Professional and Technological Education on Peripheral Catheters in the Intensive Care Unit

Educação Profissional e Tecnológica Sobre Catéter Periférico na Unidade de Terapia Intensiva
Educación Profesional y Tecnológica Sobre Catéter Periférico en la Unidad de Cuidados Intensivos

RESUMO
A utilização de cateteres venosos periféricos (CVP) em Unidades de Terapia Intensiva (UTIs) é uma prática essencial, porém apresenta desafios relacionados à sua inserção e manutenção segura. O presente ensaio teórico analisa como a educação profissional e tecnológica pode aprimorar a capacitação dos profissionais de saúde no manejo adequado dos CVPs, reduzindo complicações como infecções e tromboses. A pesquisa destaca a importância de metodologias ativas, como simulações realísticas e o uso de tecnologia digital, na formação contínua desses profissionais. Além disso, discute-se a necessidade de atualização constante dos protocolos clínicos e a superação das barreiras institucionais para a implementação de estratégias inovadoras na educação em saúde. Conclui-se que a qualificação contínua e baseada em evidências é essencial para garantir a segurança do paciente e a eficiência dos procedimentos hospitalares.
DESCRITORES: Educação profissional; Terapia intensiva; Cateter venoso periférico; Simulação realística; Inovação tecnológica.

ABSTRACT
The use of peripheral venous catheters (PVC) in Intensive Care Units (ICUs) is an essential practice but presents challenges related to their safe insertion and maintenance. This theoretical essay analyzes how professional and technological education can enhance the training of healthcare professionals in the proper management of PVCs, reducing complications such as infections and thrombosis. The research highlights the importance of active methodologies, such as realistic simulations and the use of digital technology, in the continuous training of these professionals. Additionally, it discusses the need for constant updates to clinical protocols and overcoming institutional barriers to implementing innovative strategies in healthcare education. It concludes that continuous, evidence-based qualification is essential to ensure patient safety and the efficiency of hospital procedures.
DESCRIPTORS: Professional education; Intensive care; Peripheral venous catheter; Realistic simulation; Technological innovation.

RESUMEN
El uso de catéteres venosos periféricos (CVP) en las Unidades de Cuidados Intensivos (UCI) es esencial, pero presenta desafíos relacionados con su inserción y mantenimiento seguros. Este ensayo teórico analiza cómo la formación profesional y tecnológica puede mejorar la capacitación de los profesionales sanitarios en el manejo adecuado de los CVP, reduciendo complicaciones como infecciones y trombosis. La investigación destaca la importancia de las metodologías activas, como las simulaciones realistas y el uso de tecnología digital, en la formación continua de estos profesionales. Además, aborda la necesidad de la actualización constante de los protocolos clínicos y la superación de las barreras institucionales para la implementación de estrategias innovadoras en la formación sanitaria. Concluye que la formación continua basada en la evidencia es esencial para garantizar la seguridad del paciente y la eficiencia de los procedimientos hospitalarios.
DESCRIPTORES: Formación profesional; Cuidados intensivos; Catéter venoso periférico; Simulación realista; Innovación tecnológica.

Ana Quitéria Fernandes Ferreira
Nurse Coordinator at CCIH-HRMC/RN, Specialist in Auditing and Nursing in the ICU, Master's student in Quality Management and Patient Safety at UFRN.
ORCID: https://orcid.org/0000-0002-9242-0285

Aline Guarato da Cunha Bragato
Nurse. Master's and Doctorate in Health Care Higher education professor.
ORCID: https://orcid.org/0000-0002-5762-9518

José Antônio Bruno Quirino Costa
Nurse, postgraduate student in pediatrics and neonatal ICU.

Eric Santos Santana
Intensive care nurse and stoma therapist at the Intensive Care Center of Clementino Fraga Filho University Hospital, UFRJ - Brazilian Hospital Services Company.

Ana Gabriela Pires da Cunha
Nurse, Specialist in Surgical Center and CME, Cardiology and Hemodynamics, Family Health.

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INTRODUCTION

The use of peripheral venous catheters (PVCs) is an essential practice in intensive care units (ICUs), as they are fundamental for administering medications, fluids, and nutrients to critically ill patients. However, improper insertion and maintenance of these devices can lead to significant complications, such as phlebitis, leaks, and catheter-related bloodstream infections (CRBSI), increasing morbidity and hospital costs[1].

Given this scenario, professional and technological education aimed at healthcare professionals working in ICUs is essential to ensure the safety and quality of care provided. The continuous and up-to-date training of these professionals contributes to the adoption of evidence-based practices, reducing the incidence of complications related to the use of CVPs[2]. To this end, it is necessary to implement educational programs that address not only the technical aspects of catheter insertion and maintenance, but also clinical decision-making and risk management associated with the use of these devices[3].

The literature highlights the importance of continuing health education programs, ranging from the appropriate selection of the device to aseptic techniques for catheter insertion and maintenance[4]. In addition, the incorporation of active teaching methodologies, such as realistic simulations and interactive training, has proven effective in training professionals, promoting the improvement of technical skills and critical thinking[5]. Simulations allow professionals to experience diverse clinical scenarios in a safe environment, reducing practical errors and enhancing learning through experience.

Technological advances have also played a crucial role in professional education on the use of peripheral catheters. The use of digital platforms, virtual reality, and interactive online courses has expanded access to knowledge, enabling the training of professionals even in remote locations[6]. These advances allow for more flexible learning that is adaptable to the individual needs of professionals, ensuring better absorption of knowledge and its application in clinical practice.

Given this, this theoretical essay seeks to answer the following research question: How can professional and technological education influence the safe practice of peripheral venous catheter use in intensive care units? The overall objective of the article is to analyze the contributions of professional and technological education in training health professionals for the safe management of PCVs in ICUs, highlighting challenges and proposing pedagogical innovations that can improve clinical practice and minimize risks to patients. Thus, it is hoped to contribute to improving the quality of care in ICUs, promoting more effective teaching that is aligned with the demands of the healthcare system.

DEVELOPMENT

This study is a theoretical essay, a method that allows for critical reflection on a given topic, based on existing literature. This approach is appropriate when seeking to understand complex phenomena, such as professional and technological education related to the use of peripheral venous catheters (PVCs) in intensive care units (ICUs), allowing the analysis of concepts and practices in light of different theoretical perspectives. For an in-depth analysis, this essay will be structured into two main categories: 1) Challenges in Professional Education on the Use of Peripheral Venous Catheters in ICUs and 2) Innovative Strategies for Training Healthcare Professionals in Intensive Care.

1. Challenges in Professional Education on the Use of Peripheral Venous Catheters in ICUs

The insertion and maintenance of PCVs in critically ill patients require specific skills and up-to-date knowledge from healthcare professionals. However, several challenges permeate professional education in this context. The literature points out that the maintenance of catheters, such as the Peripherally Inserted Central Catheter (PICC), is challenging for nurses, requiring specific knowledge and skill development in view of the capillary fragility and physiological vulnerability of patients[6]. Complications associated with the improper use of these devices include obstruction, catheter rupture, vessel perforation, extravasation, and infections, highlighting the need for continuous training of professionals[6]

Additionally, the implementation of continuing education programs faces obstacles such as resistance from professionals to changes in established practices and a shortage of resources for ongoing training. Lack of time due to work overload in ICUs also hinders the participation of professionals in educational activities, compromising the updating necessary for safe practice[6].

The first word cloud highlights the main challenges faced in professional education on the use of peripheral venous catheters in intensive care units (ICUs). Elements such as "lack of continuous training," "resistance from professionals," and "work overload" highlight structural and cultural barriers that hinder the implementation of safe and up-to-date practices in catheter management.

Professional resistance to adopting new methodologies may be related to a rigid organizational culture that

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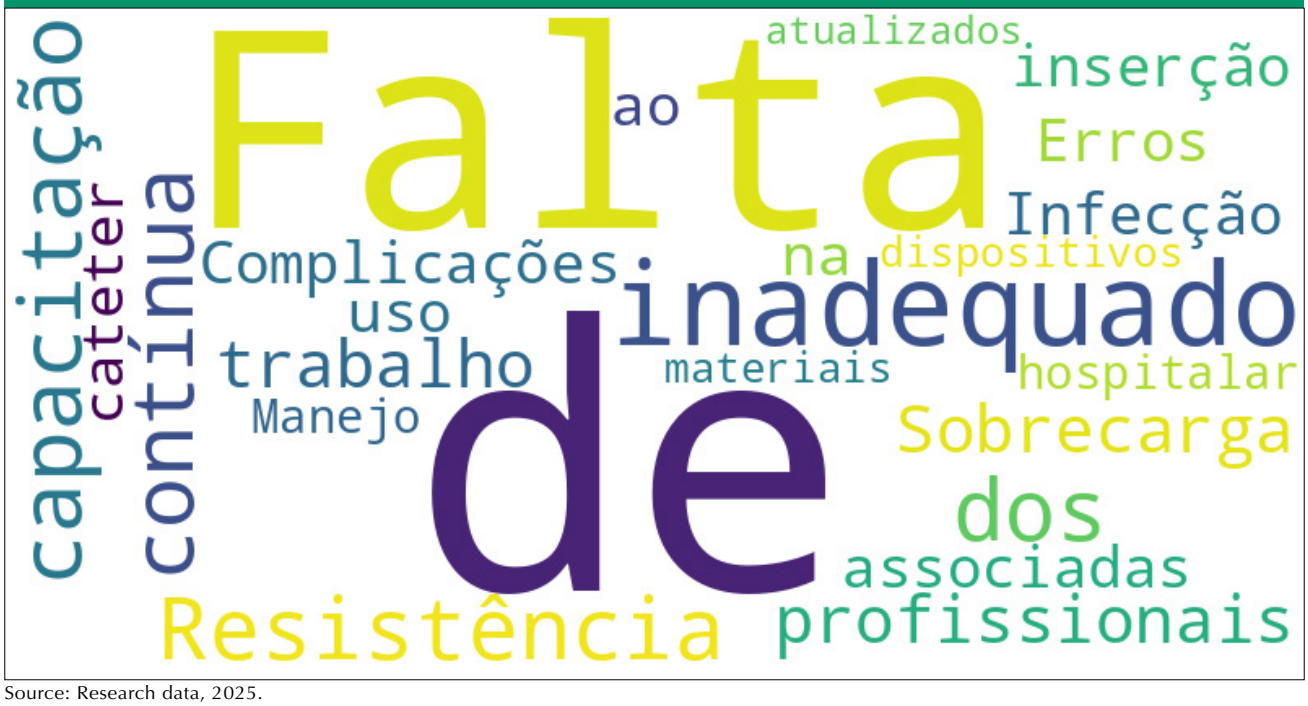
prioritizes traditional teaching and practice methods. The lack of continuous training, combined with work overload, compromises professionals' adherence to updated protocols, increasing the risk of complications such as "inappropriate device management" and "hospital infection."

Figure 1: Challenges in Professional Education in the context of intensive care:



Source: Research data, 2025.

These difficulties directly impact patient safety, increasing morbidity rates and prolonging hospital stays. Therefore, there is an urgent need to reformulate educational programs in the field to ensure that professional training is adaptable to technological changes and evidence-based guidelines.

2. Innovative Strategies for Training Healthcare Professionals in Intensive Care

In view of the challenges mentioned above, the adoption of innovative strategies in professional education emerges as a viable solution. Continuing education in intensive care units is considered a fundamental strategy for improving the care provided, promoting the continuous updating of professionals and the incorporation of new evidence-based practices[6].

A promising approach is the use of in situ simulation, which involves training in the real work environment, allowing professionals to face simulated clinical situations that reflect everyday challenges. This methodology has proven effective in improving theoretical and practical knowledge, in addition to promoting patient safety by reducing the occurrence of errors related to catheter handling[6].

Another relevant strategy is educational intervention focused on preventing complications associated with catheter use. Studies show that educational programs aimed at nursing staff result in significant improvements in theoretical knowledge about preventing complications that can lead to the non-elective removal of peripherally inserted central catheters[7] . Such interventions contribute to evidence-based practice and the quality of care provided in ICUs. In short, the continuous training of healthcare professionals through innovative educational strategies is essential to overcome the challenges in the use of peripheral venous catheters in intensive care units, ensuring the safety and effectiveness of care provided to critically ill patients.

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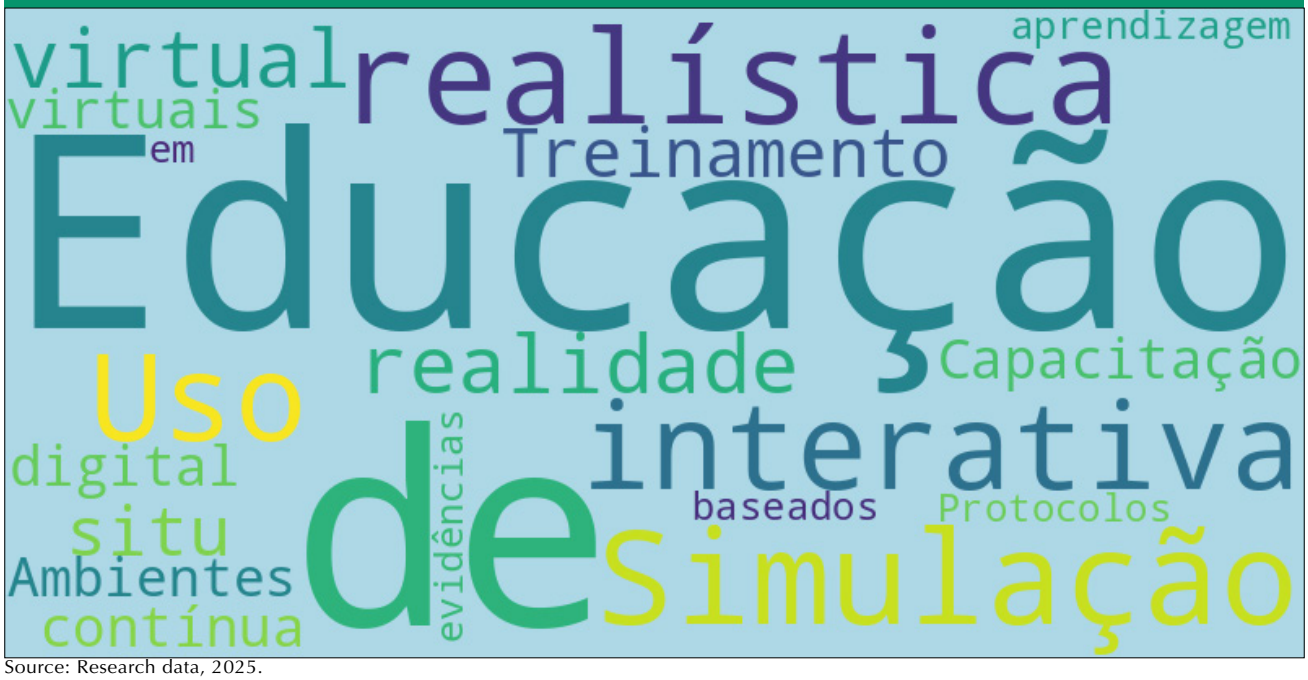
Figure 2: Challenges in Professional Education in the context of intensive care:



Source: Research data, 2025.

The second word cloud presents innovative approaches to overcoming challenges in professional training. Terms such as "realistic simulation," "use of virtual reality," and "digital education" reflect the advancement of teaching methodologies in the health field.

"Realistic simulation" emerges as a fundamental resource for developing practical skills in a safe environment, allowing professionals to face critical situations without risk to patients. The "use of virtual reality" and "virtual learning environments" represent an advance in remote and interactive training, enabling more dynamic and accessible learning, even for those working in high-demand units.

In addition, "continuous training" and the implementation of "evidence-based protocols" ensure that professionals are constantly up to date, reducing the incidence of complications related to the improper use of catheters. These strategies not only improve the quality of care provided but also promote a safer and more efficient environment in ICUs. However, despite the potential of these innovations, their implementation still faces challenges, such as the need for financial investment and the training of educators in the proper use of these technological tools.

Thus, the problematization of these two figures reinforces the need for a balance between identifying existing challenges and effectively implementing innovative educational strategies, ensuring the continuous training of professionals and the safety of patients in intensive care units.

Inadequate insertion and maintenance of peripheral venous catheters can result in significant complications, such as phlebitis and bloodstream infections, increasing patient morbidity and hospital costs. In this context, continuous and up-to-date professional education is essential for the adoption of evidence-based practices that minimize such risks[1].

Recent studies highlight the importance of educational programs that cover everything from proper device selection to aseptic techniques for catheter insertion and maintenance. The implementation of active teaching methodologies, such as realistic simulations and interactive training, has proven effective in training professionals, promoting the improvement of technical skills and critical thinking[5]. Simulations allow professionals to experience diverse clinical scenarios in a safe environment, reducing practical errors and enhancing learning through experience.

Technological advances have also played a crucial role in professional education on the use of peripheral catheters. The use of digital platforms, virtual reality, and interactive online courses has expanded access to knowledge, enabling the training of professionals even in remote locations[7]. These advances allow for more flexible learning that is adaptable to the individual needs of professionals, ensuring better absorption of knowledge and its application in clinical practice.

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However, challenges remain, such as professionals' resistance to adopting new methodologies and work overload, which can compromise adherence to updated protocols. The lack of continuous training, combined with these barriers, highlights the need to reformulate educational programs in the field, ensuring that professional training is adaptable to technological changes and evidence-based guidelines[2].

In conclusion, the integration of innovative teaching strategies with traditional approaches based on clinical experience is essential to minimize risks and optimize care practices, ensuring safer and more effective care for critically ill patients. Continued investment in professional education in the field of intensive care is essential to promote the constant updating of professionals and the implementation of evidence-based practices[3].

FINAL CONSIDERATIONS

Professional and technological education plays a crucial role in the qualification of healthcare professionals working in Intensive Care Units, especially in the safe management of peripheral venous catheters. The challenges faced in this context, such as the lack of continuous training, resistance to educational innovations, and work overload, compromise the implementation of safe and evidence-based practices.

However, innovative strategies, such as realistic simulations, interactive education, and the use of digital technologies, have proven effective in training professionals, allowing for more dynamic learning that is adaptable to the needs of the sector. The implementation of training that emphasizes practical learning and evidence-based decision-making can contribute significantly to improving the quality of care and patient safety in ICUs.

Therefore, it is essential to continue investing in professional education in the field of intensive care, promoting initiatives that encourage the constant updating of professionals. By integrating innovative teaching strategies with traditional approaches based on clinical experience, it is possible to minimize risks and optimize care practices, ensuring safer and more effective care for critically ill patients.

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