The Future of Artificial Intelligence in Nursing: Applications, Challenges, and Opportunities in Improving Healthcare

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ABSTRACT

This review aims to examine the impact of applying AI technologies in the field of nursing and healthcare. Despite the clear benefits that these technologies offer in terms of improving diagnostic accuracy, reducing medical errors, and enhancing personalized healthcare, there are challenges related to security, privacy, and the potential replacement of some nursing jobs. , which saves valuable time for nurses and contributes to improving care outcomes. However, some challenges remain such as concerns about job loss due to automation, in addition to issues related to bias in algorithms, and insufficient training in the use of these systems. This review seeks to provide an overview of how AI is being applied in nursing practice, focusing on practical applications, ethical challenges, and future opportunities for this field.

Keywords: Artificial Intelligence, Nursing, Healthcare, Robotics, and Improving Care.

Introduction

Artificial intelligence (AI) is widely used in various aspects of life. However, the health sector accounts for the highest proportion in terms of utilizing and expectations [1]. Many countries are using AI technologies in developing healthcare settings while nurses in many regions around the world have limited enrollment [2]. Applying artificial intelligence and advanced technology into nursing practices has both benefits and drawbacks [3]. As a result, it is essential to recognize the various interventions and differentiation which should be performed by nurses and which by AI system.

Generally, the goal of applying novel technologies is either solving an existing problem or engaging in making improvements. For instance, speech recognition

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technology can accelerate the process and/or increase precision, effectiveness, minimize errors, and shorten the time needed for the completion of nursing documentation [4]. Another example is the use of machine learning that assist nurses in determining patient's cancer status by illustrating the optimal model using nomograms and online calculators in addition to reducing in-hospital mortality through using early warning scores [5]. Thus, it is necessary to think about the issues and difficulties nurses encounter and the way AI can address them now and beyond. AI technology will require to be improved to maximize the performance of nursing care process.

Over the past 10 years, Research and development of AI-based technologies in healthcare have increased, highlighting the strong potential of AI to improve the quality of nursing care [6]. From its inception to the present, few studies have been conducted that apply AI in real-world settings and move beyond proof-of-concept studies or lab experiments, and even fewer have assessed how AI affects clinical outcomes [7]. It is important that the AI be integrated into nursing science and healthcare, especially in nursing care in order to meet the new requirements of nursing care [8]. However, the effect of applying these technologies in nursing has not been examined and discussed.

Therefore, this review aims to explore the impact of applying AI in nursing and healthcare systems to offer optimal nursing care. The purpose of this article is to assess the current use of AI technology systems in nursing and healthcare settings to provide an overview or stimulate further research useful for the development of AI technology systems that are perfectly suited for application in healthcare.

Increasing Adoption of Artificial Intelligence in Healthcare

Advances in technology and artificial intelligence, and advances in robotics, machine learning, and natural language processing, have led to the evolution of healthcare. Healthcare systems have increasingly adopted these technologies to improve operational efficiency, increase diagnostic accuracy, enhance healthcare, reduce costs, and improve treatment systems [9]. Artificial intelligence can significantly transform the nursing profession by enhancing nurses' skills and improving clinical workflow and patient outcomes. AI-powered tools help nurses make treatment decisions efficiently, automate office tasks, prioritize patient care tasks, and manage resources efficiently, contributing to more efficient healthcare delivery [9,10].

Despite these benefits of using artificial intelligence in nursing, there are some limitations. These include the security and privacy of patient data, nurses' fear of losing their profession and being replaced by artificial intelligence tools and modern digital technologies. In addition to the possibility of bias in the data that can be used in artificial intelligence and others, as well as the need for adequate training for practitioners to use these technologies effectively [11]. There is still great potential for AI technologies to enhance nurses' skills and enable them to deliver evidence-based and personalized healthcare, through a holistic and integrated approach.

Artificial Intelligence Nursing Concepts and Technologies:

Machine Learning:

Machine learning techniques are used in nursing practice to perform tasks such as predicting diseases, optimizing treatments, and assessing patient risks [12].

Natural Language Processing (NLP):

Natural language processing techniques help analyze textual data such as health records, scientific research, and clinical notes, by teaching computers to understand natural language [13].

Robotics:

In healthcare, robots can be used in rehabilitation, assistive procedures, and remote robotics to monitor patients and assistance. Robotics technologies contribute to supporting nurses by automating routine tasks, improving patient care, and enhancing the quality of healthcare services [14].

The role of robots in nursing

One of the common applications of artificial intelligence is robots, which are constantly advancing, and their role is prominent in healthcare, especially in the field of social robots that respond emotionally to situations, allowing them to interact with humans in a way similar to human interactions [14]. Examples of these robots include "Sophia", which was designed to be a companion for the elderly, and was modified in 2018 to include motor capabilities, and became the first robot to obtain citizenship in Saudi Arabia [15]. These robots contribute to many areas such as driving and supporting remote healthcare applications. In addition, the performance of robots in nursing has developed to include performing many nursing tasks such as measuring vital signs, administering medications, and performing written automation, which allows nurses enough time to care for patients. Since 2014, research projects have been funded by the US National Science Foundation (NSF) to support the use of robots in nursing tasks. One of these projects is the development of the "TRINA" robot, which helps reduce the exposure of healthcare workers to infection [16]. The TCHAT project was also launched at the University of Cincinnati to test nursing interventions using robots to improve chronic disease management and promote healthy lifestyles [17]. However, nurses are indispensable as they are the heart of healthcare but must effectively harness and employ new technologies to improve healthcare outcomes.

Impact of artificial intelligence in nursing

Expands Access to High-Quality Medical Care.

AI in healthcare has the highest potential to enhance and increase access to high-quality medical care, through offering individualized monitoring and intervention with lower costs and error rates [18]. In this case, Artificial Intelligence (AI) has enhanced care delivery by declining time-consuming duties that do not require specific nursing expertise or qualities, enabling nurses to offer direct patient care.

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Improves Medical Records.

The information capacity of hospital databases keeps growing up as electronic medical records (EMRs) are widely used and medical devices and instruments are digitalized. Thus, AI is needed to organize existing EMRs so that they are readily available to the appropriate medical staff and can assist in providing crucial patient-related information [19].

Improves Quality of Services.

Efficiency, safety, and access to healthcare through collaboration, coordination, and communication between healthcare disciplines can be improved through artificial intelligence applications. AI technology is essential for daily healthcare services as it reduces the workload of nurses and other healthcare professionals in order to optimize healthcare services [20].

Artificial intelligence Applications in Nursing

Artificial intelligence (AI) is being integrated into nursing practices in multiple ways, providing innovative solutions to improve patient care, speed up processes, and enhance training and educational initiatives [11,21].

- **Diagnosis and Treatment Planning:** AI systems analyze clinical notes, test results, and medical images to assist doctors and nurses in making diagnoses and developing treatment plans.

- **Patient Management:** The use of AI technologies is essential in enhancing nurses' ability to provide superior patient care, through advanced monitoring, diagnosis, and treatment planning systems.

- **Patient Monitoring:** AI-powered monitoring systems use wearable devices, sensors, and electronic health records (EHRs) to track vital signs and activities in real time, and alert medical staff to any early health deterioration.

Challenges of Artificial Intelligence in Nursing

Biases: There is a chance that AI will reinforce or institutionalize preexisting social or human biases, which could reduce the accuracy of the results produced. Furthermore, bias in AI systems can be divided into algorithmic and social bias [22].

Algorithm: clinical decision algorithms that prioritized treating less ill white patients over sicker black patients created racial bias. However, because it is still unclear whether AI algorithms will be sufficiently valid and reliable to be used for all patients in need of care, AI technology can be problematic [22].

Trust in AI: Nurses may not accept AI tools if they believe they are inaccurate. Therefore, AI systems must be accountable, explainable, and transparent to ensure users trust them [23].

Nurse-patient interactions: AI in nursing care can impact the relationship between patients and nurses. Although AI technologies can automate tedious tasks, speed up workflows, and enhance nurses' skills, they cannot replace nurses in nursing care. The

use of AI may increase feelings of dehumanization, isolation, and helplessness in patients, especially in complex or delicate treatment situations [23].

Current Insight and Interpretation

In the nursing settings, Advances in AI technology, including intelligence agents, machine learning, deep learning, natural language processing, robotic process automation, administrative applications, and explainable or interpretable AI, are being enthusiastically welcomed as a promising nursing innovation [24].AI technologies have the potential to enhance nursing care for a range of medical conditions, manage medical records, minimize medical errors, optimize nursing care procedures, improve patient experience, lower per capita healthcare costs, manage medical records, and provide comprehensive information to support decision-making. Nevertheless, one of the potential implications of substituting autonomous AI system technology for human experience is the legal implications of therapeutic accountability [25]. Accountability is defined as a process in which workers in healthcare settings hold the responsibility of defining clinical decisions to patients and being responsible for the consequences. Using AI technology in accountability is still uncertain and debated, whether the outcomes are absolute or just a consideration [23].

Future directions for the development of artificial intelligence in nursing

AI-based clinical decision support

Developing AI-powered clinical decision support systems that combine knowledge, evidence-based recommendations, and patient data to help nurses make informed and timely decisions during care delivery [10].

Health data analysis

Applying AI techniques such as predictive modeling and deep learning to analyze health data to uncover trends, patterns, and causative factors of infectious and chronic diseases [26].

Human-AI interaction and collaboration

The dynamics of human-AI interaction in nursing practice, considering the impact of AI on shared decision-making between patients and healthcare providers, teamwork, and effective communication [10].

Ethical, legal, and social implications

The ethical, legal, and social implications of integrating AI into nursing practice, considering issues related to fairness, privacy, autonomy, and trust [23,26].

Conclusion

Increasing access to high-quality medical treatment, enhancing medical records, and raising service quality are a few effects that may now be assessed and seen in the context of applying AI technology systems in nursing and healthcare. These benefits could be the reasons why implementing AI technology systems in healthcare is so urgently needed to improve healthcare services. Furthermore, bias and algorithms are

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disadvantages of using AI technology systems that must be considered when assessing the precision of the findings that are shown. To reduce the likelihood of errors, this calls for changes and measures.

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