

# MEASURING THE QUALITY OF DIABETES CARE IN URBAN AND RURAL INDIAN HEALTH PROGRAMS

**Objective:** The purpose of this study was to compare the quality of diabetes care provided to American Indians/Alaska Natives (AI/AN) by urban and rural Indian health programs.

**Design:** Medical record review data collected by the Indian Health Service as part of the *Diabetes Care and Outcomes Audit* in 2002.

**Setting:** Seventeen urban Indian health clinics and 225 rural Indian health programs.

**Patients:** All urban AI/AN patients ( $n = 710$ ) and random sample records of rural AI/AN patients ( $n=1420$ ).

**Main Outcomes Measures:** Adherence to guidelines for process measures and intermediate outcomes of diabetes care.

**Results:** Compared to the rural sample, urban patients were more likely to have received diabetes education during the prior year ( $P \leq .05$ ). Annual dental examinations were less common among urban patients than rural patients (19% vs 41%,  $P \leq .001$ ). Completion of laboratory testing and immunizations were similar in both groups. Adjusted mean levels for intermediate outcomes of diabetes care and the percentage achieving recommended levels varied slightly but were not statistically or clinically significant.

**Conclusions:** Few differences in the quality of diabetes care were found between urban and rural Indian health sites. Differences in the receipt of dental examinations may reflect differences in resources and staffing between urban and rural settings. This study serves as a baseline for the assessment of ongoing interventions aimed at improving the quality of care. (*Ethn Dis.* 2006;16:772-777)

**Key Words:** North American Indians, Rural, Quality of Care, Type 2 Diabetes Mellitus, Urban

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## INTRODUCTION

Diabetes mellitus, a leading cause of coronary heart disease, peripheral vascular disease, and death in the United States,<sup>1</sup> is epidemic among American Indians and Alaska Natives (AI/AN), and rates have increased dramatically over the past few decades.<sup>1-3</sup> The Indian health system provides care to >100,000 AI/AN people with diabetes through a network of Indian health facilities in both rural and urban locations. More than 50% of AI/AN live in urban areas,<sup>4</sup> as a result of policies from the 1950s and 1960s designed to assimilate Indian people into the mainstream of American society. In 1976, Congress passed the Indian Health Care Improvement Act (IHCA), PL. 94-437, Title V of which targeted specific funding to develop programs for AI/AN who live in urban areas. However, the 34 urban Indian health programs in the Indian health system receive <2% of the Indian Health Service (IHS) budget and have variable and limited services.<sup>4</sup> While no national studies exist on the quality of diabetes care for urban American Indians, the lack of resources and services may result in a lower quality of diabetes care. Moreover, death rates from diabetes-related causes are higher for urban American Indians compared to urban Whites.<sup>5</sup> More studies are needed to determine if differences exist in the

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quality of diabetes care in these underfunded urban Indian programs compared to other Indian health programs in rural areas.

The IHS developed the *Diabetes Care and Outcomes Audit* (hereafter referred to as the audit) to measure and improve the quality of care provided to AI/AN with diabetes. The audit is an annual, random sample of diabetes patient records from >200 Indian health facilities and includes information about indicators of the quality of diabetes care, including glycemic and blood pressure control, screening for complications, and preventive health services. Initially, information was collected for the audit exclusively from rural facilities located on or near reservations. Since the late 1990s, urban Indian health programs have also been included in the audit.

The objective of this study is to compare the quality of diabetes care provided to American Indians in urban Indian health programs with the primarily rural tribal and federally administered Indian health programs. We used national data from the 2002 audit to assess rural and urban differences in

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adherence to IHS quality-of-care guidelines and intermediate outcomes for diabetes care.

## METHODS

### Study Design and Setting

We conducted a cross-sectional study comparing the quality of diabetes care in urban and rural Indian health facilities. The IHS is a federal program established in 1955 to provide care to AI/AN. Care is provided through a network of Indian healthcare facilities that includes hospitals, ambulatory clinics, health stations, school-based clinics, and Alaska village clinics in 12 administrative IHS areas or geographic regions. More than 50% of the Indian health system is operated directly by tribal governments through contracts or compacts rather than by the IHS. Since 1976, IHS has contracted with 34 urban Indian organizations to provide services to AI/AN people who reside in 34 urban metropolitan areas in counties with populations >250,000 in the 1990 census. However, the services offered at these urban facilities vary widely, ranging from referral services to full out-patient ambulatory clinics.<sup>4</sup>

### SAMPLE

The *Diabetes Care and Outcomes Audit* is conducted by the IHS on a yearly basis in >200 Indian health facilities that provide clinical services. At each participating facility, a systematic random sample of medical records is selected from all patients with diabetes seen during the previous 12 months. The facility's diabetes coordinator abstracts information from the selected records by using a standardized form that includes >70 demographic and quality-of-care indicators.<sup>6</sup>

In 2002, a total of 20,102 individuals from 242 facilities in all 12 IHS service areas contributed data to the

audit. Seventeen of the 34 urban Indian health facilities participated in the 2002 audit, and 841 patient records were reviewed. The participating urban programs represent 17 of the 25 urban Indian programs that have clinical/medical services.<sup>4</sup> For this study, we included only those records with no missing data for our selected covariates (age, duration of diabetes, receipt of diabetes education within the past 12 months, body mass index [BMI], and tobacco use). The total number of patient records with complete covariate data was 16,559 (82%). From these complete cases, we selected all records from the urban facilities and a random sample from the rural facilities. The final sample included 710 urban and 1420 rural patient records.

### Measures

We used the following audit measures: patient characteristics; completion of recommended annual examinations, laboratory tests, and immunizations found in the IHS Standards of Care<sup>7</sup>; and selected intermediate outcomes of diabetes care. The patient characteristics we examined were age, sex, BMI, tobacco status, and duration of diabetes. Height and weight used to compute BMI were the most recent measurements during the 12 months preceding the audit date. A dichotomous variable for tobacco use was created to indicate if the AI/AN was currently smoking or using other tobacco products. Duration of diabetes was calculated in years by using the date of the audit and the diabetes diagnosis date recorded in the chart. Facility-level variables included urban Indian health program vs rural Indian health program (IHS or tribally managed) and the number of patients in the diabetes registry.

Receipt of recommended annual examinations, laboratory tests, and immunizations during the 12 months preceding the audit date were each dichotomized into an indicator of completion (yes/no). Individuals who

refused the examination or test were coded as no completion. The recommended annual examinations consisted of foot, eye, and dental exams. Values were recorded for the recommended laboratory tests of creatinine, glycosylated hemoglobin, and total cholesterol. If the value of a test was missing from the patient's record, the individual was coded as having not completed the test. Only test completion was recorded for urinalysis. Recommended immunizations were recorded as the patient's having ever received annual influenza or pneumococcal vaccination. We also examined whether each patient had received general diabetes education at least once during the 12 months preceding the audit date.

We calculated an aggregate score for each individual to summarize his or her adherence to the recommended clinical and laboratory examinations and immunizations during the year. The aggregate score was computed as the sum of diabetes care indicators completed out of the nine indicators reviewed above, according to a previously described method.<sup>8</sup> If an individual had a missing value for one or more indicators, the aggregate score was also coded as missing. Based on the median score (6), a dichotomous variable was created to indicate if most indicators had been completed in each individual (yes/no).

Intermediate outcomes of diabetes care included glycosylated hemoglobin, blood pressure, and total cholesterol values. Values for both glycosylated hemoglobin and total cholesterol were defined as the most recent recorded measurements during the 12 months preceding the audit date. Total cholesterol values were examined since missing values for low-density lipoprotein cholesterol were substantial. Blood pressure values were calculated as the mean of the three most recent recorded measurements during the 12 months preceding the audit date. Dichotomous variables were also created to indicate if patients

met the recommended levels for intermediate outcomes set by the IHS Standards of Care and the American Diabetes Association Clinical Practice Recommendations: glycosylated hemoglobin <7.0%, blood pressure <130 mm Hg systolic/<80 mm Hg diastolic, and total cholesterol <200 mg/dL.<sup>9-11</sup>

**Analytic Plan**

Descriptive statistics for continuous variables were calculated as mean values plus or minus standard deviation; percentages were computed for dichotomous variables. We used logistic regression to compare the odds of dichotomous outcomes among urban and rural Indian healthcare facilities. Linear regression was used to evaluate mean differences, by facility location, in selected intermediate diabetes care outcomes. Final regression models were adjusted for age, sex, duration of diabetes, receipt of diabetes education, BMI, tobacco status, and number of patients in the diabetes registry at each facility. All regression models used generalized estimating equations (GEE) to account for within-facility correlation.

Unadjusted percentages and adjusted odds ratios with accompanying 95% confidence intervals are presented for dichotomous outcomes. Unadjusted and adjusted means with accompanying 95% confidence intervals are presented for continuous outcomes. All analyses were performed by using Stata 8.1 for Windows, 2003 (StataCorp LP, College Station, Tex).

While records with missing covariates were excluded from all analyses, we included observations in the dataset that had partially complete outcomes (one or more missing outcomes). To assess for a missing data bias related to urban or rural facilities, we compared the proportion missing for covariates and outcome data by using GEE regression. We found no significant differences in the proportion missing for any of the covariates or outcomes ( $P \leq .05$ ).

**Table 1. Patient characteristics in the 2002 IHS Diabetes Care and Outcomes Audit according to urban and rural Indian health program location**

Characteristic	Urban n=710	Rural n=1420
Age, mean years (SD)*	51 (13)	55 (14)
Female, %	58	58
Current tobacco use, %	31	26
Diabetes education in past year, %*	76	62
BMI, mean kg/m <sup>2</sup> (SD)	34 (8)	34 (7)
Duration of diabetes, mean years (SD)*	7 (7)	8 (7)

\*  $P \leq .05$ .  
IHS=Indian Health Service; BMI=body mass index; SD=standard deviation.

**RESULTS**

Table 1 presents the descriptive characteristics of audit patients seen at urban (n=710) and rural (n=1,420) Indian health programs in 2002. The mean age, in years, was 51 ± 13 in the urban sample which was slightly younger than the mean age in the rural sample (55 ± 14) (Table 1). A greater

proportion in the urban sample had a current tobacco use status (31%) compared with the rural sample (26%). Urban patients were more likely than rural patients to have received formal diabetes education in the past 12 months (76% vs 62%). The mean duration of diabetes was slightly less in the urban (7 years [SD ± 7]) compared with the rural (8 years [SD ± 7]) sample. The mean number of patients in the diabetes registry was smaller at urban facilities (199 ± 272) than at rural facilities (508 ± 713), but the difference was not statistically significant at the  $\alpha = .05$  level ( $P = .08$ ) (data not shown).

Table 2 shows the odds ratios comparing urban to rural Indian health programs for the completion of nine recommended diabetes care indicators. Patients seen at rural facilities were significantly more likely to receive a dental examination than those seen at the urban facilities. No significant differences were seen between urban and rural health program location for

**Table 2. Odds ratios and 95% confidence intervals comparing urban to rural Indian health program location for completion of recommended diabetes care indicators for 2002 IHS Diabetes Care and Outcomes Audit**

Diabetes Care Indicators*	Unadjusted %		Adjusted OR†	(95% CI)
	Urban	Rural		
Annual examinations				
Foot examination	70	58	1.4	(.9–2.3)
Eye examination	43	52	.7	(.5–1.0)
Dental examination	19	41	.3	(.2–.5)
Annual laboratory tests				
Urinalysis	84	80	1.1	(.5–2.3)
Creatinine	83	86	.8	(.6–1.2)
Cholesterol (total)	78	77	1.0	(.7–1.4)
Glycosylated hemoglobin	94	90	1.5	(.7–3.3)
Immunizations				
Influenza vaccine (annually)	53	53	1.1	(.7–1.7)
Pneumococcal vaccine (ever)	70	71	1.2	(.7–2.0)
Aggregate score				
Completed ≥6 care indicators‡	62	67	.8	(.5–1.3)

\* Sample size for diabetes care indicators varies because of missing data, range for N= 2051–2130.  
† Adjusted for age, sex, duration of diabetes, diabetes education, body mass index, tobacco use, and number in diabetes registry at facility.  
‡ ≥6 of the 9 diabetes care indicators.  
IHS=Indian Health Service; OR=odds ratio; CI=confidence interval.

**Table 3. Mean levels for intermediate outcomes according to urban and rural Indian health program location in the 2002 IHS Diabetes Care and Outcomes Audit**

Intermediate Outcomes*	Unadjusted				Adjusted†			
	Urban		Rural		Urban		Rural	
	Mean	(95% CI)	Mean	(95% CI)	Mean	(95% CI)	Mean	(95% CI)
Glycosylated hemoglobin, %	8.0	(7.8–8.2)	8.1	(8.0–8.2)	8.0	(7.8–8.2)	8.1	(8.0–8.2)
Systolic blood pressure, mm Hg	129	(126–131)	133	(132–134)	130	(128–132)	132	(131–134)
Diastolic blood pressure, mm Hg‡	78	(77–80)	76	(75–76)	78	(76–79)	76	(75–76)
Total cholesterol, mg/dL	196	(190–201)	193	(190–196)	194	(188–200)	194	(191–197)

\* Sample size for intermediate outcomes varies due to missing data, range for N= 1640–1955.

† Adjusted for age, sex, duration of diabetes, diabetes education, body mass index, tobacco use, and number in diabetes registry at facility.

‡ P≤.05 (adjusted model).

IHS=Indian Health Service; CI=confidence interval.

completion of laboratory tests and immunizations. While a smaller percentage of urban patients completed six or more diabetes care indicators (Table 2), this difference was not statistically significant.

In Table 3, the adjusted mean levels for each of the intermediate diabetes outcomes were similar for the urban and rural samples. Only diastolic blood pressure demonstrated a statistically significant difference in which the mean in the urban sample was slightly higher than in the rural sample. Table 4 shows that attainment of recommended levels for these intermediate outcomes varied slightly between urban and rural samples, but these differences were not statistically significant.

## CONCLUSIONS

This study is the first to compare results on diabetes care indicators and intermediate outcomes for patients in urban and rural Indian health programs. Few differences were seen in the diabetes care indicators between urban and rural health programs; only dental examinations were more common in rural programs. Nor was a difference seen in the intermediate outcomes in urban and rural programs, except for a small difference in diastolic blood pressure that was not clinically meaningful. Nonetheless, rates of adherence to nationally recom-

mended diabetes care guidelines for AI/AN health programs are comparable to or surpass rates described for the general population.<sup>12,13</sup>

The completion of eye examinations was lower in urban Indian health programs compared to rural programs. These results are lower than previous audit data that focus on primarily a rural population that showed rates of 55%–56% in 1995–1997, compared to 52% in the rural sample in this study.<sup>12</sup> However, the completion of dental examinations in both urban and rural samples was low but consistent with previous studies. In another recent study, completion of dental examinations was only 32%,<sup>8</sup> similar to the results for the rural sample in this study. The completion of dental examinations was much lower in urban Indian health programs in this study (19%). In rural Indian health programs, optometry and dental services are often provided on-site. Urban Indian

health programs may not have optometrists or dentists on-site and may need to refer patients elsewhere. Unfortunately, urban Indian patients may not be able to afford these referrals, and if they do see another non-Indian health system provider, the record of their visit may not be sent back to the urban Indian health program.

The proportion of patients who received diabetes education was greater in urban vs rural Indian health programs in this study. In an analysis of audit data in 1997, completion of diabetes education was 69%, and patients who received diabetes education were three times more likely to have completed most diabetes care indicators in that same year.<sup>8</sup> Given this association of diabetes education with completion of diabetes care indicators and the difference in rates between urban and rural Indian health programs in this study, receipt of diabetes education was included as one of the adjustment factors in multivariate analyses in this study.

This study found no significant differences between urban and rural programs in completion of laboratory tests, recommended immunizations, and a variety of intermediate outcome measures. Since completion of laboratory tests and immunizations and treatment of blood pressure, blood glucose, and cholesterol do not require additional subspecialists or special equipment,

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**Table 4. Odds ratios and 95% confidence intervals comparing urban to rural Indian health program location for recommended levels of intermediate outcomes in the 2002 IHS Diabetes Care and Outcomes Audit**

Intermediate Outcomes*	Unadjusted %		Adjusted OR†	(95% CI)
	Urban	Rural		
Glycosylated hemoglobin <7.0%	36	34	1.1	(.8-1.5)
Blood pressure <130/<80 mm Hg	40	37	.9	(.7-1.3)
Total cholesterol <200 mg/dL	58	63	.9	(.7-1.2)

\* Sample size for intermediate outcomes varies due to missing data, range for N= 1640-1955.

† Adjusted for age, sex, duration of diabetes, diabetes education, body mass index, tobacco use, and number in diabetes registry at facility.

IHS=Indian Health Service; OR=odds ratio; CI=confidence interval.

results would likely be the same in urban and rural programs. The differences found in annual eye and dental examinations are likely more reflective of the differences in resources and staffing between urban and rural programs.

Several limitations should be noted. Information was not available on the type of diabetes program or healthcare facility. Some rural Indian health programs are hospital-based clinics, while others are free-standing clinics, with differences in resources and services. Urban Indian programs are all free-standing clinics, with widely variable levels of services, staff and resources. In addition, a few rural sites are designated as model diabetes programs, which receive specially designated funding and may have better diabetes care on average compared to other programs. No urban Indian health programs have received this special designation or accompanying funding. While the type of program was not available for this analysis, we used the number of patients in each program's diabetes registry as an adjustment factor in the analysis to account for program size.

Another limitation is that not all Indian health programs participate in the audit, and since programs with poorer quality of care may choose not to participate, these results may be an overestimate of the quality of care in the entire Indian health system. Data were not available on programs that did not

participate, so differences in participation rates between urban and rural programs could not be determined. Only 50% of the urban Indian health programs participated in the 2002 audit, so these findings cannot be generalized to those urban programs that did not participate. While the audit includes specific instructions about data collection, the quality of data extraction may be variable from site to site. However, how data quality might vary between urban and rural Indian health programs is not known. For example, in 2002, 30% of participating sites conducted an electronic audit through the clinical information system of the IHS called the Resource and Patient Management System. Yet, in 2002, only two participating electronic audit sites were urban Indian health programs. Finally, the audit does not collect information about other patient factors that might affect outcomes of diabetes care, including income, employment, mobility, educational attainment, activity level, frequency of visits, and diet.

Only one other study has been published on the quality of diabetes care in urban Indians. This study, conducted in a single urban Indian primary care setting in 1995, showed lower rates of adherence to diabetes care guidelines at that time.<sup>14</sup> The higher completion rates among urban Indian health programs found in our more recent study are likely due to the increase in resources for diabetes care

over the past six years as a result of the new Special Diabetes Program for Indians (SDPI) funding, a special appropriation for diabetes in AI/AN.

The SDPI was established by Congress in 1997 to reduce morbidity and mortality from diabetes in AI/AN communities. Since then, 318 new diabetes treatment and prevention programs and services have been established in IHS, tribal, and urban Indian sites. Of these, 34 are urban Indian programs. The SDPI supports a broad range of activities recommended by the US Preventive Task Force and the American Diabetes Association, including tracking patients through diabetes registries, creating diabetes clinical teams, instituting diabetes education services, and implementing best practices for a variety of diabetes prevention and treatment activities.<sup>9,15</sup> While this funding has already improved care for AI/AN with diabetes, urban Indian health programs remain significantly underfunded. More studies are needed to further examine potential differences in the quality of diabetes care between urban and rural Indian health programs.

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