Relationship of Glycemic Control to Total Diabetes-Related Costs for Managed Care Health Plan Members With Type 2 Diabetes

SHARASHCHANDRA SHETTY, PhD; KRISTINA SECNIK, RPh, MPH, PhD; and ALAN K. OGLESBY, MPH

ABSTRACT

OBJECTIVE: Glycosylated hemoglobin (A1c) is a well-established measure of glycemic control, and evidence suggests that maintaining an acceptable A1c level may be associated with lower treatment costs in adults with diabetes. Understanding the impact on total treatment costs of staying at the target A1c level is of great importance to managed care organizations. The goal of this study was to determine whether type 2 diabetes patients at or below the target A1c level of 7% had lower diabetes-related costs compared with patients above an A1c level of 7%.

METHODS: This study was a retrospective database analysis using eligibility data, medical and pharmacy claims data, and laboratory data from a large U.S. health care organization. Patients were included in the study if they had 2 or more claims for type 2 diabetes (*International Classification of Diseases, Ninth Revision, Clinical Modification* [ICD-9-CM] codes 250.x0 or 250.x2) and at least 1 A1c value (first such date defined as the index date) during the 12-month period from January 1, 2002, through December 31, 2002. Patients with 2 or more medical claims for type 1 diabetes (ICD-9-CM codes 250.x1 or 250.x3) were excluded from the study. Study patients were divided into 2 groups, those at the target A1c level (≤7%) and those at the above-target A1c level (>7%), and were followed for a period of 1 year after their index date. Demographic, clinical, and cost variables were extracted from the administrative database. Multiple linear regression analysis was used to compare treatment costs between patients at the target A1c level and patients above target level.

RESULTS: A total of 3,121 patients (46.0%) were identified as being at the target A1c level, and 3,659 patients (54%) were identified as being above the target A1c level during the study period. After controlling for confounding factors, the predicted total diabetes-related cost for the above-target group during the 1-year follow-up period was $1,540 per patient, 32% higher than the total diabetes-related cost ($1,171) for the at-target group (P <0.001).

CONCLUSION: Results of this analysis suggest that managed care members with type 2 diabetes who stayed continuously at the target A1c level of 7% or less over a 1-year follow-up period incurred lower diabetes-related costs compared with managed care members with type 2 diabetes who were continuously over the target A1c level of 7%.

KEYWORDS: Type 2 diabetes, A1c level, Glycosylated hemoglobin, Costs, Managed care, Obesity

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Diabetes is a common chronic disease that is associated with considerable morbidity and mortality.[1] Approximately 18 million people in the United States are diagnosed with diabetes. The American Diabetes Association (ADA) attributed $92 billion in direct medical expenditures to diabetes in 2002. Inadequate glycemic control is thought to be a cause of diabetic complications and higher costs.[2,3] Proper management of diabetes can delay complications, reduce mortality, and reduce the costs of diabetes care. Research has shown that aggressive glycemic control can reduce long-term complications in patients with type 1 or type 2 diabetes and result in considerable medical cost savings.[2, 4-6]

Most of the previous studies have focused on the effects of glycemic control on long-term cost savings. However, evidence of short-term cost savings is often required before studying the long-term implications. A few studies have suggested that better glycemic control may result in cost savings within a short period of time.[3,7,8] Analysis of retrospective administrative claims and laboratory data by Gilmer et al. showed that inadequate glycemic control was associated with greater health care costs over a 3-year period.[3] For every 1% increase in glycosylated hemoglobin (A1c), Gilmer et al. found that health care costs rose 7% over the next 3 years. Menzin et al. found, in a study using a retrospective cohort design, a reduced rate of admission for short-term complications and reduced medical charges for these complications in patients with better glycemic control.[7] In a study using data from a staff-model health maintenance organization, Wagner et al. suggested that a sustained reduction in A1c level was associated with significant cost savings within 1 to 2 years of improvement.[8] The studies either used change in A1c level or created categories of A1c levels while studying the effect of glycemic control on health care costs. In the present study, we examined the relationship of diabetes-related costs in patients with type 2 diabetes who stayed at the target A1c level of ≤7% compared with patients with type 2 diabetes who stayed above the target A1c level (had A1c levels >7%).

Methods

This study is a retrospective, longitudinal database analysis using eligibility data, medical and pharmacy administrative claims data, and laboratory data from a large U.S. managed care organization (MCO). All are commercial, preferred-provider organization-model regional health plans of a national MCO. The MCO had approximately 5.4 million members during 2002. The individuals covered by this health plan are geographically diverse across the United States. The MCO provides fully insured coverage for physician, hospital, and pharmacy services.

Study patients were identified during the period January 1, 2002, through December 31, 2002. The index date was the first available A1c laboratory value recorded during the subject identification period. Patients were included in this study if they met the following criteria: (1) had 2 or more claims for type 2 diabetes in either the primary or secondary position on physician or hospital claims (*International Classification of Diseases, Ninth Revision, Clinical Modification* [ICD-9-CM] codes 250.x0 or 250.x2 were used to identify patients with type 2 diabetes.); (2) had at least 1 prescription for an oral hypoglycemic agent and/or insulin; (3) had at least 1 available A1c value; (4) were commercially insured with a drug benefit; and (5) had at least 6 months of continuous enrollment prior to the index date and at least 12 months of continuous enrollment following the index date. Patients with 2 or more claims for type 1 diabetes (ICD-9-CM codes 250.x1 or 250.x3) were excluded from the study.

Study patients were divided into those at the target A1c level (≤7%) and those above the target A1c level (>7%). Patients with more than 1 A1c value were required to be at target level or above target level to be included in the at-target group or above-target group, respectively. Patients whose A1c values were not continuously at target level or above target level during the 1-year follow-up period were excluded from the study.

Demographic, clinical, and cost variables were extracted from the research database for each subject. The demographic variables included age, gender, and health plan region. The clinical variables included prescribing physician specialty and the presence of select comorbid conditions. The following comorbid conditions were identified during the preindex and the postindex periods: hypertension, congestive heart failure, ischemic heart disease, atherosclerosis, dyslipidemia, retinopathy, nephropathy, neuropathy, diseases of the extremities, obesity, and albuminuria. The practice specialty of the physician prescribing the first hypoglycemic agent during the subject identification period was determined, and 4 dichotomous variables indicating the specialty of the physicians were created (general practitioner, internist, endocrinologist, and other specialty).

To account for the difference in burden posed by comorbidities between the 2 groups, the presence of select comorbid conditions was examined during the study period. Comorbid conditions were identified using ICD-9-CM codes in any position on the physician and hospital claims and using the National Drug Codes for prescription drugs in the pharmacy claims. Total baseline cost during the 6-month preindex period was also estimated to serve as a proxy for general health status of each subject. The direct medical costs associated with the treatment of diabetes were estimated 1 year following the index date. The direct medical costs included all physician office visit, outpatient visit, inpatient, emergency room, and lab costs associated with a diagnosis of diabetes in the primary position on the medical claims. Pharmacy costs were calculated for oral hypoglycemic agents and insulin during the 1-year follow-up period. Costs were defined as the cost to the health plan as well as to the health plan member; i.e., cost in this study included the total amount paid by the health plan as well as any copayment and deductible amounts paid by the health plan member.

Statistical Analysis

The baseline characteristics of the 2 comparison groups were analyzed descriptively (frequencies and percentages), using paired *t* tests for continuous variables and chi-square tests for categorical variables. Multiple linear regression analysis was used to estimate the relationship between remaining at target A1c level and diabetes treatment cost. The primary independent variable in the regression model was the target group indicator. The regression analysis controlled for demographic and clinical confounders, including age, gender, specialty of the physician prescribing the index medication, presence of comorbid conditions, and total baseline costs. The dependent variable in the regression model was the total diabetes-related costs during the 1-year follow-up period.

The distribution of the cost data was skewed. Testing for heteroscedasticity indicated that error variances were not constant. Logarithmic transformation of the cost data was done prior to the analysis to make the data normal, and the regression analysis was conducted using robust standard errors. Since all patients in the study population had a diabetes-related cost, zero values for cost were not a concern for this study. The adjusted log means were transformed to a dollar scale using a smearing estimator in order to obtain an unbiased estimate of mean diabetes-related cost.[9,10] A subanalysis was also conducted to identify significant demographic predictors and comorbidities that are associated with increased diabetes-related costs when stratified by A1c level. Multiple linear regressions were conducted separately in the at-target group and above-target group to identify significant predictors of costs. These regression models included the same set of independent variables described above except for the target group indicator. All analyses were conducted using the SAS software, version 8.2.[11]

Results

Prior to application of the exclusion criteria, 170,566 patients were identified with 2 or more claims for type 2 diabetes during calendar year 2002, representing a prevalence of approximately 3.1% in the MCO population of 5.4 million members. After application of the exclusion criteria (Table 1), 8,991 patients were identified with at least 2 or more claims for type 2 diabetes, at least 1 pharmacy claim for a hypoglycemic agent, at least 1 laboratory value for A1c, and continuous enrollment during the study period. Patients with 2 or more claims for type 1 diabetes were excluded from the study (Table 1).

TABLE 1 Sample Selection

Criteria	Number of Patients Remaining (%)	Number of Patients Dropped (%)
Patients identified with 2 or more claims for type 2 diabetes from January 1, 2002, through December 31, 2002	170,566 (100)	–
Patients with 2 or more claims for type 1 diabetes from January 1, 2002, through December 31, 2002	110,042 (64.5)	60,524 (35.5)
At least 1 claim for oral hypoglycemic agent or insulin from January 1, 2002, through December 31, 2002	68,518 (40.2)	41,524 (24.3)
At least 1 lab value for A1c from January 1, 2002, through December 31, 2002	31,807 (18.7)	36,711 (21.5)
Continuous enrollment 6 months prior to index date and 1 year following the index date	8,991 (5.3)	22,816 (13.4)
Patients not continuously at either ≤7% or >7% A1c level during the 1-year follow-up period	6,780 (4.0)	2,211 (1.3)

A1c=glycosylated hemoglobin.

A total of 2,211 patients were excluded from the study because they were not continuously either at the target or above the target A1c level during the 1-year follow-up period. Of the 6,780 patients who were included in this study, 3,121 (46%) were identified as being continuously at the target A1c level, and 3,659 patients (54%) were identified as being above the target A1c level for the 1-year period following the index A1c value.

Table 2 shows the descriptive characteristics of the 2 groups. The at-target group (a) consisted of patients who were significantly older (mean 53.9 years) as compared with the above-target group (mean 52.3 years, P <0.001); (b) had a significantly lower percentage of patients in age groups 31-40 and 41-50 and a higher percentage of patients in the above-60-years age group (P <0.001); (c) had a slightly lower proportion of patients from health plans in the Midwest and a slightly higher proportion of patients from health plans in the South (P = 0.004); (d) had a higher percentage of patients who received only oral hypoglycemic agents (P <0.001), a lower percentage who received only insulin, and a lower percentage who received a combination of insulin and oral agents (P <0.001); (e) had a higher percentage of patients with dyslipidemia (P <0.001) and a lower percentage of patients with retinopathy (P = 0.007), neuropathy (P = 0.035), or diseases of the extremities (P = 0.003); and (f) had a lower percentage of patients who had an internist prescribe the index hypoglycemic medication (P < 0.001) but a higher percentage of patients who had an endocrinologist prescribe the index hypoglycemic medication (P = 0.004).

Costs during the 6-month baseline period were significantly (27%) higher in the at-target group ($2,419) compared with the above-target group ($1,911, P <0.001). Prior to adjustment of costs, the at-target group during the follow-up period had significantly lower medical costs, pharmacy costs, and total diabetes-related costs compared with the above-target group (all comparisons, P < 0.001, Table 2).

Table 3 presents the results of multiple regression analysis, comparing the total diabetes-related costs of the at-target and the above-target groups. The results of regression analysis are interpreted in the following way: At an A1c level of 7%, the expected cost of a subject aged 65 years with hypertension was higher than the expected cost of a subject aged 30 years without hypertension.

The results of regression analysis revealed that the at-target group had significantly lower total diabetes costs (P <0.001) as compared with the above-target group after adjusting for confounding factors. After appropriate log retransformation using the smearing estimator, it was found that the predicted total diabetes-related cost for the above-target group during the 1-year follow-up period was $1,540 per patient, 32% higher than the total diabetes-related cost ($1,171) for the at-target group.

Patients in the age groups <31 and 31-40 years had significantly lower diabetes-related costs as compared with patients older than 60 years. Patients who had an endocrinologist prescribe the first hypoglycemic medication during the study period had higher diabetes-related costs. The higher costs associated with endocrinologists may be related to referral of more complex cases from primary care physicians to endocrinologists. Patients with a comorbid diagnosis of hypertension, dyslipidemia, retinopathy, nephropathy, neuropathy, diseases of the extremities, and obesity had significantly higher diabetes-related costs.

Since some researchers have expressed concerns with the use of logged costs related to the potential difficulties associated with retransformation,[12] we also compared the costs using a gamma distribution with a log link (generalized linear model [GLM]).[13] This method avoids the retransformation problems associated with log models. The magnitude of costs in the at-target group and the above-target group using the GLM was similar to the results obtained using the logged model, thus providing us confidence in our results.

Table 4 displays the results of the subanalyses that identified the significant demographic predictors and comorbidities associated with increased diabetes costs when stratified by A1c level. Patients in the age groups <31 and 31-40 years in the at-target group had significantly lower total diabetes costs as compared with patients older than 60 years. However, the diabetes-related costs of the <31 and 31-40 years age groups in the above-target group were not significantly different from the costs of those older than 60 years, but patients in the age group

51-60 years had significantly higher total diabetes costs as compared with patients older than 60 years. Patients with dyslipidemia, retinopathy, nephropathy, neuropathy, and diseases of the extremities had significantly higher diabetes costs in both groups. The major difference in the 2 groups was that obesity was significant in explaining the higher total diabetes costs in the above-target group whereas it was not significant in the at-target group.

Discussion

A retrospective study using eligibility data, medical and pharmacy claims, and laboratory data for 6,780 patients with type 2 diabetes was conducted to determine the potential economic benefits associated with glycemic control using the A1c value of ≤7%. The results of this study found a strong association between glycemic control and total diabetes-related costs. Patients in the at-target group had significantly lower total diabetes costs as compared with patients in the above-target group after adjusting for the demographic characteristics, presence of comorbid conditions, and baseline costs.

The findings of this study suggest that patients who were at the target A1c level used fewer health care resources related to diabetes as compared with patients who were above the target level, which is reflected in the lower total diabetes costs for the at-target group patients in the 1-year follow-up period. The findings were consistent with some of the earlier studies that studied the relationship between A1c levels and health care costs. Reduced health care costs among patients with better glycemic control may be related to symptomatic relief and improvements in quality of life.[14] Wagner et al. suggest that better glycemic control may increase the comfort of the primary care physician and the patient, resulting in reduction in physician visits.[8]

The at-target-group patients had significantly higher baseline costs as compared with the above-target-group patients. This finding is consistent with the results of some of the other studies that found that patients whose A1c levels improved had increased health care use prior to the decrease in A1c levels.[8,15,16] In an effort to keep the health care costs under control, patients and physicians may have increased the intensity of treatment to achieve glycemic control.

The importance of the association between obesity and total diabetes costs in the above-target group is of great interest. Obesity was significant in explaining the higher diabetes costs in the above-target-group patients but was not significant in the at-target group although both groups had a similar prevalence of obesity. It may be particularly important to focus on reducing weight in patients who are above the target A1c level.

Given the above findings regarding the higher diabetes costs associated with patients with A1c levels continuously above 7%, it seems important to focus on getting diabetic patients in control. Previous research has shown that intervention programs

TABLE 2 Descriptive Characteristics of the Study Population

	At-Target Group* n = 3,121	Above-Target Group n = 3,659	
Characteristic	**Number (%)**	**Number (%)**	***P* Values**
Age† [mean ± SD]	53.9 [9.1]	52.3 [9.1]	<0.001
Age, years			
<31	36 (1.2)	51 (1.4)	0.380
31-40	227 (7.3)	351 (9.6)	<0.001
41-50	739 (23.7)	1,028 (28.1)	<0.001
51-60	1,331 (42.7)	1,530 (41.8)	0.489
>60	788 (25.3)	699 (19.1)	<0.001
Gender			
Male	1,792 (57.4)	2,156 (58.9)	0.210
Female	1,329 (42.6)	1,503 (41.1)	
Health plan location			
Northeast	157 (5.0)	195 (5.3)	0.580
Midwest	727 (23.3)	961 (26.3)	0.004
South	2,043 (65.5)	2,272 (62.1)	0.004
West	194 (6.2)	231 (6.3)	0.869
Type of treatment			
Oral agents only	2,954 (94.7)	2,976 (81.3)	<0.001
Insulin only	61 (2.0)	140 (3.8)	<0.001
Oral agents + insulin	106 (3.4)	543 (14.8)	<0.001
Comorbidities			
Hypertension	2,444 (78.3)	2,846 (77.8)	0.601
Congestive heart failure	79 (2.5)	114 (3.1)	0.149
Ischemic heart disease	495 (15.9)	539 (14.7)	0.197
Atherosclerosis	154 (4.9)	165 (4.5)	0.410
Dyslipidemia	2,442 (78.2)	2,681 (73.3)	<0.001
Retinopathy	332 (10.6)	466 (12.7)	0.007
Nephropathy	96 (3.1)	109 (3.0)	0.816
Neuropathy	272 (8.7)	374 (10.2)	0.035
Diseases of the extremities	40 (1.3)	82 (2.2)	0.003
Obesity	368 (11.8)	403 (11.0)	0.315
Albuminuria	90 (2.9)	129 (3.5)	0.136
Physician specialty			
General practitioner	1,332 (42.7)	1,511 (41.3)	0.250
Internist	986 (31.6)	1,302 (35.6)	<0.001
Endocrinologist	261 (8.4)	239 (6.5)	0.004
Other specialties	542 (17.4)	607 (16.6)	0.395
Baseline cost† [unadjusted]	$2,419 [$3,856]	$1,911 [$3,236]	<0.001
Outcomes† $ [unadjusted]			
Diabetes medical costs	$534 [$624]	$682 [$1,508]	<0.001
Diabetes pharmacy costs	$663 [$683]	$924 [$778]	<0.001
Total diabetes costs	$1,197 [$969]	$1,606 [$1,747]	<0.001

** Target group: patients with A1c (glycosylated hemoglobin) value ≤7%; above-target group: patients with A1c value >7%.*

† For continuous variables, mean and standard deviations are presented by [ ].

TABLE 3 Comparison of Total Diabetes-Related Costs of Patients in the At-Target Group and Patients in the Above-Target Group

Characteristic	Parameter Estimate (SE)	*P* Values
At-target group	-0.3044 (0.0189)	<0.001
Age, years		
<31	-0.2023 (0.0896)	0.023
31-40	-0.1365 (0.0416)	0.001
41-50	-0.0031 (0.0274)	0.909
51-60	0.0434 (0.0247)	0.080
Gender: male	0.0242 (0.0191)	0.206
Health plan: Northeast	0.0974 (0.0570)	0.087
Health plan: Midwest	0.0425 (0.0424)	0.316
Health plan: South	-0.0209 (0.0401)	0.602
Family practitioner	0.0418 (0.0285)	0.142
Endocrinologist	0.4266 (0.0382)	<0.001
Internist	0.0327 (0.0297)	0.270
Hypertension	0.0728 (0.0237)	0.002
Congestive heart failure	-0.0706 (0.0655)	0.280
Ischemic heart disease	0.0284 (0.0278)	0.307
Atherosclerosis	-0.0239 (0.0486)	0.622
Dyslipidemia	0.1928 (0.0234)	<0.001
Retinopathy	0.3044 (0.0274)	<0.001
Nephropathy	0.2507 (0.0541)	<0.001
Neuropathy	0.2227 (0.0312)	<0.001
Diseases of the lower extremities	0.3849 (0.0868)	<0.001
Obesity	0.0897 (0.0312)	0.004
Albuminuria	0.0612 (0.0476)	0.198
Baseline cost/100	0.0017 (0.0002)	<0.001

Adjusted R^2 (coefficient of determination) = 0.1191.
Reference groups include: above-target group, >60 years, female gender, and health plan in the Western region.

TABLE 4 Identification of Significant Predictors of Total Diabetes-Related Costs of Patients in the At- Target Group and Patients in the Above-Target Group

	At-Target Group*		Above-Target Group	
Characteristic	Parameter Estimate (SE)	*P* Values	Parameter Estimate (SE)	*P* Values
Age, years				
<31	-0.4361 (0.1704)	0.010	-0.0418 (0.0874)	0.632
31-40	-0.1880 (0.0661)	0.004	-0.0929 (0.0539)	0.085
41-50	0.0298 (0.0396)	0.451	-0.0214 (0.0380)	0.573
51-60	0.0146 (0.0357)	0.682	0.0690 (0.0345)	0.045
Gender: male	0.0422 (0.0285)	0.138	0.0090 (0.0259)	0.727
Health plan: Northeast	0.1539 (0.0853)	0.071	0.0594 (0.0766)	0.438
Health plan: Midwest	0.0083 (0.0646)	0.897	0.0756 (0.0561)	0.178
Health plan: South	-0.0188 (0.0602)	0.754	-0.0220 (0.0539)	0.682
Family practitioner	0.0337 (0.0415)	0.417	0.0461 (0.0392)	0.240
Endocrinologist	0.4463 (0.0553)	<0.001	0.4200 (0.0521)	<0.001
Internist	0.0372 (0.0443)	0.401	0.0252 (0.0402)	0.530
Hypertension	0.0666 (0.0333)	0.046	0.0710 (0.0334)	0.033
Congestive heart failure	-0.0676 (0.1061)	0.524	-0.0870 (0.0834)	0.297
Ischemic heart disease	0.0258 (0.0421)	0.539	0.0294 (0.0370)	0.426
Atherosclerosis	-0.0447 (0.0728)	0.538	0.0002 (0.0650)	0.996
Dyslipidemia	0.1515 (0.0369)	<0.001	0.2237 (0.0301)	<0.001
Retinopathy	0.3077 (0.0393)	<0.001	0.3030 (0.0376)	<0.001
Nephropathy	0.2422 (0.0835)	0.003	0.2576 (0.0704)	<0.001
Neuropathy	0.1557 (0.0478)	0.001	0.2709 (0.0412)	<0.001
Diseases of the lower extremities	0.4228 (0.1238)	<0.001	0.3563 (0.1143)	0.001
Obesity	0.0165 (0.0474)	0.727	0.1549 (0.0409)	<0.001
Albuminuria	0.1209 (0.0772)	0.117	0.0117 (0.0611)	0.848
Baseline cost/100	0.0013 (0.0004)	0.001	0.0022 (0.0005)	<0.001

** Target group: patients with A1c (glycosylated hemoglobin) value ≤7%; above-target group: patients with A1c value >7%.*
Adjusted R^2 (coefficient of determination) for at-target group=0.0762; adjusted R^2 for above-target group=0.1071.
Reference groups include: >60 years, female gender, and health plan in the Western region.

that facilitate early diagnosis of diabetes, regular monitoring of each patient's progress, patient education, and systematic follow-up will be helpful in attaining glycemic goals and ultimately will result in costs savings to the health care system.[17,18] Proper screening, early diagnosis, and effective management of diabetes will likely ensure a higher percentage of patients at target A1c levels. The use of effective drug therapy, along with patient education and systematic follow-up, may result in maintaining patients at target levels and may help reduce costs associated with diabetes treatment.

Limitations

The findings of this study must be considered within the limitations of the data and study design. First, the observational study design does not permit causal inference of the results. Further, it could be determined whether patients remained at the target A1c level only if they had follow-up visits with their physicians. We made the assumption that the proportion of patients scheduling a follow-up visit in the above-target group is distributed similar to the at-target group. Patients who achieved their target A1c level are probably less likely to have a follow-up visit scheduled as compared with patients who were above target level. We may, therefore, have overestimated the number of patients at target if the number of follow-up visits decreased dramatically after the target level was achieved. However, a post hoc analysis revealed that the number of follow-up visits was higher among the at-target-group patients as compared with the above-target-group patients, thus limiting the possibility of overestimation of the number of patients at target (data not presented).

The present study is limited by the inability to control for the number of A1c tests, the number of diabetes-related ambulatory visits, and the type of oral hypoglycemic agent. Reporting the values for these 3 variables would have provided a more comprehensive description of the study population. The study is also limited by the lack of control for the severity of disease, but the baseline costs may be a crude proxy for disease severity.

We measured only diabetes-related costs, defined as (a) the health plan and member costs for only medical claims with a primary diagnosis of diabetes and (b) pharmacy costs for diabetes drugs and insulin. We did not measure total medical costs for these 2 groups of patients with type 2 diabetes.

Patients were excluded from the study if their A1c values were not continuously at target level or above target level during the 1-year follow-up period. Since this excluded group of 2,211 patients represented 25% of the potential study population, the results of the study may not be generalizable to the general population of patients with type 2 diabetes.

The study population was a sample of managed care members. Therefore, the results of this study are applicable to the management of type 2 diabetes in a managed care setting. It may not be possible to generalize the results to a nonmanaged care population. In addition, administrative claims data have some limitations that are common to all analyses conducted using this data source. Claims data are collected for the purpose of payment and not for research. They may be subject to possible coding errors. Despite the limitations, administrative claims remain a powerful source of data for research. Claims data allow for examination of health care utilization and associated expenditures in real-world settings.

This analysis has important policy implications. The analysis suggests that better glycemic control is associated with significantly lower costs over a 1-year period. Further research should be conducted to explore if glycemic control is associated with cost savings outside the managed care environment.

Conclusion

Diabetes patients who were continuously at the target A1c level of ≤7 had significantly lower diabetes-related costs over a 1-year follow-up period compared with diabetes patients who were continuously above the target A1c level. Managed care efforts to help diabetes patients attain target A1c levels may reduce total diabetes-related medical costs.

DISCLOSURES

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Shetty served as principal author of the study. Study concept and design, analysis and interpretation of data, and statistical expertise were contributed by all authors. Drafting of the manuscript was primarily the work of Shetty, and its critical revision was the work of Secnik and Oglesby. Administrative, technical, and/or material support was provided by i3 Magnifi.

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