

A Review of Barriers, Facilitators, and Contextual Factors for the Integration of Artificial Intelligence in Nursing Education

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Abstract

Background: Artificial intelligence (AI) is becoming more common in healthcare and health professions education, but it is still not consistently used in nursing programs because of a number of contextual factors. To help with effective implementation and curriculum development, it's important to know what makes it easier or harder for nursing schools to use AI.

Methods: A scoping review was performed utilising the Peters et al. framework to delineate the current evidence regarding AI integration in nursing and allied health professions education. A systematic search of Google Scholar, PubMed, and Semantic Scholar yielded 1,245 records; subsequent screening and full-text evaluation resulted in 42 studies that satisfied the inclusion criteria. Data from empirical studies, case reports, policy papers, and discussion articles were extracted and thematically synthesised to identify principal barriers, facilitators, and contextual influences.

Results: Major problems included a lack of technological infrastructure, problems with interoperability, and a lack of technical support. There were also gaps in knowledge and skills among teachers and students. Concerns about ethics and privacy, a reluctance to change, a lack of resources, and unclear policies and regulations made it even harder for AI to be adopted. Facilitators included active participation from stakeholders, thorough training focused on AI, a supportive infrastructure, clear policy frameworks, proven benefits for learning and clinical decision-making, and collaboration between different fields. Regional, cultural, and contextual disparities significantly impacted the degree and character of AI integration, with affluent environments typically more equipped to adopt AI-enhanced education.

Conclusion: The integration of AI into nursing education is influenced by a complex interplay of technological, educational, ethical, policy, and contextual factors. To make AI adoption in nursing curricula more meaningful, it is important to deal with known barriers and strengthen facilitators using strategies that are sensitive to the context and have many different parts. The review provides a foundation for creating standardised AI curricula, funding infrastructure, and guiding future implementation research and policy in nursing education.

Key Words: Artificial Intelligence, Nursing Care, Nurses, Barriers, Facilitators and Integration

Background of the Study

Artificial intelligence (AI) is becoming increasingly embedded in healthcare. While AI is

now used in the field, its role in clinical practice and in educating health professionals remains a topic of debate.⁽¹⁾The integration of artificial intelligence (AI) into healthcare has emerged as a transformative

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force, with the potential to significantly enhance medical diagnosis, treatment, and overall healthcare delivery.⁽²⁾ Advancements in accessible storage, faster networks, and more powerful computing have enabled the integration of AI into numerous healthcare services. AI has now reached a level of maturity that allows its application in image analysis, predicting disease patterns, and triage across a range of medical fields, such as radiology, gynecology, neurology, cardiology, pathology, and robotic surgery.⁽³⁾ AI is becoming a growing trend in healthcare, driven by increased access to medical data and algorithm development. Healthcare AI integration has a unique potential to enhance healthcare services.^(4,5)

John McCarthy came up with the idea for artificial intelligence (AI) at the Dartmouth conference in New Hampshire in 1956. It refers to a new field of science that studies and creates theories and methods. Artificial intelligence (AI) is a type of computer technology that can imitate how people act and do things that people can't do.⁽⁶⁾ In recent years, AI has been used more and more in medicine, thanks to advances in data analysis, image recognition, and other technologies. This is especially true for processing medical images and making intelligent clinical decisions. AI opens up new ways to find diseases early, diagnose them correctly, and treat and manage them in a way that works best for each person.^(7,8)

Advances in machine learning, especially deep learning, along with GPU and public database development, have enabled big data usage and sparked worldwide interest in AI technology.⁽⁹⁾ Recently, artificial intelligence (AI) has gained prominence in diabetes research and clinical practice owing to its capacity to effectively and precisely manage and analyse extensive clinical and behavioural data.⁽¹⁰⁻¹²⁾ Artificial intelligence methodologies, encompassing machine learning (ML) and deep learning (DL), are employed to develop predictive models that facilitate clinical decision-making, enhance the forecasting of complication risks, and customise treatment strategies.^(13,14) AI applications in diabetes treatment encompass early

diagnosis, automated insulin dose control, and the identification of important glycaemic abnormalities, thereby establishing a novel paradigm in precision medicine for diabetes. Nonetheless, the obstacles and facilitators identified by healthcare professionals in the efficient incorporation of these AI-based technologies into standard clinical practice remain predominantly uninvestigated.^(13,15)

AI-powered predictive analytics enables proactive healthcare management. For example, AI can analyse continuous glucose monitoring data to predict and prevent diabetic crises or interpret electrocardiogram (ECG) signals from ubiquitous devices to detect arrhythmias prior to their onset.⁽¹⁶⁾ As the first people to see patients in different healthcare settings, clinicians are very important in making decisions and are the main gatekeepers for the use and integration of AI solutions. Their perspectives on the barriers and enablers to AI acceptance and deployment are expected to influence the degree and manner in which AI tools are embraced and integrated into clinical practice in a variety of situations. Furthermore, the regional context of clinicians' practice, including policy frameworks and cultural differences, influences AI adoption.⁽¹⁷⁾

AI algorithms have been actively incorporated into various domains, including the identification of biomarkers, the selection and initial screening of appropriate populations, the repurposing of therapeutic pharmaceuticals, and the detection of adverse events (AEs). These purposes include finding new drugs, clinical studies before a medicine is sold, and keeping an eye on safety once a drug is sold.⁽¹⁸⁾

Randomized controlled trials have provided evidence supporting the safety and efficacy of AI-assisted decision-making software in a range of therapeutic fields. In terms of disease detection, these tools have enabled the early identification of patients with low ejection fraction, enhanced the detection rates of actionable lung nodules, and increased the identification of polyps that are often overlooked.^(19,20) Recent research has shown that computer-aided detection (CAD) systems powered by artificial intelligence have the ability to improve

the accuracy of chest radiographs used to test for lung cancer.⁽²¹⁾

In the context of breast imaging, artificial intelligence offers advantages as well as difficulties. In particular, the challenges and facilitators related to the incorporation of AI systems into clinical breast imaging settings have not been fully described. The obstacles to AI application in breast cancer imaging have been somewhat examined in earlier scoping reviews, but they have not provided a thorough study of these obstacles.^(22,23)

Despite the many advantages, emergency care facilities have been slow to adopt Clinical Decision Support Systems (CDSSs), even those built on artificial intelligence. Common complaints about their ineffectiveness and low adoption rate include problems with usability, a lack of interaction with other medical systems, a lack of time, and alert fatigue.^(24,25)

The extensive body of academic literature reveals a complex array of ideas regarding the implementation of AI in healthcare.⁽²⁶⁻²⁸⁾ However, most of our comprehension of these complex barriers and facilitators is derived from anecdotal accounts and narrative reflections, frequently devoid of a solid basis in empirical facts or strong theoretical frameworks.⁽²⁹⁻³¹⁾ Thus, the process of attaining successful AI implementation in healthcare remains enigmatic. We lack a detailed map of the numerous parameters that affect the incorporation of AI into therapeutic settings. This study utilises implementation science to identify the facilitators and constraints by analysing existing implementation narratives.

Research Question Based on the PICO Population/ Participants, Concept and Context (PCC) as outlined by Peters et al.⁽³²⁾

What are the obstacles and enablers to the integration of artificial intelligence among nursing educators and students within the realm of nursing education, concentrating on the notion of AI adoption and implementation?

Objective of the Study

This study seeks to identify and synthesize the primary barriers and facilitators to the integration of artificial intelligence (AI) in nursing education. It further examines the impact of regional, cultural, and contextual factors on AI implementation and offers evidence-based recommendations for overcoming obstacles and leveraging facilitators to enhance the adoption of AI in nursing education.

Methods

Design

To pinpoint the main obstacles and enablers for incorporating artificial intelligence (AI) into nursing education, a scoping review method was chosen. This approach, as opposed to a systematic review, highlights the exploratory and conceptually unclear nature of the field. The scoping review follows the framework proposed by Peters et al.⁽³²⁾ and involves these steps: (1) Setting the objective and formulating the research question, (2) Defining criteria for selecting pertinent sources, (3) Planning the strategy for searching, selecting, extracting, and presenting evidence, (4) Finding relevant sources, (5) Applying inclusion and exclusion criteria to select eligible sources, (6) Gathering pertinent data from the chosen sources, (7) Analyzing the extracted data in accordance with the research objective, (8) Organizing and reporting the results, and (9) Summarizing the findings, drawing conclusions, and discussing their implications.

Results Study

Selection and Characteristics

The search strategy found a total of 1,245 records on Google Scholar, PubMed, and Semantic Scholar. After getting rid of duplicates and looking at the titles and abstracts, 78 full-text articles were checked to see if they were eligible. After applying the inclusion and exclusion criteria, 42 studies were incorporated into the review.

These studies included empirical research articles, case reports, policy papers, and discussion

papers that concentrated on the integration of AI in health professions education, especially in nursing education. The studies were conducted in North America, Europe, Asia, and Australia, which shows that they took place in different cultural and regional settings.

Obstacles to the Integration of AI in Health Professions Education The literature revealed several significant barriers:

1. **Technological Problems:** AI adoption was slowed down by poor infrastructure, AI systems that couldn't work with existing educational platforms, and not enough technical support.
 2. **Knowledge and Skill Gaps:** Teachers and students often didn't know enough about AI concepts and uses, which led to resistance or misuse.
 3. **Ethical and privacy concerns:** Stakeholders were worried about data security, patient privacy, and the moral use of AI-generated information.
 4. **Resistance to Change:** Cultural and institutional inertia, doubts about AI's dependability, and worries about losing jobs made people hesitant to use AI tools.
 5. **Resource Constraints:** Lack of money and training materials made it hard to use AI technologies in the classroom.
 6. **Uncertainty about policies and rules:** Unclear rules about how AI can be used in schools and hospitals made it hard for people to use it widely.
2. **Comprehensive Training Programs:** Teaching people the basics of AI, how to use it, and the ethical issues that come with it gives them the skills they need to use it safely and effectively.
 3. **Supportive Infrastructure:** Investments in compatible technology platforms, reliable internet access, and technical help make integration go more smoothly.
 4. **Clear Policy Frameworks:** Creating rules and standards for how AI can be used in schools and hospitals makes things less confusing and more trustworthy.
 5. **Proven advantages:** Proof that AI improves learning outcomes, clinical decision-making, and patient care encourages use.
 6. **Working together across fields:** Collaborations between computer scientists, teachers, and healthcare workers improve the design and use of AI tools.

Things that help AI become a part of health professions education

The literature also found things that help AI integration work well:

1. **Stakeholder Engagement:** Getting teachers, students, doctors, and policymakers involved in the development and use of AI helps it be accepted and useful.

Effects of Contextual, Cultural, and Regional Factors The acceptance of AI was greatly impacted by regional differences in educational resources, cultural views, and technological advances. Due to improved finance and infrastructure, high-income nations, for instance, showed stronger integration of AI, while low- and middle-income regions encountered more significant obstacles. Acceptance levels were influenced by cultural elements such as professional norms and technological trust. Wide variations in policy contexts also have an impact on the extent and speed of implementation.

Discussion

This scoping review emphasises the intricate interaction of technological, educational, ethical, cultural, and policy-related aspects affecting AI incorporation in nursing education. Although AI possesses transformative potential for improving education and clinical readiness, surmounting obstacles necessitates comprehensive approach. Highlighting stakeholder engagement, customised training, strong infrastructure, and transparent governance can expedite AI

deployment. Implementation strategies should be guided by regional and cultural nuances to guarantee contextual relevance and equity. The results correspond with the extensive literature on healthcare AI application, highlighting the necessity for empirical, theory-based research to enhance comprehension of facilitators and barriers. This review synthesises existing research and establishes a basis for focused interventions and policy formulation in nursing education. Constraints The review is constrained by possible publication bias and the heterogeneity of the included research, which differed in design, focus, and quality. The swift advancement of AI technologies may surpass the existing literature. Moreover, the emphasis on nursing education may restrict applicability to other healthcare professions.

Conclusions

The effective incorporation of AI in nursing education requires the resolution of technological, educational, ethical, and contextual challenges, alongside the utilisation of facilitators like stakeholder engagement and supportive policies. Strategies that are customised to regional and cultural contexts are crucial. Future research must focus on the empirical assessment of implementation interventions and the development of strong theoretical models to provide guidance. This scoping review has certain problems, such as possible publication bias because it doesn't include unpublished studies, grey literature that wasn't found in the databases investigated, and publications in languages other than English. These things could make the evidence less complete. The differences in design, focus, context, and quality of the studies that were included make it hard to compare them and stop us from formally judging their effectiveness or causality. Also, because AI in education is changing so quickly, the results could go out of date very quickly, especially when it comes to newer tools. Finally, the main focus on nursing and health professions education may make it hard to use the results in other educational or clinical contexts, especially in places with few resources.

Ai Adoption in Health Professions Education.

Recommendations

Create standardised AI curricula that include technical skills, ethics, and real-world uses.

Put money into infrastructure and technical support that is specific to schools.

Encourage people from different fields to work together to make AI tools that put the user first.

Set clear rules and policies for how AI can be used in education and practice.

Encourage all stakeholders to get involved to make the project more acceptable and useful.

Do long-term studies to see how integrating AI affects educational and clinical outcomes.

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