Original Article

Five-year comparison of diabetic control between community diabetic center and primary health-care centers

Mazen S. Ferwana[1,2,3], Abdulaziz Alshamlan[4], Wedad Al Madani[2,3], Bader Al Khateeb[1,2,3], Amen Bawazir[5]

[1]Department of Family Medicine and Primary Healthcare, King Abdulaziz Medical City, Ministry of National Guard Health Affairs, [2]National and Gulf Center for Evidence Based Health Practice, College of Public Health and Health Informatics, King Saud Bin Abdulaziz University for Health Sciences, [3]King Abdullah International Medical Research Center, [4]King Saud University and [5]Department of Community and Environmental Health, College of Public Health and Health Informatics King Saud Bin Abdulaziz University for Health Sciences, Riyadh, Kingdom of Saudi Arabia

Abstract

Context: Hyperglycemia is the most important factor for development of complications. A high level of hemoglobin A1c (HbA1c) is linked with such complications of diabetes. **Aims:** The aim of this study was to compare diabetic care between community diabetic center (CDC) and primary health centers. **Settings and Design:** This was a retrospective cohort study conducted at King Abdulaziz Medical City for National Guard Health Affairs at Riyadh, Saudi Arabia. **Subjects and Methods:** Data were retrieved from electronic medical records for diabetes mellitus Type 2 patients who were treated at two settings: CDCs and primary healthcare. **Statistical Analysis Used:** SPSS (V21) was used to analyze the univariate and bivariate analysis, Student's *t*-test for continuous variables and Chi-square test for binary variables were used. *P* value was set as statistically significant if it is <0.05. **Results:** The mean difference for HbA1c from first to last visits increased significantly +0.2 ± 1.67 with $P = 0.002$ while the low-density lipoprotein (LDL) on the other way around improved by decrease of –0.159 ± 0.74 and $P < 0.000$. Body mass index (BMI) among the sample increased by +0.134 ± 1.57 with no significant, $P = 0.078$. Among the sample, 39.5% improved their HbA1c while 56.8% deteriorated and 3.6% of the samples' readings remain the same. 55.3% of the sample improved in LDL and 52.4% in the high-density lipoprotein while 53.7% improved in triglycerides. The BMI was improved among 43.4% of diabetic patients. **Conclusions:** The 5-year management of diabetic patients failed to improve the A1c or BMI, at both CDC and primary health-care centers.

Keywords: Body mass index, diabetes mellitus, diabetic control, diabetes center, hemoglobin A1c, primary healthcare

Introduction

Proper diabetic control results in a reduction of diabetic complications rate.[1-4] A 1% lowering in hemoglobin A1c (HbA1c) was linked with 37% lowering in microvascular complication, 43% lowering in amputation, and 14% lowering in myocardial infarction.[1]

Many studies in different primary health-care centers (PHCC) showed an obvious lack in the following of the ideal rules in the quality of diabetic care and differ from one PHCC to another.[5-8]

Address for correspondence: Dr. Mazen S. Ferwana, Department of Family Medicine and Primary Healthcare, King Abdelaziz Medical City, MNGHA, PI Box 22490, Riyadh 11426, Kingdom of Saudi Arabia.
E-mail: Ferwanam@ngha.med.sa

Access this article online

Quick Response Code:

Website: www.jfmpc.com

DOI: 10.4103/2249-4863.197316

How to cite this article: Ferwana MS, Alshamlan A, Al Madani W, Al Khateeb B, Bawazir A. Five-year comparison of diabetic control between community diabetic center and primary health-care centers. J Family Med Prim Care 2016;5:641-5.

Recently, some of the primary health centers are upgraded to a specialized one such as for diabetic care and named community diabetic centers (CDC).

Subjects and Methods

In a historical cohort study design, we collected data from electronic medical records for Type 2 diabetic patients who were treated at two settings: CDC and PHCCs, at King Abdulaziz Medical City for National Guard at Riyadh, Saudi Arabia. CDC is a specialized center and contains more services such as ophthalmic clinic, dietician clinic, podiatric clinics, and diabetic educators.

The last reading for 5 years from 2011 to 2015 was recorded for HbA1c, body mass index (BMI), low-density lipoprotein (LDL), high-density lipoprotein (HDL), and triglyceride. Sample size was calculated at 385 (or more) using the Epi-Info (a public domain statistical software for epidemiology developed by Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia, USA) and $P < 0.05$ is considered as statistically significant.

Diabetic patients are considered controlled if their HbA1c is ≤7% and LDL target is ≤2.6 mmol/dl, HDL ≥1.03 mmol/dl, triglyceride ≤1.7 mmol/dl, and BMI is ≤25.

Results

Clinical characteristics of the study population

A total of 446 Type 2 diabetic patients who have been evaluated for the last five visits from two different settings, 232 (52.2%) from CDC, and 214 (47.8%) from PHCC. The two centers are under the umbrella of Family Medicine and Primary Health Care Department at Ministry of National Guard Health Affairs (NGHA), Riyadh, Saudi Arabia. Mean age and distribution of male and female in both groups are comparable [Table 1].

Table 1: Mean±standard deviation for the 5 years' reading of the variables

Variables	Mean±SD		*P*
	Community structured care diabetic center	Primary health care centers	
Age	52.83±11.7	53.09±13.45	0.8
HA1c-1	8.84±1.76	8.28±1.93	0.001
HA1c-2	8.82±1.63	8.32±1.96	0.004
HA1c-3	8.81±1.66	8.47±1.91	0.04
HA1c-4	9.04±1.82	8.54±1.78	0.004
HA1c-5	9.04±1.74	8.61±1.72	0.009
LDL-1	2.58±0.76	2.65±0.85	0.36
LDL-2	2.58±0.75	2.61±0.76	0.61
LDL-3	2.57±0.74	2.54±0.76	0.67
LDL-4	2.48±0.71	2.51±0.73	0.66
LDL-5	2.44±0.70	2.47±0.72	0.74
HDL-1	0.97±0.22	0.98±0.20	0.88
HDL-2	0.97±0.20	0.97±0.20	0.96
HDL-3	0.97±0.22	0.98±0.21	0.56
HDL-4	0.95±0.20	0.99±0.21	0.06
HDL-5	0.98±0.22	1.00±0.21	0.29
Tri-1	1.83±1.12	1.82±1.31	0.93
Tri-2	1.86±1.23	1.70±0.84	0.09
Tri-3	1.77±0.94	1.72±1.01	0.58
Tri-4	1.86±1.11	1.76±1.03	0.32
Tri-5	1.82±1.09	1.68±0.94	0.16
BMI-1	32.52±6.0	32.68±6.2	0.78
BMI-2	32.94±8.4	32.82±6.7	0.86
BMI-3	32.61±5.9	32.78±6.2	0.77
BMI-4	32.64±5.8	32.91±6.3	0.64
BMI-5	32.60±5.9	32.97±6.4	0.54

BMI: Body mass index; Tri: Triglyceride; HDL: High-density lipoprotein; LDL: Low-density lipoprotein; SD: Standard deviation

Community diabetic center results

The mean age is 52.8 ± 11.7 years. The percentage of female patients is 51.7%. The initial mean of HbA1c is 8.84 ± 1.76 while the last reading of HbA1c is 9.04 ± 1.74, and the HbA1c mean difference is +0.2 which is not statistically significant, $P = 0.067$. The LDL first and last readings are 2.58 ± 0.76 and 2.4 ± 0.70, respectively, and the LDL mean difference is −0.14, which is statistically significant, $P = 0.008$.The HDL first and last readings are 0.97 ± 0.22 and 0.98 ± 0.22, respectively, $P = 0.408$. Moreover, triglyceride first and last readings are 1.83 ± 1.12 and 1.82 ± 1.09, respectively, $P = 0.906$.

Finally, BMI first and last readings are 32.52 ± 6.0 and 32.60 ± 5.9, respectively, and the BMI mean difference is −0.14, $P = 0.467$.

Primary health care centers results

The mean age is 53.09 ± 13.45 years and the percentage of female patients is 54.2%. The initial mean of HA1c is 8.28 ± 1.93 while the last reading of HA1c is 8.61 ± 1.72, and the HbA1c mean difference is +0.33% which is statistically significant, $P = 0.011$. The LDL first and last readings are 2.65 ± 0.85 and 2.47 ± 0.72, respectively, and the LDL mean difference is −0.18, which is statistically significant, $P = 0.000$. HDL first and last readings are 0.98 ± 0.20 and 1.00 ± 0.21, respectively, $P = 0.019$, and triglyceride first and last readings are 1.82 ± 1.31 and 1.68 ± 0.94, respectively, $P = 0.030$.

Finally, BMI first and last readings are 32.78 ± 6.0 and 32.97 ± 6.4, respectively, and the BMI mean difference is −0.18, $P = 0.040$.

Comparison between community diabetic center and primary health care center

Table 2 and Figure 1 presents the changes between the first visit and last visit reading for the main variables. Both A1c and BMI were deteriorated while the lipid profile was improved in the two centers.

The mean 5-visit A1c level was increased in both CDC and PHCC; however, it was higher among PHCC patients compared with CDC (0.248 vs. 0.204), respectively, and moreover, it was significant in PHCC. The increased BMI at CDC was

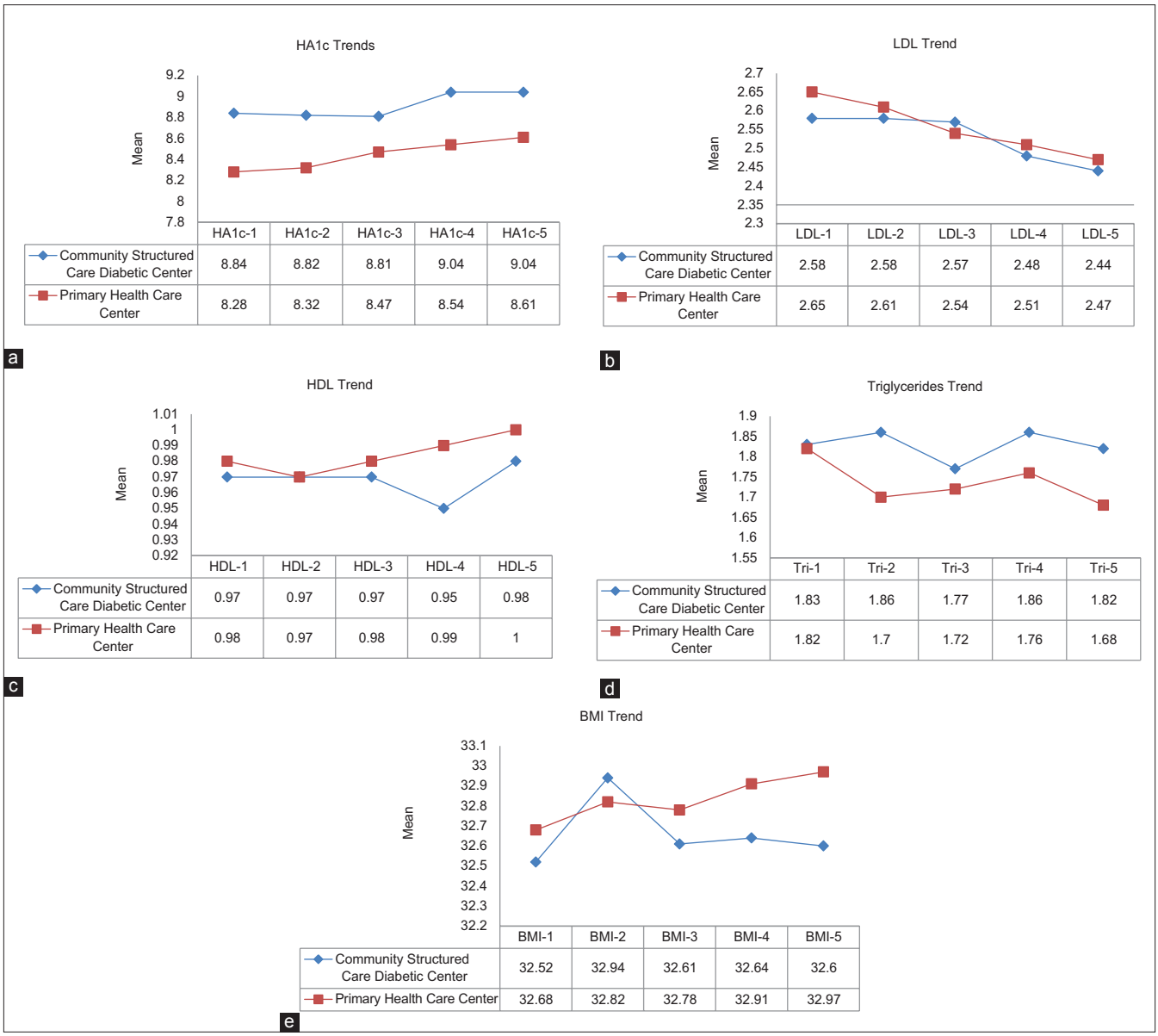

Figure 1: Comparison of 5 years trend of the main variables: (a) Hemoglobin A1c, (b) low-density lipoprotein, (c) high-density lipoprotein, (d) triglyceride, (e) body mass index

Table 2: Mean changes between first and last readings of the variables

Variables	Community structured care diabetic center (mean±SD)	*P*	Primary health care centers (mean±SD)	*P*
HA1c	0.204±1.38	0.067	0.248±1.67	0.011
LDL	−0.133±0.758	0.008	−0.187±0.733	0
HDL	0.007±0.12	0.408	0.025±0.158	0.019
Tri	−0.007±0.992	0.906	−0.136±0.908	0.030
BMI	0.085±1.78	0.467	0.189±1.29	0.040

BMI: Body mass index; Tri: Triglyceride; HDL: High-density lipoprotein; LDL: Low-density lipoprotein; SD: Standard deviation

nonsignificant (0.085, $P = 0.467$) as compared with PHCC (0.189, $P = 0.04$). In the contrary, the mean LDL and triglyceride was reduced in the two centers, but the reduction was higher in PHCC as compared with CDC (LDL −0.133 vs. −0.187 and triglyceride −0.007 vs. −0.136), respectively. The mean HDL was less improved in CDC than PHCC (0.07 vs. 0.025).

There was no association between mean A1c or BMI and both age and sex, and there was no correlation between age and A1c or BMI.

Discussion

The study aims at assessing the quality of diabetic care at two primary care setting (CDC vs. PHCC). Care for Type 2 diabetic patients is provided at NGHA by four specialties, the front line (primary care and family physicians), internal medicine, endocrinologists, and cardiologists.

The A1c and BMI values were increased in the last reading as compared to first one; however, the levels were more at PHCC than CDC.[9,10]

On the other hand, lipid profile values were improved at both centers; however, they were better at PHCC compared with CDC.[11,12]

Unfortunately, the results of both centers are disappointing, especially for A1c and BMI, because health system has failed to control both diabetes and obesity in spite of efforts and money spent in educating staff and patients, providing medication and equipment, and setting up screening programs and coordinated multidisciplinary management.

However, poor control of diabetes and obesity is an international problem, and studies from Saudi Arabia and developing and developed countries have similar results.[13-17]

Moreover, most studies reported that about 30% of diabetic patients had abnormally high A1c.[18-21]

Multiple factors contribute to the deterioration of A1c over the years in spite of the management provided to those patients by the health system. The number of active beta cells in the pancreas become less and less as the patients become older, and the need to shift from oral hypoglycemic agents to insulin become prominent. There is psychological resistance against the initiation of and insulin therapy in general by some patients due to needle pain and fear, the stigma related to insulin use, the myths patients have related to increased complications among insulin users, and many other factors related to insulin, mainly the physicians reluctance to initiate insulin at real time.

In our society, patient factors outweigh other factors. Most patients do not have a proper lifestyle, many do not have a proper diet, and most patients, especially females, do not exercise.

The number of diabetic educators is less than it is really required, and moreover, patients are reluctant to be referred to dieticians.[22]

Our hypothesis was that diabetic patients under the care of CDC have better care and control of A1c and other related risk factors, but unfortunately, our results contradicts it.[12,16]

The fact that our patients were treated for diabetes by more than one, especially and sometimes, in more than one health system is evident. This may be the reason why there was no much difference between CDC and PHCC results.

Our result is supported by a study that was conducted in Saudi Arabia and found that there was no difference in A1c level between family medicine and specialist managements.[17,22,23]

Looking at the 5 years' changes in A1c, at both setting, one can notice that there was a steady rise in A1c through the years of follow-up, which really annoying finding. A similar result was found by a retrospective study in the UK.[21]

As we know, diabetes is a complex disorder that needs frequent and multitypes of care such as glucose monitoring, diet, exercise, and medication to accomplish good glycemic control. There are some factors participating in good way of disease management included age, treatment method, duration of disease, social life, and financial status of the patients.

Amelioration of glycemic status of diabetic patients can prohibit the beginning or delay the evolution of micro- and macro-vascular complications. Structured diabetes education programs exhibit to promote clinical effect and self-management to the patients. There are effective approaches have a clear theoretical process and are carried face-to-face with higher concentration. There is more persistent to self-monitor glucose level in the blood and promote physical activity. Educational involvement for participants in the program also promotes self-efficiency.[24] The structured center has multiple workers in many specialties such as dietitian, diabetes educators, and podiatric care specialists, all of these specialties will help in good outcome in diabetic care.

Limitations

The study was a retrospective cohort chart review which affects the selection of patients and has inherent other biases. We did not study the factors that may be responsible for the improper control of diabetes.

Conclusion

Both CDC and PHCCs failed to improve A1c and BMI over a period of 5 years; however, lipid profile was improved in both settings.

Financial support and sponsorship

The study was supported by the King Abdullah International Medical Research Center.

Conflicts of interest

There are no conflicts of interest.

References

1. American Diabetes Association. Standards of medical care in diabetes – 2014. 37 Suppl 1:S14-80. Diagnosis and classification of diabetes mellitus. Diabetes Care 2014;37 Suppl 1:S81-90.
2. Nathan DM, Cleary PA, Backlund JY, Genuth SM, Lachin JM, Orchard TJ, *et al.* Intensive diabetes treatment and cardiovascular disease in patients with type 1 diabetes. N Engl J Med 2005;353:2643-53.
3. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). UK Prospective Diabetes Study (UKPDS) group. Lancet 1998;352:837-53.

4. Zinman B, Genuth S, Nathan DM. The diabetes control and complications trial/epidemiology of diabetes interventions and complications study: 30th anniversary presentations. Diabetes Care 2014;37:8.
5. Wylie-Rosett J, Basch C, Walker EA, Zybert P, Shamoon H, Engel S, *et al.* Ophthalmic referral rates for patients with diabetes in primary-care clinics located in disadvantaged urban communities. J Diabetes Complications 1995;9:49-54.
6. Wylie-Rosett J, Walker EA, Shamoon H, Engel S, Basch C, Zybert P. Assessment of documented foot examinations for patients with diabetes in inner-city primary care clinics. Arch Fam Med 1995;4:46-50.
7. Miller KL, Hirsch IB. Physicians' practices in screening for the development of diabetic nephropathy and the use of glycosylated hemoglobin levels. Diabetes Care 1994;17:1495-7.
8. Starfield B, Shi L, Macinko J. Contribution of primary care to health systems and health. Milbank Q 2005;83:457-502.
9. Al Balushi KA, Al-Haddabi M, Al-Zakwani I, Al Za'abi M. Glycemic control among patients with type 2 diabetes at a primary health care center in Oman. Prim Care Diabetes 2014;8:239-43.
10. Habib SS, Aslam M. Risk factors, knowledge and health status in diabetic patients. Saudi Med J 2003;24:1219-24.
11. Riedl R, Robausch M, Berghold A. The evaluation of the effectiveness of Austrians disease management program in patients with type 2 diabetes mellitus – A population-based retrospective cohort study. PLoS One 2016;11:e0161429.
12. Williams JS, Walker RJ, Smalls BL, Hill R, Egede LE. Patient-centered care, glycemic control, diabetes self-care, and quality of life in adults with type 2 diabetes. Diabetes Technol Ther 2016;18:644-9.
13. Chatterjee S, Khunti K, Davies MJ. Optimizing management of glycaemia. Best Pract Res Clin Endocrinol Metab 2016;30:397-411.
14. Vecchi S, Agabiti N, Mitrova S, Cacciani L, Amato L, Davoli M, *et al.* Audit and feedback, and continuous quality improvement strategies to improve the quality of care for type 2 diabetes: A systematic review of literature. Epidemiol Prev 2016;40:215-23.
15. Bain SC, Feher M, Russell-Jones D, Khunti K. Management of type 2 diabetes: The current situation and key opportunities to improve care in the UK. Diabetes Obes Metab 2016;18:1157-66.
16. Eik Filho W, Bonjorno LP, Franco AJ, Dos Santos ML, de Souza EM, Marcon SS. Evaluation, intervention, and follow-up of patients with diabetes in a primary health care setting in Brazil: The importance of a specialized mobile consultancy. Diabetol Metab Syndr 2016;8:56.
17. AlHabdan MA, AlAteeq MA, AlJurbou FI. Level of control among patients with type 2 diabetes mellitus attending diabetic clinic under family medicine compared to diabetic clinic under endocrinology. Diabetes Metab Syndr Obes 2016;9:119-24.
18. de Pablos-Velasco P, Parhofer KG, Bradley C, Eschwège E, Gönder-Frederick L, Maheux P, *et al.* Current level of glycaemic control and its associated factors in patients with type 2 diabetes across Europe: Data from the PANORAMA study. Clin Endocrinol (Oxf) 2014;80:47-56.
19. Alvarez Guisasola F, Mavros P, Nocea G, Alemao E, Alexander CM, Yin D. Glycaemic control among patients with type 2 diabetes mellitus in seven European countries: Findings from the real-life effectiveness and care patterns of diabetes management (RECAP-DM) study. Diabetes Obes Metab 2008;10 Suppl 1:8-15.
20. Daher AM, AlMashoor SA, Winn T. Glycaemic control and quality of life among ethnically diverse Malaysian diabetic patients. Qual Life Res 2015;24:951-8.
21. Fox KM, Gerber Pharmd RA, Bolinder B, Chen J, Kumar S. Prevalence of inadequate glycemic control among patients with type 2 diabetes in the United Kingdom general practice research database: A series of retrospective analyses of data from 1998 through 2002. Clin Ther 2006;28:388-95.
22. Al-Shookri A, Khor GL, Chan YM, Loke SC, Al-Maskari M. Effectiveness of medical nutrition treatment delivered by dietitians on glycaemic outcomes and lipid profiles of Arab, Omani patients with type 2 diabetes. Diabet Med 2012;29:236-44.
23. Griffin S, Greenhalgh T. Diabetes care in general practice: Meta-analysis of randomised control trials. Commentary: Meta-analysis is a blunt and potentially misleading instrument for analysing models of service delivery. BMJ 1998;317:390-6.
24. Tan MY, Magarey JM, Chee SS, Lee LF, Tan MH. A brief structured education programme enhances self-care practices and improves glycaemic control in Malaysians with poorly controlled diabetes. Health Educ Res 2011;26:896-907.