



## ARTIFICIAL INTELLIGENCE- APPLICATIONS IN HEALTHCARE AND NURSING

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### ABSTRACT

*AI applications have revolutionized healthcare in many ways. AI is used for promotion of health, early detection, faster and precise diagnosis, treatment and provision of individualized care, decision-making, research and training. The benefits of AI include faster diagnosis, reduced costs, reduced time, specificity, accuracy, prediction of outcomes and personalized care treatment. Use of robots can protect valuable human resources from hazards while working in a hazardous environment. Home-based care can be made more popular through use of Robots. Though the excitement regarding use of AI in healthcare and specially in nursing is high, it has some challenges too.*

**Key words:** Artificial Intelligence, Robots, Nursing, Machine Learning, Virtual reality, Healthcare, Nursing education.

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### INTRODUCTION

Advancements in technology has always enabled healthcare industry to achieve better patient outcomes. The latest technology that is incorporated in healthcare is the use of Artificial Intelligence (AI). Robotics, IoMT, chatbots, Virtual Reality (VR) has enabled health care services to become more sophisticated and efficient. AI based apps are making life more easy by reducing the time spent on many tasks, increasing accuracy and specificity. IBM's Watson, Microsoft's Azure Machine Learning, Google DeepMind Health etc are revolutionizing health care sector with their unique contributions. Virtual Reality (VR) is a computer-generated three-dimensional interactive environment that stimulates multiple sensory methods. Learning has become more interesting and effective through Immersive VR learning technology. AI has made a significant impact in the field of diagnostics and treatment, nursing practice, nursing education as well as nursing research.

AI is defined as the theory and development of computer systems able to complete tasks that typically require human intelligence, such as visual perception, speech recognition, decision-making, and/or language translation. Machine Learning (ML) is a subset of AI defined as enabling computing advances through testing and adaptation scenarios and by using trends and patterns for improved decision-making. Deep learning is a subset of machine learning that deals with artificial neural networks (ANNs), which are algorithms structured to mimic biological brains with neurons and synapses. Syntactic pattern recognition, NLP, search engines, computer vision, and machine perception are other examples of ML applications. Virtual Reality (VR) is a computer-generated

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three-dimensional interactive environment that stimulates multiple sensory methods.

### **Benefits of AI**

The benefits of using AI are numerous and include:

- Reducing human error
- Precise diagnosis
- Faster diagnosis
- More personalized care and treatment
- Predicting patient outcomes.
- Reducing time spent on tasks

### **Uses of AI in Healthcare and Nursing**

- **Promoting health:** AI-based apps can give patients the tools they need to manage their own health and they also transfer knowledge to the provider. Various applications in mobile phones and wearable devices are encouraging people to adopt health behaviours and a healthy lifestyle. As the tracking and analysis of various parameters are done by these apps, they give valuable suggestions to the users which enable them to properly modify their behaviours. Thus, consumers are in control of their own health and well-being.
- **Screening and early detection:** AI enabled screening helps to improve the accuracy in early detection of breast cancer, early-stage heart diseases. Traditional risk assessment surveys do not have the accuracy as by the AI based models. AI can detect patterns from large data sets and mine data from millions of EHR (Electronic health Record) with high speed and efficiency.
- **Accurate and faster diagnosis:** Though various imaging technologies have made diagnosis of diseases easier, there were lots of false positives and often the need of an expert to interpret the images and make the diagnosis. But with the invent of AI, early diagnosis has become easier and more accurate.
- **Diagnosis and treatment:** IBM's Watson for Health reviews and stores medical information from every journal and makes this data available, so that physicians can diagnose a disease and choose the best treatment faster than any human being. Google's DeepMind Health works with clinicians, researchers and patients to solve real world problems by combining Machine learning with a neural network. Deep Mind developed a clinical decision-making tool that accurately diagnose more than 50 eye diseases. "Streams" was a mobile app developed by DeepMind which aids doctors and nurses to diagnose acute kidney injury.
- **Faster treatment:** AI technology that connects ambulances with hospitals will provide data regarding the client before client reaches hospital, enabling hospitals to keep everything ready for the care of the client in advance.
- **Personalizing treatment:** AI can use predictive models or algorithms to provide individualized care by analysing data from multiple patient populations and predicting which health event or which illness may occur in a client.
- **Decision-making:** "Hark" is an app that assists in clinical task management. It identifies what

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are the tasks to be performed from admission of a client to prevent deterioration of a client, allocates patient to right kind of staff, tracks what has and has not been done and even notify staff regarding tasks when it is necessary.

- **Rehabilitation:** Microsoft Kinect is an innovative device used for effective stroke rehabilitation which makes treatment more enjoyable and thus motivating clients and encouraging adherence to the rehabilitation program. VirtualRehab and Jintronix are softwares for rehabilitation of neurological conditions like stroke, Parkinson's disease and various musculoskeletal disorders. These programs combine videogames in 3D reality with physiotherapy, allowing clients to perform the actions in their own home. As the clients feel that they are playing games, they don't feel bored and enjoys the feedback from the games which motivates them. Depending on the level of disability of the client different models of these can be chosen like the integrated model, kiosk model and Telerehab model.
- **Improving patient safety:** Predictive analytics helps to anticipate the future course of events. Hospitalization due to heart diseases can be predicted with 82% accuracy using machine learning (Wayang Dai, Brisimi TS). Risk for post hospitalization venothromboembolism could be estimated from the data entered in EHR. Also, this model was able to identify additional risk factors for VT through the data obtained from millions of HER all over the world.
- **Home health care:** Cloud based Smart Home Environment collects physiological, motion and audio signals through non-invasive wearable devices and provides information regarding client's daily activity and location in the home. The sensor data are processed to remote caregivers.
- **Research:** AI can reduce the cost in drug research and the time needed to make it reach to the market.
- **Training:** AI can make training more realistic. AI has the advantage of natural speech, ability to draw instantly a large database of scenarios and learn from previous responses from the trainees.
- **Communication:** AI combined with advancements in humanoid design can have conversation and other social interaction with people and thus help lonely elderly clients to overcome loneliness.
- **Clinical decision support:** clinical decision support tools used in nursing include alerts in EHR, clinical practice guidelines, order sets, reports and dashboards. AI based clinical decision support provides most appropriate nursing diagnoses for the client, predicts risk for fall, guided decision tree to prevent CAUTI etc.

### **Robotics in Healthcare and Nursing**

Robots relieve caregivers from tasks that are very time consuming and thus enable them to perform more important tasks. Advanced robots have more autonomy and decision-making ability, so that it will make decisions and perform tasks on its own. Robots are useful in a wide range of settings serving various purposes. They are used to assist nurses or to perform tasks independently. They can prevent hazards to nurses, like exposure to radiation or infectious agent. Robots aid in logistic chores, transportation of patients, cleaning, provide company to clients. Robots assist in homecare. *Robot Maggie* talks to user, reads magazines, plays games with the user). *RAMCIP*, a robot that assist clients

with Alzheimer's disease assist in cooking, cleaning, eating etc. Robots were utilized in screening, diagnostics, disinfection, lab automation during Covid-19 pandemic. Robots assist in treatment, for example, *REALITI*- Robotic Endoscopic Automated via Laryngeal Imaging for Tracheal Intubation handles the task of guiding the tracheal tube to correct position. Robotic surgery allows surgeons to perform complex minimally invasive procedures with maximum precision and accuracy eg: *DaVinci Surgical system*. Wearable exoskeleton robots are used for gait training. *Robot Suit Hal*, *RoSyler NT* aid in rehabilitation of clients with cerebral, nervous and muscle disorders. *Robot Kaspar* is a robot used for teaching social skills for autistic children.

There are different types of robots like:

**Supportive robots** only assist in the performance of a task.

**Cooperative robots** share the control of the task with the human user. They are used for lifting and transporting patients, rehabilitation.

**Responsive robots** are those in which the interaction between the human and the robot is by touch (eg: robot *Paro*, *Huggable*).

**Cobotic and intelligent auxiliary devices** are robots that help user to perform ADL for elderly and disabled people. (eg: *Baxter*-based dressing assistant, *AuRoRoll*).

**Telerobots** are remotely controlled robots. *TRINA* is a telenursing robot that assists nurses in quarantine areas. Telepresence robots like *ReMeDi*, *Ava* allows doctors to examine clients without being present in the same room.

### Challenges and limitations in using AI and robots in healthcare

Robots reduce human dependence and provide more privacy for the users. Though the use of AI and robots in healthcare is promising, its application is not without challenges like:

- Less user acceptance- Due to the complexity
- Poor knowledge and awareness regarding uses of robots.
- Fear of loss of companionship and isolation
- Feeling of being under continuous surveillance
- Attachment to the robot
- Deception about the abilities of robot
- Nurse's fear of losing job
- Safety challenge- physical safety and cyber security.
- Legal liability- civil and criminal liability for damages produced by robots
- Technological challenge- operating a robot in a crowded, dynamic space
- Financial constraints
- Lack of mature data to serve as foundation for AI strategies – data from all areas may not be available or sampling bias.
- Adjustment to rapid rate of technological innovation- to incorporate AI systems into the existing system of hospital, facilities are needed.

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## **Facilitating use of AI and Robotics in Nursing**

To facilitate the use of AI and Robots, action needs to be directed towards nurses as well as clients- the users of this technology. Nurses / clinicians as well as clients and all stakeholders should be involved in the development of AI solutions for healthcare problems. This will give valuable inputs which helps the output to match the user expectations thereby increasing its acceptance among the users. Robotics should be taught in the nursing educational programs which will enable them to effectively utilize these tools and appropriately present them to patients and older adults. AI application training should focus on why AI is needed, what drives the recommendations, and how it can transform patient care.

## **Virtual Reality -application in nursing education**

Virtual reality is a computer-generated 3-D simulation that delivers a wide range of sensory information to the user to allow them to interact with objects in a virtual environment and make them feel like they are physically there. In VR simulations, users wear 3-D glasses and data suits and interact with one another haptically or via a keyboard and a mouse. VR can be used to help nursing students develop skills in virtual hospital settings. Studies among nursing students have shown that virtual reality simulation (VRS) experiences developed student's clinical judgment. Immersive VR technology improved student's learning, cognitive and psychomotor performance. Virtual reality simulations show nursing students what it is like to be in a real-world clinical setting and what problems and risks they may encounter there, and thus, helps them develop skills, build confidence, and prepare for clinical practice. VR uses avatars instead of manikins or other task trainers to immerse the user into the same environment in which he or she would encounter a patient. SimConverse is an affordable AI based online communication skills training. Sim2grow, Pyxis medstation are examples of simulations used to teach medication administration. Second Life is a immersive virtual learning environment which provides rich learning environment through field trips inside virtual organs, machines and other environments like museums. Comunica-Enf is a serious game in 3D virtual reality used to teach communication competence to nursing students.

## **Benefits of using VR in nursing education are:**

Instructors can change the avatar in order to simulate different types of patients, including paediatric, adult, or patients of different cultures.

VR forces the student to have a deep understanding of how and why provider-based decisions are made and get real-time feedback throughout the case.

students can access the learning tool either at home or in the lab.

## **CONCLUSION**

AI and its applications like Machine learning, robotics, Virtual Reality, chatbots etc can transform health care and nursing care in a drastic way. They improve the accuracy, speed and efficiency of work carried out by the human user. But complete dependence on these technologies may result in harm as the success of AI is dependent on the data set available for its training. However, for AI to truly transform nursing practice, limitations must be addressed with input from nurses.

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