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Original Article

Older Adults' Electronic Health Literacy: Insights from a Cross-Sectional Study Among the Iranian Population

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Abstract

Introduction: Digital technology has profoundly transformed way of life, making the ability to access and understand information through modern technologies increasingly important, especially for older adults. This study aimed to assess electronic-health literacy (e-HL) among Iranian older adults.

Methods: This cross-sectional study was conducted between 2024 and 2025 among 420 adults (≥60 years old) attending comprehensive health service centers affiliated with Shahid Beheshti University of Medical Sciences, Tehran. Participants were enrolled using multi-stage random sampling. Data were collected using the standardized e-HL Scale, with scores ranging from 8 to 40. Eventually, statistical analyses were performed using independent t-tests and ANOVA in SPSS 16.

Results: The mean e-HL score was 17.88±7.60, which was below the acceptable level. However, higher e-HL was observed among younger older adults aged 60–64 years, those who were married, employed, and had higher educational attainment ($P<0.001$). In addition, superior economic status, daily Internet use, and higher skills in using digital devices were significantly associated with higher e-HL levels ($P<0.001$). Although men demonstrated a higher mean score than women, no statistically significant association was found between gender and e-HL ($P=0.270$).

Conclusion: Overall, the level of e-HL among older adults was below average and unacceptable, representing an unfavorable status for this vulnerable and growing group. This attempt, by providing valuable data, can be a suitable scientific basis for designing targeted interventions to promote e-HL in older adults.

Keywords: Electronic health literacy, Digital health, Health literacy, Older adults

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Introduction

Health literacy (HL) is recognized as a fundamental pillar of modern healthcare systems. First introduced in the United States in 1974 within school health education programs (1), HL has evolved from a focus on access to basic health information to a broader definition encompassing individuals' ability to access, understand, evaluate, process, and apply health-related information and services for informed decision-making in disease prevention, treatment, and health promotion (2). Today, HL is considered a key determinant of optimal health outcomes (3) and a major objective, as well as a challenge, for healthcare systems worldwide (4).

Traditionally, health information was obtained through healthcare professionals and conventional media, such as books, brochures, newspapers, and television (5). With advances in digital technologies, however, the internet has become the primary source of health-related information (3, 6). Information and communication technology has enhanced healthcare delivery (7). According to the World Health Organization, digital technologies can improve health services and promote population well-being (8). The internet enables rapid access to extensive health information and facilitates communication via websites, social media, messaging applications, and other digital platforms (9). Consequently, healthcare providers increasingly use web-based and mobile platforms to deliver health information (10), benefiting from their ability to overcome time and location constraints (3). Since the 1990s, the expansion of information and communication technology has led to the emergence of concepts such as electronic (e)-health (1), defined as healthcare services and information delivered or enhanced through electronic technologies (11). As a result, large volumes of

health information are now transmitted through online platforms (12).

Although older adults adopted internet technologies later than younger generations, their use of digital resources is increasing rapidly (1, 13). This group of people can use the internet for health self-management, including seeking information, communicating with healthcare providers, accessing services, and participating in health programs (14). Nevertheless, the diversity and limited regulation of online health content raise concerns regarding information quality, credibility, and potential bias (6). These challenges underscore the importance of considering users' e-HL levels, particularly among older adults, to ensure effective use of web-based health information (15).

E-HL has, therefore, emerged as a critical concept, referring to the ability to seek, understand, evaluate, and apply online health information effectively (7, 16). While closely related to general HL, e-HL (17) encompasses additional competencies, including traditional, health, information, scientific, media, and computer literacy (4, 18). As a dynamic and evolving construct, e-HL must continuously adapt to rapid technological advancements and changes in social contexts (7). According to evidence, higher e-HL is associated with improved health behaviors, superior psychological well-being, and enhanced health outcomes (19). However, research consistently indicates that older adults tend to have lower levels of e-HL (20, 21), despite being major beneficiaries of digital health resources (11). Hence, adequate e-HL is essential for older adults to manage chronic conditions, make informed health decisions, and improve quality of life (22). Accordingly, promoting e-HL among older populations has become a priority for the World Health Organization and an important component of healthy aging strategies (23). Nonetheless, the relevance and manifestation of e-HL among older adults may vary across countries depending on specific cultural and infrastructural contexts. In Iran, family-centered care remains a prominent cultural characteristic, with older adults frequently relying on family members for health-related support and access to information (24). In addition, generational differences in digital skills and technology use among older adults have been reported, potentially limiting their independent engagement with online health resources (25). Moreover, disparities in internet access and digital infrastructure, especially between urban and rural areas, may influence older adults' opportunities to benefit from e-health services (26). These contextual factors emphasize the importance of examining e-HL among older adults within the Iranian setting.

According to the latest report from the Iranian Statistical Center, the internet penetration rate in Iran was 59.1% in 2017; however, this rate was only 11.9% among individuals aged 50–74 years and less than 0.5% among those over 75 years (27). The number of older adults using digital technologies is rapidly increasing with the growing older population (28). Thus, assessing e-HL and its associated factors is essential to ensure effective utilization of e-health resources (29). In Iran, limited research has been conducted in this area, with one study reporting below-average e-HL among older adults and identifying education level and daily technology use as significant predictors (30). Nonetheless, a research gap regarding e-HL among older adults remains evident in Iran. Previous studies have shown that older adults generally demonstrate lower e-HL levels (11, 12), and several demographic factors (e.g., age, gender, education level, marital status, and income) have been reported to be associated with HL in this population (23, 31). Nevertheless, findings remain inconsistent in this regard. For example, Milanti et al identified gender as a determinant of e-HL (7), whereas Nikkhoo et al reported no significant gender-based differences (30). These inconsistencies highlight the need for further research using rigorous methodologies. Measuring e-HL and its relationship with demographic factors among older adults can provide valuable evidence to inform the development of targeted health information services (32). Therefore, this study aims to assess the status of e-HL among older adults covered by Shahid Beheshti University of Medical Sciences and to identify a set of demographic factors influencing e-HL levels.

Accordingly, this study has been guided by the following research question and hypothesis:

RQ1: What is the level of e-HL among the intended older adults?

H1: There are statistically significant differences in e-HL scores according to selected demographic variables among older adults.

Materials and Methods

Study Design, Setting, and Recruitment

This cross-sectional study was performed between 2024 and 2025 among older adults covered by three comprehensive health service headquarter centers affiliated with Shahid Beheshti University of Medical Sciences in Tehran, Iran. To obtain a sufficient and appropriate sample size, the probability (p) was set at 0.5 to maximize the estimated sample size (33). With an acceptable error value of 0.05, a 95% confidence level, and a 10% churn rate, the required sample size was calculated using Cochran's formula, and the sample size was estimated to be approximately 420 people.

$$n = \frac{z^2_{1-\alpha/2}\,\mathrm{p}(1-\mathrm{p})}{\mathrm{d}^2} \cong 420$$

A multi-stage random sampling method was employed to select participants. In the first stage, each of the three headquarter centers (North, East, and Shemiranat) was considered as a class. In the second stage, comprehensive health service centers within each class were identified, and clusters were randomly selected proportional to the total population in each class (14 clusters in total). In the third stage, based on the older population of each comprehensive health service center, eligible older adults

from each cluster were selected using random systematic sampling. Then, the participants were invited based on the inclusion criteria, including showing a willingness to participate in the study (written informed consent was obtained), having Iranian nationality, being 60 years or older, being literate and able to complete the questionnaire, having a household file in the covered comprehensive health service centers, and having no history of cognitive impairments at the time of the study. Participants who provided consent but returned incomplete questionnaires were excluded from the investigation (Figure 1). Cognitive impairment was assessed using the Abbreviated Mental Test Score (AMTs), a standardized screening instrument widely used to evaluate cognitive status in older adults. The AMTs consists of 10 items, with total scores ranging from 0 to 10. In the present study, a cut-off score of ≥ 7 was applied to indicate normal cognitive functioning, while scores below this threshold represented cognitive impairments. The Persian version of the AMTs has been psychometrically validated among Iranian older adults, demonstrating high internal consistency (Cronbach's alpha = 0.90) as reported by Foroughan et al (34). Only older adults who met the cognitive eligibility criteria were included in the final sample.

Instrument and Scoring

A two-part instrument consisting of demographic information and the e-HL Scale (eHEALS) was used for data collection. The demographic part included items assessing age, gender, education level, marital status, employment status, economic status, number of children, internet use frequency, self-assessed technological skill, and family structure. The eHEALS, which was developed by Norman and Skinner (2006), is one of the few valid scales available that evaluates e-HL across a wide range of populations and contexts (4). It is a self-report instrument consisting of eight items. Participants indicate their level of agreement with e-health statements on a 5-point Likert-type scale (ranging from very few = 1 to very much = 5). The reported Cronbach's alpha was 0.88. The total score range for e-HL is between 8 and 40, with a score of 32 or higher considered acceptable e-HL (11). Bazm et al were first examined the validity and reliability of the Persian version of the eHEALS (α = 0.88) in their study (35).

After inviting older adults to participate in the study and obtaining their written informed consent, the questionnaires were provided to the participants, who primarily completed them independently, with assistance from the researcher or their companions, only if necessary (for reasons such as not having their glasses).

Data Analysis

After the completion of the questionnaires by older adult participants, the data were coded and analyzed using SPSS software, version 16 (36). The analysis was performed through statistical tests of skewness and kurtosis to evaluate data dispersion and distribution normality, followed by creating frequency distribution tables and applying the analysis of variance (ANOVA) and t-tests.

Results

The mean age of 420 older adults was 66.71 ± 4.75 years, with the age group of 65–69 years (n = 168) showing the highest frequency among all age groups. In addition, there were 222 men and 198 women, with men outnumbering women by 24 individuals. Among the participants, 319 had a spouse at the time of data collection. Regarding the education level, 203 had university degrees. Additionally, 284 were non-employed, and 294 reported moderate economic status. Among the participants, 157 had three

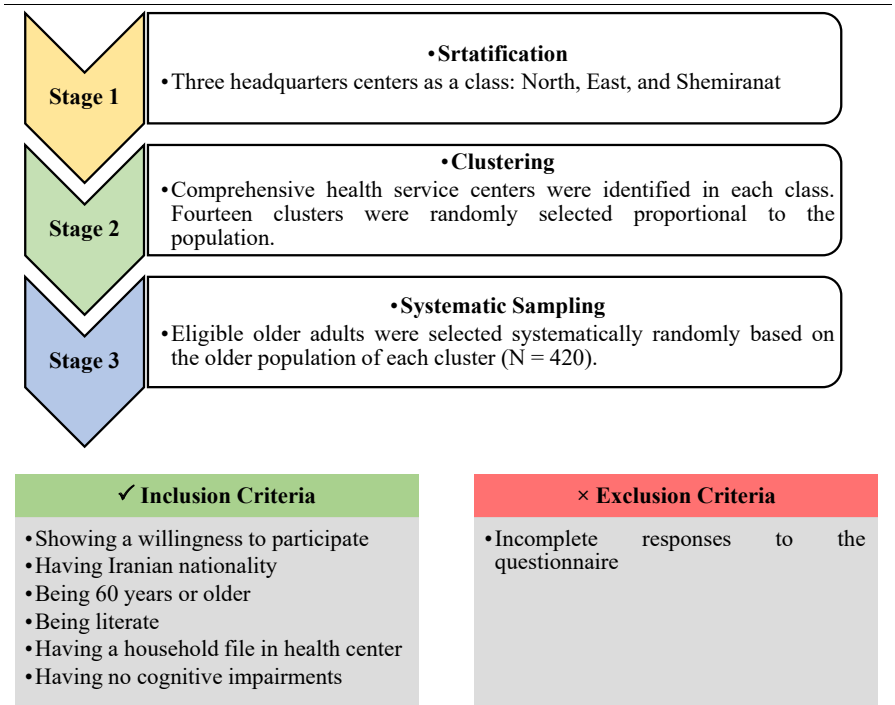

Figure 1. The Sampling Method Process

children, and 173 lived with their spouses. In terms of technological skills, 177 rated their smartphone and tablet skills as moderate, and 283 indicated daily internet use (Table 1).

Table 1. Demographic Characteristics, Internet Usage, and Technological Skills of the Samples (N = 420)

Variables	Categories	N	%
Age (year)	60-64	146	34.8
	65-69	168	40.0
	>70	106	25.2
Gender	Male	222	52.9
	Female	198	47.1
Marital status	Have a spouse	319	76.0
	Have no spouse	101	24.0
Education level	Under diploma	78	18.6
	Diploma	139	33.1
	Academic	203	48.3
Employment status	Employed	136	32.4
	Non-employed	284	67.6
Economic status	Moderate	294	70.0
	Good	126	30.0
Who do you live with?	Lonely	48	11.42
	With a spouse	173	41.2
	With children	37	8.8
	With a spouse and children	140	33.33
	Nurses and others	22	5.25
Number of children	0	27	6.4
	1	49	11.7
	2	105	25.0
	3	157	37.4
	4	82	19.5
Internet use frequency	Less than once a week	36	8.57
	At least once a week but not daily	101	24.0
	Daily	283	67.38
Self-assessed technological skill	Low	127	30.23
	Medium	177	42.14
	Good	116	27.61

The total score of the eHEALS ranged from 8 to 40, and the mean e-HL score among study participants was 17.88 with a standard deviation of 7.60. Table 2 provides the response frequencies for each item according to response options. For items one, two, three, five, six, and seven, the highest response frequency was for the "Very few" option. Moreover, the highest response frequencies for items four and eight were related to the "Much" and "Not less, not more" Options, respectively.

The assessment of the relationship between the mean e-HL score and demographic indicators was performed using ANOVA and independent t-test. The results of the ANOVA test revealed a significant relationship between the mean e-HL score in older adults and factors such as age, number of children, education level, family structure, internet use frequency, and self-assessed technological skills (P 0.001). In the age group of 60–64 years, the mean e-HL score was obtained as 22.06, which was higher than that of other age groups, indicating a higher level of e-HL at younger ages (with a large effect size, $f^2 = 0.183$). Additionally, the highest mean e-HL scores were observed among older adults with university education (22.11, with a large effect size, $f^2 = 0.410$), older adults who used the internet daily (20.91, with a large effect size, $f^2 = 0.334$), and those who had good skills in using smartphones and tablets (24.96, with a large effect size, $f^2 = 0.503$). Among older adults living with their spouses and children, the mean e-HL score was obtained as 19.40, which was higher than that of other family structures (with a small to moderate effect size, $f^2 = 0.034$). In addition, older adults with one child had a higher mean score (21.34, with a large effect size, $f^2 = 0.125$) compared to others. Based on the results of the independent t-test, there was a significant positive relationship between the mean e-HL score and factors such as marital status, economic status, and employment ($P < 0.05$). Older adults who had a spouse had a higher mean score compared to older adults who had no spouse, which was obtained as 18.59 (with a moderate effect size, d = -0.40). Further, employed older adults (22.03, with a large effect size, d = 0.872) and those with good economic status (22.98, with a large effect size, d = -1.066) achieved higher e-HL scores. Although

Table 2. Means and Standard Deviations of the e-Health Literacy and Responses' Frequencies

e-Health Literacy Score		Mean ± SD	Minimum	Maximum	Score Range
e-Health literacy score		17.88 ± 7.60	8	40	8–40
e-Health literacy items	**Very few n (%)**	**Few n (%)**	**Not less, not more n (%)**	**Much n (%)**	**Very much n (%)**
1. I know what health resources are available on the internet.	163 (38.8)	121 (28.8)	98 (23.3)	33 (7.9)	5 (1.2)
2. I know where to find helpful health resources on the internet.	142 (33.8)	119 (28.3)	107 (25.5)	45 (10.7)	7 (1.7)
3. I know how to find helpful information health resources on the internet.	138 (32.9)	121 (28.8)	121 (28.8)	35 (8.3)	5 (1.2)
4. I know how to use the health information I find on the internet to help me.	66 (15.7)	75 (17.9)	85 (20.2)	127 (30.2)	67 (16.0)
5. I know how to use the internet to answer my health questions.	131 (31.2)	107 (25.5)	120 (28.6)	50 (11.9)	12 (2.9)
6. I have the skills I need to evaluate the health resources I find on the internet.	216 (51.4)	121 (28.8)	55 (13.1)	24 (5.7)	4 (1.0)
7. I can tell high quality from low quality health resources on the internet.	217 (51.7)	127 (30.2)	51 (12.1)	20 (4.8)	5 (1.2)
8. I feel confident in using information from the internet to make health decisions.	78 (18.6)	103 (24.5)	164 (39.0)	67 (16.0)	8 (1.9)

Note. SD: Standard deviation.

the mean e-HL score in old men was obtained as 18.27, which was slightly higher than the mean score obtained by old women, the independent t-test showed that this difference was not statistically significant ($P = 0.270$, with a small effect size, d = 0.108), confirming that gender had no effect on the participants' final e-HL score (Table 3). Detailed results, including test statistics (t or F), *P*-values, effect sizes, and 95% confidence intervals, are provided in Supplementary File 1).

Discussion

It should be noted that causal relationships between demographic factors and e-HL could not be established, due to the cross-sectional design of this study; therefore, the observed associations should be interpreted with caution.

Table 3. Mean and Standard Deviation of e-Health Literacy by Demographic Characteristics, Internet Usage, and Technological Skills

Variables	Categories	e-Health Literacy Score Mean (SD)	*P*-Value
Gender	Male	18.27 (7.58)	0.270 [a]
	Female	17.44 (7.62)	
Marital status	Have a spouse	18.59 (7.57)	0.001 [a]
	Have no spouse	15.62 (7.27)	
Employment status	Employed	22.03 (6.27)	0.001 [a]
	Non-employed	15.89 (7.38)	
Economic status	Moderate	15.69 (6.57)	0.001 [a]
	Good	22.98 (7.41)	
Age	60-64	22.06 (6.24)	0.001 [b]
	65-69	16.75 (6.79)	
	>70	13.92 (7.82)	
Number of children	0	20.70 (5.34)	0.001 [b]
	1	21.34 (7.30)	
	2	20.50 (7.79)	
	3	16.58 (6.41)	
	4	14.01 (7.97)	
Education level	Under diploma	11.02 (5.39)	0.001 [b]
	Diploma	15.55 (5.84)	
	Academic	22.11 (6.75)	
Who do you live with?	Lonely	16.87 (7.78)	0.006 [b]
	With a spouse	17.84 (8.03)	
	With children	14.64 (7.10)	
	With a spouse and children	19.40 (6.92)	
	Nurses and others	16.13 (6.77)	
Internet use frequency	Less than once a week	10.30 (5.29)	0.001 [b]
	At least once a week but not daily	12.07 (5.18)	
	Daily	20.91 (6.65)	
Self-assessed technological skill	Low	10.81 (4.15)	0.001 [b]
	Medium	18.31 (5.67)	
	Good	24.96 (6.04)	

Note. SD: Standard deviation; ANOVA: Analysis of variance. [a] Significance level in t-test and [b] Significance level in ANOVA.

The findings of this study revealed that e-HL was relatively low among the older population under investigation, indicating that many older adults may face challenges in effectively utilizing online health resources and comprehending digital health information. Considering the ongoing trend of digitalization in healthcare services, limited e-HL could have significant implications for older individuals' access to, understanding of, and ability to benefit from health-related information.

Previous studies support these observations. Shi et al (11) and Lee and Tak (16) reported low-to-moderate levels of e-HL among middle-aged and older adults, highlighting the persistent challenges faced by these populations in navigating digital health platforms, which is consistent with the findings of the present study. In a cross-sectional correlational study among community-dwelling older adults in Tehran, Nikkhoo et al found similar challenges in e-HL. In their study, the sample size was 210 participants, which was smaller than that of the current study. The samples were selected through a multi-stage sampling method from all 22 districts of Tehran, with the clarification that Shahid Beheshti University of Medical Sciences covers only nine districts (including Districts 1, 2, 3, 7, 8, 12, 13, 14, and 15). In addition, the inclusion criteria consisted of informed consent, a minimum age of 60 years, and the ability to communicate logically. Notably, despite the significant presence of Afghan nationals in Tehran, Iranian citizenship was not imposed as a criterion. Spearman's correlation coefficient and multiple linear regression were utilized for data analysis. Despite methodological differences between the study performed by Nikkhoo et al (30) and the present research (in terms of sample size, sampling method, and statistical tests), their findings align with those of this study. Additionally, Li et al (12), examining the relationship between HL, digital skills, and e-HL among Chinese older adults, reported that e-HL levels were generally below average, emphasizing challenges faced by many older adults in effectively using digital health resources (12), which conforms to the results of the present study.

Similar to other studies, our study indicated that e-HL levels among older adult populations in many societies, including Iran, remained below the desired level. This deficiency may lead to adverse consequences, including limited access to e-health services, misinterpretation of medical information available online, and ultimately, negative impacts on the health status of this age group (37). Various contextual factors in Iran, such as cultural norms, socio-economic conditions, and infrastructural limitations, may help explain the relatively low e-HL among older adults. For instance, the strong role of family in supporting older adults (24), disparities in income (38), restricted availability of digital literacy programs (39), and uneven internet access across regions (26) can affect how effectively older adults engage with online health resources. Accordingly, recognizing these Iran-specific challenges emphasizes the importance of developing

tailored strategies to enhance e-HL within this population. Given the accelerating digital transformation of healthcare services, the adoption of targeted intervention strategies appears essential. In this regard, the design and implementation of structured educational programs focused on enhancing e-HL, with a particular emphasis on fundamental skills (e.g., systematically searching for reliable information, evaluating the credibility of online sources, and effectively utilizing e-health services), can serve as an efficient solution.

Our findings further revealed that certain demographic factors influence e-HL levels. Specifically, younger older adults tend to exhibit higher e-HL, which may be related to age-associated changes in cognitive and motor abilities as well as varying exposure to modern technologies. These observations are corroborate the findings of a systematic review by Shi et al, indicating higher e-HL among younger older adults (11). Likewise, systematic reviews by Jung et al and Milanti et al support the notion that younger age is generally associated with better e-HL (1, 7). Moreover, Li et al highlighted that younger older adults show higher e-HL (12), which is in line with our results. However, Nikkhoo et al found no significant correlation between age and e-HL, despite observing differences between age groups (30). This discrepancy may stem from variations in age categorization methods and study design. Gender was another demographic factor that was examined in this study. The results indicated no significant difference in e-HL between male and female older adults, suggesting that gender may not be a major determinant of e-HL in this population. This finding is consistent with those of Nikkhoo et al, demonstrating differences between men and women but no significant correlation between gender and e-HL (30). In contrast, Milanti et al (7), Shi et al (11), and Li et al (12), and Lee and Tak (16) reported gender-related differences in e-HL, indicating that the influence of gender may differ across contexts. In the older population, the gender gap in technology use may be less pronounced, as both men and women generally have limited familiarity with digital technologies. In societies like Iran, shared constraints (e.g., limited access to specialized digital literacy programs) and relatively equal opportunities (e.g., access to higher education) may contribute to similar e-HL levels among older men and women.

As regards the education level, the results revealed that individuals with higher education generally had better e-HL. This is likely because higher education enhances cognitive and analytical skills, enabling individuals to more effectively understand and evaluate online health information. Similar findings have been reported by Jung et al, Milanti et al, Shi et al, Li et al, Lee and Tak, and Nikkhoo et al, confirming the positive influence of education on e-HL (1, 7, 11, 12, 16, 30). Additionally, Berkowsky observed that higher education is associated with better performance on multiple components of the eHEALS (32), further supporting the present study's findings. Based on our results, marital status had a significant positive effect on e-HL, with individuals who had a spouse demonstrating higher e-HL scores compared to other older adults. This finding conforms to the results of Jung et al, representing a positive association between marital status and e-HL, attributing this to the social support and assistance married individuals receive when using technologies (1). Shi et al and Li et al also confirmed this relationship (11, 12), which matches our findings. However, Lee and Tak and Nikkhoo et al found no significant association between marital status and e-HL (16, 30), which contradicts the results observed in the current study.

Concerning employment and economic status, the present study found that employed individuals and those with better economic conditions generally demonstrated higher e-HL, which aligns with the findings of Milanti et al, indicating that employment and economic status influence e-HL (7). Similarly, Jung et al, Shi et al, and Li et al observed a positive relationship between income and e-HL among older adults (1, 11, 12). Individuals with better economic status may have greater access to digital devices, the internet, and related training, which can enhance their e-HL. However, Nikkhoo et al reported that despite higher income being associated with better e-HL, the correlation was not statistically significant (30), highlighting inconsistencies across studies. According to the results of the present study, frequent internet use and proficiency with digital devices are related to higher e-HL. Several other studies also support the positive relationship between e-HL and both frequent internet use (1, 11, 12, 30, 32) and computer skills (1), underscoring the important role of technological experience and familiarity in enabling older adults to effectively use e-health services. However, Lee and Tak found no significant association between the frequency of internet use and e-HL (16), which contradicts our findings. Finally, the present study revealed that older adults living with their spouses and children, as well as those with fewer children, tended to have higher e-HL, suggesting that family structure and the number of children may influence the ability to access and use digital health resources. These findings emphasize the potential role of social support and family resources in facilitating engagement with e-health technologies. However, Nikkhoo et al reported no significant relationship between family structure and e-HL (30), which contrasts with the results of the current study. Hence, further research is needed to better understand how family composition impacts e-HL among older adults.

Strengths and Limitations

This study is significant in several aspects. It provides a more comprehensive picture of influencing factors by simultaneously examining a wide range of demographic variables. Moreover, employing multistage random sampling, using standardized measurement tools, and having a larger sample size enhance its methodological validity. Finally, the findings of this study can serve as a

suitable scientific basis for designing targeted educational interventions aimed at improving e-HL among Iranian older adults, particularly within the population covered by Shahid Beheshti University of Medical Sciences, which is responsible for providing services to the largest segment of Tehran's population. However, in addition to the limitation noted at the beginning of the Discussion section, this study had other limitations, including the use of self-reported questionnaires, which may be subject to individual biases, and the potential influence of cultural and ethnic differences among older adults across the vast coverage area of Shahid Beheshti University of Medical Sciences, which may have affected the study results. Considering these limitations, longitudinal studies should examine causal relationships between demographic factors and e-HL. In addition, it is recommended that intervention studies targeting older adults with low e-HL be conducted to identify effective strategies for enhancing their digital health skills. Additionally, given the potential influence of cultural and ethnic differences among older adults across the vast coverage area of Shahid Beheshti University of Medical Sciences, it is suggested that region-specific or stratified analyses tailor interventions to diverse populations.

Conclusion

The findings of this study indicated that e-HL among older adults was below average, highlighting the need for targeted educational interventions tailored to their individual and social characteristics (e.g., education level, income, digital skills, and social circumstances). Enhancing e-HL can improve the quality of life and increase personal independence while reducing disparities in access to healthcare services. Additionally, educational programs can be delivered through health centers, nursing homes, cultural centers, and community hubs. Vulnerable populations, including those with lower education, the unemployed, and individuals with limited financial resources, should be prioritized in resource allocation and policy planning. Furthermore, assessing e-HL levels can help identify older adults who require additional support or specialized guidance, ultimately helping to bridge the digital divide and promote greater participation in health-related decision-making.

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Authors' Contribution

Conceptualization: Nasim Abdipour, Sakineh Rakhshanderou, Mohtasham Ghaffari.
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Project Administration: Nasim Abdipour.
Supervision: Mohtasham Ghaffari.
Writing–Original Draft: Nasim Abdipour.
Writing–Review & Editing: Sakineh Rakhshanderou, Mohtasham Ghaffari.
All authors read and approved the final manuscript.

Competing Interests

The authors have no competing interests associated with the material presented in this paper.

Consent for Publication

Not applicable.

Data Availability Statement

The datasets used and/or analyzed during the current study are available upon a reasonable request from the corresponding author.

Ethical Approval and Consent to Participate

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and received official approval from the Research Ethics Committee of the School of Public Health and Safety at Shahid Beheshti University of Medical Sciences (ethical approval No. IR.SBMU.PHNS.REC.1402.015).

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Supplementary File

Supplementary file 1 provides a more detailed version of Table 3, including all variables, test statistics (t or F), *P*-values, effect sizes, and 95% confidence intervals.

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