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Artificial Intelligence in Nursing (AI)

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ABSTRACT

Artificial Intelligence (AI) is rapidly transforming healthcare and nursing practice by improving decision-making, patient monitoring, documentation, and healthcare delivery. AI refers to computer-based technologies capable of learning, reasoning, and performing tasks similar to human intelligence. This review article highlights the history, stages, principles, applications, advantages, challenges, and limitations of AI in nursing. AI technologies such as machine learning, robotics, sensor-based devices, speech recognition, tele-health, and remote monitoring have significantly enhanced clinical and community nursing care. AI supports nurses in clinical decision-making, medication adherence, risk assessment, electronic documentation, and patient safety while reducing workload and improving efficiency. The article also discusses the role of AI during pandemics and in rural healthcare services. Despite its benefits, challenges such as lack of trained personnel, infrastructure limitations, high costs, and reduced human interaction remain significant concerns. Proper integration of AI into nursing education and practice can strengthen healthcare systems and promote quality, patient-centered care [1,2].

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Introduction

Artificial Intelligence (AI)

Artificial intelligence has been defined as technology that enables a computer system or computer-controlled robot to "learn, reason, perceive, infer, communicate, and make decisions similar to or better than humans", {3} or it can also be defined as the integration of science and engineering to develop computer based soft wares to aid health care. John Mc Carty first coined the term artificial intelligence in the year 1956 [3].

(Lippincott cott Williams and Wilkins)

AI is interwoven in our everyday lives through our use of technologies such as cellular phones, smart televisions, and wearable fitness devices [4]

Stages of artificial intelligence

Artificial intelligence has three stages

1. Artificial Narrow Intelligence
2. Artificial General Intelligence
3. Artificial Super Intelligence

- Artificial Narrow Intelligence: Artificial narrow intelligence has a limited scope; it uses machines as computers for a defined set of tasks. It is also referred to as weak intelligence.
- Artificial General Intelligence: Artificial general intelligence has a wide scope; it is the evolution of machines where machines have the capacity to think and make decisions, and it is also referred to as strong intelligence.
- Artificial Super Intelligence: Artificial super intelligence has a wider scope; it is the evolved stage of machines where machines work and make decisions by surpassing humans [5].

Advantages of Artificial Intelligence

- ✓ AI improves decision-making power that will save human lives
- ✓ AI aids in solving complex problems in health care
- ✓ AI performs high-level computations
- ✓ AI has increased accuracy and power

Artificial Intelligence in Nursing

Nursing Is Emerging Day by Day, Addition of Artificial Intelligence Will Augment Nursing Care

Artificial intelligence in nursing is the adoption of new technologies and equipment in Nursing care to enhance nursing quality care, help in prompt decision making, ' delivering care in hazardous situations with minimal exposure [6].

(WHO)

AI typically refers to the ability of computers to independently convert data into knowledge to guide decisions or autonomous actions. Its use will save human lives, reduce nurses' workload and enable prompt action within the golden hour.

Need of Artificial Intelligence in the Nursing Profession

- Its application will save nurses time, energy, and resources
- It will lessen the burden on hospitals' inpatient departments and outpatient department thus lessening the workload of nurses
- Its application will provide specialist-based care in the rural population
- Its application will provide need-based care
- Its application will also save clients time and unnecessary

walks to hospitals for minor ailments [7].

Principles of Artificial Intelligence in the Nursing Profession
- Protecting human autonomy
- Promoting human well-being and safety and the public interest
- Ensuring transparency, explainability intelligentibility
- Fostering responsibility and accountability
- Ensuring inclusiveness and equity
- Promotion of Artificial Intelligence that is responsive and sustainable

Clinical Artificial Intelligence Tools in the Nursing Profession [8]
- Monitoring patients
- Improving medication adherence
- Recording digital notes
- Automatic laborious work

Monitoring Patients
Monitoring patients is one of the important nursing work domains. Artificial intelligence is likely to have the greatest influence in patient monitoring e.g. nurses can use AI analysis of vital signs for cardiovascular and respiratory monitoring of patients admitted in intensive care units [9]

Patient monitoring is very important. According to a report of 2015, hundreds of thousands of patients fall each year, of which to 30 to 50 per cent of patients have suffered injuries due to falls, which can increase the hospital stay and can even result to death. Artificial intelligence tools like sensors, to analyses movements of patients in patient care rooms or wards, can alert nurses when a fall is predicted

During covid 19 pandemics, the FDA has granted permission to use a software (CLEWICU) which predicts whether the patient will develop dangerously low blood pressure or respiratory failure [10].

Improving Medication Adherence
Artificial intelligence can be tremendously helpful in improving patients' medication adherence with the help of machine learning. Some of the solutions that have shown results in this field are [11]

- Chabot
- Apps
- Smart packaging
- Smart pills
- Clever caps

E.g.,

The US Food and Drug Administration has approved the first drug in the USA with the digital ingestion tracking system.

(Abilify My Cite) (aripiprazole tablet with sensor) This tablet has an ingestible sensor embedded in the pill that records whether the medication was taken or not. It works by sending a message from the pill sensor to a wearable patch. This patch transmits the information to a mobile application so that the patients can track the ingestion of medication. The healthcare workers can also access this information through a web portal, so it will be helpful for nurses to track medication adherence of discharged or admitted patients [12].

Recording Digital Clinical Notes
Documentation in health care is very important, and it needs a huge amount of time to document each and every thing related to patients. Nurses suffer a huge workload of documentation [13]

To ease nurses' documentation workload, speech recognition and natural language processing technologies can be used for recording digital notes into HER systems.

Automating Laborious Work
Nurses usually spend the majority of their time walking between patient units, rooms and nursing stations. In OTs, nurses have to walk more to collect sterile supplies from Central sterile departments. Artificial intelligence can automate such tasks, allowing nurses to spend more time with the patients. e.g., in the developed nations, many hospitals have employed robots for delivering [14].

Applications of Artificial Intelligence in Clinical Nursing Practice
- ✓ Clinical decision-making support
- ✓ Sensor-based technologies
- ✓ Mobile health
- ✓ Robotics
- ✓ Risk assessment
- ✓ Voice assistants
- ✓ Text mining
- ✓ Speech recognition technologies [15]

o **Clinical Decision-Based Support:** AI will aid nurses to make decisions regarding patient care at a glance as electronic health record alarms and alerts, clinical practice guidelines, order sheets and dashboards will help nurses in prompt decision making in a clinical setting [16].

Clinical decision support can be integrated with mobile health apps that can provide various actionable options and actions to be taken. When coupled with AI, clinical decision support can offer predictions and suggestions with accuracy and specificity beyond human capacity.

o **Sensor-Based Technologies:** Artificial intelligence Sensor technologies have tremendously improved nursing care. Sensors have been widely used to capture and translate health data into observable electrical impulses. So these sensors will aid nurses in collecting health data, such as heart rate, blood sugar level, stress rate, oxygen saturation rate, temperature, weight, and blood pressure, which are usually captured with sensory smart devices and transmitted as electrical pulses for further processing. Sensors continue to transform health systems globally and unlock new opportunities to provide care virtually, especially during the pandemic. Sensors have been successfully integrated with smartphones and smart wearable devices, with the necessary capabilities to capture and process health data remotely. Sensors, especially biosensors, are increasingly becoming indispensable resources for monitoring daily life activities in the medical field for improved clinical diagnostics and monitoring biological molecules. Among other functionalities, wearable sensors have been used for remote monitoring of patients in healthcare, which can have a great impact on geriatric nursing care and community health nursing care [17,18].

E.gs
Skin electrodes to monitor heart rate
Piezoelectric sensor to monitor respirations

o **Robotics:** To communicate with patients remotely, Nurses can use telepresence robots as the eyes and ears. Such communication

is made possible with built-in cameras, speakers, and microphones. Some robots are simply synced with phones or tablets, and others also have autonomous navigation—they move to avoid obstacles [19].

Adding Artificial intelligence increases the capabilities of telepresence robots. For example, natural language processing improves the accuracy of speech detection, which is essential for working with people. In general, AI makes robots understand and reproduce human language. It also helps robots move in challenging areas and learn how to complete more difficult tasks over time. Some robots are smart enough to point out specific health conditions from their patient's voice or movements.

Robots are very useful in pandemics to deliver patient care and administer medications in hazardous situations to minimise exposure of virus and other dangerous chemicals to healthcare workers, especially nurses who are with the patients 24 hours a day [20].

o **Benefits**
- Reduced caregiver workload
- Enhanced decision-making

o **Risk Assessment:** Automated sepsis risk assessment systems have been developed to assess the sepsis risk of inpatients by using data mining techniques so that nurses will be alerted to make efficient and effective nursing care plans, even automatic systems generate nursing diagnoses based on data, fall risk prediction, and guided decision trees to prevent infection e.g. catheter-associated urinary tract infections.

Fall risk prediction, for instance, involves regular assessment and fall precaution implementation. However, manual risk calculation is time-consuming and vulnerable to human error, leading to inaccurate predictions. AI offers three advantages over traditional methods:

the ability to quickly consider large volumes of data in the risk prediction
increased intervention specificity (accurately flagging patients most at-risk)
Automated adjustments in variable selection and calculation.

AI accurately identifies at-risk patients by considering more diverse patient information from the Electronic health record and other information sources.

o **Voice Assistants:** AI assisted follow up system have been developed in developed countries. This system, called patients for follow up viva automatic speech telephony, to improve patient follow-up and recovery and lessens the burden of follow-up nurses. Voice assistants may have a future in Electronic health record applications, collecting patient data in the home and delivering interventions to augment care. Imagine a scenario in which a nurse uses Alexa to remind older adults to take their medications and measure their blood pressure. Alexa then records patient data in the EHR for the nurse to review. For older adults and patients with certain disabilities, such as poor eyesight, these tools may be especially useful given their voice-based interaction. The benefit of voice assistants depends on nurse involvement in technology selection and its application in practice and patient care.

o **Speech Recognition Technologies:** Speech recognition technologies can speed up and enhance nursing documentation, and machine learning has been used to develop a tool to aid nurses in using standardised technologies, by automatically suggesting the most relevant terms to be used based on the text written by the nurse.

o **Text Mining:** Text mining will require a large database, Text mining, where AI technologies are being used to mine millions of nursing notes to identify patients with fall history or drug and alcohol use disorders to support care planning and patient risk detection. Similarly, machine learning, specifically deep learning, has been experimented to predict pain sensation and physical deterioration for acute critical conditions.

o AI technologies will also help nurses integrate different types of relevant data (e.g. environmental, genomic, health data, socio-demographics), strengthening nurses' capacity to provide multifaceted care.

Application of Artificial Intelligence in the Community, Outside the Traditional Setting of Hospitals and Clinics
- Tele health
- Remote monitoring

Tele Health
Tele health or e health has gained recognition since covid times, tele health nurses have wide scope throughout the country, tele health is saving human lives and providing health care at door steps, it has been integrated in national health mission, and in health and wellness centres throughout the country with the help of e Sanjeevi apps where a patient can receive specialist consultation viva mobile phone.

E g patient visits the health and wellness centre of any village, where nurses contact specialists and provide need-based interventions within no time.

Remote Monitoring
Various wearable sensors are used in remote monitoring of patients E.g cardiac monitoring such as HR and rhythm sensors, including the Apple Watch, rhythm and Huawei devices

The Apple Watch is FDA-approved to detect and alert hearth irregular rhythms [21].

Challenges of Artificial Intelligence in the Nursing Profession
- ✓ To educate the educators in nursing colleges for better implementation of AI technologies to augment care from basic courses.
- ✓ Development of modular wards
- ✓ Integration of computer technology with Nursing basic education
- ✓ Integration of artificial intelligence tools with culture to apply it in clinical practice to promote its acceptability among patients
- ✓ Generation of a large database to use in machine learning and to develop algorithms that automatically guide prompt decision making to provide care.

Limitations of Artificial Intelligence in the Nursing Profession
- ✓ It lacks human touch
- ✓ It lacks human creativity
- ✓ Its increased use will diminish human abilities
- ✓ It leads to dependence of humans on machines
- ✓ It needs huge costs in development, maintenance and repair

Conclusion

Artificial intelligence is destined to transform clinical nursing practice, community health nursing practice and nursing education.

It will also transform the health care delivery system and will ease nursing quality care delivery and nurses' workload burdens.

Artificial intelligence will also develop algorithms related to patient care based on a nursing database that will help in prompt decision-making and will save human lives.

Nurses must contribute to the advancement of artificial intelligence to ensure development that advances the nursing role and focuses on providing client-centred care.

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