

## Prediction of Self-Care Behaviors among Type 2 Diabetes Patients in Tehran Based on Health Literacy in 2020: A Cross-Sectional Study

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### ABSTRACT

**Background and Objectives:** Diabetes places a significant treatment responsibility on the patient. Additionally, health literacy plays a crucial role in managing chronic diseases such as diabetes. The objective of the present study is to predict self-care behaviors based on levels of health literacy in patients diagnosed with type 2 diabetes.

**Materials and Methods:** This study is a cross-sectional research project. It involved 250 patients with type 2 diabetes who were receiving care at hospitals affiliated with Shahid Beheshti University of Medical Sciences. The participants were chosen through cluster random sampling in 2020/2021. Data collection tool was a three-part questionnaire, having been checked for validity and reliability, including demographic information form, the Health Literacy for Iranian Adults (HELIA) questionnaire, and the Self-Care Activities of Diabetic Patients (SDSCA) questionnaire. Analysis was performed using SPSS version 16 and AMOS 20, utilizing descriptive statistics (mean and standard deviation), inferential statistics (correlation coefficient and regression), and structural equation modeling (SEM).

**Results:** The average age of the patients was 58.70 years, with a standard deviation of 14.69. 53.6% of the participants were female, and 46.4% had a university education. Structural equation modeling analysis revealed a strong, statistically significant positive correlation ( $r=0.60$ ,  $p\text{-value}<0.001$ ) between health literacy and self-care. Additionally, the assessment and decision-making aspects of health literacy were found to predict 25% of the variance in self-care behaviors.

**Conclusion:** The assessment of information, and decision-making to influence self-care in individuals with type 2 diabetes is paramount. According to these results, the health system can promote the public from receiving information to the level of evaluation and decision-making and application of information. This approach can enhance self-care practices for managing chronic diseases.

**Paper Type:** Research Article

**Keywords:** Self-care, Health literacy, Diabetes mellitus, type 2, Structural equation modeling.

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## Introduction

Diabetes was the leading cause of 1.5 million deaths in 2019, and 48% of all diabetes-related deaths have occurred before the age of 70 (1). It has been reported approximately 95% of diabetes cases worldwide are type 2 (2). In Iran, the prevalence of type 2 diabetes is 10.80% in men and 13.4% in women, with the highest rates observed in the 55 to 65 age group at 21.7%. Geographically, the highest prevalence is in Khuzestan (15.3%), Razavi Khorasan (14.4%), Qazvin (14.3%), and Yazd (12.6%) (3).

Also, diabetes comprises a collection of long-term metabolic conditions marked by elevated blood sugar levels. It is linked to considerable health complications, increased mortality rates, and rising healthcare expenses (4). An increase in blood sugar causes about 20% of cardiovascular deaths (1). Moreover, retinal damage and blindness, pain in the foot and leg, stroke, peripheral vascular problems, kidney disease, and amputation are among the most serious health complications of diabetes (5).

Self-care is a process in which the patient uses his/her knowledge and skills to perform the recommended behaviors (6). Patients with diabetes need self-care practices, including meal planning, weight control, compliance with exercise, and medication use (7). Based on the main areas of self-care, dietary efficiency was reported 50%, blood sugar monitoring 28%, physical activity 49%, and diabetic foot care was reported 58% (8). Studies have also shown that knowledge about diabetes medications, diet, exercise, glucose monitoring and foot care is necessary for effective diabetes self-care (9, 10).

For self-care and disease management, patients need to receive correct and valid information to understand their condition and cooperate in self-care plan (6). Research studies have shown that people with low literacy are more likely to have negative clinical outcomes, including poor health status and poor blood sugar control (11, 12). Patients with diabetes who have a higher level of health literacy including a number of different skills such as document literacy (the ability to search for and understand medical information) and numerical skills (understanding and applying simple numerical concepts to interpret results) probably report sufficient information about diabetes and better blood sugar control (13). Health literacy is defined as a person's capacity to acquire, interpret, and understand basic information and health services that are necessary for appropriate decision-making (14).

It has been reported that 4.5% increase in health costs are related to diabetes among adults. Therefore, evidence emphasizes the importance of health literacy as a positive influence on patients with diabetes and their overall health (15, 16). Globally, 34.3% of patients with diabetes have limited education about health in general (17). While studies reported that educational interventions had a positive effect on reducing diabetes (18). In clinical and research environments, health literacy among patients with type 2 diabetes has received special attention (19).

AlSharit et al. (2022) demonstrated in their study that health literacy significantly influences self-care management and blood sugar control, both directly and indirectly (20). Yarmohammadi et al., in 2019, reported

that health literacy reduces A1C through the mediation of self-care (21). In the study by Marciano et al. in 2019, self-care and blood sugar control were predicted by health literacy (22). Moreover, compared to adequate health literacy, insufficient health literacy is independently associated with uncontrolled blood sugar (23).

Cultural and various background factors, and health care system can shape the impact of health literacy on the health outcomes of diabetic patients in different ways (24). Patients' education, smoking status, and the nature of antidiabetic therapy are also significantly related to self-care activities (25). The older adults with type 2 diabetes with higher income and education level, longer duration of diabetes (26), exercise, and higher understanding of diabetes (27) were more likely to perform better self-care behaviors.

By providing a more nuanced understanding of the relationship between health literacy and self-care, this study aims to inform the development of targeted interventions to improve diabetes management and outcomes. Specifically, this cross-sectional study was conducted to predict self-care based on health literacy levels in patients with type 2 diabetes. The study's objectives include identifying the specific dimensions of health literacy that are most predictive of self-care behaviors. This study aims to inform health policies and improve diabetes management strategies.

### Materials and Methods

This research represents a cross-sectional study performed in 2020, targeting patients with type 2 diabetes referred to hospitals associated with Shahid Beheshti University of

Medical Sciences in Tehran. The sample size was calculated using the following formula.

$$\frac{(Z_{1-\alpha/2})^2 \times S^2}{D^2}$$

In previous studies, such as Reisi et al. (28), the standard deviation for self-care was found to be 1.56. Consequently, with an alpha level of 0.05 and a difference (d) of 0.2, the formula yielded a sample size of 233 participants. To calculate the final sample size, an effect size of 0.5 was utilized. Considering the possibility of sample attrition, the final sample size was set at 250.

Participants were chosen through cluster random sampling. The eight hospitals associated with Shahid Beheshti University of Medical Sciences, which had the highest number of diabetic patients, were used for the study. Tehran was divided into five geographical regions: North, South, East, West, and Center, based on the distribution of these hospitals. One hospital was randomly selected from each region, and from each hospital, 50 type 2 diabetic patients were randomly chosen to participate. To be eligible, participants needed to have minimal literacy and a confirmed diagnosis of type 2 diabetes by a hospital doctor. Exclusion criteria included non-cooperation in completing the questionnaire, pregnancy, and a history of mental illness.

The data collection tool was a three-part questionnaire. The first part, which focused on personal and background information, contained 6 questions designed to gather various details about the diabetic patients, including their age, gender, marital status,

education level, economic status, and A1C levels.

The second part was the Health Literacy Instrument for Adults Questionnaire (HELIA). The HELIA questionnaire, designed and validated by Montazeri et al. (29) for Iranian adults, consists of 33 questions across 5 dimensions: access (6 questions), reading skill (4 questions), understanding (7 questions), assessment (4 questions), and decision-making and use of health information (12 questions). Each dimension utilizes a 5-point Likert scale, with responses ranging from "always" (5 points) to "not at all" or "never" (1 point), with the exception of the reading skill dimension, which ranges from "completely easy" (5 points) to "not easy-not hard" (1 point). The total raw score for an individual can range from 33 to 165, with higher scores indicating better health literacy. To convert this to a 0-100 scale, the raw score is adjusted using a formula that takes into account the minimum and maximum possible scores. The total score is then calculated by averaging the scores of the 5 dimensions, each on a 0-100 scale. Health literacy levels are categorized as insufficient (0-50), not so adequate (51-66), adequate (67-84), and excellent (85-100).

The third part was the Diabetes Self-Care Activities (SDSCA) questionnaire. The SDSCA assesses self-care behaviors in diabetes patients, covering diet (5 questions), exercise (2 questions), blood glucose testing (2 questions), foot care (4 questions), medication adherence (1 question), and smoking (1 question). Each question is scored from 0 to 7 based on the frequency of the behavior in the past week, with a total possible score of 0 to 99. The validity and

reliability of the SDSCA have been confirmed by researchers (30).

The data were entered into SPSS version 16 for statistical analysis. In this study, the Kolmogorov-Smirnov test confirmed the normal distribution of health literacy and self-care data. The frequency and percentage of demographic variables were calculated, along with the mean and standard deviation of total self-care variables and their dimensions, as well as total health literacy and its dimensions. In this study, self-care is the dependent variable, while health literacy and demographic variables are the independent variables. The relationship between self-care and gender was examined using an independent t-test, and the relationship between self-care and age, marital status, education, economic status, and A1C was analyzed using an ANOVA test. The relationship between self-care and overall health literacy, as well as its dimensions, was examined using the Pearson correlation coefficient test. The simultaneous effect of health literacy dimensions on self-care was investigated using Multiple Linear Regression. Additionally, SEM was employed to evaluate the relationship between health literacy and self-care. SEM analysis was performed using AMOS 20. The model fit was assessed using several indices, including the Minimum Discrepancy Function by Degrees of Freedom divided (CMIN/DF), Incremental Fit Index (IFI), Tucker-Lewis Index (TLI), Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA).

## Results

According to the results of the study, the mean age of the participants was  $58.70 \pm 14.69$ , and 53.6% of the participants were

women and 46.4% were men. Moreover, 84% of the participants were married, 46.4% had a university degree, 34.8% had a diploma, and 18.8% had a diploma. Also, 61.6% of the participants had an average economic status, 30.4% had a low economic status, and only 8% had reported a good economic status. Among the participants, 62% of reported their A1C as good (less than 6.5), 22.4% poor (more than 8), and 15.6% relatively good (between 6.6 and 7.9). In this study, the Kolmogorov-Smirnov test confirmed that the

distributions of health literacy ( $p=.200$ ) and self-care ( $p=.085$ ) data were normal.

The findings of the present study showed that the average score of total health literacy of the participants was 107.12, the average health literacy score was 15.01 in the access dimension, 12.89 in the reading dimension, 27.74 in the understanding dimension, and 11.01 in the assessment dimension and 46.40 in decision-making and use of health information dimension (Table 1).

**Table 1. The mean scores of variables**

Scales	Level of subscales	Mean $\pm$ sd
Self-care	Diet	18.34 $\pm$ 8.30
	Exercise	3.03 $\pm$ 3.69
	Blood glucose testing	5.97 $\pm$ 5.35
	Adherence to medication	6.44 $\pm$ 1.74
	Foot care	18.70 $\pm$ 9.60
	Smoking	.86 $\pm$ .34
	Self-care total	53.35 $\pm$ 16.94
Health literacy	Access	15.01 $\pm$ 7.11
	Reading skill	12.89 $\pm$ 5.87
	Understanding	27.74 $\pm$ 7.68
	Assessment	11.01 $\pm$ 3.90
	Decision-making and use of health information	40.46 $\pm$ 9.70
	Health literacy total	107.12 $\pm$ 27.48

The results indicated a significant correlation, as determined by the Pearson Correlation Coefficient Test, between total health literacy and its dimensions (access, reading skill, understanding, assessment and decision-making and use of health information) with self-care ( $P < .001$ ) (Table 2). Moreover, there was no correlation between background variables and total self-care, and only ANOVA showed that there was a statistically significant correlation between marital status and self-care ( $P=0.02$ ).

The simultaneous effect of the dimensions of the health literacy variable on the self-care

variable was investigated using a Multiple Linear Regression Model. The independent variables were entered into the regression equation step by step in the order of their importance in explaining the dependent variable, and the two variables of assessment and decision were entered into the model and the model had a good fit ( $F=40.79$ ,  $p<.001$ ). Table 3 shows that the two variables of assessment and decision explained and predicted almost 25% of the changes in the self-care variable ( $r\text{-square}=.248$ ).

**Table 2. Relationship between health literacy and self-care**

Variable		self-care						
		Diet	Exercise	Blood glucose testing	Adherence to medication	Foot care	Smoking	self-care total
Health literacy	Access	0.188**	0.190**	0.186**	-0.048	0.124*	0.015	0.258**
	Reading skill	0.165**	0.160*	0.136*	-0.001	0.112	-0.031	0.221**
	Understanding	0.174**	0.114	0.043	-0.064	0.177**	-0.047	0.217**
	Assessment	0.270	0.304**	0.159*	0.028	0.235**	0.059	0.387**
	Decision-making and use of health information	0.341**	0.296**	0.185**	0.059	0.293**	0.051	0.464**
	health literacy total	0.279**	0.254**	0.172**	-0.010	0.230**	0.014	0.376**

\*\*Correlation is significant at the 0.01 level (2-tailed).

\*Correlation is significant at the 0.05 level (2-tailed).

Note: Pearson Correlation Coefficient Test

**Table 3. Factors predicting the self-care of subjects based on dimensions of the health literacy variable**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	R-square
	B	SE	Beta			
(Constant)	18.21	4.07	-	4.47	<.001	.248
Decision-making, and use of health information	.629	.110	.361	5.69	<.001	
Assessment	.874	.264	.210	3.316	<.001	

Note: Multiple Linear Regression Test

The relationship between health literacy and self-care based on the structural equation model showed that increasing health literacy will increase self-care ( $r=0.60$ ,  $p\text{-value}<0.001$ ) (Figure 1). The goodness of fit criteria of the model for evaluating the relationship between health literacy and self-care showed (CMIN/DF=2.48, IFI=.90, TLI=.87, CFI=.89 and RMSEA=.07) that the model has a good fit (Table 4). According to the model, the access subscale had the highest standard coefficient in health literacy ( $\beta=0.72$ ) and in self-care, nutrition had the highest standard coefficient ( $\beta=0.46$ ).

## Discussion

The present study was conducted with the aim of predicting self-care based on health literacy levels in patients with type 2 diabetes in hospitals affiliated to Shahid Beheshti University of Medical Sciences in Tehran. Many studies have been conducted on the relationship between health literacy and self-care. In the present study, like other studies, there was a relationship between health literacy and self-care. (21, 31). Moreover, among the dimensions of health literacy, assessment, decision-making, and the use of health information dimensions were



predictors of self-care, which could be due to the academic status of most of the study participants. This suggests that merely having health information is not enough; individuals must also be able to assess and apply this

information effectively. If certain dimensions of health literacy can be targeted through educational programs, this could enhance self-care practices among populations that struggle with health literacy.

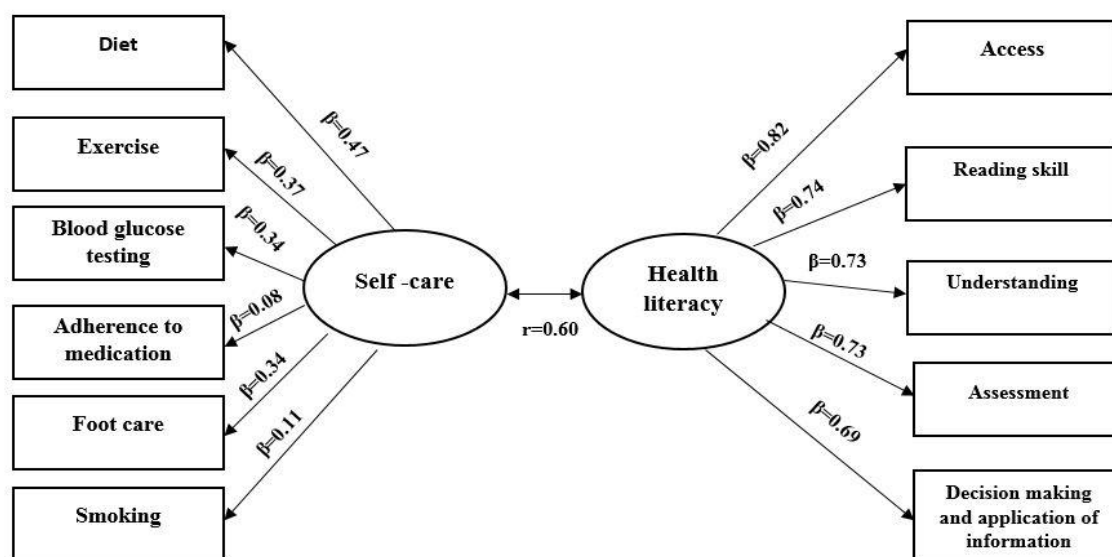


Figure 1. The relationship between self-care and health literacy

Table 4. Goodness of fit indices for the relationship between health literacy and self-care

Goodness of fit indices	CMIN/DF	IFI	TLI	CFI	RMSEA
Relationship between health literacy and self-care	2.48	0.90	0.87	0.89	0.07
Acceptable level	< 5	> 0.8	> 0.8	> 0.8	< 0.08

CMIN/DF: Minimum Discrepancy Function by Degrees of Freedom divided, IFI: Incremental Fit Index, TLI: Tucker-Lewis Index, CFI: Comparative Fit Index, RMSEA: Root Mean Square Error of Approximation

In the field of health, people are frequently required to make decisions. In this field, decision-making is a process, better decision-making requires the steps of generating options, comparing the advantages and disadvantages of the options, and then making a decision (32). In order for people to assess health information, they may need certain skills to judge the reliability of different information using assessment criteria. In addition, in case of reliable information to effectively deal with health issues, they need special skills to implement

rational decisions (33). It is important to assess health information and make decisions to affect the self-care of patients with type 2 diabetes (34).

In the study by Maleki Chollou et al. (2020), it was reported that decision-making was the strongest predictor of self-care behaviors, and dimensions of health literacy accounted for 28.8% of total changes in self-care behaviors (23), while in the present study, assessment and decision-making predicted 25% of self-care. Having these abilities (i.e. assessment and decision-

making), patients can recognize important information, identify their problems, and generally better understand what measures they should take for their health. In the study by Zahedi, et al. (2019), decision-making dimension of health literacy could predict self-care behaviors such as medication use, following a healthy diet, smoking, and weight control (34). In the study by Parichat et al. (2023), it was found that all six dimensions of health literacy (access, cognitive, communication, decision, self-management and media) were positively associated with self-care behaviors (35).

The findings of the present study showed that 62% of the participants had good A1C, and most of them had an average economic status and university education level. This suggests that a significant portion of the population is managing their diabetes effectively. The observation that most participants had an average economic status and university education indicates a potential correlation between higher education and better health outcomes.

Bijlsma-Rutte et al. (2018) reported that there was an inverse relationship between socio-economic status, especially income and education level. Diabetic patients whose education level was low and their job status was not good had higher HbA1c (36). Martinell et al. (2017) also stated that out of 3794 diabetic patients, the probability of high HbA1C was higher in those who had a low (less than 9 years) or medium (between 10 and 12 years) education level and also had low income compared to patients with high level of education and high income (37). The cited studies suggest an inverse relationship between socio-economic status and A1C

levels, reinforcing the idea that lower education and income contribute to poorer health outcomes. This highlights the need for targeted interventions to improve health literacy and self-care practices among disadvantaged groups.

It can be interesting to compare the demographics of the present study with Zahedi's study (34), which has a similar result regarding the fact that decision-making dimension of health literacy of diabetic patients is a predictor of self-care. Most of the participants in the current study were female, while in Zahedi's study, they were male. Most of the participants in the current study had a university degree, while in Zahedi's study, most of them had a diploma and high school degree, and the mean age of the participants in the current study was 58.70, while it was reported 52.5 in Zahedi's study. Although there was a difference in gender, age, and educational status variables of these two studies, both studies proposed decision-making as a predictor of self-care. Therefore, it can be concluded that these variables were not effective in this prediction. Also, in the present study, marital status was not found to be a predictor of self-care behaviors in diabetic patients, which aligns with findings from colleagues' research (38, 39).

**Study Limitations:** This study has several limitations. Firstly, like all cross-sectional studies, it is limited in its ability to establish causal relationships between variables. It can only provide correlations and cannot determine cause and effect due to the simultaneous measurement of exposure and outcome. Additionally, the findings may not be generalizable to other populations, as the



studied sample may not be representative of the broader population. Cultural, geographic, or political differences can also affect the applicability of the results.

**Suggestions for future Research:** The text indicates that individuals need specific skills to evaluate the reliability of health information, which is vital for making informed decisions. This points to the importance of education and training in health literacy. The discussion reflects a broader trend in healthcare that recognizes the importance of empowering patients with knowledge and skills to make informed decisions about their health. This is particularly relevant in chronic disease management, where ongoing self-care is essential. The findings suggest a need for further research to explore how interventions aimed at improving specific dimensions of health literacy can lead to better self-care outcomes, particularly in diverse populations.

### Conclusion

Since the two health literacy dimensions of assessment and decision-making were reported in this study as predictors of self-care in type 2 diabetic patients, providing education related to health assessment and decision-making to diabetic patients can encourage them to improve their health literacy. These educations can help to provide methods and tools to assess and make decisions when facing health issues. Practicing and strengthening assessment skills, such as the ability to collect and analyze information, diagnose symptoms and health problems, identify valid and reliable sources, and evaluate the advantages and disadvantages of different options, will help people make better decisions. Moreover,

strengthening self-concept and increasing self-confidence in assessment and decision-making can encourage people to make independent and intelligent decisions about their health and effectively participate in the management of their disease.

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