



## Health Literacy among Patients with Diabetes Mellitus Type 2 in Northeast Area of Iran

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### Abstract

**Background:** Type 2 diabetes mellitus (DM2) is the most common metabolic disorder with complex treatment, and adherence to its treatment requires sophisticated cognition, which includes health literacy. This study aimed to spread health literacy among patients with DM2 in northeast Iran.

**Methods:** A cross-sectional survey was conducted among diabetic patients in Shahroud city of Iran in 2016. Multistaged cluster random sampling was used for 450 individuals with diabetes who were interviewed using two standard questionnaires on diabetes health literacy (TOFHLA and DNT15).

Participants were enquired about their personal information (age, gender, level of education, etc.). Binary logistic regression analysis was used to identify risk factors for poor health literacy concerning diabetes prevention and control among patients with prediabetes.

**Results:** The mean diabetes health literacy score was 44.0 (18.0–92.0). This score was higher among men than women (OR=1.623), and lowest literacy score was observed in respondents with less than 1 year of education (OR=13.041). The literacy score among diabetic patients with a family history of diabetes was higher than among those with no family history (OR=2.523).

**Conclusions:** This study showed that health literacy related to diabetes prevention and control among diabetic individuals was rather low in Shahroud city. Appropriate health education for diabetic patients with low literacy should be incorporated into diabetes prevention efforts.

**Keywords:** Health literacy, Diabetic patients, Type 2 diabetes.

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the populations in both urban and rural areas have prediabetes. Without timely and effective intervention, prediabetes is very likely to progress to diabetes within 10 years.<sup>4,5</sup>

According to the previously cited references, this disease has received considerable attention by researchers and health authorities worldwide. In addition, chronic complications of DM2 represent a great burden not only to patients but also to the society. The pathophysiology of DM2 complications is certainly complex and derives mostly from chronic hyperglycemia and oxidative stress.<sup>6</sup>

Previous researches showed that adequate management of DM2 significantly reduces the risk of microvascular complications (retinopathy, nephropathy, and possibly neuropathy), myocardial infarction (fatal and nonfatal), and sudden death by about 16–25%;<sup>7,8</sup> however, appropriate management of DM2 depends entirely on patients and their families.<sup>8</sup> A major factor in adherence to the treatment is the information on diabetes (diabetes knowledge) and the understanding of the treatment protocol itself. Low adherence to treatment seems to adversely affect the clinical outcome and quality of life.<sup>9</sup>

DM2 patients with limited literacy skills may face difficulty in following the prescriptions, health care instructions, and using educational texts to increase their knowledge of the disease. Such patients are more exposed to poor glycemic control and the chronic complications of the disease;<sup>10</sup> however, Yangand et al. in their recent review concluded that the evidence for the relationship between health literacy or awareness and clinical outcomes remains unclear.<sup>11</sup>

Health literacy is the degree to which individuals have the capacity to obtain, process, and understand the basic health information and services required to make appropriate health decisions.<sup>12</sup> Health literacy may be an important nonclinical factor, decreasing the risk of adverse outcomes. Diabetes health literacy is associated with diabetes-related knowledge, and adequate health literacy is highly correlated with a better understanding of health education.<sup>13</sup> Health literacy helps in preventive healthcare. As aforementioned, health literacy mediates the relationship between education and glycemic control in low-income patients with diabetes. Moreover, it is associated with disease-related knowledge, a requisite level of which is necessary for effective behavioral change.<sup>14,15</sup> People with a high level of health literacy are more likely to engage in health-promoting behaviors; therefore, they have better health outcomes.<sup>16</sup>

## Introduction

Type 2 diabetes mellitus (DM2) is the most common metabolic disease with high morbidity and mortality; thus, it impacts the quality of life.<sup>1</sup> Diabetes mellitus (DM) is a threat to public health worldwide as the global prevalence of diabetes and prediabetes are rapidly increasing. In past 30 years, the prevalence of diabetes and prediabetes in Iran has also increased due to changed lifestyle of the Iranian people following rapid economic development.<sup>2</sup> The overall prevalence of diabetes and prediabetes in Iran in 2013–2014 was estimated to be 11.5% and 17.6%, respectively.<sup>3</sup> The occurrence of diabetes and prediabetes increases with age, especially in the elderly (aged 70 years and above). Approximately, 52% of diabetes-attributable mortality worldwide occurs among the elderly.<sup>2,3</sup> In Iran, about 15% of

Certainly, low health literacy is common. Approximately, 55% of patients with diabetes in the USA have inadequate literacy, and Korean immigrants with low health literacy are at a greater risk of T2DM.<sup>17,18</sup> People with low health literacy usually have less disease-specific knowledge, a lower quality of life, and poorer health-related outcomes. They may also have trouble reading prescriptions, following medical instructions, and interacting with the healthcare system. Due to the link between health literacy and diseases, health literacy is important, considering the rapidly developing public health sector worldwide.<sup>19</sup> Additionally and importantly, it is also reported that health literacy is consistently associated with diabetes knowledge.<sup>19,20</sup>

In Iran, few studies have investigated diabetes health literacy, and no epidemiological information is available on health literacy regarding prediabetes prevention and control among the popular patients.<sup>2,3</sup> Given the importance of literacy skills to patient's knowledge of diabetes and the lack of information on literacy and numeracy skills of DM2 patients in Shahroud city (northeast Iran), the present study was conducted to assess the health literacy among patients with DM2 in Shahroud.

## Materials and Methods

We used a multistage cluster randomized sampling method to select a representative sample of the diabetic population between April and July 2016; "cluster" here refers to the healthcare centers of the city. Subjects were aged 30 years and above, and belonged to the Shahroud city of northeast Iran. In the first stage, diabetic patients covered by the number of medical centers (10 centers) and hospitals in the city (3 hospitals) were assessed, whereas in the second stage, the diabetic patients were selected in medical centers randomly.

The study selected patients who were positive for diabetes (The diagnostic standards for diabetes as stated in the diagnostic criteria 2013 were applied) and underwent treatment for minimum 1 year to control their diabetes. People with severe physical or mental illness were excluded from the study; those with prediabetes or suspected diabetes were also excluded from the study. Volunteers visited all patients to carefully explain the study and its benefits and the rights of participants. Participants were then personally interviewed after giving written informed consent. If the participant was illiterate, the consent form was signed by a family member. The patients were allowed to deny participation in the study without penalty, and could drop out at any time during the investigation.

The 13 selected centers included 485 diabetic patients. Of these, 36 patients were excluded due to physical or mental illness, resulting in a screening sample of 450 people. No significant difference was observed in the age, sex, marital status, or education of people who were excluded from the study and revise accordingly.

Data was collected in this study by using two standard questionnaires, test of functional health literacy in adults (TOFHLA) and diabetes numeracy test 15 (DNT15).

TOFHLA questionnaire, is one of the most valid and important questionnaires of the health literacy in the world,

which has been translated into several languages. This questionnaire is divided in two sections, the calculating ability and comprehension reading; in this study, only the comprehension reading part of the questionnaire was used. Comprehension reading section is used to measure the patient's ability to read the health care-related text. This section comprises 3 parts (a, b, c) of total 50 questions that should be answered by the patients within 20 min. a: text order to prepare for the radiography of the upper gastrointestinal tract, b: relates to the rights and responsibilities of patients with bond insurance, and c: refers to the standard hospital consent form. This questionnaire was able to effectively examine the level of health literacy in diabetes prevention and control among subjects with prediabetes.

In this study, a specific DNT15 test was used for accurate calculations. Validity and reliability of the Persian version of this test has been proved in several previous studies. The test included 15 questions related to four areas: nutrition, exercise, blood sugar control, and drugs. Moreover, this test included various mathematical evaluations: addition, subtraction, multiplication, etc. Estimated time for this test was 30 min.

Sociodemographic information comprised age, gender, marital status, history of DM, family history of DM, presence of other diseases, and highest level of education.

Sample size was calculated using the formula for cross-sectional studies:  $\alpha=0.05$ , P is the prevalence of prediabetes (20% in this study), and d is admissible error (5%). The theoretical sample size was 423 patients, including an extra 5% to compensate for subjects lost during the study. The final sample size of 450 diabetic patients was considered.

The data were analyzed using SPSS V.16.0 (SPSS/IBM, Armonk, New York, USA). Data are presented as the percentage or mean $\pm$ SD. Nonparametric tests were used because the distribution of the health literacy scores on diabetes prevention and control was non-Gaussian. The Kruskal-Wallis test was used to explore differences in diabetes health literacy among diabetic patients with different characteristics. The two-tailed significance threshold was set at  $P<0.05$  in these analyses.

Binary logistic regression analysis was performed to identify the risk factors for low diabetes health literacy among the diabetic patients. The diabetes health literacy scores were selected as the dependent variables and were classified. Gender, age groups, educational level, BMI, family history of diabetes, other chronic disease status, and marital status were included as independent variables. Step-wise logistic regression was conducted to analyze the risk factors for low diabetes health literacy using significance levels of 0.05 for entry and 0.10 for removal from the model.

## Results

A total of 13 health centers were selected and 450 subjects participated in the study. The descriptive characteristics of the diabetic patients are given in table 1.

Individuals with diabetes had an average age of 63.7 $\pm$ 32 years. Men comprised 38.4% of participants. Most of the participants had a continuation of marriage (N=293, 65.1%) and a low level of education (N=165, 36.7%). There was significant

**Table 1. Characteristics of the study population**

	Number	Mean±SD or %
Age	450	63.7±32
Age group		
- Below 40 years	23	5.1
- 40–55 years	109	24.2
- 56–70 years	257	57.1
- Above 70 years	61	13.6
Sex		
- Male	173	38.4
- Female	277	61.6
Education		
- Illiterate	23	5.1
- End of primary	142	31.6
- Diploma	216	48
- College education	69	15.3
BMI		
- Below 18 kg/m <sup>2</sup>	18	4
- 18–25 kg/m <sup>2</sup>	198	44
- 26–30 kg/m <sup>2</sup>	177	39.3
- Above 30 kg/m <sup>2</sup>	57	12.7
Family history or diabetes		
- Yes	137	30.4
- No	313	69.6
Other chronic disease		
- Yes	169	37.6
- No	281	62.4
Marital status		
- Married	293	65.1
- Unmarried	157	34.9

difference in the educational level between men and women ( $P<0.005$ ). Several participants had a family history of diabetes ( $N=137$ , 30.4%). A total of 169 (37.6%) participants had other chronic diseases, 39.3% ( $N=177$ ) of participants were overweight, and 12.7% ( $N=57$ ) were obese.

The health literacy scores for diabetes prevention and control of prediabetes are shown in table 2. The median score was 44.0 (index questions range (IQR)=18.0–92.0). Men had higher diabetes health literacy scores than women (48.0 vs. 44.0,  $P<0.002$ ). The patients with illiterate had the lowest health literacy scores compared to the three educational levels (43.0 vs. 45.0 vs. 47.0 vs. 49.0,  $P<0.000$ ). Diabetic patients below 40 years of age had the highest level of health literacy (49.0 vs. 41.0 vs. 39.0 vs. 34.0,  $P<0.001$ ); hence, these patients had a positive family history for diabetes and higher health literacy (48.0 vs. 44.0 vs.,  $P<0.005$ ). No difference was observed in the diabetes health literacy scores related to other chronic diseases, BMI, and marital status ( $P>0.05$ ).

The results of the binary logistic regression analysis of risk factors for low diabetes health literacy are shown in table 3. The factors of age, gender, married and history of chronic disease were independent risk factors for low diabetes health literacy among diabetic patients. Diabetic patients who were female (OR=1.623, 95% CI: 0.715–2.312); had a family history of diabetes (OR=2.523, 95% CI: 1.055–4.312); had less than 1 year of education (OR=13.041, 95% CI: 10.875–17.154), 1–6 years of education (OR=7.524, 95% CI: 5.548–9.652), or 7–12 years of education (OR=3.255, 95% CI: 1.925–5.146), were more likely to have lower diabetes health literacy.

**Table 2. Health literacy scores for diabetes control**

	Mean±SD	Median (IQR)	P.V
Overall	46.0±22.35	44.0 (18.0–92.0)	0.000
Age group			
- Below 40 years	49.0±22.35	48.0 (18.0–92.0)	
- 40–55 years	41.0±25.73	40.0 (17.0–85.0)	
- 56–70 years	39.0±75.01	38.0 (15.0–81.0)	0.001
- Above 70 years	34.0±22.35	30.0 (11.0–73.0)	
Sex			
- Male	48.0±38.19	46.0 (19.0–92.0)	
- Female	44.0±75.05	44.0 (18.0–89.0)	0.002
Education			
- Illiterate	43.0±82.55	41.0 (18.0–87.0)	
- End of primary	45.0±62.08	43.0 (18.0–90.0)	
- Diploma	47.0±28.11	45.0 (19.0–90.0)	0.000
- College education	49.0±29.14	47.0 (25.0–92.0)	
Family history or diabetes			
- Yes	48.0±39.65	46.0 (24.0–92.0)	
- No	44.0±17.88	42.0 (18.0–87.0)	0.005
BMI			
- Below 18 kg/m <sup>2</sup>	47.0±25.08	45.0 (21.0–92.0)	
- 18–25 kg/m <sup>2</sup>	46.0±84.62	45.0 (20.0–91.0)	
- 26–30 kg/m <sup>2</sup>	47.0±34.42	45.0 (19.0–88.0)	0.185
- Above 30 kg/m <sup>2</sup>	45.0±74.74	44.0 (18.0–88.0)	
Other chronic disease			
- Yes	46.0±75.01	44.0 (19.0–92.0)	
- No	46.0±15.95	44.0 (18.0–90.0)	0.285
Marital status			
- Stable	45.0±78.19	44.0 (19.0–92.0)	
- Unstable	46.0±01.88	44.0 (18.0–91.0)	0.075

**Table 3. Results of binary logistic regression analysis of risk factors for low diabetes health literacy**

	OR	95% CI	P.V
Sex			
- Male	1.00		
- Female	1.623	0.715–2.312	0.002
Education			
- College education	1.00		
- Diploma	3.255	1.925–5.146	0.000
- End of primary	7.524	5.548–9.652	0.000
- Illiterate	13.041	10.875–17.154	0.000
Family history of diabetes			
- Yes	1.00		
- No	2.523	1.055–4.312	0.005

## Discussion

This study revealed that the level of health literacy in the Shahroud area of northeast Iran was lesser by 50%, which is similar to the findings of other studies.<sup>5,21,22</sup> These results, collectively, with the large population living in northeast Iran suggest an emerging serious public health problem in this country.<sup>3</sup> Diabetes can be prevented or delayed in individuals with prediabetes through appropriate interventions; hence, the rising prevalence of prediabetes and diabetes in Iran has highlighted a need for better prevention.<sup>3–6</sup>

Li and Xu showed a direct association between diabetes-specific health literacy and self-care assessment ability of patients, and demonstrated that health literacy measures should include indicators of disease-specific knowledge and/or understanding.<sup>23,24</sup> Thus, it is better to measure health literacy specific to diabetes prevention and control while assessing health literacy level on diabetes prevention. Health literacy specific to diabetes prevention and control is crucial for diabetes management and prevention. Thus, the questionnaire

used here accurately reflected health literacy for diabetes prevention and control among diabetic patients.<sup>25-27</sup>

The median diabetes health literacy score in patients was 44.0 (18.0–92.0); the lowest score was 18.0 and the highest score was 92.0. Our results are similar to findings of others studies from different countries.<sup>28-30</sup> A survey using the same questionnaire, which assessed 4282 residents aged 18–60 years without diabetes in China, showed a low level of diabetes health literacy.<sup>31</sup> The mean rate of diabetes health literacy was 43.0±82.55 among people with less than 1 year of education. Low health literacy is also associated with age, in particular, among people aged 70 years or above. Thus, the patients who have a high risk of progressive diabetes should be targeted for diabetes prevention as low health literacy is associated with poorer health outcomes. Diabetes health literacy is related to diabetes knowledge, self-efficacy, self-care behaviors, and glycemic control.<sup>32-35</sup>

Understanding of the positive (positive history of hyperglycemia) and negative factors (sociodemographic variables) associated with diabetes health literacy is necessary for implementing preventive measures.<sup>36</sup> In our study. Binary logistic regression revealed that the risk factors for low diabetes health literacy in diabetic patients included: female patients, low level of education, and family history of diabetes. These results are consistent with the previous studies, although the finding of hyperglycemia in first-degree relatives family is new to this study.<sup>37,38</sup>

Women have lower diabetes health literacy than men, as reported in other countries. Health literacy is identified as a key health determinant due to its link to the behavioral choices and service usage.<sup>39,40</sup>

Education is an important factor with regard to health literacy. Some studies have found an association between the education and health literacy components (e.g., nutrition literacy, health knowledge, and personal skills). The level of evidence supporting a correlation between education and health literacy was rated as moderate; people with a high level of education had better health outcomes due to the mediating effect of health literacy.<sup>41,42</sup>

We found that familial history of hyperglycemia influenced diabetes health literacy. People with a history of hyperglycemia in first-degree relatives had a higher level of diabetes health literacy, likely because they are concerned about developing diabetes and actively seek information on diabetes and related behaviors.<sup>39-41</sup>

Health literacy also mediates the relationship between education and glycemic control among low-income patients with diabetes. People with low literacy may face challenges in writing and communication,<sup>35</sup> in particular, they are less likely to initiate and maintain successful diabetes care, which involves interactive communication and participatory decision-making. Diabetic patients in Shahroud area have low diabetes health literacy, low educational levels, and insufficient health education; therefore, they may not look for effective or suitable resources. Because health literacy includes diabetes-specific knowledge, self-efficacy, self-care behaviors, and glycemic

control, strategies to improve health literacy are urgently needed.<sup>34-37</sup>

A limitation of this study is its cross-sectional design; hence, that cannot clear of causal and reason relationship. Moreover, we cannot ignore that the self-reported design introduced bias; hence, further studies are needed to confirm these findings.

Our study has revealed very low health literacy regarding diabetes prevention and control among the diabetic population in Shahroud city. Being female, having a low educational level, and history of hyperglycemia, were risk factors for low diabetes health literacy among diabetic patients. Considering the high prevalence of diabetes in Shahroud city and the low educational attainment, low income, and a wide range of age of this population, future studies should evaluate appropriate measures for improving diabetes-related health literacy among these individuals.

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## Conflict of Interest

The authors declared that they have no conflict of interest.

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