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E-Health Literacy and Its Relationship with Self-Care Behaviors among Iranian Hypertensive Patients

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ABSTRACT

Aims E-health literacy is correlated with health-related behaviors, suggesting it can act as a mediator in the process by which health-related information leads to changes in health-related behaviors. This study aimed to investigate e-health literacy and examine the relationship between e-health literacy and self-care behaviors in hypertensive patients.

Instrument & Methods This cross-sectional study was conducted in 2024 among 240 hypertensive patients covered by the healthcare centers of Neyshabur City, Iran. Participants were selected using a stratified random sampling method. Data were gathered using a demographic characteristics questionnaire, the Hypertension Self-Care Profile, and the Electronic Health Literacy Scale. The collected data were analyzed using multiple linear regression with SPSS 22.

Findings The mean age of the respondents was 41.10±5.69 years. The mean of diabetes self-care activities was 47.1±8.5, and the mean e-health literacy was 21.3±6.6. Most diabetics had low e-health literacy, with 179 (74.6%) falling into this category. After adjusting for having a blood pressure measuring device at home and sleep status, e-health literacy (B=0.313; SE= 0.092; p<0.05) was the statistically significant independent factor associated with self-care activities of hypertensive patients.

Conclusion Implementing educational programs focused on promoting e-health literacy increases the self-care activities of hypertensive patients, thereby enhancing the patient's overall quality of life.

Keywords Health Literacy; Information Literacy; Self-Care; Hypertension; Patient

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Introduction

Hypertension is a common and increasing disease in society. The number of adults with hypertension increased from 594 million in 1975 to 1.13 billion in 2015, with the increase observed largely in low- and middle-income countries. An estimated 1.28 billion adults aged 30-79 years worldwide have hypertension, with upwards of 1 in 4 men and 1 in 5 women (over a billion people) having the condition [1]. It is estimated that 7.7 to 10.4 million deaths occur annually due to hypertension [2].

Hypertension can lead to serious complications, including an increased risk of left ventricular hypertrophy, atrial fibrillation, aortic valve stenosis, diastolic dysfunction, heart failure and heart disease, chronic kidney disease, and dementia [3-6]. Additionally, healthcare costs related to hypertension are increasing annually and are estimated at around 131 billion dollars [7].

According to the results of a meta-analysis study, the prevalence of hypertension in Iran between 2004 and 2018 was estimated at 25% [8]. Factors such as urbanization, aging, smoking and alcohol consumption, overweight and obesity, and salt consumption are among the causes of the increased incidence of hypertension [9, 10]. An estimated 46% of adults with hypertension are unaware that they have the condition. Less than half of adults (42%) with hypertension are diagnosed and treated. Approximately 1 in 5 adults (21%) with hypertension have it under control [1].

One of the ways to control hypertension and prevent its complications is timely diagnosis and self-care behaviors [11]. Self-care in hypertensive patients includes adhering to medication, refraining from smoking or drinking alcohol, losing weight, eating a low-sodium and low-fat diet, being physically active, reducing stress, and self-monitoring blood pressure [12]. In research conducted among Iranian hypertensive patients, the mean score for self-care behaviors is 48.78±10.66, which is relatively undesirable [13]. In other studies, self-care behaviors have been reported at a moderate level [14, 15].

One of the factors that can influence the improvement of self-care behaviors in patients with hypertension is health literacy [15, 16]. Electronic health literacy (e-health literacy) refers to an individual's capacity to locate, evaluate, exchange, and use information from health communication technologies for their benefit and the benefit of others [17]. Today, the Internet has become a popular tool for searching for health information resources worldwide, with 50% of Americans searching the Internet for their medical issues [18].

In a study conducted by Aslani *et al.* in 2012 in Iran, the e-health literacy status of cardiac patients is estimated to be moderate [19]. In another study, patients with heart failure over 50 years of age have low e-health literacy scores [20].

The results of a systematic review and meta-analysis show a positive correlation between e-health literacy and health-related behaviors, indicating that e-health literacy can mediate the process by which health-related information leads to changes in health-related behaviors [21]. In their study, Bakhshayesh *et al.* determine that e-health literacy and self-care behaviors play an essential role in improving the quality of life of patients with heart failure [20]. In a study conducted on nurses in Turkey, a significant relationship is found between the level of e-health literacy of nurses and their overall health-improving behaviors [22].

Low e-health literacy restricts patients' ability to interpret medical instructions and health resources, leading to disengagement from their care [23]. Low health literacy is associated with lower medication adherence, impacting overall health outcomes [24]. Furthermore, low e-health literacy correlates with reduced self-efficacy, which is critical for patients to manage their health effectively [25].

Given the increasing prevalence of chronic diseases, including hypertension, the expansion of the electronic world, and the use of electronic resources to obtain information, electronic health literacy is necessary to identify reliable information sources and use them correctly. Therefore, the present study aimed to investigate e-health literacy and examine its relationship with self-care behaviors in Iranian hypertensive patients.

Instrument and Methods

Study design, setting, and participants

This cross-sectional study was conducted from March to June 2024 among 240 hypertensive patients at healthcare centers in Neyshabur City, Iran.

Eligibility criteria included at least six months since the diagnosis of the disease, being literate, having internet access and the ability to use it, and taking antihypertensive medication. Hypertensive patients with physical or mental disabilities and those who withdrew consent during the study were excluded.

The sampling method employed was stratified-cluster sampling. Neyshabur city was divided into four regions (north, south, east, west), with each region considered a stratum. Within each region, there were two healthcare centers. These healthcare centers were considered clusters. One cluster was randomly selected from each stratum, resulting in the selection of four healthcare centers. The sample size within each stratum was determined according to the population residing in that region. Samples were randomly collected from the selected healthcare centers based on health records. Subsequently, the researchers (two public health students) contacted the selected individuals via phone. After providing sufficient and appropriate explanations about the study, they were invited to participate. If the invitation was accepted, participants were scheduled

for an appointment at the healthcare centers (response rate=100%). During questionnaire completion, two public health students were present to assist with any questions.

We used primary information from a pilot study with 20 hypertensive patients to determine the sample size. The sample size was estimated using the following formula: α=0.05, β=80% (power), r=0.43 (estimated correlation coefficient), and considering approximately 20% attrition, the final sample size was calculated to be 240.

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2}{(\omega)^2}$$

$$\omega = \frac{1}{2}\log\frac{1+r}{1-r}$$

Procedure

Participants were informed about the study's aim and assured of the confidentiality of their data. All participants subsequently signed a consent form.

Instrument

Uing the demographic checklist, we collected information on socio-demographic and health-related factors, including age, gender, marital status, body mass index (BMI), occupational status, blood pressure readings, educational status, family history of diabetes, presence of other chronic diseases, ownership of a home blood pressure measuring device, home hypertension monitoring practices, insurance status, sleep status, and economic indicators.

The e-Health Literacy Scale (eHEALS), developed by Norman & Skinner, comprises eight items [26]. We utilized the validated Persian version of the e-HEALS, which has demonstrated a Cronbach's alpha of 0.88 [27]. The internal consistency of the scale in our study was evaluated using Cronbach's Alpha, yielding a coefficient of 0.79. It is a self-report measure designed to assess an individual's knowledge and understanding of various aspects of online health information. This includes awareness of available health information resources on the internet, the ability to locate helpful resources, methods for accessing them, and the capacity to use the internet to address health-related queries. A key focus of the scale is the ability to critically evaluate online health information, differentiating between high-quality and low-quality sources. Responses to the items are recorded on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The total score for the scale ranges from 8 to 40, with higher scores indicating a greater level of e-Health Literacy. A score of 24 or above on the e-HEALS is considered indicative of high e-health literacy [28].

The hypertension self-care profile, developed by Han *et al.*, with 20 questions, was used to assess various aspects of hypertension self-care, including diet, physical activity, medication adherence, blood pressure self-monitoring, and smoking cessation [29]. Items are rated on a four-point Likert scale: 1 (never/rarely), 2 (sometimes), 3 (often), and 4 (always). The total score ranges from 20 to 80, with higher scores indicating a greater level of self-care. The validated Persian version of this profile was utilized, yielding a Cronbach's alpha of 0.86 [30]. In the current study, the estimates of internal consistency, as measured by Cronbach's alpha, was 0.79.

Data analysis

All analyses were conducted using SPSS 22. Multiple linear regression, t-tests, and one-way analysis of variance were employed to achieve the study's analytical objectives.

Findings

The mean age of the respondents was 41.01±5.69 years.

Table 1. Demographic/underlying characteristics of hypertensive patients (n=240)

Parameter	Frequency (%)
Age (year)	
<40	115 (47.5)
≥40	125 (52.1)
Gender	
Female	141 (58.8)
Male	99 (41.3)
Body mass index (kg/m²)	
Underweight (<18.5)	0
Healthy weight (18.5-24.9)	39 (16.3)
Overweight (25.0-29.9)	130 (54.2)
Obese (≥30.0)	71 (29.6)
Blood pressure (mm/Hg)	
Controlled (<140/90)	228 (95)
Uncontrolled (≥140/90)	12 (5)
Family history of hypertension	
Yes	190 (72.2)
No	50 (20.8)
Health insurance	
Yes	214 (89.2)
No	26 (10.8)
Having at least one other chronic disease	
Yes	84 (35)
No	156 (65)
Having a blood pressure measuring device at home	
Yes	119 (49.6)
No	121 (50.4)
Measuring hypertension at home	
Yes	112 (50.8)
No	118 (49.2)
Marital status	
Single/divorced/widow	22 (9.2)
Married	218 (90.8)
Educational status	
Secondary school	52 (21.7)
High school	112 (46.7)
University	76 (31.7)
Occupation	
Housewife	114 (47.5)
Governmental/retired	46 (19.2)
Labor	29 (12.1)
Self-employed	51 (21.3)
Economic status	
Weak	64 (26.7)
Moderate	158 (65.8)
Good	18 (7.5)
Sleep status	
Good	69 (287)
Fairly good	123 (51.2)
Fairly bad	38 (15.8)
Bad	10 (4.2)

Table 2. Predictors of e-health literacy in hypertensive patients (n=240)

Parameter	B	Stndard error	p-Value
Age (year)			
<40	-	-	-
≥40	Ref	-	-
Gender			
Female	-0.54	1.309	0.67
Male	Ref	-	-
Body mass index (kg/m²)			
Healthy weight (18.5-24.9)	1.05	1.2	0.38
Overweight (25.0-29.9)	0.005	0.45	0.9
Obese (≥30.0)	Ref	-	-
Blood pressure (mm/Hg)			
Controlled blood pressure <140/90	2.28	2.18	0.29
Uncontrolled blood pressure ≥140/90	Ref	-	-
Family history of hypertension			
Yes	-0.28	2.18	0.29
No	Ref	-	-
Health insurance			
Yes	0.013	1.27	0.99
No	ref	-	-
Having at least one other chronic disease			
Yes	-0.726	0.83	0.38
No	Ref	-	-
Having a blood pressure measuring device at home			
Yes	0.27	2.1	0.89
No	Ref	-	-
Measuring hypertension at home			
Yes	2.01	2.1	0.32
No	Ref	-	-
Marital status			
Single/divorced/widow	Ref	-	-
Married	-3.68	1.39	0.009
Educational status			
Secondary school	Ref	-	-
High school	1.22	1.08	0.26
University	2.13	0.65	0.001
Occupation			
Housewife/unemployed	Ref	-	-
Government employee/retired	2.01	1.5	0.18
Labor	0.718	0.87	0.41
Self-employed	0.97	0.49	0.048
Economic status			
Weak	Ref	-	-
Moderate	2.03	0.98	0.041
Good	1.21	0.89	0.17
Sleep status	0.36	0.73	0.62
Good	1.24	2.12	0.56
Fairly good	0.09	1.02	0.92
Fairly bad	0.36	0.73	0.62
Bad	Ref	-	-

The sample comprised 141 women (58%). A family history of diabetes was reported by 190 participants (72.2%). The majority of participants, 218 (90.8%), were married and had a diploma-level education, with 112 (46.7%) reporting an average economic situation (Table 1).

The mean e-health literacy score was 21.3±6.6. A significant portion of the participants, 179 (74.6%), exhibited low e-health literacy, while 61 case (25.4%) showed high e-health literacy.

Educational level, marital status, economic status, and occupation were significant independent predictors of e-health literacy ($p<0.05$; Table 2).

After adjusting for the presence of a home blood pressure measuring device and sleep status, the regression model demonstrated that e-health literacy (B=0.313, SE=0.092, $p<0.05$) was a statistically significant independent factor associated with self-care activities in hypertensive patients (Table 3).

Table 3. Adjusted predictors of self-care activities in hypertensive patients (n=240)

Parameter	B	Standard error	p-Value
e-health literacy	0.313	0.092	0.001
Age (year)			
30-40	Ref	-	-
≥40	1.92	1.1	0.082
Gender			
Female	0.526	1.75	0.76
Male	Ref	-	-
Body mass index (kg/m²)			
Healthy weight (18.5-24.9)	3.01	1.63	0.062
Overweight (25.0-29.9)	0.48	0.616	0.432
Obese (≥30.0)	Ref	-	-
Blood pressure (mm/Hg)			
Controlled (<140/90)	2.63	2.97	0.37
Uncontrolled (≥140/90)	Ref	-	-
Family history of hypertension			
Yes	-1.37	1.34	0.3
No	Ref	-	-
Health insurance			
Yes	2.2	1.73	0.2
No	Ref	-	-
Having at least one other chronic disease			
Yes	-1.614	1.14	0.15
No	Ref	-	-
Having a blood pressure measuring device at home			
Yes	6.38	2.89	0.029
No	Ref	-	-
Measuring hypertension at home			
Yes	2.44	2.85	0.39
No	Ref	-	-
Marital status			
Single/divorced/widow	ref	-	-
Married	0.79	1.91	0.68
Educational status			
Secondary school	Ref	-	-
High school	0.023	1.47	0.98
University	0.269	0.91	0.76
Occupation			
Housewife/unemployed	Ref	-	-
Government employee/retired	0.25	2.05	0.9
Labor	0.015	1.18	0.9
Self-employed	0.237	0.67	0.72
Economic status			
Weak	Ref	-	-
Moderate	1.53	1.35	0.25
Good	2.39	1.21	0.055
Sleep status			
Good	6.32	2.8	0.029
Fairly good	3.89	1.39	0.006
Fairly bad	3.31	0.99	0.001
Bad	Ref	-	-

Discussion

This study aimed to investigate e-health literacy and its relationship with self-care behaviors among Iranian hypertensive patients. A significant positive correlation was found between e-health literacy and hypertension self-care behaviors in these patients. Self-care behaviors, including regular blood pressure monitoring, dietary regulation, consistent physical activity, and adherence to prescribed medications, are essential for effectively managing blood pressure [31, 32]. Higher levels of electronic health literacy are

positively associated with these self-care behaviors in hypertensive patients. Enhanced health literacy empowers patients to better understand their condition and adopt effective self-care practices, such as medication adherence and lifestyle modifications [33]. Electronic health literacy facilitates a deeper comprehension of health conditions and available treatment options, thereby promoting informed decision-making [34]. Additionally, digital platforms offer timely access to health information, which is critical for hypertension management [35].

Despite the importance of electronic health literacy, disparities in technological access and health education can impede its effectiveness. Certain populations may face challenges in utilizing digital tools, potentially widening health inequalities in the management of hypertension.

Hypertensive patients possessing home blood pressure monitoring devices exhibited better self-care behaviors compared to those without such devices. This finding aligns with previous research. A study conducted in Turkey indicated that the use of a home blood pressure monitor is associated with reductions in both systolic and diastolic blood pressure [36]. Gebresilase *et al.* report that patients with a personal blood pressure monitor are five times more likely to engage in self-care activities than those without [37]. Similarly, a study in Ethiopia found that patients lacking a blood pressure measuring device are more prone to poor self-care [38]. Ajani *et al.* also establish a significant association between home blood pressure monitoring and self-care behaviors [39].

Our results suggest that individuals with personal blood pressure monitoring devices tend to monitor their blood pressure more regularly. This consistent feedback on their condition likely enhances their engagement and leads to better disease management. Self-monitoring of blood pressure allows for timely adjustments to self-care behaviors.

There was also a significant positive relationship between sleep status and self-care behaviors, where a more favorable sleep status was linked to better self-care practices. The connection between sleep quality and self-care behaviors has been corroborated in other studies [40, 41]. Knafl & Riegel report that patients with heart failure and poor sleep quality also demonstrate poorer medication adherence [40]. Kamrani *et al.* found that older adults without sleep disorders have higher self-care behavior scores [41].

It can be inferred that poor sleep may diminish self-care capacity, thereby impairing patients' ability to manage their health effectively. Conversely, some patients might continue to experience sleep issues due to external factors like stress or environmental conditions, potentially necessitating interventions beyond self-care education.

A significant proportion of hypertensive patients, specifically 74.6%, exhibited low e-health literacy. This finding is consistent with previous research, which has also reported relatively low e-health literacy levels among patients [42, 43]. Individuals with low e-health literacy often encounter difficulties in understanding medical advice and treatment options, which can result in inadequate self-management of chronic conditions such as diabetes and hypertension [34, 44]. Furthermore, low e-health literacy may reduce self-efficacy, further impeding effective disease management [25].

The Global Burden of Disease Study estimates that deaths from chronic noncommunicable diseases will reach 52 million by 2030 [45]. Patients with chronic diseases continuously seek information online regarding medication, nutrition, disease management, and prevention strategies. Consequently, e-health interventions tailored for individuals with chronic diseases can significantly enhance self-management and patient engagement in their healthcare [46].

Our findings underscore the necessity of addressing the e-health literacy skill gap among hypertensive patients. Improving this skill set can assist them in locating and critically evaluating relevant online health resources to inform their health-related decisions. Targeted educational interventions aimed at enhancing e-health literacy can empower patients, ultimately leading to better self-management and improved health outcomes.

There was also a positive relationship between e-health literacy and the economic status of hypertensive patients. Individuals with lower incomes often demonstrate reduced e-health literacy, which consequently impacts their capacity for effective health condition management [47, 48]. Economic limitations restrict access to technology, digital devices, and the internet, further impeding the development of e-health literacy [49]. Nevertheless, e-health resources hold the potential to empower low-income individuals, enhance their involvement in healthcare decisions, and ultimately improve health outcomes when utilized effectively [47].

This correlation underscores the influence of socioeconomic disadvantages on e-health literacy within low-income populations. Targeted educational programs can equip individuals with lower incomes to better navigate health information and make more informed decisions. E-health resources can empower low-income individuals, enhancing their engagement in healthcare decisions and improving health outcomes when effectively utilized.

Occupation and education level independently predicted e-health literacy. Specifically, employed individuals and those with higher education levels tended to possess greater e-health literacy. This association between e-health literacy, education level, and employment status has been substantiated by other research [50, 51]. Patients with higher educational attainment generally exhibit better e-

health literacy, which facilitates their ability to seek and effectively utilize online health information. They are also more inclined to engage with digital health tools, leading to improved health management and decision-making [52].

Employed individuals typically possess a high level of education, suggesting that their elevated e-health literacy may be associated with their educational attainment. Furthermore, in today's increasingly digital world, most occupations necessitate internet usage. Consequently, employed individuals generally have greater access to technology and digital devices compared to the unemployed, which can influence their internet utilization and, ultimately, enhance their e-health literacy.

Understanding the connection between education and e-health literacy can guide the development of targeted educational interventions to improve health outcomes, especially for individuals with lower educational backgrounds and unemployed patients. Investing in training for both patients and healthcare professionals can help bridge the digital literacy gap, thereby enhancing healthcare delivery and patient outcomes. Patients who monitored their blood pressure at home using a blood pressure measuring device exhibited higher e-health literacy compared to those who did not engage in home monitoring.

Our study possesses several limitations. Firstly, its cross-sectional design precludes the establishment of causation and does not capture changes over time in the e-health literacy and self-care activities of hypertensive patients. Secondly, as all information was collected via self-reporting, the responses may be subject to socially desirable response bias.

Our results underscore the prevalence of low e-health literacy within this patient group, emphasizing the critical need for educational programs designed to improve e-health literacy among Iranian hypertensive individuals. Particular emphasis should be placed on supporting those with lower educational attainment. Furthermore, it is vital to stress the significance of self-care activities for hypertensive patients, coupled with comprehensive education on adopting a healthy lifestyle to effectively manage the condition and avert potential complications.

Conclusion

There is a correlation between e-health literacy and self-care practices among hypertensive patients.

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