ISCCM 2020
Clinicians and nurses	Clinicians	Clinicians	Critical care physicians and allied professionals
Composition of CPG working group	Two groups: 1. 19 experts from various specialties 2. 87 international reviewers	Two groups: 1. ESMO Guidelines Committee The external peer review group	Two groups: 1. 19-panel members from ISCCM 2. The external peer-review group
Number of documents included in the appraisal	2 CPG (334 pages); online data supplement (123 pages)	1 CPG (152 pages)	4 CPG (8 pages); 3 appendices (22 pages)

ASCO, American Society of Clinical Oncology; ASH, American Society of Haematology; CCC-IUA, Chinese Chapter Congress of the International Union of Angiology; CMA, China Medical Association; CPGs, clinical practice guidelines; CRT, catheter-related thrombosis; CVC, central venous catheter; ESMO, European Society for Medical Oncology; GRADE, Grading of Recommendations Assessment, Development and Evaluation; IITC-CNA, Intravenous Infusion Therapy Committee of Chinese Nursing Association; INS, Infusion Nursing Society; ISCCM, Indian Society of Critical Care Medicine; ITAC-CME, International Initiative on Thrombosis and Cancer; VTE, venous thromboembolism.

(eg, the WHO Manual for Guideline Development)³⁶ in conjunction with the methodological details of the AGREE II Reporting Clinical Guideline Development.¹⁶

We discovered that the Stakeholder Involvement and Applicability domains had the lowest standardised scores, which might be factors affecting implementation. This is in consistent with the findings of Wang *et al.*³⁷ Stakeholder involvement centres on obtaining support from a robust collaborative multidisciplinary network and getting the requirements of all potential users.³⁸ Truly, a multidisciplinary approach to preventing PICC-related thrombosis, which involves key stakeholders, is crucial for implementing recommendations. However, only two CPGs incorporated patients and their representatives in guideline development, and relevant suggestions were not clearly presented.^{20 21} In addition, the content of patient/

family education was also neglected in existing guidelines. Evidence-based medicine emphasises the significance of patient-centred communication.³⁹ Patient with PICC-line may have some concerns about non-pharmacological prophylaxis for thromboprophylaxis, such as the fear of catheter dislodgement and displacement due to activity, which may affect quality of life. Consequently, patients' values and preferences should be considered, and the advantages and disadvantages of these choices should be discussed with patients.⁴⁰

The low score for Guideline applicability mainly reflects the lack of description of the barriers to implementation. However, there is little consensus on how to carry out CPG in practice. Only three CPGs assess the barriers and facilitators to guideline implementation and offer strategies to enhance guideline uptake.^{20–22} While

Table 3 AGREE II-scaled domain scores of CPGs for PICC-related thrombosis prevention in patients

	ASCO 2013	ASH 2021	INS 2024	CCC-IUA 2020	CMA 2018	IITC-CNA 2022	ITAC-CME 2022	ESMO 2015	ISCCM 2020
(1) Scope and purpose (%)	100	100	100	89	97	89	97	86	92
(2) Stakeholder involvement (%)	81	92	69	67	69	58	89	58	72
(3) Rigour of development (%)	77	80	85	49	92	74	85	66	72
(4) Clarity of presentation (%)	89	97	97	97	92	89	100	97	97
(5) Applicability (%)	65	94	83	44	63	48	63	42	79
(6) Editorial independence (%)	100	96	92	88	88	92	92	100	100
Recommended use of this CPG	Yes	Yes	Yes	Yes*	Yes	Yes*	Yes	Yes*	Yes
ICC (including overall CPG score)	0.913	0.876	0.942	0.919	0.887	0.968	0.923	0.957	0.958

*Recommended with modifications.

AGREE II, Appraisal of Guidelines for Research and Evaluation II ; ASCO, American Society of Clinical Oncology; ASH, American Society of Haematology; CCC-IUA, Chinese Chapter Congress of the International Union of Angiology; CMA, China Medical Association; CPG, clinical practice guidelines; ESMO, European Society for Medical Oncology; IATC-CME, International Initiative on Thrombosis and Cancer; ICC, intraclass correlation coefficient; IITC-CNA, Intravenous Infusion Therapy Committee of Chinese Nursing Association; INS, Infusion Nursing Society; PICC, Peripherally Inserted Central Catheter.

Table 4 Levels of evidence for recommendations of PICC-related thrombosis prevention in patients as reported in included CPGs

Recommendations*	ASCO 2013	ASH 2021	INS 2024
(1) Identify patient risk factors	–	–	► History of thrombosis (I) ► Other factors (II)
(2) Identify catheter-related risk factors	–	–	► Catheter-to-vessel ratio prior to insertion no more than 45% ratio (II) ► Place small-diameter catheters (I) ► Catheter tip location (A/P)
(3) Identify operator risk factors	–	–	► Use a bundled approach for PICC insertion (II) ► Consider tunnelling PICCs (III) ► Use ultrasound for accurate insertion (V) ► Use electrocardiography for PICC tip location (III)
(4) Risk assessment of patients with PICC	–	–	► When choosing and inserting a PICC (I)
(5) Consider the use of a risk scoring system	–	–	► The Caprini Risk Assessment Model (IV) ► The Michigan Risk Score (IV)
(6) Monitor for signs and symptoms	–	–	► Measuring arm circumference (IV)
(7) Pharmacologic preventative measures for PICC-related thrombosis	► Not to use as preference (WG)	► Not using parenteral thromboprophylaxis (low) ► Not using oral thromboprophylaxis (low)	► Guided by individual patient risk (I)
(8) Non-pharmacological preventative measures for PICC-related thrombosis	► Flush with saline as preference (WG)	–	► Handgrip exercise (III)
(9) Diagnose and confirm PICC-related thrombosis	–	–	Doppler ultrasound as preference (II)
(10) Remove the PICC against	–	–	► Do not remove when the catheter is correctly positioned, functional and necessary for infusion therapy (I)
(11) Treatment after diagnosis	–	–	► Anticoagulant medication for at least 3 months after diagnosis (IV)
(12) Medical personnel training	–	–	► Ensure that the selected Vascular access device (VAD) is inserted by staff with specific training, using vascular visualisation (II)
(11) Treatment after diagnosis	► Use LMWHs for a minimum of 3 months (guidance)	–	–
(12) Medical personnel training	–	–	► Establishing education and training systems (A, 1) ► • Establishing Credentialing process (B, 2)
	CCC-IUA 2020	CMA 2018	IITC-CNA 2022
(1) Identify patient risk factors	► Patients with catheterisation (WG) ► Malignant tumours, chemotherapy and surgery (WG)	–	–
(2) Identify catheter-related risk factors	► The smallest external diameter (WG) ► Catheter tip location (WG)	–	–

Continued

Table 4 Continued

	CCC-IUA 2020	CMA 2018	IITC-CNA 2022
(3) Identify operator risk factors	▶ Repeated puncture and withdrawal of catheter (WG) ▶ Non-standard rushed, sealing tube operation can increase the risk (WG)	–	–
(4) Risk assessment of patients with PICC	–	▶ VTE risk assessment with a central venous catheter (2B)	–
(5) Consider use of a risk scoring system	–	▶ The Khorana score model (1B)	–
(6) Monitor for signs and symptoms	–	–	–
(7) Pharmacologic preventative measures for PICC-related thrombosis	–	▶ Not use for low-risk patients (2B) ▶ Use LMWH or LDUH as preference for medium and high risk (2 B)	–
(8) Non-pharmacological preventative measures for PICC-related thrombosis	▶ Handgrip exercise (WG) ▶ Providing appropriate and adequate nursing care (WG)	–	▶ Non-pharmacological measures (V, B) ▶ Providing appropriate and adequate nursing care (II, A)
(9) Diagnose and confirm PICC-related thrombosis	▶ Doppler ultrasound as preference (WG)	–	▶ Doppler ultrasound as preference (I, A) ▶ Not to routine use Doppler ultrasound (IV, D)
(10) Remove the PICC against	–	–	▶ Extractions consider the actual situation (II, B)
(11) Treatment after diagnosis	–	–	▶ Routine anticoagulation before removal (IV, B) ▶ Further assessed for appropriate interventions (I, A)
(12) Medical personnel training	▶ Establishing education and training systems (WG)	–	–
	ITAC-CME 2022	ESMO 2015	ISCCM 2020
(1) Identify patient risk factors	–	–	–
(2) Identify catheter-related risk factors	▶ Catheter tip location (grade 1B)	–	▶ Catheter tip location (A, 2)
(3) Identify operator risk factors	–	–	▶ Assess knowledge and compliance (A, 1)
(4) Risk assessment of patients with PICC	–	–	–
(5) Consider use of a risk scoring system	–	–	–
(6) Monitor for signs and symptoms	–	–	–
(7) Pharmacologic preventative measures for PICC-related thrombosis	▶ Not to use as preference (grade 1A)	–	–
(8) Non-pharmacological preventative measures for PICC-related thrombosis	–	▶ Flushing with saline as preference (I, C)	▶ Providing appropriate and adequate nursing care (B, 2)
(9) Diagnose and confirm PICC-related thrombosis	–	▶ Doppler ultrasound as preference (III, A)	▶ Doppler ultrasound as preference (B, 2)
(10) Remove the PICC against	–	–	▶ No need to extubate (A, 2)

Continued

Table 4 Continued

ITAC-CME 2022	ESMO 2015	ISCCM 2020
*Refer to Appendix 6 for the recommendations from each CPG that informed in Table 4 and Appendix 7 for an explanation of the different evidence levels. ASCO, American Society of Clinical Oncology; ASH, American Society of Haematology; CCC-IUA, Chinese Chapter Congress of the International Union of Angiology; CMA, China Medical Association; CPGs, clinical practice guidelines; ESMO, European Society for Medical Oncology; IITC-CNA, Intravenous Infusion Therapy Committee of Chinese Nursing Association; INS, Infusion Nursing Society; ISCCM, Indian Society of Critical Care Medicine; ITAC-CME, International Initiative on Thrombosis and Cancer; LMWH, low molecular weight heparin; PICC, Peripherally Inserted Central Catheter; VTE, venous thromboembolism.		

these may add to the usefulness of the guidelines, it is unclear to what extent they actually improve the implementation of the recommendations. Multiple evidence-based implementation strategies have been evaluated to prevent PICC-related issues.⁴¹ We urge guide developers to consider the Improve CPG Implementation domain as one of the development objectives.

This review has some strengths and limitations. Our assessment is based on what guideline organisations reported. The search strategy, which was developed collaboratively, was reproducible and aligned with systematic review standards. The inclusion of guidelines spanning 2013 (ASCO) to 2024 (INS) raises concerns about obsolescence based on evolving evidence. CPGs that are 'recommended' according to the AGREE II scoring might be out-of-date if they are based on obsolete evidence. Thus, some caution is necessary here. Finally, two appraisers utilised AGREE II, an assessment with methodological rigour and reliability, to assess the quality of the included guidelines and settle any disparities through discussion. Six members of our group have taken part in the evidence-based medicine training courses offered by the Joanna Briggs Institute (JBI). This participation has equipped them with valuable skills and knowledge in evidence-based practice, enhancing the quality and credibility of our research.

CONCLUSIONS

In summary, the current guidelines for PICC-related thrombosis require significant improvements in methodological quality. They showed inconsistencies in some recommendations, highlighting the need for standardised guideline development and high-quality evidence synthesis. Guideline developers should intensify focus on methodological rigour, especially in the Stakeholder Involvement and Applicability domains. Moreover, the existing guidelines need to be further clarified in the areas of risk assessment (including tools and timing of assessment, etc), pharmacological prevention and non-pharmacological prevention. High-quality randomised controlled studies are urgently needed to address these issues in the future.

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