Original Article

The Effect of Frequent Diabetes Self-Management Education on Glucose Control in Patients with Diabetes at the Dubai Diabetes Center in Dubai, United Arab Emirates

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Abstract

Aims: The aim of this study is to retrospectively assess the effect of ongoing diabetes self-management education (DSME) on glycemic control among patients who received diabetes care at the Dubai Diabetes Center in Dubai, United Arab Emirates. **Materials and Methods:** The electronic medical records of all patients who attended the Dubai Diabetes Center for an initial visit between January and December 2015 were reviewed. **Results:** Patients who attended frequent follow-up visits (≥4 visits) within 1 year were found to have significantly lower HbA1c levels at the end of the 12-month study period as compared to those who attended less frequent follow-up visits (<4 visits). The mean difference in HbA1c from the initial visit was significantly greater in the group that attended frequent follow-up visits as compared to those who did not. The logistic regression analysis revealed the frequency of follow-ups to be a significant predictor of glycemic control, whereby patients who attended more frequent follow-ups had better glycemic control. **Conclusions:** Our research revealed the significance of frequent diabetes patient education on glycemic control in the United Arab Emirates. Our results can aid in shedding light that frequent and continued DSME can have a positive impact on disease outcomes in patients with diabetes.

Keywords: Diabetes, follow-up visits, glycemic control, self-management education

Introduction

Diabetes mellitus – prevalence and implications

Due to the rapid rise in the prevalence of type 2 diabetes mellitus, it is now recognized as a global public health concern.[1] According to the International Diabetes Federation,[2] most countries are estimated to dedicate 5%–20% of their total health-care expenditures toward the treatment of diabetes. The global spending to treat diabetes and its complications were estimated to total up to 673 billion dollars in 2015 and is predicted to increase to 802 billion dollars by the year 2040.[2]

In the case of the Middle East and North Africa, the prevalence of diabetes has been projected to show an increase from 9.7% in 2014 to 11.6% by the year 2035.[1,3] In the United Arab Emirates, diabetes is estimated to affect 19% of the population, with the prevalence estimates being among the highest globally.[1,4]

As a result, high-quality medical care and multi-factorial risk reduction interventions are essential to be able to reduce the burden of microvascular and cardiovascular diseases, and in turn, improve diabetic patients' outcomes.[5]

Diabetes self-management education and support-definition and significance

The management of type 2 diabetes incorporates the ability of the patient to change his/her lifestyle, maintain a controlled diet and practice physical activity, manage his/her disease, as well as follow a program of periodic follow-ups and educational sessions.[6]

Diabetes self-management education (DSME) is defined as the process of facilitating the knowledge, skill, and ability

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necessary for diabetes self-care, and it is an essential part of diabetes care.[5,7]

Diabetes self-management support, on the other hand, refers to the support that is needed to implement and sustain coping skills and behaviors that are required to self-manage diabetes on an ongoing basis.[7]

Self-management education is recognized as an important component for managing Type 2 diabetes and the American Diabetes Association states that all patients with diabetes should receive this education from the point of diabetes diagnosis and as needed thereafter.[7,8] DSME/S programs are designed to address patient health beliefs, cultural needs, current knowledge, physical limitations and emotional concerns, health literacy, medical history as well as other factors that have an influence on the person's ability to meet the challenges of diabetes self-management.[7]

Diabetes self-management education: Its use and effect on diabetes control among diabetic patients

Studies have found that the implementation of DSME improves patient's self-management and blood glucose control and thus should be considered an essential element in diabetes treatment. DSME has been found to lead to more than 0.4% decrease in HbA1c level, more than 5 mg/dl reduction in total cholesterol levels, and more than 18 mg/dl reduction in fasting blood glucose levels.[5]

A retrospective analysis by Brunisholz *et al*.[9] assessed the impact of DSME in improving the outcome of diabetes care by comparing HbA1c in adult patients who received DSME training from an accredited American Diabetes Association and those who attended the same clinic but did not receive DSME. Patients who received DSME were found to have a significant difference in HbA1c as compared to controls, with an almost three-fold decline in HbA1c compared to controls after adjusting for possible confounders.[9]

Furthermore, in a meta-analysis, including 31 studies, aimed at assessing the efficacy of DSME in adult patients with Type 2 diabetes, HbA1c was found to decrease at immediate follow-up, with increased contact time between educator and patient significantly increasing the effect (reflected with a significant decrease of HbA1c by 0.26% at ≥4 months of follow-up).[10]

This is the first study in the United Arab Emirates, to date, that evaluated the effect of ongoing diabetes education on glucose control for patients.

Materials and Methods

The electronic medical records of all patients who attended the Dubai Diabetes Center for an initial visit between January and December 2015 were reviewed. In addition, the demographic and clinical data of each patient were obtained from the medical records (age, gender, height and weight, blood pressure, lipid profile, type of diabetes and duration, medication therapy, and attendance frequency with the diabetes educators).

Patients were included if they were aged 18 years and above, had a clinical diagnosis of diabetes mellitus (Type 1 or 2 diabetes and gestational diabetes), had an HbA1c measurement of 6.5% (47.5 mmol/mol) and/or above (measured at any of the laboratories that are under the Dubai Health Authority) within 1 month before their initial visit to Dubai Diabetes Center), had attended their initial visit with the endocrinologist as well as the diabetes and dietitian educators, and were attending their follow-up visits only at the Dubai Diabetes Center.

Frequent ongoing education was defined as having attended ≥4 follow-up visits within the 1-year period being studied.

Patient were excluded if they had attended the Dubai Diabetes Center for the initial visit and did not attend for any of the follow-up visits thereafter and if they had a clinical diagnosis of anemia, advanced kidney, and liver disease as these conditions can affect HbA1c values.

The outcome variables for this study were improved glycemic control (reflected by a reduction in HbA1c) after receiving ongoing education. The secondary outcome variables were improved weight (kg) and body mass index (BMI) (kg/m^2), lipid profile (mg/dl), and blood pressure (mm/Hg).

Data analysis

Statistical analysis was performed using the SPSS statistical package versions 18 (Statistical analysis was performed using PASW Statistics for Windows, Version 18.0, Chicago, SPSS Inc., USA).

Patients were divided into two groups: patients who attended ≥4 follow-up visits within a 1-year period (cases) and those who did not attend their follow-ups frequently (≤3 visits) (controls).

Baseline data between the groups were assessed using an independent samples *t*-test, and the results were reported as means ± standard deviations for the continuous variables, and a Chi-square analysis was used for the categorical variables with the results being reported as percentages and *P* values. Changes in HbA1c and the secondary parameters (BMI, lipid profile, and blood pressure) from baseline (at start time) to 12 months within each subject were assessed using a Student's paired *t*-test, and comparisons between time points were assessed using the repeated-measures ANOVA. A multivariate logistic regression analysis was used to evaluate the correlates of glycemic control while allowing for the control of any confounding variables. The dependent variable in the multivariate logistic regression analysis was HbA1c and the independent variables included, in addition to age, all the variables that showed statistical significance in the Chi-square analysis and one-way ANOVA. A two-sided $P < 0.05$ was considered to be statistically significant.

Results

Baseline and clinical characteristics of the study population are presented in Table 1. The study participants' mean age

Table 1: Baseline and clinical characteristics of the study participants

	Overall (*n*=371)	<4 visits (*n*=222)	≥4 visits (*n*=149)	*P**
Age (years), mean±SD	51.82±13.61	51.67±13.36	52.05±14.02	0.795
Sex, *n* (%)				
Male	189 (50.9)	118 (53.2)	71 (47.7)	
Female	182 (49.1)	104 (46.8)	78 (52.3)	0.299
Type of diabetes, *n* (%)				
Type 1 diabetes	26 (7.0)	13 (5.9)	13 (8.7)	
Type 2 diabetes	343 (92.5)	209 (94.1)	134 (89.9)	
Other	2 (0.5)	0 (0.0)	2 (1.3)	0.123
Baseline BMI, *n* (%)				
Underweight (BMI<18.5)	3 (0.8)	1 (0.5)	2 (1.4)	
Normal weight (BMI 18.5–24.9)	42 (11.4)	25 (11.4)	17 (11.5)	
Overweight (BMI 25–29.9)	106 (28.9)	65 (29.7)	41 (27.7)	
Obese (BMI≥30)	216 (58.9)	128 (58.4)	88 (59.5)	0.801
BMI_Time 2, *n* (%)				
Underweight (BMI<18.5)	3 (0.8)	1 (0.5)	2 (1.4)	
Normal Weight (BMI 18.5–24.9)	42 (11.7)	24 (11.3)	18 (12.2)	
Overweight (BMI 25–29.9)	118 (32.8)	72 (33.8)	46 (31.3)	
Obese (BMI≥30)	197 (54.7)	116 (54.5)	81 (55.1)	0.783
Telephone follow-ups, *n* (%)				
No	322 (87.0)	202 (91.4)	120 (80.5)	
Yes	48 (13.0)	19 (8.6)	29 (19.5)	0.002
Blood pressure_baseline				
Systolic	136.79±18.71	136.51±18.89	137.22±18.48	0.722
Diastolic	75.59±12.07	76.2±12.49	74.69±11.41	0.239
Blood Pressure_time 2				
Systolic	134.96±16.49	135.71±17.48	133.85±14.92	0.290
Diastolic	74.93±11.45	75.37±11.71	74.28±11.07	0.375
Cholesterol, mean±SD				
Baseline	180.25±44.16	181.14±40.48	178.97±49.11	0.648
Time_2	165.21±42.21	171.59±42.90	156.75±39.89	0.001
LDL, mean±SD				
Baseline	110.28±38.69	111.60±37.03	108.38±41.00	0.442
Time_2	165.21±42.21	101.02±36.61	88.24±32.68	0.001
HDL, mean±SD				
Baseline	48.70±13.67	48.43±13.27	49.10±14.29	0.650
Time_2	48.46±13.22	48.52±14.11	48.38±11.97	0.924
TG, mean±SD				
Baseline	149.35±100.13	154.33±102.89	142.11±95.84	0.259
Time_2	136.23±81.68	141.56±79.72	129.13±83.98	0.170

**P* value was derived using an independent samples *t*-test for the continuous variables and a Chi-square analysis to compare the means for the categorical variables. BMI: Body mass index, LDL: Low-density lipoprotein, HDL: High-density lipoprotein, TG: Triglycerides, SD: Standard deviation

was 51.8 ± 13.6 years, with no significant difference between the two groups and the majority had type 2 diabetes (92.5%). Most of the study participants belonged to the obese BMI category (54.7% of study participants), where despite statistically insignificant differences between the two groups, the percentage of those who had a BMI ≥30 was slightly higher among patients who followed up frequently (≥4 visits). Patients who attended frequent follow-ups were also more likely to be followed up by the telephone (19.5% vs. 8.6% for patients who attended frequent visits and those who did not, respectively; P = 0.002). While there were no differences in baseline cholesterol between the two groups, patients who attended frequent follow-ups had significantly lower cholesterol levels at the end of the 12 months study period (156.75 ± 39.89) as compared to those who did not attend their follow-ups frequently (171.59 ± 42.90); P = 0.001. The same held true for lipoprotein cholesterol levels at the end of the study period (88.24 ± 32.68 vs. 101.02 ± 36.61; P = 0.001).

A total of 84.6% of the patients had an HbA1c≥7% (≥53 mmol/mol) at the start of the study, and while there was no significant difference in the baseline HbA1cs between the two groups, patients who attended ≥4 follow-up visits had a significantly lower HbA1c (57.8%; mean HbA1c 7.25% [56 mmol/mol] ±1.15) at the end of the 12 months period as compared to those who attended <4 visits (69.7%; mean HbA1c: 8.69% [71 mmol/mol] ±6.66) (P = 0.01) [Table 2].

The difference in HbA1c was significantly greater in the group that attended frequent follow-ups compared to those that did not; 1.88% versus 0.13% (P = 0.002) [Table 2]. A 1% decline in HbA1c has been correlated with a 15% reduction in cardiovascular disease risk;[9,11] therefore, these small changes in HbA1c will translate to a significant risk reduction for patients clinically.

There was a significant difference in HbA1c between baseline values and at time 2 and between baseline and time 3 in both groups (P < 0.05) [Table 3]. While the difference between baseline HbA1c and at the end of the study period (HbA1c time 4) was not significant in patients who were not followed up frequently (P = 1.000), there was a significant decline in HbA1c between baseline and time 4 within the participants in the group who were seen frequently (with a mean difference: 1.989; P = 0.000). Differences in HbA1c between time 2, time 3, and time 4 were, however, not significant in all the study participants [Table 3].

The logistic regression analysis revealed that patients with an HbA1c ≥7% (≥53 mmol/mol) at the start of the study had a higher HbA1c at the end of the study. The adjusted odds ratio (OR) was significantly higher for patients with a higher initial HbA1c (OR: 3.207, 95% confidence interval [CI]: 1.644–6.258) [Table 4].

Moreover, after adjusting for all confounding variables, frequency of follow-up visits was an independent predictor of glycemic control whereby patients who followed up frequently demonstrated a significantly lower HbA1c at the end of the study as compared to those who did not follow-up frequently (OR: 0.554; 95% CI: 0.332–0.926).

Discussion

Self-management diabetes education has been shown to improve patient's self-management of their diabetes and blood glucose control, with studies reporting reductions in HbA1c, fasting blood glucose, and blood cholesterol levels.[11]

With numerous studies in the literature evaluating the effect of DSME on glycemic control in patients with diabetes mellitus, studies in the Arab region, particularly in the United Arab Emirates, are scarce. Al-Maskari *et al*.[12] sought to assess the knowledge, attitudes, and practices of diabetes patients attending

Table 2: Changes in hemoglobin A1c between the two groups from baseline to 12 months

	Overall (n=371)	Mean±SD		F	P*
		<4 visits (n=222)	≥4 visits (n=149)		
HbA1c (%)					
Baseline	9.01±2.04	8.92±2.11	9.15±1.94	1.212	0.272
HbA1c_2	7.58±1.58	7.63±1.70	7.51±1.40	0.538	0.464
HbA1c_3	7.59±2.37	7.63±1.70	7.55±3.06	0.083	0.773
HbA1c_4	8.08±5.16	8.69±6.66	7.25±1.15	6.721	0.010
Mean difference from baseline and 12 months ($HbA1c_1$ to $HbA1c_4$)	0.87±5.30	0.132±6.64	1.88±2.15	9.481	0.002

*P value was derived using a one-way ANOVA analysis for the differences between the groups. HbA1c: Hemoglobin A1c, SD: Standard deviation

Table 3: Within-subject changes in hemoglobin A1c across the study period in the study groups

<4 visits				≥4 visits			
Measure (a)	Measure (b)	Mean difference (a–b)	P*	Measure (a)	Measure (b)	Mean difference (a–b)	P*
HbA1c_baseline	HbA1c_2	1.214	0.000	HbA1c_baseline	HbA1c_2	1.682	0.000
	HbA1c_3	1.169	0.000		HbA1c_3	1.651	0.000
	HbA1c_4	0.012	1.000		HbA1c_4	1.989	0.000
HbA1c_2	HbA1c_baseline	−1.214	0.000	HbA1c_2	HbA1c_baseline	−1.682*	0.000
	HbA1c_3	−0.045	1.000		HbA1c_3	−0.0031	1.000
	HbA1c_4	−1.203	0.266		HbA1c_4	0.306	0.096
HbA1c_3	HbA1c_baseline	−1.169	0.000	HbA1c_3	HbA1c_baseline	−1.651	0.000
	HbA1c_2	0.045	1.000		HbA1c_2	0.031	1.000
	HbA1c_4	−1.158	0.300		HbA1c_4	0.338	1.000
HbA1c_4	HbA1c_baseline	−0.012	1.000	HbA1c_4	HbA1c_baseline	−1.989	0.000
	HbA1c_2	1.203	0.366		HbA1c_2	−0.306	0.096
	HbA1c_3	1.158	0.300		HbA1c_3	−0.338	1.000

*P value was derived using a repeated-measures ANOVA analysis for mean differences in HbA1c within same subjects; significant at P<0.05. HbA1c: Hemoglobin A1c

Table 4: Multivariate logistic regression model with odds ratio estimates and 95% confidence interval for the correlates of glycemic control among the study participants

	<7	≥7	OR (95% CI)
Age	50.95 ± 11.854	52.16 ± 14.184	1.023 (1.002–1.044)
Diabetes type (%)			
Type 1 diabetes	2 (1.6)	23 (10.2)	1
Type 2 diabetes	120 (97.6)	201 (89.3)	0.080 (0.017–0.376)
Other	1 (0.8)	1 (0.4)	0.088 (0.003–2.231)
Follow-up visit			
<4 visits	61 (49.6)	140 (62.2)	1
≥4 visits	62 (50.4)	85 (37.8)	0.543 (0.341–0.865)
BP_Diastolic_baseline	77.12 ± 11.253	74.35 ± 12.337	0.985 (0.965–1.005)

OR: Odds ratio, CI: Confidence interval

the outpatient clinics of Tawam and Al-Ain hospitals in the United Arab Emirates, whereby they found 31% of a sample of 575 diabetes patients to have poor knowledge of diabetes, of which 57% exhibited poor glycemic control. This study was the first to examine the effect of frequent and continuous diabetes patient education on glycemic control in the United Arab Emirates.

Our study found the difference in HbA1c to be significantly greater in the group that attended frequent follow-ups compared to those that did not. When one considers that a 1% decline in HbA1c is associated with a 15% reduction in the risk of cardiovascular disease, we find that these relatively small changes in HbA1c translate to a clinically significant risk reduction for patients.[9]

We found that the last HbA1c continued to be lower and significantly below baseline in patients who followed up more frequently, whereas the last HbA1c in the group who were not followed up frequently increased to become insignificant as compared to baseline. This could be attributed to the lack of compliance of patients to all of their scheduled follow-up visits. The diabetes education visits include assisting patients in tackling challenges that they may face in their diabetes management as well as instructing them on self-care behaviors that can aid in improving their glycemic control. As a result, patients who do not comply with attending their follow-ups frequently will likely miss important aspects of their diabetes education, which can, in turn, negatively impact their HbA1c values.

Several limitations are to be considered in this study. First, information about possible differences in education and socioeconomical levels, diabetes duration, and medication use between the groups is lacking and could have had an influence on the findings of this study. Second, the retrospective nature of the study poses as a limitation due to possible residual confounding.

Conclusion

Consistent with previous studies, our research revealed the significance of frequent diabetes patient education on glycemic control, in addition to cholesterol levels, in the United Arab Emirates. The results can aid in shedding light that frequent and continued DSME can have a positive impact on diabetes patients' disease outcomes.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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