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Review Article

Applications of point-of-care ultrasound in the nursing process for critically-ill patients: a systematic review

Aplicações do *point-of-care ultrasound* no processo de enfermagem ao paciente crítico: revisão sistemática

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ABSTRACT

Objective: to identify the applications and outcomes of point-of-care ultrasound in the nursing care process for critically ill patients. **Methods:** systematic review guided by the PICo strategy, using a combination of descriptors in the following databases: BDENF, EMBASE, LILACS, PubMed, SciELO, ScienceDirect, SCOPUS, Web of Science, and Wiley. The quality of evidence was assessed according to the Oxford classification. Descriptive data synthesis was performed. **Results:** a total of 1,859 studies were initially identified. After applying the inclusion and exclusion criteria, the final sample consisted of 28 studies. Positive outcomes were reported for the use of point-of-care ultrasound in the first, fourth, and fifth stages of the nursing process, serving as a complementary tool for assessment, guidance for interventions, and monitoring of nursing progress. Most studies were classified as level 2 evidence with a grade B recommendation. **Conclusion:** in the context of the nursing process, the applications and outcomes of point-of-care ultrasound were reported in the assessment, implementation, and evaluation stages of nursing care. **Contributions to practice:** this study highlights that point-of-care ultrasound can enhance assessment, guide interventions, and monitor the progress of critically ill patients in nursing practice, promoting more accurate and effective care.
Descriptors: Nursing; Nursing Process; Ultrasonography; Critical Care.

RESUMO

Objetivo: identificar as aplicações e desfechos do *point-of-care ultrasound* no processo de enfermagem na assistência ao paciente crítico. **Métodos:** revisão sistemática com busca guiada pela estratégia PICo, por meio de combinação dos descritores nas bases BDENF, EMBASE, LILACS, PubMed, SciELO, *ScienceDirect,* SCOPUS, *Web of Science* e Wiley. Avaliação da qualidade das evidências conforme Oxford. Síntese de dados descritiva. **Resultados:** inicialmente foram identificados 1.859 estudos, mas após a aplicação dos critérios de inclusão e exclusão, a amostra final foi composta por 28 estudos. Foram descritas aplicações com desfechos positivos do *point-of-care ultrasound* na primeira, quarta e quinta etapas do processo de enfermagem, como ferramenta complementar da avaliação, guia para implementações e monitorização da evolução de enfermagem. Houve predominância no estrato 2 do nível de evidência e com grau de recomendação B. **Conclusão:** no contexto do processo de enfermagem foram descritos aplicações e desfechos do *point-of-care ultrasound* na avaliação, implementação e evolução de enfermagem. **Contribuições para a prática:** o estudo destaca que o *point-of-care ultrasound* pode ampliar a avaliação, orientar intervenções e monitorar a evolução do paciente crítico na prática de enfermagem, promovendo cuidados mais precisos e eficientes.
Descritores: Enfermagem; Processo de Enfermagem; Ultrassonografia; Cuidados Críticos.

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Introduction

Ultrasound (US) is an imaging method that uses high-frequency sound waves to obtain real-time images of the internal structures of the human body[1]. The first images obtained through this technique originated from sonar systems developed during World War I. Decades later, driven by technological advances, US began to be applied in various clinical contexts, becoming a highly valuable tool. Its safe and effective use by properly trained health care professionals has been documented across different specialties, gaining prominence in the care of critically ill patients, especially in emergency and urgent care settings and intensive care units (ICUs)[2].

In recent years, ultrasound equipment has become more compact, portable, and accessible, offering better image quality at reduced costs — a development that has enabled its use by nurses worldwide[3]. In this context, bedside ultrasound or Point-of-Care Ultrasound (POCUS) has gained increasing relevance in health care services, being employed as a complementary tool to physical examination and in the guidance and performance of procedures[4]. The use of POCUS promotes safety and autonomy for nurses in clinical decision-making and enables more accurate results, fewer adverse events, and, consequently, improvements in the quality of care. It has therefore become a strategy aligned with the scope of advanced nursing practices, particularly in critical care settings[5].

Nursing care for critically ill patients requires nurses to continuously seek technical and scientific development in order to ensure high-quality, safe care[6]. Thus, the use of multiple tools that support clinical reasoning and decision-making becomes essential for the implementation of the Nursing Process. The Nursing Process is a methodology that guides professional nursing practice and the documentation of care, consisting of five stages: Nursing Assessment, Nursing Diagnosis, Nursing Planning, Nursing Implementation, and Nursing Evaluation[7-8]. To meet the complex needs of patients, the use of POCUS by nurses has been increasingly regarded as an essential practice for enhancing the quality of the nursing process in critical care settings.

In light of this advancement and professional development, the Federal Nursing Council (COFEN) recommends that both professionals and institutions pursue strategies for training in the Nursing Process[8]. It also authorizes nurses to perform bedside ultrasound, provided they have received proper training, while prohibiting the issuance of diagnostic reports or the use of ultrasound for nosological diagnostic purposes[9].

Despite the recognition of the importance of bedside US in clinical practice, the current Brazilian context still presents significant limitations, especially regarding the lack of financial resources for training nurses and the insufficient availability of equipment in institutions that care for critically ill patients[10]. Additionally, there is a limited number of studies that demonstrate the applications of POCUS within the nursing process for critically ill patients. In this context, there are gaps that need to be addressed regarding this topic. Therefore, this study aimed to identify the applications and outcomes of point-of-care ultrasound in the nursing care process for critically ill patients.

Methods

This is a systematic review conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines[11], with a registered protocol (ID: CRD420250650449) on the International Prospective Register of Systematic Reviews (PROSPERO). As this is a systematic review, approval from a Research Ethics Committee was not required. The review was carried out in João Pessoa, Paraíba, Brazil, between March and July 2025.

Using the PICo strategy — an acronym for: P (Population): nurses and critically ill patients; I (Phenomenon of Interest): applications and outcomes of POCUS; Co (Context): nursing process —

the following research question was developed: What are the applications and outcomes of POCUS in the nursing care process for critically ill patients?

Studies were eligible if they demonstrated the use of POCUS and its association with any stage of the nursing process in the care of critically ill patients. There were no restrictions regarding publication period, language, or patient age. Inclusion criteria were: studies conducted by or involving nurses, application of POCUS, and focused on the care of critically ill patients. Editorials, letters to the editor, and review studies were excluded.

The search for studies was based on the PICo strategy and the research question, using a combination of descriptors in the databases to locate relevant studies in titles, abstracts, and keywords. Access to databases was obtained through the CAPES (Coordination for the Improvement of Higher Education Personnel) Journal Portal, using the browser of a federal university via the Federated Academic Community (CAFe) access. The databases searched included: Biblioteca Digital de Enfermagem (BDENF), Excerpta Medica Database (EMBASE), Latin American and Caribbean Health Sciences Literature (LILACS), National Library of Medicine National Institutes of Health (PubMed), Scientific Electronic Library Online Citation Index (SciELO), ScienceDirect, SCOPUS, Web of Science, and Wiley.

Specific search strategies for each database were developed using the controlled vocabularies from the Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH). The combination of terms in the databases was carried out using the Boolean operators "AND" and "OR". The descriptors used were: nurses; patient care; critical care; nursing care; nursing process; ultrasonography; ultrasound; as well as the free term: point-of-care ultrasound (bedside ultrasound).

The decision was made not to include grey literature or additional reference lists, in order to ensure the identification of only peer-reviewed and indexed evidence, as well as to guarantee the reproducibility of the strategy. Electronic searches guided by descriptor combination strategies in databases allow for greater transparency and replicability — essential criteria for systematic reviews. The search strategy was applied on March 11 and 12, 2025 (Figure 1).

Database and date	Search strategy
BDENF 03/11/2025	((enfermagem OR nursing OR enfermería)) AND ((ultrassonografia OR ultrasonography OR ultrassonografia)) AND db:("BDENF") AND instance:"regional"
EMBASE 03/12/2025	('nursing'/exp OR 'nursing intervention'/exp OR 'nursing care'/exp OR 'intensive care nursing'/exp) AND ('intensive care unit'/exp OR 'intensive care'/exp) AND ('echography'/exp OR 'interventional ultrasonography'/exp)
LILACS 03/11/2025	((enfermagem OR nursing OR enfermería)) AND ((Ultrassonografia OR Ultrasonography OR Ultrassonografia)) AND (db:("LILACS"))
PUBMED 03/11/2025	("Advanced Practice Nursing"[Mesh] OR "Nursing Process"[Mesh] OR "Nursing Care"[Mesh]) AND ("Critical Care Nursing"[Mesh] OR "Critical Care"[Mesh] OR "Patient Care"[Mesh]) AND ("Ultrasonography"[Mesh] OR "Ultrasonography, Interventional"[Mesh] OR "Point-of-Care Systems"[Mesh])
SCIELO 03/11/2025	(Enfermagem OR Nursing OR Enfermería) (Tópico) and (Ultrassonografia OR Ultrasonography OR Ultrassonografia) (Tópico)
SCIENCE DIRECT 03/11/2025	"point of care ultrasound" AND "nurse" AND "critical care"
SCOPUS 03/11/2025	(TITLE-ABS-KEY ('nursing' OR 'nursing AND care' OR 'nursing AND process' OR 'critical AND care AND nursing') AND TITLE-ABS-KEY ('ultrasonography' OR 'point AND of AND care AND ultrasound' OR 'pocus'))
WEB OF SCIENCE 03/11/2025	((((ALL=(Critical Care Nursing)) OR ALL=(Nursing Care)) OR ALL=(Advanced Practice Nursing)) AND ALL=(Ultrasonography))
WILEY 03/11/2025	[Publication Title: nursing] AND [Publication Title: ultrasonography]

Figure 1– Search strategies used in the databases. João Pessoa, PB, Brazil, 2025

The studies identified through the search were first exported to EndNote, a reference management software, for duplicate removal. They were then imported into Intelligent Systematic Review (Rayyan), a systematic review analysis tool, where the selection of eligible studies was independently performed by two reviewers. Titles and abstracts of the studies were initially screened, and each reviewer recorded agreement or disagreement regarding inclusion. Discrepant cases were discussed and submitted for evaluation by a third reviewer with greater expertise in the subject matter. Subsequently, the selected articles were read in full in order to answer the review question. The critical appraisal of study data quality, as well as the determination of levels of evidence and grades of recommendation, followed the Oxford Centre Evidence Based Medicine framework[12]. The synthesis of the study data was guided by PRISMA[11].

From adapted forms[13], the following variables were extracted from the articles: author, year, country of origin, study design, care setting, level of evidence and grade of recommendation, as well as POCUS applications and stages of the nursing process. For the synthesis of evidence, aggregated data from the articles were used, accompanied by a descriptive summary of the findings.

Results

The search retrieved 1,859 studies. A total of 71 were read in full, of which 40 were excluded for not addressing the research question and three due to methodological design. Thus, 28 studies comprised the sample of this review. The PRISMA[11] guidelines guided the summarization of study identification, screening, and inclusion (Figure 2).

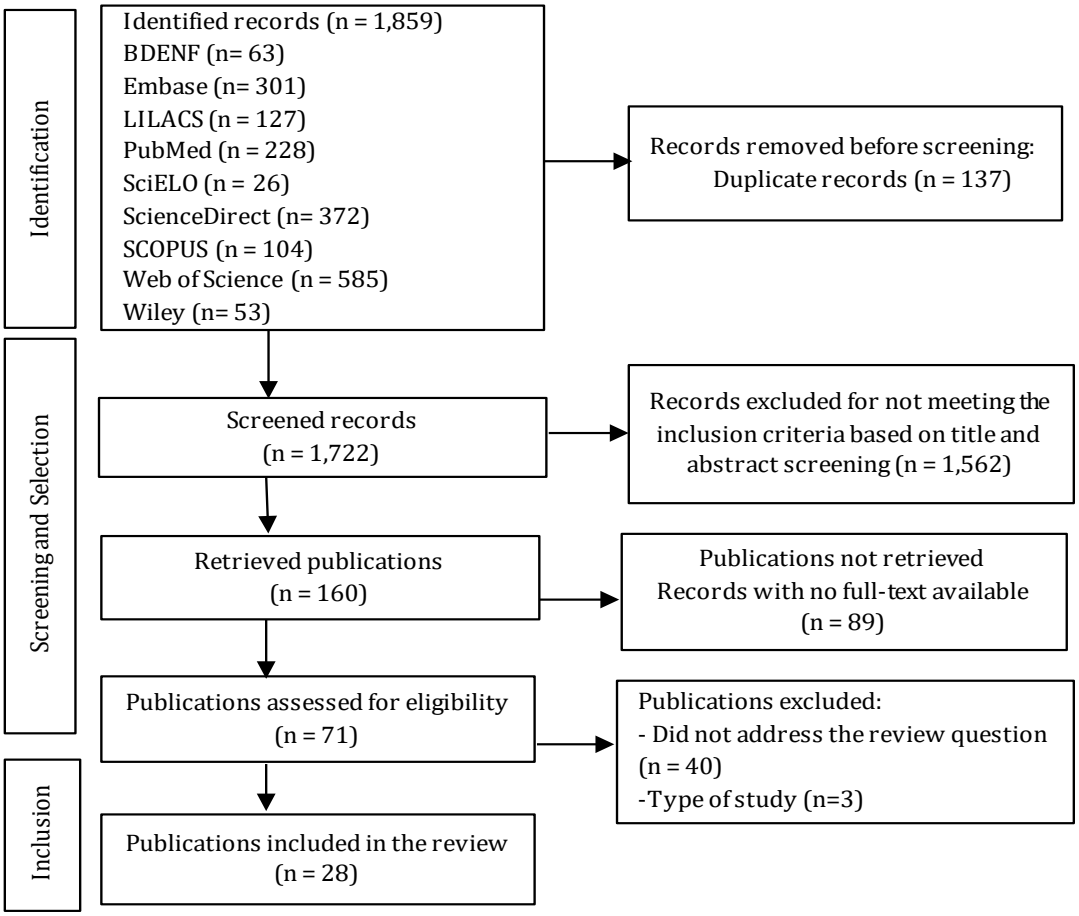

Figure 2 – Flowchart of study selection adapted from PRISMA. João Pessoa, PB, Brazil, 2025

The studies were published between 2004 and 2025, with a higher concentration in 2022 and 2023, each with five publications, originating from 15 countries, particularly the United States, with 11 studies. The quasi-experimental methodological design of the educational intervention type stood out, with 10 publications. Regarding the care setting, 20 studies were conducted in intensive care units. The publications predominantly presented level 2 evidence with a grade B recommendation (Figure 3).

Regarding linkage, POCUS applications were identified in the first[15,19,21-23,32-35], fourth[14,17-18,20,26,31,36-37,39-40] and fifth stages of the nursing process[16,24,27-28,29-30,38,41]. No studies were found reporting applications and outcomes related to the nursing diagnosis and nursing planning stages in the context of critically ill patient care (Figure 4).

Author, year and country	Design/Setting	LE/GR
Brannam et al., 2004, USA[14]	Prospective observational / Emergency and urgent care	2B/B
Henderson et al., 2010, USA[15]	Quasi-experimental, single-group educational intervention / Emergency and urgent care	2C/B
Tai et al., 2016, China[16]	Longitudinal, single-group diagnostic test / Emergency and urgent care	2C/B
Fabiani et al., 2017, Italy[17]	Prospective observational / ICU	2B/B
Bridey et al., 2018, France[18]	Randomized controlled trial / ICU	1B/A
Brunhoeber et al., 2018, USA[19]	Quasi-experimental, two-group educational intervention / ICU	2A/B
Edwards e Jones, 2018, USA[20]	Quasi-experimental, single-group educational intervention / Emergency and urgent care	2C/B
Cover et al., 2019, USA[21]	Quasi-experimental, single-group educational intervention / Pre-hospital care	2C/B
Leibenguth et al, 2019, USA[22]	Quasi-experimental, single-group educational intervention / ICU	2C/B
Tulleken et al., 2019, Germany[23]	Prospective observational / ICU	2B/B
Itoh et al, 2020, USA[24]	Quasi-experimental, single-group educational intervention / Pre-hospital care	2C/B
Mele et al., 2020, USA[25]	Retrospective observational / ICU	2C/B
Bhargava et al., 2022, USA[26]	Prospective observational / ICU	2B/B
Brotfain et al., 2022, Israel[27]	Quasi-experimental, two-group educational intervention / ICU	2A/B
Ferraboli 2022, Brazil[28]	Cross-sectional study / ICU	4/C
Saglam et al., 2022, Turkey[29]	Quasi-experimental, single-group educational intervention / Emergency and urgent care	2C/B
Tsolaki et al., 2022, Greece[30]	Prospective observational / ICU	2B/B
Burton et al., 2023, Australia[31]	Prospective observational pilot study / ICU	2C/B
Corcoran et al., 2023, England[32]	Case series / ICU	4/C
Lopes et al., 2023, Brazil[33]	Prospective observational / ICU	2B/B
Rath et al., 2023, USA[34]	Quasi-experimental, single-group educational intervention / Emergency and urgent care and ICU	2C/B
Smits et al., 2023, Netherlands[35]	Prospective observational / ICU	2B/B
Hansen et al., 2024, Norway[36]	Qualitative research with a hermeneutic approach / ICU	5/D
Kessler et al., 2024, USA[37]	Retrospective cohort / Emergency and urgent care	2B/B
Robles-González et al., 2024, Spain[38]	Cross-sectional observational pilot study / ICU	4/C
Zini et al., 2024, Italy[39]	Prospective observational / ICU	2B/B
León et al., 2025, Spain[40]	Prospective cohort / ICU	2A/B
Voulgaridou et al., 2025, Greece[41]	Quasi-experimental, single-group educational intervention / ICU	2C/B

LE: Level of Evidence; GR: Grade of Recommendation; ICU: Intensive Care Unit

Figure 3 – Summary of the studies included in the review. João Pessoa, PB, Brazil, 2025

Applications by stage	Outcomes
[E1] Thoracic assessment[34-35]	- Assessment scores and self-perceived competence ratings improved in all aspects of thoracic examination with the use of point-of-care ultrasound (Point-of-Care Ultrasound)[34]; - POCUS suggested changes in clinical management in 26% of cases; and 44% of assessments altered fluid management[35].
[E1] Abdominal[15], cardiac[19] and pulmonary assessment[21-23,32]	- A total of 227 POCUS assessments were performed by five nurses, with 27 positive findings for free fluid in the cavity. Image adequacy rates were 83%, 95%, 84%, 77%, and 100% for each nurse, respectively [15]; - Nurses demonstrated 86% accuracy in image acquisition and 80.5% accuracy in interpretation of inferior vena cava POCUS images[19]; - POCUS clarified the cause of symptoms in 67.4% of cases[21]; - Pulmonary POCUS improved knowledge, skills, and impacted clinical decision-making[22]; - A total of 230 pulmonary examinations were performed, with high agreement between supervisors' and nurses' findings[23]; - All assessments identified abnormal pulmonary findings; POCUS contributed to changes in clinical treatment, including targeted fluid removal, changes in respiratory therapy, and the need for formal echocardiographic evaluation[32].
[E1] Gastric residual volume assessment[27]	- Intergroup correlation (Group A: 0.814 [0.61–0.92]; Group B: 0.85 [0.58–0.91]) for agreement between POCUS gastric residual volume assessment and standard protocol methods.
[E1] Urinary retention assessment[33]	- Nurses using POCUS identified 40.54% of patients with urinary retention.
[E1] Umbilical catheter position assessment[25]	- Agreement of 86% (κ-0.667) between nurses and physicians regarding catheter position using POCUS.
[E4] Peripheral venous access (PVA) insertion[14,17-18,20,26,31,36-37]	- Nurses using POCUS had high success rates and few complications for peripheral venous access (PVA) in patients with difficult access [14]; - 100% success rate for catheter placement, with a mean dwell time of 14.7 ± 11.1 days when the procedure was guided by POCUS[17]; - The use of US compared to the traditional technique did not yield different results[18]; - Increased confidence in the ability to obtain ultrasound-guided PVA, with 64.3% of nurses strongly agreeing[20]; - First-attempt success rate in the POCUS group was 85.9% compared to 47.3% in the traditional group (p<0.001). Overall success was also higher in the POCUS group (94.3% versus 57.3%, p<0.001). Catheters inserted under POCUS guidance lasted longer, with a median survival of 4 ± 3.84 days versus 3 ± 3.51 days (p<0.050)[26]; - Overall success rate was 50%, with 87% achieving first-attempt success using POCUS[31]; - Nurses reported that POCUS simplifies difficult PVA procedures[36]; - The use of point-of-care ultrasound for difficult peripheral venous access more than doubled (from 606 to 1,323 procedures). Outcomes included reduced times for: contrast-enhanced computed tomography scans from 4.8 hours to 4.1 hours, pain medication infusion from 2.4 hours to 1.8 hours, intravenous antibiotic administration from 3.0 hours to 2.1 hours, and length of stay in the emergency department from 6.4 hours to 6.0 hours[37].
[E4] Arterial catheterization[40]	- Increase in first-attempt success rate from 50% in the palpation-guided group to 58% in the POCUS group.
[E4] Peripherally inserted central catheter insertion[39]	- Procedure success rate was 100%. In 80.5% of cases, insertion was achieved on the first puncture guided by POCUS. No procedure-related complications occurred in neonates.
[E5] Nasogastric tube (NGT) positioning[16,27-28,30,38]	- High sensitivity and specificity of POCUS in confirming NGT position[16]; - Strong correlation between POCUS-based nasogastric tube position assessment and standard protocol methods[27]; - Almost perfect inter-rater agreement in POCUS-guided NGT confirmation (k=0.93; confidence interval (CI) 95%: 0.65 – 0.99)[28]; - POCUS confirmed correct NGT positioning in 246/276 (89.13%) patients upon ICU admission; during hospitalization, confirmation occurred in 462/590 (78.14%) cases; in 392 cases, a chest X-ray was also requested. Sensitivity of POCUS confirmation in these cases was 98.9%, specificity 57.9%. Time for complete evaluation was 3.8 ± 3.4 min[30]; - Correct positioning was verified by direct visualization of the tube in the stomach (sensitivity 35%) and indirect visualization by fluid and air injection through the tube (sensitivity 85%)[38].
[E5] Endotracheal tube position confirmation [24,29,41]	- POCUS use resulted in 100% (95% CI: 86%–100%) of tracheal images, 100% (95% CI: 86%–100%) of pulmonary images, and 79% (95% CI: 59%–91%) of hemidiaphragmatic images being considered clinically useful for confirming endotracheal tube position[24]; - Based on 224 responses, sensitivity, specificity, positive likelihood ratio, negative likelihood ratio, and overall accuracy of nurse-performed POCUS for detecting tracheal intubation were 95.61% (90.06%–98.56%), 97.27% (92.24%–99.43%), 35.06 (11.48–107.10), 0.05 (0.02–0.11), and 96.43% (93.08%–98.45%), respectively. The mean time to assess tube location by ultrasound was 6.57 seconds[29]; - Median time for correct endotracheal tube position confirmation via chest X-ray was 12.6 min, whereas POCUS-assisted recognition ranged from 5.1 to 6.0 min[41].

E1: First Stage; E4: Fourth Stage; E5: Fifth Stage; PVA: Peripheral Venous Access; NGT: Nasogastric Tube

Figure 4 – Applications and outcomes of point-of-care ultrasound in the nursing process for critically ill patients. João Pessoa, PB, Brazil, 2025

Discussion

This study is a systematic review composed predominantly of articles published in the last decade, which reflects the recent nature of integrating POCUS into advanced nursing practices — driven by the need for faster and safer clinical decision-making. Such integration has expanded nurses' autonomy in critical care contexts, establishing itself as an emerging trend in specialized professional practice[42]. The USA stood out with the highest number of publications on the subject, which may be attributed to the widespread incorporation of POCUS into clinical practice, a robust technological infrastructure, and strong emphasis on continuing education and research in critical care settings, such as intensive care units. These factors position the country ahead of others, including Brazil[43].

Regarding the methodology, educational interventions emerge as an innovative strategy for training nurses in the use of POCUS. As this is a relatively new topic, these interventions contribute to both theoretical and practical skill development and enhance professional confidence, reinforcing the importance of active learning methods in clinical practice[44]. In this regard, this type of study revealed an innovative approach that validates the possibilities of applying US by nurses.

With respect to the care setting, a higher concentration of POCUS use was observed in ICUs, due to the specific demands and complexity of both the environment and the clinical conditions of critically ill patients. These scenarios require nursing teams to master advanced skills and to use specialized monitoring technologies[44]. Moreover, most studies were focused on the adult population. The predominance of studies involving POCUS use in critically ill adult patients may be related to the higher burden of comorbidities in this group, which demands advanced hemodynamic and respiratory monitoring. In addition, most bedside US protocols currently available are validated for adult use, facilitating their implementation in this age group[35].

Regarding the use of POCUS in the assessment and data collection stage of the nursing process, it was shown to be applicable for thoracic (cardiopulmonary), abdominal (gastric residual volume and free fluid), urinary (retention), and arterial and venous evaluations. These findings support its use in the first stage of the nursing process[15,19,21-23,32-35]. It is worth noting that, although classic physical examination techniques — such as history taking, auscultation, inspection, palpation, and percussion — remain widely used, their effectiveness may be influenced by various clinical factors. The use of POCUS, however, has demonstrated greater efficacy, significantly increasing the sensitivity and specificity of the physical exam and enhancing clinical judgment[44]. This shows that the use of POCUS as a complementary tool in the nursing process can improve the quality of data collection, provide more accurate clinical indicators, and better identify actual care needs.

In relation to the second stage of the nursing process, the findings primarily focused on implementing educational programs aimed at ICU nurses to assess their proficiency in using POCUS to detect multisystem dysfunctions. This indicates that the focus of the reviewed articles was on equipping nurses for patient assessment (the first stage of the nursing process), from which nursing diagnoses could be observed or proposed by nurses. However, no studies were found with the primary objective of using POCUS to identify defining characteristics of nursing diagnoses in critically ill patients. The results suggest that such programs may lead to changes depending on new findings made possible through POCUS[18,22-23,34], making it a highly recommended tool in clinical practice and a valuable resource for formulating nursing diagnoses.

However, it is important to highlight the absence of studies demonstrating the use of POCUS as a method to provide evidence for any nursing diagnosis listed in established nursing taxonomies. Nonetheless, this remains a possibility, as a recent publication reported the use of POCUS to identify defining characteristics for the nursing diagnosis: excess fluid volume.

The findings indicated an increase in B-lines or the presence of pleural fluid accumulation — compared to chest X-ray and physical examination — as an indicative sign of pulmonary congestion[45].

In this review, no studies were identified that sought to demonstrate a connection — even an indirect one — with the third stage of the nursing process, specifically aimed at developing a patient-centered care plan. However, when analyzing the articles that link POCUS to nursing interventions, it is possible to infer that, when a nurse develops a care plan, it is with the intent of achieving a defined outcome, which may or may not involve the implementation of specific interventions. This understanding allows us to conclude that the use of POCUS in the nursing planning phase is indeed presente — albeit implicitly — yet it still lacks further investigation.

Regarding the use of POCUS in the execution of nursing interventions, its application was predominantly observed as a guide for obtaining peripheral venous access[14,17-18,20,26,31,36-37], for guiding arterial catheterization[40], and for the insertion of peripherally inserted central catheters[39]. To demonstrate the effectiveness of POCUS in this stage of the nursing process, one study developed a new nursing intervention named ultrasonography: inferior vena cava to estimate central venous pressure and assess volume status. The study concluded that this intervention serves as a practical tool for nurses, providing guidance to maximize success rates and reduce the number of failed attempts, thereby minimizing patient pain and unnecessary material costs[46].

As for the fifth stage of the nursing process, the studies reported the use of POCUS in evaluating endotracheal tube placement[24,29,41] and, most notably, in confirming the positioning of the nasogastric tube[16,27-28,30,38]. It was noted that these investigations focused primarily on the use of POCUS for evaluating medical devices, which may be mistaken for the first stage of the nursing process. However, during assessment, data are collected to identify the patient's needs — this constitutes an initial approach. In contrast, in the nursing evaluation stage, the data collected serve to assess whether the nursing interventions achieved the expected outcomes and whether the care process requires adjustments or improvements. This is the moment for nurses to re-evaluate their care delivery and determine whether it aligns with the intended outcomes[8,41].

Study limitations

The main limitations include the heterogeneity of the included studies, which presented varying methodological designs, potentially compromising the generalizability of the results. Additionally, most studies originated from countries with different contexts and resources, limiting the applicability of the conclusions to other health care realities. The predominance of quasi-experimental studies and the inability to conduct a meta-analysis restrict the strength of the available evidence. The decision not to retrieve additional studies from grey literature or reference lists further highlights the need for broader research and diverse methodological approaches in order to expand knowledge on the applications of POCUS in nursing practice.

Contributions to practice

The findings of this study contribute to improving the quality of nursing care, enhancing nurses' autonomy, supporting their training, and strengthening the nursing process in the context of care for critically ill patients. This study highlights that Point-of-Care Ultrasound can enhance assessment, guide interventions, and monitor patient progress in critical care nursing practice, thus promoting more accurate and efficient care.

Conclusion

It is concluded that, within the context of the nursing process, Point-of-Care Ultrasound presents a wide range of applications and outcomes, particu-

larly as a complementary tool for the first, fourth, and fifth stages of the nursing process — focused on assessment, guidance for interventions, and nursing evaluation in critically ill patients. However, there is a lack of studies that directly link its use to the other stages of the nursing process. The implementation of Point-of-Care Ultrasound not only reinforces nurses' autonomy and the benefits to patient care but also highlights the need for greater investment in education and training to ensure continuous qualification and incorporation of this technology into health care services — especially in critical care settings.

Authors' contributions

Conception and design or data analysis and interpretation: Farias JJM. Writing of the manuscript or relevant critical review of the intellectual content: Pontes CAF, Vasconcelos WTF. Final approval of the version to be published: Barbosa KTF, Mangueira SO, Sousa MM, Cabral JVB. Agreement to be responsible for all aspects of the manuscript ensuring that issues relating to the accuracy or completeness of any part of the manuscript are properly investigated and resolved. Cabral JVB.

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