Quality of medical care provided to type 2 diabetic patients attending Alexandria Main University Hospital, Egypt

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Background
Diabetes mellitus is a major contributor to morbidity and mortality worldwide. A marked variability in the application of preventive and therapeutic strategies was documented. Good quality of care is associated with lower burden of complications.

Study objectives
The present study was conducted to assess the quality of medical care provided to type 2 diabetic patients attending the internal medicine outpatient clinic in Alexandria Main University Hospital.

Patients and methods
A cross-sectional survey was conducted on 490 type 2 diabetic patients. Patients were interviewed using a structured questionnaire containing data on personal and sociodemographic characteristics as well as their self-care practices. Records of interviewed patients for a set of performance measures for diabetes care during the last year were reviewed. Weight, height, and blood pressure were measured and a series of laboratory investigations were carried out in order to assess the outcome of diabetes care.

Results
The study included 490 diabetic patients, of whom 281 (57.3%) were male patients. Their mean age was 53.62 ± 10.72 years. The duration of diabetes among the studied patients ranged from 1 to 22 years, with a mean of 9.54 ± 4.78 years. Nearly one-third of them were not compliant with antidiabetic treatment; 44.1% were current smokers and 82% of them had never practiced physical exercise before. In the previous 3 months, glycosylated hemoglobin was ordered for only 60.8% of the studied patients. In the last year, foot and fundus examinations were carried out for nearly two-third of the studied patients (68.2 and 64.5%, respectively). Moreover, only 12.5, 26.1, and 38.5% of patients were investigated for microalbuminuria, serum creatinine, and blood lipids, respectively. Uncontrolled hyperglycemic state was diagnosed in a vast majority of cases (99.2%). Moreover, 78.6% were obese and 82% had hypertriglyceredemia.

Conclusion
Intermediate outcome measures – namely, poor glycemic control and high prevalence of obesity and hypercholesterolemia – denote suboptimal medical care and/or poor compliance of patients with self-care management practices. In order to improve quality of care of type 2 diabetes aiming at reducing the incidence of complications, improving outcome, and improving the quality of life of patients, multilevel intervention plan should be carried out.

Keywords:
outcome measures, process indicators, quality of care, type 2 diabetes mellitus

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Introduction

According to the International Diabetes Federation estimates in 2013, 382 million of world population suffers from diabetes mellitus, with a prevalence of 8.3%. A total of 35 million of those live in the Middle East and North Africa [1]. According to the same estimates, diabetes mellitus accounts for 8.4% of the global all-cause mortality in people between 20 and 79 years of age [1]. Increasing prevalence of diabetes is paralleled by an increase in the incidence of its chronic complications that in turn is responsible for the huge premature morbidity and mortality associated with the disease, in addition to marked reduction in the quality of life of diabetic patients and enormous healthcare costs [2].

Fortunately, effective medical care aiming at controlling glycemia, blood pressure, and blood lipid levels, improving lifestyle behavior, and reducing tobacco use were proved to be associated with substantial reduction

in this burden. Such evidence was one of the initiatives for quality assessment and quality assurance in the field of medical care of diabetes in many healthcare settings [3,4].

It was found in many small-scale randomized clinical trials that the measurement and feedback of performance in the area of diabetes care can lead to improvement in quality indicators in general and process measures in particular [5–7].

Quality assessment is defined as measuring the quality of care provided in a particular setting as a step to measure the difference between expected and actual performance according to performance standards, to identify opportunities for improvement [8]. Several quality indicators were developed in the last decade for measuring quality of diabetes care. The Diabetes Quality Improvement Project (DQIP) developed a comprehensive set of scientifically sound and relevant performance measures that can be used at the provider level and also as a benchmarking of healthcare systems by aggregating to the national level. DQIP measures included rates of annual testing (e.g. for HbA1c), screening (e.g. for foot problems and retinal disease), and levels of diabetes-related risk factor control (such as HbA1c and cholesterol) [9].

Poor quality of care of a non-negligible portion of diabetic patients in many developed and developing countries was reported in several studies, denoting inability to translate practice guidelines into routine practice in many settings [10–12].

In 2013, Egypt appeared as one of the top 10 countries in the number of people with diabetes between 20 and 79 years of age [1]. Such increase in the prevalence of diabetes is basically attributed to population growth, aging, continued urbanization and lifestyle modifications encouraging sedentary life, and obesity [13]. Development of Egyptian national practice guidelines for diabetes care in 2008 was one of the important tools to improve the quality of care provided to diabetic patients [14]. Assessment of adherence of providers to such guidelines outcomes is essential for better understanding of how to improve diabetes care and to assess the effect of future changes in the process on outcomes.

University hospitals are one of the main organizations that provide healthcare in Egypt. They are expected to provide the best quality of care. Measuring such quality of care might be considered as a thermometer for the level of care in Egypt. The present study was conducted to assess the quality of medical care provided to type 2 diabetic patients attending the internal medicine outpatient clinic in Alexandria Main University Hospital using a set of criteria mainly introduced by DQIP.

Patients and methods

A cross-sectional survey was conducted on all type 2 diabetic patients attending the internal medicine outpatient clinic in Alexandria Main University Hospital during a 3-month duration (n = 490), excluding only those who refused to participate in the study and those who did not complete the interview (n = 11 and 37, respectively). Patients were interviewed using a structured questionnaire containing data on personal and sociodemographic characteristics, their smoking habits, frequency of follow-up visits, as well as their self-care practices – namely, compliance with prescribed antidiabetes treatment, practicing exercise, and daily fruit and vegetable intake. Moreover, they were asked whether healthcare providers ask them about smoking status.

Reviewing of records for documented diabetes-related chronic complications as well as all examinations and investigations was carried out for studied patients in the last year, concentrating on foot and fundus examination, lipid tests, urine albumin, and HbA1c. Blood pressure, weight, and height were measured for all patients. Moreover, a series of laboratory investigations were carried out – namely, HbA1c, serum triglycerides, and low-density lipoprotein (LDL) cholesterol.

All patients were interviewed after being provided all information as regards the research, and they were informed that participation in the study was totally voluntary and refusal will not affect the quality of service they receive. Written informed consent was obtained from all patients who accepted to participate.

Plan for data analysis

Data were coded and transferred into a master table. Data were fed into the computer using Statistical Package for Social Science (SPSS, version 18, Microsoft Excel 2010). Possible mistakes were checked for by a series of frequency distributions to ensure that all questions had valid codes and a total set of data was entered for each respondent. The following calculations and recordings were carried out:

(1) BMI:

It was calculated using the formula: $\mathrm{BMI} = \dfrac{\mathrm{Weight}\left(\mathrm{kg}\right)}{\mathrm{Height}\left(\mathrm{m}^2\right)}$.

On the basis of BMI, the weight status was determined as follows: individuals with a BMI between 25 and

29.9 were considered as overweight; individuals with a BMI of 30 to less than 35 were considered obese grade I; individuals with a BMI between 35 to less than 40 were considered as obese grade II; and those with a BMI of 40 or greater were considered as grade III.

(a) Blood pressure is considered uncontolled if systolic blood pressure exceeds 140 mmHg and/or the diastolic pressure exceeds 90 mmHg [15].
(b) As regards the state of glycemic control, an A1c level of less than 7 denotes proper glycemic control and that higher than 7 and less than 9.5 g/dl denotes inadequate control (low threshold level). However, poor glycemic control is considered when HbA1c is 9.5 g/dl or more (high threshold level) [15].

Descriptive statistics were used using number and percentage for qualitative variables, and as mean and SD for quantitative variable.

Results

The present study included 490 type 2 diabetic patients with male predominance, constituting 57.3% of the sample. The age of studied patients ranged from 25 to 75, with a mean of 53.62 ± 10.72 years. The most commonly encountered in the sample are those who are illiterate, constituting 33.5% of the studied patients. In contrast, a minority (0.8%) was highly educated (university education). Only 41.8% of studied patients were currently working and the remaining patients were retired, housewives, or not working. The crowding index for the studied families ranged from 0.5 to 3, with a mean of 1.36 ± 0.62. An overall 44% of studied patients were either current smokers or ex-smokers (30.6 and 13.3%, respectively) (Table 1).

As regards the BMI of studied patients, more than three-quarter (78.6%) of studied diabetic patients were obese and 18.2% were overweight (Table 1).

The mean duration of diabetes among studied patients was 9.54 ± 4.78. Only one-fifth (20.4%) of them took insulin as the main antidiabetic treatment and 5.7% adjusted on a combined insulin and oral hypoglycemic drugs. On the basis of the patients' medical records, two-third of patients (66.5%) suffered from a sort of foot complications ranged from peripheral neuropathy to lower extremity amputation. Diabetic retinopathy and renal failure were recorded for 31.8 and 9.8% of studied patients, respectively (Table 2).

Table 3 shows that only two-third of studied patients (64.1%) are typically compliant with the prescribed antidiabetic treatment. Only 44.4% of them followed their diabetes at a frequency of 2 months or less. The majority of them (82%) did not practice physical exercise at all. Daily vegetable and fruit intake was reported by 77.9 and 55.1% of patients, respectively.

Table 4 shows process indicators for diabetes care provided to type 2 diabetic patients as recorded

Table 1 Background characteristics of studied diabetic patients

Background characteristics	Studied diabetic patients (n = 490) [n (%)]
Sex	
Male	281 (57.3)
Female	209 (42.7)
Age	
Minimum–maximum	25–74
Mean ± SD	53.62 ± 10.72
Educational level	
Illiterate	164 (33.5)
Read and write	68 (13.9)
Primary education	93 (19.0)
Preparatory education	40 (8.2)
Secondary education	121 (24.7)
University education	4 (0.8)
Employment status	
Currently working	205 (41.8)
Retired/not working/housewife	285 (58.2)
Crowding index	
Minimum–maximum	0.5–3
Mean ± SD	1.36 ± 0.62
Cigarette smoking	
Currently smoker	216 (44.1)
Nonsmoker	210 (42.9)
Ex-smoker	65 (11.4)
Weight status (BMI)	
Overweight	89 (18.2)
Obese grade I	237 (48.4)
Obese grade II	100 (20.4)
Obese grad III	48 (9.8)

Table 2 Diabetic history of studied diabetic patients

Medical and diabetic history	Studied diabetics (n = 490) [n (%)]
Duration since diagnosis (years)	
Minimum–maximum	1–22
Mean ± SD	9.54 ± 4.78
Types of antidiabetic treatment	
Insulin	100 (20.4)
Oral hypoglycemic drugs	362 (73.9)
Both insulin and oral drugs	28 (5.7)
Type of chronic diabetic complications[a]	
Coronary heart disease	128 (26.1)
Chronic hypertension	269 (54.9)
Diabetic retinopathy	156 (31.8)
Foot complications (neuropathy, ulceration, gangrene, amputation)	326 (66.5)
Diabetic nephropathy	48 (9.8)

[a]Categories are not mutually exclusive.

in the last year. It shows that 68.2% of patients received at least one complete foot examination, 64.5% of patients received fundus examination by an ophthalmologist, 60.8% of patients received one or more A1c test(s), 15.5% of patients received one test for microalbuminuria, and 38.6% of patients were tested for lipid profile.

High blood pressure was diagnosed in 42.2% of patients. Hypertriglyceredemia was diagnosed in 82% of patients. Moreover, the level of LDL cholesterol exceeded 130 mg/dl in 42.2 % of cases (Table 5).

As regards state of glycemic control, the level of A1c ranged from 7 to less than 9.5 g/dl in more than two-third of studied patients (69%). Moreover, 30% of patients had a poor glycemic control, with HbA1c of 9.5 or greater. Only a minority of them (0.8%) had controlled glycemic state (HbA1c <7 g/dl) (Table 5).

Discussion

Adequate adherence to clinical practice guidelines is considered the first step toward improvement of diabetes care in healthcare settings. The majority of diabetes-related complications are preventable through high-standard quality of care as well as patients' compliance with diabetes self-care practices.

Diabetes self-care practices are behaviors undertaken by people with diabetes to successfully manage the disease on their own [16]. A strong positive correlation was found between such behaviors and optimum glycemic control and subsequent reduction in the incidence of diabetes complications as well as improving their quality of life [17, 18]. Healthy diet, being physically active, and compliance with prescribed medications are among those self-care practices that are necessary for optimum control [19].

Unfortunately, in many previous studies, poor compliance of diabetic patients with self-care practices was noted [16, 20]. Similarly, in the current study, practicing physical exercise, vegetable and fruit consumption as well as strict adherence to the prescribed treatment were inadequate (18, 77, 55, and 62%, respectively). This might be one of the possible explanations for improper glycemic control noted among the studied population. One of the realities about type-2 diabetes is that only being compliant to self-care activities will not lead to good metabolic control. Research work across the globe has documented that metabolic control is a combination of many variables, not just patient compliance [21, 22].

Table 3 Self-care practices among the studied diabetic patients

Self-care practices	Studied diabetic patients (*n* = 490) [*n* (%)]
Compliance with antidiabetic treatment	
Always	314 (64.1)
Sometimes	160 (32.7)
Occasionally	16 (3.3)
Frequency of follow-up visits	
Every week	4 (0.8)
Twice monthly	8 (1.6)
Every month	206 (42.0)
Every 2 months	136 (27.8)
More	136 (27.8)
Regular exercise practicing	
Yes	88 (18.0)
No	402 (82.0)
Daily vegetables intake	
Yes	382 (77.9)
No	108 (22.1)
Daily fruit intake	
Yes	270 (55.1)
No	220 (44.9)

Table 4 Process indicators among studied diabetic patients (*n* = 490)

Percentage of patients who received at least one complete foot examination	68.2
Percentage of patients who received a dilated retinal examination by an ophthalmologist	64.5
Percentage of patients who received one or more A1c test (s)	60.8
Percentage of patients who received any test for microalbuminuria	15.5
Percentage of patients who received at least one lipid profile test (or ALL component tests)	38.6
Percentage of patients who were assessed for smoking status	0.0

Table 5 Intermediate outcome measures among studied diabetic patients

Outcome measures	Studied diabetic patients (*n* = 490) [*n* (%)]
Glycemic control	
Controlled (A1c<7 g/dl)	4 (0.8)
Inadequate control (7-<9.5 g/dl)	338 (69.0)
Poor control (≥9.5 g/dl)	148 (30.2)
Uncontrolled blood pressure	208 (42.4)
Hypertriglyceridemia	402 (82.0)
LDL<130 mg/dl	209 (42.4)

LDL, low-density lipoprotein.

Obesity is one of the known risk factors for type 2 diabetes and at the same time is associated with significantly worse cardiovascular risk factors among diabetic patients, including dyslipidemia, atherosclerosis, and hypertension [23]. In the current study, the percentage of obese individuals constitutes nearly 90% of the studied diabetics; of those, 13.6%

were morbidly obese. In accordance, many previous studies demonstrated high percentage of obesity among diabetic patients, suggesting that more active interventions directed to control weight gain must be taken into consideration in planning care for diabetic patients [23–25].

Smokers with diabetes have higher risks for serious complications, including heart and kidney disease, lower extremity amputation, diabetic retinopathy, and peripheral neuropathy [26]. More than one-half of the studied diabetic patients in the current study (55.5%) are either current smokers or ex-smokers. They constitute the vast majority of studied male diabetic patients.

High-quality medical care in the form of proper adherence to process indicators in the process of care is one of the important determinants of outcome of provided care. Annual screening of diabetic patients for complications and glycemic control constitute the main performance measures for diabetes quality of care as introduced by DQIP.

Annual foot examination for early detection of vascular insufficiency and peripheral neuropathy as the major risk factors for lower extremity amputations among diabetic patients is recommended for all diabetic patients at a usual level of risk. In the current study, it was carried out for more than two-third (68.2%) of the studied diabetic patients during the last year. However, this percentage is much higher than that reported by many previous studies, such as those of Delavari *et al.* (2009) [10] and Wesselink *et al.* (2015) [11] (17.3 and 33%, respectively), but still the quality and degree of completion of examination is not clear in the records.

Similarly, the percentage of patients who underwent fundus examination in the last year (64%) was much higher than that recorded in similar previous studies. Only 46% of Egyptian diabetic patients attending a family health center in Alexandria in 2013 [27] underwent fundus examination in the last year. Similarly, Delavari *et al.* (2009) [10] in their Iranian study reported that only 39.8% of patients underwent fundus examination. These findings might give an evidence for better quality of care provided in university hospitals as compared with other settings.

By performing an A1c test, health providers can measure a patient's average glycemic state over the preceding 2–3 months, and thus assess treatment efficacy. A1c testing should be performed routinely in all patients with diabetes: first, to document the degree of glycemic control at initial assessment, and then as a part of continuing care. Measurement of A1c approximately every 3 months is required to determine whether a patient's metabolic control has been reached and maintained within the target range [15]. In the current study, 60.8% of the studied diabetic patients were tested for A1c at least once in the last 3 months. This figure is considered suboptimal, but it still higher than those reported by many research studies. Fatouh and Nour El-Din (2009) [7] reported that none of the reviewed records had glycosylated hemoglobin results. Moreover, in an Iranian study (2009) that was carried out on 2692 type 2 diabetic patients, it was found that only 6.4% of the participants had undergone a A1c test during the year before questioning.

Annual testing for microalbuminuria and dyslipidemia was the lowest among process indicators, as only 15.3 and 38.6% of patients had undergone it in the last year, respectively. Very low performance of such expensive investigations can be attributed to the required patient copayment. This was supported by Karter *et al.* [28] in a study conducted in USA (2003) that investigated the effect of out-of-pocket expenditures on the utilization of recommended diabetes preventive services.

Indicators of intermediate outcomes of care (control of blood pressure, HbA1c, and LDL cholesterol) were also among the original DQIP measures. Measuring blood pressure and ordering for HbA1c, and LDL cholesterol in the current study showed that 42.2% showed uncontrolled blood pressure and less than 1% of patients had an optimum glycemic control. In contrast, nearly one-third (30%) had very poor glycemic control with HbA1c of 9.5 or higher. These findings are in agreement with previous studies on type 2 diabetic patients in primary care settings in Saudi Arabia, Egypt, and USA, which have often shown poor glycemic control in most of the patients [28–30].

This poor control of risk factors is not matching with the process indicators, which are considered accepted in some of them. Similar results were found in previous studies. It demonstrated that, although it is relatively easy to improve performance for simple processes of care, improvements in important intermediate outcomes such as A1c, blood pressure, and LDL cholesterol do not necessarily follow [31,32]. This was evidenced by weak correlations between system-level performance for processes of care and for intermediate outcomes [33]. This might be explained by the fact that control of these risk factors is influenced not only by provider actions but also by factors such as patient behaviors, comorbidity, and concerns about medication safety and cost.

The previous findings conclude that adherence to process measures in managing diabetic patients is not

enough to accomplish the desired outcome measures. The study recommends the importance of evaluating adequacy of management plan provided to every patient not only for calculating percentage of uncontrolled cases but also to allow proper management and follow-up of these cases. This might need development of diabetes registry using computerized recording system to enter patient's data in the initial and follow-up visits. Organized health education programs should be conducted entailing particularly healthy lifestyle, weight control, compliance with treatment, and self-care management.

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Conflicts of interest
There are no conflicts of interest.

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