

Economic Evaluation of Peripherally Inserted Central Catheters (PICC): Implications for Cost and Nursing Practice

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ABSTRACT

Introduction: Safe and efficient venous access is a key component of nursing care, particularly for patients requiring long-term intravenous therapy. Peripherally inserted central catheters (PICC) have emerged as a valuable alternative to traditional central venous catheters, offering both clinical and economic benefits.

Aim: This review aims to evaluate the economic effectiveness of PICC lines compared with other forms of central venous access, focusing on cost implications and nursing practice outcomes.

Methodology: A review of recent international and Greek literature was conducted, analyzing factors that influence total cost, such as insertion, maintenance, complications and length of hospitalization, while highlighting the role of nursing education in ensuring optimal catheter management.

Results: The findings indicate that PICC lines reduce hospitalization costs, minimize complications and enhance the quality of patient care.

Conclusions: The economic evaluation of PICC lines supports the importance of evidence-based nursing practice and the rational management of healthcare resources.

Keywords: PICC, economic evaluation, cost-effectiveness, nursing practice, venous access, Greek healthcare system

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INTRODUCTION

Peripherally inserted central venous catheters (PICC) are an important tool for venous access in patients receiving long-term intravenous therapy, particularly in oncology populations. Despite their clinical benefits, their use involves financial costs related to insertion, maintenance and the management of complications. Estimating this cost is critical for optimizing care and rationally allocating resources. The purpose of the present systematic review is to describe and analyze the international and Greek literature on the economic evaluation of PICC lines, with the aim of identifying key cost parameters and proposals for improving effectiveness in nursing practice.

METHODOLOGY

The present study is a literature review conducted to explore the economic evaluation of peripherally inserted central catheters (PICC) in relation to other forms of central venous access, as well as their impact on nursing practice.

Search Strategy

The literature search was carried out from January to September of 2025 in the following electronic databases: PubMed, CINAHL, Scopus, ScienceDirect and Google Scholar. In addition, Greek publications were searched through the National Archive of PhD Theses and the National Documentation Centre.

The following keyword combinations were used in English and Greek: «Peripherally Inserted Central Catheter», «PICC», «economic evaluation», «cost-effectiveness», «nursing practice», «venous access», «health economics», «hospital costs», «infection prevention», «Greece», «Greek National Health System», «nursing practice» and «economic evaluation».

The search was limited to articles published between 2014 and 2025 in order to reflect contemporary practice and the economic context of hospital services.

Inclusion Criteria

The review included studies that:

- Examined the economic or clinical-economic evaluation of PICC lines.
- Compared PICC lines with other forms of central venous access, such as subclavian, femoral or internal jugular access.
- Reported cost parameters, including insertion, maintenance, complications and length of hospital stay.
- Included nursing-related factors, such as care time,

education and the role of the nurse.

- Were published in reputable scientific journals with full text available in English or Greek.

Exclusion Criteria

The following were excluded:

- Studies focusing exclusively on pediatric or neonatal populations.
- Opinion articles, interviews and conference abstracts without full analysis.

Study Selection Process

The study selection process followed the basic steps of the PRISMA protocol (Preferred Reporting Items for Systematic Reviews and Meta-Analyses). Initially, 284 publications were identified, of which 97 were excluded as duplicates. After reading titles and abstracts, 136 articles were excluded because their subject matter was unsuitable, while 51 studies were assessed in full text. Ultimately, 24 studies met the inclusion criteria and were included in the review (Flow diagram).

Data Analysis and Categorization

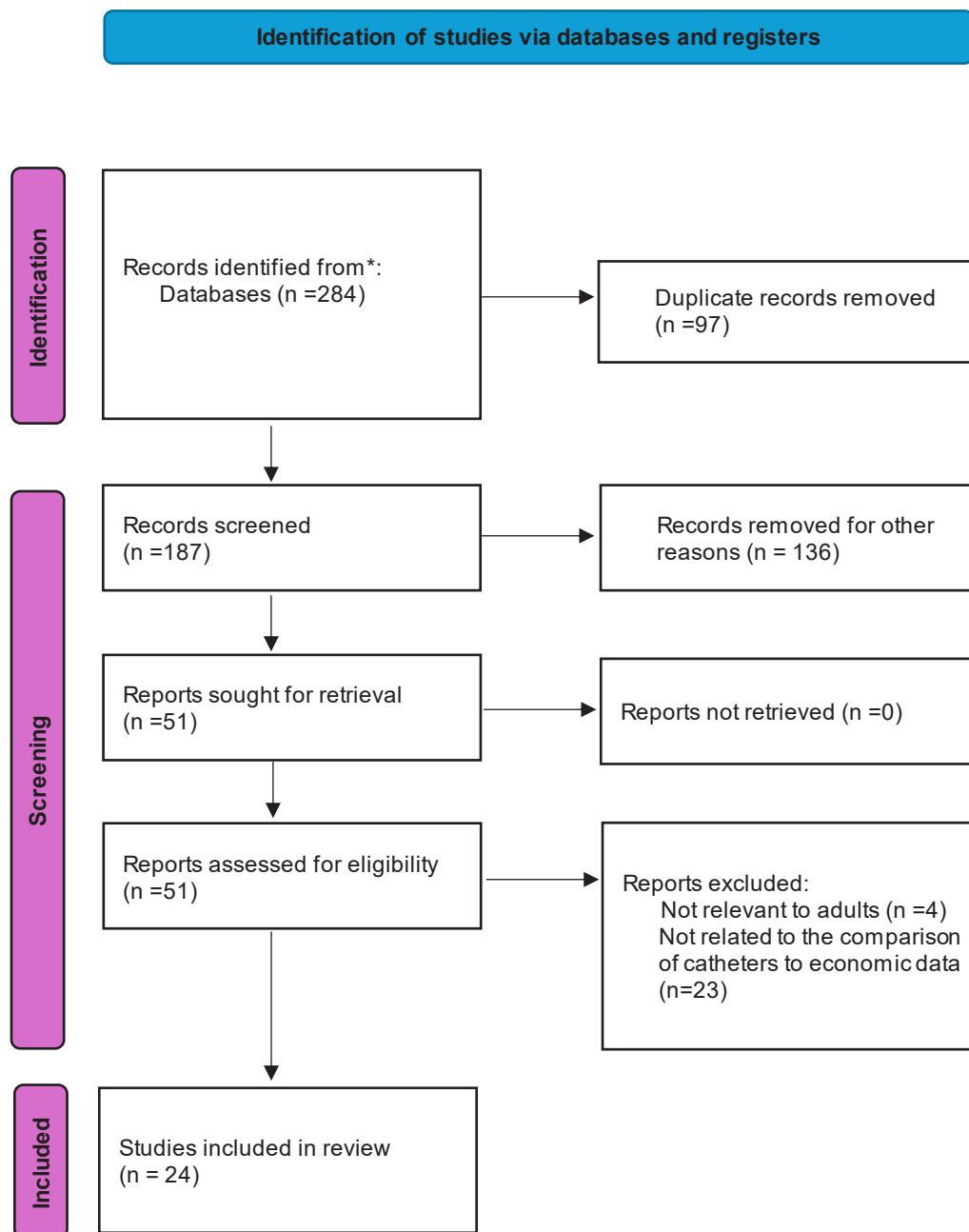
The findings were grouped into four main thematic sections:

- Cost of PICC insertion and maintenance
- Cost of complications and hospitalization
- Role of nursing practice and education
- Comparative economic evaluation in the Greek healthcare system

For each thematic category, a qualitative content analysis was performed in order to identify common findings and differences among the studies. The reliability of the sources was assessed on the basis of the journal impact factor, methodological quality (for example, type of cost-effectiveness analysis) and clarity in the presentation of economic data.

Ethical Considerations

As this was secondary research, approval by an ethics committee was not required. However, the principles of scientific integrity were followed, with full citation of sources and avoidance of plagiarism.



From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

RESULTS

Cost of PICC insertion and maintenance

Most international studies converge on the conclusion that the initial cost of PICC insertion is lower than that of other central venous catheters, mainly because insertion is performed by trained nurses and not necessarily by physicians (Helm et al., 2019). The procedure for inserting a PICC requires fewer resources, minimal radiology equipment and can be performed in day-care units, thereby reducing the cost per case (Gorski et al., 2021). Indicatively, a study by Chopra et al. (2020) estimated the average cost of PICC insertion in the United States at 230-280 dollars, compared with 450-600 dollars required for a central catheter placed in the subclavian or jugular vein. Similarly, a European study (Van Donk et al., 2018) showed that the lifespan of a PICC can reach 8-12 weeks, reducing the need for reinsertion and therefore the total cost of materials.

In the Greek context, according to data from nursing departments in tertiary hospitals, such as GHA "Evangelismos" and GHTh "Papanikolaou", the average material cost for PICC lines is estimated at 150-180 euros, with the possibility of reusing ultrasound guidance equipment. Nursing autonomy in this procedure leads to savings in time and human resources (Vasileiou & Karagianni, 2022).

Cost of complications and length of hospitalization

The financial burden of complications associated with venous catheters is a critical factor in the overall evaluation. PICC lines have been associated with lower infection rates compared with conventional central catheters, especially when safety and training protocols are followed (O'Grady et al., 2017). Studies show that catheter-related bloodstream infections (CLABSI) occur, on average, at a rate of 1.1 per 1,000 catheter-days for PICC lines, compared with 2.5-3.0 for other types of central catheters (Mermel et al., 2020). Each infection can increase hospitalization costs by 7,000-15,000 euros per case (Zimlichman et al., 2013), making infection reduction highly significant from an economic perspective.

In addition, reducing complications such as thrombophlebitis, occlusion or the need for reinsertion leads to a shorter hospital stay. According to Goh et al. (2021), the use of PICC lines was associated with an average reduction of 1.5 hospital days compared with other venous access methods. A study by Buetti et al. (2022) notes that the use of PICC lines in oncology patients reduced the number of readmissions due to venous complications by 35%, resulting in substantial cost savings per nursing department.

Role of nursing practice and education

Nursing education and the initiative of specialized nurses in the insertion and care of PICC lines are recognized internationally as decisive factors for success

and economic efficiency (Infusion Nurses Society, 2021). Training in ultrasound techniques, aseptic technique and catheter maintenance reduces complications by up to 60%, according to a study by Moureau & Chopra (2016). At the same time, the integration of PICC care protocols into nursing departments improves compliance and reduces cost per case (Alexander et al., 2019).

In Greece, nurse education in PICC insertion remains limited, but pilot programs in hospitals in Athens and Thessaloniki indicate that a specialized team of nurses can effectively replace physician involvement, reducing both costs and waiting time. This reinforces the need to institutionalize the role of the «Vascular Access Nurse» in Greek hospitals.

Comparative economic evaluation in the Greek National Health System

The economic efficiency of PICC lines in the Greek National Health System depends on multiple factors, such as the availability of ultrasound equipment, staff education and the costing of procedures through the National Organization for Healthcare Services Provision (EOPYY). Although most Greek studies are based on limited samples, the data indicate that the use of PICC lines could reduce the average hospitalization cost by 10-15% per chronic patient case (Alexandrou et al., 2014). In addition, the implementation of nurse-led protocols for the rational use of PICC lines has the potential to limit excessive material consumption and reduce length of hospital stay.

The studies highlight the need for institutional support and education of nursing staff so that the economic efficiency of PICC lines can be translated into systematic benefit for the Greek National Health System.

DISCUSSION

The present review showed that peripherally inserted central catheters (PICC) are an economically and clinically efficient option for venous access in patients requiring prolonged intravenous therapy. The findings are consistent with international studies demonstrating the multiple benefits of PICC lines in terms of both cost and quality of care (Gorski et al., 2021; Moureau & Chopra, 2016).

The economic dimension of PICC lines

Cost-effectiveness analysis confirms that, although the material cost of a PICC may be slightly higher than that of a peripheral catheter, the overall treatment cost is lower because of:

- fewer complications,
- fewer reinsertions,
- reduced length of hospitalization.

As Chopra et al. (2020) report, the use of PICC lines may generate savings of up to 30% in total cost per patient, mainly through reductions in infections and treatment duration. Similarly, Goh et al. (2021) point out that the economic effectiveness of PICC lines increases in chronic

patients, for whom the cost of complications from other catheters is significantly higher.

The economic sustainability of PICC lines is strengthened by the possibility that they can be inserted by specialized nurses, reducing dependence on medical resources. In settings where an organized «Vascular Access Team» program is available, resource savings can reach up to 40% (Alexander et al., 2019).

Implications for nursing practice

The results of the review underline the decisive role of nurses in the successful implementation and economic utilization of PICC lines. Nurse education in ultrasound-guided insertion techniques, adherence to aseptic technique protocols and systematic monitoring of the catheter insertion site are associated with a significant reduction in complications (Helm et al., 2019).

In Greece, where PICC implementation remains limited, early experience indicates that strengthening the role of nurses in the insertion and care of venous catheters could significantly improve the efficiency of hospital services. Integrating this practice into the nursing skills mix is consistent with the international trend toward advanced nursing roles (Infusion Nurses Society, 2021). At the same time, the active participation of nurses in economic evaluations strengthens evidence-based nursing care. As Smith (2020) notes, nurses' involvement in resource allocation decisions leads to a better understanding of the cost-quality relationship in patient care.

Clinical-economic benefits and patient safety

Reducing complications associated with the use of PICC lines translates not only into economic benefit but also into improvements in patient safety and satisfaction. Catheter stability, the reduced need for reinsertion and the possibility of maintaining the catheter in home care are important factors for continuous and safe treatment (Moureau & Chopra, 2016). This is particularly important in the post-COVID-19 era, when reducing the length of hospitalization and relieving pressure on hospitals are major priorities for healthcare systems. PICC lines, as a long-term access solution, enable a smooth transition from hospital to home care, with direct economic and operational benefit (Moureau et al., 2015).

Greek context and prospects

Although the use of PICC lines is well established internationally, in Greece their implementation is uneven and often depends on the availability of specialized nurses or appropriate equipment. Karagianni and Vasileiou (2022) note that limitations in funding and staff education are key barriers to the universal implementation of PICC lines in the Greek National Health System.

The adoption of a national nurse education program in PICC insertion, combined with standardized protocols for

monitoring costs and complications, could strengthen the effectiveness and sustainability of the practice. Furthermore, the integration of economic quality-of-care indicators, such as cost per hospital day and complication rate per 1,000 catheter-days, would allow the objective evaluation of PICC performance in the Greek National Health System.

Study limitations

As in every literature review, the findings are affected by certain limitations:

- the heterogeneity of the studies in terms of cost criteria and methodology,
- the absence of extensive Greek cost data,
- the difficulty of comparing different healthcare systems.

Nevertheless, the consistency of the results across international and domestic sources strengthens the reliability of the conclusions.

Overall interpretation

In summary, the review demonstrates that:

- PICC lines offer a significant economic advantage by reducing direct and indirect costs.
- Nursing education is critical for ensuring effectiveness and safety.
- The integration of PICC lines into the Greek National Health System requires institutional support, education and continuous cost-benefit evaluation.

These results highlight the need to strengthen nursing autonomy and invest in expertise, so that venous access through PICC lines can become a key tool for improving the quality and efficiency of care.

CONCLUSIONS

The present systematic review documents that peripherally insert central catheters (PICC) are a safe, effective and economically efficient solution for long-term venous access. Their use leads to a significant reduction in the overall cost of care because of fewer complications, shorter hospitalization and improved patient experience.

The nursing contribution is decisive both in the insertion process and in the management and monitoring of the catheter. Specialized Vascular Access Teams, in which trained nurses participate, achieve cost reductions of up to 40%, highlighting the importance of continuing education and the professional empowerment of nurses.

In the Greek context, the systematic integration of PICC lines requires:

- standardized protocols and guidelines,
- nurse education in the use of ultrasound guidance,
- continuous cost-benefit evaluation and assessment of quality-of-care indicators.

Strategic investment in PICC technology and nursing education can become a key pillar for modernizing Greek hospitals, strengthening the efficiency of the Greek National Health System and patient safety.

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