Adherence to American Diabetes Association Standards of Care by Rural Health Care Providers

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OBJECTIVE — To determine whether rural health care providers are compliant with American Diabetes Association (ADA) clinical practice guidelines for glycemic, blood pressure, lipid management, and preventative services.

RESEARCH DESIGN AND METHODS — This study was performed using a retrospective chart review of 399 patients 45 years of age and older, with a definitive diagnosis of diabetes seen for primary diabetes care at four rural health facilities in Montana between 1 January 1999 and 1 August 2000.

RESULTS — Glycemic testing was adequate (85%), and glycemic control (HbA_{1c} 7.43 ± 1.7%) was above the national average. Comorbid conditions of hypertension and dyslipidemia were not as well managed. Mean systolic blood pressure (SBP) was 139 ± 18.8 mmHg and LDL was 119 ± 33 mg/dl. Of 399 patients, 11 were considered as needing no additional treatment based on ADA guidelines of an HbA_{1c} level <7%, a BP <130/85 mmHg, and a LDL level <100 mg/dl. Monofilament testing and dilated eye examinations were poorly documented, as were immunizations. There were few referrals for diabetic education.

CONCLUSIONS — Rural health care practitioners are not adequately following the ADA standards for comprehensive management of their patients with diabetes. Glycemic testing is being ordered, but HbA_{1c} values indicate that patients do not have their diabetes under optimal control. The comorbid conditions of hypertension and dyslipidemia are not optimally managed according to the ADA guidelines.

Diabetes Care 25:2224–2229, 2002

Diabetes is the 7th leading cause of death in the U.S. Financial expenditures for the treatment and care of patients with diabetes are considerable (1). Research has shown that the key to proper diabetes control is early detection and strict glycemic control. Epidemiological studies have demonstrated a strong association between hyperglycemia and microvascular and macrovascular complications (2,3). Intervention-based research has shown that microvascular complications including retinopathy, nephropathy, and neuropathy can be reduced in both type 1 and type 2 diabetic subjects if tight glycemic control is maintained (3,4).

Multiple comorbid conditions, including hypertension and dyslipidemia, often complicate diabetic treatment and increase risk for macrovascular complications, leading to the development of vascular disease (5). A reduction of these complications has been associated with a comprehensive vascular risk-management program that includes hypertension and dyslipidemia control (4,6–8b). To prevent end organ damage and other health complications associated with both microvascular and macrovascular complications, it is important for health care providers to follow the American Diabetes Association (ADA) guidelines for disease management (8a,8b). This treatment should include a team approach that involves the primary medical provider (physicians, physician assistants, or nurse practitioners), nurses, dieticians, educators, and mental health professionals.

In rural areas of the U.S., the array of available health services is limited. One-half of older rural seniors feel that they do not have readily available information about diabetes and other chronic disorders (9,10). Recruitment and retention of providers in rural areas is often difficult due to decreased financial incentives and difficulty staying current in the treatment of chronic diseases such as diabetes. It is important to provide a cost-effective intervention to improve diabetes management among rural health care providers. Computer-based programs integrating evidence-based practice into medical record keeping has been one of the recent interventions shown to increase adherence to current clinical practice guidelines (12).

Before an intervention could be instituted to help rural providers improve care, it was important to determine whether rural providers are currently providing comprehensive management of type 2 diabetic patients. Current research has studied glycemic compliance with ADA standards in urban areas (13,14). Little research has examined how effective rural providers are in achieving glycemic control as well as blood pressure and lipid management in rural diabetic patients (11). The goal of this study was to determine whether rural providers are compliant with comprehensive ADA clinical practice guidelines for preventative services and glycemic, blood pressure, and lipid management.

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Received for publication 11 March 2002 and accepted in revised form 11 September 2002.
Abbreviations: ADA, American Diabetes Association; DBP, diastolic blood pressure; SBP, systolic blood pressure.
A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

Table 1—*Compliance with 1999/2000 ADA standards of treatment*

Laboratory values/recommended frequency of testing	ADA standard of treatment: Diabetic goals	ADA standard of treatment: Additional action suggested (guideline)	*n*	Treatment compliance: Treated to goal (%)	Treatment compliance: Additional action suggested (%)	Mean value ± SD
HbA_{1c} Every 6 months if stable, otherwise quarterly	<7.0%	>8.0%	340	47.6	30	7.43 ± 1.7
SBP Every 6 months	<130	>130	377	35.3	64.6	139 ± 18.8
DBP Every 6 months	<85	>85	377	79.6	20.4	75 ± 11.5
LDL Annual unless low risk	<100	>130*	228	33	72	111 ± 33

*For diabetic patients with multiple coronary heart disease risk factors, some authorities recommend action between 100 and 130 mg/dl.

RESEARCH DESIGN AND METHODS

— This is a descriptive study conducted at multiple rural health clinics in Montana. It was designed to determine rural provider's baseline compliance with 1999/2000 ADA clinical practice guidelines. Screening for and management of the comorbid conditions of hypertension or dyslipidemia were also included.

Rural providers. Providers practicing in four rural communities in Montana were included in this study. These communities varied in population from 364 to 8,487 and were on average 182.5 miles from the closest urban area that had a full range of medical services including a certified diabetic educator (15). The number of primary health care providers at each rural site ranged from one to eight. Rural clinic sites were well established in their community, and providers had remained consistent at these sites for several years. In three sites all providers were represented. In the fourth site 8 of 17 community providers were represented. Approximately 6 of these 17 providers included specialties other than family practice or internal medicine, such as woman's health and pediatrics, that were not appropriate for study inclusion. There were no facilities that had computerized records. One facility had a diabetic registry, but it was not in use by all providers. Providers consisted of internal medicine and family practice physicians and physician assistants. No nurse practitioners were currently employed at the rural clinic sites.

Sample selection. A retrospective chart review was conducted on all patients ≥45 years of age diagnosed with diabetes who were seen by providers between 1 January 1999 and 1 August 2000. Medical records from patients with ICD-9 codes between 250.0 and 250.9 were pulled for possible chart review. Charts were reviewed if the rural patient had a definitive diagnosis of diabetes and the rural medical provider was the primary source of diabetes care for the patient. Patient records were excluded if there was steroid, drug, or illness-induced diabetes.

Data collection. A data collection form was developed for the chart reviews based on standards of care established by the 1999/2000 ADA guidelines (Tables 1 and 2 (8a,8b). The entire medical record was examined for evidence of documentation of testing and treatment. Variables from medical records included patient demographics, chronic conditions, measures of glycemic control (HbA_{1c} or GHb), microalbumin-to-creatinine ratio, systolic blood pressure (SBP), diastolic blood pressure (DBP), and lipid levels and documentation of or referral for monofilament examinations, immunizations (influenza and pneumococcal), dilated eye examinations, diabetes education, smoking habits, and alcohol use. Diagnosis of and treatment for comorbid conditions of hypertension and dyslipidemia were recorded. Ethnic background, educational level, and socioeconomic status were not consistently recorded in the medical records and consequently not reported in the study results. County census information reports that 97–99% of the residents are Caucasian, 1–4% are Native American, and 1% are black. Mean county incomes ranged from $22,923 to $33,260. It is expected that subject characteristics are consistent with these estimates. There was no patient contact or testing performed as part of this study. Laboratory testing was performed at the laboratory routinely used by the rural health care provider. All information collected was found in medical records at the four rural facilities. Information had been recorded in the records according to the facility's usual practices. Institutional review board approval was obtained for all study protocols before data collection. The study's medical and research directors trained all data collectors. Data collectors were registered nurses with several

Table 2—*Compliance with preventative services*

Preventative services/ recommended frequency of testing	*n*	Treated to standard (%)
Monofilament test Yearly	33	8.3
Dilated eye examination Yearly	47	12
Influenza vaccine Yearly	107	27
Pneumonia vaccine* Once in lifetime	121	30

*If had before age 65 and if 5 or more years have passed since first dose or at risk of infection, need a second dose.

years of diabetic education experience. Inter-rater reliability was established before data collection began. Decisions about patient eligibility due to the possibility of drug- or illness-induced diabetes was made by the medical director, a board-certified internist.

Statistical analysis. Data were analyzed using SPSS 11.0 statistical software. Data are presented as means ± 1 SD unless otherwise specified. Demographic results were descriptive for age, sex, length of time since diagnosis of diabetes, medication use, and presence of other diagnosis. Frequencies, cross-tabs, and measures of central tendency were used to compare medical record information with ADA standards. Student's *t* tests were used to examine differences between sex for treatment and comorbid conditions. There was no statistical difference in performance rates or mean values between sites. GHb values were measured in place of HbA_{1c} for 70 patients. The laboratory that performed the GHb tests ran control samples for both GHb and HbA_{1c}. We used these values to establish a regression analysis to allow conversion of GHb values to HbA_{1c} values. For this study, the conversion formula used was HbA_{1c} = GHb (0.671) + 1.182. HbA_{1c} data includes the converted GHb values.

RESULTS

Sample characteristics. Medical records of 399 diabetic patients met the inclusion criteria and were included in the final analysis. Subjects ranged in age from 45 to 96 years. The mean age was 69 ± 11.5 years, with 64% of the sample being 65 years of age or older. Diabetes had been diagnosed for 3 or more years for 74% (n = 259) of patients. A diagnosis of hypertension was recorded for 59% (n = 236) patients, and 77% (n = 182) of these patients were on antihypertensive medication. Dyslipidemia was recorded in 31% (n = 125) of the subjects with 26% (n = 104) taking a lipid-lowering medication. A total of 85 patients had a diagnosis of both dyslipidemia and hypertension. The majority of the sample was female (59%), took five or more different prescription medications per day (58%), and had three or more diagnosed chronic conditions (63%). The majority of subjects had a current weight recorded, but <30% had heights available. Consequently, BMI could not be calculated.

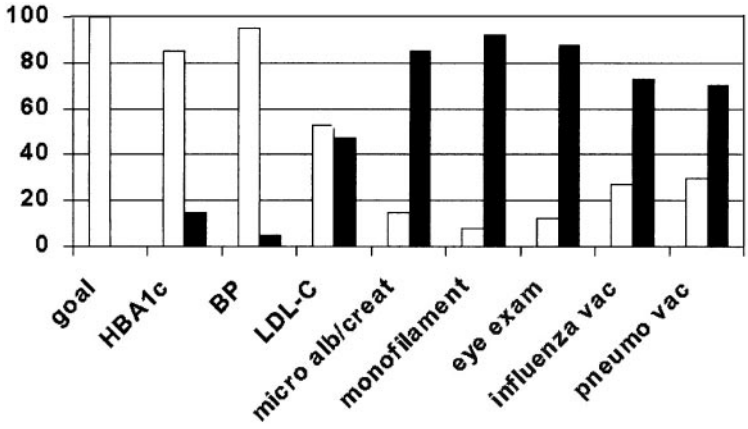

Figure 1—*Percentage of subjects with missing or recorded test results.* □*, percent tested;* ■*, percent not tested. BP, blood pressure; micro alb/creat, microalbuminuria-to-creatine ratio; vac, vaccination.*

Compliance with preventive care services. Documentation of ADA-recommended testing was variable (Fig. 1). HbA_{1c} was measured in 85% (n = 340) of the patients. Testing was completed within the past year for 81% (n = 322) of the patients and within the last 6 months for 60% (n = 241) of the patients. A total of 58 patients had not had a HbA_{1c} value recorded for the past 18 months, and one patient had an HbA_{1c} ordered, but no value was recorded in the medical record. Of 399 patients, there were 21 patients without a recorded blood pressure, and 61% had lipid panels results. LDL values were reported for 228 patients (57%). An additional 16 patients had lipid panels recorded, but their triglyceride levels were too high to calculate an LDL value. Microalbumin-to-creatinine ratio was reported for 15% (n = 61) of the patients.

Few dilated eye examinations, monofilamant tests, influenza and pneumococcal vaccinations, or smoking and alcohol patterns were documented in the chart. Influenza vaccines and pneumococcal vaccines were recorded for 27 (n = 108) and 30% (n = 121) of the patients, respectively. There were eight people (of 399) that had both a documented dilated eye examination and a monofilament test. Two of these eight patients also had a current flu and pneumococcal vaccine. None had the recommended diagnostic tests (HbA_{1c}, blood pressure, and LDL cholesterol) plus a documented monofilament test, dilated eye examination, and flu vaccine in the past year (Fig. 2). Any type of information about smoking habits was recorded for 20% and alcohol use for 10% of the sample.

There were few referrals to a nurse educator or dietitian documented in the medical records by the rural health care providers. Five patients (1.3%) were referred to a diabetes educator and 16 (4%) to a dietitian. None of the rural communities included in this study had a certified diabetes or health educator available.

Glycemic control. Mean HbA_{1c} was 7.43 ± 1.7%, and 47% (n = 160) of patients with HbA_{1c} values met the ADA-recommended goal of <7%. In addition, 30% (n = 102) needed additional treatment for their diabetes based on HbA_{1c} levels >8%, and 25% of these subjects had not had an HbA_{1c} test in the past 6 months. Therapeutic management included use of insulin by 22% (n = 89),

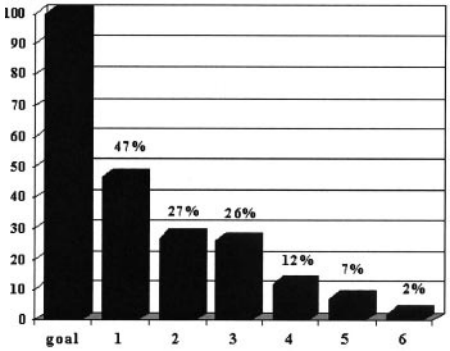

Figure 2—*Percentage of commutative compliance with ADA guidelines based on the total sample* (N = *399). Treatment goal = 100%. 1: HbA_{1c} <7%, 2: blood pressure <130/85, 3: LDL cholesterol <100, 4: HbA_{1c} <7% and blood pressure <130/85, 5: HbA_{1c} <7% and LDL cholesterol <100, and 6: HbA_{1c} <7%, blood pressure <130/85, and LDL cholesterol <100.*

oral hypoglycemic agents by 77% (n = 306), and combined therapy (insulin and oral hypoglycemic agents) by 11.5% (n = 46) of the patients. Twenty-five subjects were controlled by diet alone. No difference in the pattern of medication management was detected between the controlled and uncontrolled groups.

Comorbid disease control. Optimal blood pressure and lipid control had not been achieved in these rural diabetic patients. Mean SBP and DBP were 139 ± 18.8 and 75 ± 11.5 mmHg, respectively. Based on the 1999/2000 ADA blood pressure goal of 130/85, 28.6% (n = 108) of the patients had controlled SBP, 79.3% (n = 300) had controlled DBP, and 27% (n = 103) had both. Of the 226 patients with a diagnosis of hypertension, 51 were treated to the ADA goal of 130/85 and an additional 40 patients were <140/90. Ninety-eight patients with a diagnosis of hypertension, whose systolic blood pressure was >130 or diastolic blood pressure was ≥85, were not taking an antihypertensive medication. Seven percent (n = 11) of the patients without a diagnosis of hypertension had a blood pressure ≥140/90.

The mean total cholesterol level was 206 ± 45 mg/dl, mean LDL was 119 ± 33 mg/dl, and mean HDL was 45 ± 12 g/dl in the 228 patients with lipid profiles. Twenty-six percent (n = 60) had the ADA recommended LDL values of <100 mg/dl. Forty percent (n = 91) had LDL values ≥130 g/dl, which is the suggested level for treatment of all diabetic individuals, regardless of vascular disease history. Of these 91 patients who needed additional treatment, there were 67 patients not on lipid-lowering medications. Twenty-five percent of the patients (n = 125) with a diagnosis of dyslipidemia had LDL levels <100 mg/dl.

Optimal disease management includes adequate glycemic, blood pressure, and lipid control. Eleven patients of the total sample of 399 met the recommended ADA treatment values of HbA_{1c} level <7%, a blood pressure <130/85 mmHg, and an LDL level <100 mg/dl (Fig. 2).

Comparison by sex. Several sex differences were noted in this study. Women were slightly older (70 ± 11 vs. 67 ± 11 years, $P < 0.01$), had lower HbA_{1c} values (7.2 ± 1.6 vs. 7.7 ± 1.8%, $P < 0.02$), and higher HDL levels (49 ± 12 vs. 39 ± 9 mg/dl, $P < 0.001$). No sex difference in LDL level was found. Woman tended to trend toward more diagnoses of hypertension, dyslipidemia, congestive heart failure, other heart problems, and depression. Only hypertension (66 vs. 49%, $P < 0.001$) and depression (13 vs. 7%, $P < 0.045$) were significantly different. Despite a higher percentage of diagnoses of hypertension in woman, no significant sex difference in SBP or DBP was found.

CONCLUSIONS — Study results indicate that rural health care providers are achieving better glycemic control in their patients with diabetes than reported national and state averages (13,14,16,24–26). Previous research found mean HbA_{1c} values between 8.6 and 8.9% and annual HbA_{1c} testing rates ranging from 16.3 to 90% (13–16,26). In this study, the mean HbA_{1c} value was 7.43%, less than the ADA recommendation for additional treatment needed. However, >50% of the patients had HbA_{1c} levels above the 1999/2000 ADA-recommended HbA_{1c} level of 7%. Using the recent American College of Endocrinology target for diabetes control of HbA_{1c} <6.5%, an even higher percentage would need more intensive management (19).

Rural Montana providers were ordering HbA_{1c} levels for their patients with diabetes comparable with those of university-based endocrinologists (26). Eighty-five percent of diabetic patients had a recorded HbA_{1c} in the past 18 months. In contrast, results from the 1993–1995 Montana Medicare claims data show that HbA_{1c} claims were only filed for 35% of diabetic seniors in Montana (20,21). This suggests that rural Montana providers are using HbA_{1c} to monitor glycemic control and have improved compliance with guidelines. Frequency of testing, especially for patients with suboptimal control, needs improvement. Evidence suggests that intensive blood glucose control in type 2 diabetic subjects reduces microvascular complications (4). Thus, the efforts of multiple national health organizations in addition to the ADA to encourage primary health care providers to optimize glycemic control in all diabetic patients may help explain improved testing and glycemic control by these rural providers.

Management of the comorbid conditions for hypertension and dyslipidemia was suboptimal but better than that reported in other studies (26). Rural providers were better at documenting blood pressure than lipid levels. According to ADA recommendations, patients with diabetes should have a blood pressure measurement at the initial and each subsequent follow-up examination. Only 5% (n = 20) of these diabetic patients did not have a blood pressure recorded. However, 10 of these diabetic patients with a diagnosis of hypertension did not have a blood pressure recorded. Research has shown that lowering blood pressure to a mean of 144/82 mmHg in hypertensive diabetic patients significantly reduced complications of macrovascular and microvascular disease and diabetes-related deaths (5,7,8a,8b). Epidemiological data have shown a continuous relationship between these outcomes and SBP >130 mmHg. In addition, 1999/2000 ADA guidelines recommend lowering blood pressure in diabetic patients to <130/85 mmHg. The 2001 ADA recommendations have a more stringent requirement of 130/80 mmHg. Although the majority of patients in the study had blood pressure measured, only 27% of the total sample met criteria for control. In the patients with a diagnosis of hypertension, only 22% were treated to the ADA goal.

Dyslipidemia is prevalent in diabetic patients and increases risk for atherosclerotic vascular disease (5,8a,8b). ADA guidelines recommend a yearly cholesterol profile unless the patient is at low risk. In this study, 39% of the patients did not have documented lipid profiles in the 18-month period studied, a value which is down from 51% reported in 1995 by Stolar (26). There was no indication in the medical records that previous testing placed these patients at low risk, thus eliminating the need for yearly lipid screening. Dyslipidemia increases risk for artherosclerotic vascular disease in diabetic patients, and effective management has been shown to reduce secondary vascular events (8a,8b,13). Management of elevated cholesterol and triglycerides in diabetic patients has become increasingly more stringent. ADA guidelines recommend a LDL level ≤100 mg/dl. In this study, only 60 of 399 patients had documented LDL levels ≤100 mg/dl. Furthermore, only 25% of the 132 patents with a diagnosis of dyslipidemia were at ADA goals. More importantly, 74% (n = 67) of patients whose LDL was ≥130 mg/dl were not on lipid-lowering medication.

Strategies to improve rural provider compliance with documenting screening and management of dyslipidemia and hypertension in diabetic patients are needed.

Few rural patients had referrals recorded for diabetes education or dietary counseling. This is problematic because research has shown that a multidisciplinary approach to comprehensive disease management improves provider and patient compliance (8a,8b). Ninety-eight percent had no diabetes education and 96% no referral to a registered dietitian. This was anticipated due to the rural location of the study sites. Small community hospitals and clinics have limited resources beyond the health care providers, so interdisciplinary teams are not possible. Certified diabetic educators are located only in Montana's urban areas, thus the distance becomes a barrier for patients to receive effective diabetic education.

Rural provider's adherence to ADA guidelines was better than previous research studies have indicated. However, significant improvement is still needed. To achieve better compliance, it is important to understand the barriers faced by the rural providers. Barriers to successful management by the rural providers is not known but could include lack of knowledge of current recommendations, ageism, provider inertia, patient compliance issues including medication cost and side effects, and lack of available educators (24). Further research is needed to determine barriers to successful diabetes management by rural health care providers so that alternative strategies can be implemented and tested.

A limitation of this study is that all data were collected from medical record review of diabetic patients primarily managed by rural providers. Information collected at the office visits, such as laboratory test results, blood pressure, monofilament examination, and presence of comorbid conditions should be complete and reliable. However, the rate of vaccination and dilated exe examinations may be inadequately documented, since these are performed outside of the rural office practice. Information or education that was given by either the provider or patient informally cannot be accounted for in a medical record review. While information that is not documented does not exist by the legal definition, we found that small rural communities often have informal networks in place. In some cases this means everyone at the health care facility knows multiple generations of the family and knows if they had an immunization or eye examination by another provider or facility. This may indicate that rates of dilated eye examinations and vaccinations are much higher than indicated by the study results. This is supported by the 1993–1995 Medicare claims data, which showed higher rates for eye examinations and immunizations (20).

Results of this study indicate that rural health care practitioners are not adequately following the 1999/2000 ADA standards for comprehensive disease management of their patients with diabetes. Glycemic testing is being ordered, but HbA_{1c} values indicate that patients do not have their diabetes under optimal control. The comorbid conditions of hypertension and dyslipidemia are not managed according to the ADA guidelines. Other preventative services including monofilament testing, dilated eye examinations, microalbumin-to-creatinine ratio, and immunizations are not being documented. Findings suggest a need for interventions, such as a decision support system with prompted reminders to improve provider compliance with ADA guidelines. In addition, improved patient access to diabetic educators, either through telemedicine or certification of rural office nurses, could benefit rural patients and practitioners.

Acknowledgments— This study was funded by Administration on Aging Grant no. 90-AM-2304.

The authors thank the Deaconess Billings Clinic Center on Aging, including Connie Koch, Brenda Hellyer, and Karen Granbery

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