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## Gerontechnological factors affecting successful aging of elderly

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### ABSTRACT

In this article, the gerontological factors affecting the successful aging of the elderly have been uncovered, the quality of life and successful aging issues have been related to gerontology and investigated on a different dimension. It has been emphasized that the importance of gerontechnology on the successful aging, creation of awareness through formal and non-formal education, qualitative and quantitative researches should be increased. Qualitative and quantitative researches on the subject were evaluated together, gerontology and gerontechnology were considered together with successful aging, and gerontology functions and ergonomics should be taken into consideration in increasing quality of life. In addition, the concept of geronsafety, a new concept in gerontology, has been put forward, emphasizing the effects of safety on gerontology and successful aging.

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### Introduction

Improved living conditions, technological developments in the health field have enabled the elderly population to grow rapidly [1]. In 2017, 12% of the world's population consists of 60 and over-age groups. The average age shows an increase with respect to the total population. In 2017, the number of people aged 60 and over reached 962.3 million and the world population reached 7.6 billion. Of the individuals aged 60–79 years, 41% are male, 45% are male, and 6% are males and 9% are females of age 80 and older [1].

The adaptation of the aging population with developing technology and successful aging has become important issues to be solved. Gerontechnology is a concept that represents electronic or digital products and services aimed at increasing the free living and social participation of individuals under the conditions of health, comfort and trust [2]. In this context, technology, products and services developed and produced on the basis of knowledge about the aging process are included in the field of gerontology [3]. The useful products and services developed with gerontechnology also contribute to gerontology as well as helping the social networks of the individuals to develop and secure their security. An example of this is the attempt to compensate for the declining tendency of physical and cognitive functions due to disease and aging with supportive and adaptive medical

technology [4,5]. As technology advances, assistive and adaptable technologies are evolving, but this brings security vulnerabilities. Technological contributions of gerontechnology to the product and service network must be ensured by taking safety aspects into consideration. Successful aging is about issues such as avoidance from illness, high physical and mental functioning, active participation in life, lack of biomedical meaning, psychological well-being, life satisfaction, financial security, positive perspective on life [6]. The well-being of these individuals in the aging process of an individual affects the quality of life of the individual. In addition to determining the factors affecting the successful aging of the individual physically, psychologically, biomedically, socially and financially, the effect of technological factors is also important. Particularly, physical problems are important in aging. Sarcopenia is one of the physical problems that affects successful aging. This disease is the loss of muscle mass quality. A study on this symptom highlighted the effects of sarcopenia on the functionality of elderly [7].

Biological factors and diseases have important effects in successful aging. İlhan et al. [8] developed IMSelf-neglect questionnaire (Istanbul Medical School Elder Self-Neglect questionnaire) which is used to determine self-neglect status of elderly individuals in terms of quality of life and successful aging. According

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to this study, individuals with self-neglect decreased functionality and low quality of life. In addition according to another finding, individuals without self-neglect tended to have more depression [8].

Testosterone levels and reproductive health are effective particularly in the aging male. In this context, Afsharnia et al. [9] revealed the positive effect of the computer-based educational package on quality of life and reduction of hypogonadism symptoms (gonad deficiency). This symptom adversely affects the physical and psychological health of the individual in the aging process. According to another study, Canguven et al. [10] revealed that vitamin D treatment improves testosterone levels and metabolic syndrome in middle-aged ( $53.2 \pm 10.4$  years) men.

A study on different glucose tolerance state, testosterone and osteocalcin demonstrated that serum total testosterone decreased significantly with the deterioration of glucose tolerance status [11]. Otherwise, MacDonald et al. [12] highlighted the adverse and efficacy effects of newer drugs used to treat lower urinary tract symptoms. According to this systematic review shows that lower urinary tract symptoms can negatively impact quality of life in aging [12].

Faced with the rapid increase in the average age of the population as proposed by the United Nations Department for Economic and Social Affairs (2017), governments proactively propose policies for sustainable development in which the needs and interests of elderly people are related to housing, employment, health care, social protection and intergenerational solidarity [1]. In addition, it will contribute to the daily activities of the elderly, to increase the quality of life, to help them to live healthy and to contribute to the literature and policy makers to examine the gerontechnological factors that will provide social participation. In this study, gerontechnological factors affecting successful aging are examined in the context of technology adoption and use, suggestions for future studies are presented.

## Aging

Aging, the advanced period in which the physical and mental changes of the life span from venter until death are seen; the age at which biological, social and psychological interactions are complicated [13]. It is that the essence of the cell and the organism starts to deteriorate and grows in the advancing age with the influence of the environmental factors. This is not a single process [14]. Old age, the emergence of physical disabilities and diseases, the beginning of mental

health and loss of cognitive functions, and the start of social and active participation are beginning to fall [15].

The social concept of aging has been tried to be explained by the theory of activity developed by Havighurst in 1960 [13]. It is demonstrated by this theory that continuing activities and social roles are important factors affecting aging. Social inactivity will push people into misery, so that the individual will become isolated from the social point of view and will become obsolete. The biologically aging individual is thus accelerating with the loneliness and unhappiness situations [16]. Studies show that active individuals who integrate with the society feel healthier in spiritual and physical terms than their inactive individuals and that their happiness is higher [17].

Aging becomes evident by the lack of skills of learning, reflex, and intelligence. The person with whom these effects are seen begins to be felt as a gradually diminished entity. The elderly person, who is depressed in social and mental terms, begins to weaken economically. For this reason, in order to achieve success in old age in terms of sociology, it is necessary to develop the relationship between the individual and society [18]. In terms of psychology, there is a constant need for a successful aging [19]. Psychologically declining, socially deprived, and increasingly physically and mentally increasing problems, individuals are increasingly approaching death in later ages, causing the individual to withdraw from the social side [20].

## Successful aging

According to the definition made by Rowe and Kahn [21], successful aging is positive in terms of mental and physical competences. The low risk for the disease is indicative of successful aging [21]. There are social, mental, physiological, health, and activity factors that affect successful aging. Differences in these factors led to different opinions about successful aging [22, p. 930]. One of these views is a pathological aging. The fall of aging and the depression of the disease due to the disease reveals the fact that aging is successful [23]. Due to the age-related physical stresses and decreased functioning of the organs, the increase in external dependency affects successful aging negatively [19]. An individual who actively performs physical movements and actively participates in life activities is a pathologically successful aging candidate [24].

**Table 1.** Successful aging approaches.

Approach	Explanation
Healthy/pathological aging	Pathological aging is based on the assumption that aging is a co-morbid phenomenon, includes age-related disease symptoms, and regressive processes [23]. Decreased brittleness and increased brittleness of bones, sarcopenia, dotage, loss of functioning of organs caused aging to be seen as a kind of chronic disease. Pathological aging is an age-related process characterized by medical and cognitive syndromes [19]. Dementia, dotage, amnesia due to old age are the most common disease syndromes in this process
Positive aging	Positive aging is an extension of positive psychology. It has been shown that aging of some specific behaviors mediates the deteriorating effects of the present situation. The ability to mobilize hidden or undiscovered forces is called positive aging characteristics according to Hill [25], the flexibility in thinking and behavior, the decision-making style that supports individual well-being, and the optimistic viewpoint on age-related decline [25,91]. Hill [25] stated that the main features of positive aging are the ability to mobilize the power to cope with hidden or unexplained difficulties, flexibility in thought and behavior, an optimistic view of retrospective issues, and decisions that confirm personal well-being [25]
Biomedical approaches	Biomedical theory discloses successful aging as an attempt to raise life expectancy while trying to reduce physical and mental impairments [6]
Psychosocial approaches	Life satisfaction, social functioning and participation, and psychological resources are key concepts for successful aging according to psychosocial theory [13]. Life satisfaction refers to persistence, pleasure, morale, perseverance, relationships between the desired and desired ends, self, mood, and well-being. Social functioning refers to social role, positive interaction and communication with other people, social integration and social participation. Psychological resources refer to self-esteem, positive point of view, self-efficacy, sense of control over life, independence and autonomy, and the ability to cope effectively with changing circumstances [29]
Lay view	Situation vision, mental, psychological, physical and social health, function and resources, life satisfaction, financial security. Bowling and Dieppe [6] suggest that learning about new things, achievements, physical appearance, productivity, addiction to life, sense of humor and spirituality are effective on successful aging. Success is related to the status of aging and the situation at the same time social capital refers to safe neighborhood relations and social opportunities to keep the quality of life high after retirement [6]. Bowling and Iiffe [92] suggested that the status/lay-based successful aging model is multi-dimensional in comparison to others and should be used to assess outcomes in the development and promotion of health

Positive aging, a branch of positive psychology, is another of the successful aging approaches. Being flexible in thought and action, being able to make decisions that reflect individual well-being, and having a nimble and optimistic thinking structure are indicators of positive aging [25]. Positive decisions, optimism, flexibility, mobilization of resources constitute the four dimensions of positive aging [26]. Flexibility refers to the harmonious thoughts and behaviors that an individual has in managing his or her activities. Optimism refers to looking at a positive and optimistic view of life. This behavior and way of thinking can be learned by other individuals [27]. The decline in the physical functioning of the individual can lead to the uncovering of hidden competences. The decline in physical communication can lead to the emergence of competence in conversation via the Internet. This can be explained by the fact that the individual activates the resources they possess [28]. Another factor influencing quality of life and successful aging is personal acceptance. Personal acceptance is psychologically influential in revealing intentions. Individuals who accept events, people or products exhibit their behavior positively. This is in the form of positive decisions [25]. Examples of these decisions include the acceptance and use of gerontological devices by elderly individuals, the use of medical devices for healthy living, and the purchase of services for personal care.

Concepts such as personal pleasure, life satisfaction, social participation, social interaction, autonomy in the aging process are examined in psychosocial approach. The social status of the individual in the elderly

process, the reflection of self-respect in the social environment, the level of achievement of the objectives are effective factors on successful aging. The psychosocial approach explains the individual's success in the aging process with the meaning that psychological and social factors add to his or her life together [29].

Factors related to personal circumstances such as neighborhood relationships, financial problems, social opportunities, productivity and spiritual life are influential in successful aging working life. All these factors are explained under the name of the situation view because they are changed from person to person. This approach addresses the issue of how an individual begins to retire with retirement, how he or she practices the position of social relations, what contributions contribute financially to their lives, what they do for personal care, and how they use their resources [6]. Approaches and explanations for successful aging are shown in Table 1.

### Successful aging and quality of life

According to the definition made by the World Health Organization, quality of life, culture and values are the individual perception of their existence in the system and their position in their life, their aims, expectations, standards, and their anxieties related to their concerns [30]. Quality of life is an individual's physical and mental health, level of freedom and independence, social relations, personal beliefs and the relationship with the environment. In particular, the quality of life,

which indicates a perceptive phenomenon, refers to a subjective situation that changes with cultural, social and environmental influences in this respect and is also related to successful aging. The quality of life is a multidimensional concept due to the different perspectives that vary with each individual [31,32]. The quality of life is a composite of two components: (a) physical, social and psychological well-being as a result of daily life activities, (b) patient satisfaction with functional and disease control and level of care response [33]. These two components reveal tools for determining successful aging.

### Factors affecting quality of life in the elderly

Social support satisfaction is an important front-line for quality of life. Declaration of interpersonal sensitivity may reduce the proximity. In a study conducted on 128 adults living in rural areas, it is supported that social support satisfaction plays an important role between interpersonal sensitivity and quality of life [34]. This is an important predictor of the quality of life with the aging of a person who begins to become emotionally sensitive as the age progresses.

Social support includes supportive perception and various forms of help from formal and non-formal social networks [35,36]. Individuals need to be perceived as support for their social support as well as benefits from social networks. This situation reveals the concept of relationship satisfaction. A life style in which emotional support is low and relationships are not reciprocal pose a risk to the mental health of elderly individuals [37,38]. Psychological well-being, feeling of inadequacy, feeling of weakness as a quality may be closed to the environment of the elderly, and it can lead to weakening of relations [39].

Health-related quality of life is measured by the perception of physical, social and mental well-being [40]. Research shows that low health-care quality is seen in older people with chronic conditions such as diabetes, hypertension, dyslipidemia (having a high level of fat) and dementia [41]. In the same way, health problems that make older people's physical activities difficult, such as ophthalmologists, also decrease quality of life and productivity [42]. Issues such as inadequate natural or artificial lighting, glare, reflection rate of objects, transmission and reflection of light, color temperature of light are visually influencing the quality of life of the elderly [43].

Ergonomics in the quality of life of elderly people have an important role. Many elderly individuals are resistant to gerontechnological products. Personal

anxiety, the level of complexity of technology, the lack of self-sufficiency in self-sufficiency, the needs are the main causes of resistance [44]. In studies conducted in the field of gerontology, the measurement of patient satisfaction has been shown to increase the quality of life and psychological well-being of ergonomic devices [45]. Increasing patient responsibility and self-determination increase satisfaction in the elderly, making health care more difficult [46].

### The gerontechnology

Gerontechnology is an approach derived conceptually from gerontology and technology words, given to the whole of old age and technology work for the improvement of the daily activities of the elderly [47]. Gerontechnology is the sub-branch of Gerontology [47,48], which is interested in exploring, developing, presenting and evaluating technological products and practices that improve the life and daily activities of older people, improve their quality of life, improve their physical, mental and social capacities and situations. This approach, initiated by Graafmans and Brouwers [48], has begun to provide significant contributions to social service and old age science [48]. Gerontechnology is a multi-disciplinary approach that includes research, design, production and marketing. In the context of aging, many subjects such as scientific studies, development and implementation of products, environment, social services, consumption, law, politics, investment, etc., are included in this approach. Gerontechnology provides an analytical perspective on the versatility of aging [47].

This approach, which includes various elements such as physical, mental and technological aspects, is accompanied by harmonization and security elements. To minimize the effects of aging in life and work activities requires a harmonization process. The design and design of the technology is required in accordance with this adaptation process. However, the most important issue that should not be forgotten before anything is security. Safety is a priority in technology design. A healthy life and business activity may be possible with safe technology. For this reason, personal safety in gerontechnology needs to be investigated in the context of geronsafety [49].

### Geronsafety

The daily life activities of elderly people are tried to be facilitated with gerontechnology. Rapid change of technology, daily activity difficulties arising with aging,

environmental factors becoming increasingly threatening factors, together with ergonomics, make safety-oriented workings almost imperative. The age-related decline in mobility suggests that the increasing risk of possible accidents in urban life means that the safety factor of technology should be taken into consideration at a significant level. Geronsafety is concerned with researching, developing, presenting and evaluating products and social services that improve the physical, mental, health, social capacities and situations in terms of personal safety and provide safe living conditions for the elderly, the sub-branch of Gerontology [46,50].

In today's world, the population is growing rapidly, and technology is advancing to the point where this increase is behind. Environmental pollution, health problems, the increase in the number of electrical equipment significantly increases the risk of accidents. Sensory and operational weaknesses such as sight, hearing and movement in old age increase the risks of these accidents. For these reasons, gerontechnology should be at the forefront of studies that takes into account personal safety measures. It has become a necessity in today's world to carry out gerontechnology in the geronsafety study field which will keep the safety factor at the first level. Safety is important not only in the use and production of technology, but also in the conduct of social services. Safety is an integral part of this factor, as health care is an important factor in elderly care in the first instance. In particular, safety measures should be taken to address issues such as drug use, routine controls, psychological support, physical protection, and physical needs [51]. It should not be ruled out that the gerontology topic may have significant effects on successful aging, quality of life and acceptance of technology.

### **Facilitators and obstacles to technology adoption by older users**

In a survey of 68 elderly e-mail users and non-users, it was determined that participants focused more on profits than costs, and that age of barriers such as usability had a determining role in new technology use and perceived profit [52]. The interrelation between perceived ease of use (PEOU) and technology use is very strong in old age. Perceived usefulness has a stronger impact on young people's use of technology. While behavioral intention is a dependent variable, independent expectant effort strongly influences older workers and women. Social influence strongly influences women and older workers under the

conditions of forced use [53,54]. Socio-demographic variables indicate that men consider the perceived usefulness more highly, and women are highly influenced by the PEOU in making decisions about technology acceptance [53,55]. Psychological preconditions and attitudinal factors are as important as socio-demographic characteristics. Wagner et al. [56] found that anxiety-related constructs such as technophobia are the main barriers to computer use among the elderly [54].

A survey of 450 microcomputer users in Finland found that the PEOU had an indirect effect on usage, and the PEOU had a direct or indirect effect on the use of PEOU it has been shown that it has indirect influence on the perceived usefulness if it has strong direct influence on the usefulness. According to this research, organizational support and computer anxiety have only indirect impact on usage through perceived usefulness [57].

In a survey conducted using the structural equation model with 55 years and over 120 Chinese, the proposed smartphone acceptance model is based on the technology acceptance model (TAM), unified technology acceptance and technology use model (UTAUT), individuals with good economic conditions due to their support from the wage or family have been found to be more likely to use smartphones. It has been demonstrated by this study that personal satisfaction and facilitating conditions (FC) have an effect on perceived usefulness (PU) and PEOU. The survey of the work done consists of four parts. The first section contains information on how often a user uses a smartphone: very often (1), often (2), occasionally (3). In the second part, information on researching the acceptance structure is included: PU, PEOU, attitude towards using (AT), FC, self-satisfaction (SS), cost tolerance (CT). The third part consists of the skills and health of the elderly and the fourth part shows the demographic characteristics of the elderly users. Expressions were measured using a seven-point Likert scale [58].

In a study conducted by Deng et al. [59] on 424 elderly and middle-aged mobile healthcare users in China, the perceived value in the light of the theory of planned behavior (TPB), perceived physical condition, and resistance to change were determined as factors influencing resistance. Attitude, perceived value, perceived behavioral control, technology acceptance, self-fulfillment need and behavioral intention were found to be significantly related. Heart and Kalderon [60] found a significant relationship between perceived behavioral control and behavioral intentions in a study of health-related information and

**Table 2.** Technology adoption models.

Theory	Behavioral intentional components	Explanation
TAM	AT behavior	This dimension measures positive or negative feelings about the achievement of a person's target behavior (evaluative effects) [93]
	Perceived usefulness	This dimension measures the degree to which one believes that using a given technological system will improve business performance [94]
	PEOU	This dimension measures the degree to which one believes that using a given technological system does not require effort [94]
TPB	AT behavior	This dimension measures the level of positive or negative feelings about the attainment of one's target behavior (evaluative effects) [93]
	Subjective norm	This dimension measures the level of thinking that many people who are important to him should or should not do this [93]
	Perceived behavioral control	The perception meter [95, p. 188] about the ease or difficulty of performing the behavior
UTAUT	Performance expectation	This dimension measures the degree to which one believes that using a technological system will help him to make a profit in business performance [53]
	Effort expectancy	This dimension measures the degree of convenience associated with the use of the technological system [53]
	Social effect	This dimension measures the degree to which one believes that the most important people should use a new technological system [53]
	FC	This dimension is the level of belief that there is an organizational and technical infrastructure to support one's use of the technological system [53]
Unified theory of acceptance and use of technology (UTAUT2/Unified unified theory of acceptance and use of technology)	Performance expectancy	This dimension measures the degree to which one believes that using a technological system will help him to make a profit in business performance [53]
	Effort expectancy	This dimension measures the degree of convenience associated with the use of the technological system [53]
	Social effect	This dimension measures the degree to which one believes that the most important people should use a new technological system [53]
	FC	This dimension is the level of belief that there is an organizational and technical infrastructure to support one's use of the technological system [53]
	Hedonic motivation/perceived pleasure	This dimension measures the level of perceived use of technology as pleasure and entertainment [96]. Technology users have been added to UTAUT, keeping in mind that they are consumers at the same time
	Price value	In a marketing research, the monetary cost/price is often assessed with the quality of the product or services to determine the perceived value of the products or services [97]. It measures the level of cognitive change between the perceived benefits of the practitioners and the monetary cost of using them [98]

Source Adapted from Venkatesh et al. [99], Rahman et al. [100].

communication technologies over 63 in the USA and 60 in Israel. Tseng et al. [61] was identified as a predictor of intervention in the research on the international health monitoring system of 32 elderly people living in Taiwan, performance expectancy, social impact, facilitating factor. It has been found that there is a significant relationship between enterprise expectation, performance expectancy, social impact, facilitating situation and intention of behavior. Wilson and Lankton [62] identified 1750 middle and elderly patients in the United States as factors influencing health information, information research, and health care needs in e-health care research. PEOU with health information; PEOU, PU with information research; The PEOU was found to be a significant relationship between PU and behavioral intent.

Table 2 contains the theories and dimensions of technology acceptance and use. The limited number of researches on technology acceptance of elderly individuals in the literature suggests that researches on this field should be increased. Increasing researches that demonstrate the applicability of the dimensions on Table 2. In the elderly will reveal the importance of the technology factor in the successful aging of elderly individuals. In a study using a structural equation model based on variance to analyze data collected from Portuguese elderly individuals, UTAUT2 was used in a survey, some of which were direct (behavioral intent, habit) and others indirect (performance expectancy, effort expectancy, social impact, FC, hedonic motivation) has been found suitable for this population group. The study suggests that older adults

support behavioral intentions and UTAUT2 validity in order to effectively explain the use of information and communication technology [63].

### **The impact of technology on the quality of life**

Many clinical and ergonomic studies have shown that ergonomic devices improve quality of life and psychological well-being [43]. These studies, conducted through patient satisfaction measurement, demonstrate the importance of ergonomics in technology [64]. A general health survey of 48 elderly patients showed that increasing patient responsibility and free will can improve patients' self-efficacy levels [65]. More explicitly, increasing the confidence and responsibility of the elderly themselves will improve their level of satisfaction with technological products and services associated with these products. Brod et al. [66] describe the quality of life in the context of the lives of individuals. Individuals' personalities and characteristics change the way they view their present lives and their lives. For this reason, the quality of life status varies with each individual [66].

In terms of technology, the collection of information on the quality of life can be categorized into three categories: telephone, computer and Internet. These three category formatting options have common benefits, such as language selection, medical stimulation. Phone-based technology, mobile phone and phone line with the elderly and has the qualification of technology for patients. Phone-based technology, which is beneficial in many ways, such as social communication in emergencies, is an important factor in improving quality of life. It is a technological device that can act jointly with computer, telephone and internet. Smart houses can manage many wired or wireless devices, such as security cameras, and computers that can record the data of these devices increase the quality of life. Finally, whatever the geographical location, the internet plays an active role in increasing the quality of life [67], which enables remote communication and video interviewing to make the latest situations visible to the patient and the elderly. These three technology categories, which also have risk or harmful factors in addition to their benefits, are also important in terms of gerontology. Computer, telephone or internet costs, security vulnerabilities, electrical or mechanical failures arise as risk and harm elements. Social isolation is another unfavorable aspect of these three categories [68].

### **Relationship between gerontological devices and quality of life**

Communication technology helps information flow in gerontology and communication with related persons in emergency situations helps elderly people to connect clinical devices with additional devices. Involvement in social groups, social support, communication with family and friends, and communication are possible through communication technology [69]. Communication technology has features such as security, legal rights seeking, communication with public institutions, social, physical and psychological needs. When all these features are considered together, it should be taken into account that communication technology is an important element of gerontology assistance [51].

Attempts are being made to improve the quality of life of elderly people with devices such as loss of consciousness, loss of balance, memory weakness, dementia, protection against falling in the form of psychological problems, emergency warning pendants and bracelets, reminder clocks, fall prevention devices. For memory problems, smartphones, digital clocks and calendars, timer devices are used. Orthopedic and assistive devices for falling risk and physical condition, wheelchair and patient lifts suitable for the surrounding area, hearing aids are used. In home care services, home radiology imaging, patient monitoring systems, adjustable beds, home medical device service, patient and elderly transfer services are among the areas where gerontologic devices are used by portable devices [70].

These devices affect the qualities of life according to whether the needs of the elderly are met, not satisfied and not adequately met [71]. The design of gerontological devices depends on the use of the elderly and on the level of meeting their needs for quality of life [72]. Research has shown that reinforced physical movement support devices that support the daily activities of the elderly have a significant impact on the individual's mobility, social participation and quality of life [73].

The level of response required by a gerontecologic device, what needs are, and expectations from the device are the determining factors for quality of life. Gerontologic devices developed to monitor the health status of individuals improve their quality of life by solving the health, safety, physical, social and psychological problems of the elderly. All these factors must be considered together in the design of gerontology [74].

**Table 3.** The quality of life functions of gerontechnology at home

Function	Explanation
Social interaction and psychological	It aims to improve the mental health of the elderly and reduces the sense of loneliness, providing communication and interaction between people and groups. E.g. Smartphones, television and computer systems that provide video calling
Security/protection	It triggers the alarm from environmental threats, such as fire, electrical contact, gas leak, explosion, flooding. E.g. Fire sensor, smoke and gas detector, natural gas alarm device
Cognitive	Cognitive deficits such as forgetfulness and memory loss serve as reminders for important tasks such as preventing negative situations that may arise, drinking medicine, and going to a doctor. E.g. Android apps for drug reminders, smartphone plug-in devices that act as reminders
Security	The intent is to prevent and eliminate interference in the privacy of the elderly, such as theft, intrusion into the Han, phone disturbance. E.g. Burglar alarm, emergency help buttons, android and smartphone applications that transmit messages to security forces in danger
Providing Information	Provides feedback on the health, social, physical, mental and many aspects of the elderly individual's needs and desires, complaints and satisfaction, loneliness and socialization, and the use of gerontological tools. E.g. GPS tracking devices, computer network used for reporting, drug reminders
Physiological and medical help	It provides the urine and blood tests of the elderly in home care services and controls whether the body functions regularly. E.g. Home laser rhinitis rehabilitation therapy machine, cold laser for hypertension patients, blood pressure care device, home oxygen generator

Source Adapted from Demiris and Hensel [77], Cohen-Mansfield and Biddison [70].

Techniques used for home care services in the elderly also affect quality of life. Elderly patients (e.g., those with Alzheimer's disease) who need to be kept under constant control in their nursing care can be monitored closely with mobile tracking devices and drug monitoring systems [75]. The elderly think at home that life is synonymous with being well formed. Most elderly people feel safe at home. Because life in the home creates a free space in which individuals can live their way of life [76]. For this reason, it is important for the gerontological devices to be used for the use of the elderly in areas where they are free, comfortable, anxious, and stress levels are low. Smart houses serve this purpose. Motion sensors, remotely controllable electrical equipment, fire alarm systems, wireless multi-purpose sensors, security cameras, reminder programs that can be installed on electronic devices can be found in smart home systems. Cameras in and out of the house, and the monitors to which these cameras transmit images, are able to see the threats that may arise from the outside of the house, and the live view of the elderly person can be monitored from outside. Whenever an individual is alone at home, this monitor feels safe. Sensors are used to prevent everyday accidents such as falls and bumps. Sensors such as lighting, adjusting the temperature level, warning against fire or gas escape are the most important helpers of the elderly person [69].

Gerontechnology fulfills some quality of life functions in life at home. These functions are social interaction and psychological, security/protection, cognitive, confidentiality, information provision, physiological and medical help [70,77]. The functions and explanations of the quality of life for gerontechnologic home life are shown in Table 3.

As seen in Table 3, the relation of the quality of gerontechnological devices to the quality of life depends on the functions of gerontechnology. These functions may evolve with changing and developing technology, the current situation of the patient or the elderly, environmental factors, culture. The current and relevant situation of the person has an important place in the quality of life. Personal goals, self-esteem, personal control/self-efficacy, values and judgments are issues that affect the quality of life, changing the individual person, motivating the person, reflecting the person's point of view of life [78,79].

### The effects of technology on elderly

Modern technology is becoming more and more complex nowadays, leading to feelings of dependence, backwardness and inadequacy in old age [80]. In 1999, an interdisciplinary research project was conducted as a national research project called "Daily Technology for the Household Large Individual" and the outlook of perception of individual control beliefs was identified as an important predictable value in terms of loneliness. There is a negative relationship between loneliness and the ability to act actively in one's life (internal control beliefs). Technological progress has been supported by requests, and innovative technology has been found to be less interesting for those who are interested [80].

In a survey conducted by Russellet al. [81] on a questionnaire from the UCLA (University of California, Los Angeles) loneliness questionnaire, there were no significant differences between the genders in terms of internet and computer use; women were using computers for documentation rather than men; The multiple regression analysis used to generate patients

was found to be the least predictive of the loneliness survey compared to women and groups. The results show that mobile phone use is not related to loneliness but there is a positive relationship between internet use and loneliness [82]. According to another survey, household structure, education, health status, volunteerism, the number of social relations and the social environment are powerful explanations alone. Transport modes such as public transport, bicycle or car reduce loneliness. This clearly demonstrates the impact of technological product use on human psychology [83].

The use of technology meets the needs and satisfactions of individuals. People living alone seek different satisfaction with the use of the internet. The Internet is a versatile and effective means of communication that meets social and psychological needs and differs in this respect from television. People living alone tend toward Internet games. With online Internet games, it is possible to communicate with the individual who plays the game. People who are not alone perform activities such as reading e-mails and newspapers on the Internet more than people alone [84]. Indicating that technology is an important means of communication, whether alone or living alone, considering the use of technology.

Experimental studies in 14 nursing homes in Taiwan were conducted in 24 experimental and 33 control groups. Experimental group was informed by videoconferencing for 5 months a week for 3 months and regular care was provided for the control group. Negotiated social support behavior scale, California Los Angeles Loneliness scale, Geriatric depression scale was used. Once a week, video conferencing has improved emotional and social support, depressive status, and loneliness. However, this computer-mediated communication tool has no effect on informational and effective social support [85]. These studies show that some technological products have psychological effects on elderly individuals, but this cannot be achieved independently of social support and communication.

All these studies show that technology plays an important role in people's successful aging [86]. High physical and mental functional capacity, poor prospects for disease, active participation in life are key determinants of successful aging. Especially when considering the effect of active participation in life on the successful aging, it is seen that the technology that enables interpersonal communication has a significant effect on successful aging [87].

## Conclusions and recommendations

Individuals become emotional as they get older and are looking for support from many directions. This emotional and introverted situation pushes the individual away from sociability and toward loneliness despite the need for the day. Giving support to an elderly individual who needs physical, psychological, medical, social assistance in the last days of his life needs to be made aware that this support is given not because of being an elderly or weak individual but because he is a social being. Thus, the individual will be able to positively respond to the support requests for technology use, which can reflect this lack of support and the need for support that he/she has had in his life to his perception of quality of life. It should not be forgotten that both the quality of life and aging are the natural consequences of mental process. Personal concerns, lack of self-sufficiency perception, lead to inefficient results on technology compliance. It should be taken into consideration that successful aging is affected by biological factors and diseases, moreover, these factors differ according to men and women. Musculoskeletal diseases such as sarcopenia [7], self-neglect status and depression level [8], hypogonadism symptoms [9], testosterone levels and vitamin D treatment [10], different glucose tolerance state, testosterone and osteocalcin [11], lower urinary tract symptoms [12] are recommended for successful aging and gerontechnology fields with multidisciplinary studies.

The gerontechnology approach carries out studies to determine this deficiency and perception. This approach, which considers the needs and expectations of the elderly in many aspects such as ergonomics, individual perception, abilities, cooperation, interaction, communication, harmony, takes important steps in contributing to the quality of life of the technology. The changing perspective of the individual makes it necessary to carry out some studies in the field of gerontechnology, which is a multidisciplinary approach to the diversity of the needs of the elderly. At the beginning of future studies, gerontechnological and safety factors affecting the quality-of-life of elderly people are investigated by field studies. Despite the fact that most of the quality-of-life studies conducted in the direction of health are still inadequate to investigate the factors affecting quality-of-life due to the use of gerontechnological devices. In the work to be done, the quality-of-life of the elderly should be considered together with the functions of gerontechnology.

Proper use of technology for the purpose of educating conscious individuals may become more possible with formal and non-formal education. Awareness can be created by emphasizing the ability of the technology to communicate and interact with visual, written and virtual media. In addition, the fact that education has a significant relationship between participation and successful aging should be considered and technology should be used efficiently [88]. The elderly population and, in parallel, generational interactions are increasing. The active involvement of universities, public education centers, non-governmental organizations, government incentives and voluntary individuals and the relationship between older and younger individuals can be improved through technology [1]. In-service trainings on the effective and efficient use of technology by organizations in which they work can be organized and unintentional trainings such as panels or meetings for other individuals can be made aware of this issue [89]. The importance of communication in the use of technology in trainings and events to be organized should be emphasized. The low inclinations of elderly individuals to adapt to new technologies and use technology should be taken into consideration in training and technological product design [90]. Finally, successful aging, the adoption and use of technology by elderly individuals, the enhancement of qualitative and quantitative research on geronsafety issues, and the relationship between these two issues are suggested for future studies.

### Disclosure statement

No potential conflict of interest was reported by the author.

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