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Understanding the Role of Technology Readiness and Digital Health Literacy in Intention to Use Remote Healthcare Services

Uzaktan Sağlık Hizmetlerini Kullanma Niyetinde Teknolojiye Hazır Bulunuşluk ve Dijital Sağlık Okuryazarlığının Rolü

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Abstract

Aim: Health systems seek cost-effective and more accessible ways of healthcare provision. Remote provision of healthcare services is becoming a more important part of health systems. Because it might alleviate the burden of geographical constraints, cost of service production, and waiting times in the system. Many countries including Türkiye have made it a part of healthcare provision. However, the effectiveness of these services mostly depends on the adoption level of the population, which is strongly related to technology readiness and digital health literacy. Evaluating the factors that affect the intention to use remote healthcare services is crucial for health managers and policy makers. However, knowledge about these factors is limited. Therefore, this study aimed to explore the level of intention of the population to use remote healthcare services, considering the effect of technology readiness and digital health literacy.

Method: The data were collected through a general survey from the population aged over 18 in Türkiye. The Technology Readiness Index 2.0, the Digital Health Literacy Scale, and a 5-item questionnaire created by the researchers measuring the intention to use remote healthcare services were included in the survey form with demographic variables. The data were analyzed using structural equation modeling.

Results: The results of the structural equation modeling revealed that among the dimensions of the technology acceptance model, innovation and optimism were significantly and positively related to the intention to use remote healthcare services, while insecurity-discomfort had no significant relation. The digital health literacy level was also found to have a positive and significant relation with the intention to use remote healthcare services.

Conclusion: The study showed that remote provision of healthcare services might be promoted by highlighting its benefits and ease of use, which will positively affect the perception of the population. Also, increasing the level of digital health literacy may be an effective way to enhance the usage and effectiveness of remote healthcare services.

Keywords: Remote healthcare, technology readiness, digital health literacy, health management.

Öz

Amaç: Sağlık sistemleri, maliyet etkin ve daha erişilebilir sağlık hizmeti sunma yolları arayışındadır. Uzaktan sağlık hizmetlerinin sunumu, sağlık sistemlerinin önemli bir bileşeni haline gelmektedir. Coğrafi kısıtlamaların yükünü hafifletebileceği, hizmet üretim maliyetini azaltabileceği ve bekleme sürelerini kısaltabileceği için Türkiye gibi birçok ülkede, uzaktan sağlık hizmeti sunumunu sağlık hizmetlerinin bir parçası haline gelmiş bulunmaktadır. Ancak bu hizmetlerin etkinliği, toplum tarafından benimsenme düzeyine bağlı olmaktadır. Bu durum teknolojiye hazır bulunuşluk ve dijital sağlık okuryazarlığı ile açıklanabilecek bir ilişkiye odaklanılmasını gerektirmektedir. Ayrıca uzaktan sağlık hizmetlerini kullanma niyetini etkileyen etmenlerin değerlendirilmesi, sağlık yöneticileri ve politika yapıcılar için de oldukça önemlidir. Ancak bu alandaki çalışma ve bilgi düzeyi oldukça sınırlı olması nedeniyle bu çalışmada, teknolojiye hazır bulunuşluk ve dijital sağlık okuryazarlığının etkisi göz önünde bulundurarak, toplumun uzaktan sağlık hizmetlerini kullanma niyetinin incelenmesi amaçlanmıştır.

Yöntem: Araştırmanın verileri, Türkiye'de yaşayan ve 18 yaş üstü bireylerden anket yöntemiyle toplanmıştır. Anket formu "Teknolojiye Hazır Bulunuşluk İndeksi ile Dijital Sağlık Okuryazarlığı Ölçeği" ve araştırmacılar tarafından hazırlanmış olan beş maddelik "Uzaktan Sağlık Hizmetlerini Kullanma Niyeti" ölçeklerinden ve tanımlayıcı bilgilerden oluşmaktadır. Veriler yapısal eşitlik modellemesi yolu ile analiz edilmiştir.

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Bulgular: Yapısal eşitlik modellemesi sonuçları, teknolojiye hazır bulunuşluk modelinin boyutlarından yenilikçilik ve iyimserlik ile uzaktan sağlık hizmetlerini kullanma niyeti arasında anlamlı ve olumlu bir ilişki olduğunu, güvensizlik ve rahatsızlık boyutları ile arasında ise anlamlı bir ilişki olmadığını ortaya koymuştur. Dijital sağlık okuryazarlık düzeyi ile uzaktan sağlık hizmetlerini kullanma niyeti arasında da olumlu ve anlamlı bir ilişki bulunmuştur.

Sonuç: Çalışma, uzaktan sağlık hizmeti sunumunun, bu hizmetlerin yararlarını ve kolaylığını vurgulayarak toplum algısını olumlu yönde etkileyerek desteklenebileceğini savunmaktadır. Ayrıca dijital sağlık okuryazarlığı düzeyini artırmanın, uzaktan sağlık hizmetlerinin kullanımını ve etkinliğini artırmada etkili bir yolu olabileceği görülmüştür.

Anahtar Sözcükler: Uzaktan sağlık hizmeti, teknoloji hazır bulunuşluk, dijital sağlık okuryazarlığı, sağlık yönetimi.

Introduction

Progress in living conditions, reducing birth rate, and increasing life expectancy have significantly changed the demographic characteristics of countries. A shift from the domination of communicable diseases to chronic diseases due to demographic change lead to a rise in demand for high-quality and continuous care. However, health systems struggle with the insufficiency of human and capital capacities to meet healthcare service demand (Wilkinson and Marmot, 2003). New technologies have been considered as a coping mechanism for these challenges (Thimbleby, 2013). Also considering the effect of the COVID-19 pandemic, most healthcare organizations have begun to benefit more intensively from communication technologies and providing services remotely (Mbunge et al., 2022). Türkiye has been making progress in remote provision of healthcare services and has made a legal regulation about it recently (Akgün, 2021). Hence, remote provision of healthcare services comes to the front as a prominent tool for the Turkish health system.

Remote provision of healthcare services refers to electronic applications in healthcare without the physical presence of patients, such as telemedicine, telecare, virtual healthcare services, or e-health. Remote healthcare can be encountered in many different services such as; primary care consultations (Tuijt et al., 2021), older adult care (Reeves et al., 2006,) or even online screening (Alhamid, 2017). Remote provision of healthcare services can be beneficial in coping with geographical barriers to improve accessibility. It can be useful for following up with patients who have infectious diseases, disabilities, or cannot access traditional healthcare services for any reason (Haleem et al., 2021). These implications can also be a significant way to reduce the costs of hospitals or other medical centers (Weinstein et al., 2014).

The success and continuance of new technological approaches, such as remote healthcare services, strongly depend on the intention to use them (Bhattacherjee, 2001). However, there is limited evidence on the acceptance and intention level of the community to use remotely provided healthcare services. The use of remote healthcare services may be linked to compliance with technological devices/advances and a strong e-health literacy level. Some of the major issues with remote healthcare programs are whether users have sufficient skills to use them and whether the program is appropriate or acceptable to people. The satisfaction level of the patients and the success of the remote care are mostly determined by individuals' ability to use information technologies and comprehend online information. For instance, in a study examining user satisfaction and readiness to use e-health, e-health literacy was found to be significantly related to satisfaction and readiness to use (Duplaga and Turosz, 2022). Literature also emphasizes the importance of the ability to seek out and find sufficient information in consumer-directed e-health programs (Norman and Skinner, 2006). This gives a hint about the importance of technology readiness and e-health literacy levels on the intention to use remote healthcare services.

In this study, by readiness to technology, we mean "people's propensity to embrace and use new technologies" in healthcare services based on the definition of Parasuraman (Parasuraman, 2000). The propensity to use new technologies varies across people due to different positive and negative feelings about new technologies (Odlum, 2016). A sufficient measurement of this propensity can provide significant data on improving and promoting new technologies in healthcare.

The other predictor of the study, e-health literacy is defined as "people's ability to seek, find and comprehend the health information from the electronic sources and address that knowledge to solve health-related problems". E-health literacy is comprised of six core skills: traditional literacy, health literacy, information literacy, scientific literacy, media literacy, and computer literacy (Norman and Skinner, 2006).

Many studies have explored the technology readiness of healthcare staff (Odlum, 2016), nursing and medical students (Caison et al., 2008). There are also some studies focusing on some specific groups' readiness to technology in healthcare such as; people who perform fitness (Chiu and Cho, 2021) or people with dementia (Rosenberg et al., 2012). E-health literacy is also a widely explored phenomenon in the literature. There are plenty of studies on e-health literacy levels of different groups such as; health education students (Tarihoran et al., 2021; Tümer and Sümen, 2022), people with chronic diseases (Shiferaw et al., 2020), bank employees (Riahi and Mousavi, 2020). Some studies have also explored the relationship between e-health applications and e-health literacy (Alshammari et al., 2021).

However, to the best of our knowledge, there is no study that explored the intention to use of remote healthcare services considering the effect of technology readiness and e-health literacy level in Türkiye.

Method

Aim: This study aims to contribute to the literature by exploring the relationships between technology readiness, e-health literacy, and intention to use remote healthcare services.

Study Population: The research data was collected through an online questionnaire. The online survey aimed to reach a wider population and individuals who can use the online survey platform and therefore have the minimum infrastructure necessary for remote healthcare services. Convenience and snowball sampling methods were used based on the personal networks of the researchers. The questionnaire form included the purpose of the research, the voluntary participation and information about the researchers. In addition, a description of the remote healthcare services was also included in the questionnaire. Inclusion criteria were determined as being over the age of 18 and having the ability to fill in the online questionnaire. A total of 390 respondents who met the inclusion criteria were recruited. The minimum sample size was determined as 10 times the number of items. Therefore, it was calculated that a minimum of 280 respondents was necessary. However, due to the criticisms at this point, whether the sample size of 390 people was sufficient was examined with G*power and the results illustrated that the statistical power when using a sample size of 390 for this study is above the recommendations (Hair et al., 2011).

Design: The 16-item Technology Readiness Index (TRI) 2.0 scale developed by Parasuraman and Colby (2014) was used in the research by modifying items in terms of wording. The scale was first translated into Turkish independently by the researchers and the items used were adapted to the research. Then, the opinions of 5 experts were obtained to ensure the compatibility of the obtained propositions with the research and to ensure content validity. The experts consisted of academicians working in the field of health management. The opinions of the experts were compiled using a three-point scale (1: the item is incompatible with the construct, 2: the item has low compatibility with the construct, 3: the item is compatible with the targeted construct). It was found that all propositions were evaluated as appropriate and received a score of 3. After the expert evaluation, the obtained form was subjected to exploratory (EFA) and confirmatory factor analyses (CFA). Thus, the construct validity of the scale was also ensured. Finally, the reliability of the final form was examined by calculating Cronbach's alpha coefficient, average variance extracted (AVE) and composite reliability (CR) values. The results of the steps taken in the process of obtaining the form were presented in the findings.

The 8-item Digital Health Literacy Scale, developed by Norman and Skinner (2006) and adapted into Turkish by Tamer Gencer (2017), and a 5-item questionnaire designed by the researchers to measure the intention to use remote healthcare services were used. The Digital Health Literacy scale has already been adapted into Turkish. Still, EFA and CFA were conducted to evaluate the compatibility of the scale with the research purpose and the sample. Then, the reliability of the scale was examined by calculating Cronbach's alpha coefficient, AVE and CR values. The results are presented in the findings.

In order to evaluate the intention to use remote health services, 5 items were prepared based on the information from previous studies (Alhamid, 2017; Haleem et al., 2021; Tuijt et al., 2021). These items were subjected to content validity, construct validity and reliability analysis. The items created were as follows;

- I would like to receive services from my family physician via remote consultation.
- I would like to have follow-up regarding my illness(es) via remote consultation.
- I would like to receive the renewal of my prescriptions remotely.
- I would like to receive psychological counseling services remotely.
- I would prefer to receive health services remotely instead of going to the hospital.

Academics who are experts in the field of health management evaluated whether the items were suitable to measure the targeted construct on a three-point scale (1: the item is incompatible with the construct, 2: the item has low compatibility with the construct, 3: the item is compatible with the targeted construct). It was found that all the proposals were rated as adequate or could be made adequate with minor corrections. After the forms were first examined by 5 experts and necessary corrections were made, a pilot test was carried out. The pilot test was conducted on 30 participants in order to ensure the clarity of the measurement instruments. The measurement tool was finalized according to the pilot test results. The items with content validity were subjected to EFA and CFA. Thus, the construct validity of the scale was also ensured. Finally, the reliability of the final form was examined by calculating Cronbach's alpha coefficient, AVE, and CR values. The results of the steps taken in the process of obtaining the form were presented in the findings.

Statistical Analysis: The data were analyzed using IBM Statistical Package for Social Sciences (SPSS) version 20 and SPSS AMOS version 23. In the exploratory factor analysis of the TRI scale, 2 items that did not fit the factor structure and had a low factor load were removed from the scale. It was determined that the dimensions of discomfort and insecurity emerged as a single factor. In the CFA performed for the same scale, it was determined that the 3-dimensional structure showed a good fit. The digital health literacy scale was used without any changes. Both the Digital Health Literacy Scale and the Intention to Use Remote Healthcare Services Questionnaire consisted of one dimension, as designed, and no item was needed to be removed. The one-dimensional structure for both scales was confirmed by CFA. The CFA fit indices for all scales were within the acceptable range. All of the scales are 5-point Likert scales scored as “1=Strongly Disagree”, “5=Strongly Agree”. In addition to the scales used in the questionnaire, general information such as gender, age, education level, daily non-work internet use, annual number of applications to the family physician, and annual hospital admissions were also included.

The differences between the means of intention to use remote healthcare services were evaluated using independent groups t-tests and one-way analysis of variance. A structural equation model was used to examine the effects of technology readiness sub-dimensions and digital health literacy on the intention to use remote healthcare services. A p value of <0.05 was considered significant in hypothesis tests.

Ethical Consideration: Ethical approval was obtained from a University Scientific Research and Publication Ethics Committee with the number of 2022/99 and the date of 23/12/2022.

Results

In the study, descriptive statistics regarding the general information of the participants were calculated. Then, kurtosis and skewness values were examined for the scale of intention to use remote healthcare services to test normality. Each indicator value was between -2 and +2, which is an acceptable range for normal distribution (Lei and Lomax, 2005). Besides, the Variance Inflation Factor (VIF) was below 3.3 (Sarstedt et al., 2021). Descriptive statistics of the general characteristics of the participants are summarized in Table 1.

Table 1. General characteristics of the participants (N:390)

Measure	Items	n	%
Gender	Female	274	70.3
	Male	116	29.7
Educational Status	Literate	8	2.1
	Primary School	14	3.6
	High School	51	13.1
	Associate-Undergraduate	272	69.7
	Graduate	45	11.5
Daily Non-Work Internet Use	Less than 1 hour	25	6.4
	1-3 hours	162	41.5
	More than 3 hours	203	52.1
Annual Number of Applications to Family Physician	None	50	12.8
	1-5 times	268	68.7
	6-12 times	63	16.2
	More than 12 times	9	2.3
Annual Number of Applications to Hospital	None	27	6.9
	1-5 times	272	69.7
	6-12 times	80	20.5
	More than 12 times	11	2.8
TOTAL		390	100

Age	N	Minimum	Maximum	Mean	SD
	390	18	65	31,06	10,01

70.3% of the participants were female and the mean age was 31.06 (SD=10.01). 69.7% of them had associate's or bachelor's degrees. Daily non-work internet use was more than 3 hours at a rate of 52.1%. The annual number of visits to the family physician was 1-5 times at a rate of 68.7%, and the number of applications to the hospital was 1-5 times at a rate of 69.7% (Table 1).

Table 2. Convergent validity and internal consistency of the scales (N:390)

Factor (Number of Items)	Cronbach Alpha	C.R.	AVE
Optimism (OPT) (4 Items)	0.930	0.93	0.79
Innovation (INN) (4 Items)	0.690	0.80	0.50
Insecurity-Discomfort (INDC) (5 Items)	0.712	0.81	0.46
Digital Health Literacy (DHL) (8 Items)	0.920	0.93	0.64
Intention to Use Remote Health Services (INT) (5 Items)	0.875	0.91	0.67

According to the EFA results, the Digital Health Literacy Scale and the intention to use remote healthcare services questionnaire consisted of a single dimension and no items were excluded. The TRI 2.0 scale consisted of 3 factors and 3 items had to be excluded. It was determined that insecurity and discomfort dimensions merged in the resulting structure. After the EFA, CFA was performed. As a result of the CFA of the scales used in the research, it was determined that the fit indices were acceptable. The reliability values for each scale and sub-dimension are summarized in Table 2.

Accordingly, both construct validity and reliability of the scales validated by CFA were ensured. It was examined whether the intention to use remote healthcare services differed according to the general characteristics of the participants. The results are shown in Table 3.

Table 3. Intention to use remote healthcare services by demographic variables (N:390)

Measure	Items	Mean	SD	Test Value	p
Gender	Female	16.69	5.50	-2.477	**0.014***
	Male	15.32	4.78		
Educational Status	Literate	12.75	3.95	8.249	**<0.001**
	Primary School	15.35	4.53		
	High School	16.50	4.50		
	Associate-Undergraduate	15.10	5.15		
	Graduate	19.28	3.33		
Daily Non-Work Internet Use	Less than 1 hour	15.24	4.67	0.278	0.758
	1-3 hours	15.60	5.02		
	More than 3 hours	15.89	5.11		
Annual Number of Applications to Family Physician	None	16.86	4.98	2.268	0.080
	1-5 times	15.39	4.97		
	6-12 times	16.55	5.09		
	More than 12 times	13.77	5.80		
Annual Number of Applications to Hospital	None	15.92	5.92	1.491	0.216
	1-5 times	15.61	4.88		
	6-12 times	16.41	5.12		
	More than 12 times	13.18	5.45		

*p<0.05

There was a statistically significant difference in the intention to use remote healthcare services according to the gender and education level of the participants (p<0.05). Women and those with postgraduate education had a higher intention to use than others. On the other hand, there was no statistically significant difference in the intention to use remote healthcare services according to daily non-work internet use, annual family physician consultations, and hospital admissions (p>0.05) (Table 3).

Table 4. Fit values for the structural equation model

Index	Acceptable Value (Harrington, 2008)	Value in the Model
X^2/df	≤3	3.158
GFI	≥0.85	0.86
AGFI	>0.80	0.82
CFI	≥0.90	0.90
NFI	>0.85	0.86
RMSEA	≤0.08	0.074

In the research, the effects of the sub-dimensions of technology readiness and digital health literacy on the intention to use remote healthcare services were examined by establishing a structural equation model. It was determined that the goodness of fit values of the established model were acceptable (Table 4).

It was determined that the established model was compatible with the theoretical model. The findings of the analysis are summarized in Table 5.

Table 5. Effect results from the structural model evaluation (N:390)

Hypothesis	Estimates	Standardized Estimates	C.R.	p-value
DHL → INT	0.277	**0.199**	2.776	**0.006***
OPT → INT	0.369	**0.402**	7.266	**<0.001**
INDC → INT	-0.192	-0.075	-1.491	0,136
INN → INT	0,432	**0.263**	2.916	**0.004***

DHL: Digital Health Literacy; OPT: Optimism; INDC: Insecurity-Discomfort; INN: Innovation;
INT: Intention to Use Remote Health Services

*p<0.01

According to the analysis, innovation and optimism from the dimensions of readiness for technology and digital health literacy positively affected the intention to use remote healthcare services (p<0.05). On the other hand, the negative effect of the discomfort/insecurity sub-dimension of technological readiness on the intention to use remote healthcare services was not statistically significant (p>0.05). The total effect of the independent variables on the intention to use remote healthcare services was 0.563.

Discussion

Remote provision of healthcare is gaining significant interest from the health systems around the world. Evidence shows that the use of remote healthcare services can reduce geographical constraints, contain the cost of services, and reduce the workload of the health workforce (Kruse et al., 2021). However, two prominent factors are strong determinants of the adoption and usage of remote healthcare: technology readiness and digital health literacy. This article aimed to explore the impact of these two factors on the intention to use remote healthcare services.

The findings of the study indicated that the intention to use remote healthcare services differed according to the gender and education level of the participants. Women and those with a postgraduate level of education showed a higher intention to use remote healthcare services. This basic outcome aligns with some previous research (Bashshur et al., 2016; Kontos et al., 2012). This may be related to the social position of women, who have more responsibility for healthcare in the household (Lupton, 2017). The result for those with higher education may be linked to their tendency and comfort to use technology more easily than others (Norman and Skinner, 2006). The findings of a lack of a statistically significant difference in the intention to use remote healthcare services based on daily non-work internet use annual family physician consultations and hospital admissions contradict some previous studies (Van Deursen and Van Dijk, 2011).

The positive relationship between the innovation-optimism dimension and the intention to use remote healthcare services has supported the Technology Acceptance Model developed by Davis (Davis, 1989). Similarly, the current study suggests that the positive perception of the users towards remote provision of healthcare services positively influences the level of intention to use them. The study by Chen and colleagues (2014) also found that optimism and innovativeness positively influenced the continuance intention to use the e-appointment system. A recent study also found a significant and positive relation between innovation and the continuance intention to e-health. The finding of the non-significant effect of the discomfort/insecurity sub-dimension of technological readiness on the intention to use remote healthcare services also aligns with the results of the same study (Leung and Chen, 2019). The findings of a study on telehealth acceptance regarding the positive effect of optimism and innovation on perceived value align with the current study, while the finding of negative and significant effect of discomfort is contradictory (Li et al., 2023). A plausible explanation for the non-significant impact of discomfort/insecurity can be that the community widely considers technology as a part of daily life and does not have significant reservations about it.

There are also other studies that are in line with the findings of the current study on the effect of digital health literacy. A study on the intention to use digital therapeutics showed that digital literacy is expected to affect the spread and utilization of digital health care (Kim et al., 2022). Literature also supports the relationship between technology readiness and adoption of digital technologies in healthcare. A qualitative study indicated that the decision to adopt e-health services is influenced by the technology readiness of the users (Ramtohul, 2015). Some studies explored the influence of technology readiness on the intention to use mobile applications and reported a significant relationship between them (Chiu and Cho, 2021; Dash and Mohanty, 2023).

Considering that technology readiness and digital health literacy are key predictors of the intention to use remote healthcare services, future interventions should focus on improving these aspects across all demographic groups. This is especially important considering the intersectionality of gender and education with other social determinants of health, such as socioeconomic status, race, and age, among others. Additionally, the implications of these disparities on health outcomes, including access to quality of care, need to be further explored.

Conclusions

As many studies focused on mobile applications and on patients with some specific diseases, this study poses a difference by providing a wide insight by considering the perception of the general population. The study provides the following practical implications based on the findings and discussion:

Given the influence of gender and education on the intention to use remote healthcare services, healthcare providers and policymakers should consider implementing strategies that will ensure equitable access to these services, taking into account gender-specific needs and educational disparities.

The findings of the study highlighted the importance of technological readiness and digital health literacy in the adoption of remote healthcare services. Therefore, targeted initiatives to improve digital literacy and increase technological readiness among potential users can be beneficial.

The non-significant impact of discomfort/insecurity on the intention to use remote healthcare services suggests that user reservations about technology are rare and do not necessarily deter usage. Therefore, interventions designed to alleviate user concerns and improve the user experience could potentially increase the adoption of these services.

Finally, since the study found no clear relationship between daily non-work internet use, annual family physician consultations, and hospital admissions, and the intention to use remote healthcare services, healthcare providers might consider broadening their outreach strategies beyond simply increasing internet usage or relying on traditional health service utilization patterns.

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