

Comprehensive Review on Artificial Intelligence (AI) in Nursing

Vijayalakshmi

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ABSTRACT

Artificial Intelligence in nursing offers tools to enhance efficiency, improve patient care, and support nurses. AI can automate administrative tasks, predict patient needs, and provide personalized care plans, ultimately reducing workload and allowing nurses to focus on direct patient interaction. While AI presents exciting possibilities, it also raises important considerations and challenges about algorithmic bias, data privacy, and the ethical implications of integrating technology into a profession that values human connection. AI is transforming nursing practice, and its impact will continue to grow as technology advances. Nurses will need to adapt to this changing landscape by embracing continuous learning, developing new skills in data analysis and AI interpretation, and prioritizing the human element of care.

KEYWORDS

• Artificial Intelligence • Nursing • Review

INTRODUCTION

Artificial intelligence (AI) comprises many healthcare technologies transforming nurses' roles and enhancing patient care. In healthcare, AI typically refers to the ability of computers to independently convert data into knowledge to guide decisions or autonomous actions. However, precisely defining AI can be challenging because of its breadth

of applications, including risk prediction algorithms, robots, and speech recognition all of which augment nursing practice and are on a fast track to changing healthcare as a whole (Brian J. Douthit, *et al.*, 2022).¹ Artificial Intelligence (AI) is reshaping various sectors, and healthcare is no exception. As healthcare providers seek to improve patient outcomes and operational efficiency, the integration

AUTHOR'S AFFILIATION:

Principal, S.B.S, Institute of Nursing, Sohian Kalan, FGC Road, Amritsar, Punjab, India.

CORRESPONDING AUTHOR:

Vijayalakshmi, Principal, S.B.S, Institute of Nursing, Sohian Kalan, FGC Road, Amritsar, Punjab, India.

E-mail: Vijayal2006@gmail.com

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of AI technologies has become increasingly prominent, particularly in nursing (Anja Grimes, 2024).²

DEFINITION

In nursing, Artificial Intelligence (AI) refers to the application of technologies that enable computers to perform tasks that usually require human intelligence, particularly in the context of patient care, administrative tasks, and decision-making.

Artificial Intelligence refers to the simulation of human intelligence processes by machines, especially computer systems. These processes include learning (the acquisition of information and rules for using it), reasoning (using rules to reach approximate or definite conclusions), and self-correction (Anja Grimes, 2024)².

HISTORICAL DEVELOPMENT OF AI IN HEALTH CARE (Ross Pancho MACN, 2024)³

The historical development of AI in health care has been marked by significant milestones and advancements, reflecting the growth of AI technology and its integration into clinical practice. Below is an overview of its evolution:

1950s: Initial concepts

The concept of using computers to simulate intelligent behavior and critical thinking was first described by Alan Turing in 1950 in the book *Computers and Intelligence*. Six years later, John McCarthy described the term artificial intelligence (AI) as 'the science and engineering of making intelligent machines' (Kaul, Enslin & Gross, 2020)⁴.

1950s – 1970s: The early AI

The early AI was focused on developing machines that had the ability to make inferences or decisions that previously only humans could make. The first industrial robot arm (named Unimate) was able to follow step-by-step commands to handle heavy objects and perform repetitive tasks (Kaul, Enslin & Gross, 2020)⁴.

In 1966, Shakey, 'the first electronic person,' was developed as the first mobile robot to be able to interpret instructions. This was an important milestone in robotics and the future of AI (Kaul, Enslin & Gross, 2020)⁴.

1970s – 2000s: The AI winter

Most of this time period is referred to as the 'AI

Winter' due to the period of reduced funding and interest in AI and, subsequently, fewer significant developments (Kaul, Enslin & Gross, 2020)⁴.

During the 1980s, Expert Systems (ES) were developed to assist in medical decision-making by mimicking the knowledge and decision-making skills of human experts. In the same period, AI applications expanded into medical imaging, like the early versions of Computer-Aided Diagnosis (CAD), which were employed to help radiologists detect abnormalities in X-rays and MRIs (Salem *et al.*, 2021)⁵.

2000s – 2020s: Advancements in AI

The emergence of machine learning (ML) was pioneered during the early 2000s which enhanced the ability of AI systems to analyze large datasets. This period saw the integration of AI into various healthcare applications, including predictive analytics and personalized medicines (Rajpurkar *et al.*, 2022)⁶.

Electronic Health Records (EHRs) emerged as the widespread health records management system, providing a rich source of data for AI, enabling more accurate predictions and efficient healthcare delivery.

Deep Learning, Personalized Medicine, and Clinical Decision Support (CDS) were developed during the early 2010s, significantly improving AI's capabilities in processing and interpreting complex medical data, developing personalized treatment plans, and assisting healthcare providers in making clinical decisions (Askin *et al.*, 2023⁷; Ludervold & Ludervold, 2018⁸; Sloane & Silva, 2019⁹).

2020s – present: Generative AI and modern AI Applications

The explosion of Generative AI (GenAI) in the early 2020s ushered in a new era of tangible applications of AI in consumers and the healthcare system. GenAI, such as ChatGPT and DALL-E 2, started creating entirely new things, from realistic images to complex text formats.

The potential application of GenAI in medicine and health care currently focuses on drug discovery, personalized medicine and report generation, and for nursing, patient education, documentation, simulation and training, and predictive analytics.

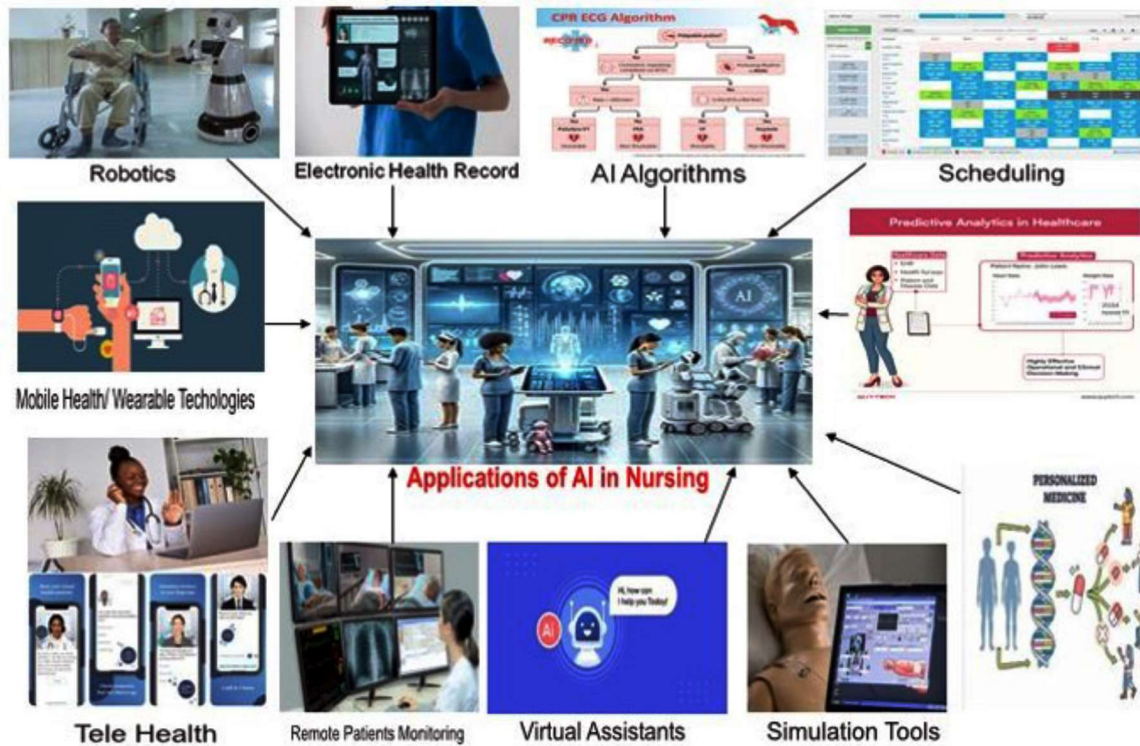


Figure 1: Applications of AI tools in nursing

APPLICATIONS OF AI TOOLS IN NURSING: (Figure 1)

- Patient Monitoring and Care:** AI-powered systems can continuously monitor patients' vital signs and other health data, alerting nurses to potential issues early on and allowing for timely intervention.
- Mobile Health and Wearable Technology:** Smartphones, apps, and wearables all help nurses manage their patients' chronic illnesses by sending and receiving data directly to each other, creating a more comprehensive picture of their health. In addition, sensor-based technologies, whether in patients' homes or hospital environments, help nurses compose messages, measure body movements, and collect other data, including weight, environmental, and movement. All of these technologies are useful across the healthcare continuum, following patients from inpatient to outpatient care. Mobile devices help improve access to care, and wearables that monitor sleep, heart rate, physical activity, etc., are becoming increasingly affordable.
- Clinical Decision Support:** AI tools can analyze patient data from various sources, including electronic health records (EHRs), lab results, and imaging studies, to provide real-time decision support. For example, AI can help nurses identify early signs of sepsis or other critical conditions, enabling timely interventions. Research shows that AI-driven alerts can improve patient safety and outcomes. AI can provide nurses with evidence-based recommendations and alerts, helping them make more informed clinical decisions and improve patient safety.
- Remote Patient Monitoring:** Advanced AI algorithms can analyze large data sets (clinical, experiential, socioeconomic, etc.) to give nurses a more holistic view of the people they treat. Based on that analysis, they can identify risk levels and better understand the individuals who would benefit most from remote patient monitoring. AI programs can step in to make recommendations not only about which patients should get enrolled in your remote monitoring programs, but

they can also help determine what will work best to get your patients activated and engaged. Then, nurses can collect and monitor data from patient devices and self-reported information (symptoms, pain levels, etc.).

- **Administrative Tasks:** AI can automate tasks like scheduling, billing, and documentation, freeing up nurses to focus on direct patient care.
- **Predictive Analytics:** Predictive analytics powered by AI can help nurses anticipate patient needs and potential complications. By analyzing historical data, these tools can identify patterns and predict which patients are at higher risk for issues such as readmission or falls. This proactive approach allows for more tailored care and resource allocation. AI can analyze patient data to predict potential health problems, allowing nurses to proactively address them.
- **Telehealth and Virtual Assistants:** The rise of telehealth has been accelerated by the COVID-19 pandemic, and AI plays a crucial role in enhancing these services. Virtual nursing assistants, powered by AI, can interact with patients, gather information, and provide basic care instructions. This not only improves accessibility but also helps in managing patient flow in healthcare facilities. AI-powered virtual assistants can answer patient questions, provide information, and even offer emotional support.
- **Chatbots:** AI-based chatbots are computer programs or software applications that have been designed to engage in simulated conversation with humans using humanlike language. Chatbots can provide patients with 24/7 access to health information, such as symptom assessment, supportive information, medication reminders, or appointment scheduling, allowing access to information when health care providers are unavailable (Michelle Clark, and Sharon Bailey, 2024)¹⁰
- **Robotics:** Robots can assist with tasks like lifting patients, delivering medications, and disinfecting rooms, reducing the physical burden on nurses. AI-driven robotics are increasingly being used to

assist nurses in their daily tasks. Robots can help with medication dispensing, patient lifting, and even companionship for elderly patients. These innovations can reduce physical strain on nurses and improve patient engagement, particularly in long-term care settings.

- **Personalized Medicine:** AI can help tailor treatment plans to individual patients based on their unique characteristics and medical history.
- **Education and Training:** AI is also being integrated into nursing education. Simulation tools that utilize AI can provide nursing students with realistic scenarios for practice, enhancing their clinical skills without risking patient safety. AI can also track student performance and personalize learning experiences, ensuring that future nurses are well-prepared for the challenges of modern healthcare.
- **Workload management:** AI has the potential to streamline care coordination and reduce the workload. AI algorithms can automate administrative tasks, prioritize patient needs and facilitate seamless communication in a healthcare team. This enables healthcare providers to focus more on direct patient care and ensures the efficient and coordinated delivery of healthcare services (Wang H, Zu Q, Chen J, Yang Z, Ahmed MA (October 2021)¹¹.

BENEFITS OF AI IN NURSING

1. Enhanced Patient Care:

- **Real-time Monitoring:** AI-powered systems can continuously monitor patients' vital signs and other health data, alerting nurses to any potential issues in real-time.
- **Personalized Care:** AI can analyze patient data to create personalized treatment plans and care recommendations, leading to more effective and patient-centered care.
- **Early Detection and Diagnosis:** AI algorithms can analyze patient data to identify potential health problems early on, enabling timely intervention and

better outcomes.

- **Predictive Analytics:** AI can help predict potential complications and health risks, allowing nurses to proactively address them and prevent adverse events.
- **Improved Communication:** AI-powered tools can help facilitate better communication between nurses, doctors, and other healthcare professionals, ensuring seamless coordination of care.

2. Improved Efficiency:

- **Streamlined Documentation:** AI can automate tasks like documentation, reducing the time spent on administrative work and freeing up nurses to focus on patient care.
- **Automated Scheduling:** AI can help optimize scheduling and resource allocation, ensuring that the right nurses are available at the right time.
- **Reduced Cognitive Burden:** AI-driven tools can help nurses make more informed decisions by providing real-time data and insights, reducing their cognitive workload.
- **Reduced Errors:** AI can help reduce the risk of medication errors and other safety issues by providing alerts and reminders.
- **Increased Productivity:** AI can help improve nurse productivity by automating routine tasks and providing real-time data and insights.

3. Other Benefits:

- **Reduced Costs:** AI can help reduce healthcare costs by improving efficiency, preventing complications, and optimizing resource allocation.
- **Enhanced Patient Experience:** AI-powered tools can provide personalized health tips, schedule reminders, and assist with digital communication, improving patient engagement and satisfaction.
- **Addressing Nurse Burnout:** By optimizing workflows and providing decision support, AI can help alleviate some of the pressures that contribute to nurse burnout, promoting a more balanced and manageable workload.
- **Training and Education:** AI can be used to create interactive simulations and training modules for nursing students,

providing them with a more immersive and engaging learning experience.

CHALLENGES OF IMPLEMENTING AI IN NURSING

1. Data Privacy and Security:

- **Protecting Patient Data:** AI systems require large amounts of data to function effectively, but this data is often sensitive and needs to be protected from cyberattacks and unauthorized access.
- **Compliance:** Healthcare providers must comply with regulations like HIPAA to ensure patient information is handled safely and securely.
- **Robust Encryption and Monitoring:** Implementing robust encryption methods and continuously monitoring for potential security threats are essential.

2. Ethical Considerations:

- **Transparency and Accountability:** Patients need to understand how their data is being used, and AI decision-making needs to be transparent.
- **Human-Centered Care:** AI should enhance, not replace, the human touch in nursing, and ethical guidelines should prioritize patient-centered care.
- **Algorithmic Bias:** AI systems can perpetuate existing biases if the data they are trained on is not representative or contains biases.

3. Training and Education:

- **Adequate Training:** Nurses need proper training on how to use AI tools effectively and understand their limitations.
- **Preparing for the Future:** Nursing education programs must adapt to prepare students for AI-enhanced healthcare workplaces.

4. Compatibility with Existing Systems:

- **Integration Challenges:** Integrating AI into existing healthcare systems can be complex and costly, especially for older systems.

- **System Upgrades:** Upgrading outdated systems can disrupt patient care and staff routines, requiring careful planning and support for staff.

5. Reliability and Trust:

- **Algorithm Reliability:** Concerns exist about the reliability and safety of AI algorithms, especially in critical situations.
- **Human-Machine Interaction:** Nurses need to be able to trust the AI systems they are using and understand how they work.

6. Other Challenges:

- **Cost:** Implementing AI solutions can be expensive, particularly for smaller healthcare providers.
- **Lack of High-Quality Data:** The availability of sufficient, high-quality data for training AI systems can be a barrier.
- **Resistance to Change:** Some healthcare professionals may be resistant to adopting new AI technologies.

CONCLUSION

The comprehensive review of Artificial Intelligence in Nursing contributes the multifaceted view of applications, benefits and challenges of implementing AI in Nursing. It reveals different methods of AI which aids nurses for early identification of high-risk patients for readmission, patient classification, betterment of nursing care, developing effective nursing care plans, ensuring integrity and security of medical records and evolution in nursing research and education.

REFERENCES

1. Brian J. Douthit, *et al.* (2022). Artificial intelligence in Nursing. American nurse Journal.
2. Anja Grimes. (2024). Introduction to AI in Nursing: Transforming health care delivery. <https://wildirismedical education.com>.
3. Ross Pancho MACN. (2024). The Role of AI in Modern Nursing Practice: Nurse Click. <https://www.acn.edu.au>.
4. Kaul, V., Enslin, S., & Gross, S.A. (2020). History of artificial intelligence in medicine. *American Society for Gastrointestinal Endoscopy*, 92(4), 807-812.
5. Salem, H., Soria, D., Lund, J.N., & Awwad, A. (2021). A systematic review of the applications of Expert Systems (ES) and machine learning (ML) in clinical urology. *BMC Medical Informatics and Decision Making*, 21(223), 1-36.
6. Rajpurkar, P., Chen, E., Banerjee, O., & Topol, E.J. (2022). AI in health and medicine. *Nature Medicine*, 28, 31-38.
7. Askin, S., Burkhalter, D., Calado, G., & El Dakrouni, S. (2023). Artificial Intelligence applied to clinical trials: Opportunities and challenges. *Health and Technology*, 13(2), 203-213.
8. Lundervold, A.S., & Lundervold, A. (2018). An overview of deep learning in medical imaging focusing on MRI. *Z Med Phys.*, 29(2), 102-127.
9. Sloane, E.B., & J. Silva, R. (2020). Artificial intelligence in medical devices and clinical decision support systems. *Clinical Engineering Handbook*, 556-568.
10. Michelle Clark, and Sharon Bailey (2024). Chatbots in Health Care: Connecting Patients to Information. Canadian Agency for Drugs and Technologies in Health, Report No.: EH0122.
11. Wang H., Zu Q., Chen J., Yang Z., Ahmed MA. (October 2021). "Application of Artificial Intelligence in Acute Coronary Syndrome: A Brief Literature Review". *Advances in Therapy*. 38 (10): 5078-5086.