Editorial

Healthc Inform Res. 2018 July;24(3):155-156.
https://doi.org/10.4258/hir.2018.24.3.155
pISSN 2093-3681 • eISSN 2093-369X

HIR
Healthcare Informatics Research

Use of Robots as a Creative Approach in Healthcare ICT

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Due to recent population aging trends and healthcare workforce shortages, the focus on information and communication technology (ICT) related to healthcare has increased. ICT is an advanced concept that converges technologies, such as the Internet of Things, wearable Internet, artificial intelligence, decision-making, and robot services, with gamificaiton elements. This could lead to innovative changes in the healthcare industry. Therefore, we investigated the usefulness of creative medical services based on ICT from a consumer health informatics perspective, such as robots for rehabilitation, nursing, and surgical applications.

The first robot to appear in the healthcare field was the ROBODOC at California's Sutter General Hospital in 1994, which was approved by the Food and Drug Administration (FDA) in 1993 [1]. ROBODOC was an artificial joint robot co-produced by Thomas J. Watson Research (also known for 'Watson', an artificial intelligence-fueled system) and the University of California. An early version of ROBODOC was developed in 1986. Since then, many robots, including AESOP and ZEUS, have been used in clinical settings across various surgical fields [2]. Today, Da Vinci systems are used in surgical practice, particularly for tasks that are too sophisticated and detailed for human hands [3]. While these robots have certain drawbacks, such as dependence on an operator's experience level and financial costs, robots are widely used for intricate procedures (i.e., small incisions and control of subtle hand movements).

As human life expectancy has increased, and surgical recovery has improved due to advances in medical technology, the number of patients experiencing nervous system diseases due to aging and accidents has also expanded. Furthermore, the number of younger individuals available to help care for older adults and individuals with disabilities is expected to decrease due to reduced birthrates. Therefore, there is a current demand for further development of medical and rehabilitation robots, and robot convergence within rehabilitative medical fields is expected to become a highly valued area of inquiry [4].

Rehabilitation robotics, which is dedicated to aiding older individuals and patients with disabilities during their rehabilitation, is an industry with a high potential for growth within modern aging societies. Robots in current use can be divided into two categories: (1) robots that facilitate rehabilitation and (2) wearable exoskeleton robots that are worn by patients to assist with movement. Rehabilitation robots are currently being used in various fields to aid with gait, eating, and upper limb, hand, and trunk movement. Wearable exoskeletal robots (shoot robots, exoskeleton robots, exosuits, etc.) refer to devices that are attached to a specific body part, such as the arms or legs, to enhance muscle strength and endurance.

In particular, these wearable devices are largely divided into upper and lower limb exoskeletons and are further classified according to the specific body part and purpose of use. Wearable robots were first developed for military purposes in the 1990s. The range of use has expanded throughout areas related to industrial applications as well as rehabilitation and assistance services. Claire Lomas, a British woman who

became paraplegic in her lower limbs as a result of a riding accident in 2012, completed a marathon wearing the ReWalk robotic suit [5]. Thus, the paradigm for medical/rehabilitative robots has shifted from 'rehabilitative/therapeutic robots' to 'companions in the journey to a healthy life' to help with basic daily tasks [4].

On the other hand, when thinking of the first prototypical nursing robot, the highly advanced robot, Baymax from the 2014 film 'Big Hero', comes to mind. However, the current state of nursing robotics is not quite as advanced as depicted in this film. Nevertheless, several robots are being used in nursing practice to check patients' conditions (either in a hospital or remotely) and assisting nurses with transporting both patients and medical supplies. Japan is among the few countries that actively use nursing robots. The Ministry of Economy, Trade, and Industry in Japan included home care support, dementia care support, and walking robots for assistive toileting in five items (transfer support, movement support, excretion care support, dementia monitoring, and bath support) outlined in the "Robot-Based Nursing Service Support (2012)" provisions in 2014 [6].

To successfully apply robots within healthcare settings, a developmental process that meets consumer needs is necessary. Furthermore, rapid prototyping and usefulness assessments across various medical institutions (i.e., those with the available infrastructure) is needed for testing. While ICT is quickly advancing, verification of ICT usefulness is lacking. Data regarding therapy with robots and its resultant effects must be collected through future research and development, and the efficacy of such robot-based treatment must be verified. Additionally, policies and regulations that can support technological development and clinical research must be created to facilitate stable growth. Finally, experts from medical, academic, and industrial fields must actively collaborate to determine how to best utilize and appropriately implement technology-based medical services with robotics.

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