



Robotics in the Nursing Field: A Comprehensive Review Article

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ABSTRACT

Robotics and artificial intelligence have emerged as powerful innovations in modern healthcare systems, significantly transforming the nursing profession. The growing demand for quality healthcare services, increased patient dependency, shortage of nursing professionals, and rising workload have accelerated the adoption of robotic technologies in nursing practice. Robotics is increasingly being utilized to assist nurses in patient handling, monitoring, rehabilitation, infection control, and administrative activities. This comprehensive review explores the concept of robotics in nursing, its types, applications, benefits, challenges, ethical and professional implications, role of nurses, and future scope. The integration of robotics, when guided by ethical principles and adequate training, has the potential to enhance nursing efficiency, patient safety, and quality of care.

Keywords: Robotics, Nursing profession, Healthcare technology, Artificial intelligence, Patient safety

INTRODUCTION

Nursing is one of the most demanding professions within the healthcare system, requiring a high level of physical, emotional, and intellectual commitment. Nurses play a crucial role in patient care by providing continuous monitoring, administering medications, assisting in procedures, offering emotional support, and coordinating with healthcare teams. However, increasing patient population, aging society, chronic diseases, and shortage of nursing staff have placed a significant burden on the nursing workforce.

Nurses make up the largest group of healthcare professionals and are an essential component of the healthcare system. Globally, there are an estimated 29 million nurses and midwives, including about 2.2 million midwives, according to the World Health Statistics Report. In order to satisfy the increasing demands of patients worldwide, the World Health Organization warns that by 2030, the global healthcare system may experience a serious shortage of 310,000 midwives and 4.5 million nurses.

A programmatic actuated mechanism with a degree of autonomy to perform locomotion, manipulation, or positioning" is what is meant by a robot. Robots are becoming commonplace in contemporary healthcare settings, transcending the realm of science fiction. Robots are being used more and more in clinics, hospitals, and even patients' homes for anything from telepresence and automated medicine dispensers to sophisticated surgical assistants and AI-powered monitoring systems. Instead of taking the job of nurses, these technologies are meant to assist them by removing tedious and taxing chores. This enables nurses to concentrate on providing complex care, exercising critical thought, and cultivating deep connections with their patients.

Robots must continuously be aware of their own embodiment and capabilities in order to grow more self-sufficient as they are incorporated into human-populated contexts, such as homes and healthcare facilities. In an effort to swiftly and effectively rework and reword your content, this self-awareness entails not just comprehending their physical skills and constraints but also anticipating future actions and the potential outcomes of those activities.

Technological advancement has become essential to address these challenges. Robotics, a branch of technology involving the design and use of automated machines, has gained attention for its ability to support healthcare professionals. In nursing, robotics is not intended to replace human caregivers but to complement nursing practice by reducing workload and improving care outcomes. The integration of robotics represents a shift towards technology-supported and patient-centered nursing care.

HISTORICAL DEVELOPMENT OF ROBOTICS IN HEALTHCARE

The use of robotics in healthcare began primarily in surgical fields, where robotic systems were developed to enhance precision and reduce human error. Over time, advancements in artificial intelligence, machine learning, sensors, and computing power expanded the role of robotics beyond surgery. Robots gradually entered areas such as diagnostics, rehabilitation, and patient care support.

In recent years, robotics has become increasingly relevant in nursing due to the need for efficient healthcare delivery. During the COVID-19 pandemic, the importance of robotics was further highlighted as robots were used for patient monitoring, disinfection, and delivery of medical supplies, reducing the risk of infection among healthcare workers. This period marked a turning point in the acceptance of robotics in nursing practice.

CONCEPT OF ROBOTICS IN NURSING

Robotics in nursing refers to the application of automated or semi-automated machines that assist nurses in performing clinical, administrative, and supportive tasks. These robotic systems may operate independently or under human supervision. They are designed to enhance efficiency, accuracy, and safety in nursing care.

Robotic systems in nursing may include physical robots, software-based automation, and intelligent monitoring systems. Their primary goal is to support nurses in delivering high-quality care while minimizing physical strain and stress.

TYPES OF ROBOTS USED IN THE NURSING FIELD

1. Assistive and Patient Handling Robots

Patient handling is one of the most physically demanding tasks in nursing practice. Assistive robots help nurses lift, reposition, and transfer patients safely. These robots reduce the risk of musculoskeletal injuries among nurses and improve patient comfort and safety. They are commonly used in intensive care units, orthopedic wards, and geriatric care settings.

2. Service and Logistics Robots

Service robots are designed to perform non-clinical tasks such as delivering medications, transporting laboratory samples, distributing meals, managing linen, and disposing of waste. By performing routine tasks, service robots allow nurses to devote more time to direct patient care and critical clinical responsibilities.

3. Monitoring and Surveillance Robots

Monitoring robots assist nurses by continuously observing patient vital signs, movement, and behavior. These robots can detect early signs of deterioration, falls, or distress and alert nursing staff promptly. Continuous monitoring enhances patient safety, especially in high-dependency units.

4. Socially Assistive and Companion Robots

Social robots interact with patients through speech, gestures, and expressions to provide emotional and psychological support. These robots are particularly beneficial for elderly patients, children, and individuals with dementia or mental health conditions. Social robots help reduce loneliness, anxiety, and depression while promoting patient engagement.

5. Rehabilitation and Therapeutic Robots

Rehabilitation robots support patients during physical therapy and recovery. They assist in improving mobility, strength, and coordination after stroke, surgery, or injury. Nurses play a vital role in guiding patients and monitoring progress during robotic-assisted rehabilitation.

6. Educational and Training Robots

Robots are also used in nursing education and training. Simulation robots and mannequins help nursing students develop clinical skills, critical thinking, and decision-making abilities in a safe and controlled environment.

APPLICATIONS OF ROBOTICS IN NURSING PRACTICE

Robotics has a wide range of applications in nursing practice. These include assisting with patient mobility, monitoring vital signs, supporting medication management, maintaining infection control, improving documentation, and enhancing patient communication. Robotics is particularly useful in critical care units, long-term care facilities, rehabilitation centers, and home healthcare settings.

The American Nurses Association published a paper in 2020 that offers a thorough analysis and perspectives into the use of robotics in nursing care. Given that robots are especially good at low-risk, repetitive tasks, the results imply that they can improve and augment nursing services. They can also help with quality and safety measures, such as lowering the risk of falls in both home and hospital settings. Efficient supply delivery, improved nurse productivity, more time spent interacting with patients, and pleasant emotional reactions are some of the review's main topics.

ROLE OF NURSES IN ROBOTIC INTEGRATION

Nurses play a central role in the successful integration of robotics into healthcare systems. They are responsible for operating robotic systems, monitoring patient responses, ensuring safety, and maintaining ethical standards. Nurses also educate patients and families about the use of robotics and address concerns related to technology-assisted care.

Robots are frequently utilized in nursing homes and healthcare facilities to help with direct-care tasks, transport, retrieve supplies, and clean. By following preset paths to deliver supplies, lab samples, and medications, robots such as Moxi lessen the effort for clinical staff. These robots' safety features include sensors that keep them from colliding with objects or humans. In certain situations, robots can also help with direct care tasks like feeding. With the help of a robotic arm and a spoon attached, people with significant movement impairments can feed themselves by moving food from a designated dish toward their lips.

ADVANTAGES OF ROBOTICS IN THE NURSING PROFESSION

The integration of robotics in nursing offers numerous benefits. These include reduction in physical workload, prevention of occupational injuries, improved patient safety, enhanced efficiency, better time management, reduced human error, and increased job satisfaction among nurses. Robotics also supports nurses during staff shortages and emergency situations.

CHALLENGES AND LIMITATIONS

Despite its advantages, the implementation of robotics in nursing faces several challenges. High cost of robotic systems, lack of technical infrastructure, need for continuous training, resistance to change, ethical concerns, and fear of job displacement are significant barriers. Addressing these challenges requires proper planning, policy support, and education.

ETHICAL AND LEGAL CONSIDERATIONS

The use of robotics in nursing raises ethical and legal issues related to patient dignity, privacy, confidentiality, informed consent, and accountability. Nurses must ensure that robotic care respects human values and does not compromise compassionate care. Clear ethical guidelines and legal frameworks are essential for safe and responsible use.

FUTURE SCOPE OF ROBOTICS IN NURSING

The future of robotics in nursing is highly promising. With advancements in artificial intelligence, robots are expected to become more intelligent, adaptive, and interactive. Robotics may play a significant role in home healthcare, geriatric care, tele-nursing, disaster management, and remote patient monitoring. Integration of robotics into nursing education will prepare future nurses for technology-driven healthcare environments.

CONCLUSION

Robotics represents a significant advancement in the nursing profession by supporting nurses in delivering safe, efficient, and patient-centered care. While challenges exist, appropriate training, ethical oversight, and supportive policies can ensure successful integration. Robotics should be viewed as a supportive tool that enhances nursing practice rather than replacing human caregivers.

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