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# Evaluation of the relationship between different factors of self-management and control of diabetes in diabetic patients group

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## Abstract

**Introduction:** Diabetes is one of the most common chronic diseases that severely affects the quality of life. Self-Management and glycemic control minimize the development and progression of diabetes's complications.
**Objectives:** We aimed to evaluate self-care behaviors and their relationship with hemoglobin A1c (HbA1c) level in patients with type 2 diabetes, using the Diabetes Self-Management Questionnaire (DSMQ).
**Patients and Methods:** This is a cross-sectional study conducted on type 2 diabetic patients referred to the Shahid Beheshti hospital of Qom. A total of 325 patients with type-2 diabetes participate in the study. Diabetes self-management parameters were assessed using the translated (Persian) version of the DSMQ.
**Results:** The mean score of self-management (±SD) in patients was 26.82 (±9.43). In addition, the mean HbA1c and fasting blood sugar (FBS) levels of the participants respectively were 8.35 (±1.97) and 187.25 (±77.51). There was a significant inverse correlation between self-management score metabolic control indices. ($P<0.001$). Health care use subscales have been best associated with better glycemic control ($P<0.001$) and physical activity had the least effect on it ($P<0.001$).
**Conclusion:** The findings of this study revealed that there is a significant relationship between self-management indicators and control of diabetes.

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## Introduction

Diabetes mellitus is one of the important causes of premature death and depletion of quality of life that constrains high economic and social costs on individuals and countries (1, 2). It is also one of the major health problems in most countries, which the World Health Organization (WHO) has described as a silent epidemic (3).

The worldwide prevalence of diabetes mellitus (DM) increases constantly (4). It is estimated that in 2019, 463 million people will living with diabetes, representing 9.3% of the world's adult population (20-79 years). This number is anticipated to increase to 578 million in 2030 and 700 million (10.9%) in 2045. For type 2 diabetes (T2D), which estimates for approximately 90% of the total, the increasing trend can be ascribed to aging, rapid urbanization and obesity (5,6).

DM is the most common non-communicable disease in Iran (3). This is a significant public health concern in Iran due to its high prevalence, increased incidence and heavy economic burden (4,7). The International Diabetes Federation (IDF) estimates that there were more than 4.6 million cases of diabetes in Iran in 2015 [8.5% of the adult population (20-79 years)] (4,7,8).

Both type 1 and type 2 diabetes have long-term complications. These complications threaten patient health, reduce life expectancy and increase diabetes mortality (2-5). Most of these complications are probably due to microvascular and macrovascular dysfunction; and they make diabetics more

### Key point

Diabetes is one of the most common non-communicable diseases, which imposes a great economic and social burden on communities due to its high prevalence and irreversible complications. Given the various factors influencing the control of this disease, researchers suggest that different aspects of patients' self-management play an important role in controlling diabetes. The results of our study revealed a significant relationship between self-management indicators and control of diabetes.

susceptible to diseases such as cardiovascular disease, nephropathy, neuropathy, retinopathy (9). Aging, obesity, and physical inactivity are important risk factors for the development of diabetes and these complications (10). Proper management of diabetes delays or prevents complications.

The principal purpose of DM treatment is to manage the metabolic status and prevent complications (1,11). Diabetes self-management is propounded as the cornerstone of DM management (2).

Diabetes self-management is the process by which a patient uses his information, skills, and abilities to manage and improve his condition (12,13). Diabetes self-management includes self-care activities include appropriate diet, regular physical activity, and foot care, regularly self-monitoring blood glucose, adaptation to life-long medication treatment and being on a healthy lifestyle (1, 4).

Self-management and glycemic control minimize the development of diabetes complications; thereby diabetic patients who have basic self-management skills are more successful in controlling diabetes (11,14).

The study in South Korea has reported that strengthened self-management competency may lead to better healthcare transition readiness and better life quality in adults with DM (15). Other studies have shown that long-term complications of diabetes are seen in patients with poorer self-management and the development of diabetic neuropathy and nephropathy is associated with poor self-management (12). Other studies have also shown a direct relationship between patients' self-care and their blood glucose control and HbA1c levels (16).

Hemoglobin A1c (HbA1c) is a major predictor of future complications that are related to diabetes, this endocrine test has averaged blood glucose concentrations over the past three months, HbA1c level is considered above 7% uncontrolled glycemia (4,17).

Although many factors may be effective in glycemic control, accomplishing self-management behaviors such as a healthy diet, regular exercise, self-monitoring of blood sugar and medication play a key role in glycemic control (17). To date, various tools have been used to assess the self-care behaviors of diabetic patients .In this study, we used the Diabetes Self-Management Questionnaire (DSMQ) to measure the level of self-care and its relationship with the HbA1c level. The questionnaire was designed by the research department of the Mergentheim Diabetes Academy of Germany to evaluate self-care behaviors that can be linked to blood HbA1c levels Therefore, this data can be used for statistical calculations.

## Objectives

This study would shed light on the relationship between the levels of self-care of patients with diabetes on their serum HbA1c levels.

## Patients and Methods

### *Study design*

This cross-sectional study was conducted on type 2 diabetic patients referred to internal or endocrinology clinics of Shahid Beheshti hospital of Qom university of medical sciences (January 2019 and April 2020).

Patients aged 20 to 70 years were included in this study. Other inclusion criteria for the study were: type 2 DM, diagnosed at least eight weeks before, recent HbA1c measurement (taken less than 8 weeks from the date of interview), consented to participate in this study, taking anti-diabetic drugs for at least eight weeks and sufficient communication skills in the Persian language. Patients with type 1 and gestational diabetes, chronic complications of diabetes like nephropathy, or inability to complete the interviews were excluded. The required sample size for the study (325 subjects) was calculated according to and power of 0.90% and type I error of 0.05.

Study participants were interviewed face-to-face for the collection of socio-demographic data and DSMQ questioner. Diabetes self-care activities were assessed using the translated (Persian) version of the DSMQ. Around 325 eligible patients consented to participate in the study (response rate approximately 100%).

### *Measurements*

The questionnaire was designed by the research department of the MDAG. DSMQ was developed to investigate diabetes self-care behaviors related to glycemic control in adult patients with type 1 and type 2 DM over the past two months.

Patients were requested to answer 16 items of the DSMQ. Ranking was conducted using a four-point Likert scale. In addition to the "Sum Scale" (sum of the scores of all 16 items), the tool also examines four sub-scores. "Glucose management", "Diet Control", "Physical activity" and "Use of Health Care". We used the Persian version of this questionnaire, the reliability and validity of which were proven by a study published by Mehravar et al (12).

### *Scoring criteria*

DSMQ scores include summing the scores of all items after reversing the scores of nine negative sentences). The scores of the subscales will also be calculated separately.

### *Data analysis*

The data were finally described by SPSS software version 20 with central indicators and by independent *t* tests to compare the mean of quantitative variables in two-state variables, analysis of variance (ANOVA) to compare the mean of quantitative variables in three-state variables and Pearson's correlation coefficient to examine the correlation of quantitative variables. It should be noted that, the significance level of the tests used was less than 0.05.

## Results

The sample characteristics are displayed in (Table 1). The total sample comprised 325 patients with type 2 diabetes mellitus (T2DM). Patients had a mean (±SD) age of 58.43 (±10.44) years; the mean body mass index (BMI) was 30.49 (±8.34) kg/m$^2$ and the participants comprised 89 (28.3%) men and 236 (71.7%) women.

The mean duration of diabetes in studied participants was 12.03 (±7.95) years. Regarding their education, 67.0% of participants had completed primary or lower education and 3.1 % had a college education Most participants were married (98.4%). The Majority of patients used oral hypoglycemic agents alone (63.6%) or in combination with insulin (13.8%), whereas 22.6 % used insulin exclusively. The mean HbA1c and fasting blood sugar (FBS) levels of the participants respectively were 8.35(±1.97) and 187.25 (±77.51).

The mean score of self-management (±SD) in patients was 26.82 (±9.43). Mean score for the subscales of glucose management, dietary control and health care use and also physical activity was 10.55, 6.89, 6.35, and 1.33.

In all four sub-scores, there is a significant inverse correlation between self-management score and HbA1c and FBS levels, therefore with increasing self-care scores, HbA1c and FBS levels decrease. (r = -0.62, $P<0.001$). In the meantime, health care use subscales were best associated with better glycemic control (r = -0.54, $P<0.001$) and physical activity had the least effect on it (r=-0.279, $P<0.001$).

Regarding the relationship between the demographic index and self-management score, there was a significant relationship between patients' age and the glucose management subscales (r= 0.11, $P=0.04$). There was no significant relationship with other demographic indicators. Furthermore, among the glycemic control indicators, only FBS showed correlation with gender ($P$ =0.005). The relationship between medication tolerances was significant. The strongest relationship was for oral hypoglycemic agent group ($P<0.001$). There was also a significant relationship between FBS, HbA1c and type of medication ($P<0.001$). Most effective behaviors on glycemic control were health care use, dietary control and glucose management, whereas physical activity appeared less effective on this regard. Except for age, other demographic variables did not extremely consequence these results.

## Discussion

The present study was designed to determine the relationship between patients' self-management scores and hyperglycemic control. The results of this study revealed a significant relationship between self-management indicators and diabetes control. The insights gained from this study may help us find the right strategies to improve patients' self-management and thus better control diabetes. The mean BMI of the patient was 30, indicating that the BMI range of our study sample differs from the BMI range in the general population. This could be due to the fact that the prevalence of obesity among patients with type 2 diabetes is significantly higher than the normal population (18). About 69.3 of our patients were female. We should not be unaware that in the Iranian population, the number of women seeking medical services from men is higher. The study conducted by Bahrami et al, in the same city, confirms this too (19). In our sample, 98.4% were married. In this regard, it should be noted that the average age of our population is 58.43 years; and normally, type 2 diabetes occurs in old age. The study also described different self-management subscales and their relationship to demographic indicators and metabolic control indicators. Interestingly, the mean blood sugar control subscale, among other self-management subscales, scored higher on our sample. This is due to the fact that our clinicians ask patients to present their self-monitor blood glucose–chart (SMBG chart) at each visit. This chart helps clinicians to titrate the dose of blood sugar lowering drugs. Physical activity and exercise have the lowest score among all subscales. Part of this has to do with the lack of culturalization for physical activity in Iranian people. Numerous articles support this topic Extensive epidemiological studies in Iranians confirm this (20-22). It seems that some patients with diabetes suffer from other concomitant diseases, such as heart disease and osteoarthritis and think that they are not capable of effective physical activity. In our findings, metabolic control indices were significantly associated with all subscales of self-management. The DMSQ questionnaire was designed by Schimitte et al in the MDAG. A previous study showed also a very strong association was reported between glycemic control metabolic indices and self-care behavior (23). The researchers also published another study in 2016, suggesting DMSQ as the preferred tool for analyzing the self-report behavioral problem of hypoglycemia in diabetics. DMSQ was also found to be useful for the clinical evaluation of behaviors that reduce hyperglycemia. In this study, the predictive power of the DMSQ questionnaire for controlling HbA1c was significantly higher ($P<0.001$) (24). These findings support the results of our study. In

**Table 1.** Demographic characteristics

| | Age (y) | Weight (kg) | Height (cm) | Duration of catch (year) | BMI (kg/m$^2$) | FBS (mg/dL) | HbA1c (%) |
|---|---|---|---|---|---|---|---|
| Mean | 58.43 | 76.4228 | 161.08 | 12.0303 | 30.10 | 187.25 | 8.3560 |
| Standard deviation | 10.440 | 13.54475 | 36.169 | 7.95668 | 5.50 | 77.511 | 1.97445 |

addition, in a study conducted with this questionnaire in Pakistan, the findings were similar to our study (17). The other two articles that studied self-management on Iranian participants contradicted the results of our work (12,25). The lack of a relationship between self-management behaviors and HbA1c does not seem logical. This is probably due to differences in sampling methods and questionnaire filling techniques. We used one of the most authoritative techniques, the interview-based method, to fill out the questionnaire, to minimize bias.

The scope of this study was limited in terms of the investigation of self-management effect on type 1 diabetes. Another possible limitation of this study is the low level of literacy of the respondents. This is probably not compatible with the literacy level of the healthy population. It should be noted that this finding has been seen in other similar studies (17).

## Conclusion

The present study was designed to determine the effect of patients' self-management in their glycemic control. The results of our study revealed a significant relationship between self-management indicators and control of diabetes. Some demographic indicators of patients such as age, duration of illness and type of medication were related to the level of self-management of patients. The results showed that self-management and disease control is highly dependent on the support of the treatment team. We suggest that subsequent clinical trials be conducted on the impact of support and the physician's request for a regular self-management program on the patient self-management level.

## Limitations of the study

The study was conducted in a public hospital and patients with higher socio-economic status were less likely to come to the center. It is suggested that in future studies, the study be conducted in a multi-central manner with the participation of private health care centers.

### Authors' contribution

SA, NK and RT were the principal investigators of the study. SA, NK, RT, SS and RS were included in preparing the concept and design. RT and MV revisited the manuscript and critically evaluated the intellectual contents. All authors participated in preparing the final draft of the manuscript, revised the manuscript and critically evaluated the intellectual contents. All authors have read and approved the content of the manuscript and confirmed the accuracy or integrity of any part of the work.

### Ethical issues

The research followed the tenets of the Declaration of Helsinki. The Ethics Committee of Qom University of Medical Sciences approved this study. The institutional ethical committee at Qom University of Medical Sciences approved all study protocols (IR.MUQ.REC.1397.147). Conscious consent was obtained from all patients to participate in the study. Accordingly, ethical issues (including plagiarism, data fabrication, double publication) were completely observed by the authors.

### Conflicts of interest

All authors have no conflicts of interest.

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