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The Acceptance of Health Information Systems by Senior Citizens: A Technology Acceptance Model

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ABSTRACT

With the accelerating ageing of the population, there is an increasing need for older citizens to adapt to using digital healthcare solutions, including Health Information Systems (hereinafter – HIS), as an important element of affordable medicine. The primary purpose of this study is to examine the use and acceptance of HIS among senior citizens in Turkey who are actively employed or capable of working, using the Technology Acceptance Model (hereinafter – TAM) as the theoretical framework. A quantitative research design was applied, including survey data from 221 elderly individuals and a comparative dataset from 50 middle-aged and 56 elderly participants. The results showed that self-efficacy ($\beta = 0.73$, $p < 0.001$) and facilitating conditions ($\beta = 0.77$, $p < 0.001$) significantly predicted perceived ease of use, which in turn was significantly related to perceived usefulness ($\beta = 0.73$, $p < 0.001$). However, neither perceived usefulness nor perceived ease of use significantly affected attitude or behavioral intention among elderly participants. T-tests revealed no statistically significant differences in HIS acceptance between middle-aged (33–40) and elderly (65–76) groups across all factors ($p > 0.05$). The analysis results indicated that the physical, motor and cognitive skills of elderly individuals who are active in working life or able to work are in better condition than their peers. Accordingly, the usage and acceptance levels of HIS among middle-aged and elderly individuals are almost at the same level. However, it has been determined that some improvements will improve the usage level.

KEYWORDS: Technology Adoption, Technology Acceptance Model, Digital Transformation, Healthcare Strategy, Digital Inclusion, Economic Efficiency

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Восприятие пожилыми людьми информационных систем в здравоохранении: модель принятия технологий

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АННОТАЦИЯ

С учетом ускоряющегося процесса старения населения возрастает необходимость адаптации пожилых граждан к использованию цифровых решений в сфере здравоохранения, включая информационные системы здравоохранения (далее – ИСЗ), как важного элемента доступной медицины. Целью настоящего исследования является изучить использование и принятие ИСЗ пожилыми гражданами Турции, которые продолжают трудовую деятельность или обладают трудоспособностью, с применением модели принятия технологий (далее – МПТ) в качестве теоретической основы. В исследовании был использован количественный подход, включающий анализ данных анкетирования 221 пожилого человека, а также сравнительного набора данных от 50 представителей среднего возраста и 56 пожилых участников. Результаты показали, что такие факторы, как самоэффективность ($\beta = 0,73$, $p < 0,001$) и сопутствующие условия ($\beta = 0,77$, $p < 0,001$), статистически значимо предсказывали воспринимаемую простоту использования, которая, в свою очередь, была значимо связана с воспринимаемой полезностью ($\beta = 0,73$, $p < 0,001$). Однако ни воспринимаемая полезность, ни воспринимаемая простота использования не оказали значимого влияния на отношение и поведенческое намерение пожилых участников. Результаты t-критерия не выявили статистически значимых различий в уровне принятия ИСЗ между представителями среднего (33–40 лет) и пожилого (65–76 лет) возраста по всем исследуемым факторам ($p > 0,05$). Анализ также показал, что физические, моторные и когнитивные способности пожилых лиц, продолжающих трудовую деятельность или обладающих трудоспособностью, находятся в лучшем состоянии по сравнению со сверстниками. Соответственно, уровень использования и принятия ИСЗ среди представителей среднего и пожилого возраста оказался практически одинаковым. Тем не менее, установлено, что определенные улучшения в системе могут способствовать повышению уровня использования ИСЗ.

КЛЮЧЕВЫЕ СЛОВА: внедрение технологий, модель принятия технологий, цифровая трансформация, стратегия здравоохранения, цифровая инклюзия, экономическая эффективность

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INTRODUCTİON

Information technology is becoming more involved, especially in the health sector, and health technologies play an important role in preparing for the economic and social changes that will occur with the ageing population. Information technologies have a dominant role in the health field, which are vital for individuals to organize and regulate their health activities, enable easy management of health activities, and make fast and practical decisions. For patients who manage their own health activities and take on more responsibility, information technologies are an essential tool that facilitates communication between patients and providers (Mendi, 2012). With the rapid ageing of the population, information technology needs to be adopted by the elderly and age-related issues need to be addressed (Aranha et al., 2024).

The increasing proportion of people aged 60 and over in the population is indeed a significant global trend with implications for various aspects of society, including healthcare, social services, and the economy. According to the World Health Organization (WHO), the number of individuals aged 60 and above was 1 billion in 2019. This number is projected to rise to 1.4 billion by 2030 and increase to 2.1 billion by 2050. The ageing process can lead to the emergence of various chronic diseases, leading to a greater need for healthcare services and technologies. The United Nations recognize the need for countries to adapt their public programs in response to ageing populations. On the flip side, as the population ages, there may be greater demand for healthcare services tailored to the needs of older adults, as well as an increased need for long-term care facilities and support systems for seniors.

Governments and policymakers may need to consider strategies to support an ageing population, such as implementing policies encouraging healthy ageing, promoting intergenerational solidarity, and ensuring access to quality healthcare for older adults. Societies need to adapt to this demographic change by implementing policies and programs that support the well-being and inclusion of older adults in various aspects of life. This can help to ensure that older adults can lead fulfilling and active lives as they age. Accordingly, the needs and demands of these societies for information and information technologies in the management and operation of health services in the health sector are increasing (Ismail et al., 2015). It has been stated that the health sector is an important issue for governments to provide high-quality, fast, manageable, and equal services for all citizens. Today, many health technologies serve users.

Effective implementation of Health Information Systems (hereinafter – HIS) provides many benefits, such as improving the quality of health services, reducing medical errors, manageable health information, easy patient follow-up, reducing health expenditures, and saving time (Ngafeeson, 2013). Many nations, both developed and developing, like Turkey, must contend with the difficulty of managing healthcare operations in tandem with the ageing population and containing rising healthcare expenses. With the coronavirus pandemic, these expenditures have become a significant challenge for governments, with inadequate resources and healthcare personnel. With the coronavirus epidemic, many countries focused on reforms in the field of health to improve insufficient health services and reduce unnecessary waste in the health system. Duplicate tests, unnecessary hospital visits, and poor management of patient health status are some of the problems (Ayabakan et al., 2017).

The ageing population and prevalence of chronic conditions will continue to escalate the need for health technologies, increasing both cost and resource pressures. Health technologies have a significant impact on older adults' quality of life. For instance, telemedicine applications and digital health monitoring systems make seniors feel more independent and safe at home. Moreover, these technologies help seniors regularly monitor their health status and detect potential health problems early. However, older people also face challenges in accessing and using these technologies. Unfamiliarity with technology, physical limitations and cognitive decline can prevent older people from using health technologies effectively. For this reason, it is necessary to determine the level of adoption and utilization of health information technology by senior citizens and to reveal how age-related problems (declining cognitive and motor abilities, short-term memory loss, etc.) affect usage and acceptance levels. This improves early detection of health issues and facilitates timely intervention.

HIS offers medication reminders, dosage tracking, and drug interaction warnings, particularly valuable for elderly individuals on multiple medications. Thanks to it, medication errors are prevented, and medications are taken as prescribed. It can provide educational resources and support for the elderly to manage and understand their health conditions. This empowers them to make informed decisions about their health and engage in self-care. HIS facilitate better communication and coordination among healthcare providers, caregivers, and elderly individuals. This enhances collaboration, enables timely information sharing, and ensures a holistic approach

to healthcare. On the other hand, it allows researchers to collect, store, and analyze vast amounts of health-related data. This aids in conducting studies, identifying patterns and trends, and generating valuable insights for medical advancements. It provides a platform for training healthcare professionals in various medical procedures and scenarios through simulations. This helps improve skills, reduce errors, and ensure efficient and safe practices.

Healthcare technologies streamline administrative tasks such as scheduling, billing, and resource allocation in healthcare facilities. This improves operational efficiency, reduces paperwork, and enhances patient satisfaction. It serves as a foundation for developing innovative healthcare solutions and technologies. It provides a framework for creating applications to improve patient outcomes, automate processes, and enhance healthcare delivery. One new methodology or technique used in healthcare software development is machine learning data sets, which machine learning algorithms can analyze to find trends and generate recommendations or forecasts. This can be applied to several healthcare tasks, including disease diagnosis, treatment planning, patient outcome prediction, and the detection of possible side effects. One example of how machine learning software meets a previously unmet need is in the field of radiology. Traditionally, radiologists manually review medical images to identify abnormalities and diagnose diseases. This process is time-consuming and subjective, leading to variations in diagnoses. Machine learning algorithms can analyze medical images and learn from a vast amount of labelled data to accurately identify abnormalities, such as tumours, in medical images. Ultimately, this can result in better patient outcomes by greatly increasing the speed and accuracy of diagnoses. By automating these procedures, healthcare workers can save time and concentrate more on patient care. Overall, these new algorithms, methodologies, and techniques in healthcare software development provide innovative solutions to previously unmet needs and solve complex problems in ways that were not possible before.

In this context, the present study aims to inform system developers about the key drivers of HIS acceptance and rejection, enhance understanding of user behavior, and offer theoretical insights for successful HIS design. In this way, the appropriate use and acceptance of HIS by the elderly will provide many benefits, such as improving the quality, efficiency and effectiveness of healthcare services, saving time, reducing healthcare costs, facilitating early diagnosis and disease management, easy access to health history, eliminating the tracking of paper-based documents.

SİGNİFİCANCE OF THE STUDY

Physical and mental limitations such as chronic diseases that increase with age, short-term memory loss, physical diseases, decline in motor and cognitive abilities, and reduced visual capacity negatively affect the daily activities of the elderly (Ghasemaghaei et al., 2019). Elderly people often use information and communication technologies (ICT) to communicate with their relatives and friends, participate in leisure activities, read news online (Wagner et al., 2010), or manage their health activities. However, statistics show that the internet and technology usage of elderly individuals is lower than that of other age groups. The digital inequality experienced by older adults may differ from that of the general population due to their poor health conditions, greater anxiety, lower technology literacy, and lower economic status due to retirement (Smith, 2014). Elderly individuals cannot benefit from many information technology products due to their weakened physical and cognitive abilities (Lee et al., 2011; Selwyn, 2004). Their ability to comprehend decreases, and this situation causes them to feel anxious about any action they take. They are especially concerned about making mistakes when using technology, losing data, or disrupting the system.

The literature has long emphasised that users' prejudices and reluctance towards technology are important problems in successfully implementing information technology (Vrhovec & Rupnik, 2011). Lack of access to technology and resources (facilitating conditions) also causes them to be less familiar with technology, which brings about less self-efficacy and more anxiety. Considering all these, the technology use and acceptance of older individuals may be different from other age groups, so the acceptance and use levels of HIS of this age group, which needs these health technologies the most, should be determined, and the main factors in using or not using the system should be revealed. Assessing user acceptance early in development can provide valuable insights into new technologies' potential success or challenges. By involving end users in the design and development phases, developers can identify usability issues, address user needs, and tailor the technology to fit the intended users' preferences and capabilities. Low usage of healthcare technologies can undermine their effectiveness and limit their impact on patient outcomes. By evaluating user acceptance early on, developers can identify barriers to adoption and implement strategies to mitigate these barriers, thereby increasing the likelihood of technology uptake and usage.

RESEARCH PROBLEM AND GAP

Technology resistance has long been recognized as a significant problem for the effective use of information technology (Vrhovec & Rupnik, 2011). Their limited access to the internet hampers their ability to utilize such systems effectively, thereby impeding their potential benefits. Additionally, elderly individuals encounter obstacles when learning to use new technologies due to age-related changes in sensory, motor, and cognitive functions. Moreover, elderly individuals often experience physical and mental limitations, including reduced visual acuity, short-term memory loss, and various chronic illnesses. Research indicates that cognitive decline can commence as early as the mid-50s, with a rapid decline typically set in by one's 70s (Drag & Bieliauskas, 2010; Li & Luximon, 2018). These factors collectively contribute to the challenges faced by the elderly population in adopting and utilizing new technological advancements. Cognitive abilities are essential for comprehending the use of complex technology. Given the challenges that older adults may face with their cognitive abilities, it is important to recognize that their perspectives on technology systems may differ from those of other age groups. This highlights the need for a separate assessment of technology systems that considers older individuals' unique needs and capabilities.

HIS has the potential to significantly lower healthcare costs while simultaneously improving patient privacy, quality, and effectiveness, especially in ageing countries. However, it is crucial to ensure that these systems are designed with consideration for older adults and their specific needs. Healthcare providers, policymakers, and technology developers need to consider factors such as usability, accessibility, and adaptability when designing HIS systems for older adults. This includes ensuring that the systems are easy to navigate, have clear instructions, and incorporate features that accommodate age-related limitations, such as larger font sizes, audio options, and simple interfaces. Furthermore, involving older adults in the design and development process through user testing, feedback, and co-creation can help to ensure that the HIS systems meet their needs and preferences. By recognizing and addressing the unique perspectives and needs of older adults, we can harness the potential of HIS to improve healthcare outcomes and support the well-being of ageing populations. Measurement of the acceptance rate is very useful in determining the success of the implementation of the system, and the use of information technology acceptance theory is very significant in predicting end-users reactions to health information technology (Holden & Karsh, 2010). It is stated that an information system cannot be accepted as successful unless it is used by the targeted users (Ngafeeson, 2013). When the acceptance levels of individuals towards technology are examined within the framework of TAM, the results may differ according to the organizational and individual level usage as well as mandatory and voluntary use. The use of the health information system by health professionals and patients will also differ in this context. Voluntary and mandatory usage differences need to be taken into account. A thorough assessment and description of technology acceptance in general and IS adoption by senior citizens, in particular, are lacking in the information systems (IS) literature, even though evaluation is currently required (Niehaves & Plattfaut, 2014). Recent calls in the literature emphasized the importance of further research on end-user acceptance of HIS (Agarwal et al., 2010). However, studies on users' perceptions and use of HIS are limited as most of the studies focused on healthcare professionals (doctors, nurses, patient care workers, technicians etc.) perceptions (Gardner et al., 2019; Srivastava et al., 2022; Tat, 2018; Zallman et al., 2018) rather than the end-users (Hu et al., 1999; Sinha et al., 2021). After the literature review, it was seen that the studies conducted in Turkey were generally conducted with health professionals (Bozkurt et al., 2021; Mendi, 2012; Yetkin, 2021). Studies on accepting individuals who are not healthcare workers have generally been conducted with the young population (Gardner et al., 2019). Since our research population is inherently difficult to reach compared to the general adult population, studies conducted with them are more limited. Therefore, conducting a comprehensive study will help reveal the success of Turkish HIS and determine what can be improved and the attitudes of older individuals towards these technologies. Especially after the coronavirus epidemic, there have been shifts in the use of health technologies. New technologies have been developed, and the reasons for their use have begun to differ. In this context, an updated study was required to fill the gap, and this study attempted to fill this gap by determining the use and acceptance of HIT by senior citizens who can work or are in active working life and making comparisons with middle-aged adults to show age-related differences.

A thorough literature analysis showed that the Technology Acceptance Model (hereinafter – TAM) was primarily utilized and validated to measure information technology use and acceptance levels among the aged (Ma et al., 2016; Nayak et al., 2010). Because frequent usage of TAM in determining health technology acceptance and usage, in this

study, the research model was developed within the framework of the TAM (Chau & Hu, 2002; Holden & Karsh, 2010).

RESEARCH PURPOSE AND QUESTİONS

TAM, proposed by Davis in 1989, remains the most widely cited and validated framework for predicting and explaining individuals' use and acceptance of technology (Davis & Davis, 1989). The robustness of TAM has been confirmed through several different technologies that are used both at individual and organizational levels (Adams et al., 1992; Chin & Todd, 1995; Davis & Davis, 1989; Igbaria et al., 1997; Mathieson, 1991; Subramanian, 1994; Taylor & Todd, 1995; Venkatesh, 1999; Venkatesh et al., 2003). Other acceptance models in the literature have been compared with TAM, and the suitability of TAM for health systems has been confirmed in many studies (Anderson & Agarwal, 2011; Chau & Hu, 2002; Chau & Hu, 2001; Davis & Davis, 1989; Fishbein & Ajzen, 1977; Ha & Park, 2020; Holden & Karsh, 2010; Hong et al., 2013; Hsiao & Tang, 2015; Nguyen et al., 2020).

TAM was developed within the framework for two primary purposes: (1) to provide new theoretical insight for the successful design and implementation of information systems from the perspective of system developers, and (2) to build a deeper understanding of user acceptance behaviors. In response to the need to theorize about health technology acceptance, in this study, we will try to understand the main drivers of the acceptance or rejections of health technology and provide foresight to implement these technologies at the individual level successfully.

The primary purpose of this research is to determine the use and acceptance of HIS at the individual level by senior citizens who can work or are in active working life in Turkey within the framework of the TAM and compare with middle-aged adults to understand age-related differences deeply. Accordingly, the central research questions are:

(1) What are the main drivers that affect the use and acceptance of Health Information Systems by seniors who can work or are actively working?

(2) How are these factors interrelated?

To address these questions, a literature review was conducted using the following keywords: {Health Information Systems}, {Health Technology}, {Technology Acceptance}, {Acceptance of HIS}, {Elderly's Technology Acceptance}, {Technology Acceptance Model}, {E-pulse}, and {E-health}. After completing the literature review, the research design was selected based on the research objective, the problem statement, appropriate data collection techniques, and prior technology acceptance studies (Zhang et al., 2014; Li et al., 2016).

Considering this fact, this research was conducted using a relational research design, one of the quantitative research methods. The instrument of the study was developed based on different sources, such as the TAM developed by Davis (1989) and the Unified Technology Acceptance and Use Theory (hereinafter – UTAUT) developed by Venkatesh (2003) and Agarwal's studies (1998). Studies in the literature were considered to decide which variables would or would not be included in the study and to develop the research model and hypothesis. The research hypotheses were tested by applying the Structural Equation Model (hereinafter – SEM) to ensure the model's validity. The main hypothesis of this study is that the acceptance level of Health Information Systems of elderly individuals who are actively working or able to work and middle-aged individuals are at the same level. Elderly people who can or will work are still in good condition regarding their cognitive, motor and physical abilities. The fact that these abilities of individuals have not declined means that they can use and accept these systems at least as much as middle-aged individuals.

CONCEPTUAL FRAMEWORK: THE TECHNOLOGY ACCEPTANCE MODEL

The technology acceptance model is an information systems theory that attempts to identify the psychological, internal, external, and environmental elements that influence people's acceptance or rejection of technology by modelling how users will accept and use it. Perceived usefulness and ease of use are two key determinants of technology acceptance. In other words, the most significant determinants of attitude and behavioral intention (Benbasat & Dexter, 1986; Davis & Davis, 1989; Lee et al., 2003; Legris et al., 2003; Venkatesh & Davis, 1996), and these two variables are affected by many external variables. According to TAM, perceived usefulness and ease of use, as two fundamental constructs that influence users' system use and are influenced by many external variables, are particularly important for solving the problem of technology acceptance (Davis & Davis, 1989). Perceived usefulness is defined as the degree to which a person believes that using/accepting a specific system would his or her job performance (Davis et al., 1989). On the other hand, perceived ease of use refers to the degree to which a person believes that using a particular system would be free of effort (Davis & Davis, 1989). In healthcare technology, patients would be more likely to use health technologies if they believed the

information technology was easy to use. These two variables are affected by many external variables.

We created a variable pool to determine which external variables were omitted or included in the study. After completing the comprehensive literature review to develop the research model, these variables were determined as possible variables of the research model which is in the pool: Accessibility, Compatibility, Attitude, Complexity, Trialability, Perceived Enjoyment, Facilitating Conditions, Image, Playfulness, Visibility, Relative Advantage, Social Pressure, Anxiety, Self Efficacy, Social Influence, Subjective Norms, Voluntariness, Usability, and Social Presence. The items within acceptance/adoption models tend to overlap in their meaning. The five variables have similar meanings to perceived usefulness, one of TAM's primary constructs. These variables are job fit, outcome expectation, extrinsic motivation and relative advantage (Venkatesh et al., 2003). Therefore, none of these variables were included in the research model. Venkatesh's studies showed that social influence is significant among senior citizens, but social influence is significant only in mandatory settings. The social influence construct is not significant in a voluntary context. The use of Health Information Systems by the senior citizens in this study is voluntary. Seniors who participated pilot study stated that social influence did not change their minds about whether or not to use technology. The social influence variable relation with other variables was found weak, and the literature review showed that the effect on intention to use was not significant. Therefore, the social effect variables have been removed from the possible variables pool. Three variables capture the concept of perceived usefulness: effort expectancy and complexity. For this reason, complexity was dropped from the possible variables pool. Facilitating conditions, anxiety and self-efficacy are the most used external variables in elderly citizens' technology acceptance studies (Alsswey et al., 2018). Therefore, self-efficacy, facilitating conditions, and anxiety are included in the model. While considering all these, Self Efficacy (hereinafter – SE) and Facilitating Conditions (hereinafter – FC) variables were determined as independent variables and Perceived Usefulness (hereinafter – PU), Perceived Ease of Use (hereinafter – PEOU), Behavioral Intention (hereinafter – BI), Attitude Toward Use (hereinafter – ATU), and Anxiety (hereinafter – ANX) variables were determined as dependent variables of this research.

The proposed conceptual model and hypothesized relationships are presented in Figure 1.

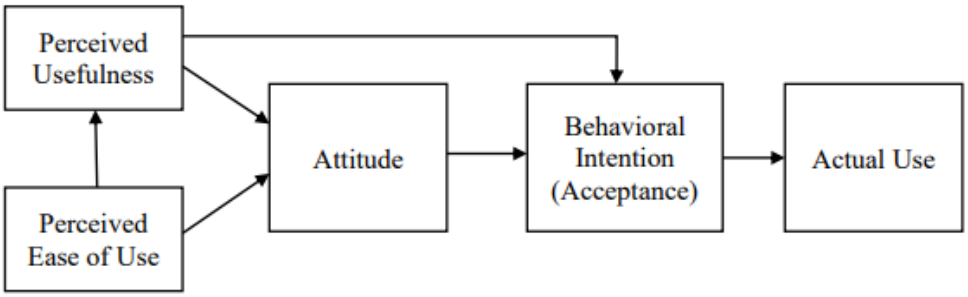

Figure 1. Technology acceptance model

Note: compiled by authors based on source (Davis & Davis,1989)

Perceived usefulness and perceived ease of use are the two main determinants of technology acceptance, in other words, the most significant determinants of attitude and behavioral intention (Benbasat & Dexter, 1986; Davis & Davis, 1989; Davis et al., 1989; Lee et al., 2003; Legris et al., 2003; Venkatesh & Davis, 1996), and these two variables are affected by many external variables. The significant relationship between PEOU and PU has been validated in many technology acceptance research (Anderson, 1996; Bozionelos, 2004; Davis & Davis, 1989; Davis et al., 1989; Godoe & Johansen, 2012; Venkatesh, 1999; Wu et al., 2007). TAM proposes that two primary constructs of TAM predict attitudes toward use as a mediating variable: perceptions of usefulness and ease of use (Albarracin & Ajzen, 2007; Davis & Davis, 1989; Davis et al., 1989; Godoe & Johansen, 2012). An individual's overall emotional

reaction to using a target system, or a favorable or unfavorable disposition that affects his or her intention toward an item, person, or activity, is called attitude toward use. (Venkatesh et al., 2003). In this context, attitude can be summarized as an individual evaluation that shapes feelings about accepting or rejecting a system (Ajzen & Fishbein, 1977). Numerous research studies have proven the substantial influence of perceived usefulness and ease of use on people's attitudes and behavioral intentions regarding the use (Bandura, 1992; Bandura et al., 1999; Brown & Venkatesh, 2005; McKnight et al., 2002). If the user's perception of the system's usefulness is positive, their attitude towards using it will also be positive. Hypotheses show that perceived usefulness and perceived ease of use are the main factors influencing elderly adults' usage attitudes, which is in line with earlier research on technology acceptance. Taking all these findings into account, the hypotheses are formulated as follows:

H1: Perceived usefulness is positively related to the attitudes of the elderly who can work or are actively working towards using health technologies.

H2: Perceived ease of use is positively related to the attitudes of the elderly who can work or are in an active working life towards using health technologies.

H3: Perceived ease of use is positively related to the perceived usefulness of the health technologies of the elderly who can work or are in active working life.

According to Venkatesh et al. (2003), facilitating conditions (hereinafter – FC) are the extent to which a person thinks that the technical and organizational framework is in place to promote or boost system usage (Venkatesh et al., 2003). Providing resources to facilitate the use of health technologies, especially for the elderly, may positively impact the use and acceptance of the system. Considering these findings, the hypotheses were formed as follows:

H4: Facilitating conditions are positively related to the perceived ease of use of health technologies by the elderly who are able to work or are in active working life.

SE is a person's judgment of their ability to use technology to perform a specific job or task (Venkatesh et al., 2003). Another definition of self-efficacy by Bandura (1992) is defined as judgments about how well a person can implement the necessary action plan to cope with possible situations (Davis & Davis, 1989; Davis et al., 1989; Hoque & Sorwar, 2017). In the context of health technology, self-efficacy is an important factor in determining older patients' intention to use health technology through system usage ability and mediating factors. Self-efficacy has been identified as an indirect predictor of intention mediated by perceived ease of use (Benbasat & Dexter, 1986; Lee et al., 2003). Individuals believe they have the self-efficacy to act in parallel with the ease of that action, and individuals with self-efficacy are more likely to engage in a particular behavior (Agarwal & Prasad, 1997, 1998).

H5: Self-efficacy is positively related to the perceived ease of use of health technologies among older adults who can work or are in an active working life.

ANX is expressed as the emergence of anxious or emotional reactions when acting (for example, using a computer) (Venkatesh & Davis, 1996). The significance of the anxiety variable in IS literature has been validated in many studies (Chua et al., 1999; Vroman et al., 2015). It has been revealed in previous studies that older people have a higher level of anxiety about the use of technology (Guner & Acarturk, 2020; Ticehurst & Veal, 2000), and this anxiety causes them to have negative attitudes towards the use of new technologies (Lam & Lee, 2006). In the pilot study, some elderly individuals stated they were afraid of losing data or having personal information stolen by making a wrong operation while using the health information system. Therefore, they felt the need to get help from someone while using the system. Taking these findings into consideration, hypotheses were created as follows:

H6: Anxiety is negatively related to the perceived ease of use of health technologies for elderly people who can work or are in active working lives.

The attitude construct significantly predicts the behavioral intention to use any technology. Whether a person feels good or bad about achieving the desired behavior, they will have a positive attitude about using health technology and a positive intention to utilize it. As a result of the opinions of elderly individuals who participated pilot study, the attitude variable was included in the research as the predictor of behavioral intention.

H7: Attitude toward using is positively related to behavioural intention to use the HIS by seniors who can work or are in active working life.

The research model of study is demonstrated in Figure 2.

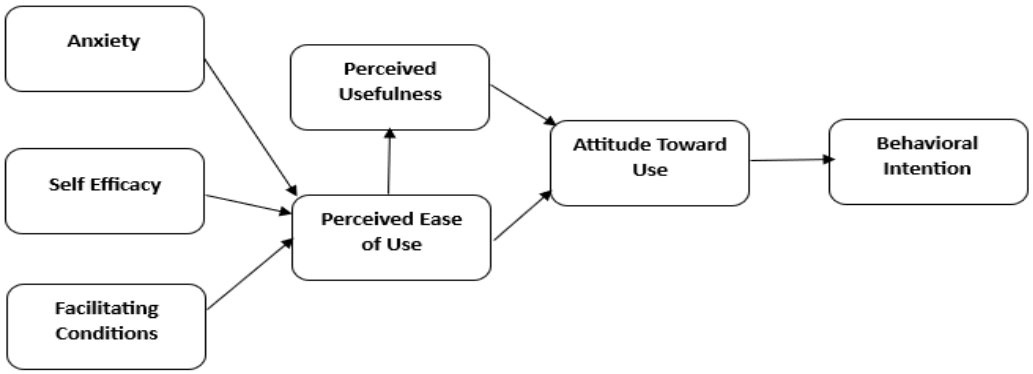

Figure 2. Research model

INSTRUMENT AND DATA COLLECTİON

Questionnaires and interviews were conducted to examine the factors affecting the acceptance of HIT by older individuals who can work or are in active working life in Turkey and to make a comparison with middle-aged adults in terms of the difference in the level of system use depending on age. During the instrument development process, the Technology Acceptance Model developed by Davis (Davis & Davis, 1989), the studies of Venkatesh et al. (2003) and Agarwal et al. (1998) were taken as basis. Measurement items of each construct in this study were adapted from previous studies related to technology acceptance to ensure the validity of all measures. The research questionnaire was initially developed in English and then translated into Turkish by experts. The questions were shared with several elderly individuals in order to determine that the survey questions were understandable and free of ambiguity. After receiving feedback, corrections were made and rechecked. All flaws were eliminated for the final version of the survey, and approval was obtained from the elderly individuals whose opinions were taken. After the pilot study, the last version of this research instrument consists of three parts: demographic questions, TAM questionnaires and an evaluation section. In the demographic part of the instrument comprises age, gender, education status, occupation, monthly income, marital status, daily use of technological devices, internet usage, healthcare preferences, and health technologies-related information. The constructs and the items are given in Table 1.

Table 1. Constructs and items of study

Construct	Item	Variable
Perceived Usefulness	PU1: “Using HIS would enable me to accomplish my healthcare activities more quickly.” PU2: “Using the HIS would enhance my effectiveness in managing my healthcare activities.” PU3: “Using the HIS would make it easier to do my healthcare activities.” PU4: “I find the HIS useful in managing my healthcare activities.”	Dependent Variable
Perceived Ease of Use	PEOU1:” Learning to use the HIS would be easy for me.” PEOU2: “I would find it easy to get HIS to do what I want it to do.” PEOU3: “My interaction with HIS would be clear and understandable.” PEOU4: “I would find HIS easy to use.”	Dependent Variable
Anxiety	Anx1: “I feel apprehensive about using the HIS.” Anx2: “It scares me to think that I could lose a lot of information using the HIS by hitting the wrong key.” Anx3: “I hesitate to use the HIS for fear of making mistakes I cannot correct.” Anx4: “The HIS is somewhat intimidating to me.”	Dependent Variable

Self-Efficacy	I could complete a job or task using the HIS ... SE1: "If there was no one around to tell me what to do as I go." SE2: "If I could call someone for help if I got stuck." SE3: "I would feel comfortable using HIS on my own."	Independent Variable
Facilitating Conditions	FC1: "I have the resources necessary to use the HIS." FC2: "I have the knowledge necessary to use the HIS." FC3: "A specific person (or group) is available for assistance with HIS difficulties."	Independent Variable
Attitude Toward Use	ATT1: "Using the HIS is a good idea." ATT2: "Using HIS is fun." ATT3: "I like using HIS."	Dependent Variable
Behavioral Intention	BI1: "I intend to use the HIS in the next 6 months." B2: "I predict I would use the system in the next 6 months." B3: "I plan to use the system in the next 6 months." B4: "I intend to increase my use of HIS in the future."	Dependent Variable

Note: compiled by authors

The Likert scale, which has widespread use in social sciences, was decided to be used in this study to demonstrate how much they agree with the statements presented to them about an attitude, behaviour or situation in parallel with the subject of this study. In the second part, all items of constructs were questioned by 5-point Likert scales with the following anchors: (1) Strongly disagree, (2) Disagree, (3) Nature, (4) Agree, (5) Strongly agree. A group of older individuals who can work or are in active working life in Turkey were chosen as a sample, and simple random sampling was used as the sampling method. Before collecting data, the ethical clearance was taken from the Research Center for Applied Ethics at AYBU. Particapation of elder individuals in this study was completely voluntary basis. Firstly, data were collected from 50 middle-aged and 56 elder individuals. In the second phase, data was collected from 221 senior individuals. Interviews were conducted with five elderly people face-to-face. The data were analyzed using the SPSS-27 program. The data analysis consisted of two parts: first, data were collected from 221 senior individuals to determine the HIS acceptance level of seniors and analyzed. The second part investigated data collected to compare middle-aged adults and senior individuals regarding their acceptance of HIS. For the second analysis, data were collected from 50 individuals between the ages of 33-40 and 56 individuals over the age of 65. This research interviewed five older adults to gain deeper insights into the factors influencing health technology use and acceptance. Additionally, we used Structural Equation Modeling (SEM) to test the research model. SEM is a statistical method that combines factor analysis and regression analysis to examine relationships between independent and dependent variables. Descriptive statistics was used to indicate tendencies in the collected data.

Appendix 1 shows the descriptive statistics of 221 senior individuals.

RESULTS

Exploratory factor analysis and confirmatory factor analysis were applied to measure the scale's validity in this research. KMO coefficient indicates whether the data matrix is suitable for factor analysis, and it is appropriate for this coefficient value to be greater than 60. Since the KMO value = 0.908 > 0.70, it was determined that factor analysis of the data set of this study was appropriate. Exploratory factor analysis was conducted, and as a result, it was seen that the items consisted of four factors, which explained 84.30% of the total variance. As a result of exploratory factor analysis, PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3 and PEOU4 items pertain in the first factor, ANX1, ANX2, ANX3 and ANX4 items pertain the second factor, SE3, FC1, FC2 and FC3 items pertain third factor, BI1, BI3, BI4 and BI5 items pertain the fourth factor. During exploratory and confirmatory factor analyses, SE1, SE2, ATT1, ATT2 and ATT3 items were removed from the scale. To determine reliability of scales, Cronbach Alpha coefficient were taken into consideration. Between 0.60 and 0.80 values indicates that the scale is moderately reliable, and between 0.80 and 1.00 indicates that the scale is highly reliable. As a result of reliability analysis, all scales are higher than 0.90. For this reason, the reliability of the scales in this research is high. Correlation analysis was applied to determine the relationship between the constructs in the structural model (Table 2).

Table 2. Correlational analysis of contstructs

Variable	Factor 1	Factor 2	Factor 3	Factor 4	HIS	Age Variable
Factor 1	1					
Factor 2	0,051	1				
	0,449					
Factor 3	0,771**	-0,035	1			
	0,000	0,608				
Factor 4	0,728**	0,111	0,730**	1		
	0,000	0,100	0,000			
HIS Acceptance Scale	0,923**	0,300**	0,850**	0,854**	1	
	0,000	0,000	0,000	0,000		
Age Variable	-0,097	0,034	-0,207**	-0,151*	-0,137*	1
	0,153	0,610	0,002	0,025	0,043	

Note: compiled by authors

The correlation matrix reveals several significant positive relationships. Strong associations are observed between perceived ease of use, self-efficacy, facilitating conditions, and behavioral intention, reflecting the model's internal consistency and theoretical coherence. The overall HIS Acceptance Scale also shows robust correlations with each factor, confirming the validity of the latent structure. Notably, age demonstrates a weak but statistically significant negative correlation with self-efficacy, behavioral intention, and the overall acceptance score. This suggests a slight decline in acceptance levels with age, though the effect is minimal. Overall, the results indicate that age alone is not a decisive determinant of HIS acceptance among older adults, especially those who remain professionally active or digitally engaged.

Table 3 presents the results of hypothesis testing for elderly individuals, summarizing which theoretical linkages were supported and which were not.

Table 3. The results of hypothesis testing for elderly individuals

Relation	Hypothesis	Result
PU->ATT	H1: Perceived usefulness is positively related to the attitude toward using the health technologies of elderly who can work or are in active working life.	Not supported
PEOU->ATT	H2: Perceived ease of use is positively related to the attitude toward using the health technologies of elderly who can work or are in active working life.	Not supported
PEOU->PU	H3: Perceived ease of use is positively related to the perceived usefulness of the health technologies of elderly who can work or are in active working life.	Supported
FC->PEOU	H4: Facilitating conditions is positively related to the perceived ease of use of the health technologies of elderly who can work or are in active working life.	Supported
SE->PEOU	H5: Self-efficacy is positively related to the perceived ease of use of the health technologies of elderly who can work or are in active working life.	Supported
ANX>PEOU	H6: Anxiety is negatively related to the perceived ease of use of the health technologies of elderly who can work or are in active working life.	Not supported
ATT->BI	H7: Attitude toward using is positively related to behavioural intention to use the HIS by seniors who can work or are in active working life.	Not supported

Note: compiled by authors

The analysis shows that only some of the hypotheses based on TAM were confirmed in the sample of elderly respondents. In particular, a statistically significant influence of the perception of ease of use on the perception of the system's usefulness was revealed, as well as a significant influence of conditions conducive to use and self-confidence on the perception of simplicity. These results confirm the stability of the relationships between structures related to the functional perception of the system. At the same time, key links, such as the impact of usefulness and ease of use on attitudes towards technology, as well as the impact of attitudes on behavioral intent, have not been confirmed. There was also no statistically significant effect of anxiety on the perception of simplicity, which may indicate a decrease in the role of emotional barriers in the context of the digital maturity of active senior citizens. Thus, the results confirmed the partial applicability of the TAM model for older users while indicating the need for its adaptation, considering age, motivational and contextual factors.

An independent sample t-test was conducted to compare responses between middle-aged individuals (33–40 years) and older adults (65–76 years) to explore whether age significantly affects HIS acceptance. Table 4 shows no statistically significant differences across all four latent factors and the overall HIS Acceptance Scale ($p > 0.05$).

Table 4. Age Variable T-Test

Scale	Group	n	Mean	SS	t	Sd	p
Factor 1	33-40	50	28,84	9,72	,678	104	,499
	65-76	56	27,70	7,29			
Factor 2	33-40	50	14,68	4,52	1,482	104	,141
	65-76	56	13,46	3,92			
Factor 3	33-40	50	23,20	7,96	-,865	104	,389
	65-76	56	24,38	5,67			
Factor 4	33-40	50	14,42	5,01	,243	104	,808
	65-76	56	14,20	4,44			
HIS Acceptance	33-40	50	81,14	21,70	,375	104	,708
	65-76	56	79,73	16,85			

Note: compiled by authors

According to the age variable groups, the Health Information Systems Acceptance scale score does not differ statistically significantly (p=,708>0,05). If elderly individuals are in good cognitive, mental and physical health, they are at a similar level to middle-aged individuals using health information technologies. In addition, the results revealed that well-educated elderly individuals are better at using health technologies than middle-aged or low-educated middle-aged individuals. Observing situations where individuals exhibit positive technology acceptance despite negative sensory connections is interesting. According to the proposed model, individuals who fall into this category are called "digital hibernators". In this study, it was found that older individuals, who are generally considered to be less connected to the digital age compared to other age groups, actually displayed high levels of technology acceptance. This suggests that they can be classified as digital hibernators.

CONCLUSION

The study results showed that the TAM is not fully applicable to older users who use digital medical systems voluntarily. Although the perception of ease of use and the presence of enabling conditions significantly affect the perception of usefulness, these factors do not translate directly into behavioral intent through attitudes towards technology. Socio-economic factors such as income, education, access to technology, and learning opportunities have a more significant impact. The study highlights the importance of creating conditions that facilitate the use of technology: Internet access, learning, ergonomic and intuitive device design. Contrary to common stereotypes, older people with a high level of education and digital engagement demonstrate acceptance comparable to middle-aged users. The revealed phenomenon of "digital hibernators", elderly people with limited digital experience but a high degree of technology adoption, indicates the need to rethink age as a barrier.

The participants emphasized the importance of user-oriented design and the role of technologies with elements of artificial intelligence in overcoming barriers to perception. In general, the integration of digital medical solutions into the lives of the elderly depends not so much on chronological age but on the elimination of structural, educational, and technological limitations.

AUTHOR CONTRIBUTIONS

Conceptualization and theory: SY, IM and TM; research design: IM and TM; data collection: IM and TM; analysis and interpretation: SY, IM, TM and MG; writing draft preparation: TM and MG; supervision: IM, TM and MG; correction of article: IM, TM and MG; proofread and final approval of article: SY, IM, TM and MG. All authors have read and agreed to the published version of the manuscript.

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Appendix 1

Descriptive analysis and demographic data

Category	Subcategory	n	Percentage (%)
Gender	Female	116	%52,5
	Male	105	%47,5
Income	No income	47	%21,3
	Between 5000-10000TL	13	%5,9
	Between 10000-15000TL	64	%29,0
	More than 15000TL	97	%43,9
Maritul Status	Married	160	%72,4
	Single	61	%27,6
Where healthcare is most provided	Public Hospital	123	%55,7
	Private Hospital	30	%13,6
	Policlinic	9	%4,1
	Cottage Hospital	42	%19,0
	Bachelor's Degree Hospital	17	%7,7
Internet Usage Status	Yes	194	%87,8
	No	27	%12,2
Time spent on the Internet	0-1 hour	75	%33,9
	1-2 hours	34	%15,4
	2-3 hours	42	%19,0
	3-4 hours	34	%15,4
	More than 4	36	%16,3
The state of knowing HIS	I have no information.	24	%10,9
	I have little knowledge.	74	%33,5
	I have an intermediate level of knowledge.	64	%29,0
	I am quite knowledgeable.	59	%26,7
Frequency of use of HIS	I do not use	21	%9,5
	Rarely	79	%35,7
	Sometimes	71	%32,1
	Often	33	%14,9
	Always	17	%7,7
Education Level	Secondary school and under	73	%33,0
	High	34	%15,4
	Bachelor's Degree	74	%33,5
	MSc. & PhD	40	%18,1
Use of Smartphone Technology in Daily Life	I do not use it.	51	%23,1
	I use.	170	%76,9
Use of Computer Technology in Daily Life	I do not use it.	118	%53,4
	I use.	103	%46,6
Use of Internet Technology in Daily Life	I do not use it.	52	%23,5
	I use.	169	%76,5
Use of Tablet Technology in Daily Life	I do not use it.	180	%81,4
	I use.	41	%18,6
Use of Cell Phone Technology in Daily Life	I do not use it.	97	%43,9
	I use.	124	%56,1
Use of Smartwatch Technology in Daily Life	I do not use it.	201	%91,0
	I use.	20	%9,0