

Diabetes care and control: the effect of frequent visits to diabetes care center

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Ann Saudi Med 2014; 34(3): 229-234

DOI: 10.5144/0256-4947.2014.229

BACKGROUND AND OBJECTIVES: Frequent visits to diabetes care clinics linked with better control of diabetes mellitus (DM), but debates exist about how frequently visits should be done. The objective of this study was to assess the effect of frequent visits on diabetes care and control.

DESIGN AND SETTINGS: A prospective study of 100 diabetic patients attending Prince Abdul-Aziz Bin-Majed Diabetes Care Centre (PAMDCC), Al Madinah Al Munawwarah, Saudi Arabia, during the period from March 2011 through December 2012.

METHODS: Demographics, lifestyle, and diabetes data were obtained at the index visit. At that and subsequent visits, glycosated hemoglobin (HbA1c), blood pressure (BP) and low-density lipoprotein (LDL) were measured. All these data together with visit number and gap were recorded. Statistical analysis including linear regression analysis was done.

RESULTS: A significant reduction in the mean of diabetic control parameters was observed at the last visit. The highest mean changes were observed in patients with >6 visits, visit gap ≤ 1 month, and visit-month index ≥ 8 . Adjusted linear regression showed that each visit significantly lowered HbA1c by 0.25%, BP by 2.1/0.7 mm Hg and 0.2 mmol/L for LDL. The number of visits needed to get HbA1c <7% and BP <130/85 was 8 and 5 visits with a visit-month index of 14 and 5, respectively.

CONCLUSION: The study suggests that frequent visits at short intervals may lead to better diabetes control. Other prospective clinical trial studies are needed to confirm these findings and to outline the appropriate cost-effective intervals and visit gaps.

Diabetes mellitus (DM) is growing to be one of the most important health problems worldwide. The number of people globally with DM is projected to rise from 285 million in 2010 to 439 million by 2030, a 54% increase.¹ In Saudi Arabia, the estimated prevalence of type II diabetes in 1996 was 17.32% in males and 12.18% in females, in the age group >30,^{2,3} and that prevalence increased dramatically in <8 years to reach about 24% in the age group of 30 to 70.³

Diabetes requires life-long treatment and periodic health care visits with both clinical and laboratory testing to assess its control.⁴ Also, health education of diabetic patients to follow a healthy diet and physical activity is to be one of the first lines of treatment of DM.⁵

Since the UK Prospective Diabetes Study proved that long-term complications of diabetes, which were

thought to be inevitable, could actually be reduced or delayed with more glycemic and blood pressure control,^{6,7} researchers have been trying to find out every possible method to control these two parameters along with plasma low-density lipoprotein (LDL) cholesterol. One of these methods was increasing clinic visits for diabetic patients. Also, availability and accessibility to health care centers have been suggested to improve hypertension and DM treatment and control.⁸⁻¹⁰ A recent retrospective study examined the association between frequent visits to primary health care centers and control of diabetes, hypertension, and hyperlipidemia in type II diabetic patients.⁸ The authors in that study concluded that the fastest achievement of target HbA1c, blood pressure, and LDL-C was seen in the group seeing their doctor every 2 weeks. Similarly, other studies have also reported an association between en-

counter frequency and better control of hypertension and diabetes in diabetic patients.^{9,10}

Most of these studies, however, were retrospective and were carried out in Western countries. Regionally, there is still shortage in published reports concerning this important issue. Accordingly, this prospective study aimed to assess the effect of frequency of visit number to diabetes care centers and the visit gap on the treatment and control of DM in Saudi patients.

METHODS

The current study was conducted in Prince Abdul-Aziz Bin-Majed diabetes care centre (PAMDCC), Al Madinah Al Munawwarah, Saudi Arabia. The aim was to study the effect of frequent visits to diabetes care clinic on DM treatment and control during the period from March 2011 through December 2012.

A prospective study of 100 diabetic patients attending PAMDCC was conducted. At the index visit, detailed information was obtained by a structured questionnaire on each patient's age, gender, marital status, type of diabetes (type I and II) and duration, type of diabetic medication (oral agents, insulin, or both), and family history of DM. Data about smoking status, height and weight, and presence of associated medical conditions were also collected. The data of the study outcome were collected at the index and subsequent visits. Diabetic outcome variables were studied by measuring glycosated hemoglobin (HBA1c), LDL, and blood pressure at each visit. HBA1c was measured by a high-performance liquid chromatographic assay as used in the Diabetes Control and Complication trials. According to the American Diabetes Association (ADA), a level of HBA1c more than 7.0% was considered as a poor control of DM (1). Low-density lipoprotein level was also calculated for each studied patient. Seated blood pressure was measured in the right arm to the nearest 2 mm Hg with a random zero sphygmomanometer, and the mean of the 2 readings (for both systolic blood pressure [SBP] and diastolic blood pressure [DBP]) was recorded. Ischemic heart disease (IHD) was diagnosed by history and electrocardiographic abnormalities.¹¹ Motivating patients to frequent visits, a health education, and lifestyle counseling sessions (5-10 minutes) were carried out for all patients during each visit. The scientific materials of these sessions complies to that of the ADA,¹² and included knowledge and practice of healthy lifestyle for diabetic patients such as healthy diet, sound personal hygiene, and physical activity.

The studied frequent visit variables were frequent visit number, visit gap (month), and visit index. The

visit index was defined as the number of visits times the visit gap in a month (e.g., 1 visit-month index means visiting the diabetes care center 1 time a month; in other words, visiting the clinic once every month). These variables were then categorized into 2 groups according to their median distribution in the studied patients.

The collected data were analyzed by using the SAS software package. The studied data were presented by their frequency number and percent for categorical variables and by mean (SD) for continuous variables. Paired and unpaired t test were used as appropriate to compare the mean and mean change of the diabetic outcome parameters, such as HBA1c, SBP, DBP, and LDL, by the studied frequent visit variables. Univariate linear regression analyses were also used to examine the association of outcome variables with the frequent visit variables, while controlling for possible confounders as age, gender, BMI, diabetes type, and duration. *P* value was considered significant at $\leq .05$.

Necessary Approvals were taken from PAMDCC administrative authority. Ethical consideration to avoid physical or emotional harm and to ensure confidentiality and privacy of the collected data was undertaken. Furthermore, the collected data were made only accessible for the researchers.

RESULTS

The study analysis included 100 diabetic patients attending PAMDCC, Madinah, Saudi Arabia. All the studied patients were Saudi nationality. **Table 1** presents the characteristics of the studied patients at the index visit. The mean age of the patients was 52.0 (15.2) years, and 13% of them were type I DM. About 24% were male and 23% were single. Patients had diabetes for 12 years on average; with 43% reported family history of diabetes and 17% have had IHD at their index visit. Nearly one-fifth (17%) of patients were on insulin regimen therapy. The median visit number for patients during the study period was 6.0 with 63% of them have had a visit gap of less than or equal a month. The median visit-month index was 4.2 months.

Table 2 presents the mean of the studied diabetic parameters by index and last visits. The results showed highly statistically significant differences between the mean parameters at index and last visits of the study ($P < .0001$).

Table 3 presents the percent of mean change of the studied diabetic parameters by the frequent number of visits. There have been statistically significant differences with regard to the percent mean change of HBA1c and systolic blood pressure among those with >6 visits and those ≤ 6 visits; the higher percent of mean change

of these 2 parameters was observed in patients with >6 visits. The percent of mean change of other studied parameters, however, was nearly the same in the studied 2 groups with no statistically significant difference.

Table 4 shows the mean change of the studied diabetic parameters by the frequent gap of visits. The mean change in HBA1c was higher (19%) among those patients with frequent visit gap of less than 1 month compared with those with more than month visit gap with statistically significant difference ($P=.04$). For other studied parameters, however, the mean change was

nearly similar in the studied categories of frequent visit gap with no statistically significant difference.

Table 5 shows the mean change of the studied diabetic parameters by the visit-month index. The mean change of the diabetic parameters was higher among those patients with the visit-month index >8 months in all studied diabetic parameters, and there have been statistically significant differences with regard to HBA1c and diastolic blood pressure. P values for these 2 parameters were .03 and .01, respectively.

Table 6 displays linear regression analyses for the

Table 1. Characteristics of the studied diabetic patients at their index visit.

Characteristics	No. (%), N=100
Age in years, mean (SD) (range)	52.0 (15.2) (16, 87)
Gender	
Male	42 (42.0)
Female	58 (58.0)
Marital status	
Single	23 (23.0)
Married	74(74.0)
Divorced	2 (2.0)
Smoking	
Never	68 (68.0)
Current smoker	32 (32.0)
Education	
Illiterate	10 (10%)
Less than secondary	30 (30%)
Secondary and higher	60 (60%)
BMI kg/m ²	28.8 (6.4) (22, 43)
Type of diabetes	
Type I	13 (13.0)
Type II	87 (87.0)
Duration of diabetes (y), mean (SD) (range)	12 (2.1) (4, 15)
Diabetic medication	
Oral hypoglycemic	41 (41.0)
Insulin	17 (17.0)
Combined	42 (42.0)
Family history of diabetes	
No	43 (43.0)
Yes	57 (57.0)
Associated IHD	
No	83 (83.0)
Yes	17 (17.)
Number of visit, mean (SD) (range)	6.1 (2.1) (2, 14)
Visit gap	
≤ mo	63 (63.0)
> mo	27 (27.0)
Visit month index, mean (SD) (range)	8.5 (6.2) (1, 28)

Table 2. Mean of the studied outcome parameters at index and index visits.

Outcome parameters	Index visit Mean (SD)	Last visit Mean (SD)	P value
HBA1C	8.3 (1.6)	5.8 (1.7)	<.000 ^a
Systolic blood pressure (mm Hg)	146.2 (8.1)	132.2 (10.4)	<.000 ^a
Diastolic blood pressure (mm Hg)	93.7 (3.6)	87.1 (4.6)	<.000 ^a
LDL ^b	3.6 (1.0)	2.5 (0.8)	<.000 ^a

^aSignificant, LDL, ^bLow-density lipoprotein (measured in mmol/L).

Table 3. Percent of mean change of the studied outcome parameters by visit number.

Outcome parameters	% of mean change		P value
	≤ 6 visits	> 6 visits	
HBA1C	0.14	0.17	.001 ^a
Systolic blood pressure (mm Hg)	0.07	0.11	.01 ^a
Diastolic blood pressure (mm Hg)	0.06	0.08	.45
LDL ^b	0.28	0.26	.66

^aSignificant, LDL, ^bLow-density lipoprotein (measured in mmol/L).

Table 4. Mean change of the studied outcome parameters by visit gap.

Outcome parameters	Mean change		P value
	Visit gap ≤ 1 mo	Visit gap > 1 mo	
HBA1C	0.19	0.12	.04 ^a
Systolic blood pressure (mm Hg)	0.08	0.10	.29
Diastolic blood pressure (mm Hg)	0.08	0.06	.15
LDL ^b	0.28	0.27	.65

^aSignificant, LDL, ^bLow-density lipoprotein (measured in mmol/L).

association of diabetic outcome parameters with frequent visit number and visit-month index. Significant negative associations were detected between visit number and HBA1c and systolic blood pressure. Increase in visit number by 1 was associated with a decrease in HBA1c by 0.25% ($\beta = -0.25$) and a decrease in systolic blood pressure by 2.1 mm Hg ($\beta = -2.1$). Frequent visit number has explained 20% variation in HBA1c and 25% in systolic blood pressure. For the studied DBP and LDL levels, there has also been a decrease in their

levels by increase in visit number, although not significant. Increase in visit-month index by 1 has also been negatively associated with all studied diabetic parameters, but statistically significant associations were observed only with systolic blood pressure and LDL level.

DISCUSSION

The study findings revealed a significant reduction in the mean of the studied diabetic parameters at the last visit. Also a high and significant mean changes for HBA1c and DBP were observed in patients who underwent >6 visits during the study period, with a median visit gap of 0.4 month. Compared with patients with >1 month visit gap, those having ≤ 1 month visit gap showed a significant higher mean change in the studied HBA1c and SBP parameter, and accordingly better control of diabetes. The median time in the latter group was 0.5 month and that in the former group was 2 months. Similar findings have been reported in a retrospective study including 26 496 people with Type II DM and elevated HBA1c, blood pressure, and/or cholesterol levels, who had been treated by primary-care doctors between 2000 and 2009. The study showed that patients who had a doctor visit every 1 to 2 weeks achieved better and faster control compared to those patients who had clinic visit 1 every 3 to 6 months.⁸ However, because of the retrospective nature of the study and a lack of information on what happened during the doctor visits, we cannot affirm that frequent visits were the actual cause behind the better health outcomes.

The present study has assessed the effect of each visit on control of diabetes while controlling the confounding effect of age, sex, and type and duration of DM using multivariate linear regression analyses. The findings showed a significant negative association between the number of clinic visit and the levels of all studied parameters. For example, HBA1c has reduced by 0.25% and SBP/DBP by 2.1/0.7 mm Hg per visit. Also, each visit-month index (i.e., 1 visit a month) was found to reduce HBA1c by 0.10% and SBP/DBP by 1.0/0.5 mm Hg. These findings suggest a lowering of HBA1c to level less than 7.0% in a period of 14 months and SBP/DBP to below 130/85 mm Hg in a visit period of 5 months. According to these results and the used visit-month index, HBA1c and BP may reach the target level in 7 and 2.5 months, respectively, if time between the visits becomes half a month instead of a month. Morrison et al⁸ reported that halving the time between doctor visits reduced the time to reach target levels by as much as 35% for HBA1c, 87% for blood pressure, and 27% for cholesterol. In our study, we build up a visit-month index to calculate this suggested time

Table 5. Mean change of the studied outcome parameters by visit month index.

Outcome parameters	Mean change		P value
	Visit month index ≤ 8	Visit month index > 8	
HBA1C	0.14	0.20	.03 ^a
Systolic blood pressure (mm Hg)	0.09	0.10	.11
Diastolic blood pressure (mm Hg)	0.05	0.10	.04 ^a
LDL ^b	0.25	0.30	.12

^aSignificant, LDL, ^bLow-density lipoprotein (measured in mmol/L).

Table 6. Association of outcome variables with visit index.

Outcome parameter ^a	Intercept	Regression coefficient (β)	R ²	P value
Frequent visit number				
HBA1C (%)	8.9	- 0.25	0.20	.02 ^b
Systolic blood pressure (mm Hg)	142.2	- 2.1	0.25	<.0001 ^b
Diastolic blood pressure (mm Hg)	86.9	- 0.7	0.10	.31
LDL ^c	3.8	- 0.20	0.05	.42
Visit month index				
HBA1C	8.4	- 0.11	0.12	.21
Systolic blood pressure (mm Hg)	135.0	- 1.1	0.10	.03 ^b
Diastolic blood pressure (mm Hg)	87.5	- 0.5	0.10	.60
LDL ^c	3.5	- 0.15	0.15	.02 ^b

^aAdjusted by age, gender, BMI, and type and duration of diabetes and educational level. ^bSignificant, LDL, ^cLow-density lipoprotein (measured in mmol/L).

period, a factor not used in the study by Morrison et al. that used the median time.

A health education program was planned during the study visits and that may involve the entire health care team. It seems likely that HBA1c as well as BP levels would be influenced by the frequency of visit and its time gap as well as patient counseling and education.¹³ Another study showed that a focus on patient education alone without emphasis on the use of more pharmacotherapy may produce only modest improvements in HBA1c levels.¹⁴ It is also possible that diabetes clinic patients benefited skills and knowledge about their disease from the health education program carried out during the period of the study. It would be manifest as medication adherence and healthful lifestyle.

Current guidelines provide little guidance for how frequently patients with DM should be seen by their physicians, apart from the recommendation for HBA1c measurement every 3 months.¹⁵ The present study findings suggest doctor visit to at least once every month and every 2 weeks for the most severely uncontrolled patients. More frequent visits, however, could increase the load on physicians and health care resources.¹⁶ Trained nurses/health providers, and physician-assistants can alleviate physician workload without any negative effect on patient outcomes.¹⁷⁻²⁰ Once a patient achieves DM control, the frequency of visits may be decreased to alleviate the load on health care resources.²¹ It has been shown that in patients with controlled hypertension, patient-provider encounters can be 6 months apart without adverse effects.²²

The present study being prospective consolidates more the study findings. Physicians meet patients face to face and provided them with health education and life-

style counseling during all visits. These factors are known to motivate patients to frequent visits and medication adherence.²³⁻²⁵ Assessing the effect of frequent visit by using visit-month index has reduced the confounding that might result from the analysis of visit number and gap independently.

The study was limited by the small sample size. Larger study and sample size are required to confirm these findings and to allow assessing the effect of frequent visits on diabetes outcome by age categories, type and duration of medication, and type of medication, as low frequency of visits were observed in some of these categories in the current study. However, all of these factors were adjusted in multivariate linear regression models.

In summary, the study findings suggests an association between visit frequency, in terms of visit number, visit gap, and visit-month index and a better control of DM in the studied Saudi patients. Frequent visits at short interval visit gap, particularly when accompanied with health education and lifestyle counseling, may lead to better diabetes control. Other prospective clinical trial studies are needed to confirm these findings and to outline the appropriate cost-effective intervals and visit gaps.

Acknowledgments

I am very grateful to doctors and nurses at Prince Abdul-Aziz Bin-Majed diabetes care center, for their help and co-operation throughout the duration of this study. Also, I would like to thank the medical students who participated in data collection period (Ala'a Bakkary, Ghadah Al Rehaili, Malak Al Amry, Mona Odwan, Razan Al Garni). Finally, I would like to thank Dr. Khaled Kasim for his help in statistical analysis for this paper.

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