The Effects of the Number of Physicians Visited byType 2 Diabetes Mellitus Patients on the Rate of Achieving Target Values and Adherence to Medication

Elmira Cemalettin[1]
İlhami Ünlüoğlu[1]
Uğur Bilge[1]
Aysen Akalın[2]
Hülya Yılmaz[3]

[1]Eskişehir Osmangazi University Faculty of Medicine Department of Family Medicine
[2]Eskişehir Osmangazi University Faculty of Medicine Department of Internal Medicine Division of Endocrinology and Metabolism
[3]Eskisehir Osmangazi University, Faculty of Medicine, Department of Biostatistics and Medical Informatics

ABSTRACT
Aim: The aim of this study is to identify the adherence to antidiabetic and antihyperlipidemic medications of type 2 diabetes mellitus (DM) patients, and to determine the total number physicians they visited in different healthcare centers for the control and treatment of diabetes, the rate of achieving glycemic and lipid targets and the relationship between these variables.
Material and Methods: A survey was administered to find out the rate of achieving target levels of lipid and HbA1C in type 2 DM patients and the factors that affect adherence to treatment (i.e. the number and type of healthcare centers visited for diabetes and the number of physicians visited) as well as the rate of resort to complementary medicine and the methods used.
Results: A total of 400 DM patients – i.e. 226 (56.5%) women aged between 51 and 65 years and 174 (43.5%) men aged between 52 and 67 – were included in this study. We found that patients visited minimum 1 and maximum 4 physicians. The comparison of patients by the number of physicians they visited suggests that the values of fasting glucose, HbA1C, triglyceride, low-density lipoprotien and total cholesterol were statistically lower and the level of high-density was higher in patients that visited 2 or fewer physicians.
Discussion: It becomes more difficult to achieve target values and ensure adherence to treatment when patients seek help from more than one or two physicians for the follow-up of DM.

Key words: Type 2 Diabetes Mellitus, Number of phycisian, metabolic control

Corresponding Author:
Ugur Bilge
Eskişehir Osmangazi University Faculty of Medicine Department of Family Medicine
E-mail: dr_ubilge@windowslive.com

Tip 2 Diabetes Mellituslu Hastalar Tarafından Başvurulan Hekim Sayısının Hedef Değerlere Ulaşma ve Tedaviye Uyum Oranları Üzerine Etkileri

ÖZET
Amaç: Bu çalışmanın amacı, tip 2 diabetes mellitus (DM) hastalarının antidiyabetik ve antihiperlipidemik ilaçlarına uyumunu ve diyabetin kontrolü ve tedavisi için farklı sağlık merkezlerinde ziyaret ettikleri toplam hekim sayısını belirlemek, glisemik ve lipid hedeflerine ulaşma oranları ile bu değişkenler arasındaki ilişkiyi araştırmaktır.
Gereç ve Yöntem: Tip 2 DM hastalarında; lipid ve HbA1C hedef değerlerine ulaşma oranını ve tedaviye uyumu etkileyen faktörleri (yani üniversite hastanesine diyabet nedenli ziyaret edilen sağlık merkezlerinin sayısı ve tipi ve hekimlerin sayısı) belirlemek için bir anket uygulandı.
Bulgular: Toplam 400 DM hastası, yani 51-65 yaş arasındaki 226 (% 56.5) kadın ve 52-67 yaşları arasında ki 174 (% 43.5) erkek hasta çalışmaya dahil edildi. Hastaların en az 1 ve en fazla 4 hekimi ziyaret ettikleri tespit edildi. Hastalar; ziyaret ettikleri hekim sayısına göre karşılaştırıldığında, 2 veya daha az hekim ziyaret eden hastalarda; açlık, glikoz, HbA1C, trigliserid, düşük yoğunluklu lipoprotien ve total kolestrol değerleri istatistiksel olarak daha düşük ve yüksek yoğunluklu lipoprotein düzeyleri ise daha yüksekti .
Tartışma: Hastalar DM takibi için iki doktordan fazlasından yardım aldıklarında hedef değerleri yakalamak ve tedaviye uyumu sağlamak daha zor hale gelmektedir.

Anahtar Kelimeler:: Tip 2 Diabetes Mellitus, Doktor sayısı, metabolik kontrol

INTRODUCTION

Diabetes Mellitus (DM) is a chronic metabolic disease that requires continuous medical care, where the organism cannot make use of carbohydrate, lipid and proteins sufficiently due to insulin deficiency or insulin-associated defects. The aims of DM treatment are ensuring glycemic control during the day, reducing the risk of developing acute complications, preventing micro and macrovascular complications, fixing other associated disorders, and thus improving the life quality of diabetic patients (1).

In diabetic patients, it is important to raise awareness about diabetes, change their lifestyle and ensure adherence to medications and diet. Adherence to treatment facilitates achieving target values, and at the same time, affects morbidity and mortality. Thus, adherence to antidiabetic and antihyperlipidemic medication is important in diabetic patients (2).

Change in lifestyle is an indispensable component of type 2 DM treatment in all its stages. There is no medication that may replace a change in lifestyle. Related suggestions should be reiterated in every visit of patients. Eating habits, extent of physical activity and medication therapy should be adjusted individually to the properties of each patient (1). There isn't any data about the positive or negative effects of consulting different physicians in different healthcare centers in the literature.

Located on the northwest of Turkey, Eskişehir has the potential of representing the country in average terms. In the provincial center of Eskişehir, there are 1 faculty of medicine (i.e. a university hospital), 2 state hospitals, 4 private hospitals and 48 family healthcare centers. In Eskişehir, there are endocrinology clinics in the university hospital, 2 state hospitals and 2 private hospitals.

Referral chain is currently not an obligatory practice in Turkey. Patients may directly visit healthcare providers at all levels and receive all types of healthcare services. This allows patients with any kind of health problems to be admitted to university hospitals. Thus, these healthcare institutions are never faced with the problem of insufficient number of patients. However, patients with simple health problems who may get service from primary and secondary healthcare providers cause an increase in workload in university hospitals. In cases of chronic diseases such as DM, patients have access to healthcare providers at all levels, which allows them to get service from different physicians and centers. It is assumed that this may have some negative consequences such as problems in treatment and follow-up and increase in costs. However, there is no study conducted to prove this assumption. In this study, our main aim was to evaluate the negative impacts on treatment targets of seeing more than one healthcare provider for the treatment of chronic diseases such as DM. Also we tried to identify the adherence to antidiabetic and antihyperlipidemic medications of type 2 DM patients, who presented to endocrinology policlinics of Education and Research Hospital, Faculty of Medicine, Eskişehir Osmangazi University, and to determine the total number physicians they visited in different healthcare centers for the control and treatment of diabetes, the rate of achieving glycemic

and lipid targets and the relationship between these variables.

MATERIALS AND METHOD

This study was carried out with patients followed in the Endocrinology Policlinic of the Department of Internal Medicine, Education and Research Hospital, Faculty of Medicine, Eskişehir Osmangazi University during a period of 6 months between October 1, 2013 and March 31, 2014. This research was designed and conducted as a cross-sectional study to evaluate the relationship between the number of visits, number of healthcare centers and number of physicians, and the rate of achieving target parameters. For this purpose, a survey was administered to find out the rate of achieving target levels of lipid and HbA1C intype 2 DM patients and the factors that affect adherence to treatment (i.e. the number and type of healthcare centers visited for diabetes and the number of physicians visited before and in the university hospital) as well as the rate of resort to complementary medicine and the methods used. The survey questions were constructed by the researchers.

The research data were collected through laboratory results and surveys of individuals that were admitted for routine DM control.

The criteria for inclusion in the study were being aged over 18, voluntariness, having type 2 DM and not having any cognitive disorder that prevented the individuals from answering the questions.

The following factors were considered in the study: age, gender, educational status, TA, height, weight, body mass index (BMI), fasting blood glucose (FBG), HbA1C, level of lipid at the time of admission, whether any complication developed and there were any additional diseases, smoking, adherence to treatment, number of physicians and number and type of healthcare centers visited by the patient, approximate number of annual follow-up, and period of taking antidiabetic and antihyperlipidemic medications.

Power analysis was used to determine the number of individuals to be included in the study. The number of 350, with a power of 80%, was considered sufficient for the study, given the number of survey questions and diffusion of the disease.

In the study, the target value for HbA1C was determined as below 7.0%, in view of two different guidelines. The target value for LDL-K was determined as below 100 mg/dl in accordance with the Third Report of the National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (NCEP-ATP III). The target values for triglyceride (TG) weredetermined as below 150 mg/dl and for HDL-K over 40 mg/dl (3-4).

The study was approved by decision no. 6 of January 2, 2014 of the local ethics board in the Education and Research Hospital, Faculty of Medicine, Eskişehir Osmangazi University.

Statistical analysis

Statistical analyses were done with IBM SPSS 21. Normality of the variables was searched with Shapiro Wilk test. Descriptive statistics of non-normal countinous

variables were given as median (Q1-Q3) and categorical variables were shown with percentage. Mann Whitney U test was used to compare two independent groups that were non-normal distributed. Pearson Chi Squared Test was performed to assess the differences between groups for categorical variables. Risk factors of being in a non-target group was evaluated with logistic regression analysis. p<0.05 was found statistically significant.

RESULTS

A total of 400 DM patients – i.e. 226 (56.5%) women aged between 51 and 65 and 174 (43.5%) men aged between 52 and 67 – were included in this study. The average period of DM was within the range of 3 to 20 years.

A brief anamnesis was obtained from patients about their chronic diseases. Among participants, 367 (91.8%) patients reported that they had an additional disease. The most frequent three additional diseases were hypertension (HT) (n=266, 66.5%), coronary artery disease (CAD) (n=148, 37.0%) and goiter (n=111, 27.8%).

It was observed that as the period of DM got longer, the rate of developing complications increased. While no complication had developed yet in patients who had DM for 5 years, various complications were observed in patients who had DM for 10 years. The most frequent complications were neuropathy (49%), retinopathy (17%) and nephropathy (16%).

When women and men were compared in the research population, it was found that only body mass index (BMI) varied by gender (p<0.001), and that there was no difference with regard to age and values such as systolic blood pressure (SBP), diastolic blood pressure (DBP), FBG, HbA1C, TG, cholesterol, LDL-K and HDL-K. BMI levels were found to be higher in women (32.52±6.62 vs 29.52±6.09 kg/m^2)

Given that the target value for HbA1C is ≤7.0%, 203 (50.8%) individuals had HbA1C at the target level while 197 (49.3%) individuals did not have it at the target level in the group of 400 volunteers.

The study also examined the rate of achieving target lipid profiles,as defined in NCEP-ATP III. In this respect, the rate of achieving target LDL value of ≤100 mg/dl was 34.5%, target TG value of ≤150mg/dl was 41%, and target HDL value (M>50 mg/dl, W> 40mg/dl) was 38.5%.

In the research, patients were asked how many physicians in how many different healthcare centers they visited for the follow-up of diabetes, and it was found out that patients visited minimum 1 and maximum 4 physicians. Of 59 patients who mentioned that they visited a single physician, 59 patients were followed by a specialist of endocrinology in university hospital.The total number of patients that visited two physicians was 171: 159 visited family healthcare centers, 8 visited state hospitals, 4 visited private hospitals and 170 visited university hospitals. The total number of patients that visited three physicians was 117: 115 visited family healthcare centers, 93 visited state hospitals, 25 visited private hospitals and 114 visited university hospitals. The total number of patients that visited four physicians was 53: 53 visited family healthcare centers, 52 visited state hospitals, 45 visited private hospitals and 53 visited

university hospitals. All the latter were followed by endocrinologists, and these patients also visited endocrinologists in state and private hospitals. With regard to the number of physicians visited, the median was 2. The patients were divided into two categories, i.e. patients that visited 2 and fewer physicians (NP≤2), and patients that visited 3 and more physicians (NP≥3). The statistical analyses were carried out according to this categorization. The number of patients that visited 2 or fewer physicians for DM follow-up was 230 and that visited 3 or more physicians was 170.

The comparison of patients by the number of physicians (NP) they visited suggests that the values of FBG, DBP, HbA1C, TG, LDL-K and total cholesterol were statistically lower and the level of HDL-K was higher in patients that visited 2 or fewer physicians. There was no significant difference between the two groups with regard to age, SBP, BMI and period of DM (p<0.05) (Table 1).

Table1. The Comparison of Variables by Number of Physicians (NP)*

Variable	NP ≤2	NP ≥3	p
Age	60 (53-68)	58 (51-65)	0.058
SBP	130 (110-130)	130 (120-130)	0.811
DBP	80 (80-90)	80 (80-85)	0.033
BMI	30 (27-33)	31 (28-34)	0.182
FBG	118 (104-139)	136(117-180)	**0.001**
HbA1C	6.0 (6.0 -7.0)	8.2 (7.2-9.2)	**0.001**
LDL	103 (83-114.3)	117 (107-127)	**0.001**
TG	160 (114-204)	217 (208-227)	**0.001**
Cholesterol	153 (137-185)	162 (147-198)	**0.001**
HDL	43 (35-52)	39 (33-46)	**0.001**
Period of DM	9 (4-15.50)	8 (4-15)	0.383

* The values related to groups are presented in the table as median (Q25-Q75).

The number of patients who had HbA1C at the target value of HbA1C ≤7.0% was 230 (50.8%) and who did were not at the target were 197 (49.2%). While 75.2% of patients in the NP≤2group had HbA1C2 at the target level, only 17.6% of patients in the NP≥3 group had HbA1C2 at the target level. There was no significant difference between the two groups with regard to age, gender and period of diabetes (Table 1). In brief, we observed in this study that the rate of achieving the target value of HbA1C decreased as the number of physicians visited increased, and reversely the rate of achieving the target value increased as the number of physicians visited decreased.

The rate of achieving the target HbA1c value was taken as a dependent variable. Age, gender, period of diabetes and BMI were considered the factors that are likely to affect this rate. The logistic regression analysis of this model suggested that BMI and the number of physicians affect the rate of achieving the target HbA1c value. Therefore, a 1 unit increase in the number of physicians increases the risk of achieving the target HbA1c value by 8.38 times (OR:8.38, CI:5,43-12,95), and a 1 unit

increase in BMI increases the risk by 1.04 times (OR:1.04, CI:1.01-1.09).

The fact that the number of physicians visited is 3 or over has a negative effect on the HbA1c value. According to the posterior power analysis conducted for this correlation, the power was calculated as 1.00.

There was a significant relationshipbetween target values of FBG (≤100 mg/dl; ≤120mg/dl) and number of physicians (p<0.01). The value of FBG was ≤100 mg/dl (at the target value) in 78.3% of patients in the NP≤2 group and only in 45.4% of patients in the NP≥3group.

With respect to the rate of achieving target values according to the number of physicians visited, the rate was the highest in patients visiting 2 physicians and the lowest in patients visiting 4 physicians. Table 2 presents the rates of achieving target values as distributed by the number of physicians visited by patients.

Table 2. The Rates of Achieving Target Values by Number of Physicians Visited

Target Values	Number of Physicians			
	1	2	3	4
HbA1C ≤ 7.0	23.6%	61.6%	10.8%	3.9%
FBG ≤ 100	31.1%	42.6%	21.3%	4.9%
FBG ≤ 120	22.2%	50.0%	20.5%	7.4%
LDL	26.1%	71.7%	1.4%	7.0%
TG	27.4%	66.5%	4.9%	1.2%
TK	15.6%	44.2%	27.4%	12.7%
HDL	18.2%	48.7%	23.4%	9.7%

The study presented a significant relationship between the number of physicians visited and adherence to treatment (p<0.001). There was a total number of 221 patients that only took oral antidiabetics (OAD). Whereas 84.4% of patients in the NP≤2 group reported that they regularly adhered to treatment, the adherence to treatment was 37.6% in the group of patients with NP≥3 (p<0.001). There was a total number of 179 patients that had insulin treatment. Whereas 67.7% of patients in the NP≤2 group reported that they regularly adhered to treatment, the adherence to treatment was 24.7% in the group of patients with NP≥3 (p<0.001).

DISCUSSION

The present study investigates adherence to treatment and number of physicians visited in other healthcare institutions by type 2 DM patients admitted and followed in endocrinology policlinics of Education and Research Hospital, Faculty of Medicine, Eskişehir Osmangazi University, and searchesthe relationship between DM and achievement of metabolic target values.

The most important finding of this study is that although there was no significant difference between diabetics followed by 1 or 2 physicians and diabetics followed by 3 or more physicians with regard to age, period of diabetes, gender and rate of complications, the metabolic control was better in patients followed by 1 or 2 physicians. The rate of achieving target values of HbA1c, FBG and lipid profile was significantly lower in patients that visited 3 or more physicians. This was probably because there were changes in patients' treatment because

they did not question previous treatment, time of changing treatment and period of treatment while receiving support from different physicians and healthcare centers for the follow-up of same disease. It may be difficult to achieve metabolic values in patients who change their treatment and thus have lower adherence to treatment because of seeing different physicians. Although there was no significant difference between the two groups with regard to age, period of diabetes, gender and rate of complications, it seems that seeing more than 2 physicians was not attributable to development of complications and period of diabetes. What is known is that lower adherence to, and unreasonable use of medications are the factors that increase mortality and morbidity by rendering the control of chronic diseases harder and increasing side effects and non-adherence to medications(5-7).

Great efforts have been exerted to develop new strategies with a view to ensurebetter metabolic control in diabetes and to reduce the complications associated with diabetes. In addition to causing physical disorders, diabetes impairs the quality of life and leads to psychosocial problems (8). Even medical treatment alone has strong positive effects on patients' quality of life. Today, the quality of life has been acknowledged as the key variable of the outcomes of treatment. The quality of life should be taken into consideration when new methods and tools of treatment are developed in diabetes management (9). In this respect, the main objective of a successful treatment approach should be dealing with social and psychological aspects of diabetes, as well as complications associated with the disease (10).

We also examined the number of physicians that diabetics visited for the follow-up and treatment of their disease with regard to the rate of achieving target values of FBG, and found out that there is a significant relationship between the achievement of target values of FBG and number of physicians visited (p<0.001). The rate of achieving target values was higher in patients that visited smaller number of physicians. Particularly in the case of patients with NP≤ 2, the rate of achieving the FBG target value of ≤100 was 73.8% higher.

Small but continuous increase in HbA1C elevates the risk of major complications significantly in diabetic patients. The study related to the results of diabetes reports that primary healthcare physicians with numerous type 2 diabetes patients prescribed OAD, antihypertensive and lipid lowering medications for the treatment of diabetics (11).

The UKPDS and Steno-2 studies clearly demonstrated the benefits of intensive treatment protocols. Despite these studies and recommendations, the rate of patients that achieve target values of HbA1C, LDL-K and blood pressure is low in the world and in Turkey. A study suggested that only 37% of patients had HbA1C value lower than 7%. This study reported the rate of patients that achieved target values in HbA1C, LDL-K and blood pressure to be 7%. The problems in attaining the target in treatment evince the need for revising treatment strategies (12,13).

The results of present study indicate that the rate

of achieving target HbA1C values decreased as the number of physicians seen by patients increased and vice versa.

In a systematic study based on the analysis of data collected from 28,464 adult type 2 DM patients in Turkey between 1990 and 2010, it was reported that although there was no desirable decrease in the development of complications in a period of 20 years, there was an improvement in glycemic control level of patients and an increase in the rate of patients that achieved target values (12,13). Our study results suggested that glycemic control was better and the rate of achieving target HbA1C values was higher to a certain extent (50.8% had HbA1C value of ≤7.0%). It is concluded that these positive developments derive from the change in antidiabetic treatment choices. There is still a need for supporting these results with controlled prospective observation studies or larger studies based on medical records. Nevertheless, the findings point to the apparent contribution of insulin analogues – increasingly used in diabetes treatment in the last 10 years – to positive outcomes. In Turkey, there is not a large-scale study which focuses on the effects of various treatment alternatives on glycemic control in diabetics.

NCEP ATP III guidelines provide target values for lipid profiles in addition to blood glucose in DM. These guidelines require that fasting lipid profile should be checked once a year in adult type 1 and type 2 diabetes patients, and the target values should be as follows: LDL-K<100 mg/dl (<70 mg/dl is recommended for diabetics that had a primary cardiovascular disorder and that have continuing risk factors, e.g. smoking), TG <150 mg/dl, HDL-K >40 mg/dl for men and >50 mg/dl for women (3,4).

It has been reported that target lipid values are not achieved in a considerable rate of patients in clinical practice although the benefits of achieving target values has been evident and mentioned in guidelines. The lipid values of only 30.0% to 50.0% are under control in accordance with the guidelines (14,15-17). In Keskin's study with 106 patients, 28.3% of patients had target lipid values (18). In the present study, the rate of achieving the target LDL-K was 34.5%. In a paper on the Turkish part of Cepheus Study, it was put that the rate of achieving target LDL-K values, defined by ATP III guidelines, was 35.1% in the Turkish population (19). Similarly, in the present study, the rate of patients that achieved the target level of LDL-K was 34.5%.

In diabetic patients, glycemic control is dependent on the group of treatment, gender and period of diabetes. Non-adherence to treatment is one of the factors that causes an increase in acute and chronic complications of diabetes (20,21).

The results of our study indicate that when the number of physicians visited was 3 ormore, there was a considerable decrease in achieving target parameters and adherence to medication (see Table 2). Seeing different physicians results in polypharmacy, and thus, causes an increase in the risk of side effects and treatment costs and a decrease in adherence to treatment. Therefore, it is an obstacle to the achievement of the target of treatment (22).

In Turkey, family medicine practices were initiated after the first steps taken in 2003. The pilot scheme started in 2005 (after the *Regulation on Pilot Scheme of Family Medicine Practice* was published in the Official Gazette no. 25867 of July 6, 2005), and was then extended to cover the whole country as from 2010. One of the main aims of this practice is to ensure that an individual is followed by a single physician (and has recourse to transfer or consultation when further medical intervention is required) and stays under the control of same physician regardless of variables such as age, gender and disease, as mentioned in definitions of family medicine.

In the present study, it was not taken into consideration whether the physicians that patients visited were specialists or not. Patients were only asked how many physicians they visited for follow-up and treatment of diabetes.

Since transfer has not systematically become a part of family medicine practice yet, patients get out of the control of family physicians after they are transferred to another healthcare center.

Our study suggests that if transfer and consultation systems function completely, long-term outcomes will be positive for many diseases, particularly for diseases that require chronic follow-up, e.g. DM.

The review of literature demonstrates that the main problem in the treatment of type 2 DM is adherence to treatment, and that there is no study on the effect of the number of physicians visited by patients ontreatment outcomes. Patients' adherence to treatment is influenced by many factors, all related to each other. Complexity of treatment, reasonable course of treatment and possible side effects play an important role in patients' adherence (23). Physicians and other healthcare professionals are faced with the hard task of treating diabetic patients with poor glycemic control. The task becomes more complex because of the scarcity of treatment alternatives, limited resources and lack of education required by patients to manage their disease effectively (13).

The most important limitation of this study is that patients admitted to a single healthcare center were included in the study and that patients were not asked about the factors that affected their choice of treatment. Nevertheless, the study still provides significant data related to effects of receiving treatment from different healthcare centers and physicians.

As a conclusion, it becomes more difficult to achieve target values and ensure adherence to treatment when patients seek help from more than one or two physicians for the follow-up of DM. In our country, there is no practice of referralchain. Without any restriction from the social security institution, patients have the right to visit as many healthcare centers as they wantand as many times as they want. Therefore, visiting more than one of physicians is seen as one of the obstacles to the control of diabetes in Turkey.

Conflict of interest

None Declared Ethical Statement

The original study was approved by the local university ethics committee in Eskişehir Osmangazi University and informed consent had been obtained from the patients for participation.

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