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Self-management Status and Its Associated Factors Among Rural Patients With Type 2 Diabetes in Guilan Province, North of Iran

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ABSTRACT

Introduction: Self-management programs play a crucial role in improving health outcomes among diabetic patients. However, implementing such programs in rural areas faces challenges due to cultural, economic, and accessibility-related barriers. Therefore, evaluating the effectiveness of these programs in rural communities is essential.

Objective: This study aimed to determine the self-management status and its associated factors in rural patients with Type 2 Diabetes (T2D) in Guilan, north of Iran.

Materials and Methods: This analytical cross-sectional study was conducted on 350 patients with T2D living in rural areas of Guilan Province in 2023, who were selected using a multistage cluster random sampling method. Data were collected using a socio-economic/demographic/clinical form and the Diabetes Self-Management Questionnaire-Revised (DSMQ-R). Statistical analysis was performed using the independent t-test, one-way Analysis of Variance (ANOVA), Pearson's correlation test, and linear regression analysis, considering a significance level of P<0.05.

Results: The majority of participants were female (55.4%), housekeepers (50.3%), married (70.9%), with lower than high school education (54.9%), low income sufficiency (74.9%), and a family history of diabetes (79.7%). The mean total DSMQ-R score was 5.23±1.42. Over half of the participants demonstrated unfavorable self-management practices. Among the DSMQ-R domains, the highest score was for blood glucose monitoring (5.99±1.57), and the lowest was for physical activity (3.87±2.06). About 50% of participants had an HbA1c level below 7%, indicating good glycemic control. Significant predictors of self-management scores included: High school education (b=0.95, 95% CI; 0.2, 1.7 P=0.013), university education (b=1.48, 95% CI; 0.62, 2.33, P=0.001), diabetes duration (b=-0.07, 95% CI; -0.1, -0.04, P=0.001), number of comorbidities (b=-1.02, 95% CI; -1.5, -0.54 P=0.001), body mass index (b=-0.13, 95% CI; -0.18, -0.08, P=0.001) and diastolic blood pressure (b=-0.06, 95% CI; -0.07, 0.02, P=0.001). These factors explained 48.7% of the variance in the DSMQ-R score.

Conclusion: Self-management practices (particularly physical activity) of rural patients with T2D in Guilan Province are not favorable. To enhance their effectiveness, the diabetes prevention programs in the country should be tailored to the individual, clinical, and social characteristics of rural communities.

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Highlights

- Diabetes self-management practices of rural patients in Guilan Province are below the desired levels.
- Self-management scores were significantly associated with age, diabetes duration, and blood pressure level.
- Rural self-management programs in Iran should be reviewed and tailored to local sociodemographic and cultural characteristics.

Plain Language Summary

Type 2 diabetes (T2D) is prevalent in rural areas and poses considerable risks to patients' health and quality of life (QoL). Self-care programs can effectively reduce diabetes-related complications and help manage the disease. This study aimed to assess the self-management practices of 350 rural patients with T2D in Guilan Province, Iran. Findings showed that over half of the participants had suboptimal self-management behaviors, and these behaviours were associated with age, diabetes duration, and blood pressure level. Educational level (high school/university education), diabetes duration, number of comorbidities, and diastolic blood pressure were predictors of self-management score in diabetic patients.

Introduction

Type 2 Diabetes (T2D) is a chronic and progressively burdensome condition that can significantly affect patients and the health systems [1]. Statistics show that the prevalence of this disease in Iran is 4.11%, and approximately 4 million people are infected [2]. Guilan Province has shown the highest prevalence of T2D (18.9%) in Iran, with a prediabetes prevalence of 18.2% [3]. In Iran, the prevalence is notably higher in rural areas—approximately 17% more than in urban regions [4]. Globally, it is estimated that around 12% of total health expenditures are spent on treating T2D and its complications, with countries allocating between 5-20% of their national health budgets to combating this disease [5]. In Iran, the annual negative economic burden of diabetes has been estimated at over 3.78 billion USD [6, 7].

Effective diabetes management is achievable through self-care behaviours and ongoing self-management [4]. Diabetes self-management encompasses the ongoing, independent practices adopted by individuals with or at risk of diabetes to learn how to live with the disease, effectively manage their conditions, and control the potential complications [8]. The American Diabetes Association (ADA) emphasizes that patients should actively participate in self-care [9]. It includes a healthy diet, physical activity, glucose monitoring, appropriate medication, problem-solving beliefs, adaptation skills, and risk-mitigation behaviours [8]. Given the lifelong nature of diabetes management, patient education and self-management support are essential components of diabetes care. To improve clinical outcomes and Quality of Life (QoL), various health systems, including Iran, have implemented comprehensive diabetes self-management programs [9]. Iran's National Program for Prevention and Control of Diabetes (NPPCD) aligns with this self-management approach, focusing on early diagnosis, appropriate treatment, continuous care, and the prevention of complications [10-12]. This program aims to help patients maintain near-normal blood glucose levels and prevent disease-related complications [7, 13].

The findings of studies on the effectiveness of diabetes self-management programs in rural areas are contradictory. Some studies report inadequate self-care behaviours [7, 8, 13], some showed limited attempts to change unhealthy habits unless severe symptoms are present, and some demonstrated low engagement in overall self-care. Many rural patients fail to meet care objectives [12], underestimate disease severity, exhibit poor treatment adherence, and achieve target Haemoglobin A1c (HbA1c) levels in only about half of cases [7, 12]. Given the influence of cultural, social, and economic factors on self-management behaviours and the paucity of research on rural settings in Iran, the present study aimed to investigate the status of diabetes self-management and its associated factors among patients with T2D in rural areas of Guilan Province, north of Iran.

Materials and Methods

This analytical cross-sectional study was conducted in 2023 on 350 patients with T2D residing in rural areas of Guilan Province, Iran. Participants were selected using stratified, cluster, and convenience sampling methods from those

enrolled in the NPPCD. Rural comprehensive health centers in Bandar Anzali, Guilan Province, were stratified into western and eastern centers as clusters. Then, 2–4 health centers were randomly selected from each cluster using a random number table. Finally, a convenience sample was used to select participants from the selected health centers. The study was conducted across three rural comprehensive health service centers and 16 affiliated health houses in the county. These centers provide regular care and diabetes education, led by trained community health workers, including periodic health assessments and laboratory tests. Inclusion criteria were age over 30 years, at least six months of diagnosed T2D, receiving training from the community health workers in accordance with NPPCD, regular performance of clinical lab tests including HbA1c and Fasting Blood Sugar (FBS) tests, at least two consecutive face-to-face visits to health houses for follow-up, informed consent, no mental or cognitive disorders, no visual or hearing impairments, no hospitalizations during the study due to diabetes complications, and no gestational diabetes, type 1 diabetes, cancer, or other disabling conditions requiring home care.

Data collection was performed by a structured questionnaire consisting of three sections: (A) a socio-economic/demographic form surveying age, sex, marital status, job, level of education, income, number of family members, diabetes duration, family history, and history of smoking; (B) a clinical profile form measuring anthropometric factors (height, weight, Body Mass Index [BMI]), physiological factors (blood pressure), and biochemical factors (FBS and HbA1c; HbA1c <7% indicating good glycaemic control, and ≥7% representing poor glycaemic control [14]); (C) The Diabetes Self-Management Questionnaire - Revised (DSMQ-R), developed by Schmitt et al. [15-17]. We used its Persian version validated by Hosseinzadegan et al [18]. The DSMQ-R evaluates diabetes self-management practices in the past 8 weeks. It has two versions: A 20-item version for patients treated with oral antidiabetic medications and a 27-item version for those on insulin therapy. Both versions were used in this study. Items are scored on a 4-point Likert scale from 0 (does not apply to me) to 3 (applies to me very much), assessing self-management in the following domains: Eating behavior, glucose monitoring, physical activity, and cooperation with the diabetes team. Scoring involved summing up the scores for each domain, and then transforming it to a scale range 1-10. Higher scores indicate more favorable self-management practices. In developing countries, 75% of participants score below the desired level of self-management. Consequently, in this study, scores ≥6 indicate favorable self-management, while scores <6 indicate unfavorable self-management [19, 20]. In our study, the reliability of the DSMQ-R was assessed among 30 participants. Cronbach's α values were 0.844 for the 20-item version and 0.778 for the 27-item version, indicating acceptable internal consistency.

Data collection was carried out from March to June 2023. The researcher completed the socio-economic/demographic and DSMQ-R questionnaires via face-to-face interview. The clinical profile form was completed based on the patients' registered health records. Statistical analysis was performed using descriptive and inferential statistics. Quantitative data were presented as Mean±SD and qualitative data as frequency (percentage). The normality of data distribution was assessed using the Kolmogorov-Smirnov test, graphical plots, and skewness and kurtosis indices. For univariate analyses, parametric tests (including independent t-test, one-way ANOVA, and Pearson's correlation test) or their non-parametric equivalents (Mann-Whitney U, Kruskal-Wallis, and Spearman's correlation test) were applied. The multivariate analysis was conducted using multiple linear regression. All analyses were conducted in SPSS software, version 16. The statistically significant level was set at 0.05.

Results

In this study, the majority of participants were female (55.4%), housewives (50.3%), married (70.9%), with lower than high school education (54.9%), low income (74.9%), and with a family history of diabetes (79.7%) (Table 1). The mean age of participants was 59±6.96 years; their mean BMI, 26.98±2.72 kg/m^2; and their mean systolic blood pressure, 131.11±6.47 mm Hg. Most patients had 2-3 comorbid diseases.

The total mean DSMQ-R score was 5.23±1.42. There was a significant difference in the mean scores of the DSMQ-R domains based on the independent t-test results. The glucose monitoring domain had a score higher than that of other domains (5.99±1.57, P=0.001). The mean scores for eating behavior (5.28±2.05) and cooperation with the diabetes team (5.35±1.55) domains were significantly higher than that of the physical activity domain (3.87±2.06) (P=0.001). These results are shown in Figure 1.

The total DSMQ-R score had a significant negative correlation with age (r=-0.23, P=0.001), diabetes duration (r=-0.44, P=0.001), BMI (r=-0.38, P=0.001), systolic blood pressure (r=-0.22, P=0.001), and diastolic blood pressure (r=-0.41, P=0.001) according to the Pearson correlation test results. According to independent t-test results, there were significant differences in total DSMQ-R score based on sex and type of medication (P=0.001), where the scores were higher in females than in males, and lower in those using insulin plus oral medications than in those using only oral medications

Table 1. Sociodemographic characteristics of diabetic patients (n=350)

Variables		Mean±SD/No. (%)
Age (y)		59±6.96
Sex	Male	156(44.6)
	Female	194(55.4)
Marital status	Married	248(70.9)
	Others	102(29.1)
Educational level	Illiterate	12(3.4)
	Lower than high school	192(54.9)
	Diploma	99(28.3)
	Academic	47(13.4)
Occupation	Unemployed	63(18)
	Housekeeper	176(50.3)
	Worker	29(8.3)
	Farmer/Stockbreeder	49(14)
	Employed	33(9.4)
Income sufficiency	Less than sufficient	184(52.6)
	Sufficient	166(47.4)
Duration of diabetes		12.71±4.92
Family history of diabetes	Yes	279(79.7)
	No	71(20.3)
Family history of smoking	Yes	119(34)
	No	231(66)
BMI (kg/m^2)		26.98±2.72
Smoking	Yes	135(38.6)
	No	215(61.4)
SBP (mm Hg)		134.11±6.47
DBP (mm Hg)		78.54±5.9
Medication type	Oral medications	225(64.3)
	Oral medications + insulin	125(35.7)
Number of comorbidities	0	7(2)
	1	55(15.7)
	2	122(34.9)
	3	125(35.7)
	≥4	41 (11.7)

SBP: Systolic Blood Pressure, DBP: Diastolic Blood Pressure.

Table 2. The total diabetes self-management scores based on sociodemographic factors and the correlation coefficients (n=350)

Variables		Mean±SD	Test Results
Age (y)			P=0.001* r=-0.236
Sex	Male	4.91±1.34	P=0.001**
	Female	5.49±1.42	
Marital status	Married	5.26±1	P=0.460**
	Other	5.14±1.45	
Educational level	Illiterate	3.53±0.71	P=0.001***
	Lower than high school	4.95±1.19	
	Diploma	5.38±1.54	
	Academic	6.47±1.19	
Occupation	Unemployed	4.51±1	P=0.001***
	Housekeeper	5.36±1.4	
	Worker	5.43±1.13	
	Farmer/Stockbreeder	4.97±1.71	
	Employed	6.1±1.27	
Income sufficiency	Less than sufficient	5.04±1.26	P=0.010
	Sufficient	5.43±1.55	
Duration of diabetes			P=0.001* r=-0.442
Family history of diabetes	No	4.96±1.44	P=0.079**
	Yes	5.29±1.41	
Family history of smoking	No	5.37±1.39	P=0.006**
	Yes	4.94±1.44	
BMI (kg/m^2)			P=0.001* r=-0.384
Smoking	No	5.33±1.36	P=0.079**
	Yes	5.06±1.5	
SBP (mm Hg)			P=0.001* r=-0.221
DBP (mm Hg)			P=0.001* r=-0.41
Medication type	Oral medication	5.48±1.53	P=0.001**
	Oral medication + insulin	4.77±1.04	
Number of comorbidities	0	5.36±1.5	P=0.001***
	1	5.56±1.47	
	2	5.43±1.2	
	3	5.3±1.45	
	≥ 4	3.86±1.09	

SBP: Systolic Blood Pressure, DBP: Diastolic Blood Pressure.

*Pearson correlation test, **Independent t-test, ***One-way ANOVA

Table 3. Regression coefficients for the factors predicting the diabetes self-management score

Variables		Unstandardized Coefficient (b)	SE	95% CI Lower, Upper	Standardized Coefficient (β)	P
Age (y)		0.01	0.01	-0.01, 0.04	0.06	0.347
Sex (female vs male)		0.71	0.42	-0.11, 1.53	0.25	0.089
Marital status (other vs married)		-0.1	0.14	-0.39, 0.18	-0.03	0.472
Educational level	Lower than high school vs illiterate	0.7	0.37	-0.02, 1.42	0.25	0.056
	Diploma vs illiterate	0.95	0.38	0.2, 1.7	0.3	0.013
	Academic vs illiterate	1.48	0.44	0.62, 2.33	0.36	0.001
Occupation	Housekeeper vs unemployed	-0.05	0.4	-0.83, 0.73	-0.02	0.902
	Worker vs unemployed	0.12	0.3	-0.47, 0.71	0.02	0.690
	Farmer/stockbreeder vs unemployed	0.12	0.25	-0.37, 0.61	0.03	0.623
	Employed vs unemployed	-0.05	0.34	-0.73, 0.62	-0.01	0.883
Income (sufficient vs less than sufficient)		0.08	0.16	-0.23, 0.39	0.03	0.604
Duration of diabetes		-0.07	0.02	-0.1, -0.04	-0.24	0.001
Family history of diabetes		0.05	0.17	-0.28, 0.38	0.01	0.764
Family history of smoking		-0.11	0.25	-0.6, 0.39	-0.04	0.670
BMI (kg/m^2)		-0.13	0.03	-0.18, -0.08	-0.25	0.001
Smoking		0.25	0.22	-0.18, 0.68	0.09	0.254
SBP (mm Hg)		0.02	0.01	-0.01, 0.04	0.1	0.061
DBP (mm Hg)		-0.06	0.01	-0.07, -0.02	-0.25	0.001
Medication type (combined vs oral)		-0.02	0.07	-0.09, 0.17	0.02	0.763
Number of comorbidities	2 vs ≤1	-0.23	0.19	-0.6, 0.14	-0.08	0.217
	3 vs ≤1	-0.13	0.2	-0.51, 0.26	-0.04	0.524
	≥4 vs ≤1	-1.02	0.24	-1.5, -0.54	-0.23	0.001

Abbreviations: SBP: Systolic Blood pressure, DBP: Diastolic Blood Pressure, SE: Standard Error.

R^2=0.487.

(P=0.001). Significant differences in total DSMQ-R scores were also observed based on education level (P=0.001) and number of comorbidities (P=0.001), according to one-way ANOVA results. These results were shown in Table 2.

Multivariate analysis revealed that patients with high school education (b=0.95, 95% CI; 0.2, 1.7, P=0.013), and university education (b=1.48, 95% CI; 0.62, 2.33, P=0.001) had total DSMQ-R scores significantly higher than illiterate individuals by 0.95 and 1.48 units, respectively. However, longer duration of diabetes (b=-0.07, 95% CI; -0.1, -0.04, P=0.001) was significantly associated with decreased in DSMQ-R score; for every one-year increase in the disease duration, the score decreases significantly by 0.07 units. Patients with ≥4 comorbid conditions had significantly lower scores than those with only one comorbidity by 1.02 units (b=-1.02, 95% CI; -1.5, -0.54, P=0.001). For every one unit increase in BMI, the DSMQ-R score significantly decreases by 0.13 units (b=-0.13, 95% CI; -0.18, -0.08, P=0.001). Diastolic blood pressure was predictor for DSMQ-R score (b=-0.06, 95% CI; -0.07, 0.02, P=0.001 The regression model showed

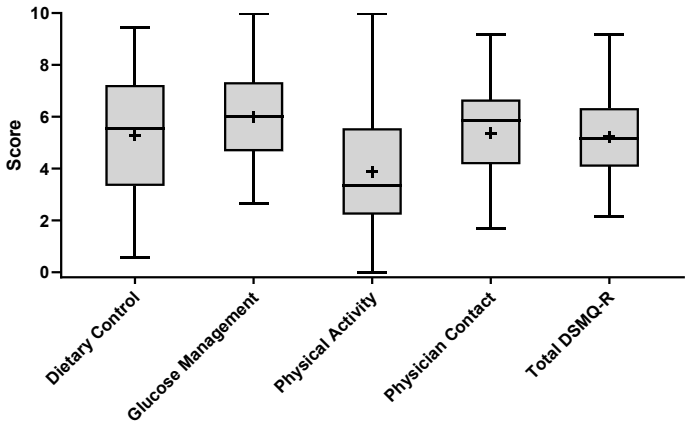

Figure 1. Scores of the DSMQ-R domains in the Type 2 diabetes (n= 350)

DSMQ-R: Diabetes self-management questionnaire-revised.

Note. Box plot shows minimum, first quartile (Q1), median, third quartile (Q3), and maximum values. The plus sign (+) represents the mean.

that these factors explained 48.7% of the variance in total DSMQ-R score (Table 3).

Discussion

Our study revealed that most of the rural patients with T2D in Guilan Province had suboptimal self-management behaviors. This finding is consistent with the results of other studies [21-26], where the results indicated poor or inadequate levels of self-management behaviors in diabetic patients. Although different studies may have used different tools to examine self-management behavior and the levels of literacy and health literacy of their samples may have been different, the results of most studies are similar and indicate that patients are weak in self-management of their disease. Self-management education is essential for all diabetic patients. While traditional methods focused mainly on knowledge, modern approaches are patient-centered [27, 28]. For these modern programs to be effective, they should build self-efficacy, be culturally appropriate, and accommodate those with low health literacy [29]. Although appropriate, the NPPCD in Iran is so traditional and inadequately tailored to the specific needs of rural communities. Rural populations face distinct barriers, including marginalization, a shortage of specialists, logistical and transportation challenges, cultural differences, and low health literacy [30, 31].

In this study, physical activity had the lowest score among the self-management domains, consistent with the results of Jordan and Jordan [23]. A key challenge in rural areas is that daily farm labor is often mistaken for exercise. Therefore, rural patient education is needed to help them distinguish between them and promote the incorporation of exercises into daily routines. Effective interventions should offer specific, tailored guidance on the type, duration, intensity, and frequency of exercises, based on the patient's capacity [32]. Family involvement and healthcare provider support are essential for sustaining this behavior change. Health literacy is also a key facilitator [33]. Blood glucose monitoring had the highest score among the self-management domains. Barriers such as the lack of monitoring devices and personal preferences may hinder its proper practice among some patients [34].

In this study, a higher educational level was significantly associated with higher self-management scores, although findings vary globally [35-38], and programs should be tailored for those with lower educational levels. Also, consistent with similar studies [39, 40], longer diabetes duration was significantly associated with a lower self-management score. In some studies, patients with longer diabetes duration showed greater self-care [41, 42], probably due to experiential learning or fear of complications. Higher BMI, combination therapy (insulin plus oral medications), and multiple comorbidities were also associated with poorer self-management in our study. Individuals with a higher BMI often struggle with physical activity and have unhealthy diet [35-38], and those on medication regimens face treatment burden, psychological stress, fear of hypoglycemia, and barriers to comply with self-management practices [43]; highlighting the need for enhanced education and emotional support.

This study had some limitations, including a small sample size, selection of samples from only rural areas in Guilan Province, and a cross-sectional design reliant on self-reported data, which may lead to response bias. Future research

should use longitudinal designs and objective measures to confirm findings and better understand the dynamics of self-management behaviours.

In conclusion, despite over a decade of national self-management programs in Iran, this study found that self-management practices (particularly physical activity) of rural patients with T2D in Guilan Province are not favorable. Therefore, to improve the NPPCD in Iran, a tailored strategy for rural areas is needed, prioritizing patient activation, targeted education, and empowerment, and improving service accessibility and financial support, with continuous evidence-based monitoring. The interventions using the teach-back technique can be effective.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Research Ethics Committee of Guilan University of Medical Sciences, Rasht, Iran (Code: IR.GUMS.REC.1401.572). Written informed consent was obtained from all participants after explaining the study objectives to them.

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Authors' contributions

Conceptualization and study design: Hojjat Houshyari Khah and Sajjad Pourbagheri; Data collection and interpretation: Sajjad Pourbagheri, Leilla Mirhadian, and Hojjat Houshyari Khah; Statistical analysis: Saman Maroufizadeh; Writing: Marzieh Shayesteh Fard; Final approval: All authors.

Conflict of interest

The authors declared no conflict of interest.

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