



Original Article

Acceptance of Information and Communication Technology and Its Related Factors among Older Adults: A Cross-Sectional Study in Iran

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Introduction: Given the increasing elderly population and the decreasing role of families in elderly care, the use of up-to-date technologies by older adults will become increasingly important in helping them live healthier and better lives. This study aimed to determine the acceptance of information and communication technology (ICT) by older adults and related factors in Yazd city, Iran.

Methods: This cross-sectional study was conducted in 2022 with the participation of 360 older adults aged over 60 years from comprehensive health care centers in Yazd city, Iran. Participants were selected using a multi-stage random sampling method. Data were collected using a demographic information questionnaire and an Information and Communication Technology Acceptance Questionnaire completed by interview. Data were analyzed using descriptive indices, independent two-sample t-tests, one-way analysis of variance, and regression by SPSS.

Results: The ICT acceptance rate among older adults was 22.5%. The highest mean score was related to the dimension of perceived usefulness (15.37). The most significant barriers to ICT acceptance were lack of interest (48.6%), lack of sufficient skills (46.4%), and lack of perceived need (45.3%). The regression results showed that age, level of education, smartphone use, and time spent on technology tools were predictors of ICT acceptance by older adults, accounting for 82% of the variance in ICT acceptance.

Conclusion: Given the low level of technology acceptance among older adults in Yazd city and the need to learn and use ICT to meet their individual, social, health, and medical needs, as well as to live a more independent life and save time and costs, providing older adults with the opportunity to become familiar with technology is essential.

Keywords: Information and Communication Technology, Older Adults, Acceptance of Technology, ICT, Technology Tools

Introduction

Information and communication technology (ICT) encompasses technologies that facilitate remote access

to information through communication channels like the Internet, wireless networks, mobile phones, and other

communication devices capable of sending and receiving various verbal, audio, and video messages. These technologies also enable the production, distribution, storage, and retrieval of information for communication between individuals (1). The emergence and advancement of ICTs have presented societies with immense potential to address the challenges posed by aging, enabling older adults to lead healthier, more independent, and socially connected lives (2-4). ICT serves as a source of enhanced social support and improved quality of life for older adults, offering a convenient tool for accessing health information and fostering communication with family and friends (4).

Despite the remarkable progress and diverse applications of ICT tools, evidence suggests that older adults have not fully embraced these technologies, resulting in a digital age gap in Iran, characterized by low ICT acceptance among older adults (2). While many older adults exhibit a positive attitude towards technology, the acceptance and utilization of certain technologies remain low within this demographic (5).

Acceptance is a multifaceted concept that encompasses a wide range of key variables, including individuals' perceptions, beliefs, attitudes, characteristics, and their engagement with information technology (3). In the United States (2017), internet acceptance among individuals over 75 years of age stood at 34%, with only 21% having access to broadband internet. Similarly, only about 33% of individuals aged 65 and older utilized online social networks (5). In the United States, older adults are significantly less likely to own a computer (56%) and use the Internet (52%) compared to younger generations. In the UK, only 17.78% of the elderly population had never used the Internet (6). In Iran, the average ICT usage stands at around 35%, with only 10% among individuals over 55 years old (7).

Considering the existing barriers, the diminishing role of families in providing care for older adults, the declining number of children, and the increasing life expectancy, a significant gap exists between older adults and the technological landscape. However, given its practical applications in everyday life, technology has provided effective and practical methods for performing daily activities (8, 9).

Barriers to ICT acceptance among older adults are often related to privacy concerns (10), usability and reliability issues, ease of use, annoyance factors, social stigma (11), access limitations (12), low literacy levels (13), lack of awareness, insufficient access, limited training opportunities, lack of skills and experience (14), and low self-confidence in using technology (15).

The most crucial issue arising from the information gap in ICT usage is the substantial disparity in patients' ability to locate the required health information on the Internet. The most significant factors influencing the information gap include geographical location, skill level, and the utilization of subsidies. These challenges can be addressed through training older adults, increased investment, and government support (16).

Due to mobility and cognitive limitations, the majority of older adults spend a considerable amount of

time at home, making ICT usage a valuable tool for supporting their daily activities (17).

While ICT acceptance offers advantages such as enhanced independence and improved quality of life for older adults, including increased usefulness and convenience (12), the use of mobile phones by older adults can also reduce costs, enhance healthcare quality, promote preventive health behaviors (18), save time, and maintain relationships (19).

However, older adults face challenges when using ICT due to factors such as low motivation stemming from memory problems (20), low income (21), low education levels (2), geographical location (16), low computer/Internet literacy (22), and changes in cognitive and physical functioning (23). Additionally, chronic physical disorders such as visual impairment, reduced motor control, or impairment in instrumental activities of daily living can hinder ICT usage in healthcare management for older adults (24).

The development and utilization of technologies have accelerated with the spread of COVID-19. Given the growing reliance on technologies, the theme of the International Day of Older Persons in October 2021, "Digital Equity for All Ages," and the increasing elderly population, it is imperative to equip older adults with the knowledge and skills necessary to utilize technologies effectively. This study was conducted to investigate ICT acceptance and its associated factors among older adults in Yazd city, Iran.

Methods

Study design and participants

This cross-sectional study involved 360 older adults aged 60 years and above from comprehensive health care centers in Yazd city, Iran, in 2022. A multi-stage random sampling method was employed to select participants. Inclusion criteria were being 60 years of age or older, possessing minimal reading and writing literacy, being covered by comprehensive healthcare centers in Yazd city, and not having cognitive impairment. Older adults with hearing or speech impairments were excluded from the study.

Sampling procedure

A multi-stage random sampling method was used to select participants. In the first stage, using cluster sampling proportional to the sample size, comprehensive healthcare centers were sampled in proportion to the number of centers in each district (5 districts in Yazd city). For this purpose, 10 comprehensive healthcare centers were selected, from which 40 older adults were randomly selected from each center. Initially, 400 older adults were included in the study. However, 40 older adults were excluded due to non-response or non-cooperation, resulting in a final sample size of 360.

Data collection

Data were collected through face-to-face interviews using a structured questionnaire. The questionnaire comprised demographic information, an ICT acceptance questionnaire, and questions assessing general health



status, economic status, reasons for not using ICT, ICT tool usage, and technology-related activities.

Instruments

Demographic information and the Information and Communication Technology Acceptance questionnaire were used to collect data. Demographic information included age, gender, number of children, marital status, level of education, occupation, housing type, lifestyle, primary source of income, chronic diseases, and medication use.

The Information and Communication Technology Acceptance Questionnaire, developed by Basakha et al., in Iran (2), comprises 24 questions measuring five dimensions: user independence, perceived usefulness, perceived ease of use, attitude towards use, and intention to use ICT. Responses to each item are based on a five-point Likert scale (ranging from strongly agree to strongly disagree) with a score of 1-5. The questionnaire has a content validity index of 0.98, and its construct validity has been confirmed through confirmatory factor analysis. The tool's reliability has been established through Cronbach's alpha coefficient, with Cronbach's alpha values ranging from 0.83 to 0.87 for the dimensions and 0.88 for the overall questionnaire (2). In the present study, a cutoff score of 72 was used to determine ICT acceptance. Older adults scoring 72 or higher were considered to have accepted technology, while those scoring below 72 were considered non-adopters. In addition to demographic questions, older adults were asked about their general health and economic status, reasons for not using ICT, ICT tool usage, and technology-related activities (e.g., talking on a mobile phone, sending and receiving text messages, taking photos with mobile phones).

Data analysis

Descriptive statistics, including frequencies and percentages for qualitative data and mean scores and standard deviations for quantitative data, were employed to analyze the collected data. To assess the relationship between ICT acceptance scores and demographic variables, various statistical tests were utilized. For bivariate demographic data (gender, type of tool used, and activity), the two-sample independent t-test was used. The Bonferroni test was applied for multivariate demographic data (level of education, age, marital status, and lifestyle). Additionally, single and multiple linear regression analyses were conducted to investigate the factors associated with ICT scores. All statistical analyses were performed using SPSS version 19 at a significance level of 5%.

Ethical considerations

Prior to initiating data collection, the study's objectives were clearly explained to the participants, and they were assured of the confidentiality of their information.

Written informed consent was obtained from all participants. The study was conducted in adherence to relevant guidelines and regulations. Ethical approval was granted by the Research Ethics Committee of Shahid Sadoughi University of Medical Sciences, Yazd, Iran (Ethics Code: IR.SSU.SPH.REC.1401.001).

Results

Demographic characteristics and ICT usage

The mean age of the participants was 66.88 ± 5.69 years. The majority of participants were in the 60-69 age group (70.8%), were male (55.6%), and had a primary or elementary school education (57.5%). (Table 1)

The most common ICT tools used by older adults were talking on a cell phone or landline phone (91.1%) and watching TV (89.4%). Conversely, the least used tools were personal websites and blogs (0.3%), sending and receiving emails (1.4%), playing computer games (2.2%), and typing text on the computer (2.5%). Only 39.4% of older adults owned and used a smartphone.

Reasons for not using ICT

The primary reasons for not using ICT were lack of interest (48.6%), lack of sufficient skills (46.4%), and lack of perceived need (45.3%). (Table 2)

ICT acceptance score and dimensions

The mean ICT acceptance score among older adults was 60.89 ± 15.50 (range= 24-120). Using the cutoff score of 72, the ICT acceptance rate among older adults was 22.5%. Perceived usefulness had the highest mean score (15.37), while user independence had the lowest mean score (8.91) among the different dimensions of ICT acceptance. (Table 3)

Factors associated with ICT acceptance

There was a significant relationship between ICT acceptance score and several demographic variables, including age, gender, marital status, level of education, lifestyle, type of tool and activity, and employment status. Younger older adults, males, married individuals, those with higher education, and employed individuals had higher ICT acceptance scores. (Table 4)

Predictors of ICT acceptance

Multiple linear regression analysis revealed that age, level of education, smartphone use, and time spent on ICT tools were significant predictors of ICT acceptance among older adults. Older age was associated with decreased ICT acceptance, while higher education levels, smartphone ownership, and increased time spent using ICT tools were associated with increased ICT acceptance. The multiple regression model explained 82% of the variance in ICT acceptance among older adults. (Table 5)

Table 1. Frequency distribution of demographic variables of the participants

Variable	Level	N	%
Age	60-69	255	70.8
	70-79	93	25.8
	80 and above	12	3.3
Gender	Male	200	55.6
	Female	160	44.4
Marital status	Single	32	8.9
	Married	328	99.1
Level of education	Primary school	207	57.5
	Elementary school	56	15.6
	Diploma	61	16.9
	Academic	36	10
Employment status	Employed	41	11.4
	Housewife	164	45.6
	Retired	148	41.1
	Others	7	1.9
Living condition	With their spouse	317	88.1
	With their single children	10	2.8
	With their married children	13	3.6
	Alone	20	5.6

Table 2. Reasons for not using ICT by the studied older adults

Reasons for not using ICT	N	%
I have no need	163	45.3
I am not interest in it	175	48.6
It is expensive	26	7.2
I have no skill to use it	167	46.4
I have no access to it	6	1.7
I am unable to use it due to physical problems	7	1.9
I am afraid that my privacy will not be respected	6	1.7
I forget how to work with it	44	12.2
It is not working	1	0.3

Table 3. Distribution of the mean and standard deviation of ICT acceptance score and its dimensions among older adults

Variable	Mean	SD	min-max score	theoretical min-max
User independence	8.91	3.82	4-20	4-20
Perceived ease of use	13.83	3.80	6-25	6-30
Perceived usefulness	15.37	2.62	5-22	5-25
Attitude to use	11.93	3.78	5-22	5-25
Intention to use	10.79	3.58	4-19	4-20
Acceptance of technology	60.86	15.50	23-97	24-120

Discussion

Despite the increasing development and widespread use of various communication tools, statistics indicate the existence of an age gap and limited utilization of these tools by older adults (25). This study aimed to assess the acceptance of ICT among older adults and its associated factors. According to the results of the current study, only 39.4% of older adults used smartphones, with televisions and basic phones being the most commonly used technological tools. Watching TV doesn't require literacy, a certain level of education, or special skills, making it accessible to everyone. Additionally, activities such as talking on mobile phones, reading the news, and sending and receiving text

messages were common among older adults, contributing to their individual and social lives.

Older adults did not engage in online shopping, use the Internet, or access email services, aligning with the findings of previous studies (26-29). For instance, Chen et al., in a review, revealed that only 12% of older adults, compared to 65% of the youth, used a computer in the last 12 months (30). In Iran, the mean Internet penetration rate in 2017 was 30%, 6.4% for age groups of 50-74 years, and less than 0.1% for age groups over 75 years (2). The results indicated that many older adults struggled with using computers due to low literacy or illiteracy, lack of knowledge and skills in using computers and internet services, cognitive, vision, and movement impairments, and difficulty understanding the messages displayed on the monitor.



Table 4. Distribution of the mean and standard deviation of ICT acceptance score by older adults according to demographic information

Variable	Level	Mean (SD)	Significance level
Gender	Female	64.79 (14.30)	< 0.001
	Male	55.95 (15.33)	
Marital status	Single	47.90 (14.02)	< 0.001
	Married	62.13 (15.07)	
Age	60-69	64.42 (14.73)	< 0.001
	70-79	50.17 (12.13)	
	80 and above	43.10 (8.55)	
Level of education	Primary school	52.80 (10.22)	< 0.001
	Elementary school	61.51 (13.48)	
	Diploma	76.72 (11.40)	
Living condition	Academic	79.36 (12.87)	< 0.001
	With their spouse	62.55 (15.05)	
	With their single children	58 (15.72)	
	With their married children	46.07 (11.77)	
Employment status	Alone	45.20 (10.38)	< 0.001
	Employed	69.63 (16.32)	
	Housewife	55.45 (13.67)	
	Retired	64.88 (15.15)	

The study results also highlighted that the primary reasons for older adults not using ICT were lack of interest, motivation, and skills, consistent with other studies (1, 2, 16, 20). The lack of interest may stem from the neglect of the context and needs of ICT for older adults, as product developers often prioritize features and functions without considering the specific needs of this demographic. Additionally, suitable programs and software for older adults have not been designed, hindering their ability to benefit from these tools (31). The deficiency in interest and motivation can be attributed to society's failure to inform older adults about the various possibilities and benefits of these tools, coupled with their lower literacy levels, which diminish their technological skills and motivation. A study by Walker et al., (2018) in America identified ability, attitude, feeling of need, and social influence as the determinants of smartphone use among older adults (32).

The acceptance of ICT among the studied older adults was low, at approximately 22%. Within its dimensions, perceived usefulness scored the highest, while user independence scored the lowest, indicating that a significant limitation in this context may be the older adults' independence in utilizing these tools. Chen and Chan's study (33) found similar results, showing low acceptance of advanced technologies among older adults, with perceived usefulness and ease of use predicting attitudes toward technology use and influencing behavioral intentions. However, in our study, despite high scores for perceived usefulness and ease of use, they did not significantly impact the intention to use technology.

Jarvis et al.'s research in 2020 (34) on technology acceptance by older adults in residential centers revealed low acceptance influenced by attitudes, age, and education level. The attitude of use and perceived usefulness scored highest, while intention to use had the lowest score. In contrast, a study by Yong and Liu in Taiwan (35) reported moderate to high technology acceptance among older adults due to higher education and income levels, diverging from our findings. Our results also differed

from Basakha et al.'s study in Tehran (2), where technology acceptance was moderate, with intention to use and perceived usefulness scoring highest. This disparity may be attributed to the higher literacy levels, urban development, and greater facilities available to the active elderly population in Tehran.

Bouma et al., (36) noted that older adults often struggle with adopting new technologies and learning new skills due to a long-standing routine and a slower pace of change during their youth. Additionally, reduced cognitive and perceptual abilities in old age can impede their interaction with technology, as understanding and learning become more challenging. The aging process leads to a decline in the ability to process information, creating obstacles and barriers to embracing new technologies.

The results of the current study revealed that the acceptance of ICT was higher among younger elderly individuals, those who were married, those with a higher level of education, men, and those who were employed. Among the older adults in the study, the majority were married, and they exhibited higher ICT acceptance compared to unmarried individuals. These findings are consistent with other studies (2, 37). Married older adults, often employed and financially supported, were more inclined to use technology, while unmarried older adults, facing issues such as depression, loneliness, and economic problems, were less likely to adopt ICT tools.

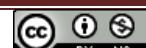
The study results also indicated that older men used ICT more than older women. While this aligns with several studies (28, 29, 35), it contradicts findings from studies by Chen and Chan, Dogruel and Joecket, and Basakha et al., (2, 33, 38). The disparity may be attributed to differing objectives in using technology tools between men and women, with older women having fewer skills in using computers and the Internet and experiencing anxiety when using such tools (39). This could be influenced by historical factors such as lower education and limited access to education for women, traditional roles as homemakers, and reduced social interactions.



Table 5. Predictors of the ICT acceptance among older adults

Variable	Level	Univariate		CI	Multivariate		CI
		β	p		β	p	
Age		-1.308	< 0.001	[-1.55, -1.05]	-0.651	<0.001	[-0.80, -0.49]
Gender	Female	-8.839	< 0.001	[-11.94, -5.73]	-0.64	0.64	[2.06, -3.42]
Level of education	Primary school ^R	-	-	-	-	-	-
	Elementary school	0.771	0.733	[-3.66, 5.21]	4.64	<0.001	[2.43, 6.84]
	Diploma	19.08	< 0.001	[15.28, 22.89]	11.38	<0.001	[8.85, 13.92]
	Academic	20.5	< 0.001	[15.63, 25.46]	14.35	<0.001	[17.11, 63.07]
Marital status	Married	14.22	< 0.001	[-19.68, -8.76]	2.69	0.27	[-7.55, 2.16]
	Single	-	-	-	-	-	-
Living condition	With their spouse ^R	-	-	-	-	-	-
	With their single children	-2.949	0.554	[-12.73, 6.83]	0.79	0.8	[-5.49, 7.09]
	With their married children	-15.34	< 0.001	[-23.82, -6.86]	-0.89	0.73	[-6.07, 4.28]
	Alone	-16.5	< 0.001	[-23.39, -9.77]	-1.83	0.46	[-6.74, 3.07]
Employment status	Employed	9.89	< 0.001	[4.93, 14.85]	0.75	0.66	[-2.64, 4.16]
	Housewife ^R	-	-	-	-	-	-
	Retired	6.82	< 0.001	[3.63, 10.01]	1.64	0.24	[-1.1, 4.39]
Time spent	Very high	-2.38	0.829	[-24.02, 19.26]	-6.12	0.226	[-16.05, 3.81]
	High	11.89	< 0.001	[4.61, 19.17]	-2.6	0.19	[-6.53, 1.32]
	Moderate ^R	-	-	-	-	-	-
	Low	-7.08	< 0.001	[-10.26, -3.90]	-4.98	<0.001	[-7.14, -2.83]
	Very low	-12.29	< 0.001	[-15.75, -8.82]	-4.65	<0.001	[-7.12, -2.18]
Simple mobile phone	Yes	23.51	< 0.001	[21.29, 25.73]	9.50	<0.001	[6.50, 12.49]
	No	-	-	-	-	-	-
Smartphone	Yes	-	-	-	-	-	-
	No	-10.23	< 0.001	[-13.32, -7.15]	1.73	0.08	[-0.21, 3.69]
Electronic banking	Yes	-	-	-	-	-	-
	No	27.13	< 0.001	[22.98, 31.27]	2.27	0.15	[-5.98, 5.07]
Internet search	Yes	-	-	-	-	-	-
	No	26.22	< 0.001	[21.44, 31]	0.75	0.67	[-2.84, 4.34]
Use of the website	Yes	-	-	-	-	-	-
	No	26.20	0.091	[-4.24, 56.65]	-9.82	0.3	[-28.48, 8.83]
Online shopping	Yes	-	-	-	-	-	-
	No	23.58	< 0.001	[15.91, 31.25]	3.87	0.07	[-0.37, 8.11]
Use of virtual social networks	Yes	-	-	-	-	-	-
	No	25.51	< 0.001	[23.09, 27.74]	2.08	0.21	[-1.19, 5.35]
Using mobile phones to remember programs	Yes	-	-	-	-	-	-
	No	23.09	< 0.001	[20.50, 25.68]	1.78	0.21	[1, 4.56]

R= Reference



Furthermore, the study found that working older adults used technology more than retired individuals, with a higher mean ICT acceptance. Retired older adults exhibited less familiarity with technologies and, consequently, experienced significant technology anxiety. Reasons contributing to technology anxiety in older adults included less familiarity with new technology and a perceived lack of control over technology.

The multiple linear regression analysis demonstrated that age, level of education, smartphone use, and time spent on ICT tools were predictors of ICT acceptance by older adults. The regression model successfully predicted 82% of the variation in ICT acceptance by older adults. As age increased, ICT acceptance decreased significantly, consistent with findings from other studies (1, 3, 35, 40). The decline in physical and cognitive capacities with age limits the ability of older adults to learn and use new technologies, posing challenges to technology adoption.

Additionally, the study found that the acceptance of ICT by older adults with a higher level of education was significantly higher, consistent with previous research (1, 2, 16, 28, 37). Higher education was identified as a crucial factor in narrowing the technology usage gap between older adults and the youth (40). It suggests that a higher level of education enhances the capability to learn and use technology, improving skills in utilizing the Internet and other tools.

Lastly, the time devoted to using ICT by older adults significantly influenced technology acceptance. This finding is in line with studies by Basakha et al., (2) and Nayak et al., (39), indicating an increase in the technology penetration rate among older adults. A higher level of technology use facilitates acceptance, as increased learning and a positive inclination toward using technology become more prevalent.

Conclusion

The findings revealed that ICT acceptance was relatively low, with perceived usefulness being a significant predictor. However, user independence, attitude, and intention to use technology were identified as key barriers to ICT acceptance. Additionally, age, level of education, and time spent on technology tools were found to be significant predictors of ICT acceptance.

These findings suggest that interventions aimed at enhancing the perceived usefulness of ICT, addressing user independence concerns, and fostering positive attitudes and intentions towards technology use could potentially increase ICT acceptance among older adults. Moreover, providing educational and training opportunities to improve digital literacy and promote the benefits of ICT could further encourage technology adoption among this population.

Furthermore, research on the impact of ICT acceptance on the quality of life of older adults could provide valuable insights into the potential benefits of technology adoption. Additionally, interventions focused on familiarizing older adults with new

communication technologies could help bridge the digital divide and enhance their ability to navigate the digital landscape.

Study limitations

The present study acknowledges several limitations that may influence the generalizability of its findings. One limitation was the difficulty in recruiting older adults to participate due to the COVID-19 pandemic, which restricted their mobility and access to comprehensive healthcare centers. Additionally, the majority of participants had a primary or elementary school education level, which may have influenced their overall ICT acceptance scores. Furthermore, the questionnaire focused on the acceptance of smartphones and the internet, limiting the scope of ICT tools assessed. Future research could adopt a more specific approach to examine the acceptance of individual ICT tools or technologies.

Conflict of interests

The authors declare that there is no conflict of interest in this article.

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Authors' contributions

HR and ED contributed to the study conception and design. Material preparation, data collection and analysis were performed by HR, FM and ED. All authors read and approved the final manuscript.

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