

Chapter 16

Artificial Intelligence in Nursing (AI)

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Learning objectives

- Understand the brief history of AI
- Define AI
- Discuss stages of AI
- Discuss advantages of AI
- Discuss AI in nursing profession
- Understand need of AI in nursing profession
- Identify principles of AI
- Discuss tools of AI
- Discuss application of AI in clinical and community health nursing practice
- Identify the challenges of AI in nursing profession
- Identify the limitations of AI in nursing profession

Keywords: Artificial Intelligence (AI), Machine Learning, Healthcare Technology, Health Informatics, Clinical Decision Support, Digital Health, Wearable Devices.

Introduction

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” or it can be also be defined as 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. (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.

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 limited scope it uses machines as computers for defined set of tasks. It is also referred as weak intelligence.

Artificial general intelligence

Artificial general intelligence has wide scope, it is the evolution of machines where machines have capacity to think and make decisions, and it is also referred as strong intelligence.

Artificial super intelligence

Artificial super intelligence has wider scope, it is the evolved stage of machines where machines work and make decisions by surpassing humans.

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 have increased accuracy power.

Brief history of AI

1. 1956- AI word was first used and coined by renowned American computer scientist (John McCarthy) in the year of 1956 at the Dartmouth conference.
2. 1966- The first chat bot was built in 1966 by Joseph Weizenbaum named as Eliza. It was the time when researchers emphasized on problem solving with the help of algorithms.
3. 1980- Expert systems were developed and programmed to aid human being in decision making in 1980 and also the first conference of AI were held at Stanford.
4. 1981- Fifth generation computers were developed with the aim to create computers that could translate and converse human language in 1981.
5. 1985- AARON an autonomous drawing programme developed in 1985 and in 1997 Windows released a speech recognition software developed by Dragon system.
6. 1997- Super computer named as Deep Blue was designed in 1997 which defeated the world champion chess player in a match. It led to the development of large computer.
7. 2002- The first commercially successful robotic vacuum cleaner was created in 2002.
8. 2005-2019- The speech recognition, robotic process automation (RPA), a dancing robot, smart homes, and other innovations are making their debut from 2005 to 2019.
9. 2020- Baidu releases the Linear Fold AI algorithm to medical and scientific and medical teams developing a vaccine during the early stages of the SARS-CoV-2 (COVID-19) pandemic. The algorithm can predict the RNA sequence of the virus in only 27 seconds, which is 120 times faster than other methods in 2020.
10. 2021- OpenAI developed DALL-E, which can process and understand images enough to produce accurate captions, moving AI one step closer to understand the visual world 2021.
11. AI is now being used in all fields like cyber security, autonomous vehicles and in health care particularly, it is having now wide applications in all fields of health care from 2022 to 2023.

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's in Nursing care to enhance nursing quality care help in prompt decision making, delivering care in hazardous situations with minimal exposure (WHO) (2).

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 will enable prompt action within golden hour.

Need of artificial intelligence in Nursing profession

- Its application will save nurses time, energy, and resources
- It will lessen the burden on hospitals inpatient departments and outpatient department thus will lessen work load of nurses
- Its application will provide specialist based care in rural population
- Its application will provide need based care
- Its application will also save clients time and unnecessary walk to hospitals for minor ailments.

Principles of Artificial intelligence in 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 nursing profession (3)

- Monitoring patients
- Improving medication adherence
- Recording digital notes
- Automatic laborious work

Monitoring patients

Monitoring patients is one of the important nurses work domain, artificial intelligence is likely to have 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.

Patient monitoring is very important, According to a report of 2015, hundreds of thousands patients fall each year, of which to 30 to 50 percent 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 analyze movements of patients in patient care rooms or wards can alert nurses when a fall is predicted.

During covid 19 pandemics, FDA has granted permission to use a software (CLEWICU) which predicts whether the patient will develop dangerously low blood pressure or respiratory failure (4).

Improving medication adherence

Artificial intelligence can be tremendous helpful in improving patients medication adherence with the help of machine learning, some of the solutions which have shown results in this field are.

- Chatbots
- Apps
- Smart packaging
- Smart pills
- Clever caps

Example:

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 that the medication was taken or not. It works by sending a message from the pills 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 health care 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.

Recording digital clinical notes

Documentation in health care is very much important and it needs a huge time to document each and every thing related to patients, nurses suffer huge work load of documentations.

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 spent the majority of their time walking between patients unit, rooms and nursing stations while 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. Example: in the developed nations many hospitals have employed robots for delivering.

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

Clinical decision based support

AI will aid nurses to take decisions regarding patient care at a glance as electron health record alarms and alerts, clinical practice guidelines, order sheets and dashboards will help nurses in prompt decision making in clinical setting.

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.

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 to collect health data, such as heart rate, blood sugar level, stress rate, oxygen saturation rate, temperature, weight, and blood pressure, 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 pandemics. Sensors have been successfully integrated with smartphones, 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 great impact on geriatric nursing care and community health nursing care.

Example:

- Skin electrodes to monitor heart rate
- Piezo electric sensor to monitor respirations

Robotics

To communicate with patients remotely, Nurses can use tele presence 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.

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 much 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 hour.

Benefits

- Reduced caregiver workload
- Enhanced decision-making

Risk assessment

Automated sepsis risk assessment system have been developed to assess sepsis risk of inpatients by using data mining techniques so that nurses will be alert to make efficient and effecting nursing care plans, even automatic system generate nursing diagnosis based on data, fall risk prediction, and guided decision trees to prevent infection Example: 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:

1. The ability to quickly consider large volumes of data in the risk prediction
2. Increased intervention specificity (accurately flagging patients most at-risk)
3. 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.

Voice assistants

AI assisted follow up system have been developed in developed countries this system called patients for follow up viva automatic speech telephony. That improves enormously patient follow up and recovery and lessened 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.

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 standardized technologies, by automatically suggesting the most relevant terms to be used based on the text written by the nurse.

Text mining

Text mining will require large data base, 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.

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

Application of artificial intelligence in 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 through out 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 centers through out the country with the help of e sanjeevni apps where a patient can receive specialist consultation viva mobile phone.

Example: Patient visits health and wellness center 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.

Example: Cardiac monitoring such HR and rhythm sensors including the apple watch, iRhythms and huawai devices. Apple watch is FDA approved to detect and alert hearth irregular rhythms.

Challenges of artificial intelligence in 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 cultural to apply it in clinical practice to promote it's acceptability among patients
- Generation of large data base to use in machine learning and to develop algorithms which automatically guide prompt decision making to provide care

Limitations of artificial intelligence in nursing profession

- It lacks human touch
- It lacks human creativity
- It's 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 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 nursing data base 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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