Health Reflections of Gerontechnology

Abstract

Gerontechnology designs technological equipment suitable for the needs of the older people whose psychomotor, perceptual, and cognitive abilities deteriorate with age. Gerontechnology improves the quality of life of such people both physically and socially and gains them independence by providing necessary technological products taking the needs of older people into account. The use of technology brings about many advantages for older people, which enables them to maintain their activities of daily living, to manage chronic diseases, and to protect and improve their health. The aim of this review is to discuss the relationship between gerontechnology and the field of health in the light of current literature, and to draw health professionals' attention to the contribution of support provided for older people through gerontechnology applications suitable for their needs to the general health status of older people.

Keywords: Older people, Technology, Gerontechnology, Health professionals

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Introduction

The spread of technology in the modern world leads to changes in almost all areas of daily life and affects many areas such as banking, transportation, communication, work, recreation, and health services.[1,2] In today's world, where the elderly population is gradually increasing (projected to be 2 billion in 2050), the elderly dependency ratio is 54.3%,[3] and concepts such as independence, self-sufficiency, active aging, and aging in place put forward by the United Nations for older people come to the fore, technology is gaining more and more importance day by day.[4] Given the effects of technology on older people, it provides convenience for them by increasing their quality of life and enabling them to maintain their social relationships, to communicate, to obtain information, to live safely, and to protect/maintain their independence.[2] Technological products not only improve the quality of life of older people and enable them to live safely but also provide great benefits for the management of chronic diseases, implementation of safe environmental practices, and monitoring of their health status. Because the possibility of being disabled or having a worsened health status in advanced age increases, health technologies are used more in older people.[4] The aim of this review is to discuss the relationship between gerontechnology and the field of health in the light of current literature and to draw health professionals' attention to the contribution of support provided for older people through gerontechnology applications suitable for their needs to their general health status.

Definition of Gerontechnology

Gerontechnology, which derived from the words gerontology and technology, is an interdisciplinary research and application field that has been on the agenda for the last 20 years and ensures the development, implementation, and services of technological products needed as a result of research and developments related to older people and the aging process. While the gerontology side of gerontechnology refers to aging in physical, psychological, and social functions such as vision, hearing, motor function, memory, and learning in addition to demographic, epidemiological, and sociological aging, the technology side refers to concepts and "developments related to industrial design, user interfaces and ergonomics, developments related to appropriate engineering disciplines".[5] At this point, the primary purpose of gerontechnology is to use technology in order to prevent and to delay or compensate for the perceptual, cognitive, and physical deficiencies caused by aging. The second purpose of gerontechnology is to use technology to support or advance older people in the fields of communication, entertainment, and learning.[5,6] Technological products used by taking the needs of older people into account in line with these purposes improve these people's quality of life both physically and socially and enable them to acquire independence.[6-8]

Gerontechnology's Goals and Fields of Application

The five main goals of gerontechnology put forward to support older people and to solve their problems in different fields are listed in Table 1. These goals include different practices regarding the needs of the older people matching the primary, secondary, and tertiary prevention levels.[9]

Table 1. Main Goals of Gerontechnology[9]

Goals	Tasks	Applications
Prevention and education	Teaching them health and habits, and observing, monitoring them	Prevention of falls, nutrition, empowerment
Improvement and satisfaction	Gaining them hobbies, providing support activities	Improving communication with the virtual world
Support and help	Compensating for power loss, supporting motor activities	Support for movement, robotic equipment, and assistive technology
Healthcare support and organization	Providing support for movement and lifting	Ergonomically designed equipment
	Monitoring and managing their medications	
Clinical follow-up and evaluation	Measuring and analyzing physiological changes	Medical imaging, non-invasive techniques

In many countries, the concept of "aging in place" is increasingly being adopted in policy and practices. For aging in place, it is important for people to be able to maintain their independence in order that they can perform activities of daily living. At this point, gerontechnology greatly contributes to the independence of the older person, takes its place in

Table 2. Application Areas of Gerontechnology in Daily Life[9.]

Application areas	Purposes of applications
Health and self-realization	Supporting physical, cognitive, and emotional functions Preserving independence
Housing and daily living	Building technology such as ergonomic doors, safe bathroom arrangements, and maintenance of routine work appropriately, safely and independently through architectural knowledge, and regulation of heating, lighting and other environmental factors
Personal mobility and transportation	Applications that facilitate transportation such as stair rails, walkers, wheelchairs, and barrier-free environments
Communication and management	Establishing communication with young people and peers, social interaction, and remote monitoring of health
Work and leisure time activities	Applications helpful for physically demanding jobs
	Applications for working in a safe work environment
	Work at home or part time applications
	Participating in learning and creative and entertaining activities

different application areas of daily life such as health, housing, transportation, communication, work and recreation, and serves the purpose of realizing aging in place (Table 2). Kalinkara et al.[9] mention five application areas of gerontechnology (Table 2). One of these application areas is "Health and self-realization application area". With this application area, technological developments in the physical, emotional and cognitive fields ensure the provision of support for older persons in daily life in order to protect their independence in their homes and daily lives. The aim in the "Housing and daily living application area" is to carry on routine work safely and independently. In the "personal mobility and transportation application area," the concepts of convenience and comfort come to the fore in order to maintain the mobility of the older person. The "communication and management application area" is also an important application area in which communication is established and maintained in order that the older person maintains social relations and that areas such as telehealth take their place in elderly health. In the "work and leisure time activities application area," the aim is to maintain safe working environments or working styles in the working life and to perform high quality and efficient leisure time activities by using technological developments/products.[9]

The International Society for Gerontechnology, the first official institution related to Gerontechnology, was established in 1997, and it has been organizing international congresses every two years since 1999.[10] In our country, Turkey, the first Gerontechnology center was opened within the scope of the "Aging and Innovation: Istanbul Gerontechnology Research and Application Center" project carried out by Istanbul University Faculty of Health Sciences. In the center, various interventions and applications such as necessary rehabilitation initiatives, environmental arrangements related to ergonomics, healthcare procedures to be provided with technological devices used in the solution of health problems, training to support activities of daily living are carried out by evaluating older people's problems such as balance and falls.[11] The spread of such centers throughout the country will improve the comfort and quality of life of older people living in every geographical region.

Gerontechnology Products

A wide variety of supportive healthcare technologies has been developed to facilitate the daily lives of older people. These products produced by different companies in several countries are classified under three headings (Table 3).[12-30]

Wearable Technologies Area

Clothing that Facilitates Older People's Walking
It helps older people with walking difficulties to walk with the system placed in their hip, knee, and foot areas fitting their body.[12]

Smart Clothes
Information about the vital functions of the individual is obtained thanks to the system that can measure and display the vital signs (such as pulse, blood pressure, fever, etc.) of the elderly person wearing smart clothes, and can communicate with the necessary places bilaterally. Smart clothes ensure that the necessary intervention be performed easily and quickly in emergencies. Data analyzed by software is accessed via mobile devices.[13]

Self-balancing Shoes
Thanks to the sensors in their heel, these shoes detect the imbalance in any still position or movement and stabilize the foot, and prevent the risk of falling. If a fall still occurs, a warning signal is sent to the mobile phones of the relatives of the older person.[14]

Table 3. Supportive Healthcare Technologies Areas of Gerontechnology

Supportive healthcare technologies areas	Product type
Wearable technologies	Clothing that facilitates walking
	Smart clothes
	Self-balancing shoes
	Smart watches
	Robotic walker
	QR code badges that help lost older people find their ways
Indoor and outdoor technologies	Smart homes
	Wireless communication sensors
	Personal emergency response systems
	Automatic medication time reminders
	House cleaning robots
	Socially interactive robots
Information and communication technologies	Telephone
	Internet
	Television
	Telehealth
	Phone chain

Smart Watches for Older People

These watches, whose simplest function is to tell the time, perform several functions such as telephoning, sending messages, and accessing social media without a mobile phone. A smart watch not only enables family members to easily track the person wearing the watch through GPS but also meets the needs of the older person with applications such as contact list and medication reminders.[15]

Robotic Walker

It provides the shortest and most suitable route for the older person by performing location analysis with its simple touch screen and sensors. Equipped with brakes and motorized wheels, the device adjusts the stopping and turning times by preventing the older person from making turns in the wrong direction.[16]

QR Code Badges that Help Lost Older People Find Their Ways

QR code badges, which can be scanned and read with smartphones or any similar device, can easily provide details such as ID information, address information, etc. to those who are to help. It can be placed on any object such as an ID card, bracelet, necklace, key chain, or even on the skin.[17] Such auxiliary tools will greatly facilitate the daily lives of both older people and their caregivers.

Indoor and Outdoor Technologies

Indoor and outdoor technologies include systems and applications that will contribute to the socialization of the older person both at home and outside the home. These systems and applications are listed below:

Smart Homes

These homes have the systems designed to respond cognitive, affective and physiological needs of older people. In these homes equipped with technological tools and equipment, all the systems are interconnected. With remote control or sound sensors, automatic control of the electrical devices, heating systems, security system, television, sound system, irrigation system, curtain, and garden/garage door can be easily realized. In addition, these houses can be constantly monitored by the relatives of older people, and they can be contacted whenever desired by means of communication tools. Thus, the health, safety and communication needs of the older person are met.[18]

Wireless Communication Sensors

These sensors that detect the movements of elderly people when they are alone in the house can be attached to household goods and furniture. If a danger is detected by the sensor at the time of movement, the relatives of the older person are warned.[18]

Personal Emergency Response Systems

This device, which makes it possible to contact the family in case of emergency, sends a warning to the call center with a single button. These devices, which are like a watch or accessory that can be worn on the neck, enable people to communicate with their caregivers or families when they are in need of care.[18,19]

Automatic Medication Time Reminders

These products, which remind older people who have to take many drugs as they get older, enable the older person to take his or her medication timely. These devices give an alarm or send messages to the phone if the medicine box is not opened when the time to take the medicine comes. In this context, some telephone applications prepared in Turkish as medicine reminders have been put into practice.[20]

House Cleaning Robots

These robots prevent the older person from bending over, and perform cleaning tasks at desired times. They can be programmed, are rechargeable, have remote control features and verbal warning systems.[21]

Socially Interactive Robots

These robots are used to help older people perform activities of daily living, to ensure their security and to recover their movements by supporting their independence. On the other hand, these human-like robots act like a friend and thus make older people feel mentally better.[22]

Information and Communication Technologies (ICT) Area

The use of ICT provides various solution opportunities for health care problems faced by older people. These technologies including the internet, wireless networks, cell phones, computers, television, telehealth, and phone chain enable their users to exchange data over the phone or the internet (Table 3).

Phone

Older people who cannot adapt to phones that develop with technology prefer phones designed for those people. These phones produced in appropriate sizes in different brands and models have simple-to-use software, and provide clear images in cases where zooming is required. Due to their low light performance, magnifying glass and programs that help to read texts, shortcut keys suitable for use in emergencies and integration with hearing aids facilitate older people's communication on the phone.[23]

Internet

The internet, which makes such activities of daily living as shopping, ordering, paying bills, and banking transactions, etc., much easier, is used not only by young people but also by older people a lot. In addition, applications such as social media and video chat comfort older people who are far from their family members and are filled with longing to hear and see them. Making use of their spare time facilitates the life of older people who want to learn new things.[24]

Television

When older people are retired or they are not able to work, they tend to spend their spare time by watching television, which is an economical and easy-to-use tool. In addition, because TV does not require physical movement, it is easy to use for people with hearing and vision problems, and it enables them to stay in contact with the outside world in a social way, they tend to watch television.[25]

Telehealth

It is an application that provides remote communication between the individual and the health personnel with the help of telecommunication in order to meet the individual's needs and to provide care for him or her.[18] People should be informed about tele-health and be taught how the system works, how to use the equipment and what to do in an emergency, and older people and their relatives should be given comprehensive training on issues such as the treatment and care of chronic diseases. In order for older people to easily understand and use the telehealth system, it is of great importance to choose the most appropriate and easy-to-use tools.[18,26,27]

Phone Chain

It is a system created to maintain communication between older people living close to each other. Each person in the chain has a list of phone numbers of all people in the chain. The first person in the list gets information about the health status of the next person by calling that person. Then, the person called, in turn, calls the next person, and the chain is completed as the last person calls the first person. If any one of the people in the list cannot be reached, their relatives are informed, and if necessary, their homes are visited to find out if anything is wrong.[28]

These applications, which are increasingly used in information and communication technologies, have an important place in determining and meeting the health and social needs of older people.

Benefits and Challenges of Gerontechnology

Health professionals, who assume significant responsibilities to identify and diagnose the health problems of older people in a timely manner and to find solutions to their problems, take an active role in supporting the independence and autonomy of older people to ensure their aging in place, and at this point, gerontechnology applications/products come to the fore.[28] The positive aspects of the use of gerontechnology in older people are as follows:[1,7,9,18,28]

- Older people with chronic diseases can be monitored more closely, and management of a chronic disease can be carried out effectively.
- Thanks to the facilitation of transportation and communication, older people can be accessed easily, they are enabled to benefit from health services better, and thus their quality of life improves.
- Detection of possible diseases and risks can be easier and changes in their health status can be intervened earlier, and thus the number of hospitalizations, workload of the health team, health, and social costs are reduced.

- By preventing possible accidents and falls likely to be experienced by older people living in safe environments, hospitalizations rates, and sudden deaths can be prevented.
- Thanks to older people's being able to maintain their social communication, psychological problems such as loneliness, depression, etc., brought about by social isolation can be prevented/reduced.

However, technology, despite its positive aspects, may pose some challenges for older people while they use these technological products.[29,30] The decrease in movement, comprehension, and hand skills resulting from the deterioration of psychomotor, affective, and cognitive abilities with aging limits their use of technological products. With the development of technology, the technologic products' features have become more complex, which brings along problems such as not being able to read small prints and not understanding the technical features in older people. Another serious problem is that older people stay away from technology because they think that technological products are too complicated, expensive or dangerous for them to understand. Another problem that should be taken into account is that older people, whose incomes decrease with retirement and whose health needs increase, limits their access to technological products due to the inability to allocate a budget for these technological products. Considering all these problems, it is important for healthcare professionals providing care for older people at home and nursing homes to consider not only conveniences but also difficulties brought about by gerontechnology products.

Conclusion

Gerontechnology products play an effective role in older people' participation in social life, enables them to live without dependence on others, provides a space for them to fulfill their movements more comfortably, and ensures their aging in place, security, and protection. The use of technology by older people has brought about many advantages for them, because it has enabled them to maintain activities of daily living and to manage their chronic diseases more independently, and has contributed to the protection and improvement of their health. Health professionals' carrying out various studies to determine the effects of the use of technological products by older people on their care will contribute to the development of this field. It is recommended that studies aimed at enabling health professionals working with older people or their relatives to be knowledgeable about the use of gerontechnology products in protecting, developing and maintaining older people's health should be carried out. It is also recommended that activities to raise healthcare professionals' awareness of the use of gerontechnology devices should be disseminated, and that older people and their relatives should be encouraged and supported to use these products. It is also recommended to conduct training and consultancy studies to investigate the effect of gerontechnology on health care practices, convenience and challenges of using gerontechnology devices and users' satisfactions of these devices.

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