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The Relationship of Self-efficacy and Demographic Characteristics With Blood Glucose Control in Iranian Older Adults With Diabetes Type II: A Cross-Sectional Study

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Abstract

Objectives: The present study was conducted to investigate the relationship of self-efficacy and demographic characteristics with blood glucose control in older patients with diabetes type II who referred to an endocrinology clinic in the northwest of Iran.

Materials and Methods: This descriptive cross-sectional study was conducted using a random sampling method through which the patients were divided into controlled and uncontrolled groups. A total of 290 eligible volunteers participated in the research during November-March 2016. The Diabetes Management Self-efficacy Scale and demographic information form were completed by face-to-face interviews. Based on the hemoglobin A1c (HbA1c) level, the patients were assigned to controlled (HbA1c<7) and uncontrolled (HbA1c>7) groups. Finally, the data were analyzed using SPSS.

Results: The results showed a significant difference between the 2 groups regarding the mean self-efficacy scores after adjusting for the blood glucose control confounding variables ($P \leq 0.05$). Moreover, all the dimensions of participants' self-efficacy scores had significant relationships with the glycosylated hemoglobin level ($P \leq 0.05$). In terms of personal details, variables including the time since diagnosis of diabetes, education, and economic status had significant relationships with blood glucose control as well ($P \leq 0.05$).

Conclusions: In general, the economic status, education, and time since diagnosis of diabetes affected diabetes control. Thus, performing interventions to improve the self-efficacy and well-being of these patients can improve their self-care and blood glucose control.

Keywords: Self-efficacy, Glycosylated hemoglobin, Demographic characteristics, Diabetes type II

Introduction

Despite the rise in the incidence of diabetes type II in young adults and even adolescents in the last 2 decades, this disease is normally associated with older age (1). The prevalence of diabetes and glucose disorder is also increasing in Iran. According to the World Health Organization, the prevalence of diabetes and related risk factors was 10.3% (9.6% and 11.1% for males and females, respectively) in Iran (2). Diabetes is one of the most important illnesses which is attributed to old age. Almost ¼ of over-65-year-old individuals suffer from diabetes, and the number of diabetic patients is predicted to increase in the future. In addition, seniors with diabetes have a high mortality rate, are unable to function, have low muscle strength, and are susceptible to other diseases. These may undermine the self-care abilities of diabetic patients (3).

Several parameters such as the daily control of diabetes, using self-care methods, and high self-confidence can help these patients control their disease and the factors affecting diabetes control include the relationship between self-efficacy and self-care behaviors (4). According to the American Diabetes Association, health consultants providing healthcare services should take the responsibility of treating and monitoring the effective self-care behaviors of the patients (5). Self-efficacy is an influential factor that can play an important role in self-care and diabetes control. Further, researchers believe that self-efficacy is an appropriate framework for understanding and predicting patients' behaviors and commitment regarding taking care of themselves.

Self-efficacy was first introduced by a psychologist called Albert Bandura. He believed that self-efficacy is the principal device for predicting people's behaviors and indicates extensive changes in individuals' behaviors and high functioning (6).

Several studies reported a significant relationship between self-efficacy and health behaviors (7,8). Although enhanced self-efficacy in diabetic patients contributes to improved self-care and diabetes control, limited data is available regarding the relationship between diabetes self-efficacy and health behaviors in senior people. However, it

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should be mentioned that self-efficacy may be influenced by experience, older age, and self-care beliefs (9).

Similarly, some studies confirmed the effect of self-efficacy on various dimensions of the life of the elderly. For example, self-efficacy was found to be associated with self-care, physical activity, and the quality of life in the elderly. Different researchers have widely discussed self-efficacy in terms of age conditions, physiological changes, and their vulnerability in all age groups, especially in the elderly (10)

The increase in diabetes self-efficacy is concerned with improvements in the patient's ability to manage factors such as self-care behaviors including foot care, as well as diet, physical activity, medications, and blood glucose monitoring (11).

The hemoglobin A1c (HbA1c) assay provides a dependable measure of chronic glycemia and correlates with the risk of long-term diabetes complications so that it is currently considered as the selection test for monitoring and chronic management of diabetes (12). Glycosylated HbA1c, which is formed through a nonenzymatic and unalterable rebound between Hb and glucose, is the primary successor marker for long-term glycemic control and provides data on the average glucose levels during the old months (13).

Previous studies on diabetes discussed the relationship between diabetes and the control of metabolic biomarkers such as glycosylated hemoglobin with little certainty. For example, the results from a randomized clinical trial showed that increased self-efficacy over time has a significant relationship with improved metabolic control and glycosylated HbA1c (14). Some studies indicated that self-efficacy has no relationships with physiological variables such as glycosylated HbA1c and body mass index (15-18). The Australian Diabetes Society recommends a target glycosylated Hb of less than 7% in diabetic patients. Nevertheless, the patient's conditions should be considered as well. Therefore, identifying these factors can have a positive or negative effect on blood glucose control and reduce the complications of this disease (19). Under the new conditions of health care provision, patient-oriented care requires assessing factors leading to improved clinical and economic outcomes for diabetic patients by policy-makers and health care providers (20). Furthermore, designing effective approaches to diabetes self-care in Iranian diabetic patients requires evaluating the predictive value of demographic characteristics in these patients for determining their treatment adherence and future clinical outcomes. Given the importance of diabetes and the variables of self-efficacy and demographic characteristics, previous studies (9,15-18,21) have demonstrated conflicting results in this regard. Moreover, different cultural settings can lead to different results regarding psychological constructs such as self-efficacy (22). Accordingly, the present study aimed to evaluate the relationship of self-efficacy and demographic characteristics with blood glucose control in older Iranian patients with diabetes.

Materials and Methods

Study Design and Participants

The present descriptive, correlational, cross-sectional study was conducted in Tabriz located in the northwest of Iran during November-March 2016. The study population consisted of over-65-year-old people with diabetes type II who had medical records at the Endocrinology Clinic of Sina hospital in Tabriz. The sample size was determined as 135 per group (276 patients in total) based on the results of a study conducted by Ebady et al (23), a 95% CI (1-α=0.95), an 80% test power (1-β=0.8), and equal sample sizes in the 2 groups (K=1). Then, the total sample size was increased to 290 to take account of a potential sample loss of 10%.

The inclusion criteria consisted of being over-65-year-old males or females, having diabetes type II and records at Tabriz University of Medical Sciences Teaching Hospital (the Endocrinology Clinic of Sina Hospital), having at least a 2-year history of diagnosis with diabetes, and finally, having the minimum reading and writing literacy. The exclusion criteria included having acute diabetes complications (i.e., diabetic acidosis, hypoglycemia, lactic acidosis, orthostatic hypertension, and hepatomegaly), stroke in the last 3 months, severe infection (i.e., septicemia, endocarditis, and debilitating infections), severe cognitive problems unrelated to diabetes complications (i.e., chronic alcoholism, congenital brain syndromes, tumors, and psychological disorders), severe kidney failure, diabetic foot ulcers, any severe or large physical lesions, or severe cognitive disorders.

The researcher reviewed the medical records of patients who referred to the Endocrine Center of Sina hospital and identified eligible individuals. Patients were initially requested to perform the HbA1c test on the instructions of the relevant endocrinologist. Then, they referred to the laboratory of the same hospital for this test. This test was performed with a Diazyme test kit and its result was documented in the patient's medical records which were then examined by the researcher and an endocrinologist. Glycosylated Hb HbA1c was considered as an indicator of blood glucose control in the present study. Further, the patients were assigned to controlled (HbA1c<7) and uncontrolled (HbA1c>7) groups by the endocrinologist based on their HbA1c level and in accordance with the instructions of the American Diabetes Association. This study was conducted on patients over 65 years old with diabetes considering the problems of the elderly period (3), the necessity of investigating the self-efficacy of diabetes in these patients (6,9,10), and the limited number of previous studies in this field (9,10).

After introducing himself, the researcher briefed the participants on the study objectives and obtained written consent from them and then completed the questionnaires

based on their conditions and eligibility. There were no cases of withdrawal from the study and all the 290 patients completed the project.

Instruments

The data were collected using a demographic information form containing 11 items on the variables of age, gender, marital status, education, economic status, physical status, time since diagnosis of diabetes, diabetes control medications, HbA1c level in the past year, as well as a history of smoking and drug use and the duration of smoking.

The Diabetes Management Self-Efficacy Scale was used to assess the patients' self-efficacy. This scale, developed by Bijel et al, contains 20 items that assess the patients' ability to adhere to self-care behaviors based on 5 domains, including specific nutrition (5 items), general nutrition (5 items), blood glucose control (5 items), physical activity and weight control (3 items), and medical care (4 items). The scores on the scale ranged from 0 to 200, and the patients were divided into 3 groups based on their self-efficacy scores, including high (scores 134-200), moderate (66-133), and low (0-65) self-efficacy groups. The items were scored based on an 11-point Likert-type scale ranging from "cannot do it at all" (0 points) to "certainly can do it" (10 points). Several studies across different countries validated this questionnaire, including McDowell et al (24) in Australia and by Wu et al (25) in China. In addition, its validity and reliability were confirmed in previous studies. Noroozi and Tahmasebi assessed the validity and reliability of this instrument in Iran as well (26), where its internal consistency was confirmed with a Cronbach alpha coefficient of 0.92.

Statistical Analysis

The collected data were analyzed in SPSS, version 15. The independent *t* test was used to compare the controlled and uncontrolled groups in terms of their quantitative demographic variables. Further, the chi-square test was utilized to compare the groups in terms of their qualitative demographic variables.

Self-efficacy was compared between the 2 groups using the independent *t* test. Furthermore, this variable was compared between the 2 groups using the Mann-Whitney test once it was categorized into normal, moderate, and low levels since it became ordinal after categorization.

The relationship between self-efficacy and A1c was assessed using the Pearson correlation coefficient and Spearman test for normal quantitative and ordinal data, respectively. Moreover, the severity of the effect of A1c on the self-efficacy score was evaluated using the linear regression, and the regression coefficients, confidence intervals, and significance levels of the coefficients were reported as well. The $P<0.05$ was considered as a statistically significant level and the associations were expressed as the odds ratios and 95% CIs.

Results

The Relationship of Demographic Variables With Blood Glucose Control and the General Details of Participants

In general, 290 older patients with diabetes type II were assessed in controlled and uncontrolled groups, including 156 (53.8%) males and 134 (46.2%) females with a mean age of 71 years. The results of the chi-square test showed that blood glucose control had a significant relationship with education ($P=0.014$), economic status ($P=0.009$), time since diagnosis of diabetes ($P=0.002$), and glycosylated hemoglobin level ($P<0.001$) in both controlled and uncontrolled groups. However, no such relationships were observed regarding the other demographic variables such as age, gender, marital status, physical status, diabetes control medications, a history of smoking and drug use, and the duration of smoking ($P>0.05$), the related data are provided in Table 1.

The Comparison of Self-efficacy and its Dimensions in Controlled and Uncontrolled Groups

The logistic regression test demonstrated significant differences between the 2 groups of patients with diabetes type II regarding the mean score of self-efficacy based on the 3 categories of the variable ($P\leq0.05$). After adjusting for the confounding variables of age, gender, marital status, education, economic status, and smoking history, the logistic regression test indicated that self-efficacy has a significant effect on the good or poor control of diabetes ($P\leq0.05$), the details of which are presented in Table 2.

Based on the results of the Mann-Whitney test, significant differences were found between the controlled and uncontrolled groups of patients with diabetes type II in terms of the mean score of self-efficacy in all domains and the overall score ($P\leq0.05$). Among the different domains, the mean (SD) score of self-efficacy was 34.92 (10.32) and 36.34 (9.18) respecting specific and general nutrition in the controlled group, respectively. These scores were 26.15 (12.77) and 26.97 (12.27) in the uncontrolled group (Table 3).

The Relationship of Self-efficacy and its Dimensions With Glycosylated Hemoglobin Level

The results of Spearman test (Table 4) showed that self-efficacy has a significant relationship with glycosylated hemoglobin in the domains of specific nutrition, general nutrition, and medical care and the total score in the controlled group, as well as the scores of all domains and the total score in all the participants ($P\leq0.05$).

Discussion

The present study was designed and conducted to determine the relationship of self-efficacy and demographic characteristics with blood glucose control in Iranian older patients with diabetes type II.

Based on the results, 51.3% of the study participants had uncontrolled HbA1c, suggesting poor diabetes control.

Table 1. The Personal and Demographic Characteristics of the Participants in Controlled and Uncontrolled Groups

Variable	Subgroup	Controlled Group (n=141), No. (%)	Uncontrolled Group (n=149), No. (%)	*P* Value
Age (years)		71.80 (5.39)	71.51 (5.45)	0.648
Gender	Male	78 (55.3)	78 (52.3)	0.612
	Female	63(44.7)	71(47.7)	
Marital status	Single	13(9.2)	16(10.7)	0.850
	Married	108(76.6)	106(71.1)	
	Divorced	3(2.1)	5(3.4)	
	Widowed	14(9.9)	19(12.8)	
	Other	3(2.1)	3(2.0)	
Education	Primary	71(50.4)	91(61.1)	0.014*
	High school	52(36.9)	51(34.2)	
	High school diploma and above	18(12.8)	7(4.7)	
Economic status	Income less than expenses	31(22.0)	53(35.6)	0.009*
	Income equal to expenses	96(68.1)	87(58.4)	
	Income more than expenses	14(9.9)	9(6.0)	
Physical status	With debilitating conditions	16(11.3)	21(14.1)	0.484
	Without debilitating conditions	125(88.7)	128(85.9)	
Time since diagnosis with diabetes	5 years and less	47(33.3)	23(15.4)	0.002*
	6 to 10 years	59(41.8)	60(40.3)	
	11 to 15 years	19(13.5)	36(24.2)	
	16 to 20 years	10(7.1)	19(12.8)	
	20 years and longer	6(4.3)	11(7.4)	
Diabetes medications	Insulin therapy	12(8.5)	9(6.0)	0.303
	Oral antidiabetics	111(78.7)	112(75.2)	
	Both	18(12.8)	28(18.8)	
One-year HbA1C		6.52(0.52)	9.13(1.43)	<0.001*
History of smoking and drug use	Yes	20(14.2)	31(20.8)	0.139
	No	121(85.8)	118(79.2)	
Duration of smoking (years)		1.76(7.60)	4.76(10.43)	0.061

HbA1C, Glycosylated hemoglobin.

* $P<0.05$.

The findings of studies in Jordan, Saudi Arabian, and the American Diabetes Association revealed that more than half of their participants had poor diabetes control (27-29), which is in line with our findings. One possible explanation in this regard is that this sample of Iranian subjects demonstrated low levels of self-management behaviors that may contribute to their higher levels of glycosylated HbA1c.

According to the results, the patients had moderate to poor self-efficacy, which corroborates with the results of some other studies conducted in Iran (30-34), reporting a poor self-efficacy. One possible explanation for this similarity is that the average age of the participants was over 40 years and the same cultural community. Therefore, self-efficacy and its relationship with self-care should be further emphasized in health planning and educational interventions among Iranian diabetic patients.

In the present study, the majority of the patients in the controlled group had high self-efficacy scores even when controlling the confounding variables affecting diabetes control, including age, gender, marital status, education,

Table 2. A Comparison of the Frequency of Self-efficacy in Controlled and Uncontrolled Groups

Self-efficacy	Group	Number (%)	*P* Value
High (134-200)	Controlled	99 (63.5)	<0.001[a]
	Uncontrolled	57 (36.5)	
Moderate (66-133)	Controlled	36 (38.7)	
	Uncontrolled	57 (61.3)	
Low (0-65)	Controlled	6 (14.6)	
	Uncontrolled	35 (85.4)	

[a] Logistic regression test.

Table 3. The Mean Self-efficacy Score in Controlled and Uncontrolled Groups According to the Domains

Domain (Range of Score)	Group	Mean (SD)	*P* Value
Specific nutrition (0-50)	Controlled	34.92 (10.32)	≤0.001[a]
	Uncontrolled	26.15 (12.77)	
General nutrition (0-50)	Controlled	36.34 (9.18)	≤0.001[a]
	Uncontrolled	26.97 (12.27)	
Blood glucose control (0-30)	Controlled	21.85 (5.83)	≤0.001[a]
	Uncontrolled	16.91 (7.99)	
Physical activity and weight control (0-30)	Controlled	21.75 (6.04)	≤0.001[a]
	Uncontrolled	26.61 (7.42)	
Medical care (0-40)	Controlled	32.00 (5.97)	≤0.001[a]
	Uncontrolled	24.37 (10.22)	
Total score (0-200)	Controlled	146.86 (32.43)	≤0.001[a]
	Uncontrolled	111.00 (47.56)	

[a] Mann-Whitney test.

Table 4. The Relationship of Self-efficacy and its Dimensions With Glycosylated Hemoglobin in Patients With Type II Diabetes

Domain	Group	Glycosylated Hemoglobin
Specific nutrition (0-50)	Controlled	r=0.196*, *P*=0.020*
	Uncontrolled	r=0.146, *P*=0.076
	Total	r=0.366, *P*≤0.001
General nutrition (0-50)	Controlled	r=0.231, *P*=0.006
	Uncontrolled	r=0.146, *P*=0.075
	Total	r=0.417, *P*≤0.001
Blood glucose control (0-30)	Controlled	r=0.155, *P*=0.066
	Uncontrolled	r=0.080, *P*=0.331
	Total	r=0.340, *P*≤0.001
Physical activity and weight control (0-30)	Controlled	r=0.163, *P*=0.054
	Uncontrolled	r=0.085, *P*=0.305
	Total	r=0.367, *P*≤0.001
Medical care (0-40)	Controlled	r=0.206, *P*=0.014
	Uncontrolled	r=0.140, *P*=0.088
	Total	r=0.411, *P*≤0.001
Total score (0-200)	Controlled	r=0.239, *P*=0.004
	Uncontrolled	r=0.137, *P*=0.095
	Total	r=0.420, *P*=0.001

[a] Spearman test.

economic status, and smoking history. However, the patients in the uncontrolled group received moderate to low scores, which conforms to the results of several studies (35-38) who found that increased self-efficacy in diabetic patients leads to better diabetes control and improved self-care. The participants who projected poor self-care behaviors were believed to have poor diabetes control. Poor diabetic self-care behaviors may be associated with potential barriers such as social, cultural, financial, and medical factors, which were not assessed in the present study, leading to poor self-care adherence and thus poor glycemic control.

Given that the obtained theories from diabetes educational programs are based on the theory of self-efficacy, the results of some studies show that diabetes educational programs based on this theory affect self-care in these patients. Yoo et al also argued that interventions that increase self-efficacy can help improve self-care behaviors and health status in these patients (39).

Studies conducted on the relationship between self-efficacy and metabolic biomarkers, including HbA1c, reported conflicting results in this regard. Based on the results of the present study, self-efficacy had a completely significant relationship with HbA1c, and an increased self-efficacy reduced HbA1c in diabetic patients. Some studies reported similar results (9,40-42).

In a study on 240 diabetic patients, Latham et al found a significant relationship between diabetic self-efficacy and physiological variables such as HbA1c (37). Nonetheless, some other studies conducted in the United States and Australia reported no relationship between self-efficacy and HbA1c (15-18). This disparity of findings may be due to the use of different self-efficacy measurement tools, as well as the different examined societies and cultures and the use of different HbA1c measurement tools with varying sensitivities.

Among the 5 subscales of self-care in the dimensions of self-efficacy, the patients had problems in terms of nutrition control, and diet self-efficacy was the most considerable predictor of glycemic control. Further analysis showed that subjects with greater diet self-efficacy behavior had lower HbA1c levels, which agrees with the results obtained by Lee et al (43), Rashidi et al (44), Ludlow and Gein (45). The findings of previous studies (25,46-48) were associated with better glycemic control in which participants had poorer perceived self-efficacy in terms of behaviors related to a diabetes diet.

The results of this study can have many applications respecting caring for diabetic patients and their proper training. In addition, our results suggest that using interventions regarding increasing self-efficacy in training programs for diabetic patients should be part of counseling and skill enhancement programs for patients to control diabetes. Drawing on these results, appropriate training can be developed for nurses regarding correct and accurate therapeutic measures to control blood sugar. Diabetic patients can better control diabetes and prevent further complications as well.

Nurses and other healthcare specialists dealing with these patients can only evaluate both their knowledge of diabetes and patients' self-caring level in taking care of themselves.

Moreover, there was a significant relationship between economic status and blood glucose control in diabetic patients, implying that the patients with a high income and good economic status had good self-management and blood glucose control, which is in line with the results reported in other studies (49-53). In comparison, the defects in self-control and poor nutrition habits can be controlled with high incomes. For instance, financial empowerment can solve the problem by encouraging the purchase of new types of food that did not previously exist in the diabetic patient's diet and helping plan for smaller portions of food at a higher frequency as recommended by nutritionists. The patients thus can overcome the problems with the costs of medications as well (50).

Additionally, patients with high education had greater success in controlling the blood glucose and their HbA1c was lower, which concurs with the results of several studies (20,49,51,53,54). These results and those of previous studies show that education may affect the patients' knowledge of diabetes, as well as their relationship with the health care providers and their adherence to complex treatment regimens, which may explain the positive relationship between education and clinical outcomes (20).

In a study conducted in the United kingdom, Abubakari et al reported that diabetic patients with a longer time

since their disease diagnosis have a greater understanding of their condition, have overcome their negative feelings about the disease, have come to terms with the reality about their condition, and thus have a better control over the disease (49). However, the results of the above-mentioned study disagree with those of the present study, which showed that blood glucose control reduces over a long time since the diagnosis of disease. The results of some other studies (50,55) match with the present findings. In general, the long time since the diagnosis of diabetes may adversely affect self-management in these patients, especially when it is accompanied by long-term complications. Therefore, older patients with poor self-care adherence and long-term complications require a caregiver (50).

The strengths of the present study include dividing the patients into controlled and uncontrolled groups according to their HbA1c level and comparing the obtained results in the 2 groups, as well as the selection of the outpatients with no acute or mobility problems that could affect their self-esteem. In addition, using participants' local Turkish dialect helped communicate with them more effectively.

The study limitations included the possibly inadequate sample size. Likewise, given that self-efficacy is a culture-dependent psychological construct, the results may differ between these patients, who were Iranians with a Turkish dialect, and other Iranians. Different studies use different tests for measuring the HbA1c, which may affect the results (44). In the present study, the Diazyme test kit was used, which may have affected the HbA1c results.

Accordingly, future studies on this subject should be conducted on larger statistical populations. The investigation of the factors affecting self-efficacy and self-care behaviors and the successes that increase self-efficacy in diabetic patients, along with the patients' expected outcomes require further studies. To control the effect of culture, this study should be repeated several times in the same cultural setting and the results should be compared and analyzed in order to remove any bias in this regard.

Conclusions

In general, the findings showed that patients with higher self-efficacy, higher education, better economic status, and shorter time since their diabetes diagnosis have better self-care adherence and blood glucose control. Therefore, patients' demographic and psychological characteristics (e.g., self-efficacy) should receive particular attention in order to achieve desirable clinical outcomes. Thus, using the theory of self-efficacy as a framework for designing diabetes educational and interventional programs is essential. Accordingly, health service providers should consider different aspects of the theory of self-efficacy, including a healthy diet, regular physical activity, and blood glucose monitoring when designing educational programs to improve self-care behaviors and achieve desirable glycemic control in diabetes patients.

Conflict of Interests

Authors have no conflict of interests.

Ethical Issues

This study was approved and conducted under the ethics code of 5/d/96454 obtained from Tabriz University of Medical Sciences in compliance with the ethical principles of research.

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