

Artificial Intelligence: Applications in Nursing

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ABSTRACT

As in many areas of health-care delivery, nursing practice is being transformed by technological advances such as artificial intelligence (AI). Nurses play an integral role in health-care delivery system and it is essential for nurses to integrate these new technologies into practice. Nursing students, practicing nurses, nursing faculty, and nurse leaders need be aware of AI and its implications in nursing. This paper presents the significance of AI technologies application in health care specially nursing.

Keywords: Artificial intelligence, Nursing, Health-care delivery

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INTRODUCTION

Rapid technological advancements have restructured nursing to a great extent. Some of the most common examples include electronic health records, to advances in biomedical and engineering technologies that enable the development of ever more sophisticated technologies in health care including robotics technology and artificial intelligence (AI).^[1]

Nurses represent the largest group of health-care professionals involved in care delivery. AI in medicine is mainly divided into two main branches, namely, virtual and physical. The virtual branch includes informatics approaches is mainly represented by health management systems, including electronic health records. The physical branch is best represented by robots used to assist in surgical interventions and intelligent prostheses for handicapped people.^[2]

Figure 1 outlines the subbranches of AI. AI encompasses the techniques used to teach computers to learn, reason, perceive, infer, communicate, and make decisions similar to or better than humans.^[3] In simple words AI is the term used to describe the use of computers to simulate intelligent behavior and critical thinking.

APPLICATIONS OF AI IN NURSING

As we embrace the change of inculcating AI into nursing practice, there is a need to understand that the aim of AI-related applications in nursing focus mainly on diagnosis process, nursing care planning, health monitoring, and care. The most of the nursing functions such as ambulation support and infectious disease protocols and care can be provided by robots. Research suggests that between 8% and 16% of nursing time is spent on non-nursing activities and tasks that could be reallocated to others. Nurses with robot support might feel empowered with the additional support provided and can spend quality time interacting with patients.^[4]

Literature review points out that an example of robot collaboration telerobotic intelligent nursing assistant (TRINA), a remote-controlled robot, to address healthcare workers who are especially at risk for infections due to handling of contaminated materials. The robot TRINA has been tested in the nursing simulation laboratory and is able to perform about 60% of predefined nursing tasks; however, comparatively, it is much slower compared to a human nurse.^[5]

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AI is paving its way into health care and nurses can channelize its power to enhance standard patient care processes and workflows to improve quality of care, impact cost, and optimize the patient and provider experience.^[6]

AI-powered predictive analytics in nursing can help nurses determine the length of hospital and accordingly plan treatment outcomes of patients. AI can assist nurses in making clinical decisions for their patients based on trends in data being used in clinical practice currently. AI in health care enables public health nursing to use AI smart home technology sensor data to assist older adults by monitoring their movement in their homes.^[7]

IMPLICATIONS OF AI

AI-based technologies could assist nurses in many tasks such as lifting, staffing assignments, real-time documentation, and predictive decisions using techniques such as the review of health data and health monitoring.

Robots

Nurses tend to injure themselves at high rates while assisting, turning, and lifting patients.^[8] Nurses are considered to be among the professionals with the highest incidence rates of work-related low back problems. Due to the low back pain caused by these risk factors, every year, thousands of nurses in the world work with less efficiency or opt for retirement or remain confined due to severe pain.^[9] Newer AI-based robots can provide assistance nurses to ambulate patients. Existing literature also points out an robot for interactive body assistance robot from Japan which can lift patients up to 80 kg.^[10]

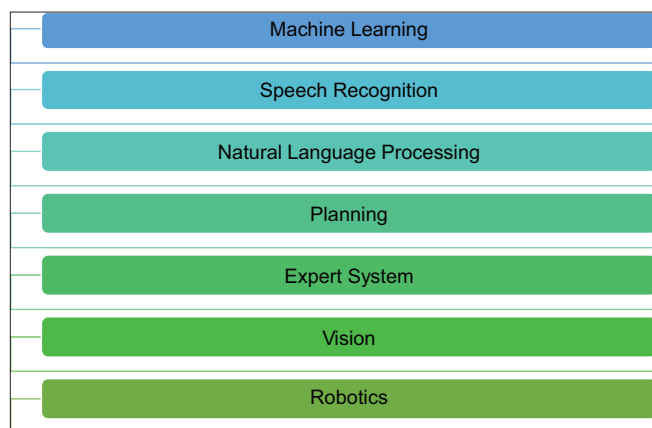


Figure 1: Subbranches of artificial intelligence

Staffing

The assignment of patient care has always been a strenuous task for nurse managers. AI-based prediction of patient load based on software analysis can assess patterns of patient transfer and possible admissions to predict census over time. This level of analysis supports further helps us foreseeing patterns and staff allotment accordingly.

Documentation Improvement

The immense amount of time spent on meticulous documentation by nurses can be reduced significantly by incorporating AI solutions for documentation which includes use of voice enabled smart speakers used to convert spoken words to clinical notes and documentation. Studies show that physicians who used documentation support such as dictation assistance or medical scribe services engaged in more direct face time with patients than those who did not use these services.^[11] Therefore, AI supported documentation techniques will further help nurses reduce the time spent on documentation and enhance patient interaction time.

Patient Generated Health Data

Many commercially available health trackers can monitor heart rate, activity levels, sleep levels, and ECG tracings. There is a surge in the amount of health-care data collected by individuals using smart watches, glucometers, automated BP apps, and other devices. AI software can efficiently filter these new data sources given the care context, present it to the nurses/health-care coordinators in a meaningful way, and allow the visualization of important trends when integrated into the EHR.

Clinical Decision Making

AI technologies in health care assist in identifying the progression of the disease. Recent studies have been identified where AI systems were able to outperform dermatologists in correctly classifying suspicious skin lesions. This is due to the fact that AI systems can learn more from successive cases and can be exposed to multiple cases within minutes, which far outnumber the cases a clinician could evaluate in one mortal lifetime. AI-based decision-making approaches bring used in situations where experts often

disagree, such as identifying pulmonary tuberculosis on chest radiographs.^[12]

Vaccine Research

AI helps us to embrace the new concept of precision medicine. AI in vaccine Research by studying the proteins that make up the virus, such as the spike protein (S), thereby helping in vaccine development. Especially at time of crisis with the rise of the pandemic COVID, an AI system can assist in development of vaccine within a short span of time. AI can sort through thousands of components in a complicated structure to find the ones most likely to elicit a strong immunological response. To ensure that a vaccine remains effective over time, AI systems also help in identification of components that are unlikely to change or mutate. In the search for a vaccine, a crucial role has been seen for computational analyses and machine learning algorithms.^[13]

Drug Development

Searching and developing pharmaceutical agents against a specific disease by performing clinical trials take several years and is costly. Recent examples in research show that AI was used to screen existing medications, which could be used to fight against the emerging Ebola virus menace which would have taken years to process otherwise.^[11]

Diagnostics

AI provides significant aid in radiology by identifying abnormal exams in computed tomographies, X-rays, and magnetic resonance images. This could essentially be of especially in high volume settings and in hospitals with less available human resources.^[11]

Medical Treatment

AI-based online application in UK named as Babylon can be used by the patients to consult the doctor online, check for symptoms, get advice, monitor their health, and order investigations. Literature also points out Molly a virtual nurse that has been developed to provide follow-up care to discharged patients allowing doctors to focus on more critical cases.^[14]

Surgical Treatment

AI powered Da Vinci robotic surgical system developed by Intuitive surgicals has revolutionized the field of surgery especially urological and gynecological surgeries. The robotic arms of the system mimic a surgeon's hand movements with better precision and has a 3D view and magnification options which allow the surgeon to perform minute incisions.^[2] These breakthrough techniques are considered to be a boon to mankind.

CHALLENGES IN USING AI

Code of ethics for nurses clearly states that the nurse is accountable and responsible for nursing practice and the impact on patient care. The code addresses accountability for nursing judgments, decisions, and actions, and specifically refers to systems and technologies as aids rather than substitutions for nursing skill and judgment. The code states "Systems and technologies that

assist in clinical practice are adjunct to, not replacements for, the nurse's knowledge and skill." Technologies introduced newly to assist nursing remain as adjunct as the primary role of caregiving and responsibility is bestowed on the human nurse. It is the primary responsibility of the nurse using new technologies to knowledgeable about the data used to train the system and how the system results were checked and how exactly the system works to rule out errors.^[15]

Occasionally with misleading data, the algorithms can give misleading results. In rare instances when the individuals creating an algorithm might not know that the data, they feed misleading until it is too late, and their algorithm has caused medical malpractice. This error needs to be prevented primarily by diligent observation and by being alert while providing nursing care.^[16]

CONCLUSION

Emerging technologies have necessitated the need for incorporating AI in nursing. Technology may change how nurses spend time delivering patient care, but the need for nurses will remain the same. AI development in nursing can occur only with thoughtful development and active participation from nurses. The main aim of incorporating AI in health care is to optimize potential benefits and minimize potential negative consequences for patients. Nurses are in a position to influence the design and implementation of AI solutions in health care. Nursing will be reshaped in the future with AI technologies but art of human caring will always remain as the heart of the nursing profession.

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