Comparison of Metabolic Control Among Diabetic Subjects at Two Clinics

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The study was supported in part by Public Health Service grant No. 1-D32-PE-11106. The opinions expressed in this paper are those of the authors and do not necessarily reflect the views of the Indian Health Service. A portion of this paper was presented at the 20th Annual U.S. Public Health Service Professional Meeting on April 19, 1985, in Atlanta, GA. Dr. O'Connor was awarded the J. D. Lane Junior Investigator Award by Surgeon General Everett C. Koop for this presentation.

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Synopsis

A cross-sectional study was conducted to investigate whether glucose control in 20 non-insulin-dependent diabetic subjects seen at a remote rural clinic was comparable to control achieved in 66 diabetic subjects seen at the regional hospital clinic. Sampling was done to assure that study subjects were representative of all care-seeking, diagnosed diabetics in a well-defined Navajo community. The two groups of patients were comparable in terms of age, sex, and duration of diabetes from time of diagnosis. Compliance with care, hospitalization rates, and complication rates were similar in each group.

Results showed no significant differences in glycemic control between the rural clinic (mean fasting plasma glucose = 177, mean random plasma glucose = 227) and the regional hospital clinic (mean fasting plasma glucose = 187, mean random plasma glucose = 249). The percentages of diabetics under "acceptable" control by American Diabetes Association guidelines was 40 percent at the rural clinic and 29 percent at the hospital clinic ($P > .05$*).*

The authors conclude that adequacy of glycemic control in diabetics is not compromised by providing care at a remote rural clinic.

EXPERTS generally acknowledge that adequate metabolic control of non-insulin-dependent diabetes mellitus (NIDDM) is a goal that can be achieved in the primary care setting (*1*). Several studies have examined metabolic control in diabetic subjects managed in different practice settings (*2–8*). In all these studies, only a minority of diabetic subjects were in good metabolic control. Because of conflicting results and methodologic concerns in these studies, it is difficult to draw specific conclusions about how different ways of organizing primary care service for diabetic subjects may be associated with differences in patient outcomes, such as metabolic control.

This study was done to help care providers decide whether to exclude routine diabetic care to patients attending a remote rural clinic because of the lack of laboratory and support services for the clinicians at that site. A "natural experiment" presented itself, and a cross-sectional study was done to assess (*a*) the comparability of patients attending two clinical sites and (*b*) the health outcomes of the patients, as assessed by metabolic control. The population studied is representative of the diagnosed, care-seeking diabetic population in a geographically defined Navajo community.

Methods

Site and population. This study was conducted in the Tuba City Service Unit of the Navajo Indian Reservation in Arizona. The patient population of 18,700 is served by only two sources of outpatient care, both Indian Health Service clinics. The Tuba City Clinic is attached to the regional hospital, receives approximately 80,000 patient visits annually, and serves approximately 500 patients with NIDDM. Diabetic clinic is held twice weekly and

diabetics are seen by two board certified internists with a special interest in diabetes. Serum glucose and urinalysis and other indicated laboratory tests are completed before the physician sees the patient. Health educators, nutritionists, and clinic nurses assist in the care of these patients. Optometry services and a diabetic foot care clinic run by physical therapists are at hand. Physicians use a diabetic flow chart to keep track of data and help make management decisions. Patients are scheduled to visit the diabetic clinic every 3 months if they are stable. Field health nurses in four-wheel-drive vehicles sometimes follow up noncompliant patients at home.

Dinnebito Clinic is 40 miles east of Tuba City and is open only 1 day a week. It serves the health care needs of local residents for whom geographic access to Tuba City is often difficult because of unpaved roads and severe weather conditions. There are 2,500 patient visits yearly.

The clinic is located in a trailer with two examining rooms, electricity, but no telephone. The diabetic clinic meets every other month and patients, if they are stable, are seen routinely by either a board-certified family physician or a certified physician associate every 2 months. Urinalysis results are available during the clinic visit; blood samples for serum glucose are taken back to the Tuba City Hospital laboratory. Nutritionists attend about once a year. Field health nurse followup is also utilized, and patients are referred to Tuba City for eye and foot care when indicated. Similar flow sheets and clinical algorithms are used by clinicians at both clinics. Furthermore, Dinnebito providers were easily able to discuss patient management issues with Tuba City physicians.

Services and medications at these two clinics are offered to Native American patients without charge. Other sources of care are at least 80 miles distant in Flagstaff or Page, AZ. Inquiries of health care providers at these towns reveal that no diabetic patients who reside in the service area of the Tuba City Service Unit are known to get regular care in Flagstaff or Page. Therefore, the Tuba City and Dinnebito clinics appear to provide care to all known diabetics who live in that geographic area.

Sample selection. All patients in the service unit who had the diagnosis of NIDDM were identified in November 1984. Patients with insulin-dependent diabetes mellitus and patients who failed to meet American Diabetes Association criteria for diagnosis of NIDDM were excluded. Furthermore, a patient was required to have attended two diabetic clinics at either Tuba City or Dinnebito during the previous 2 years to be eligible for inclusion.

Records were reviewed and 439 potentially eligible subjects were identified at Tuba City. From this a random sample of 100 subjects was selected using a table of random numbers. After exclusion of subjects who failed to meet the inclusion criteria, 66 subjects were included as study subjects at Tuba City. None of these subjects had visited the Dinnebito Diabetic Clinic. The selection criteria identified 20 eligible subjects at Dinnebito, and all of them were included in the study. While many of these patients had received emergency, inpatient, or some outpatient services at the Tuba City facility in the past, none had been seen at the Tuba City Diabetic Clinic in the 2-year study period.

Data collection. The medical record of each subject was retrospectively reviewed over a 2-year period. For the Dinnebito patients, it was necessary to review their records at both the field clinic and the Tuba City Hospital to obtain all the required information. Charts were abstracted by one of the investigators (R. F.) for (*a*) demographic data, (*b*) date of diagnosis of NIDDM, (*c*) presence of diabetic complications, (*d*) all fasting and random plasma glucose values in the medical record that were drawn at the time of scheduled diabetic clinic appointments only, (*e*) mode of treatment, (*f*) number and cause of hospitalizations, (*g*) total number of scheduled diabetes clinic appointments and number of appointments kept in the 2-year study period, and (*h*) weight change during the study period.

The complications studied in this project included nephropathy as evidenced by proteinuria greater than or equal to 2+ on at least two occasions, or a serum creatinine level greater than 2.0 milligrams per deciliter (mg per dl); coronary artery disease as evidenced by a history of myocardial infarction, angina, or an abnormal electrocardiogram; amputation; and cerebrovascular accident. Treatment was categorized as diet alone, diet plus oral hypoglycemic agents, or diet plus insulin.

Analysis

To assess metabolic control, mean fasting plasma glucose and mean random plasma glucose values were calculated for each patient based on values obtained at all scheduled diabetes clinic appointments over the 2-year study period. Patients were categorized into groups of acceptable, fair, and poor metabolic control, using the indices prescribed

Table 1. Criteria used for classification of metabolic control in diabetes mellitus, adapted from American Diabetes Association Guidelines

Criteria	Good	Fair	Poor
Fasting plasma glucose (mg per dl)	140	200	>200
Random plasma glucose (mg per dl)	175	235	>235
Glycosylated hemoglobin (percent)	8	10	>10

by the American Diabetes Association (table 1). If patients' mean fasting and random plasma values placed them in different control groups, they were assigned to the better of the two groups. Glycosylated hemoglobin assays were not available at the field clinic and were only rarely ordered at the Tuba City Clinic prior to the time of this study (one test among the 66 Tuba City patients). As a measure of patient compliance, the ratio of kept versus scheduled diabetic clinic appointments was determined for each patient.

To evaluate differences in means of continuous variables, the Student's *t*-test was used. The chi-square statistic, corrected for small sample size by Yates continuity procedure when needed, was used to test for association of dichotomous variables (*9*).

Results

Demographic and clinical characteristics of the diabetic subjects attending the two clinics are shown in table 2. The two groups of patients were similar in terms of age, sex, duration of diabetes from the time of diagnosis, and complication rates.

The mode of treatment, categorized as "diet alone" versus "all others" showed a chi-square value of 6.05 ($P<.05$) with more patients at Dinnebito on oral agents and more patients at Tuba City on diet alone. When the three modes of treatment are considered together, however, the Fisher's exact test yields $P=.10$. Compliance with appointments was very similar in the two groups, and no differences in mean weight or mean weight change during the 2-year period were noted.

The measures of metabolic control as measured by mean fasting plasma glucose or mean random plasma glucose were not significantly different for patients at the two clinics ($P > .05$). Patients at the Dinnebito clinic had a mean fasting plasma glucose of 177 mg per dl and a mean random plasma glucose of 227 mg per dl (95 percent confidence interval 183–271 mg per dl). Patients at the Tuba City clinic had a mean fasting plasma glucose of 187 mg per dl and a mean random plasma glucose of 249 mg per dl (95 percent confidence interval 229–269 mg per dl). The percentage of diabetic subjects under "acceptable" control by American Diabetes Association guidelines was 40 percent at Dinnebito clinic and 29 percent at Tuba City clinic ($P>.05$). The power of the study to detect a 50 mg per dl difference in mean plasma glucose values is about 0.8 in a study with this number of subjects (*10*).

That the Dinnebito group had significantly more total outpatient visits than did the Tuba City group ($P=.04$) may reflect the policy at Tuba City of seeing "stable" patients every 3 months; at Dinnebito patients are routinely seen every 2 months. There were no differences in hospitalization rates. When admissions for elective surgery were excluded from both groups, the hospitalization rate was 0.21 admissions per patient per year for Tuba City patients and 0.22 admissions per patient per year for Dinnebito patients during the study period.

Discussion

These data demonstrate no significant difference in metabolic control between one group of NIDDM patients receiving relatively sophisticated care from board-certified internists in a modern facility with various support services available (Tuba City), and another group of patients receiving basic care from board-certified family physician and physician associates in a field clinic setting (Dinnebito). The interpretation of this finding is limited somewhat by the small sample sizes in this study, but the difference of 22 mg per dl in mean random plasma glucose (in favor of the field clinic) is not clinically significant.

The groups of patients were comparable in age and duration of disease. It is possible that patients with more severe disease were more likely to receive care at the Tuba City Clinic, but in that case such patients should have been hospitalized more often. We found no significant differences in hospitalizations or emergency room visits. In addition, a greater proportion of Tuba City patients were treated with diet alone, and the Dinnebito patients had more total ambulatory visits—both of these observations weaken the assumption that a more severely diseased patient population was followed at Tuba City.

The complication rates observed in these patients indicate a rather high prevalence of clinically significant proteinuria and cardiovascular complications. No differences were noted between the two clinical

sites; however, the power of this test is limited by small sample size.

How do the metabolic outcomes of these patients compare with results in other studies of how diabetic subjects fare in different practice settings (*2–8*)? Unfortunately, none of these studies used a randomly selected sample of diagnosed, care-seeking diabetics from a geographically defined community. In all studies reviewed, the subjects represented a highly selected subset of the diagnosed, care-seeking diabetic patients in the community. Thus, selection bias may have skewed results.

Standard practice at both clinic sites in this study included use of flow sheets for clinical and laboratory data, delivery of care in organized "diabetes clinics," continuity of care by providers, and field health nurse followup of noncompliant patients. Factors which were not available at both clinics, and which do not appear to be closely associated with patient outcomes, include care by specialist physicians, availability of plasma glucose results at the time of the patient visit, and every 2 months versus every 3 months scheduled diabetic clinic visits.

Hospitalization rates were similar for the two groups of patients, and they do not appear to be related to glycemic control. There were no significant differences in baseline weight or in weight change in the two groups of patients, but a coincidental observation of significantly greater weight gain in patients treated with insulin compared to those treated with oral agents may merit further investigation.

The generalizability of these findings is quite limited. Unique cultural factors affect care of these diabetics. In general, Navajo residents in older age groups adhere to traditional cultural systems, and many speak Navajo exclusively. Thus, translators are needed for a majority of diabetics and some pathophysiologic and treatment concepts are difficult to reconcile with traditional health and illness beliefs.

Many Navajo herd sheep, but a wage economy is increasingly dominant on the reservation. Acculturation and economic factors have resulted in dietary changes in recent generations, and the impact of these dietary changes on diabetes incidence and control has yet to be completely elucidated. In Dinnebito, land has recently been partitioned to another tribe, resulting in the relocation of some Navajos during the study period. This change may have caused psychological stress for certain patients. Coincident with the acculturation process, the prevalence of diabetes among Navajo adults has risen sharply. Joslin, in a 1940 survey, found less than 1 percent of adult Navajos to have diabetes (*11*). Current prevalence estimates are that 10.5 percent of Navajo adults ages 20–74 years have diabetes (*12*).

Table 2. Comparison of clinical and demographic characteristics of diabetic subjects attending different clinical sites for diabetes care

Characteristic	Tuba City Clinic (N = 66)	Dinnebito Clinic (N = 20)
Female (percent)	55	65
Mean age (years)	59.9	57.2
Mean duration of diabetes (years)	7.4	7.4
History of myocardial infarction (percent)	4	0
History of angina	6	5
Abnormal electrocardiogram (percent)	27	20
History of stroke (percent)	4	0
History of amputation (percent)	0	5
Proteinuria (percent)	24	30
Serum creatinine greater than 2 mg per dl (percent)	8	10
Any of above 7 complications (percent)	45	45
Treated with diet alone (percent)	24	[1] 5
Treated with oral agent (percent)	50	60
Treated with insulin (percent)	26	35
Mean weight change (pounds)	−1.4	+0.9
Poor control of diabetes	36	30
Fair control of diabetes	35	30
Good control of diabetes	29	40
Mean fasting plasma glucose	187	177
Mean random plasma glucose	249	227
Compliance with diabetes clinic scheduled appointments	0.74	0.76
Mean number of diabetes clinic appointments kept (in 2 years)	6.7	[1] 8.6
Mean outpatient clinic visits made (in 2 years)	4.1	[1] 7.0
Mean emergency room visits made (in 2 years)	0.45	0.50
Mean hospitalization rate (hospital-patient-year)	0.23	0.25

[1] Differences statistically significant at $P < 0.05$ using either ANOVA or Fisher's exact test.

In conclusion, this study reports equivalent metabolic control of NIDDM diabetic subjects treated at two clinics. Availability of sophisticated support services, specialty of physician, or frequency of diabetic clinic visits did not appear to be associated with differences in metabolic control. Delivery of care in organized diabetes clinics by providers interested in diabetes, continuity of care, use of data flow sheets, and field health nurse followup of noncompliant patients were associated with outcomes similar to those reported elsewhere in the literature.

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Morbidity Following Mexico City's 1985 Earthquakes: Clinical and Epidemiologic Findings from Hospitals and Emergency Units

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Synopsis

Medical records of 822 inpatients and outpatients cared for by the Department of the Federal District medical services during the 1985 Mexico City earthquakes were reviewed. Record incompleteness varied between 92.8 percent and 14.0 percent for the various study variables. No gender differences were detected among the groups; more than 70.0 percent of the patients were ages 15 to 64 years. Multiple traumatic injuries were frequent for inpatients across age groups, while simple contusions were more frequent among outpatients. Multiple head traumas, thorax-abdomen multiple traumas, and simple fractures of an arm or leg were more frequently recorded for inpatients than for outpatients. Head wounds with contusions; simple contusion of the thorax-abdomen, arms, and legs; and psychological trauma were more frequently recorded for outpatients.

Although a great many records were incomplete, the data may reflect what actually happened to these patients, given the similarity of the findings with other reports of disasters. Improved record keeping during emergencies is needed to standardize the quantity and the reliability of the data so that statistical and medical care requirements are soundly based. The use of standard questionnaires for data collection is stressed to facilitate the management of clinical and epidemiologic activities. Longitudinal studies are needed to determine patterns of physical injuries, psychological trauma, and survival.

THE COMBINED EFFECTS of the September 19 and 20, 1985, Mexico City earthquakes have been considered by some as the worst national disaster of the century, not only because of the number of recorded deaths (*1,2*) but also because of the economic impact and of the loss of infrastructure of the health care system (*3*). The first quake registered as an 8.1 tremor on the Richter scale and the second, which followed nearly 36 hours later, as a 6.5 tremor.

Natural and manmade disasters are of importance in public health not only from the knowledge