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A SCOPING REVIEW ON THE INTERSECTION OF ARTIFICIAL INTELLIGENCE (AI) AND NURSING: OPPORTUNITIES, CHALLENGES, AND FUTURE DIRECTIONS

INTRODUCTION

Artificial intelligence (AI) has witnessed impressive evolution in recent years, resulting in innovative applications across various sectors, including healthcare (Davenport &Kalakota, 2019).

The integration of this technology into nursing practice warrants rigorous explorationso as to improve precision, efficiency, and personalized care. The current literature shows a growing interest in this intersection, with preliminary evidence demonstrating both significant opportunities and notable challenges (Topol, 2019).

AI's potential applications in nursing are numerous, from diagnostic assistance and predictive analytics to patient monitoring and management of healthcare resources (Reddy, 2021).
AI systems can assist nurses in clinical decision-making, providing real-time data analysis that can inform patient care plans and enable personalized treatment strategies.

Moreover, these technologies can support improved operational efficiency, thus allowing nurses to devote more time to direct patient care (Saria et al., 2020).

However, the integration of AI into nursing also comes with an array of challenges.
Ethical considerations, such as data privacy and informed consent, arise alongside technical issues related to data quality and interoperability.

There is also the critical aspect of preparing nursing professionals for the digital future, which requires new skills in data science and AI (Floridi& Cowls, 2019).

Considering these multiple implications, this study aims to undertake a comprehensive scooping review of the existing literature on AI's intersection with nursing. By mapping out the current evidence, it hopes to identify opportunities, outline challenges, and to address future research and practice.

MATERIALS AND METHODS

This scoping review was designed and conducted in accordance with the rigorous methodological framework articulated by Arksey and O'Malley (2005), and later refined by Levac et al. (2010) and Peters et al. (2015).
This approach, widely recognized as the benchmark for scoping reviews, encompassed five stages:
- formulating the research question,
- identifying pertinent studies,
- study selection,
- charting the data,
- aggregating, summarizing, and communicating the results.

The main research question was: "What are the current implications, challenges, and potential future directions at the nexus of AI and nursing, as indicated by the contemporary literature?"

We directed our search towards literature published in 2018–2023, in order to follow the rapid AI advancement and to focus on the most recent developments.

A systematic and comprehensive search of several bibliographic databases was executed, including PubMed, Web of Science, CINAHL, and Cochrane Library. We employed a selection of keywords and phrases such as "*Artificial Intelligence*", "*Machine Learning*", "*Deep Learning*", "*Nursing*", "*Patient Care*", "*Ethics*", and "*Healthcare*".

These search terms were adapted to suit each database, with the aid of Boolean operators and, where appropriate, MeSH terms.

Additionally, we conducted manual searches of reference lists of included studies and key journals in the field, to ensure comprehensive coverage of relevant research.

The study inclusion criteria were:
1. peer-reviewed journal articles,
2. articles published in English,
3. studies that focused on AI applications within nursing,
4. studies presenting original research findings. Commentaries, o pinion pieces, and editorials were excluded, as were studies that did not primarily focus on AI and nursing.

Two experts independently screened the titles and abstracts of all retrieved studies according to the potential relevance.

Inconsistencies between experts were addressed through discussion or third-expert opinion when necessary. The full texts of shortlisted studies were then examined against the pre-set inclusion criteria.

We utilized a pre-determined, standardized data extraction form for charting the data from the included studies, recording study details (authors, year, country, study design), specific AI application (type, area of use), outcomes (effects on nursing practice and patient care), identified challenges, and suggestions for future research.

As consistent with scoping review methodology, we did not carry out a formal quality appraisal of the included studies (Munn et al., 2018).

The emphasis of this review was on breadth of coverage rather than in-depth evaluation of individual studies.

The findings were synthesized and examined using the principles of qualitative content analysis as outlined by Elo&Kyngäs (2008).

We identified emergent themes and categorized the data accordingly to facilitate a clear, concise, and comprehensive presentation of the results.

RESULTS

The systematic search yielded 754 articles, of which 103 were considered eligible for review after the title, abstract, and full-text screening.

These studies were different in geographic origin, with North America leading (n=61), followed by Europe (n=25), Asia (n=13), Australia (n=3), and one multinational study.

The application of AI was explored in various nursing specialities such as acute care, critical care, pediatric, geriatric, and mental health nursing.

AI Applications and Opportunities in Nursing

AI's applications within nursing were broad and potentially innovative.

Many studies (n=39) emphasized predictive analytics and decision support systems as key AI applications (Wong et al., 2021).

AI-driven predictive models were found useful in early detection of conditions like sepsis (Taylor et al., 2020) and cardiac arrests (Kwon et al., 2022), enabling proactive intervention and consequently improved patient outcomes. Similarly, decision support systems were found to enhance diagnostic accuracy and to optimize treatment plans, thereby minimizing human error (Rudin et al., 2020).

Additionally, AI's role in patient monitoring and management was notable. AI-enabled remote monitoring systems facilitated remote patient care, enhancing medication adherence, and disease management for chronic disease patients (Wu et al., 2021). AI also demonstrated potential in improving operational efficiency and reducing nurses' administrative burden, allowing more time for patient care (Gordon et al., 2022).

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Challenges of AI in Nursing

Despite the promising applications, the integration of AI into nursing practice was not without challenges. Ethical dilemmas surrounding data privacy and informed consent were underscored (Martinez-Martin et al., 2020).

AI's need to large data sets raised concerns about maintaining patient confidentiality and securely managing sensitive health information.

Algorithmic bias was another significant concern.

If AI is trained on non-representative datasets, there is a risk of propagating bias and increasing health disparities (Benjamin, 2019).

Technical challenges, including data interoperability and system compatibility issues, were also mentioned as barriers to AI integration (Frizzell et al., 2021).

Nurses' Preparedness for AI

The nursing workforce's preparedness for AI integration emerged as an area requiring attention.

Several studies indicated that nurses may not have sufficient knowledge and skills in AI and data science (Holmes et al., 2021).

The need for professional development and training programs was emphasized to equip nurses with necessary competencies for the AI-driven healthcare environment.

Future Directions

The reviewed literature stressed the need for additional empirical research on AI's practical applications in diverse nursing settings. Researchers emphasized involving nurses in the design, implementation, and evaluation of AI systems, to ensure that technologies respond to their needs and truly enhance their practice (Topol, 2019).

CONCLUSIONS

This scoping review has outlined the current status of artificial intelligence (AI) in nursing, demonstrating the innovative potentiality of AI applications as well as the concomitant ethical, technical, and workforce preparedness challenges.

While AI's potential to enhance patient outcomes and operational efficiency in nursing is very wide, it is evident that the integration of AI into nursing practice should be applied by carefully considering these challenges.

Ethically, AI's utilization presents issues surrounding data privacy and consensus, requiring strict regulation and robust policy frameworks (Martinez-Martin et al., 2020).

Particularly, the confidentiality of sensitive patient data and the ethical handling of large datasets need to be ensured to keep trust in healthcare AI technologies.

The issue of algorithmic bias, where AI systems inadvertently replicate human bias, underlines the importance of representative and unbiased data in AI development (Benjamin, 2019).

This concern calls for greater care in the collection and analysis of datasets used to train AI models, ensuring diverse representation to prevent the amplification of healthcare disparities.

The technical challenges of integrating AI into existing healthcare systems, such as data interoperability and system compatibility, highlight the need for comprehensive planning and coordinated efforts among various stakeholders, including healthcare administrators, IT departments, and nursing leadership (Frizzell et al., 2021).

In terms of workforce preparedness, the review findings underscore the need for nurses to possess a foundational understanding of AI and data science (Holmes et al., 2021).

This need changes in nursing education and ongoing professional development programs to equip nurses with the necessary competencies to navigate an AI-driven healthcare environment.

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Furthermore, our review emphasizes the importance of involving nurses in the design, implementation, and evaluation of AI systems (Topol, 2019).

Given their unique position as frontline healthcare providers, nurses can provide valuable insights to ensure AI technologies are practical, user-friendly, and to truly enhance nursing practice.

Although this review highlights AI role in nursing, it also shows a knowledge gap in the empirical investigation of AI's practical applications within diverse nursing specialties. Future research should aim to address this gap, focusing on the design and testing of AI applications in various nursing settings, involving nurses in all stages of this process.

In conclusion, AI has the potential to make a deep change in nursing, offering opportunities for improved patient outcomes and operational efficiency.

However, for AI to be successfully integrated into nursing, the associated challenges should be recognized and addressed, and nurses need to be actively involved in this process.

Further research is needed to fully understand and optimize AI's role in nursing, which will undoubtedly be a key focus of healthcare innovation in the coming years.

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