Investigating the e-Health Literacy of Patients with Type 2 Diabetes in the Use of Self-Care Mobile Health Applications

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Authors
Karbasi Z.[1*] *PhD*
Ram M.[2] *MSc*
Hajesmaeel Gohari S.[1] *PhD*
Sabahi A.[3] *PhD*

[1]Medical Informatics Research Center, Institute for Futures Studies in Health, Kerman University of Medical Sciences, Kerman, Iran
[2]Faculty of Medical Sciences, Birjand University of Medical Sciences, Birjand, Iran
[3]Department of Health Information Technology, Ferdows Faculty of Medical Sciences, Birjand University of Medical Sciences, Birjand, Iran

*Correspondence
Address: Kerman, Islamic Republic Blvd., Shefa Crossroads, Kerman University of Medical Sciences Virtual Education Center. Postal code: 7616913555
Phone: +98 (34) 32113709
Fax: +98 (34) 32113005
karbasizahra4@gmail.com

ABSTRACT

Aims One of the most common types of diabetes is type 2 diabetes (T2D). Self-management can play a significant role in controlling the disease. The positive effects of mobile health (m-Health) applications on self-care and knowledge enhancement among patients with diabetes have been established. This study was conducted to investigate the e-Health literacy of patients with T2D in using self-care m-Health applications in Kerman City in 2023.

Instrument & Methods This cross-sectional study was conducted in 2023. Patients referred to a selected clinic in Kerman City were the research population of this study. A total of 198 patients were included in the study using available sampling and the questionnaire was distributed among them. Frequency, mean, and standard deviation were used to describe the data. Analytical statistical methods such as Mann-Whitney were also employed.

Findings 188 individuals participated in this research, of which 103 (54.8%) were men and the rest were women. The average age of the participants in the research was 50.17±12.91 years. The average health literacy score of the participants in the study was 24.75±9.04. Among the patients, only 39 participants used diabetes applications to manage their disease and 33 patients (82.5%) reported the daily blood glucose level monitoring feature as the most useful feature of the application.

Conclusion The participants have a low level of e-health literacy. About one-third of patients use diabetes applications to control their disease. The most helpful component of the studied apps is the daily blood glucose level report.

Keywords Literacy; e-Health; m-Health; Diabetes

CITATION LINKS

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Introduction

One of the most common types of diabetes is T2D [1], with its incidence increasing due to various reasons, including obesity, unhealthy diet, and metabolic syndrome [2-4]. Evidence shows that there is a possibility of more than 500 million individuals suffering from T2D by 2030 [5]. However, many people are not aware of the complications associated with diabetes [6]. Individuals with T2D suffer from complications such as diabetic retinopathy and cardiovascular diseases that affect their quality of life [7]. Self-management can play a significant role in controlling the disease [8]. One of the ways to improve the self-care of patients is acquiring knowledge [9].

The basis of diabetes care is self-management [10]. Today, health literacy is essential [11] and can be highly effective for diseases such as T2D [12]. The ability of individuals to acquire health information and process it to make appropriate decisions is referred to as health literacy [13].

Electronic health literacy is almost defined as similar to health literacy, with the difference that it focuses on electronic information resources [14]. Evidence has shown that high health literacy has an indirect effect on diabetes self-care and blood sugar control [15].

The results of the research by Ernsting *et al.* revealed that patients with heart diseases or diabetes who used m-Health applications demonstrated a high level of e-Health literacy [16].

According to the literature, mobile applications are widely used by individuals, but not all of them can use these applications for blood sugar control and self-care [17].

Using information technology such as the Internet, mobile phones, and computers, electronic health has provided individuals with the possibility of self-care and disease management [18, 19].

Using electronic health programs, patients can monitor their health status and interact with healthcare providers [20-22]. The positive effects of m-Health applications on self-care and knowledge enhancement among patients with diabetes have been established [23]. Factors such as limited understanding of technology, lack of knowledge about electronic health programs, and lack of tools to access electronic health prevent from using digital interventions for self-management and changing health behaviors [24, 25]. In addition to m-Health applications that have facilitated access to information [26], information available on the Internet is effective in changing health behaviors and disease management [27].

The use of electronic health information and programs among patients with diabetes depends on various factors that need to be examined. Therefore, this study was conducted to investigate the e-health literacy of patients with T2D in using self-care m-Health applications in Kerman City in 2023.

Instrument and Methods

This cross-sectional study was conducted in 2023. Patients referred to a selected clinic in Kerman City were the research population of this study. A total of 198 patients were included in the study using available sampling, and questionnaires were distributed among them. After reviewing the completed questionnaires, 10 participants did not responded to the questionnaire precisely and the remaining 188 questionnaires were analyzed. The inclusion criteria were diagnosis of diabetes and informed consent of the participants, and those who did not cooperate in filling the questionnaire were excluded. The collection tools in this study included a demographic information checklist, an e-health literacy questionnaire, and a researcher-made questionnaire to investigate patients' preferences and tendencies. Demographic information included age, gender, marital status, type of residence, duration of disease, and other diseases. In this study, Norman and Skinner's e-health literacy questionnaire was used, which includes eight components to evaluate e-health literacy [28]. The validity and reliability of the Persian-translated version of the questionnaire were evaluated by Bazm *et al.*, and Cronbach's alpha coefficient was reported as 0.88 [29]. The third part of the researcher-made questionnaire includes 14 questions about m-Health methods for the self-management of the disease, patient preferences and inclinations for using a variety of m-Health methods, patient preferences and inclinations for using m-Health for self-management of T2D, and intervals and sequences preferred to receive training. Experts in health information management and medical informatics were used to determine content validity, and the reliability of the questionnaire was calculated based on Cronbach's alpha coefficient and using SPSS version 26 software. Accordingly, Cronbach's alpha coefficient of this questionnaire is 0.876. Frequency, mean, and standard deviation were used to describe the data. Analytical statistical methods such as Mann-Whitney were also employed. Confidentiality of information was maintained in this study, and the questionnaires were completed voluntarily and anonymously.

Findings

188 individuals participated in this research, 103 (54.8%) participants were men. The average age of the participants in the research was 50.17±12.91 years, with the lowest age being 22 years old and the highest age being 80 years old. A total of 151 participants (80.3%) were married and the rest were single. Most of the participants (88.8%) lived in urban areas. Among the participants, 38 individuals (20.2%) were employed. In terms of disease duration, 69 individuals (36.7%) had been suffering from the disease for one to five years (Table 1).

Table 1. Frequency distribution of demographic variables in study participants

Variable	Variable classification	Frequency (%)
Gender	Man	103 (54.8)
	Female	85 (45.2)
Marital status	Single	37 (19.7)
	Married	151 (80.3)
Address	City	167 (88.8)
	Village	21 (11.2)
Education	Literacy for reading and writing	29 (15.4)
	Diploma	29 (15.4)
	Associate degree	52 (27.7)
	Bachelor's degree	44 (23.4)
	Master's degree	28 (14.9)
	PhD	6 (3.2)
Job	Employee	38 (20.2)
	Housewife	36 (19.1)
	Unemployed	14 (7.4)
	Farmer	11 (5.9)
	Retired	37 (19.7)
	Other	52 (27.7)
The duration of the disease	Under one year	49 (26.1)
	One to five years	69 (36.7)
	Five to ten years	44 (23.4)
	More than ten years	26 (13.8)
Other diseases	Yes	89 (47.3)
	No	99 (52.7)

Table 2. Frequency of answers to e-health literacy questions

Question	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1- I know what health resources are available on the Internet	23	96	29	7	22
2- I know where to go when using the Internet to find useful health and healing resources	39	60	45	8	19
3- I know how to find useful health resources on the Internet	30	61	52	8	19
4- I know how to use the health and healing resources I have found on the Internet	30	55	56	10	18
5- I know how to use the Internet to answer my health questions	28	53	59	13	13
6- I have the necessary skills to evaluate the sources of health and treatment resources that I find on the Internet	32	48	67	13	11
7- I can distinguish quality online health and treatment resources from poor quality ones	23	46	54	19	36
8- I am confident in using the information available on the Internet to make health decisions	21	47	54	34	26

Regarding e-health literacy questions, 51.3% of the participants disagreed and did not know what resources are related to health issues on the Internet. The majority of the participants (35.1%) chose the disagree option for question 2. Regarding question 3, 35.9% of the participants disagreed and did not know how to find healthcare resources on the Internet. In response to questions 4, 5, 6, 7, and 8, the percentages of participants who chose "neither agree nor disagree" were 33.1%, 35.5%, 39.2%, 30.3%, and 29.7%, respectively (Table 2).

Table 3. The frequency of reasons for not using m-Health-based programs in disease management by type 2 diabetes (T2D) patients

Reasons	Frequency (%)
I didn't know they existed	54 (61.4)
They don't work on my cell phone	12 (13.6)
Cost-related problems	3 (3.4)
I don't feel confident using them without help from another person	7 (8)
I had tried one before and didn't like it	0 (0)
Other reasons	12 (13.6)

Based on the obtained information, the average health literacy score of the participants in the study was 24.75±9.04. The number of participants who used methods based on m-Health to manage their disease was 100, and telephone calls were the most frequent with 54% among the different methods based on m-Health.

Table 4. Frequency of issues encountered by patients while working with diabetes applications

Problems working with the application	Frequency (%)
Software failure	5 (12.8)
Difficulty understanding the recommendations provided by the application	8 (20.5)
Inconsistency of the results with the recommendations given by the doctor	8 (20.5)
Other cases	18 (46.2)

Out of 188 patients participating in the study, 88 had not used any of the m-Health methods in the management of their disease, and the majority of the participants (61.4%) mentioned that they were

unaware that these methods were available for managing their disease (Table 3).

Among the patients, only 39 participants used diabetes applications to manage their disease. According to the data, 33 patients (82.5%) reported the daily blood glucose level monitoring feature as the most useful feature of the application (Table 4). There was a statistically significant difference between the health literacy of patients who had used applications for the self-management of their disease and those who had not (p=0.029).

Discussion

This cross-sectional study investigated the e-health literacy of patients with T2D using self-care mobile health applications in Kerman City. The mean score of the e-health literacy in the participants was low. In another study by Guo *et al.*, the mean score of e-health literacy in the participants is 30.16, and only a few participants use eHealth tools [17]. These discrepancies may be due to differences in the number of participants and the mean age of the participants, as well as cultural differences. This study was conducted in Iran with 188 patients with a mean age of 50.1 years old, while another study is performed in Taiwan with 262 patients with a mean age of 44.5 years old. Younger individuals are more likely to use the Internet in their daily lives and have higher e-health literacy than the elderly [30]. On the other hand, 80% of Iranians use the Internet [31], while this number in Taiwan is 91% of the total population [32].

Most of the participants used phone calls among the different m-Health methods for managing their diabetes. The results of a study shows that phone call education about diabetes had a significant impact on the reduction of Hemoglobin A1c (HbA1c) levels and increases patients' knowledge about diabetes management [33]. According to the participants, the main reason for not using other methods was the lack of knowledge about the existence of these methods. This lack of knowledge is a crucial factor that affects e-health literacy. Awareness of the accessibility of online resources is the predictor associated with a higher e-health literacy level [30].

Only 39 patients used diabetes apps to manage their disease. In contrast. another multinational study reports that 48% of the participants use the apps to manage their diabetes [25]. Smartphone apps can significantly reduce HbA1C levels compared to the Short Message Service (SMS) and websites [34]. There is a relationship between the usability of the apps, e-health literacy, and willingness to use mobile apps. E-health literacy has an impact on patients' perceptions of usefulness and ease of use. Moreover, perceived usefulness and ease of use influenced patients' willingness to use mobile apps to manage diabetes [35]. According to the patients, the most useful feature of the apps was the daily blood glucose level report.

This result is similar to the result of the previous study [25]. Monitoring blood glucose is a vital task for controlling diabetes; Therefore, measuring and reporting its level daily can be useful for identifying values outside the normal range for proper and timely treatment.

Patients prefer to use m-Health tools for blood glucose control, insulin dose management, and adherence to the diet. Patients prefer features such as nutrient values of foods, blood glucose control, and physical exercise tracker for future apps [25]. In addition to taking insulin, nutrition and physical activity are important in diabetic patients. A healthy meal plan and being active can help to keep the blood glucose level in the normal range.

The main issues with using application were difficulty in understanding the recommendations provided by the application and the inconsistency of the results with the recommendations provided by the doctor. Considering these challenges, researchers believe that mobile health applications should be designed according to guidelines [36]. According to the results of the study by Jezrawi *et al.*, in addition to the desire to use applications, patients heavily rely on doctor's prescriptions [37]. In our study, the majority of the participants stated that they did not know about the existence of applications. Therefore, through increasing e-health literacy and providing necessary training, patients can be directed to use safe applications [37].

Overall, patients who are more knowledgeable about using mobile health applications tend to manage their disease more effectively and achieve better outcomes than other patients. As a result, the complications of the disease will decrease and the quality of life will improve. In this regard, more training from doctors and healthcare providers on the use of trusted applications can improve the e-health literacy of patients.

To the best of our knowledge, this is the first study to investigate the e-health literacy of patients with T2D in using self-care apps in Kerman. However, this study had some limitations. Patient cooperation in filling out the questionnaires was not very good, which may have affected the results. Additionally, this study focused solely on patients with T2D, and better results might have been obtained if all types of diabetes were included.

Conclusion

The e-health literacy level of the participants is low. About one-third of patients use diabetes apps to manage their disease. While, the most useful feature of the studied apps is the daily blood glucose level report.

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Ethical Permissions: This research was approved by the Ethics Committee of Kerman University of Medical Sciences with Ethical ID IR.KMU.REC.1401.410.

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