Factors Associated With Implementation of Preventive Care Measures in Patients With Diabetes Mellitus

Dan A. Streja, MD; Simon W. Rabkin, MD

Background: There is only limited information on the extent to which physicians’ characteristics affect the level of care and implementation of guidelines in patients with diabetes mellitus.

Objective: To identify physician characteristics associated with implementation of measures for preventive care in patients with diabetes mellitus and the distribution of implementation of these measures among them.

Patients and Methods: A retrospective chart audit of 519 patients eligible for health maintenance organization insurance on December 31, 1994, representing patients with diabetes receiving care from 22 primary care physicians—providers of a managed care medical group in suburban North Los Angeles, Calif, and seen by physicians between January 1993 and December 1994. A short retroactive questionnaire for participating physicians was also used. The outcome measures were (1) measurement of serum high-density lipoprotein cholesterol; (2) urinalysis for the detection of proteinuria; and (3) ophthalmology referral for dilated fundus examination.

Results: Over a period of 2 years 78% of the patients had a high-density lipoprotein cholesterol determination, 80% had a test for proteinuria, and 62% were referred to an ophthalmologist. After adjustment for patient pool differences, physicians who were perceived by the administration of the medical group as “fast,” based on a blinded evaluation of their number of patient encounters per unit time, had an odds ratio of 0.60 (95% confidence interval [CI], 0.37-0.95; P = .03) to obtain a high-density lipoprotein cholesterol determination in their patients and an odds ratio of 0.53 (95% CI, 0.32-0.87; P = .01) to test their patients for proteinuria. In patients requiring insulin, of fast physicians, the odds ratio for a referral for ophthalmology screening was 0.25 (95% CI, 0.07-0.85; P = .03). Duration of time in practice of over 15 years and disagreement with practice guidelines were associated with better outcomes. There was no association between physician sex, internal medicine training, or number of patients with diabetes in the practice and the implementation of outcomes. There was a highly significant association between the implementation of an outcome and the implementation of the other 2, resulting in a nonhomogeneous distribution of health care delivery. Physicians’ estimate of their rate of implementation of outcomes, as assessed by the questionnaires, overestimated their actual performance while being in proportion with the documented rates. Most physicians took responsibility for the nonimplementation, accepting that it was an oversight on their part as opposed to an encounter with patient resistance.

Conclusions: Most physicians believe that the lack of implementation of the measures for preventive care in patients with diabetes mellitus is an oversight. The oversight is more prevalent in the practices of busy physicians. The result is a nonhomogeneous distribution of health care. Computer reminders might be the solution.

Arch Intern Med. 1999;159:294-302

From the Section of Endocrinology of Greater Los Angeles VA Health Care System at West Los Angeles and the Disease State Management Unit of Community Medical Group of the West Valley, Los Angeles, Calif (Dr Streja); and the Section of Cardiology, Department of Medicine, University of British Columbia, Vancouver (Dr Rabkin).

Diabetes mellitus is an important cause of morbidity and mortality. Care of patients with diabetes mellitus requires a large part of health care resources available to most countries. Diabetes cost to the US health care system has been estimated at more than $100 billion per year. Most of the diabetes-related health care expenses are in-hospital costs for management of the long-term complications of the disease. In the last 10 years numerous studies have identified the risk factors for diabetes complications and documented that clinical intervention, besides control of glycemia, is effective. The most important areas are control of hyperlipidemia and early intervention in diabetic nephropathy and retinopathy.

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patients, materials, and methods

description of practices and physician characteristics

The chart audit was done in the practice of 22 primary care providers of Community Medical Group of the West Valley, a managed care medical group in southern California. The group is located in a relatively affluent, predominantly white, middle-class, suburban Los Angeles area. All physicians were board certified in internal medicine, family practice, and/or surgery. The physicians were selected if they took care of at least 5 patients with diabetes. Early in 1993, before the publication of the second report guidelines of the National Cholesterol Education Program, physicians received continuous medical education concerning the importance of HDL-C determination. During the 1990-1995 period, physicians received numerous letters from various health care plans concerning the need to ensure that an annual dilated fundus examination is performed in patients with diabetes.

At the time of the first visit, all patients completed a questionnaire, which asked them to list all current and past medical problems as well as their history of cigarette smoking, and the presence of a family history of heart disease or diabetes. The questionnaire was reviewed and signed by the primary care physician. Appointments were scheduled every 15 minutes. Physicians had the right to reserve 30 or 45 minutes for a difficult patient or to accept double booking. As a result, physicians differed in the number of patients seen per unit time. There was a small financial incentive for a higher number of patients seen per unit time. After each visit, each patient was offered a return appointment, no later than 6 months after the visit.

There were no barriers to laboratory investigations and prescription of drugs. Referral to an ophthalmologist, dietitian, or diabetes educator required a written request that was automatically approved by the administration of the medical group. All eye care was provided by board-certified ophthalmologists.

chart selection

We audited the charts in all patients older than 16 years who had their diabetes care provided exclusively by the 22 providers. Patients were identified by services for International Classification of Diseases, Ninth Revision (ICD-9) code 250.0 (diabetes mellitus) or by pharmacy records showing prescriptions for oral hypoglycemic agents and/or insulin and verified by chart audit. Patients were included in the study if they were free of terminal illnesses, had at least 1 visit to their primary care provider in 1993 and 1994, and were eligible for health maintenance organization insurance on December 31, 1994. All chart audits were reviewed by one of us (D.A.S.).

main outcomes

We hypothesized that during a period of 2 years every patient should have had an HDL-C determination, a urine test for proteinuria and/or microalbuminuria, and a referral to an ophthalmologist. The HDL-C determination and the proteinuria test were considered "obtained" if results were available in the chart. The patient was considered "referred" if an ophthalmology referral was present in the chart. The number of the patients who received referrals but did not use them was not established in the study. These 3 behaviors of the physicians were selected as main outcomes. The presence of a foot examination was not entered in the model since the quality of the information obtained from the audit was not comprehensive.

At the end of the study physicians answered a brief questionnaire. They were asked to estimate their level of implementation of the outcomes and the reasons for possible nonimplementation. For the latter, they were given 3 choices: (1) they were unaware of the outcomes or did not agree with them; (2) they agreed with the outcomes but encountered patient resistance; and (3) they did not encounter significant resistance in implementation but forgot to implement.

variables studied

The variables included in the statistical model were obtained either from the chart or from the administration of the medical group. The entire chart was audited but the information concerning appointments, referrals, and laboratory results was restricted to that recorded during 1993 and 1994. Independent variables were divided into physician variables and patient variables.

Physician Variables

- Sex.
- Practice experience (less vs more than 15 years in practice).
- Specialty (internal medicine vs family practice or surgery).

continued on next page
Diabetes is the single most prevalent cause of blindness in industrialized nations in patients aged 25 to 75 years. Early treatment of diabetic retinopathy has been shown to prevent the progression of diabetic retinopathy. The ADA and other health care agencies have recommended an annual dilated fundus examination. The association between physicians’ estimate of compliance and the actual proportion of patients in whom the outcomes were implemented was tested by $\chi^2$ test.

To our knowledge, the consequences and the reasons for this physician behavior have not been investigated.

Our study specifically sought characteristics of physicians and their practice that might determine their behavior in the area of prevention of complication of diabetes and to determine whether the implementation of one set of guidelines predicts the implementation of another.

**RESULTS**

**PATIENT AND PHYSICIAN CHARACTERISTICS**

Primary care physicians in this area appear to be predominantly male interns with an average (SD) practice experience of 14.0 ± 0.3 years. The average (SD) number of patients with diabetes per practice was 23.4 ± 4.3.
Four of the 22 physicians disagreed with at least 1 of the outcomes. Three physicians disagreed that an HDL-C determination is necessary in all patients; 2, that proteinuria should be tested; and 2, that an ophthalmology referral is annually required. The management of the medical group classified approximately half the physicians as fast and the other half as slow.

During the 2 years of the study, 404 (78%) of the patients had an HDL-C determination and 413 (80%) a test for proteinuria, but only 320 (62%) were referred to an ophthalmologist.

ASSOCIATIONS OF PHYSICIAN AND PATIENT CHARACTERISTICS AND MAIN OUTCOMES

The association between physician characteristics and main outcomes is shown in Table 1 and Table 2. A fast practice style was associated with noncompliance with all outcomes reached by univariate analysis and with HDL-C determination and proteinuria testing reached by multivariate analysis. Having 15 years or more in practice seems to improve significantly an ophthalmology referral and was associated with increased proteinuria testing. Surprisingly, physicians who objected to the need to implement the outcomes were more likely to order an HDL-C determination in their patients.

The association between patient characteristics and main outcomes is shown in Table 3 and Table 4. Patients in whom an HDL-C determination was obtained were significantly older (mean ± SD age, 52.3 ± 0.6 vs 46.8 ± 1.3 years; F = 17.8; P = .001) and so were patients in whom a proteinuria test was obtained (mean ± SD age, 51.7 ± 0.6 vs 48.6 ± 1.2 years; F = 5.18; P = .02). There was no difference in age according to the referral to an ophthalmologist, and no difference in systolic or diastolic blood pressure between groups.

Physicians were more likely to obtain an HDL-C determination in patients with macrovascular disease or with kidney disease. Patients with less than 2 appointments per year were less likely to be tested for either HDL-C or for proteinuria. In univariate analysis, eye disorders were associated with testing for proteinuria and kidney disease was associated with an ophthalmology referral. Patient receiving insulin therapy were significantly more likely to be referred to an ophthalmologist.

Additional analyses were thought to be necessary for the association with an ophthalmology referral. First, all patients with eye disease received a referral to the ophthalmologist. Therefore, the true rate of ophthalmology screening was not accurately reflected after the inclusion of these patients. Second, studies have shown that the incidence of retinopathy depends on insulin therapy status40,41 and, therefore, the rate of referral to an ophthalmologist is higher in insulin-treated patients.42,43 Consequently, the analyses were repeated after the elimination of the 110 patients with eye disease and performed separately in patients treated with diet and oral agents, or insulin.
Of 409 patients free of eye disease, 210 (52%) received ophthalmology referrals. A fast style was associated with a lower referral rate (43% vs 55%; $\chi^2$, 5.68; $P = .02$) and a longer practice experience was associated with a higher referral rate (60% vs 43%; $\chi^2$, 12.4; $P = .001$). Patients receiving insulin therapy were more likely to be referred (64% vs 47%; $\chi^2$, 8.96; $P = .003$).

Two hundred ninety-seven patients free of eye disease were treated with diet and oral agents. In these patients, the practice experience of the physicians was associated with an ophthalmology referral in univariate analysis (55% vs 40%; $\chi^2$, 6.78; $P = .009$) and multivariate analysis (odds ratio, 1.80; 95% confidence interval, 1.16-3.43; $P = .014$). A fast style was not associated with a lower referral rate in this subgroup. One hundred twelve patients free of eye disease were being treated with insulin. In these patients, a fast style was associated with a lower referral rate in univariate (41% vs 69%; $\chi^2$, 5.96; $P = .015$) and multivariate analyses (odds ratio, 0.25; 95% confidence interval, 0.07-0.85; $P = .03$). Practice experience was not associated with an ophthalmology referral in this subgroup.

**ASSOCIATIONS BETWEEN THE IMPLEMENTATION OF THE MAIN OUTCOMES**

There was a strong association between the implementation of different outcome measures, whether they were entered in the analysis separately or together (Table 5). To test if this association was attributable to patients with poor appointment compliance, the analysis was repeated after the elimination of patients who had less than 2 appointments per year. Of the 427 compliant patients, 345 underwent an HDL-C determination, 353 had a test for proteinuria, and 268 were referred to an ophthalmologist. Each pair of outcomes

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**Table 3. Patient Characteristics and Outcomes: Univariate Analysis**

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. (%)</th>
<th>HDL-C Testing</th>
<th></th>
<th>Proteinuria Testing</th>
<th></th>
<th>Ophthalmology Referral</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>% Y N $\chi^2$</td>
<td>$P$</td>
<td>% Y N $\chi^2$</td>
<td>$P$</td>
<td>% Y N $\chi^2$</td>
<td>$P$</td>
</tr>
<tr>
<td>Sex, male</td>
<td>309 (59)</td>
<td>79 76 0.92 .35</td>
<td>81 78 0.47 .49</td>
<td>59 65 1.91 .17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Therapy, insulin</td>
<td>164 (32)</td>
<td>75 79 1.12 .29</td>
<td>78 80 0.34 .56</td>
<td>75 55 18.10 .001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family history of diabetes</td>
<td>172 (33)</td>
<td>83 76 3.32 .07</td>
<td>81 79 0.52 .47</td>
<td>60 62 0.15 .69</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family history of atherosclerosis</td>
<td>172 (33)</td>
<td>81 77 0.69 .41</td>
<td>89 78 4.49 .03</td>
<td>62 62 0.01 .93</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Treated hypertensives</td>
<td>224 (43)</td>
<td>81 76 2.00 .16</td>
<td>81 78 0.68 .41</td>
<td>65 59 1.58 .21</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significant comorbidity</td>
<td>75 (14)</td>
<td>84 77 1.93 .17</td>
<td>83 79 0.52 .47</td>
<td>72 60 3.97 .05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cigarette smoking</td>
<td>80 (15)</td>
<td>80 77 0.25 .61</td>
<td>75 80 1.22 .27</td>
<td>59 62 0.34 .56</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Macrovascular disease</td>
<td>92 (19)</td>
<td>92 75 11.80 .001</td>
<td>85 78 1.87 .17</td>
<td>65 61 0.60 .44</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Renal disease</td>
<td>150 (26)</td>
<td>89 73 14.30 .001</td>
<td>... ... ... ...</td>
<td>69 59 4.39 .04</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eye disorders</td>
<td>110 (21)</td>
<td>81 77 0.76 .38</td>
<td>86 78 3.96 .05</td>
<td>... ... ... ...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appointments, &lt;2 per year</td>
<td>92 (18)</td>
<td>81 64 12.20 .001</td>
<td>83 65 14.20 .001</td>
<td>93 57 1.25 .26</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*HDL-C indicates high-density lipoprotein cholesterol; ellipses, not applicable. Y meaning yes, and N, no, relate to the respective variable (eg, N for sex entries signifies female patients. Renal disease and eye disorders were not included in the analysis for proteinuria testing and ophthalmology referral.*

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**Table 4. Patient Characteristics and Outcomes: Logistic Regression Analysis**

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. (%)</th>
<th>HDL-C Testing</th>
<th></th>
<th>Proteinuria Testing</th>
<th></th>
<th>Ophthalmology Referral</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>OR 95% CI $P$</td>
<td></td>
<td>OR 95% CI $P$</td>
<td></td>
<td>OR 95% CI $P$</td>
<td></td>
</tr>
<tr>
<td>Mean (± SE) age, y</td>
<td>51.0 ± 1.0</td>
<td>1.03 1.01-1.06 .004</td>
<td>1.02 0.99-1.04 .18</td>
<td>1.01 0.99-1.03 .12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex, male</td>
<td>309 (59)</td>
<td>1.17 0.75-1.83 .49</td>
<td>1.28 0.81-2.00 .29</td>
<td>0.80 0.55-1.17 .25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Therapy, insulin</td>
<td>164 (32)</td>
<td>0.84 0.52-1.38 .49</td>
<td>0.86 0.52-1.40 .53</td>
<td>2.49 1.63-3.84 .001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family history of diabetes</td>
<td>172 (33)</td>
<td>1.74 1.08-2.89 .03</td>
<td>1.20 0.74-1.96 .47</td>
<td>0.97 0.65-1.45 .88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family history of atherosclerosis</td>
<td>172 (33)</td>
<td>1.14 0.58-2.40 .70</td>
<td>2.24 1.04-5.60 .06</td>
<td>1.01 0.58-1.79 .97</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treated hypertensives</td>
<td>224 (43)</td>
<td>0.84 0.50-1.39 .49</td>
<td>0.91 0.55-1.51 .71</td>
<td>1.18 0.78-1.78 .45</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significant comorbidity</td>
<td>75 (14)</td>
<td>0.89 0.44-1.91 .75</td>
<td>0.91 0.46-1.92 .80</td>
<td>1.32 0.73-2.42 .36</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cigarette smoking</td>
<td>80 (15)</td>
<td>1.33 0.73-2.55 .37</td>
<td>0.79 0.45-1.45 .43</td>
<td>0.91 0.55-1.52 .73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macrovascular disease</td>
<td>92 (19)</td>
<td>2.36 1.08-5.73 .04</td>
<td>1.14 0.58-2.35 .71</td>
<td>0.80 0.46-1.40 .43</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Renal disease</td>
<td>150 (26)</td>
<td>2.57 1.47-4.73 .002</td>
<td>... ... ... ...</td>
<td>1.50 0.99-2.31 .06</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eye disorders</td>
<td>110 (21)</td>
<td>0.85 0.48-1.55 .58</td>
<td>1.71 0.93-3.31 .09</td>
<td>... ... ... ...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appointments, &lt;2 per year</td>
<td>92 (18)</td>
<td>1.95 1.13-3.32 .02</td>
<td>2.32 1.36-3.94 .002</td>
<td>1.07 0.65-1.74 .78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (± SE) systolic BP</td>
<td>133 ± 1</td>
<td>0.99 0.98-1.01 .75</td>
<td>0.99 0.98-1.01 .22</td>
<td>0.99 0.98-1.01 .46</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*HDL-C indicates high-density lipoprotein cholesterol; OR, odds ratio; CI, confidence interval; BP, blood pressure; and ellipses, not applicable. Renal disease and eye disorders were not included in the analysis for proteinuria testing and ophthalmology referral.*
was significantly associated with the third after adjustment for patient and physician characteristics, indicating that elimination of noncompliant patients does not affect the results.

From the proportion of patients having each outcome implemented, we calculated the expected number of patients having 3, 2, 1, and no outcome implemented. Figure 1 shows the difference between the expected and actual distribution of rates of outcome measures ($\chi^2 = 88.9; P < .001$). The proportion of patients having all outcome implemented was higher than predicted by chance alone, but so was the number of patients with no outcomes or only 1 outcome implemented.

**PHYSICIANS’ AWARENESS OF THEIR OWN BEHAVIOR**

The rates specified by the physicians in their self-evaluation were an overestimate of the actual rate of compliance, particularly for the percentage of patients referred to an ophthalmologist (Figure 2). Half the physicians thought that they implemented each outcome at a higher than 90% rate, which, in reality, happened only occasionally. When patients were grouped according to the rates of implementation of outcome measures perceived by their physicians, a significant difference in the actual rates was noted. This indicates that physicians are aware of their performance as being high, medium, or low compared with their colleagues.

The results of the questionnaire attributing the causes of noncompliance to either disagreement with the outcomes, or physician’s problem (oversight) or patient’s problem (resistance) showed that physicians believe that the responsibility lies with them in most situations of nonimplementation. Of 66 possible answers, 7 indicated disagreement with the outcomes, 14 indicated that patients refused the test or referral, and 45 indicated oversight as a cause.

**COMMENT**

Previous studies have documented that variations in health care delivery cannot be accounted for by patient characteristics alone. Physician characteristics may contribute substantially to these differences. In our study, the single most important physician characteristic associated with the implementation of all 3 outcomes for management of patients with diabetes mellitus was the practice style. Physicians who were characterized by the medical group as having a high number of patient encounters per unit time had a lower level of implementation of outcomes after adjustment for patient charac-
teristics. The patients of these physicians were less likely to have an HDL-C determination, to be tested for proteinuria and, if they were treated with insulin and free of eye disease, to be referred to an ophthalmologist for a dilated fundus examination. This confirms previous beliefs that the care of patients with diabetes mellitus is improved if more time is allocated for patient care and that a possible solution is protection of physician time with the patient by a mini-clinic setting. There is no standardized method for classifying physicians according to the number of patients per unit time and little information concerning the impact of this number on the quality of care. An analysis of prescribing behavior in New Brunswick has shown that physicians who have a higher number of patients per day also have a higher morbidity and mortality in their practice. The New Brunswick data could, however, be interpreted as representing a polarization of sick patients toward busier physicians since there was no adjustment for patient characteristics. In another study, physicians with high-volume practices were described as having a “less participatory decision making style,” that is, they involved their patients less in the health care delivery process. Although this could be detrimental to diabetes care where patient empowerment seems to be essential, it would not explain our data since the outcomes studied by us were not dependent on the patient.

INSULIN-TREATED PATIENTS seem to receive a higher rate of preventive eye care. In our study the effect of practice style on eye care may be explained by a higher referral rate of insulin-treated patients by physicians with a slow style. A high-volume practice has been associated in other studies with a higher use of innovations (including hemoglobin A1c) by pediatricians and with a lower length of hospital stays for psychiatric disorders. Since there is no accepted definition of high volume, and a high volume does not always mean a fast style, we are not sure of the applicability of this information to the physicians studied by us.

Being in practice for more than 15 years was associated with a higher rate of testing for proteinuria and a higher rate of ophthalmology referrals, particularly in patients treated with diet and oral hypoglycemic agents. There was also a borderline trend toward fewer HDL-C determinations in patients treated by physicians with more than 15 years of practice. One could speculate that ophthalmology referrals and proteinuria testing are more established standards of care while the emphasis on treatment of hyperlipidemia is more recent. In other studies, physicians with longer time in practice were less likely to report ophthalmology referrals or to implement preventive practices. The time since graduation does not seem to be consistently associated with physician’s preventive care practices. We could speculate that the effect of time since graduation on physician behavior might be dependent on the level of continuous medical education of older physicians.

Factors not associated with the outcomes were physicians’ sex, internal medicine training, and the number of patients in the practice. These variables were examined because of significant associations documented by other studies. Female physicians have been reported to have higher levels of preventive care practices. The level of implementation of guidelines by internists may be higher or similar to that of family physicians. The number of patients with a certain diagnosis in a physician’s practice might be interpreted as the physician’s interest in the condition. In other studies, physicians who expressed an interest in diabetes were reported to achieve a higher level of diabetic care. However, this is not supported by our data.

Our study examined medical practice in the managed care setting. Physicians agreed to participate in a study that tested their beliefs in adherence to recommended guidelines. Even within this practice model there were variations in the management of patients with diabetes mellitus. Because the objective of the study was not to compare managed care with other forms of health care delivery, we were unable to determine whether the standard of care was better or worse than in other settings.

The possibility existed that physicians did not implement the outcomes because they did not agree with them. This was particularly important for the determination of HDL-C, since the randomized trial evidence for the benefit of hyperlipidemia treatment was published after the completion of the study. To our surprise, physicians who disagreed with the outcomes had a higher rate of determining HDL-C in their patients, unrelated to the differences in patients’ characteristics. In another study, the physician’s rating of the importance of a risk factor had no correlation with his or her screening and treatment rate of this factor. To the extent that physicians accurately recall their compliance with guidelines, perhaps, disagreement with the outcomes identifies physicians who were more knowledgeable and more critical about the guidelines and who were less likely to ignore them.

Physicians overestimated the percentage of outcome measures achieved. This supports studies reporting a poor correlation between a physician’s stated belief and performance. In this study, physicians having lower performance rates seem to be aware of it. This has implications for medical education or for initiatives to assist individual physicians in achieving better compliance.

We believe that patients should have had all outcomes implemented. However, a patient in whom a certain outcome is not implemented is less likely to receive other forms of preventive care. This leads to an uneven distribution of health care in an organization that is by definition dedicated to health maintenance. This defines a problem requiring practice management and/or physician education. Since our study did not identify correctable patient characteristics associated with a low level of preventive care, we do not know whether patient education might have improved the outcome implementation. Modifiable patient behavior was shown to be a strong determinant of physician compliance. More studies are necessary to determine if other factors, such as psychological or socioeconomic, are associated with the quality of health care.

In summary, the likelihood of obtaining preventive health care measures in patients with diabetes was
associated with the physician having a lower number of patients per unit time. The physicians were aware of their relative performance and their behavior could not be explained by their lack of agreement with the outcomes. Most physicians blamed the nonimplementation on an oversight. Assuming a compliance of 100% would lead to optimal care, a system of computer reminders seems to be the optimal solution for this type of practice. Computer reminders have been shown to improve the provision of health care without increasing the time spent with the patients. The clinical and economic effectiveness of computer-reminder programs, allowing internists to approach the level of care provided by subspecialists, remains to be tested. Although this is a relatively small medical group, we believe that the results may be generalized and the proposed solution tested in any suburban group practice in the United States.

Accepted for publication May 12, 1998.

This study was supported by a grant from Bristol-Myers Squibb Co, Plainsboro, NJ.

Reprints: Dan A. Streja, MD, 7345 Medical Center Dr, West Hills, CA 91307 (e-mail: dstreja@pol.net).

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