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The Effect of Individual Innovativeness Level on Attitudes Towards Telemedicine Applications

Abstract

This study was conducted to examine individual innovativeness is associated with attitudes and approaches toward telemedicine in the context of advancing healthcare technologies. This study uses a cross-sectional design based on a relational screening model. The study sample consisted of 489 individuals aged 18 and above residing in Türkiye. The data collection tools employed in this study included a personal information form, the Individual Innovativeness Scale, and the Society's Approach and General Attitudes Toward Telemedicine Applications scale. The analysis of the data was conducted using SPSS 25.0 and AMOS programs, with the application of parametric and non-parametric tests depending on the normality of the data. A partial correlation analysis was also performed, with the resultant data controlled for relevant socio-demographic variables. The study indicated that the degree of individual innovativeness exhibited significant variations according to sex and age demographics. A comparison of the results by sex revealed that male participants demonstrated higher levels of individual innovativeness. Furthermore, the 18-24 age group exhibited lower scores than other age groups. Attitudes towards telemedicine applications differed significantly by age group; however, no significant differences were observed with respect to sex, income level, education level, or the presence of chronic diseases. When socio-demographic variables were controlled for, a weak but statistically significant positive correlation was found between the level of individual innovativeness and attitudes towards telemedicine applications. The research results indicate that the level of individual innovativeness is a significant variable in shaping general attitudes towards telemedicine applications.

Keywords: Attitude, innovativeness, telemedicine.

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Bireysel Yenilikçilik Düzeyinin Tele-Tıp Uygulamalarına Yönelik Tutumlara Etkisi

Öz

Bu çalışma sağlık hizmetlerinde yaşanan teknolojik gelişmelerle birlikte bireysel yenilikçiliğin tele-tıp uygulamalarına olan yaklaşım ve genel tutumlarıyla ilişkisinin incelenmesi amaçlanmıştır. Bu çalışma kesitsel bir çalışma olup nicel araştırma yöntemlerinden ilişkisel tarama modeli kullanılmıştır. Araştırmanın örneklemini Türkiye'de yaşayan 18 yaş ve üzeri 489 birey oluşturmuştur. Veri toplama aracı olarak kişisel bilgi formu, Bireysel Yenilikçilik Ölçeği ve Toplumun Tele-tıp Uygulamalarına Yaklaşım ve Genel Tutumları ölçeği kullanılmıştır. Veriler SPSS 25.0 ve AMOS programları ile analiz edilmiş; normallik durumuna göre parametrik ve non-parametrik testler uygulanmıştır. Aynı zamanda sosyo-demografik değişkenler kontrol edilerek kısmı korelasyon analizi gerçekleştirilmiştir. Çalışmada bireysel yenilikçilik düzeyinin cinsiyet ve yaş gruplarına

göre anlamlı farklılıklar gösterdiği tespit edilmiştir. Erkeklerin bireysel yenilikçilik düzeylerinin kadınlara kıyasla daha yüksek olduğu, 18-24 yaş grubunun ise diğer yaş gruplarına göre daha düşük bireysel yenilikçilik puanlarına sahip olduğu belirlenmiştir. Tele-tıp uygulamalarına yönelik tutumlar yaş gruplarına göre anlamlı farklılıklar gösterirken; cinsiyet, gelir durumu, öğretim düzeyi ve kronik hastalık varlığına göre anlamlı farklılık tespit edilmemiştir. Sosyo-demografik değişkenler kontrol edildiğinde bireysel yenilikçilik düzeyi ile tele-tıp uygulamalarına yönelik tutum arasında zayıf ancak istatistiksel olarak anlamlı pozitif bir ilişki olduğu belirlenmiştir. Araştırma sonuçları, bireysel yenilikçilik düzeyinin tele-tıp uygulamalarına yönelik genel tutumların şekillenmesinde anlamlı bir değişken olduğunu göstermektedir.

Anahtar kelimeler: Tutum, yenilikçilik, tele-tıp.

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Introduction

Technological advancements have led to shifts in disease patterns, increased societal expectations, and new demands on healthcare systems, making innovation essential.[1] The restructuring of healthcare delivery has emphasized continuity of care and accelerated the transition from hospital-centered to patient-centered models, closely linked to technological progress.[2] Developments in information and communication technologies (ICT) have transformed patient perceptions of time, space, and access, reshaping the way healthcare professionals and patients interact.[3]

Understanding the behavioral dimensions of innovation is crucial for evaluating individual participation in such transformations. Innovation has been increasingly conceptualized not only as the introduction of new ideas, products, or processes, but also as a willingness to abandon outdated knowledge, assumptions, and routines in favor of novel alternatives;[4,5] in this context, individual innovativeness is conceptualized as a psychological disposition or stable personality trait that reflects an individual's tendency to perceive, evaluate, and respond to new ideas, alternative approaches, and change.[6] Innovation competence allows individuals to recognize opportunities, generate creative ideas, and compare new and existing processes.[7] For innovation to be adopted in healthcare, it must be simple to implement and its benefits clearly observable.[8] Rogers classified adopters of innovation into five categories: innovators (risk-takers and visionaries), early adopters (opinion leaders), early majority (careful but open-minded), late majority (skeptical and cautious), and laggards (resistant and last to adopt).[9]

ICT has significantly impacted healthcare delivery, contributing to the rise of telemedicine—a remote healthcare model that improves accessibility and service delivery.[10] Defined as the remote provision of medical services in real time or asynchronously using telecommunications,[11] telemedicine addresses access barriers for individuals in rural areas or those with mobility limitations.[12] The increasing use of telemedicine aligns with ongoing technological advances in healthcare. Moreover, new technologies have enhanced the transfer of health information, which is crucial for the effective implementation of telemedicine. Telemedicine can help reduce diagnostic and treatment delays, eliminate unnecessary tests and patient transfers, and ultimately improve the quality of care.[13]

As innovations continue to spread rapidly across all areas of life, adaptability has become more important than ever.[14] Understanding individual attitudes toward innovation is critical for public acceptance and use of telemedicine services. In this context, the present study examines the impact of individual innovativeness on attitudes and approaches toward telemedicine within the broader framework of technological advancements in healthcare.

The Development of a Hypothesis

Technology acceptance refers to individuals' willingness to employ technologies developed for specific functions and has been widely examined in the literature. Research in this area primarily seeks to identify the determinants that shape the adoption and continued use of technological innovations.[15] To address this aim, several theoretical models have been proposed, among which the Technology Acceptance Model (TAM) has emerged as one of the most influential and empirically validated frameworks for explaining technology usage behavior and adoption processes.[16]

Originally introduced by Davis et al., TAM posits that perceived usefulness and perceived ease of use constitute the core beliefs influencing an individual's attitude toward a technology and subsequent usage behavior.[17] Within this framework, attitude represents an individual's overall evaluative judgment regarding the desirability of using a specific information technology and serves as a key predictor of actual use. In the context of healthcare, perceived benefit and ease of use have been identified as significant factors influencing the adoption of telemedicine and behavioral intention.[17-19] The extensive application of TAM in

studies of complex and emerging technologies—particularly in health information systems and telemedicine—underscores its robustness and relevance in explaining technology acceptance in healthcare contexts.

Beyond perceptual determinants, prior research highlights the importance of demographic factors in shaping technology acceptance and adoption. Age, in particular, has been extensively studied as a determinant of technological engagement. Compared to younger people, older adults possess distinct capabilities, requirements and apprehensions with regard to the utilization of digital technology, exhibiting lower adoption rates of digital health technology and its integration. It is well-documented that older adults may encounter physical and mental challenges related to age when using digital technology and engaging in new learning processes.[20] A number of factors have been identified as potentially limiting the adoption of digital tools by older adults, including low digital literacy levels, limited use, difficulties encountered during use, and decreased confidence in using technological systems.[21] In contrast, younger individuals born into the digital age are generally more familiar with digital health applications and more comfortable and confident in using these technologies due to their early and continuous exposure to information technologies.[22,23]

H1: Individual innovativeness differs significantly across age groups.

H3: Attitudes toward telemedicine applications differ significantly across age groups.

Sex has also been identified as a significant factor in the adoption of technology. Differences in social roles, cognitive styles, and perceptions of technology may lead male and female to follow distinct decision-making processes when adopting new technologies.[16,24] Empirical evidence suggests that female tend to place greater emphasis on perceived usefulness, whereas male are more strongly influenced by attitude.[25] Accordingly, attitudes toward digital health technologies, including telemedicine applications, may vary by sex.

H2: There are significant differences in individual innovativeness between males and females.

H4: There are significant differences in Attitudes toward telemedicine applications between males and females.

Individual innovativeness, conceptualized as a personal trait reflecting an individual's willingness to embrace new ideas, practices, and technologies, represents a critical antecedent of technology acceptance.[26] Within the framework of Diffusion of Innovations, innovative individuals are characterized by greater openness to novelty and lower resistance to uncertainty, which facilitates positive evaluations of emerging technologies and leads to higher adoption tendencies toward new technologies.[27] In technology acceptance research grounded in the Technology Acceptance Model, dispositional traits such as innovativeness have been shown to shape users' attitudinal responses by influencing how technologies are perceived and evaluated. In healthcare contexts, innovative individuals tend to report more favorable attitudes toward digital health technologies.[28,29] Given that telemedicine represents an innovative digital healthcare service, it is therefore reasonable to expect a positive association between individual innovativeness and attitudes toward telemedicine applications.

H5: Individual innovativeness is positively associated with attitudes toward telemedicine applications.

Materials and Methods

In this study, a cross-sectional research design based on the relational survey model was adopted to examine the quantitative relationships among the variables. The main objective was to assess how individuals' levels of innovativeness are associated with their attitudes toward telemedicine applications. Approval was obtained from the Social and Human Sciences Research Ethics Committee to conduct the study (Date: 30.09.2022, Number: 2022/799).

Population and Sample of the Study

The study population consisted of Turkish residents aged 18 and above. Based on Neuman's sample size table, a minimum of 384 participants were needed for a 95% confidence level and a 5% margin of error.[30] To account for a potential 10% attrition rate, the target sample size was increased to 422. Data were collected from 489 participants via an online survey distributed through the investigators' networks, using a convenience sampling method supplemented by a snowball sampling approach. The response rate could not be accurately determined due to the distribution method, which limits the sample's representativeness and the generalizability of the findings. The study was predicated on voluntary participation.

Data Collection Tools

Data were collected using a three-part questionnaire. The first section consisted of five questions regarding sex, age, education level, monthly income, and chronic disease status. The second section used the 20-item Individual Innovation Scale (IIT) to assess participants' perceptions of their innovativeness. The third section employed an 18-item scale to evaluate participants' approaches and general attitudes toward telemedicine applications.

The Individual Innovativeness Scale (IS), developed by Hurt, Joseph, and Cook[26] and adapted to Turkish by Kılıçer and Odabaşı, assesses individuals' general innovativeness and categorizes them into innovation categories.[9] The scale defines innovativeness as a personal willingness to try new things and includes four sub-dimensions: resistance to change (8 items), opinion leadership (5 items), openness to experience (5 items), and risk-taking (2 items), totaling 20 statements. Resistance to change reflects concerns about innovation; opinion leadership captures distinguishing traits within a group; openness to experience indicates a tendency to embrace innovation; and risk-taking measures persistence amid uncertainty. Items are rated on a 5-point Likert scale from "Strongly Disagree" to "Strongly Agree," with 12 positively (1, 2, 3, 5, 8, 9, 11, 12, 14, 16, 18 and 19 items) worded and 8 negatively (4, 6, 7, 10, 13, 15, 17 and 20 items) —worded items. The total innovation score is calculated by subtracting the score from negative items from the positive item score and adding 42. The overall internal consistency coefficient is 0.82, with sub-dimension reliabilities ranging from 0.62 to 0.81.

The Society's Approach and General Attitudes Toward Telemedicine Applications Scale, developed by Gürgen, includes 18 items rated on a 5-point Likert scale from "Strongly Disagree" to "Strongly Agree".[31]

Data Analysis

The analysis of the data was conducted utilizing the SPSS 25.0 and AMOS programs. Prior to statistical analysis, the data were assessed for normality. Although the Kolmogorov–Smirnov and Shapiro–Wilk tests were conducted, distributional characteristics were primarily evaluated using skewness and kurtosis coefficients, histograms, and Q–Q plots. Previous research indicates that traditional normality tests may be unreliable for Likert-type scale data, as they tend to detect statistically significant deviations even when departures from normality are negligible, particularly in medium and large samples. Resulting, skewness and kurtosis values, together with graphical inspection methods, are considered more appropriate indicators of normality.[32,33]

Accordingly, normality was evaluated using skewness and kurtosis coefficients and Q–Q plots. The analysis showed that some sub dimensions of the Individual Innovativeness scale (e.g., resistance to change) exhibited acceptable distributional properties, whereas others (including openness to experience and opinion leadership) deviated from normality. Parametric tests were therefore applied to sub dimensions that met normality assumptions, while nonparametric tests (Mann–Whitney U and Kruskal–Wallis H tests) were used for sub dimensions that did not. In addition, parametric analyzes—including independent samples t-tests, one-way ANOVA, and Welch ANOVA—were conducted for variables with acceptable distributions, such as the Individual Innovativeness and General Attitudes toward Telemedicine scales. Prior to the implementation of parametric tests, an assessment of homogeneity of variance was conducted using the Levene test. In instances where the assumption of homogeneity of variance was not met, Welch-corrected tests were employed instead of classical parametric tests. To control the probability of Type I error in multiple comparisons made in the study, the Bonferroni correction was applied. In addition, the relationships between individual innovativeness and attitudes towards telemedicine applications were re-examined using partial correlation analysis, controlling for variables such as age, sex, education level, monthly income, and the presence of chronic disease. Consequently, the potential confounding effects of demographic variables were controlled, allowing for the evaluation of the true effects of the relationships between variables. The reliability of the scale and its sub-dimensions was determined by employing Cronbach's α and McDonald ω coefficients.

Results

This section presents the findings from statistical analyses examining the relationship between participants' individual innovativeness, their attitudes toward telemedicine, and demographic variables.

The study sample consisted of 65.2% females. The age distribution was as follows: 18-24 years (40.1%), 25-34 years (36.4%), 35-44 years (17.4%), and 45 years and older (6.1%). Regarding education, 41.1% held an undergraduate degree, and 2.7% had completed primary school—almost half of the participants (49.1%) earned below the minimum wage. The majority (87.5%) reported no chronic disease. Most participants (42.1%) learned about "telemedicine" from healthcare professionals, while 9.2% were

unfamiliar with the term. Post-pandemic, 54.0% reported no change in in-person healthcare visits, and 67.5% reported no change in telemedicine service utilization (Table 1).

Table 1. Descriptive statistics regarding demographic characteristics of participants.

Variables	n	%	Variables	n	%
Sex			**Have you heard the term Telemedicine before?**		
Female	319	65.2	I Haven't Heard It	45	9.2
Male	170	34.8	I Heard It From a Healthcare Worker	206	42.1
Age Group			I Heard It From My Social Circle	43	8.8
18-24 years	196	40.1	I Heard It From Social Media	76	15.5
25-34 years	178	36.4	I Heard It on TV	23	4.7
35-44 years	85	17.4	I Heard It From Books, Newspapers, Magazines, etc.	55	11.2
45 years and above	30	6.1	I Heard It From Other Places	41	8.4
Education Level			**How has the frequency of your visits to healthcare institutions changed after the pandemic?**		
Primary School	13	2.7			
High School	46	9.4	Increased	86	17.6
Associate Degree	154	31.5	Decreased	139	28.4
Undergraduate	201	41.1		264	54.0
Postgraduate	75	15.3	**Has your use of telemedicine services changed since the pandemic?**		
Income					
Min. wage and below	240	49.1	Increased	121	24.7
Above min. wage	168	34.4	Decreased	38	7.8
No income	81	16.6	Unchanged	330	67.5
Do you have any chronic diseases?			**Total**	**489**	**100**
Yes	61	12.5			
No	428	87.5			

The results of the validity and reliability tests for the Individual Innovativeness Level and Sub-Dimensions scale and the Attitude Towards Telemedicine Applications scale are presented in Table 2.

Table 2. Statistics of the ındividual ınnovativeness scale and its sub-dimensions and the general attitude towards telemedicine scale.

	$\bar{x}$±sd	Min-max	CA (α)	McDonald ω	Skewness	Kurtosis
Resistance to change	2.97 ± 0.63	1.50 – 4.88	0.654	0.719	0.506	0.015
Opinion leadership	4.24 ± 0.56	1.00 – 5.00	0.721	0.735	-1.172	3.608
Openness to experience	4.43 ± 0.52	1.00 – 5.00	0.763	0.772	-2.058	8.573
Risk taking	3.76 ± 0.82	1.00 – 5.00	0.374	**0.378**	-0.722	0.634
Individual Innovativeness Scale	3.73 ± 0.41	1.65 – 4.95	0.758	0.801	-0.143	0.925
General Attitudes Towards Telemedicine	3.00 ± 0.54	1.18 – 4.29	0.817	0.853	-0.306	0.245

$\bar{x}$±sd=mean± standard deviation, CA (α)=Cronbach's Alpha

The Cronbach's α values for the scales were found to be 0.758 for the Individual Innovativeness Level scale and 0.817 for the General Attitudes Towards Telemedicine scale. Additionally, the McDonald's omega values were found to range between 0.719 and 0.853. The obtained reliability coefficients exceed the accepted reliability value of 0.70. The highest reliability coefficient was found in the Openness to Experience sub-dimension (α=0.763; ω=0.772), while the lowest reliability coefficient was found in the Risk-Taking sub-dimension (α=0.374; ω=0.378). The findings showed that the Risk-Taking sub-dimension of the Individual Innovativeness scale, which originally consisted of four sub-dimensions, was excluded from the analysis due to its low internal consistency coefficient in the sample group (Cronbach α = 0.374; McDonald ω = 0.378). Confirmatory factor analysis (CFA) was applied to evaluate the structural validity of the remaining three dimensions of the scale (resistance to change, opinion leadership, and openness to experience).

The results of the CFA analysis demonstrate that the proposed three-dimensional model exhibits an acceptable degree of compatibility with the data (as indicated by the following parameters: X2/df=2.71; Root Mean Square Error of Approximation (RMSEA)=0.059; Goodness of Fit Index (GFI)=0.923; Average Weighted Root Mean Square Residual (AGFI)=0.901; Comparative Fit Index (CFI)=0.905; Tucker Lewis

Index (TLI)=0.890; Standardized Root Mean Square Residual (SRMR)=0.052). The obtained fit indices are within the acceptable fit range, and the structural validity of the model is supported.

The calculated internal consistency coefficients for the sub-dimensions and the overall scale, using Cronbach's α and McDonald's ω, are as follows: resistance to change 0.654; 0.719, opinion leadership 0.721; 0.735, openness to experience 0.763; 0.772, individual innovativeness level 0.758; 0.801, and general attitudes towards telemedicine applications 0.817; 0.853, respectively. In consideration of these values, it can be concluded that the internal consistency coefficients of the scales and subscales are satisfactory at an acceptable level. In accordance with the findings of the CFA and internal consistency, this study examined the individual innovativeness level scale through a three-dimensional structure, and statistical analyses were performed using the sub-dimension scores. The normality of the data distribution was evaluated by examining the skewness and kurtosis coefficients, as well as the Q-Q plot. Upon examining the obtained coefficients, it was observed that the skewness and kurtosis values of the Openness to Experience and Opinion Leadership sub-dimensions fell outside the normal distribution limits (±1.5) (see Table 2). The Q-Q plot also exhibited deviations from the normality line of the distribution. These results suggest that the scales used are generally reliable and suitable for analysis using normal distribution methods.[34]

The assumption of homogeneity of variances was met in the analyses performed, and the results of the applied parametric and non-parametric analyses are as follows.

Table 3 presents the study's findings on the differences between various demographic and health characteristics, individual innovativeness scale, and general attitudes toward telemedicine.

Table 3. Differences between demographics, ındividual ınnovativeness scale, and general attitudes toward telemedicine.

	Resistance to change			**Opinion leadership**		**Openness to experience**		**IIS**		**General Attitudes Towards Telemedicine**	
Sex	n	$\bar{x}$	sd	$\bar{x}$ ± sd	Mean Rank	$\bar{x}$ ± sd	Mean Rank	$\bar{x}$	sd	$\bar{x}$	sd
Female	319	2.90	0.59	4.24±0.53	241.72	4.43±0.46	238.80	3.70	0.40	3.00	0.54
Male	170	3.09	0.68	4.24±0.62	251.15	4.43±0.63	256.64	3.79	0.47	3.01	0.54
	Welch p=0.003		**t=-3.045**	U=26070.0 p=0.479		U=25136,0 p=0.179		**t=-2.408 p=0.016**		t=-0.255 p=0.799	
Age Group											
18-24 years	196	2.81	0.53	4.22±0.53	236.28	4.34±0.52	215.81	3.64	0.39	2.90	0.52
25-34 years	178	3.08	0.66	4.27±0.52	253.71	4.53±0.42	269.89	3.80	0.40	3.09	0.53
35-44 years	85	3.08	0.69	4.26±0.65	255.95	4.46±0.58	263.56	3.81	0.40	3.10	0.59
45 years and above	30	2.97	0.67	4.13±0.71	219.28	4.33±0.78	235.40	3.67	0.50	2.85	0.47
	Welch F =7.53		**p<0.001**	H = 2.973 p= 0.396		**Z=-3.738 =0.001***		**Welch F=7.36 p<0.001**		**F=5.830 p=0.004***	
Education Level											
Primary School	13	2.81	0.72	4.26±0.60	252.00	4.48±0.48	253.42	3.68	0.49	3.19	0.60
High School	46	3.00	0.69	4.10±0.68	216.42	4.30±0.64	220.22	3.67	0.49	3.08	0.57
Associate Degree	154	2.84	0.55	4.30±0.46	253.90	4.43±0.43	233.30	3.69	0.36	2.96	0.54
Undergraduate	201	3.01	0.61	4.24±0.60	246.72	4.43±0.58	250.15	3.75	0.44	2.96	0.55
Postgraduate	75	3.10	0.73	4.22±0.54	238.43	4.52±0.44	268.98	3.81	0.45	3.14	0.48
	Welch F=2.887		**p= 0.028**	H = 2.76 p=0.599		H= 5.056 p=0.282		Welch F=1.285 p>0.05		**F=2.507 p=0.041****	
Income											
Min. wage and below	240	2.93	0.60	4.24±0.51	239.90	4.42±0.50	238.50	3.70	0.40	3.02	0.57
Above min. wage	168	3.06	0.68	4.25±0.60	250.69	4.45±0.54	256.47	3.78	0.45	3.01	0.49
No income	81	2.89	0.58	4.24±0.63	248.31	4.42±0.55	240.49	3.69	0.44	2.93	0.55
	Welch F=2.720		**p>0.05**	**H=0.641 p=0.726**		**H=1.736 p=0.420**		**F=1.717 p=0.181**		**F=0.849 p=0.428**	
Do you have any chronic diseases?											
Yes	61	3.05	0.65	4.22±0.60	238.54	4.44±0.52	248.43	3.76	0.46	3.02	0.53
No	428	2.95	0.62	4.24±0.56	245.92	4.43±0.52	244.51	3.72	0.42	3.00	0.54
	t=1.167 p=0.244			U=12660.00 p=0.70		U=12844.50 p=0.837		t=0.701 p=0.484		t=0.241 p=0.809	

t=Independent Sample t Test, U=Mann Whitney U Test, H=Kruskal Wallis H Test, F=One-Way Analysis of Variance (ANOVA) Welch F = Welch ANOVA Analysis, Welch t = Welch t Test, Z= Dunn-Bonferroni Test p<0,05
*p-value is reported according to the Bonferroni correction. p=0.008, ** p-value is reported according to the Bonferroni correction. p=0.01

The selection of statistical tests was made on the basis of the results of the normality assessment. Non-parametric tests were applied to sub-dimensions that did not meet the normality assumptions, while parametric tests were used for scale scores that had acceptable distribution characteristics. Following the violation of the homogeneity of variances assumption (Table 3), Welch ANOVA was used to compare individual innovativeness and resistance to change across age groups and education levels. Significant differences were found between age groups for both individual innovativeness (Welch F (3, 112.20) = 7.36, p <0.001) and resistance to change (Welch F (3, 11.29) = 7.53, p <0.001). Games-Howell post-hoc tests revealed that the 18-24 age group had significantly lower innovativeness scores than the 25-34 (p = 0.046) and 35-44 age groups (p <0.001), suggesting that innovativeness increases with age. Furthermore, the 18-24 age group showed significantly lower resistance to change than the 25-34 (p <0.01) and 35-44 age groups (p <0.05). A significant difference was also found between age groups regarding attitudes towards telemedicine applications (F = 5.830, Bonferroni-corrected p = 0.008), with the 25-34 age group ($\bar{x}$= 3.09) exhibiting higher scores than the 18-24 age group ($\bar{x}$ = 2.90) (p = 0.004).

No significant difference was found in individual innovativeness (Welch F (4, 70.234) = 1.285, p> 0.05) or attitudes towards telemedicine applications (Bonferroni-corrected p = 0.01) based on education level. However, a significant difference was identified in resistance to change (Welch F (4, 70.067) = 2.887, p <0.05). Games-Howell post-hoc tests revealed that associate degree students had lower resistance to change scores than undergraduate students (p <0.05), indicating that resistance to change may increase with higher education levels. Because the assumption of homogeneity of variance was not met, resistance to change scores were compared by sex using the Welch t-test, which revealed a significant difference (t 304.10 =-3.05, p = 0.003). Male participants demonstrated higher resistance to change ($\bar{x}$= 3.09) compared to female participants ($\bar{x}$= 2.90). A significant difference was also found in individual innovativeness by sex (t[487] = -2.125, p < 0.05), with males exhibiting higher levels of innovativeness than females. No significant differences were found between individual innovativeness, resistance to change, attitudes towards telemedicine applications, income levels, or the presence of chronic diseases (p> 0.05). Furthermore, no significant difference was observed between attitudes towards telemedicine applications and sex (p> 0.05).

A Kruskal-Wallis test showed a significant association between age and openness to experience. After Bonferroni correction, the adjusted p-value was 0.008. A Dunn-Bonferroni post-hoc analysis revealed a significant difference between the 18-24 and 25-34 age groups (z =-3.738, p = 0.001). No other age group comparisons were significant following Bonferroni correction (p> 0.05). The 25-34 age group displayed greater openness to experience, as indicated by a higher mean rank than the 18-24 age group.

The relationship between the innovativeness level of each individual participant and their attitudes toward telemedicine applications was determined using a partial correlation analysis. This analysis was conducted after controlling for the age, sex, monthly income, education level, and presence of chronic disease of the participants. The findings are presented in Table 4. The correlation coefficients indicate the strength of the relationship: weak (0-0.29), moderate (0.30-0.64), strong (0.65-0.84), and very strong (0.85-1).[35]

Table 4. The relationship between individual innovativeness level and general attitudes towards telemedicine, controlling for socio-demographic variables.

		General Attitudes Towards Telemedicine
Individual Innovativeness Scale	Pearson r	0.167
	p	0.000
	n	489

p<0.05

After controlling for age, sex, income, education, and chronic disease, a weak but statistically significant positive correlation was observed between individual innovativeness and attitudes towards telemedicine ($r_{partial}$ = 0.167, p <0.05). Individual innovativeness accounts for 2.6% of the variance in attitudes toward telemedicine applications.

Discussion

In today's world, information and communication technologies are evolving rapidly, driving the acceleration of digital transformation in the healthcare sector. Telemedicine—an outcome of these advancements—has significantly improved healthcare accessibility, chronic disease monitoring, and cost reduction, especially in rural and remote areas. The successful adoption of telemedicine depends heavily on

individuals' openness to technological innovation, which is associated with usage, acceptance, and attitudes toward it. This study aimed to assess the relationship between individual innovativeness and general attitudes toward telemedicine. Most participants were aged 18–24 (40.1%) or 25–34 (36.4%), with females comprising 65.2% of the sample. The majority held associate (31.5%) or undergraduate (41.5%) degrees. Only 9.2% had never heard of telemedicine. Additionally, 54.0% reported no change in their frequency of in-person healthcare visits after the pandemic, while 67.5% noted no change in their use of telemedicine.

The findings show that the majority of participants fell into the pioneering (52.35%) and questioning (40.9%) categories of innovation. Only a small portion was identified as innovative (4.09%), skeptical (1.84%), or traditionalist (0.82%). In total, 93.25% of participants identified themselves as pioneers or questioners. These results align with previous studies by Gökbulut, [36] Örün et al., [37] Bodur, [38] and Korucu and Olpak, [39] which also found that most participants (ranging from 75% to 91.6%) were in the pioneering and questioning categories.

An analysis was conducted to examine the relationship between participants' innovativeness levels and demographic variables. Significant differences were found based on sex and age. Male participants had higher innovation scores than females, potentially due to a greater tendency toward risk-taking, adaptability, and openness to innovation. Significant differences were also observed in resistance to change, openness to experience, and overall innovativeness across age groups, particularly between the 18–24, 25–34, and 35–44 age brackets (Welch F=7.53, p<0,01; Z =-3.738, p=0.001, and Welch F = 7,36, p <0,001). A significant relationship was also found between educational attainment and the resistance to change sub-dimension (Welch F (4, 70.067) = 2,887; p<0.05) with higher resistance observed among individuals with undergraduate education or less. Similarly, Karayağız Muslu[1] found that nurses with higher education levels showed greater openness to experience and inclination toward innovation. Özkan et al. found that employees aged 31-35 were more innovative than those aged 18-25, and doctoral graduates more innovative than bachelor's degree holders.[40] While Çetin and Bülbül found age to be a significant factor, they found no significant relationship between innovation and sex or education.[41] Similarly, Akay found that age, sex, marital status, and education level were significantly related to healthcare workers' resistance to change.[42]

The study also explored the relationship between demographic variables and general attitudes toward telemedicine. No significant relationship was found between these attitudes and sex, income, education, or the presence of chronic disease (p> 0.05), consistent with findings by Korkmaz and Hoşman.[43] However, a significant relationship was identified between participants' age group and education level and their attitudes towards telemedicine applications. A multiple comparison test was conducted to ascertain which groups demonstrated differences, thus revealing a discrepancy between the 18-24 and 25-34 age groups ($\bar{x}$=2.90 and $\bar{x}$=3.09, respectively; p=0.004). The increase in average scores with age suggests that individuals' attitudes towards telemedicine applications become more positive as they age.

Controlling for socio-demographic factors, the study found a significant positive correlation between individual innovativeness and general attitudes towards telemedicine, indicating that more innovative individuals tend to view digital health applications more favorably.

The study confirmed that individual innovativeness varies significantly by age group and sex (supported H1 and H2). General attitudes toward telemedicine applications differed significantly across age groups (H3 supported) but not sex (H4 rejected). Finally, a significant relationship was found between individual innovativeness and attitudes toward telemedicine (H5 supported).

Conclusion

This study investigated the relationship between individual innovativeness and attitudes toward telemedicine. Results showed that innovativeness varied by age and sex, with younger individuals and female displaying lower scores. No significant differences in innovativeness were found based on education, income, or chronic disease status. General attitudes toward telemedicine differed significantly across age groups but not by sex, education, income, or chronic health conditions. After controlling for socio-demographic variables, a weak but significant correlation emerged between innovativeness and attitudes toward telemedicine. While this suggests a possible link, the relationship's weakness and the study's cross-sectional design warrant cautious interpretation. Future research should investigate the impact of interventions and training programs designed to enhance individual innovativeness on the adoption of telemedicine.

This study employed a three-dimensional structure to address individual innovation, given the low internal consistency of the Risk-Taking sub-dimension items. This limited the use of the scale's total score and associated categorical classifications. Additionally, the generalizability of the findings should be considered

in light of the study's cross-sectional design and sample characteristics. Future research should utilize diverse samples and strive for higher reliability across all sub-dimensions. The cross-sectional design also restricts the study to identifying associations, rather than causal relationships, between innovativeness and attitudes toward telemedicine. The use of non-probabilistic convenience and snowball sampling methods in sample formation limits the generalizability of the findings.

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Reviewer: External, Independent
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Declarations:
1. Originality Statement: 5th International 15th National Congress on Health and Hospital Administration, 13-15 October 2022, Samsun, Türkiye. This study was not derived from any thesis.
2.Author Contributions: Conceptualization: BYK, NK; Idea: BYK, NK; Literature Review: NK; Data Collection: BYK, NK; Data Processing: BYK; Analysis: BYK; Writing – Original Draft: BYK, NK; Writing – Review and Editing: BYK
3. Ethics Committee Approval: Ethics committee approval for this study was obtained from the Ondokuz Mayis University Social and Human Sciences Research Ethics Committee with the decision dated 30/09/2022 and numbered 2022/799.
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5.Conflict of Interest: The author(s) declare that there is no conflict of interest.
6.Generative Artificial Intelligence Statement: Generative artificial intelligence tools, namely DeepL, were used solely for translate and linguistic editing.
7.Sustainable Development Goals: This work is related to the following United Nations Sustainable Development Goals

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