

Are Patients with Type 2 *Diabetes Mellitus* at a University Hospital in Jeddah Achieving Treatment Goals?

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ABSTRACT

Background: *Diabetes mellitus* is one of the most prevalent chronic diseases worldwide and is very debilitating. Studies have shown that adherence to treatment recommendations are rewarded with a decrease in *diabetes mellitus* - related morbidity and mortality. The aim of this study is to assess adherence to the American Diabetes Association treatment goals in patients with type 2 *diabetes mellitus*.

Methods: This was a retrospective chart review study, between February and April, 2013, of patients with type 2 *diabetes mellitus* who attended outpatient clinics at King Abdulaziz University Hospital, Jeddah, Saudi Arabia. We included patients provided they were adults (≥ 18 years) with type 2 *diabetes mellitus* who were regularly followed up at the outpatient clinics, and they have had the disease for more than one year.

Results: We included 201 patients between 27 – 96 years old. Most patients had their blood pressure and creatinine levels measured during each visit, and close to half had their HbA1c levels measured twice in the last year of follow up. Approximately 55.10% of the patients achieved an LDL level < 2.6 mmol/L. A relatively small proportion of the patients had blood pressure measurements and HbA1c levels within the recommended guidelines (29.03% and 24.53%, respectively).

Conclusion: *Diabetes mellitus* is not very well controlled. This could be attributed to physicians' factors and patients' factors. Further studies to assess this issue are recommended.

Keywords

Diabetes mellitus; Therapeutic goals; Retrospective study.

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INTRODUCTION:

Diabetes mellitus (DM) is one of the most prevalent chronic diseases worldwide. According to a recent report by the World Health Organization, one in every ten adults worldwide has DM^[1]. Beside being highly prevalent, DM is a very debilitating disease. It is the leading cause of renal failure, blindness, and lower limb amputation^[2], and it is a common cause of worldwide deaths either directly or indirectly by causing cardiovascular and cerebrovascular diseases^[3]. Furthermore, the disease imposes substantial healthcare costs. According to one report the cost of healthcare for diabetes in 2012 exceeded \$471 billion^[4].

In addition to this global burden of the disease, DM is also a public health problem in Saudi Arabia. Its prevalence ranks among the highest in the world and is projected to increase. In 2004, the prevalence of DM was 23.7%, but more recent studies showed that the prevalence increased to 30% in 2009^[5,6]. The higher rates compared to other countries could be attributed to the different lifestyles.

Research in better treatment options are expanding, there are currently many treatment modalities for patients with DM, including lifestyle modifications, islet cell transplantation, oral hypoglycemic agents and insulin. However, patient compliance is crucial for optimum therapeutic outcome. As a result, diabetes organizations have set guidelines and recommendations to follow-up this compliance. Studies have shown that adherence to these recommendations and goals was rewarded with a decrease in DM-related morbidity and mortality. For instance, microvascular complications of DM (nephropathy, neuropathy, and retinopathy) decreased by 40% for every one percent drop in glycated hemoglobin (HbA1c) levels. Moreover, the risk of cardiovascular complications was decreased by up to 50% when blood pressure was controlled in diabetic patients^[2]. The authors also reported that blood pressure control in patients with DM decreased the risk of microvascular complications by 33%. These findings have prompted researchers to conduct studies aimed at assessing adherence to treatment goals in patients with DM, and the results, so far, are not satisfactory^[7-11].

Even though research in the field of DM is expanding in Saudi Arabia, there is a paucity of data that explore adherence to treatment goals. Thus, the aim of this

study was to assess adherence to the American Diabetes Association (ADA) treatment goals in patients with type 2 DM who were followed up at a university hospital in Jeddah, Saudi Arabia.

MATERIALS AND METHODS

This was a retrospective chart review study of patients with type 2 DM who attended outpatient clinics at King Abdulaziz University Hospital, Jeddah, Saudi Arabia. After acquiring approval from the Biomedical Ethics Research Committee of King Abdulaziz University, we collected a computer-generated list of patients with type 2 DM. We included patients provided they were adults (≥ 18 years) with type 2 DM who were regularly followed up at the outpatient clinics of the hospital, and have had the disease for more than one year. Patients who didn't meet the inclusion criteria were excluded. We collected the data in a quiet dictation room, thus ensuring the confidentiality of patients' records, between February and April, 2013.

We created a data collection sheet, which consisted of three parts. The first part covered the demographic data of patients. The second part assessed whether or not the ADA treatment goals for adult diabetic patients (Table 1)^[12] were achieved. The third part provided information about the treatments the patient received.

Some of our results were compared with the study by Qari, who investigated glycemic control among diabetic patients at King Abdulaziz University Hospital and Erfan Private Hospital in 2006. The author compared compliance to guidelines between 100 patients at King Abdulaziz University Hospital with a similar number of patients at a Dr. Erfan and Bagedo Hospital, a private hospital.

Statistical Analysis

The IBM SPSS Statistics for Windows (IBM Corp., Armonk, NY USA), version 20, was used to enter and analyze the data. Descriptive statistics were computed to determine the frequency of patients who achieved treatment goals. The chi-square (χ^2) and *t* tests were used to compare treatment goals with type of treatment administered. One sample *t* test was applied to compare our results with those of Qari^[7]. Results are expressed as frequency (percent) and as mean (standard deviation [SD]).

TABLE 1.

American Diabetes Association treatment goals for adults with *diabetes mellitus*.

Parameter	Target
Measuring HbA1C	At least twice a year
Measuring Blood Pressure	At every routine visit
Measuring Lipid Profile	At least once a year
Measuring Urine Albumin Excretion	At least once a year
Measuring Serum Creatinine	At least once a year
Ophthalmology Referral	At least once a year
HbA1C	< 7%
Blood Pressure	< 130/80 mmHg
LDL cholesterol	< 100 mg/dL (< 2.6 mmol/L)

Abbreviations: HbA1C: Glycated hemoglobin; LDL: Low-density lipoprotein

RESULTS

We included 201 patients aged between 27 – 96 years (mean [SD], 62.2 [11.9] years). Males comprised a slightly higher proportion of the sample (Table 2). Of the 201 patients, approximately one-quarter (27.36%) were followed up at the endocrinology clinics. The remainder

of the patients was followed up at other clinics, including general medicine and family medicine (Table 2). The median follow up period was 11.5 years. The most frequent co-morbidity was hypertension (84.08%), followed by ischemic heart disease (45.77%). About one-third of the patients had dyslipidemia; less than one-tenth had a history of cerebrovascular accident.

TABLE 2.
Demographic and clinical data of our patients (n = 201).

Variable		Frequency (%) / Mean or Median	Standard Deviation or Range
Clinic	Endo	55 (27.36%)	
	Non-Endo	146 (72.64%)	
Gender	Male	113 (56.22%)	
	Female	88 (43.78%)	
Age in years		62.2	11.9
Duration in years		11.5	1-55
Weight in Kg (165/201)		79.9	16.9
Height in cm (32/201)		158	87.8-178
	Hypertension	169 (84.08%)	
	Dyslipidemia	69 (34.33%)	
	IHD	92 (45.77%)	
	CVA	15 (7.46%)	
	Other	81 (40.30%)	
	HbA1c measured twice	100 (49.75%)	
	BP measured	186 (92.54%)	
	LDL measured	147 (73.13%)	
	Urine albumin measured	44 (21.89%)	
	Creatinine measured	182 (90.55%)	
	Ophthalmology referral	72 (35.82%)	
	HbA1c < 7%	39/159 (24.53%)	
	BP < 130/80	54/186 (29.03%)	
	LDL < 2.6	81/147 (55.10%)	
HbA1c (%)		8.6	3.1-16
SBP (mmHg)		139	92-220
DBP (mmHg)		74.5	50-120
LDL (mmol/L)		2.5	0.43-5.5
	Insulin	69 (34.33%)	
	Anti-dyslipidemic	114 (56.72%)	
	Aspirin	139 (69.15%)	
Oral Anti-diabetic	Zero	43 (21.39%)	
	One	77 (38.31%)	
	Two	75 (37.31%)	
	Three	4 (1.99%)	
	> Three	2 (1.00%)	
Anti-hypertensive	Zero	39 (19.40%)	
	One	47 (23.38%)	
	Two	63 (31.34%)	
	Three	35 (17.41%)	
	> Three	17 (8.46%)	
HbA1c	< 7%	39/159 (24.53%)	
	7 - 9%	57/159 (35.85%)	
	> 9%	63/159 (39.62%)	

Abbreviations: BP: Blood pressure; CVA: Cerebrovascular accident; CVD: Cardiovascular disease; DBP: Diastolic blood pressure; HbA1c: Glycated hemoglobin; IHD: Ischemic heart disease; LDL: Low-density lipoprotein; SBP: Systolic blood pressure.

Most patients had their blood pressure and creatinine levels measured during each visit, and close to half had their HbA1c levels measured twice in the last year of follow up (Table 2). Only 35.82% of the patients had been referred to see an ophthalmologist. While low-density lipoprotein (LDL) levels were measured in 73.13% of the patients, approximately 55.10% of the patients achieved an LDL level < 2.6 mmol/L. A small proportion of the patients had blood pressure measurements and HbA1c levels within the recommended guidelines.

Most of the subjects were on one or two oral hypoglycemic drugs; approximately one-third of the patients were on insulin. Similarly, most patients received two or less anti-hypertensive medications.

Regarding follow-up, there was no statistically significant difference in HbA1c levels, blood pressure measurements, and LDL levels between patients who were followed up at the endocrinology clinics and those who were followed up at other clinics (Table 3). Patients who were followed up at the non-endocrinology clinics were more likely than those who were followed up at endocrinology clinics to achieve HbA1c level < 7% and target LDL levels; however, these results did not reach statistical significance (Table 3).

When compared with the results of Qari^[7] the mean HbA1c level in our study was significantly higher than that observed in their study (*P*-value < 0.001). Likewise, the mean systolic blood pressure was significantly lower in Qari^[7]'s study (*P*-value < 0.001). On the other hand, the mean LDL level in our study was lower than that reported by Qari (*P*-value < 0.001). Furthermore, the duration of DM in our study was 14.13 years compared with 9.8 years in Qari's study (*P*-value < 0.001). (Table 4)

DISCUSSION

In this study, we report patient non-adherence to the American Diabetes Association Treatment Guidelines for adults with type 2 diabetes. All the patients in this study were followed up at the endocrinology, internal medicine, and family medicine outpatient clinics of a university hospital in Jeddah, Saudi Arabia.

We found that only 49.75% of the patients in this study had their HbA1c measured at least twice per year. This can be partly explained by the difficulty that patients face in booking follow up appointments every three to six months due to patient overload at outpatient clinics. Consequently, patients may have to wait several months before they can see a physician for follow-up. The average HbA1c achieved

TABLE 3.

A comparison of clinical and laboratory parameters between patients followed up at the endocrinology and non-endocrinology clinics*.

Variable	Endocrinology	Non-Endocrinology	P-value
HbA1c measured twice	54.55%	47.95%	0.40
BP measured	90.91%	93.15%	0.60
LDL measured	81.81%	69.86%	0.09
Urine albumin measured	25.46%	20.55%	0.45
Creatinine measured	94.55%	89.04%	0.23
Ophthalmology referral	41.82%	33.56%	0.28
HbA1c < 7%	18.00%	27.52%	0.20
BP < 130/80 mmHg	38.00%	25.74%	0.10
LDL < 2.6 mmol/L	51.11%	56.86%	0.52
HbA1c % (mean)	8.87	8.71	0.69
SBP mmHg (mean)	143.8	143.1	0.87
DBP mmHg (mean)	75.96	75.27	0.75
LDL mmol/L (mean)	2.9	2.6	0.054
Insulin	34.55%	34.25%	0.97
Anti-dyslipidemic	63.64%	54.11%	0.22
Aspirin	63.64%	71.23%	0.30
Oral Anti-diabetic	Zero	18.18%	0.85
	One	41.82%	
	Two	38.18%	
	Three	1.82%	
	> Three	0%	
Anti-hypertensive	Zero	27.27%	0.54
	One	21.82%	
	Two	29.09%	
	Three	14.55%	
	> Three	7.27%	

Abbreviations: BP: Blood pressure; DBP: Diastolic blood pressure; HbA1c: Glycated hemoglobin; LDL: Low-density lipoprotein; SBP: Systolic blood pressure. *Data are presented as percentage unless otherwise specified.

TABLE 4.

A comparison between the clinical and laboratory parameters of the patients in our study and those in Qari's study*.

	Current Study	Qari's Study (7)	P-value
Duration of DM in years	14.13 (8.94)	9.8 (5)	< 0.001
SBP mmHg	143.3 (27.04)	130 (22)	< 0.001
DBP mmHg	75.5 (12.92)	76 (12)	0.570
HbA1c %	8.76 (2.35)	7.8 (1.8)	< 0.001
LDL mmol/L	2.67 (0.98)	3.22 (0.9)	< 0.001
Insulin	34.33%	37.00%	
Statin	56.72%	29.00%	
Aspirin	69.15%	26.00%	

Abbreviations: DBP: Diastolic blood pressure; DM: Diabetes mellitus; HbA1c: Glycated hemoglobin; LDL: Low-density lipoprotein; SBP: Systolic blood pressure. *Data are presented as mean (SD) unless otherwise specified.

by the patients was 8.67%, and only 24.53% achieved A1c levels < 7%. The poor blood glucose control can be partly attributed to the fact that most patients in our sample were old, as the mean age of the patients was 62.2 years. Furthermore, co-morbidities, such as ischemic heart disease were documented in nearly half of the patients. Target HbA1c levels < 7% do not necessarily have to be achieved in elderly patients, and levels between 7% and 9% are acceptable^[13]. In elderly patients, it is more important for physicians to prevent hypoglycemia than targeting A1c levels below 7%. In addition, strict blood glucose control is not recommended in patients with ischemic heart disease in whom A1c levels above 7% are acceptable. The ACCORD trial actually showed an increase in mortality in diabetic patients with ischemic heart disease where the goal was strict blood glucose control^[14]. It is possible that results of the ACCORD trial influenced decision-making among physicians regarding blood glucose control among elderly patients, especially in those with ischemic heart disease. Another important factor that may have influenced the A1c levels in our patients is their socio-economic condition. Most patients who consult at King Abdulaziz University Hospital tolerate long waiting times for follow-up appointments and mainly do so to avail of free health care, which is offered by our institution. More so, most patients who present to the outpatient clinics of our institution have a poor financial status, and they do not have the means to purchase newer more expensive and effective medications. As a result, many patients tend to cut or skip doses in order to reduce their expenses.

Blood pressure measurement at each clinic visit is common practice, and most of our patients had their blood pressure levels measured during their appointments. Blood pressure levels were not measured, in most cases, for walk-in patients who did not have a medical file and whom the health care team at the clinics sought to help control their blood glucose in the acute setting. It was either this or they had to wait for several months before they can be seen with official appointments. A target blood pressure of < 130/80 mmHg was only achieved in 29.03% of our patients. Despite this low percentage of patients with controlled blood pressure, only 25.87% of the total patients were on more than two medications for blood pressure. More

emphasis on the deleterious effects of hypertension should be discussed between patients and physicians, and use of more medications should be sought in order to better control the pressure under recommended targets. We also believe "white coat" hypertension phenomenon might be playing a role, and that it's important for patients to keep a logbook with their home readings and bring it with them to the clinic. In practice, target blood pressure levels of < 130/80 mmHg are not easy to achieve. Recently, the ADA revised their guidelines and recommended a target systolic blood pressure below 140 mmHg, as target levels of < 130 mmHg did not confer additional benefit except in patients with nephropathy, especially those with proteinuria^[15].

Approximately three-quarters of our patients had their LDL levels measured. We believe that the remaining patients did not have their LDL levels checked due to test orders procedures. In general, when a physician orders a lipid profile at our hospital, the laboratory analyzes patient samples for total cholesterol and triglyceride levels, and LDL levels are only measured when the physician makes a separate request for LDL analysis; however, this is frequently missed.

Compared to the findings of Qari^[7], which were published about 9 years ago, we did not find any improvement in patient adherence to ADA treatment guidelines for adult type 2 diabetic patients, except that the mean LDL levels of our patients were lower than those achieved by the patients in Qari's study^[7] (2.67 mmol/L vs. 3.22 mmol/L in the study by Qari^[7]). However, nearly half of the patients in our study had ischemic heart disease, and strict control for LDL cholesterol is recommended for diabetic patients with ischemic heart disease^[12]. Another factor that may explain the discrepancy between our findings and those of Qari^[7] lies in the difference between study design and methods.

Taken together, our results suggest that the control of diabetes is suboptimal. This needs to be taken seriously given the complications of the disease. One of the options that can help in better managing those patients are the preset laboratory orders given to each patient before leaving the clinic, so that all appropriate tests are done before the next visit. A template visit note can also be used in the clinic to

ensure that blood pressure, anthropometric measurements, complications and lab values are documented each visit. Moreover, physicians need to work in collaboration with their diabetic patients to achieve treatment targets recommended by the ADA. Physicians who follow up diabetic patients need to be better educated and informed about the most recent recommendations regarding diabetes management through lectures, workshops, and courses, for example. More resources should be put in place to provide manpower and space to look after the ever-increasing number of diabetic patients to shorten follow-up appointment times at clinics. Patients with a low economic status need to be supported so that they can have all their medications in a timely fashion without interruption to improve compliance. Furthermore, we recommend making more effective medications available to diabetic patients.

Conflict of Interest

The authors have no conflict of interest.

Disclosure

None of the authors received any type of commercial support either in forms of compensation or financial for this study. They have no financial interest in any of the products or devices, or drugs mentioned in this article.

Ethical Approval

Obtained.

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هلي تتحقق أهداف علاج مرضى السكري من النوع الثاني في المستشفى الجامعي في جدة ؟

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المستخلص.

الأهداف: يعد مرض السكري النمط ٢ من أكثر الأمراض المزمنة إنتشارا على مستوى العالم، وقد أثبتت الدراسات أن الإلتزام بتحقيق أهداف العلاج نتج عنه تراجع في مضاعفات ووفيات هذا المرض، لذا فإن الهدف من هذه الدراسة هو تقييم مدى تحقق أهداف العلاج لمرضى السكري النمط ٢ حسب منظمة السكر الأمريكية.

آلية البحث: جرت مراجعة ملفات مرضى السكري النمط ٢ المراجعين للعيادات الخارجية في مستشفى جامعة الملك عبد العزيز في جدة، المملكة العربية السعودية، وشملت الدراسة المرضى ممن هم فوق ١٨ سنة والمصابين بمرض السكري النمط ٢ والمراجعين للعيادات بانتظام، والذين ثبت لديهم المرض منذ أكثر من سنة.

النتائج: كان عدد المرضى المشمولين في الدراسة هو ٢٠١ تراوحت أعمارهم بين ٢٧ - ٩٦ عاما، وكان ربع هؤلاء المرضى يتابعون في عيادة الغدد الصماء، كما تم قياس ضغط الدم ووظائف الكلى في كل زيارة، بينما جرى عند نصفهم قياس معدل السكر التراكمي مرتين في السنة

١،٥٥٪ حققوا معدل الكوليسترول الخبيث بأقل من ٢,٦، بينما حقق عدد قليل من المرضى معدل سكر تراكمي وضغط الدم بعيدا عن الهدف المطلوب.

الخلاصة: أظهرت هذه الدراسة أن التحكم والمراقبة في علاج مرضى السكري من النوع الثاني يشوبه كثير من القصور والانضباط، وربما يرجع ذلك إلى أسباب تتعلق بالطبيب المعالج أو المريض، ونوصي بإجراء دراسات مستقبلية لتحديد هذه الأسباب ومحاولة علاجها.