Benefits of Artificial Intelligence for Safe Care: Integrative Review

Benefícios da Inteligência Artificial para o Cuidado Seguro: Revisão Integrativa
Beneficios de la Inteligencia Artificial para el Cuidado Seguro: Revisión Integrativa

RESUMO
Este estudo investigou os benefícios da Inteligência Artificial (IA) na prática da enfermagem, focando na melhoria da qualidade do cuidado e segurança do paciente. Por meio de uma revisão integrativa, com a estratégia PICo, foram analisados 14 estudos publicados entre 2014 e 2024, em português e inglês, nas bases SciELO, BVS, EBSCO e PubMed. A IA foi aplicada em áreas como monitoramento de sinais vitais, análise de imagens, passagens de plantão e avaliação da carga de trabalho. Os benefícios incluem melhora no diagnóstico, redução de complicações e aprimoramento do cuidado clínico. No entanto, desafios como vieses de dados e overfitting foram apontados, indicando a necessidade de mais pesquisas e capacitação profissional. Apesar das limitações, a IA apresenta grande potencial para transformar a prática de enfermagem e melhorar a segurança do paciente, com avanços promissores na área da saúde.
DESCRITORES: Inteligência artificial, Segurança do paciente, Enfermagem.

ABSTRACT
This study investigated the benefits of Artificial Intelligence (AI) in nursing practice, focusing on improving care quality and patient safety. Through an integrative review using the PICo strategy, 14 studies published between 2014 and 2024 in Portuguese and English were analyzed, from SciELO, BVS, EBSCO, and PubMed databases. AI was applied in areas such as vital signs monitoring, image analysis, handover processes, and workload assessment. Benefits included improved diagnosis, reduced complications, and enhanced clinical care. However, challenges such as data bias and overfitting were noted, highlighting the need for further research and professional training. Despite limitations, AI shows significant potential to transform nursing practice and improve patient safety, with promising advances in healthcare.
DESCRIPTORS: Artificial intelligence, Patient safety, Nursing.

RESUMEN
Este estudio investigó los beneficios de la Inteligencia Artificial (IA) en la práctica de enfermería, enfocándose en la mejora de la calidad del cuidado y la seguridad del paciente. A través de una revisión integradora utilizando la estrategia PICo, se analizaron 14 estudios publicados entre 2014 y 2024 en portugués e inglés, provenientes de las bases SciELO, BVS, EBSCO y PubMed. La IA se aplicó en áreas como el monitoreo de signos vitales, análisis de imágenes, procesos de entrega de turno y evaluación de carga de trabajo. Los beneficios incluyeron mejoras en el diagnóstico, reducción de complicaciones y mejora del cuidado clínico. Sin embargo, se señalaron desafíos como el sesgo de datos y el sobreajuste, destacando la necesidad de más investigaciones y formación profesional. A pesar de las limitaciones, la IA tiene un gran potencial para transformar la práctica de enfermería y mejorar la seguridad del paciente, con avances prometedores en la salud.
DESCRIPTORES: Inteligencia artificial, Seguridad del paciente, Enfermería.

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INTRODUCTION

The concept of care has been updated every day, and, focused on the nursing area, it is currently understood as a set of knowledge and practical applications in patient care. This concept has been taking on a new form as new technological methods are applied to the health area and, consequently, to the nursing area, which reaches new lines of care and quality of care, changing the daily lives of professionals who benefit from these technologies and, thus, helping to improve the health system. [1]

In this context, nursing care has as its principle patient safety, fundamental in the daily practice of nurses inserted in the interprofessional team, being characterized as an organizational structure of actions, processes and creation of cultures and environments, with the objective of reducing risks and the occurrence of adverse events and their respective impacts. [2] Therefore, patient safety is taken into consideration in the development process in care focused on the health environment, related to current technologies and their incorporation into safe practices.

Among the major new technologies, artificial intelligence (AI) emerged as a term in 1956, by John McCarthy, during the conference "The Dartmouth Summer Research Project". Evolving over the following decades, AI took on a new form during the 1990s with the notorious Deep Blue computer, which demonstrated worldwide the power that AI could achieve [3], breaking new barriers in understanding data analysis and interpretation of technological processes. Since then, AI can be characterized as the branch of computer science, statistics and engineering, which uses algorithms to perform tasks and exhibit behaviors such as decision-making, learning and predictions. [4] From another perspective, AI is understood as the ability of electronic devices to operate in a logical way, resembling human thought, making decisions and solving problems. [5]

In this universe, two main requirements stand out: Machine Learning (ML), which is defined as an essential subtype of AI, which is based on statistical and mathematical models from which data analysis is defined, with these standards being applied to achieve task performance and predictions; and Big Data, which consists of a complex collection of data that is collected quickly and in almost unimaginable quantities, and dimensioned by its characteristics, such as the potential value that can be extracted from this data, the speed at which the data is generated and processed, the variety of data types and the veracity that guarantees the reliability of the processed data. [2]

In the contemporary healthcare scenario, machine learning is used in two main categories: as a supervised method, which has as an example the use of devices to interpret risks related to anticoagulant therapy, up to the detection of cancer, through x-rays, and the unsupervised method, in which no type of labeling of the data found is necessary, with one of its main objectives being to find hidden patterns, widely used in the generation of new hypotheses within the learning process [6], which naturally present themselves as challenging paradigms.

As a central element of care, nursing is no exception in redefining these paradigms related to the use of AI. In practice, nursing professionals can dedicate themselves to providing safe care, with high-level assistance, increasingly improving the quality of life and care of patients, as they incorporate new technologies into their daily lives [7], with nurses being one of the drivers of these new technologies for contact with patients. [1]

In the global context, AI is increasingly used, mainly in the integration of information between health units, standardizing assistance and quality levels, assisting professionals in creating care flows, triaging primary care patients, with diagnostic suggestions based on evidence analysis and assistance in managing complex cases using Big Data accumulated from Machine Learning. [8] In Brazil, the inclusion of AI in health also influences the professionalization of nurses, since the communication between AI and nursing begins from academic training until its use in the hospital environment, improving the patient experience in accessing care. [9] This occurs through continuing education, as AI can contribute by mediating training in areas such as leadership, skills improvement and real-time assessment of nursing teams, identifying specific deficiencies in practice and interdis-

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ciplinary cohesion within the professional community, through nursing management, the creation of standard operating procedures and an improvement in health services. [10]

Although AI is already used in healthcare in a wide range of possibilities, when focused on the nursing area, there has been little discussion about its possibilities for improving nurses' daily practices and its influence on patient safety.

> "When used at various levels, the discussion becomes pertinent when evaluating how AI contributes to optimizing the nursing process and, consequently, patient safety."

In view of this, the present study proposed to analyze scientific evidence on the benefits of AI for safe care. Furthermore, we sought to understand how AI optimizes the operational efficiency of daily nursing practice, aiming to obtain new horizons on the influence of technologies aimed at the health area and, specifically, nursing professionals, in the daily professional experience and their benefits for safe care.

METHOD

This is an integrative literature review, with the following phases: Identification of the theme and research question; Literature search; Data extraction or categorization; Critical analysis of the studies; Data interpretation; Presentation of the review. [11] The proposed theme is AI and its benefits in daily care practice. For the guiding question, the PICo strategy was used [12], having for Population/problem (nursing care), Intervention (use of AI), Context (Benefits in daily practice and patient safety), culminating in the guiding question: "How can artificial intelligence benefit daily nursing care and patient safety?"

The selection included articles published between 2014 and 2024, in Portuguese and English, available in full and free of charge, and addressing the topic of AI in nursing, in the databases: Scientific Electronic Library Online (SciELO) and Virtual Health Library (BVS), where it was possible to access other databases such as: IBECS; CINAHL Complete; Library, Information Science & Technology Abstracts, EBSCO. In addition, Google Scholar was used to guarantee studies from journals not indexed in databases, excluding literature reviews, incomplete texts or incompatible with the topic addressed. The following descriptors were used: enfermagem, cuidados de enfermagem, segurança do paciente, inteligência artificial, nursing, nursing care, patient safety e artificial intelligence, combined with the Boolean operators "AND", "OR" (table 1).

Table 1 – Description of descriptors. Ribeirão Preto, 2024.

Inteligência artificial E enfermagem, inteligência artificial OU enfermagem, Inteligência artificial E cuidados de enfermagem, inteligência artificial OU cuidados de enfermagem, inteligência artificial e segurança do paciente, inteligência artificial OU segurança do paciente, artificial intelligence AND nursing care, artificial intelligence OR nursing care, artificial intelligence AND nursing, artificial intelligence OR nursing, artificial intelligence AND patient safety, artificial intelligence OR patient safety.

For sample selection, the Rayyan® platform was used. [13] In the analysis of the strength of evidence, the classification proposed by Melnik/Fineout-Overholt was used [14], of hierarchical evidence from academic articles. After data collection, the results were compared to integrate the information collected, making it possible to find evidence relevant to the guiding question, using critical analysis of each piece of evidence found, followed by the presentation of the results. [12]

RESULTS

To identify and understand the benefits of AI in daily nursing care practice and patient safety, 1364 articles were initially obtained, of which 14 were eligible (figure 1).

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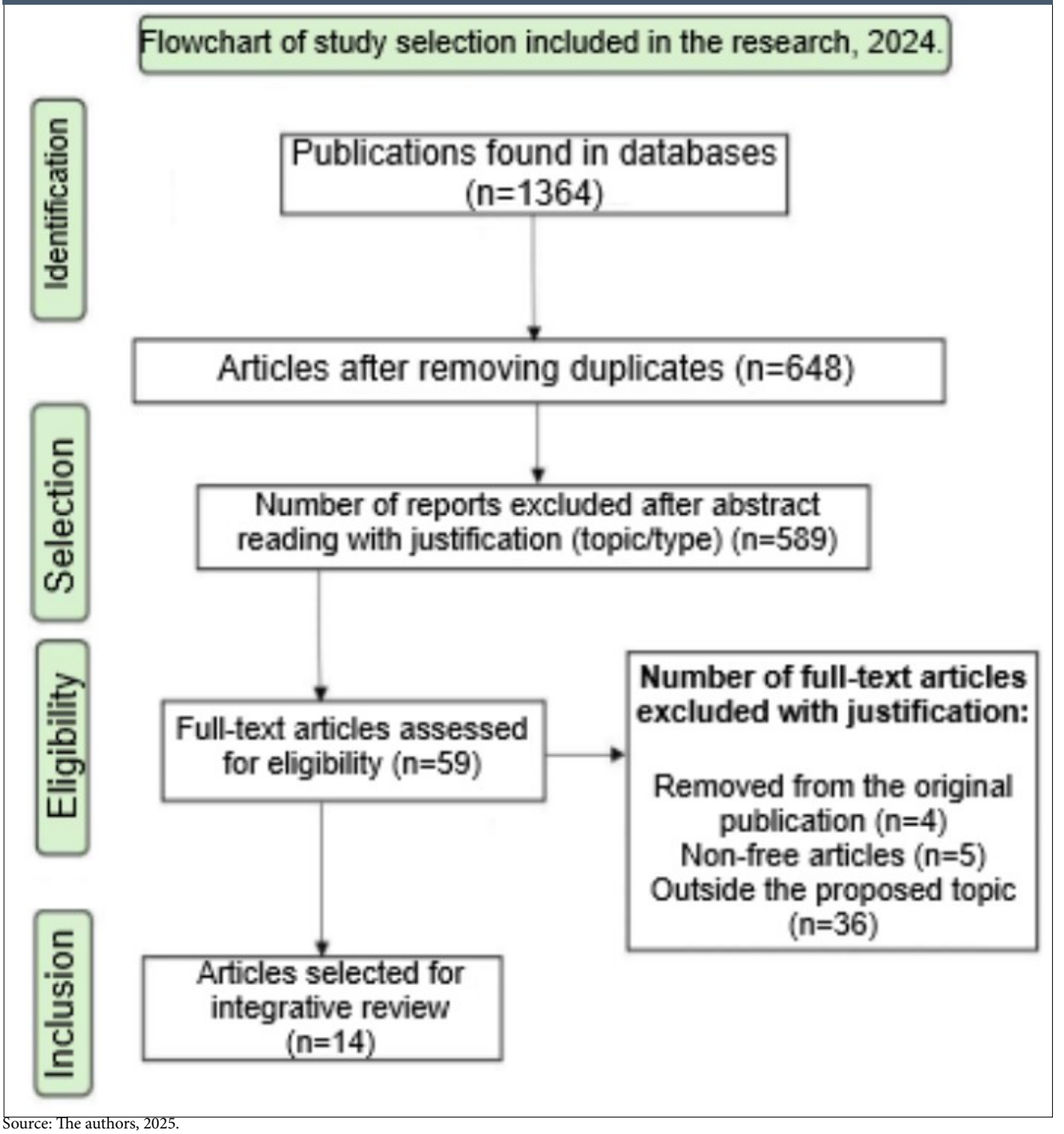
Figure 1 - Article selection flowchart.



Source: The authors, 2025.

Regarding the origin of the selected studies, Brazil (n=5/35.71%), United States (n=3/21.43%), China (n=3/21.43%), United Kingdom (n=1/7.14%), Turkey (n=1/7.14%), Taiwan (n=1/7.14%) predominate. The studies show a variety of intelligences used, different types of Machine Learning, evidencing a wide range of possibilities for AI in nursing (Table 2).

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Table 2: Reviewed articles on the benefits of AI for safe care.

Articles	Objective	Type of Artificial Intelligence (AI)	Benefits
A1	To describe the development and validation of an application for classification and assistance in topical therapy of burns in real time.	The application used AI to automatically assess and classify burns.	The application enabled automatic image diagnosis, classification of burn type and identification of appropriate treatments.
A2	Establishing whether it is safe to conduct nursing observation remotely from the nursing room using AI.	Sensors using AI software to detect micro movements and color changes (through photoplethysmography) from meters away.	The use of AI has improved the patient experience at night, as well as the safety of professionals during bedside visits, reducing adverse events.
A3	Identify patients at high risk of readmission in a 300-bed hospital.	ML was used to predict the likelihood of patients being readmitted within 30 days.	AI provided a useful way to identify patients at high risk of readmission in order to improve the quality of nursing care.
A4	To measure changes in diagnostic accuracy associated with AI assistance for primary care physicians and nurses without dermatology training.	An AI-based tool was developed for multi-reader, multi-case diagnostic study, and professionals retrospectively reviewed skin cases.	AI significantly improved the accuracy of diagnoses made by primary care physicians and nurses.
A5	A predictive AI was created for the early detection of micro-progressions of pressure injuries, based on nurses' perceptions, to aid in the effectiveness of care.	The AI was used to assess pressure injuries by image subtraction.	The AI achieved an accuracy of 89%, showing that it can be a tool to assist nursing in clinical care.
A6	To analyze critical alarms that predict clinical deterioration/sepsis for clinical decision-making in hospitalized patients.	A ML was used to evaluate predictors of clinical deterioration/sepsis in hospitalized patients.	The ML improved nurses' clinical decision-making, optimizing resources and nursing care.
A7	To explore the diagnostic value of ML-based digital subtraction angiography in hemodialysis patients and provide a theoretical basis for clinical nursing.	AI models were used to evaluate subtraction images of arteriovenous fistulas in the implementation of comprehensive nursing care.	The nursing intervention was better evaluated by patients with higher satisfaction in the experimental group, improving patient care and well-being.
A8	To evaluate an AI used to improve the diagnosis of ovarian endometriosis, while assessing how different nursing methods affect patient recovery.	An AI was used to visualize and process magnetic resonance images in patients with ovarian endometriosis.	By optimizing diagnostic accuracy, nursing benefits can be gained by improving care planning, with personalized interventions, reducing risks, and improving clinical outcomes.
A9	To explore the effect of ultrasound image evaluation using a nursing scheme based on AI algorithms in patients with diabetic nephropathy.	The AI based on the bee colony algorithm was used to evaluate images for monitoring diabetic nephropathy.	AI brought benefits in the management of diabetic kidney disease, reducing complications and improving patients' renal function.
A10	Qualify an AI added to a handover workflow.	No specific AI was used..	AI can bring benefits to perioperative nursing, such as handovers.
A11	Develop a Web App based on a predictive model to estimate the risk of hospitalization of COVID-19 patients in the ICU.	The application used AI based on a decision tree to predict the risk of hospitalization of COVID-19 patients in the ICU.	The application improved decision-making, contributing to the reduction of complications and optimization of hospital resources.
A12	To evaluate the predictive performance of different types of AI for the time required to perform bed baths in critically ill patients.	Several AI models were evaluated to estimate the time required to perform bed baths in critically ill patients.	AI helped professionals in decision-making and improved the planning and execution of interventions, optimizing the allocation of human resources and the work process.
A13	To assess the quality of obstetric and gynecological nursing plans created by AI models for the management of Postpartum Hemorrhage.	Three AI platforms were used to create care plans using the GRADE scale, testing the quality of AI-generated care plans.	AI was able to carry out the nursing care plan quickly and accurately.
A14	Implement an AI-based model to predict nurses' workload.	ML was used to develop the predictive classifier model.	Implementing an AI-based predictive model can bring improvements such as: shift planning, improved care, and nursing management.

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DISCUSSION

This review identified several benefits of AI in daily nursing care practice and patient safety. The selected sample also highlighted some pertinent limitations regarding clinical analysis and patient safety. Various ML models used in the selected studies were highlighted, as well as applications in daily nursing care practice, in various care processes, showing that AI can be used broadly.

Construction of AI models for application in nursing care

The application of AI in the nursing process is general and is not confined to a specific niche. Studies have obtained varied results according to the AI model used and its purpose in the research carried out.

Thus, for each ML construction used in the AI process, a specific plan model is developed, even if the knowledge source comes from the same base. [15] This is due to the way each model is constructed and its general construction, considering that, today, only the Med-PaLM model is used specifically for the health area. Thus, the authors state that each ML construction project that will feed the AI has a specific plan, depending on what is intended. Other authors [17-18] corroborate that ML is presented as the vector of construction and analysis in their studies, showing that before use, a learning model was created in which ML is trained before its application in a real test, obtaining results according to the characteristics of each data used by the Intelligence itself.

The studies have shown that AI can be beneficial not only in systems created without a direct focus on health, but also when developed to perform ML creation processes, specific to each area. By using data provided by experts, AI can be adapted to improve patient care, optimizing clinical practices and increasing safety. The personalization of these systems, based on real data, allows for a more efficient and precise approach, making AI a valuable tool both for improving prescriptions and interventions and for meeting specific needs in nursing care and quality of care.

Use of AI-enhanced images in nursing care

The use of AI can assist nursing based on images processed by AI itself, for better assessment and diagnosis of specific alterations. The use of AI for image analysis was used by Jiang *et al.* [20] Wu *et al.* [17], and Zhao *et al.* [19] with magnetic resonance imaging, microprogression imaging and ultrasound imaging. Magnetic resonance imaging with the Fuzzy C-means (FCM) algorithm in the diagnosis of patients with ovarian endometriosis has been shown to be highly beneficial for nursing practice. [20] FCM has significantly increased diagnostic accuracy, enabling more accurate interventions. It has also increased patient satisfaction and reduced postoperative complications. These technological advances, combined with a patient-centered approach, have improved recovery, quality of care, and well-being, demonstrating the positive impact of integrating AI and nursing practices into clinical care. [20]

Images by subtraction [17] also showed these benefits when the goal was to help nurses monitor and evaluate the effectiveness of pressure injury care. A predictive model for early detection of microprogression of pressure injuries was established using AI, from the perspective of nurses. In this model, AI uses two different images of the same injury and differentiates microprogressions, which can be evaluated by a nurse, with an AI prediction indicating whether or not there was wound progression. This model brought agility to diagnosis and interventions for timely treatment.

In subtraction images [19] that used AI to care for patients with diabetic nephropathy (DN), AI evaluated ultrasound images and demonstrated high accuracy in detecting changes in kidney function levels. This allowed nurses to monitor patients' progress more clearly, adapting interventions and assessment to manage vascular resistance and perform arteriovenous access punctures, techniques frequently used in the treatment of these patients. Furthermore, by applying AI, the study suggests that technology can act as a catalyst for safer and more efficient processes.

In primary care, the use of AI in teledermatology of skin lesions may also reveal an increase in diagnostic accuracy [19], indicating a decrease in the rates of biopsies and referrals to specialists. The need for biopsies in the study decreased by 2% for nurses, while the rate of referrals was reduced by 3%. These reductions are crucial, as biopsies are invasive procedures that can cause discomfort to the patient and involve additional costs for the healthcare system. By improving the ability of clinicians to correctly diagnose dermatological conditions, AI can not only save financial resources, but also reduce patients' stress and anxiety about unnecessary procedures.

Nurses' perception of the benefits of AI

In general, the studies describe nursing professionals as receptive to the AIs addressed, showing an openness in this process of transforming the profession in conjunction with the evolution of modern health. This demonstrates a favorable and very welcome acceptability, already traditionally attributed to nursing, which has shown itself to be revolutionizing itself every day, seeking new perspectives for safe patient care.

Another author [18] discusses this process of renewal and search for improvement, through the use of AI in

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the surveillance model for the care of acute patients in a psychiatric hospital. Surveillance brought safety not only in patient care, but also for the nurses themselves. Similarly, another study [16] highlighted that nursing professionals demonstrated relevance and effectiveness in the use of the AI-based application, contributing to the construction of a more precise intervention in the treatment of burns.

AI in Brazilian practice

In Brazil, studies report the benefits of AI in various models, taking into account their levels of coverage, showing that national nursing is also moving in tandem with international nursing in terms of the use of new AI technologies. In recent years, several technological solutions have been implemented, shedding light on the benefits of these interactions. [16,22-23] The use of AI in intensive care units has been found to have the potential to assist in clinical decision-making. [22] However, it pointed out the need for new studies to validate the model and integrate it into the electronic medical record, in order to guarantee its practical applicability and interoperability in the health environment, since there were failures and error biases in the tested application.

Another study [16] presented the importance of AI for clinical nursing practice, assisting in decision-making and facilitating access to information about burns. Although validation was limited to a single burn center, the study suggested that the application created in the research has the potential to be used in educational contexts and by laypeople, contributing to the qualification of care. For the authors, the use of AI in the classification and assistance in topical therapy of burns in real time brought effectiveness in care and a positive impact on their treatment, showing that nursing is able to use this resource, keeping up with technological developments and contributing to patient care.

The benefits of AI in the context of care management were also presented, demonstrating that length of hospital stay, risk of falls and pressure injury prevention protocols were crucial for calculating the workload of the nursing team. The study also highlighted the importance of care for elderly patients, who often have greater dependence on nursing professionals. AI proved to be effective in automating workload assessment, facilitating the planning of activity schedules and adequate staffing. [23]

In a study [24] using a platform for monitoring sepsis, it shows that AI can also optimize the process of rapid response to signs of clinical deterioration in patients with sepsis and COVID-19. Thus, the implementation of AI can provide improvements in nursing care and clinical decision-making, enhancing available resources even in environments where resource scarcity is challenging.

Therefore, it is possible to state that nursing in Brazil is aligning with international trends in the adoption of advanced technologies, although there are still limitations to be overcome. AI promises to be a crucial ally, both in clinical practice and in resource management, but it must be applied with caution, ensuring safety and precision in patient care specifically for Brazilians.

The relationship between the use of AI and patient safety

Although it is clear that the application of AI in nursing care contributes significantly to patient safety, the concept has not been explicitly stated in the reviewed articles, even though it is a fundamental principle in the care process. By its very nature, the care process is intrinsically linked to patient safety, serving as a basis from which the quality of care is assessed. From this perspective, several studies have demonstrated the importance of AI in improving the quality and safety of care.

An example of this is the study [19] which showed that AI not only improved clinical technique and practice, but also ensured safer patient care, avoiding losses of arteriovenous vascular access fistulas and improving comfort and care. These considerations were also in another study [25], by highlighting that patient safety is one of the main pillars in handovers. These authors demonstrated that the communication process can be flawed and AI was able to mitigate these errors and improve handovers by improving nursing interventions and diagnoses and consequently increasing patient safety.

In the context of psychiatric nursing [18], a study showed that the practice of surveillance and verification of signs using AI also helped in safe care, not only physically, but also in the intervention process and its influence on the psychiatric care of patients. With this, it was possible to carry out the treatment more carefully and without triggers caused by nursing interventions.

The study that used the integration of ML with electronic medical record systems [26] demonstrated that it was possible to accurately identify readmissions of high-risk patients, allowing for early, targeted nursing interventions. This approach improved the quality of care by highlighting medical and social factors that may contribute to readmission, such as multiple comorbidities, frequent use of emergency services, and socioeconomic factors. By providing detailed risk profiles, electronic health record systems allowed nurses and clinical teams to tailor care plans, ensuring a more efficient allocation of resources, especially for socially vulnerable populations. In addition, this technology promoted more proactive care, reducing lapses in care and potentially preventing complications, which contrib-

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uted to decreased readmissions and improved patient safety throughout the care continuum.

Challenges of the processes of using ML and AI applied in clinical practice

The benefits of AI in nursing show a variety of possibilities, but the shortcomings of AI and ML, obtained in the studies analyzed in this review, must also be considered. In other studies [17,20], have shown that AI can significantly improve diagnostic accuracy and clinical decision-making. However, these technological innovations have also presented challenges, with error bias being a central issue. Error bias occurs when AI models produce inaccurate results due to limitations in the training process, data collection, or inappropriate use of algorithms, which can compromise the quality of the body of knowledge built, and therefore the care provided.

A recurring problem in the use of AI is overfitting, which occurs when the model overfits the training data but fails when applied to new cases. This has been observed [17], where an AI model for detecting microprogression of pressure injuries showed high accuracy on the training dataset (89%), but this rate dropped significantly (59%) when validated with new data. This highlights the weakness of models that, when trained with a limited number of images or variables, end up being unable to generalize adequately to different clinical situations.

Another study that used the evaluation of a care plan for postpartum hemorrhage (PPH) generated by an AI model [15], revealed that the nursing diagnoses section presented medical diagnoses rather than appropriate nursing diagnoses, resulting in poor quality of information provided. Similarly, another study [16] showed that nurses had difficulty using the application to classify burns, highlighting the need for integration with AI through training and resolving doubts.

In addition, it should be considered that the lack of understanding of the nuances of patient care by AI can lead to inappropriate interventions, compromising the effectiveness of treatment and patient safety. Since AI does not have the ability to discern complex health contexts and individual patient experiences, it is plausible to infer that human supervision is essential for the interpretation and implementation of the data generated by these tools.

These error biases, AI failures and limitations can directly impact nursing practice, since incorrect diagnoses or inaccurate assessments can result in erroneous clinical decisions. Inappropriate use of AI can lead to inaccurate or unnecessary care interventions, which would compromise the quality of treatment offered to patients. Furthermore, over-reliance on AI systems without ongoing, expert human validation can put patient safety at risk, as the technology itself is not infallible.

To mitigate these challenges, it is essential that AI models are constantly improved and validated with a greater number of data and a diversity of clinical scenarios. Human supervision also remains essential, as nurses play a critical and decisive role in the continuous evaluation of the results generated by AI. Only with this integration between technology and human supervision will it be possible to ensure that AI truly contributes to the improvement of nursing practice, minimizing the impact of biases and technological failures.

Technology changes daily, and this also influences nursing care. Thus, AI becomes a main driver in the evolution of nursing on the global stage, enabling the use of technology at various levels of care processes in addition to management, always focusing on patient safety. The future of AI appears to be inevitable, placing professionals in a new cycle, generating new care plans and facilitating daily care, in the complexity of clinical assessment and interprofessional interventions.

CONCLUSION

The results analyzed in this review allow us to conclude that AI contributes to the daily practice of nurses and that, although patient safety is not explicitly addressed in the studies, the different types of AI that were built or tested were contributing significantly to improving the quality and safety of patients. Furthermore, AI error biases in practice constitute a real risk that must be managed critically, given the harm involved in using AI without systematic evaluations by trained professionals.

Such evidence allows us to conclude that new research should be carried out to mitigate these flaws. Therefore, the future of AI in daily nursing practice is promising, bringing real benefits to patients, professionals and health, as long as due care is taken with validation by human intelligence in its construction and application process.

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