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Assessment of Factors Affecting the Management of Chronic Diseases in Patients with Type 2 Diabetes: A Community-Based Cross-Sectional Study

Tip 2 Diyabetli Hastalarda Kronik Hastalıklarının Yönetimine Etki Eden Faktörlerin Değerlendirilmesi: Toplum Tabanlı Kesitsel Bir Çalışma

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Öz

Çalışmamız Manisa merkez ilçede yaşayan tip 2 diyabetli hastalarda kronik hastalıklarının yönetimlerini etkileyen faktörleri değerlendirmek amaçlanmıştır. Kesitsel tipteki araştırmamıza çok aşamalı, tabakalı rastgele örnekleme yöntemiyle 505 tip 2 diyabetli hasta katılmıştır. Katılımcılara yüz yüze anket uygulanmıştır. Anket literatür taraması ile hazırlanmış yarı yapılandırılmış sorular ve hastaların kronik hastalık bakımlarını kendilerinin değerlendirdiği Patient Assessment of Chronic İllness Care (PACIC) Türkçe ölçeğinden oluşmaktadır. Çok değişkenli çözümlemelerde regresyon analizi uygulanmıştır. Katılımcıların HbA1c düzeyi ortalaması 6.9±1.7 mg/dl'dir. HbA1c'ye göre %61.7'sinin metabolik kontrolü iyi ve sadece %69.5'i evde kendi kendine kan şekeri takiplerini yapmaktadır. Katılımcıların toplam PACIC skor ortalaması 2.59±0.62'dir. Tek değişkenli analiz sonuçlarına göre; kent merkezinde yaşayanların, erkeklerin, 45 yaş altındakilerin, yüksek gelirlilerin, yüksek eğitimlilerin ve evde kendi kendine şeker takibi yapanların, HbA1c, kan lipid düzeyleri kontrol altında olanların, rutin izlemlerini düzenli yaptıranların ve diyabete bağlı sağlık problemi olmayanların toplam PACIC skorları anlamlı olarak daha yüksektir ($p<0.05$). Çok değişkenli modelde; karar verme becerisinin toplam PACIC skorlarındaki değişimin %52.5'ini, düzenli rutin izlemleri yaptıranların ise %19.0'ını açıkladığı bulunmuştur. Bu, hastaların kendi sağlık yönetimlerinde aktif roller alması ve düzenli sağlık kontrolü yaptırmasının, hasta merkezli bakımın kalitesini önemli ölçüde etkileyebileceğini gösterir. Diyabet eğitiminin nicel ve nitel kalitesinin artırılması, hastaların karar verme becerilerini geliştirmesi kronik hastalık yönetimini kolaylaştırabilir.

Anahtar Kelimeler: HbA1c, Kronik Bakım Modeli, Kronik Hastalık Bakımının Hasta Değerlendirmesi Ölçeği (PACIC), Metabolik Kontrol, Tip 2 Diyabet

Abstract

Our study aimed to evaluate the factors affecting the management of chronic diseases in patients with type 2 diabetes living in Manisa central district. In our cross-sectional study, 505 type 2 diabetic patients participated in a multi-stage, stratified random sampling method. A face-to-face questionnaire was applied to the participants. The questionnaire consisted of semi-structured questions prepared with a literature review and the Patient Assessment of Chronic Illness Care (PACIC) Turkish scale in which patients self-assessed their chronic disease care. Regression analysis was applied in multivariate analysis. The mean HbA1c level of the participants was 6.9±1.7 mg/dl. According to HbA1c, 61.7% had good metabolic control and only 69.5% of the participants self-monitored their blood glucose at home. The mean total PACIC score of the participants was 2.59±0.62. According to the results of univariate analysis, the total PACIC scores of those living in urban centers, males, those under the age of 45, those with higher income, those with higher education, those who self-monitor glucose at home, those with controlled HbA1c and blood lipid levels, those who have regular routine follow-ups and those who do not have diabetes-related health problems are significantly higher ($p<0.05$). In the multivariate model; decision-making ability was found to explain 52.5% of the change in total PACIC scores and 19.0% of those who had regular routine follow-ups. This indicates that patients taking active roles in their own health management and having regular health check-ups can significantly impact the quality of patient-centered care. Increasing the quantitative and qualitative quality of diabetes education and improving patients' decision-making skills can facilitate chronic disease management.

Keywords: HbA1c, Chronic Care Model, Patient Assessment of Chronic Illness Care Scale (PACIC), Metabolic Control, Type 2 Diabetes

Introduction

Noncommunicable diseases (NCDs) are the result of a combination of genetic, physiological, environmental, and behavioral factors that are usually long-lasting. The main types of NCDs are cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes. They continue to be an important public health challenge in all countries, including low- and middle income countries where more than three quarters of NCDs deaths occur (1). Diabetes mellitus (DM) describes a group of metabolic disorders characterized by high blood glucose levels. Type 2 diabetes mellitus (T2DM) is the most common type of diabetes, accounting for over 90% of all diabetes worldwide. In T2DM, the response to insulin is diminished, and this is defined as insulin resistance. Thus, insulin secretion is unable to maintain glucose homeostasis, producing hyperglycemia (2).

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The Global Picture (burden of disease and health effect)

Globally, more than one in 10 adults are now living with diabetes. The distribution of diabetes prevalence is estimated to increase due to aging populations. A systematic literature review was

estimated 537 million adults aged 20–79 years are currently living with diabetes. This represents 10.5% of the world's population in this age group. The total number is predicted to rise to 643 million (11.3%) by 2030 and to 783 million (12.2%) by 2045 (3). According to the International Diabetes Federation (IDF)'s project, that there are 61.4 million (9.2%) diabetics in the European region, where our country is located, according to 2021 data, and this number will increase to 69.2 million (10.4%) in 2045 and an increase of 13% is expected in the estimated number of diabetics. Turkey ranks first with 14.5% among the five countries with the highest prevalence of age-standardized diabetes among 20-79 adults, according to 2021 estimates (2).

It is estimated that approximately 6.7 million adults between the ages of 20-79 have died due to diabetes or complications in 2021. This corresponds to 12.2% of global deaths for all reasons in this age group (3). Persistent hyperglycemia can cause several complications such as cardiovascular disease (CVD), blindness, kidney failure, and amputation of lower limbs. Acute complications include hypoglycemia and hyperglycaemic diabetic coma. Chronic microvascular complications include nephropathy, neuropathy, and retinopathy, whereas chronic macrovascular complications include coronary artery disease (CAD), peripheral artery disease (PAD), and cerebrovascular disease.

Strategies for improving care management and promoting health

Diabetic patients must assume an active role in their care, in order to learn self-management skills and follow-up systems. Patients must be educated to take responsibility for their diabetes management including diet control, physical exercise, self-monitoring of blood glucose, regular screening for the development of early diabetic complications, such as kidney disease, retinopathy, neuropathy, peripheral artery disease, and foot ulceration to avoid complications associated with DM. With regular check-ups and effective lifestyle management, as well as medication if required, people with type 2 diabetes can lead long and healthy lives (4). Thus, The Chronic Care Model (CCM) was developed for improving the quality of diabetes care. The CCM is a patient-centered approach to care that requires a close working relationship between the patient and clinicians involved in treatment planning. The CCM consists of 6 basic elements in providing high-quality chronic disease care services in health systems. These elements are respectively self-management support, decision support, redesign of the health service delivery system, clinical information systems, links with community resources, and organization of health services. Many studies indicate that the CCM can be applied in diabetes patients, is beneficial, and has achieved clinical and behavioral effective results. Patients who were enrolled in the CCM experienced the cumulative incidence of diabetes-related complications and all-cause mortality reduced (5). Patient assessment of Chronic Illness Care (PACIC) originated from the chronic care model and was developed by Glasgow et al. in 2005. It has been found that a scale is an appropriate tool for evaluating the quality of care in diabetes, as it is in various chronic diseases (6,7). The Turkish version of the Chronic Disease Care Assessment Scale (Turkish PACIC), which allows it to be used in our country for those with chronic diseases (8).

Our results will be guiding in terms of ensuring that health professionals participate in their patients' own health management is an effective strategy in chronic disease management. This study aims to improve the quality of care of individuals with chronic diseases by evaluating the follow-up and care services of people with type 2 diabetes living in the central district of Manisa, quantitatively and qualitatively.

Material and Method

Study design and Sample selection

The population of the cross-sectional study consists of 30,518 with diabetes patients living in the central district of Manisa, according to the standardized prevalence rate of 13.7%, which is expected to be approximately 222,766 people over the age of 20 in the region. The sample size was calculated as 95% confidence, when the prevalence of inadequate service/care was taken as 35% according to The Turkish Epidemiology Survey of Diabetes, Hypertension, Obesity and Endocrine Disease (Turdep 2) study, it was calculated as a minimum of 384 people with a deviation of 5% (9).

Step 1: Twenty-four primary health care center (PHC) (58 urban; 28 semi-urban and 12 rural), were selected proportionally from ninety-eight family physicians to each stratum using a multi-stage, stratified, simple random sampling method. It was planned to reach 480 people in total, with a sample size of 20 patients for each primary health care physicians (PHPs).

In primary care, patients with suspected diabetes should be screened with the acceptance of a preliminary diagnosis. It was understood that 98 of them did not actually have diabetes, and only 330 of the remaining ones were surveyed. These 98 people, whose pre-diagnosis of diabetes was entered into the system by the physician, did not actually have diabetes.

The accessibility rate was calculated to be 68.75%, and a new reserve list of 240 people in total was created from 10 patients with type 2 diabetes for each PHPs.

Step 2: It was understood that 35 people from the new reserve list did not actually have diabetes, and a questionnaire was applied to 175 patients from the

remaining ones. As a result, the rate of participation in the research (505/587) was 86.1%. The questionnaires were filled in by face-to-face interview method at patients' home through their addresses registered to the PHPs in 2014.

Properties of the Participants

The independent variables are grouped into four main clusters:

1. Sociodemographic variables (age, gender, marital status, job, educational status, family type, etc.)
2. Positive Health Behaviors (alcohol, smoking status, physical activity, nutrition, diabetes education)
3. Variables of accessibility to health services, health service utilization
4. Other variables related to the disease (laboratory tests results, acute and chronic diabetes complications, regular follow-up visits (10).

Dependent variables (quantitative and qualitative):

1. The quantitative indicator: HbA1c was chosen to assessment of the metabolic control. In patients diagnosed with type 2 diabetes, the first single oral antidiabetic drug therapy is started simultaneously with lifestyle adjustments. If glycated hemoglobin A1c (HbA1C) >7% despite lifestyle adjustments, adjustments are made by adding new additional drugs in the treatment. If the patient's HbA1C is >7% despite the new treatment, the treatment is rearranged by adding new drugs. HbA1C was chosen because it is the parameter that changes the treatment regimen in evaluating the achievement of glycemic targets of type 2 diabetes patients with poor metabolic control (11).

2. The qualitative indicator: Patient Assessment of Chronic Illness Care (PACIC), which was adapted to Turkish society and validated was used. PACIC is a scale developed in English by Glasgow et al., based on the chronic care model, that allows patients to evaluate the health care services offered to chronic diseases, and consists of 20 items and 5 sub-dimensions, and each item consists of five-point Likert-type response options. These sub-dimensions are (Questions 1-3) Patient Activation, (Questions 4-6) Decision support, (Questions 7-11) Goal setting (Questions 12-15) Problem-Solving, (16-20 Questions) Follow-up/Coordination. The total score of the scale and the mean score of each sub-dimension are obtained by summing the scores in a five-point Likert-type rating such as 1 = never, 2 = rarely, 3 = sometimes, 4 = often, and 5 = always in each item and then dividing by the number of items. Total scale score and sub-dimension scores can get a minimum of 1 and a maximum of 5. An increase in scale scores indicates that individuals with chronic disease are satisfied with the care/service they receive, and that chronic disease management is sufficient (12).

Statistical Analysis

Statistical analyses were performed by using IBM SPSS version 15 package program. The dataset was prepared for analysis with checked for missing data and outliers. In the study, we used both descriptive and inferential statistics to analyze our results. Descriptive statistics were used to summarise background characteristics of the study population. Qualitative parameters were presented by percentages and frequencies. Continuous data were analyzed using mean, median, standard deviation, and min-max values. In univariate analyses, we checked the goodness of fit using by Kolmogorov-Smirnov test which determines the normal distribution of continuous data. Student's t-test was used to compare the means between two groups, and one-way ANOVA was used to compare the means among three or more groups. Where parametric test assumptions could not be met, non-parametric methods were used to compare the groups. Chi-square test was used to evaluate the differences between the ratios.

Multiple linear regression analysis was performed to explain the effect on the total PACIC score, which is one of the independent variables that are significant in univariate analysis. The total PACIC score was taken as the dependent variable. In order for multiple linear regression analysis to give reliable results, the linear relationship between the independent and dependent variables was examined with a scatter graph, extreme values were checked with case wise diagnostics, randomness of errors was verified with the Durbin-Watson test, and multilinearity was evaluated through VIF and Tolerance values.

In all statistical analysis p-values of <0.05 were considered statistically significant.

Results

Descriptive statistics

In our study, a questionnaire was applied to 505 patients. The mean age of the patients was 57.9±12.3 years, 65.7% were female, 17.4% had high school education or higher, and 39.8% had income less than expenses.

The mean diagnosis of diabetes in the study group was 7.9±6.7 years and 64.2% had diabetes for less than ten years. In terms of metabolic control parameters, hemoglobin A1C (HbA1C) 61.7%, fasting plasma glucose (FBG) 41.3%, Triglycerides (TG) 47.7%, LDL 34.4%, cholesterol 59.2%, and systolic blood pressure (SBP) 65.2% of the diabetics were found to be at desired levels. Only 56.8% of the diabetics who participated in our study had HbA1c results. The mean HbA1c level was 6.9±1.7 mg/dl. We achieved follow-up controls of diabetic patients

such as 81.8% for electrocardiogram (ECG), 71.7% for fundoscopic examination, 78.4% for glucosuria, 57.2% for ketonuria, 17.4% for microalbuminuria and 28.5% for neurological sensory examination. These results are shown in table 1.

Distribution of Turkish PACIC and Sub-Dimensional Scores

Patient Activation (items 1-3) subscale mean score is 2.60±0.89, Decision/Support (items 4-6) subscale mean score is 2.58±0.91, Goal Setting (items 7-11) subscale mean score is 2.59±0.77, Problem Solving (items 12-15) subscale mean score is 2.58±0.75, Monitoring\Coordination (items 16-20) subscale mean score is 2.59±0.77 and total scale mean score is 2.59±0.77. items) sub-dimension was 2.58±0.75, the mean of the Monitoring\Coordination (items 16-20) sub-dimension was 2.59±0.77 and the mean of the total scale score was 2.59±0.62, the lowest score was 1.24 and the highest score was 4.36.

Univariate analysis

The qualitative indicator

Total (Turkish PACIC) scale and subscale scores were analyzed with independent variables using univariate analysis. The PACIC scores of diabetics were statistically significantly higher those living in urban areas than those living in rural areas ($p<0.001$), those under 45 years of age than those aged 45 and over ($p<0.001$), those male than those female ($p=0.043$), those with higher education than those lower educated ($p<0.001$), those with good perceived income those with poor perceived income ($p<0.001$), those had a family history of diabetes than those had not ($p=0.012$). The findings are shown in table 2.

Table 1. Distribution of Socio-demographic and Chronic Disease Management Skills of Patients with Type 2 Diabetes.

Variables		N	%
PCC Region*	Urban	285	56.4
	Semi-urban	156	30.9
	Rural	64	12.7
Age	45 ≤	436	86.3
Gender	Female	332	65.7
Educational Status	High school & higher	88	17.4
Diabetes diagnosis time	≤ 9 years	324	64.2
Diabetes treatment method	Diet and OAD Drug	365	72.3
Diabetes treatment satisfaction	Good and higher	343	67.9
Using medication regularly	Good and higher	192	38.0
Self-monitoring blood glucose	+	351	69.5
Flu vaccination	Regular (once per 1 year)	70	13.9
Pneumonia vaccination	Regular (once per 5 year)	35	6.9
Hospitalization or emergency	+ (last 6 months)	75	14.8
Low blood glucose (less than 50 mg/lt)	+ (last 6 months)	80	17.6
High blood glucose (over 250 mg/dl)	+ (last 6 months)	212	42.0
Diabetes complications	Hypertension	245	48.5
	Loss of sensation in the feet	149	29.5
	Retinopathy	139	27.5
	Cataract	95	18.8
	Heart Disease	61	12.1
	Wound in the feet	49	9.7
	Renal Failure	12	2.4
	Foot or finger amputation	6	1.2
Diabetes education	Never	82	16.2
	Once when diagnosed	180	35.6
HbA1c (n:287); M±Sd: 6.9±1.7	<7,00 mg/dl	177	61.7
FBG (n:392); M±Sd: 144.5±59.1	70 – 120 mg/dl	162	41.3
TG (n:381); M±Sd: 176.5±115.3	<149 mg/dl	182	47.8
LDL (n:366); M±Sd: 116.8±41.3	<99 mg/dl	126	34.4
SBP (n:374); M±Sd: 132.6±19.3	≤139 mmHg	244	65.2
DBP (n:374); M±Sd: 81.4±11.8	≤89 mmHg	249	66.6
Cholesterol (n:380); M±Sd: 195.3±47.0	≤199 mg/dl	225	59.2
Microalbuminuria (n:16); M±Sd: 63.9±128.8	≤29 mg/day	7	43.8
ECG (n:413)	≤1 year	322	78.0
Fundoscopic examination (n:362)	≤1 year	295	81.5
Glucose urine test (n:396)	≤ 6 months	269	67.9
Ketones in urine test(n:289)	≤ 6 months	195	67.5
Microalbuminuria test (n:88)	≤1 year	77	87.5
Neurological examination (n:144)	≤1 year	108	75.0

N: numbers, %: Percent, M±Sd: Mean±standard Deviation, *PCC: Primary Care Center, OAD: oral antidiabetic drug, HbA1c: glycated hemoglobin, FBG: fasting blood glucose, TG: Triglyceride, LDL: low-density lipoprotein, SBP: Systolic blood pressure, DBP: diastolic blood pressure, ECG: electrocardiogram

Table 2. The relationship between the sociodemographic characteristics of the participants and the Turkish PACIC scale scores.

Variables	Patient Activation Mean±SD	Decision Support Mean±SD	Goal Setting Mean±SD	Problem Solving Mean±SD	Follow-up Mean±SD	Total Scale Mean±SD
PCC Region*						
Urban	2.75±0.88†	2.69±0.90†	2.69±0.76†	2.65±0.78†	2.72±0.81†	2.70±0.63†
Semi-urban	2.42±0.91	2.45±0.95	2.48±0.80	2.51±0.74	2.45±0.73	2.46±0.60
Rural	2.41±0.78	2.39±0.88	2.48±0.74	2.48±0.69	2.38±0.65	2.43±0.54
P	**0.000**	**0.006**	**0.009**	0.104	**0.000**	**0.000**
Age						
<45	2.93±0.82	2.92±0.89	3.00±0.73	2.92±0.78	2.85±0.67	2.92±0.57
≥45	2.55±0.89	2.53±0.90	2.54±.076	2.53±0.73	2.55±0.78	2.54±0.61
P	**0.001**	**0.001**	**0.000**	**0.000**	**0.004**	**0.000**
Gender						
Male	2.71±0.82	2.71±0.89	2.65±0.76	2.65±0.72	2.63±0.79	2.67±0.61
Female	2.55±0.92	2.52±0.93	2.57±0.79	2.55±0.77	2.58±0.77	2.55±0.63
P	**0.045**	**0.028**	0.260	0.174	0.458	**0.043**
Educational Status*						
Un-educated	2.26±0.85	2.25±0.81	2.35±0.74	2.37±0.72	2.28±0.72	2.30±0.55
Primary & Middle school	2.65±0.85	2.65±0.92	2.61±0.74	2.58±0.69	2.64±0.75	2.62±0.57
High school and above	3.00±0.91†	2.89±0.90†	2.95±0.83†	2.94±0.87†	2.94±0.79†	2.95±0.67†
P	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Perceived Income*						
Less	2.47±0.87	2.52±0.92	2.48±0.77	2.44±0.76†	2.39±0.76	2.46±0.61
Equal	2.64±0.88	2.58±0.90	2.64±0.78	2.67±0.74	2.70±0.77	2.65±0.62
Much	3.03±0.93†	2.91±0.98†	2.96±0.63†	2.76±0.69	2.93±0.65	2.92±0.55†
P	**0.001**	**0.046**	**0.001**	**0.001**	**0.000**	**0.000**
Perception of educational competency*						
Bad	2.35±0.90	2.35±0.81	2.34±0.74	2.37±0.71	2.26±0.69	2.33±0.56
Moderate	2.57±0.85	2.56±0.91	2.65±0.74	2.58±0.74	2.68±0.79	2.61±0.60
Good	2.95±0.83†	2.87±0.96†	2.84±0.78†	2.84±0.75†	2.88±0.71†	2.88±0.59†
P	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Current perception of health						
Bad	2.40±0.88	2.41±0.99	2.37±0.69	2.34±0.72	2.47±0.81	2.40±0.61
Moderate	2.52±0.84	2.57±0.86	2.54±0.78	2.49±0.76	2.55±0.72	2.53±0.58
Good	2.69±0.91	2.62±0.93	2.68±0.78	2.68±0.74	2.64±0.80	2.66±0.64
P	**0.029**	0.278	**0.014**	**0.002**	0.210	**0.005**
Presence of Physician						
+(a)	2.67±0.91†	2.64±0.93†	2.64±0.78†	2.63±0.77†	2.66±0.78†	2.65±0.63†
- (b)	2.18±0.64	2.17±0.68	2.23±0.61	2.23±0.56	2.14±0.56	2.19±0.41
Not Sure(c)	2.23±0.64	2.25±0.70	2.41±0.75	2.38±0.62	2.17±0.67	2.29±0.45
P	**0.000** a>(b=c) *	**0.001** a>(b=c) *	**0.003** a>(b=c) *	**0.003** a>(b=c) *	**0.000** a>(b=c) *	**0.000** a>(b=c) *
Family History of Diabetes						
+	2.69±0.90	2.64±0.91	2.65±0.81	2.64±0.73	2.62±0.77	2.65±0.61
-	2.47±0.86	2.50±0.93	2.52±0.73	2.50±0.78	2.55±0.79	2.51±0.63
P	**0.006**	0.089	0.072	**0.034**	0.301	**0.012**

PCC: Primary Care Center; *One-way analysis of variance; †Post hoc Tukey b (the group that makes the difference)

The PACIC scores of diabetics were statistically significantly higher those who self-measure glucose at home compared to those who did not (p=0.005), those who did not visited to the emergency room in the last 6 months compared to those who have (p=0.002), those who did not experienced an episode of hypoglycemia (p=0.012) or hyperglycemia (p=0.001) in the last 6 months compared to those who have (p=0.001), those who have regular flu (p=0.001) or pneumonia vaccination (p=0.003) than those who did not have regular vaccinations, those who were satisfied with their diabetes treatment (p=0.001) than those who were not satisfied with their treatment, those who knew the symptoms associated with diabetes than those who did not (p=0.005). The findings are shown in table 3.

Total (Turkish PACIC Scale) scores of those whose HbA1c value, fasting and postprandial blood glucose levels, and blood lipid (TG, HDL, LDL and cholesterol) values were under control and who have routine health checks such as fundus examination, neurological examination, glucose and ketone examination in the urine on time, was found to be statistically significantly higher than those with poor values and those who did not have regular follow-ups (p<0.005). The relationship between total PACIC score and other metabolic control indicators such as routine follow-up and laboratory parameters of diabetic patients are shown in table 4.

The quantitative indicator

The HbA1c measurement was used to assess the patients' glycemic management who have diabetes. The HbA1c value was cut from <7.00 mg/dl and the metabolic control target was categorized as binary. According to the test results, the significance relationship between the two variables was evaluated by Chi-Square test.HbA1c levels in diabetic patients were found to be statistically significant in terms of glycemic control; these included those diagnosed in year ≤9 (p=0.003), those receiving diet-only treatment (p=0.003), those who were physically active (p=0.012), those who checked their blood glucose levels self-monitoring (p=0.012), those who received a routine flu vaccination (p=0.044), those who did not experience an episode of hyperglycemia (p=0.027), and those without peripheral neuropathy (p=0.002).

Table 3. The relationship between the disease management characteristics of patients and the Turkish PACIC scale scores.

Variables	Patient Activation Mean±SD	Decision Support Mean±SD	Goal Setting Mean±SD	Problem Solving Mean±SD	Follow-up Mean±SD	Total Scale Mean±SD
Self-monitoring at home (n:351)						
+	2.68±0.90	2.62±0.93	2.62±0.78	2.64±0.77	2.66±0.76	2.64±0.64
-	2.43±0.85	2.49±0.89	2.54±0.76	2.46±0.71	2.44±0.80	2.47±0.56
P	**0.005**	0.127	0.301	**0.017**	**0.004**	**0.005**
Emergency admission in the last 6 months						
+ (n: 42)	2.29±0.87	2.37±0.80	2.35±0.79	2.26±0.72	2.26±0.67	2.31±0.53
-	2.63±0.89	2.60±0.92	2.62±0.77	2.61±0.75	2.62±0.78	2.62±0.62
P	**0.019**	0.132	**0.033**	**0.004**	**0.004**	**0.002**
Hypoglycemia in the last 6 months*						
-	2.67±0.91†	2.66±0.92†	2.67±0.79†	2.65±0.78†	2.67±0.78†	2.66±0.62†
+ (n: 89)	2.46±0.79	2.41±0.90	2.42±0.67	2.43±0.62	2.44±0.67	2.43±0.56
-	2.37±0.91	2.28±0.83	2.35±0.77	2.37±0.68	2.26±0.88	2.32±0.60
P	**0.029**	**0.006**	**0.002**	**0.007**	**0.001**	**0.000**
Hyperglycemia in the last 6 months*						
-	2.74±0.86†	2.69±0.96†	2.75±0.77†	2.69±0.77†	2.71±0.79†	2.72±0.62†
+ (n: 212)	2.47±0.89	2.49±0.85	2.45±0.76	2.49±0.75	2.51±0.72	2.48±0.59
-	2.40±1.05	2.29±0.89	2.39±0.76	2.36±0.56	2.24±0.90	2.34±0.64
P	**0.002**	**0.010**	**0.000**	**0.003**	**0.000**	**0.000**
Flu vaccination						
No	2.56±0.90	2.50±0.92	2.55±0.78	2.55±0.76	2.54±0.78	2.54±0.61
Yes(n:117)	2.75±0.84	2.85±0.87	2.77±0.75	2.68±0.72	2.77±0.75	2.77±0.62
P	**0.041**	**0.000**	**0.006**	0.111	**0.005**	**0.001**
Pneumonia vaccination						
No	2.58±0.89	2.56±0.92	2.59±0.79	2.59±0.76	2.55±0.78	2.57±0.62
Yes (n: 35)	2.94±0.88	3.05±0.98	2.87±0.79	2.75±0.78	2.91±0.82	2.90±0.64
P	**0.020**	**0.003**	**0.044**	0.250	**0.010**	**0.003**
Perception of disease management compliance *						
Never-Little	2.41±0.86	2.43±0.92	2.44±0.76	2.55±0.76	2.38±0.73	2.44±0.62
Moderate	2.66±0.89	2.63±0.92	2.60±0.74	2.55±0.75	2.54±0.73	2.59±0.58
Good and higher	2.68±0.90†	2.63±0.90†	2.70±0.81†	2.64±0.76†	2.79±0.81†	2.69±0.64†
P	**0.020**	0.099	**0.011**	0.420	**0.000**	**0.002**
Diabetes treatment satisfaction*						
Never-Little	2.31±0.70	2.33±0.86	2.33±0.66	2.28±0.63	2.30±0.63	2.31±0.50
Moderate	2.53±0.91	2.55±0.90	2.50±0.79	2.45±0.76	2.37±0.71	2.48±0.61
Good and higher	2.67±0.90†	2.63±0.92†	2.67±0.78†	2.67±0.75†	2.71±0.79†	2.67±0.63†
P	**0.021**	0.104	**0.005**	**0.000**	**0.000**	**0.000**
Diabetes Education						
Never	2.28±0.84	2.39±0.91	2.32±0.70	2.41±0.70	2.39±0.76	2.36±0.57
At least once	2.67±0.89	2.62±0.91	2.65±0.78	2.62±0.76	2.63±0.78	2.64±0.62
P	**0.000**	**0.039**	**0.000**	**0.024**	**0.008**	**0.000**
Knowing the symptoms of hypoglycemia						
-	2.40±0.82	2.25±0.88	2.18±0.76	2.33±0.77	2.43±0.79	2.32±0.60
+	2.62±0.90	2.61±0.92	2.63±0.77	2.60±0.75	2.61±0.78	2.61±0.62
P	0.149	**0.022**	**0.000**	**0.030**	0.179	**0.005**
Diabetes related health problems						
- (n:298)	2.97±0.92	2.83±0.92	2.88±0.74	2.81±0.75	2.80±0.73	2.86±0.62
+ (n:207)	2.52±0.87	2.53±0.91	2.54±0.77	2.54±0.75	2.55±0.78	2.53±0.61
P	**0.000**	**0.004**	**0.000**	**0.002**	**0.005**	**0.000**

*One-way analysis of variance; †Post hoc (group that makes the difference): Tukey b

Table 4. The relationship between total Turkish PACIC scale and subscale scores with metabolic control and routine follow-ups

Variables	Patient Activation Mean±SD	Decision Support Mean±SD	Goal Setting Mean±SD	Problem Solving Mean±SD	Follow-up Mean±SD	Total Scale Mean±SD
HbA1c value (mg/dl) (n:287)						
≤ 6.99	2.76±0.92	2.75±0.90	2.70±0.80	2.70±0.80	2.72±0.82	2.73±0.64
≥ 7.00	2.40±0.91	2.38±0.85	2.44±0.70	2.42±0.71	2.49±0.75	2.42±0.56
P	**0.001**	**0.001**	**0.004**	**0.002**	**0.016**	**0.000**
FBG (mg/dl) (n:392)						
70 -120	2.71±0.87	2.81±0.91	2.73±0.76	2.76±0.76	2.75±0.79	2.75±0.61
≥ 121	2.51±0.89	2.43±0.88	2.50±0.74	2.42±0.72	2.51±0.75	2.48±0.58
P	**0.027**	**0.000**	**0.003**	**0.000**	**0.003**	**0.000**
PBG (mg/dl) (n:113)						
≤139	2.97±0.89	2.89±1.18	2.73±0.92	2.87±1.03	3.09±0.96	2.91±0.83
≥140	2.57±0.90	2.57±0.88	2.59±0.65	2.53±0.60	2.57±0.67	2.56±0.51
P	0.065	0.156	0.393	**0.049**	**0.029**	**0.016**
Total Cholesterol / HDL						
≤ 3.99	2.65±0.87	2.77±0.94	2.73±0.79	2.69±0.82	2.76±0.77	2.72±0.64
≥ 4.00	2.58±0.89	2.53±0.88	2.53±0.73	2.51±0.72	2.55±0.78	2.54±0.58
P	0.463	**0.016**	**0.015**	**0.025**	**0.011**	**0.006**
SBP (mmHg) (n:374)						
≤ 139	2.67±0.91	2.63±0.95	2.69±0.83	2.65±0.79	2.67±0.80	2.66±0.66
≥140	2.50±0.76	2.49±0.85	2.44±0.63	2.50±0.73	2.47±0.75	2.48±0.51
P	0.052	0.159	**0.003**	0.068	**0.019**	**0.003**
DBP (mmHg) (n:374)						
≤ 89	2.67±0.89	2.62±0.94	2.69±0.80	2.70±0.79	2.66±0.78	2.67±0.65
≥ 90	2.50±0.79	2.50±0.86	2.44±0.71	2.39±0.68	2.48±0.79	2.46±0.54
P	0.058	0.233	**0.003**	**0.000**	**0.034**	**0.002**
LDL* (mg/dl) (n:366)						
≤ 99	2.72±0.89	2.81±0.96†	2.79±0.79†	2.68±0.83†	2.74±0.85†	2.75±0.67†
100- 129	2.61±0.85	2.53±0.87	2.59±0.74	2.66±0.76	2.71±0.78	2.62±0.56
≥130	2.50±0.88	2.48±0.88	2.41±0.69	2.41±0.64	2.41±0.67	2.44±0.55
P	0.153	**0.008**	**0.000**	**0.009**	**0.001**	**0.000**
Routine Follow ups of diabetic patients						
Fundoscopic examination (n:362)						
≤1 year	2.71±0.91	2.72±0.93	2.63±0.80	2.65±0.77	2.68±0.78	2.68±0.63
>1 year	2.47±0.86	2.39±0.85	2.50±0.75	2.43±0.70	2.46±0.76	2.45±0.60
P	**0.045**	**0.008**	0.233	**0.031**	**0.038**	**0.007**
Glucose analysis in the urine (n:396)						
≤6 months	2.75±0.91	2.69±0.94	2.68±0.79	2.69±0.80	2.70±0.79	2.70±0.66
>6 months	2.50±0.84	2.45±0.87	2.58±0.73	2.49±0.71	2.54±0.74	2.51±0.56
P	**0.010**	**0.015**	0.212	**0.020**	**0.050**	**0.005**
Ketone analysis in the urine (n:289)						
≤6 months	2.76±0.94	2.67±0.98	2.65±0.79	2.68±0.83	2.76±0.81	2.70±0.68
>6 months	2.55±0.79	2.53±0.87	2.65±0.70	2.47±0.66	2.57±0.72	2.55±0.53
P	0.051	0.226	0.933	**0.019**	**0.048**	**0.043**
Neurological examination (n:144)						
≤1 year	2.73±0.91	2.75±0.94	2.69±0.75	2.76±0.81	2.81±0.75	2.75±0.63
>1 year	2.36±0.81	2.46±0.84	2.33±0.75	2.25±0.65	2.46±0.81	2.37±0.53
P	**0.034**	0.108	**0.014**	**0.001**	**0.018**	**0.002**

*One-way analysis of variance; †Post hoc (group that makes the difference): Tukey b HbA1c: glycated hemoglobin, FBG: fasting blood glucose, PBG: postprandial blood glucose, TG: Triglyceride, HDL: high-density lipoprotein, LDL: low-density lipoprotein, SBP: Systolic blood pressure, DBP: diastolic blood pressure, ECG: electrocardiogram.

Multiple Linear Regression Analysis Results

The total PACIC score was taken as the dependent variable. Factors such as age, gender, education level, duration of diabetes diagnosis, presence of diabetes-related complications, status of measuring blood glucose at home, status of receiving diabetes education, knowledge of diabetes-related problems, continuous physician follow-up, regular follow-up, flu vaccination, ability to recognize complications and go to the doctor, and the latest HbA1c value were taken into account as independent variables to the model.

When the significance level corresponding to the F value was examined, it was seen that the established model was statistically significant ($F=191.90$; $p<0.05$). In the last model, those who have the ability to make decisions in visited to their physician, have regular follow-ups, are university graduates, and when the t-value and significance levels of the Beta coefficients of HbA1c variables are examined; It appears to have a statistically

significant effect on total PACIC scores ($p<0.05$). It is seen that the change in total PACIC scores was explained by 52.5% of those who had decision-making skills and 19.0% of those who had regular routine follow-ups. The findings are shown in table 5.

Discussion

HbA1c (Quantitative Approach)

Socioeconomic status variables such as age, gender, education, income, occupation, health insurance, and ownership of the house are strong indicators of the development of diabetes complications and diabetes management (13,14). Our study showed same findings in literature that those with poor socioeconomic diabetics were had poor glycemic control, then those with good socioeconomic status. In addition, poor socioeconomic diabetics were less pay attention to checking their laboratory tests, vaccination, access to a physician, compliance diabetes treatment, and screening exams.

In the quantitative examination, which we consider as an indicator of metabolic control in diabetes management, HbA1c data of only 56.8% of type 2 diabetes patients diagnosed in the region were obtained. The mean HbA1c level is 6.9±1.7 mg/dl, and 61.7% of the patients have good metabolic control. The mean time after diagnosis of diabetes is 7.4±6.9 years, and 35.5% of patients have diabetes for ten years or more. According to the duration of diabetes, 50.9% of diabetics for ten years or more have good metabolic control. Metabolic control worsens significantly as time passes after the diagnosis of diabetes. We can interpret this as the lack of self-responsibility of the patients as well as the lack of continuity of service. When a model which consists of blood pressure control, blood lipids levels, and smoking status for the patients that HbA1c levels unknown (43.2%) and calculated for diabetics who meet all 3criteria at the same time and then customized for the whole group, the good metabolic control drops to 40.4%. When metabolic control was evaluated simultaneously for a total of four variables together with the HbA1c value, it was seen that only 22.7% of the patients had good metabolic control.

According to the National Diabetes Statistics 2021 Report prepared by the Centers for Disease Control (CDC) in the USA, 49.4 % of have poor metabolic control and just 18.2% of diabetics was good metabolic control level which were evaluated with HbA1c, blood pressure, cholesterol, and smoking (15).

Table 5. The final model of multiple linear regression analysis results for Turkish PACIC total score

Final model*									
Dependent Variable	**Independent Variable**	**ß**	**t**	**p**	**VIF**	**F**	**Model (p)**	**Adjusted R2**	**DW**
	Constant	1.56	14.46	<0.001					
Total	Decision-making skills	0.375	15.91	<0.001	1.19			52.5	
PACIC	Regular monitoring	0.597	13.68	<0.001	1.16	191.90	<0.001	71.5	1.93
Score	University of Education	0.162	3.38	<0.001	1.02			72.5	
	HbA1c	-0,024	-2.13	0.034	1.04			72.8	

*Stepwise, VIF: (Variance Inflation Factor), DW (Durbin-Watson), F: Overall significance of the model

When HbA1C<7% mg/dl cut-off value of metabolic control is taken as a criterion in other international studies: 50.6% in Spain (15), 54.6% in Italy (16), 18.0% in Bangladesh (17) and 24.1% in Saudi Arabia (18) had adequate glycemic control. The condition of our diabetic patients in our study is better in terms of both the average HbA1c and the rates of patients with metabolic control compared to many international study examples. Some study samples of our country findings were same when compared metabolic control ratios to international examples. For example; 40.2% of diabetics in Turkish Endocrine Metabolism Society (TEMD) study (19), 28.1% of diabetics in Turkey's 5th wave results study (20) and 25% of Prospective Urban Rural Epidemiology (PURE) study (21) had good metabolic control.

Our findings, evaluated HbA1c value for good metabolic control, is better than in many other studies. Diabetes management should be evaluated together with the level of control of risk factors (HbA1c, blood pressures, LDL cholesterol, smoking) that may lead to complications. Only in National Diabetes Statistics 2021 Report (15) provides all four condition and we found same good metabolic control levels. We avoid interpreting results while we were aware of how other studies evaluated good metabolic control.

On the other hand, the level of availability of HbA1c data may affect the validity of quantitative results. When the differences between the sociodemographic variables between the 43.2% group without HbA1c data and the 56.8% group with HbA1c recorded data were examined, it was seen that the group without HbA1c data was statistically significantly older and belonged to the lower socioeconomic strata. Accordingly, it can be assumed that the group with missing HbA1c data has more disadvantaged social class characteristics and, as mentioned in the literature, the group's HbA1c glycemic control is poor. This shows that the level of

good glycemic control we obtained in our study may have been lesser than it was.

PACIC (Qualitative approach)

In our study, the PACIC total score, which was evaluated as indicator of metabolic control, was (2.59). Our total score was found to be similar or better than Aung's study (2.20) (22), Simonsen's study (2.32) (23), Anne's study (2.44) (24) and Aghili's study (2.52) (25). A systematic meta-analysis that used PACIC to evaluate diabetes care, which included 25,942 diabetics from 34 studies in 13 different countries, showed the overall total PACIC score ranged from 1.7 to 4.3 (26). We thought that the cause of the wide range of total PACIC scores might be affected by cultural norms and local languages.

Congruent with some studies; regarding demographic variable, our study showed gender of men, higher education (28), younger patients (29,30) had significantly had higher PACIC score while some other studies showed not significantly results (26,31). Contrary to our study some investigations in which with lower level of education had higher PACIC score (26,30). We thought that diabetics with higher education had better awareness and ability to search for information about their treatment.

In our study showed crucial results on self-management of diabetes care to the health care providers. Higher Turkish PACIC scores were associated with self-care behaviors (self-monitoring blood glucose levels, regular vaccinated, satisfied treatments, treatment compliance, received diabetes education, checked follow up exams, routine physical activity, healthy eating), under control HbA1c, FBG, PBG, blood pressure and LDL cholesterol, and diabetes-related health problems such as applied to the emergency department, hyperglycemia and hypoglycemia attacks.

There were some studies in which the chronic care model was applied that demonstrate significant association between self-care behaviors, laboratory results such as HbA1c and PACIC scores (32,33).

In addition, the intervention study by Piatt et al. (34), the 5-year study by Griffin et al. (35) showed that an increase in PACIC scores, diabetes education, patient participation in goal setting and decision making significantly improvement in HbA1c, LDL cholesterol, blood pressure and also reduced diabetes-related complications. Similarly, to our findings, some studies found positive association between PACIC scores and increasing health literacy and ensuring patient-centered decision-making in diabetes management (36-38). Finally, in multivariate regression analysis showed advanced age, being uneducated, could not reach physician at any time were negatively associated with PACIC scores. We also noticed that only one-third of diabetics were able to reach their glycemic control target. We concluded that the perception of blood glucose control in the Turkish population cannot be in harmony with quantitative assessments, and metabolic control cannot be measured only with patient reporting.

Conclusion

One of the most striking findings was that one in five diabetic patients seen in the family physician information system records did not actually have diabetes. We noticed that family physicians had to enter a preliminary diagnosis to request tests from their patients. It is recommended to ensure the integration of patient records and results in the continuity of primary and secondary health care services in disease management.

In terms of HbA1c, the quantitative metabolic control variable of diabetes, approximately three-fifths are under control. We found that the contribution of primary health care services in the follow-up of diabetes was very limited. About one in seven didn't have a constant physician for diabetes and half of them didn't self-monitor their blood glucose levels. However, we demonstrated that self-monitoring blood glucose is one of the main variables affecting the HbA1c level. There was a statistically significant relation between higher Turkish PACIC scores and social determinants such as younger age, high education, and diabetes education. Besides, diabetics who had higher Turkish PACIC scores had good metabolic control parameters such as HbA1c levels, total cholesterol, and blood pressure.

It is important to note that diabetes care management should not be taken lightly and requires a collaborative effort from both the healthcare team and the patient. A comprehensive approach is necessary to ensure long-term success. Adequate lifestyle modifications, such as improved diet, exercise and regular monitoring of blood glucose levels, are essential for successful diabetes management. Furthermore, access to health services, presence of a regular follow-up physician, medications used and comprehensive diabetes education regarding diabetes self-management is also important in providing effective treatment and preventing further complications. Healthcare providers should also consider the individual's cultural and social aspects when designing patient education programs. Finally, supporting patients' self-management efforts in diabetes management, including training in the choice of treatment method and decision-making skills of the diabetic, will play a facilitating role in providing metabolic control.

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Conflict of interest statement

Authors declare no conflict of interest.

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