



A REVIEW STUDY ON ROBOTIC HEALTHCARE REVOLUTION

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ABSTRACT:

The past two decades have witnessed the rise of robotics as a challenging, emerging, developing and innovative field of research for academicians and industries. Robot can be defined as a machine that is capable of taking on a wide range of tasks with more autonomy and degree of freedom (DoF) than human beings. Presently, healthcare services and systems have become very complicated and include several entities that are marked by shared, distributed, heterogeneous devices, sensors together with information and communication technology or ICT. Internet of things (IoT) has integrated robots in things so that they connect with other things via internet. The application of robotics in healthcare facilities has guaranteed possibilities in the course of treating patients, increasing relief of clinicians and avoiding the patients as well as the healthcare staff. This chapter shows clearly the long terms benefits of people's existence in healthcare facilities such as e-health, medical emergency using robotics and IoT.

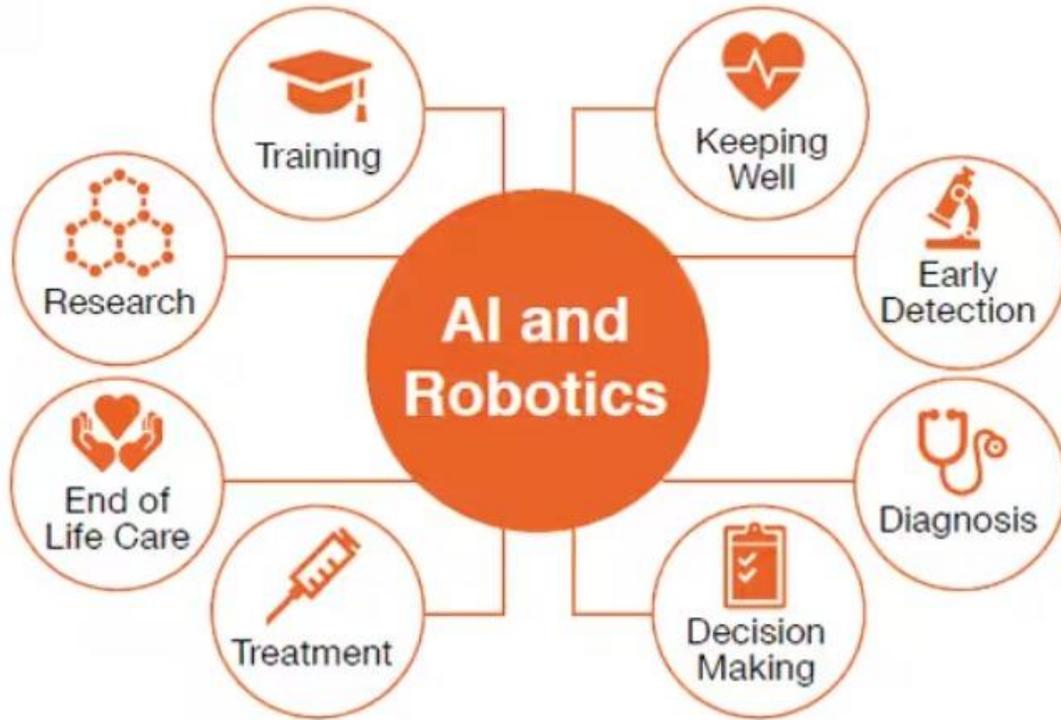
Keywords: Medical robotics, Healthcare robotics, Assistive robotics, Rehabilitation robotics, Surgical robotics, Health design, Health information technology, Evidence based medicine.

[1] INTRODUCTION

Healthcare robotics therefore involves the application and implementation of medical robot technologies and systems mainly in health facilities with the purpose of performing numerous jobs, operations, and duties that are of concern to the healthcare industry. The use of robots in healthcare represents an exciting opportunity to help a large number of people. Robots can be used to enable people with cognitive, sensory, and motor impairments, help people who are ill or injured, support caregivers, and aid the clinical workforce.[1]

They are revolutionary surgical procedures in the medical facilities, transporting supplies and guiding the process of disinfection, as well as making providers' work more about interacting with and attending to patients. Medical applications of robotics are one of the most promising fields for robotic development, and Intel provides various toolkits for creation of surgical assisting, modular, and autonomous mobile robots. Medical robots fall into several categories: By breaking down these an industry's functional responsibilities into three categories, namely surgical assistance, modular, and autonomous, it is possible to see that there is indeed room for growth. This paper will therefore argue that the incorporation of robots in the medical setting advances patient care and treatment and widens facility productivity.

Although Intel's emphasis is on the data center and the IoT, its involvement in robotics can be observed through AI-assisted surgery, automation of various process as well as real-time patient data analytics.



[2] APPLICATION OF ROBOTICS IN HEALTHCARE

The incorporation of robotics in healthcare environments is becoming increasingly common. Currently, task automation is adapted to any sector and robotics in medicine is frequently used thanks, in part, to the evolution of technologies such as 5G, AI or augmented reality.

The use of robots in hospitals has become a mainstay for the healthcare sector, especially in recent times. Robotics applications in medicine, and in hospitals in particular, have experienced a definite boost in the fight against COVID-19.[2]



ROBOTS are used in healthcare:

- Enhance patient care in clinical settings and support health workers
- Alter the way surgeries are conducted.
- Simplify supply delivery and disinfection.
- Give healthcare providers more time with their patients
- Designing drugs, and producing them
- Disseminating pharmacy dispensing information
- The effect of information technology on how surgery is performed
- This includes surgical as well as rehabilitation aids
- Assisting patients in recovery from severe diseases such as strokes.

[3] COMBINING EXISTING TECHNOLOGIES WITH ROBOTICS

Here is the list of some existing technologies that should be paired with Robotics to enhance its efficiency in health care centers: Some of the topical technologies that are appended on

robotics include: Artificial Intelligence also referred to as ‘AI’, Internet of Things also referred to as ‘IoT’, and Blockchain. The roles executed by artificial intelligence powered robots are very many and in most cases are done independently of human influence.

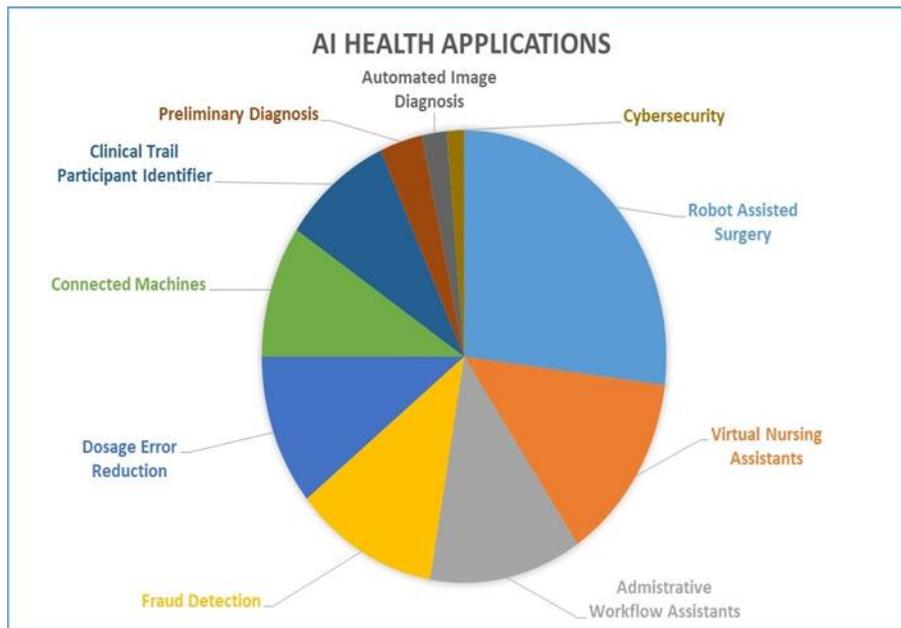
These robots can be used to monitor a patient’s form as they perform exercises, measure degrees of motion, and track progress. Service robots primarily serve healthcare professionals by completing routine logistical tasks and sending a report once a task has been completed.[3] incorporation of robotics with present day technology in the healthcare for the upcoming generation has endless opportunities for assurance of customized patient care, precise diagnosis of ailments, unique approach to treatment and a new face to the healthcare facilities. Here are some ways this integration could unfold: Here are some ways this integration could unfold:

Medication Management: Medical technology, particularly robotics, can be used to manage medication delivery and administration in health care facilities to avoid adverse events and guarantee that the correct doses of medication are given to the patient at the optimal time.

Remote Monitoring and Care: Robotic devices for patients with sensors can observe vital signs and health parameters constantly, making it possible to develop certain diseases at an early stage and take the necessary actions by doctors.

Robot-Assisted Surgery: They noted that robotics can be integrated with existing technology to enhance the accuracy of operation and reduce invasiveness. Some of the top benefits that can be derived from the application of robotic systems include the possibility of minimizing post operation effects evident from surgeries that are delicate in nature due to increased precision.

Rehabilitation Robotics: As it is known integrating robotics into the therapy and rehabilitation of patients will help improve the results in the case of injuries and surgeries. For instance, robotic exoskeletons can help refuel mobility and strength faster or even enable the ailing to walk again.



[4] FUTURE OF ROBOTS IN HEALTH CARE

Robotics in healthcare are anticipated to grow in the future, since better technologies are likely to enhance delivery of health care to people. undefined

Autonomy and Remote Presence: Some of the trends that are expected to occur include the following: Robots will become more independent, and they will be capable of completing tasks on their own and from a distance. This will allow for instance physicians, nurses and other care givers to attend directly to the patients, all the time minimizing contact with potential infection causing agents. (4) (5)

Increased Adoption and Applications: The robots in the medical field are expected to be very popular, with market potential of up to USD 44 billion by 2030. It will also be employed in surgery and physical therapy, cleaning services, and telemedicine to increase patient care and decrease the burden of work on human personnel.

Advancements in Artificial Intelligence and Data Analytics: One of the key areas of development is the integration of artificial intelligence and real-time data processing that will allow robots to make more independent decisions and perform a wider range of tasks. These

benefits will result in enhanced accuracy, safety, and effectiveness of surgeries and other treatment techniques.

Enhanced Patient Care and Recovery: Rehabilitation will be done with the help of robots which will make patients more responsive, more coordinated, stronger and mobile. They will also aid in bringing down the time of recovery and improving the general wellbeing of patients.

Cybersecurity and Training: There will be an added issue of cybersecurity with medical robots becoming more sophisticated. Medical practitioners, particularly surgeons, will need to be trained so that they can easily switch to using the new technology and approach to performing surgeries. (4) (5)

Global Accessibility and Impact: It will be possible to perform life-saving operations in various regions short of medical equipment; geographic constraints and choice of the most qualified surgeons for patients will be available to robots anywhere in the world.

[5] CHALLENGES OF USING ROBOTICS IN HEALTHCARE

The adoption of robotics in healthcare is very viable given considerable benefits that can be attained regarding patients' situation and organizational processes. However, it is necessary to outline certain difficulties to achieve these advantages which are essential in their implementation. The key challenges include:

1. High Costs:

Initial Investment: Public hospitals and many private ones, especially those that are not big and therefore receive less funding, cannot afford to invest in expensive robotic system

Operational Costs: In the same respect, there is constant purchasing of associated consumables, and servicing while complicated software also requires constant updating and the cost of specialized human personnel who operate and service the robots increases the recurring costs.

2. Technical Limitations

Complexity and Reliability: These robots' systems can be technical-intensive and at times hitches, and their issues could warrant much fix and expenses.

Integration with Existing Systems: Adapter challenges: Laying the new robotic methods over the existing healthcare systems such as e-Health records, diagnostics etc., may prove to be an immense fit.

3. Training and Adoption

Staff Training: Various forms of robotic systems require considerable training to be applied by healthcare professionals starting with the simple form, which builds to the complex form and takes considerable time and costs.

Resistance to Change: Tenders, deliveries and other activities may be completed resistance by the staff who stem from the convention- traditional methods, mid low trust new technologies, or feel threatened by them.

4. Ethical and Legal Concerns

Data Privacy: It is thus important to consider that robotics can sometimes use large amounts of patient data, which poses a potential data security and privacy issue.

Liability: The identity of the parties responsible for the errors or malfunction often can be a challenge to ascertain, especially when it is in an area such as surgical robotics that the consequences of an error could be fatal.

5. Patient Safety and Acceptance

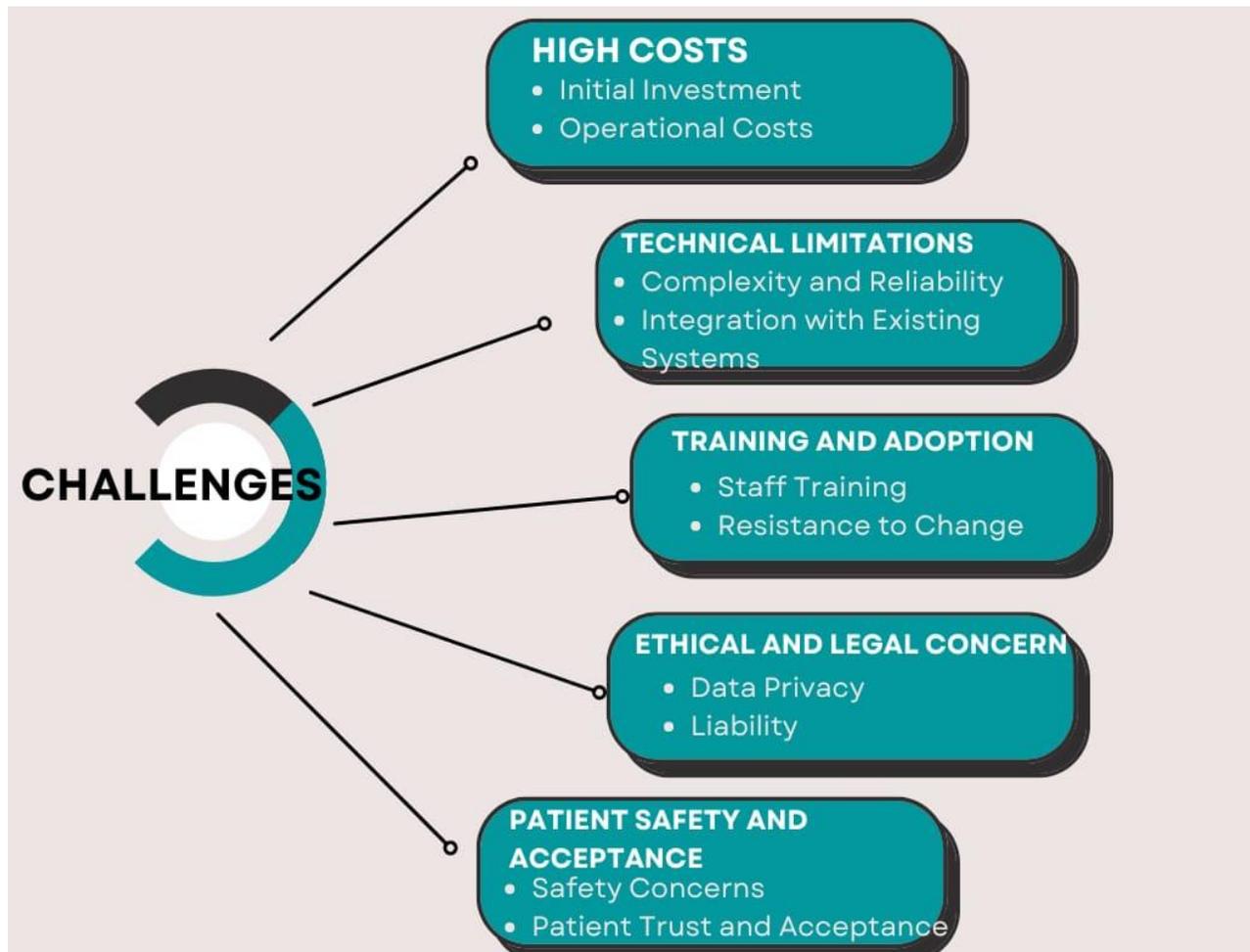
Safety Concerns: It is crucial to guarantee that robotic systems perform minimally invasive and safe movements in the clinical environment. Any breakdown of equipment can be disastrous, and it will affect patients' health.

Patient Trust and Acceptance: Patients will not be willing to have robots attend to them, especially on procedures involving their sensitive parts like the heart or their bodies.

6. Regulatory Hurdles

Approval Processes: Obtaining permission from relevant authorities (normally a health bureau within the human geography country, for example, the Food and Drug Administration in the USA) to employ new models of robotic systems may take time besides being strict.

Compliance with Standards: Robotics in the health sector will also be bound by different standard and regulatory bodies depending on regions of practice hence can be complex in implementation.



[6] CONCLUSIONS

The integration of robotics in healthcare is expected to revolutionize the industry, improving patient outcomes, increasing efficiency, and reducing costs. As technology continues to advance, the scope of robotics in healthcare will expand, offering new and innovative solutions to some of the most pressing challenges in medicine.

Addressing these challenges requires a multidisciplinary approach involving collaboration between engineers, healthcare professionals, policymakers, and ethicists. Continued research and development, alongside careful implementation and evaluation, are essential to overcoming these obstacles and fully harnessing the potential of robotics in healthcare.

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