Is Having a Regular Provider of Diabetes Care Related to Intensity of Care and Glycemic Control?

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BACKGROUND. We investigated whether having a regular health care provider for diabetes was related to the intensity of care, use of preventive services, or glycemic control in a well-defined population of adults with diabetes.

METHODS. Adults with diabetes who were continuously enrolled in a health maintenance organization (HMO) for 1 year were identified by diagnostic and pharmacy databases (estimated sensitivity=0.91, positive predictive value=0.94). In a stratified random sample, 1828 patients were sent a survey by mail that had a corrected response rate of 85.6%. Further data on utilization of services and glycosylated hemoglobin values were obtained from administrative databases and linked to survey responses.

RESULTS. HMO members who reported having a regular health care provider (RP) for their diabetes (N=1243) were comparable with those (N=144) who denied having such a provider (NRP) in age, race, sex, comorbidity, and years of education, but had longer-duration diabetes (10.9 years vs 8.3 years; $P = .002$). After adjusting for age, sex, education level, duration of diabetes, and type of HMO clinic (owned vs contracted), RP subjects were more likely than NRPs (all $P < .001$) to follow a special diet for patients with diabetes (55% vs 33%), regularly monitor glucose levels at home (68% vs 47%), have greater frequency of glycosylated hemoglobin (Hb A_{1c}) testing (65% vs 38%), have more foot examinations (42% vs 17%), have recommended cholesterol checks (77% vs 63%), and have had a recent preventive examination (86% vs 68%). Smaller differences favoring having a regular provider were noted for insulin use (48% vs 33%, odds ratio [OR]=1.71, $P = .013$), for an influenza immunization within 1 year (65% vs 51%, $P = .029$), and for dilated retinal examinations (64% vs 51%, $P < .027$). No differences between groups were noted for dental checkups (69% vs 67%, $P = .724$) or likelihood of endocrinology referral (17% vs 10%, $P = .104$). Mean Hb A_{1c} level was 8.2% (normal is <6.1%) in in the RP group and 8.6% in the NRP group ($P = .182$). Twelve percent of RPs and 24% of NRPs had an Hb A_{1c} level of greater than 10% ($\chi^2=3.7$, OR=0.48, $P = .05$) after adjusting for age, sex, duration of diabetes, and education level.

CONCLUSIONS. After adjustment for case mix, patients with diabetes who identified a regular primary health care provider for their diabetes were more likely to receive most recommended elements of diabetes care and to have better glycemic control than patients without such a provider. This effect was partially, but not completely, mediated by a higher number of clinic visits for those with a regular health care provider. Innovators seeking to improve diabetes care should be mindful of the relationship between having a regular primary health care provider and the quality of diabetes care.

KEY WORDS. Diabetes mellitus; outcomes; glycemic control [non-MeSH]; managed care; continuity of patient care. *(J Fam Pract 1998; 47:290-297)*

Diabetes mellitus is a chronic disease that requires ongoing clinical care, including regular office visits and regular surveillance of glycosylated hemoglobin (Hb A_{1c}), blood pressure, lipids, renal function, eyes, and feet.[1,2] Accumulating evidence suggests that more intensive diabetes care is associated with better clinical outcomes for patients with either type 1 or type 2 diabetes.[3-5] Although our understanding of factors related to the quality of diabetes care is incomplete, the need for its improvement is clear[6-9] and is felt in an especially intense way by care delivery systems that publicly report quality of care.[10-12] Purchasers of health care are demanding greater provider accountability for health care outcomes, and purchasing decisions are increasingly based on quality of care, as well as on price and patient satisfaction.

Having a regular care provider is a basic tenet of primary care,[13] but little is known of its relationship to the process of care and clinical outcomes, even for patients with chronic diseases, such as diabetes.[14-16] If having a regular provider is related to quality of care and clinical out-

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comes, then strategies to further improve care may need this feature incorporated in their design.[17] If having a regular provider of care is not strongly related to quality of care or clinical outcomes, it may not be a necessary element of new chronic disease care models being considered by health maintenance organizations (HMOs) and other care innovators.[18-21]

After adjusting for patients' sex, educational level, age, duration of diabetes, and care system (owned vs contracted HMO clinic), we hypothesized that patients who have a regular primary provider of diabetes care will receive more intensive diabetes care, better general preventive care, and achieve better glycemic control than patients with no regular provider of diabetes care. The data also serve to benchmark the overall quality of diabetes care in a large and representative sample of all adults with diabetes who receive nearly all their diabetes care from primary physicians.

METHODS

This study was conducted collaboratively by the Minnesota Department of Health Diabetes Control Program and HealthPartners, a large HMO in Minneapolis/St. Paul with approximately 700,000 members in owned and contracted clinics. Adults 19 years and older who were continuously enrolled in calendar year 1994 were defined as having diabetes if they had either two or more clinic visits that resulted in a primary or secondary diagnosis of diabetes mellitus (defined as any ICD-9-CM 250 code) during 1994 or had filled at least one prescription for a diabetes specific drug, including insulin, sulfonylureas, biguanides, or others, in that year. This method of identifying diabetes in this HMO has an estimated sensitivity of 0.91, specificity of 0.99, and positive predictive value of 0.94 based on previous work.[22]

A random sample of 1828 adult HMO members with diabetes was drawn from all such adults attending either owned or contracted clinics. These members were surveyed in July 1995 by mail with telephone follow-up, with an 85.6% corrected response rate (N=1565). After exclusions for incomplete data on all variables of interest, 1387 study subjects (732 in owned clinics and 655 in contracted clinics) were included in the analysis and are the basis of this report.

The 16-page, 61-item diabetes survey included questions from the Centers for Disease Control and Prevention's Behavioral Risk Factor Surveillance System (BRFSS) core items and diabetes module.[23] Data collected included demographics, disease characteristics, comorbidity, duration of disease, diabetes treatment, preventive care, diabetes monitoring, self-care practices, and other topics. Whether patients reported a regular provider of care was ascertained from their response to this question: "Do you have one physician or nurse practitioner in particular who takes care of your diabetes?"

Additional claims and laboratory data including number of primary care visits, visits with endocrinologists, dilated retinal examinations, and Hb A_{1c} test results from the 12 months preceding the survey were reported anonymously and linked to survey responses before purging all personal identifiers. All Hb A_{1c} assays were performed at the same centralized, accredited clinical chemistry laboratory using a high-pressure liquid chromatographic assay with a normal range of 4.5 to 6.1% and a coefficient of variation of less than 0.05 at an Hb A_{1c} level of 8.8%.[24] Of 732 study subjects enrolled in owned HMO clinics, 620 (84.6%) had at least 1 Hb A_{1c} test performed in the previous 12 months. However, Hb A_{1c} data were not available for any patients enrolled in contracted clinics that used many different laboratories and laboratory reporting systems.

Intensity of diabetes care included measures of patient report or database identification of primary care diabetes visits, Hb A_{1c} tests, microalbuminuria screening, and type of treatment given for diabetes (diet only, oral agents, insulin) in the previous 12 months. Preventive care included measures of routine checkups, blood pressure checks, blood cholesterol checks, dental checkups, and influenza and pneumonia immunizations. Diabetes outcome measures, including Hb A_{1c} values, rates of foot examinations, and dilated eye examination rates, were selected because they have been found predictive of long-term clinical outcomes.[3-5,25,26]

Analysis of data was done first using chi-square and t tests to evaluate the relationship between having a regular provider and other variables. Multivariate modeling of the data then used logistic regression and least-squares linear models[27,28] to adjust for covariates, including various combinations of age, sex, duration of diabetes, education level, number of diabetes-related clinic visits, and whether the patient attended an HMO-owned or contracted clinic. To minimize type I error due to multiple comparisons, only results of $P \leq .01$ were considered statistically significant.

RESULTS

Characteristics of patients who had a regular health care provider (RP) and no such regular health care provider (NRP) are shown in Table 1. Of the 1387 study subjects, 1243 (89.6%) reported a regular provider and 144 (10.4%) reported no regular provider. RP and NRP patients were similar in age, age at diagnosis of diabetes, gender, race, ethnicity, and educational level. RP patients had longer duration of diabetes (10.9 years vs 8.3 years, $P = .002$). Table 2 shows the patient-reported frequency of comorbid conditions. The proportion of RP and NRP subjects who reported having heart problems, high blood pressure, and lipid disorders was high and similar in both groups. In the RP group, 13.2% were current smokers, while in the NRP group 21.0% were current smokers ($X^2=4.4$, odds ratio [OR]=0.62, $P = .04$).

Table 3 compares the use of various health care services by the two groups of study subjects. The RP group had higher rates of all preventive services evaluated. The

difference between groups reached statistical significance for two of six measures: having a routine preventive visit within 1 year (OR=2.85, P <.001) and a blood cholesterol check within 1 year (OR=2.05, P <.001 before and after adjustment for duration of diabetes, age, sex, educational level, and type of clinic). After covariate adjustment, influenza immunizations within 1 year favored the RP group (OR=1.50, P =.029).

Table 4 shows measures of intensity of diabetes care for all 1387 study subjects. For all 10 measures, RP subjects received more intensive care than NRP subjects, including mean reported number of diabetes care visits, proportion of subjects with two or more visits in the last year (OR=5.26, P < .001), mean reported number of Hb A_{1c} tests, having two or more Hb A_{1c} tests in the previous year (OR=3.22, P < .001), mean number of foot examinations, having 2 or more foot examinations in the previous year (OR=3.08, P <.001), and having a dilated retinal examination in the last year (OR=1.49, P < .03). With regard to diabetes self-care behaviors, those patients reporting a regular provider of diabetes care were more likely to be following a special diet for diabetes (OR=2.50, P <.001), have a glucometer for home use (OR=2.11, P <.001), conduct home blood glucose monitoring at least 2 or 3 times per week (OR=2.40, P <.001), and do weekly or more frequent examinations of their own feet (OR=1.63, P <.01). Table 5 shows additional measures that were obtained only among the 732 study subjects enrolled in HMO-owned clinics. In the RP group, 83% received all their diabetes care from primary physicians. Analysis showed no relationship between endocrinology referral and eye examination rates or glycemic control.

Mean Hb A_{1c} value was 8.2% for RP subjects and 8.6% for NRP subjects (F=1.8, P =0.182) based on the test done closest to the time of the survey. Among the RP group, 12% of patients had Hb A_{1c} levels greater than 10%, compared with 24% among the NRP group (χ^2=3.7, OR=0.48, P =.05), and 48% had Hb A_{1c} under 8%, compared with 46% among NRPs (χ^2=0.02, OR=0.96, P =.89), after adjustment for sex, education level, duration of diabetes, and age. Among those subjects with more than one Hb A_{1c} test during the 12 months preceding the survey, RP subjects had improved their Hb A_{1c} level by 0.7%, while the NRP subjects improved their Hb A_{1c} level 0.3% (F=1.4, P =.24). The proportion of patients with Hb A_{1c} levels less than 8% increased from 35% to 50% for RP subjects but remained at 35% at both times for the NRP group. The proportion of patients with Hb A_{1c} levels greater than 10% fell from 23% to 9% for RP subjects and from 35% to 24% for NRP subjects. These numbers suggest greater improvement in Hb A_{1c} values over time in the RP group, but because of the small number of NRP subjects who had two tests in 12 months (n=17), there is insufficient power for a statistical test of change over time.

It is of considerable interest that the mean number of office visits in the previous year with a diabetes ICD-9-CM code identified by administrative databases was 3.3 in the RP and 2.9 in the NRP group (F=6.1, P =.013). Because differences in intensity of care attributed to having a regular provider might be mediated by the number of visits, all logistic models were repeated to explicitly adjust the analysis for number of diabetes care visits. In these additional analyses, adjusted models showed weaker associations of intensity of care with having a regular provider.

TABLE 1

Characteristics of Participants (N = 1387) Who Reported Having a Regular Health Care Provider (RP) for Their Diabetes Care Versus Those with No Regular Provider (NRP)

Characteristic*	N	RP (n=1243)	NRP (n=144)	F Ratio	*P* Value†
Mean age, y	1387	57.7	56.1	1.7	.196
Mean age at diagnosis, y	1387	46.8	47.8	0.4	.518
Duration of diabetes, y	1387	10.9	8.3	9.2	.002
Sex, % male	1387	50.8	50.7	0.0	.987
Education, % >high school	1387	63.2	57.6	1.7	.196
Marital status, % married	1383	71.8	63.9	4.0	.049
Race: white, %	1371	90.9	90.1	0.1	.749
Insulin use, % yes	1350	47.9	33.1	11.3	< .001
Diabetes mellitus diagnosis at age 30 and currently using insulin, %	1350	16.3	9.9	4.0	.045
Reported primary care clinic is HMO-owned, %	1387	53.4	43.1	6.1	.014
Reporting any care outside of managed care organization, %	1333	8.6	10.0	0.8	.362

*These analyses are unadjusted. The significance level was set at alpha=0.01 to minimize multiple comparison biases.

TABLE 2

Cardiovascular Comorbidity and Risk Factors of Participants (N = 1387) with a Regular Health Care Provider (RP) for Their Diabetes Versus Those with No Regular Provider (NRP)

Characteristic*	N	RP (n=1243)	NRP (n=144)	F/x1 Ratio	Odds Ratio	*P* Value†
Current smokers, %	1366	13.2	21.0		.062	.036
Mean body mass index (kg/m^2)‡	1255	29.8	29.2	1.0	—	.312
Told by a health professional that they had heart trouble, %	1387	25.2	20.8	—	1.05	.836
Told by a health professional that they had high blood pressure, %	1387	52.0	56.9	—	0.76	.133
Told by a health professional that they had high blood cholesterol, %	1387	37.8	34.0	—	1.23	.275

*These analyses were unadjusted unless otherwise indicated.
†The significance level was set at alpha=0.01 to minimize multiple comparison biases.
‡These analyses were adjusted for duration of diabetes, age, education, sex, and type of health maintenance organization clinic.

TABLE 3

General Preventive Care Reported by Participants (N = 1387) Who Reported Having a Regular Health Care Provider (RP) for Their Diabetes Compared with Those with No Regular Provider (NRP)

Characteristic*	N	RP (n=1243)	NRP (n=144)	χ^2	Odds Ratio	*P* Value†
Had a visit for a routine checkup within 1 year, %	1387	86.0	68.1	27.8	2.85	< .001
Blood pressure checked by health professional within 1 year, %	1387	94.1	93.3	0.3	1.23	.60
Blood cholesterol check within 1 year, %	1387	78.1	63.4	14.8	2.05	< .001
Dental checkup within 1 year, %	1387	59.4	58.3	0.1	1.07	.72
Flu shot within 1 year, %	1387	66.8	56.4	4.8	1.50	.03
Have ever had a pneumonia immunization, %	1387	47.8	42.8	0.8	1.19	.36

* These analyses were adjusted for the duration of diabetes, insulin use, education, sex, and type of health maintenance organization clinic.
†The significance level was set at alpha=0.01 to minimize multiple comparison biases.

However, most of the previously noted associations still favored the RP group.

No attempt was made to separately classify these adult patients as having type 1 or type 2 diabetes, because previous research has shown that a significant proportion of adults with diabetes cannot be definitively classified on the basis of routinely available clinical data.[29] However, age at diagnosis, body mass index, and current diabetes treatment were available. The proportion of these adult study subjects who had received a diabetes diagnosis at 30 years of age or younger, were currently using insulin, and had a body mass index less than 25 was 8.3% in the RP group and 4.0% in the NRP group (F=2.9, *P* =.09).

DISCUSSION

Having a regular provider of care is generally recognized as an important characteristic of primary care[13] and has traditionally been viewed as especially important for patients with chronic diseases.[14-16] The results of this study demonstrate that having a regular provider of diabetes care was significantly associated with receiving more recommended elements of such care, higher rates of desirable diabetes self-care behaviors, and several measures of better preventive care and better glycemic control. These associations persisted for the most part after adjusting in the analysis for the greater number of office visits made by those with a regular provider, although the magnitude was attenuated. The analysis suggests that the better diabetes care received by RP patients was partially, but not completely, mediated by more office visits.

The more intensive diabetes care received by the RP group appeared to translate into

improved glycemic control. The proportion of patients with Hb A_{1c} levels greater than 10% was lower in the RP group than in the NRP group. These data provide some support for the hypothesis that more intensive care of patients with diabetes is associated with improved glycemic control. Hb A_{1c} levels usually worsen with increasing duration of diabetes,[30] but in the data reported here, improvement in Hb A_{1c} values over time was noted in the group with regular providers of care. It is not surprising that having a regular provider was more strongly related to process of care than it was to glycemic control, because glycemic control is affected by many factors in addition to medical care.

The relationship of having a regular care provider to the process and outcomes of diabetes care noted in these data is consistent with other studies that show that neither physician specialty nor systems of care (HMO or fee-for-service) were associated with case-mix adjusted differences in process of diabetes care or clinical outcomes.[31] It is possible that having a regular provider of care may influence diabetes care more than these other factors. Previous work demonstrates that continuity of care is related to greater trust in a physician and a greater likelihood of following physician recommendations.[16,32-38] Greater adherence to physician recommendations and treatment regimens could lead to better glycemic control as well as better preventive care.[35]

In addition, having a regular provider of care may be associated with greater physician understanding of patient views of diabetes, an important factor influencing self-care behaviors.[34,35] Recent studies have also documented the influence of provider-patient relationship characteristics on outcomes of care: more egalitarian relationships, which take time to develop, are associated with better care outcomes.[39] It has been proved that having a regular provider of care is associated with differences in the content of office visits, which is plausible on clinical grounds. With less need to get acquainted, more time may be available to review in a forthright manner issues substantively related to diabetes care.[40] For diabetes, as well as other chronic diseases, there is a growing literature on the value of encouraging patients' decision-making and active participation in their health care plans.[41-46] The relationship between provider-patient communication and quality of care needs further investigation.

Although having a regular provider of care was associated with significantly better diabetes care, the possibility that linking more patients with regular providers will further improve diabetes care remains to be tested.

TABLE 4

Diabetes Care in Participants (N=1387) Who Reported Having a Regular Health Care Provider (RP) for Their Diabetes Versus Those with No Regular Provider (NRP)

Characteristic*	N	RP (n=1243)	NRP (n=144)	F Ratio	Odds Ratio	*P* Value†
Reported seeing a health professional for their diabetes two or more times in the last year, %	1387	79.2	41.7	—	5.26	< .001
Number of times reported for seeing a health professional about diabetes in the last year, mean	1387	2.9	1.5	110.7	—	< .001
Reported having their Hb A_{1c} checked by a health professional two or more times in the last year, %	1387	65.4	37.5	—	3.22	< .001
Insulin use, % yes	1350	47.9	33.1	—	1.70	.013
Number of times a health professional checked Hb A_{1c}, mean	1387	2.2	1.3	46.1	—	< .001
Number of times the feet were checked by a health professional in the last year, mean	1387	1.6	0.9	23.8	—	< .001
Reported currently following a special diet for their diabetes, %	1387	55.0	33.3	—	2.50	< .001
Reported checking their blood for sugar 2 or 3 times per week, %	1387	67.7	46.5	—	2.40	< .001

Hb A_{1c} denotes glycosylated hemoglobin.

*These analyses were adjusted for the duration of diabetes, education, sex, and type of health maintenance organization clinic.

†The significance level was set at alpha=0.01 to minimize multiple comparison biases.

The association between having a regular provider of care and receiving higher-quality care was consistently found in both HMO-owned clinics and in HMO-contracted clinics and was not affected by adjustment for sex, age, education level, duration of diabetes, or use of insulin. The RP and NRP subjects were similar in comorbidity and demographics. Thus, it is unlikely that the lower intensity of diabetes care in the NRP group was related to those patients' having other more serious conditions that would distract from diabetes care.

There may be important psychological factors, however, that contribute to a patient's lack of a regular health

TABLE 5

Diabetes Care in Participants Who Reported Having a Regular Health Care Provider (RP) for Their Diabetes Compared with Those with No Regular Provider (NRP) in the HMO-Owned Clinics Only (N=732)

Characteristic*	N	RP	NRP	F Ratio	Odds Ratio	*P* Value†
Value of most recent Hb A_{1c} test, mean‡	620	8.2 (n=574)	8.6 (n=46)	1.8	—	.182
Change in Hb A_{1c} in the last year, mean‡	415	-0.7 (n=398)	-0.3 (n=17)	1.4	—	.242
Number of database reported Hb A_{1c} tests in last year, mean‡	732	1.9	1.1	22.2	—	< .001
Number of self-report of Hb A_{1c} tests in last year, mean‡	732	2.1	1.3	14.7	—	< .001
Database ≥2 Hb A_{1c} tests in last year, %	732	59.4	27.4	—	3.82	< .001
Self-report of ≥2 Hb A_{1c} tests in last year, %	732	63.9	38.7	—	2.97	< .001
Database reported number of visits with ICD-250 code in last year, mean	732	3.3	2.9	6.1	—	.013
Database reported number of diabetes visits with a primary care provider, mean‡	732	2.9	2.0	22.4	—	< .001
Number of self-reported diabetes visits in last year, mean‡	732	3.0	1.6	51.5	—	< .001
Database report of ≥ 2 diabetes visits in the last year, %*	732	87.9	82.2	—	1.47	.29
Self-report of ≥ 2 diabetes visits in the last year, %*	732	80.9	43.5	—	5.58	< .001
Number database reported endocrinology visits, %‡	732	0.9	0.3	2.8	—	.096
Database report of at least one endocrinology visit, %	732	17.0	9.7	—	2.10	.10
Database report of retinal eye examination, %	732	66.9	59.7	—	1.11	.70
Self-report of having a dilated pupil examination less than 1 year ago, %	732	68.0	61.3	1.2	1.19	.53

* These analyses are adjusted unless otherwise indicated.
† The significance level was set at alpha=0.01 to minimize multiple comparison biases.
‡ These analyses were adjusted for duration of diabetes, age, education, sex, and type of health maintenance organization clinic

care provider. High-risk patients in poor glycemic control have a higher prevalence of concomitant psychiatric illnesses, more often live in families with high levels of conflict, and may be disengaged from medical care, so that they are less likely to keep appointments consistently.[47,48]

Public pressure to improve diabetes care is driving radical experimentation with new diabetes care models in some HMOs.[10-11] Some of the new care models being tested disrupt ongoing relationships between providers and patients, especially for people who have more than one chronic disease.[16,20,21] The demonstrated link between a regular provider of care and higher-quality diabetes care suggests that regular providers should be retained and strengthened as HMOs evolve new care delivery models.[49]

The intensity of diabetes care given mostly by primary care physicians to subjects in this HMO compares favorably with that received by patients in many other settings. For example, in one group of patients attending contracted HMO clinics in California, the mean number of Hb A_{1c} tests per year was 0.8, 56% of patients with diabetes had no Hb A_{1c} test in the year, and 6% had a documented foot examination.[41] In a study of 97,388 Medicare-insured elderly patients with diabetes in three states during 1990 through 1991, only 16% had any Hb A_{1c} tests, and 46% had seen an ophthalmologist in the previous year.[51]

Although patients from more than 200 clinics were involved in the study, the generalizability of the findings is limited by patient characteristics, including the fact that all study subjects had health insurance coverage. Estimates of the proportion of Americans with diabetes who lack a regular provider of care vary widely, but the number could be quite high because many people with diabetes lack health insurance or have very high deductibles or limited coverage of services. To the degree that lack of a regular provider of care is related to insurance coverage, it may be in society's interest to extend insurance coverage to encourage regular ongoing care for these chronically ill patients.

CONCLUSIONS

We conclude that having a regular primary provider of health care, beyond its previously demonstrated benefits of patient satisfaction and provider trust, is significantly related to better diabetes care. In a time of radical experimentation with models of chronic disease care, the importance of preserving and strengthening the doctor-patient relationship must be carefully considered.[52-53]

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