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Review Article

Artificial Intelligence Applications in Nursing and Clinical Decision-Making: A Review

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Abstract

Background: The increasing use of artificial intelligence (AI) in healthcare has created new opportunities to support clinical decision-making and improve the quality of care. In nursing practice, AI technologies are being adopted to assist with patient monitoring, risk assessment, and workflow management.

Aim: The aim of this review is to analyze the role of AI in nursing practice, with emphasis on its applications in clinical decision-making, impact on patient outcomes, and challenges to implementation.

Methods: A narrative review of the literature was reported using Google Scholar to identify peer-reviewed articles related to AI, nursing practice, and clinical decision support systems (CDSSs). Relevant studies were selected according to predefined inclusion and exclusion criteria and synthesized thematically.

Findings: The review highlights the use of key AI technologies in nursing, including machine learning, natural language processing, expert systems, and robotics. CDSSs were commonly reported as effective tools for supporting nursing decisions related to patient safety, early warning systems, and care planning. AI applications were associated with improved quality of care, reduced errors, and enhanced nursing efficiency. However, challenges such as data quality issues, lack of interoperability, limited AI literacy among nurses, and concerns related to usability and trust were frequently reported.

Conclusion: AI has the potential to enhance nursing practice and clinical decision-making. Strengthening education, improving system design, and addressing implementation barriers are essential for the successful integration of AI into nursing care.

Keywords: Artificial intelligence, clinical decision support systems, decision-making, nursing informatics, nursing practice

Introduction

Artificial intelligence (AI) has become an important component of modern healthcare, supporting clinical decision-making through technologies such as machine learning, natural language processing (NLP), and clinical decision support systems (CDSSs). In nursing practice, AI helps manage complex patient data, improve clinical efficiency, and support timely, evidence-based care. Nurses play a critical role in patient assessment and care planning, often under increasing workload and clinical complexity. AI-based tools assist by analyzing large datasets, identifying risks, and supporting clinical judgments, thereby enhancing patient safety and care quality.

However, the adoption of AI in nursing remains uneven due to ethical concerns, data privacy issues, limited transparency, and gaps in digital skills. In addition, evidence specifically focused on nurse-led decision-making is limited. This review therefore aims to summarize current literature, highlight

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applications of AI in nursing, and identify challenges and future research needs.

Definitions: AI, Clinical Decision-Making, and Nursing Practice

AI refers to the field of computer science focused on developing systems capable of performing tasks that typically require human intelligence. In healthcare, AI includes technologies such as machine learning, NLP, and expert systems that analyze complex data, support predictive modeling, and assist clinical decision-making.

Clinical decision-making is a structured process in which healthcare professionals collect and interpret patient information to make informed decisions regarding diagnosis, treatment, and care. In nursing, this process involves ongoing patient assessment, critical thinking, prioritization of interventions, and the application of clinical knowledge and evidence-based guidelines to ensure safe and effective care. Nursing practice includes a wide range of professional activities aimed at health promotion, disease prevention, and holistic patient care.[1] It involves direct clinical care, patient advocacy, health education, care coordination, and participation in interdisciplinary decision-making. The integration of AI into nursing practice can enhance these roles by supporting clinical reasoning, reducing cognitive workload, and allowing nurses to focus more on patient-centered care.[2]

Methodology

Search strategy

A structured literature search was carried out using Google Scholar to identify relevant studies on AI applications in nursing and clinical decision-making. The search included keywords such as AI, AI in nursing, clinical decision-making, CDSS, machine learning in healthcare, and nursing informatics. These terms were used individually and in combination to retrieve a broad range of relevant publications. The search was limited to articles published in English in peer-reviewed journals.

Selection criteria

Studies were selected based on predefined inclusion and exclusion criteria. Articles were included if they discussed AI technologies applied in nursing practice or nurse-related clinical decision-making. Both review articles and original research studies were considered. Studies were excluded if they focused solely on physician-centered applications, technical algorithm development without clinical relevance, non-peer-reviewed literature, or articles without full-text access. Titles and abstracts were initially screened, followed by full-text evaluation of eligible studies.[3]

Data extraction and synthesis approach

Data were extracted systematically from the selected studies, including information on study design, type of AI technology, nursing application, and reported outcomes related to clinical decision-making or patient care. A narrative synthesis approach was used to analyze and summarize the findings due to variation in study designs and AI applications. The extracted information was grouped into thematic categories to highlight key applications, benefits, challenges, and research gaps related to AI in nursing and clinical decision-making.[4]

Types of AI Technologies in Nursing

Machine learning and predictive analytics

Machine learning involves algorithms that learn from historical and real-time healthcare data to identify patterns and make predictions. In nursing practice, machine learning and predictive analytics are widely used for early risk identification, such as predicting patient deterioration, infection risk, hospital readmissions, and length of hospital stay. These tools assist nurses in prioritizing care, supporting timely interventions, and improving patient safety. Predictive models also help in workload management and resource allocation by forecasting patient needs based on clinical trends.[5]

NLP

NLP enables computers to understand and analyze unstructured clinical text, such as nursing notes, electronic health records (EHR), and discharge summaries. In nursing, NLP applications support clinical documentation, extract meaningful information from free-text records, and improve communication across healthcare teams. NLP-based systems can assist nurses by reducing documentation burden, identifying relevant clinical information, and supporting decision-making through automated alerts and summaries derived from patient records.

Expert systems and rule-based CDSS

Expert systems and rule-based CDSSs are among the earliest and most widely implemented AI technologies in healthcare. These systems use predefined clinical rules, guidelines, and protocols to support nurses in making consistent and evidence-based decisions. In nursing practice, CDSS applications assist with medication administration, clinical assessments, care planning, and adherence to clinical guidelines. By providing alerts, reminders, and recommendations, these systems enhance clinical accuracy and reduce the risk of errors.[6]

Robotics and automated tools

Robotics and automated tools represent an emerging area of AI application in nursing. These technologies are used to support routine and physically demanding tasks, such as patient transport, medication delivery, vital sign monitoring, and infection control. In some settings, robotic systems also assist with patient rehabilitation and companionship, particularly in long-term care environments. By automating repetitive tasks, robotics helps reduce nurse workload, improve efficiency, and allow nurses to focus more on direct patient care and clinical decision-making.

CDSS

Role and functioning in clinical decision-making

CDSSs function by integrating patient-specific data with clinical knowledge, guidelines, and decision rules to support clinical judgments. In nursing practice, these systems analyze information such as vital signs, laboratory results, medication records, and nursing assessments to generate real-time alerts or recommendations. By supporting nurses in recognizing clinical risks, prioritizing care, and adhering to evidence-based protocols, CDSSs enhance consistency and accuracy in clinical decision-making while reducing cognitive workload.

Examples of CDSS in nursing practice

In nursing practice, CDSSs are commonly used for medication administration safety, including dosage verification and drug interaction alerts. They also support clinical assessments by identifying early warning signs of patient deterioration, such as sepsis or respiratory failure. Additional applications include pressure injury risk assessment, fall prevention, infection control, and adherence to standardized care pathways. These systems are often integrated into EHR, enabling seamless access during routine nursing workflows.

Effectiveness and outcomes in decision support

Evidence from the literature suggests that CDSSs improve decision accuracy, enhance adherence to clinical guidelines, and reduce the incidence of preventable errors. In nursing, the use of CDSS has been associated with improved patient safety, better clinical outcomes, and increased efficiency in care delivery. By providing timely and relevant information, CDSSs support nurses in making informed decisions, leading to improved quality of care and optimized clinical performance.[7]

Applications of AI in Nursing Practice

Patient monitoring and early warning systems

AI-driven patient monitoring systems continuously analyze real-time and historical clinical data, including vital signs, laboratory values, and nursing observations. These systems are designed to detect subtle physiological changes that may indicate early patient deterioration. Early warning systems supported by AI help nurses identify high-risk patients, generate timely alerts, and initiate prompt interventions. This proactive approach supports patient safety, reduces adverse events, and improves outcomes, particularly in critical care and acute care settings.

Diagnostic and predictive applications

AI technologies are increasingly used to support diagnostic processes and predictive decision-making in nursing practice. Predictive analytics models assist in identifying patients at risk of complications such as infection, pressure injuries, falls, or readmission. These applications enable nurses to prioritize care, implement preventive strategies, and individualize care plans. By supporting early and accurate risk assessment, AI enhances clinical judgment and promotes evidence-based nursing interventions.

Workflow optimization and documentation support

Workflow optimization is a major area where AI contributes to nursing practice. AI-powered systems automate routine administrative tasks, including clinical documentation, data entry, and information retrieval from EHR. NLP tools assist in summarizing nursing notes and improving documentation accuracy. By reducing documentation burden and minimizing repetitive tasks, AI allows nurses to dedicate more time to direct patient care and clinical decision-making.[8]

Resource allocation and staffing tools

AI applications also support nursing management through efficient resource allocation and staffing optimization. Predictive staffing tools analyze patient acuity, admission trends, and workload patterns to forecast staffing requirements. These systems help ensure appropriate nurse-to-patient ratios, reduce workload imbalance, and support workforce planning. Effective use of AI in resource management contributes to improved care quality, enhanced job satisfaction, and reduced nurse burnout.

Impact on Patient Care and Outcomes

Improvements in patient safety and quality of care

AI-based tools play an increasingly important role in enhancing patient safety and improving the overall quality of care. By enabling early identification of clinical risks, AI-driven systems support nurses in recognizing subtle changes in patient conditions that may not be immediately apparent through routine monitoring. Technologies such as early warning systems, predictive analytics, and continuous vital sign monitoring assist in the early detection of patient deterioration, allowing for timely nursing interventions and escalation of care. This proactive approach has been shown to reduce the incidence of adverse events, including falls, pressure injuries, sepsis, and unplanned intensive care admissions. In addition, AI applications promote standardization of care processes by integrating evidence-based guidelines into clinical workflows. This helps ensure that nursing interventions are consistent, timely, and aligned with best practice recommendations.[9] By supporting clinical decision-making and enhancing care coordination, AI contributes to improved treatment outcomes, reduced variability in care delivery, and higher levels of patient satisfaction across diverse healthcare settings.

Clinical accuracy and error reduction

The integration of AI into clinical decision-making processes has been associated with enhanced clinical accuracy and a reduction in preventable healthcare errors. AI-powered CDSSs provide nurses with real-time alerts, reminders, and guideline-based recommendations, which assist in identifying potential risks and omissions in care. These systems are particularly effective in reducing medication-related errors by flagging issues such as incorrect dosages, drug interactions, and allergies before administration. Furthermore, AI tools support more accurate and complete clinical documentation by identifying inconsistencies, missing data, or deviations

from established care protocols. This not only improves the reliability of patient records but also strengthens continuity of care and interdisciplinary communication.[10] By augmenting nurses' clinical judgment and reinforcing adherence to best practices, AI technologies enhance patient safety and promote higher standards of care delivery.

Efficiency gains and nurse performance

AI applications contribute significantly to improved efficiency and enhanced nurse performance by streamlining clinical workflows and reducing administrative burden. Automation of routine and time-consuming tasks – such as clinical documentation, scheduling, and data analysis – allows nurses to devote more time and attention to direct patient care and therapeutic interactions. This shift supports more patient-centered care while reducing time pressures associated with documentation and reporting requirements. In addition, AI-enabled systems provide rapid access to relevant patient information, clinical trends, and risk assessments, supporting faster and more informed decision-making. By minimizing cognitive overload and improving task prioritization, AI helps nurses manage complex workloads more effectively. As a result, AI integration leads to improved time management, reduced burnout risk, increased productivity, and enhanced overall performance within nursing practice, ultimately contributing to better patient outcomes and healthcare efficiency.[11]

Barriers and Challenges to AI Integration

Technical limitations

Technical challenges continue to represent a substantial barrier to the effective integration of AI in nursing practice. One of the most critical issues is data quality, as AI systems depend heavily on large volumes of accurate, complete, and standardized clinical data to generate reliable outputs. In many healthcare settings, clinical data may be fragmented, poorly documented, or inconsistent due to variations in EHR systems, manual data entry errors, or missing patient information. These data-related shortcomings can compromise the accuracy of AI algorithms, leading to biased predictions or unreliable clinical recommendations. Another significant technical barrier is the lack of interoperability among healthcare information systems. Many hospitals and clinics use multiple, incompatible digital platforms, which restrict seamless data exchange and integration. This fragmentation limits the ability of AI systems to access comprehensive patient data across departments or institutions, reducing their effectiveness in clinical decision support.[12] In addition, infrastructure limitations such as insufficient computing resources, unreliable network connectivity, and high implementation costs further restrict AI adoption, particularly in resource-constrained healthcare settings. Collectively, these technical constraints can undermine system performance and reduce nurses' trust in AI-supported tools.[13]

Workforce readiness and digital literacy

Workforce readiness is a critical factor influencing successful AI adoption in nursing practice. Many nurses have limited exposure to digital health technologies and AI concepts during their formal education and professional training. As a result, they may lack the knowledge and skills required to understand AI functionality, interpret algorithm-driven recommendations, or critically evaluate system outputs. This knowledge gap can lead to uncertainty, reduced confidence, and hesitation in using AI tools in clinical settings. Resistance to change is another major challenge, often driven by concerns about job displacement, increased workload, or fear that AI may replace human judgment. Nurses may also perceive AI systems as disruptive to established workflows, particularly when adequate organizational support and training are lacking. Furthermore, time constraints, staffing shortages, and limited access to continuing education programs can prevent nurses from acquiring necessary digital competencies.[14] Addressing these challenges requires ongoing professional development, structured training programs, and leadership support to foster a culture that encourages innovation and builds confidence in AI-enabled care.

Human-technology interaction concerns

Effective human–technology interaction is essential for the safe and efficient use of AI in nursing practice. Poor system usability, complex interfaces, and inadequate alignment with clinical workflows can create frustration and reduce adoption among nurses. When AI systems lack transparency and explainability, nurses may struggle to understand how decisions or recommendations are generated, leading to skepticism and reduced trust in the technology. Over-reliance on automated recommendations poses another significant concern, as it may weaken critical thinking and clinical judgment if nurses accept AI outputs without appropriate evaluation. Conversely, excessive system alerts and notifications can contribute to alert fatigue, causing nurses to overlook or ignore important warnings. Ethical concerns related to accountability, responsibility, and patient safety further complicate human–AI interaction. To address these issues, AI systems must be designed with user-centered principles, clear explainability, and appropriate clinical oversight to ensure that technology supports – rather than replaces – professional nursing judgment.[15]

Conclusion

AI has emerged as a valuable tool in nursing practice, offering significant support for clinical decision-making and patient care delivery. This review highlights the growing use of AI technologies, including CDSS, predictive analytics, and automated tools, to enhance patient monitoring, improve clinical accuracy, and optimize nursing workflows. Evidence from the reviewed literature indicates that AI applications contribute to improved patient safety, reduced clinical errors, and enhanced efficiency in nursing performance. Despite these benefits, challenges related to data quality, interoperability, digital literacy, ethical considerations, and human–technology interaction continue to affect the effective integration of AI in nursing practice. Addressing these barriers through targeted

education, system transparency, and supportive organizational policies is essential for successful adoption. Overall, AI holds considerable potential to strengthen nursing practice and healthcare outcomes. Continued research, education, and policy development are necessary to ensure the ethical, safe, and effective use of AI in nursing and clinical decision-making.

Conflict of Interest

NA.

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