Ethnic Disparities in Glycemic Control Among Rural Older Adults with Type 2 Diabetes

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Glycemic control is a predictor of diabetes-related morbidity and mortality. However, little is known about how well older adults in rural communities, with limited access to self-care resources and specialty care practitioners, control their diabetes. Even less is known about whether minority, older, rural adults are at increased risk for poor glycemic control. We analyzed data from a cross-sectional survey of randomly selected older (≥65 years) adults with type 2 diabetes in rural North Carolina. Participants (N=693) were men and women from three ethnic groups: African American, Native American, and White. Capillary blood samples were collected for HbA1C analysis. HbA1C levels (<7%, 7%–<8%, and ≥8%) were compared across ethnic and gender groups. Two multiple logistic regression models (model 1: personal characteristics; model 2: personal and health characteristics) were used to evaluate potential predictors of HbA1C ≥7%. Overall, 36.4% had HbA1C ≥7%. Native Americans and African-American men had the highest proportion at levels of poor glycemic control (≥7%), and African-American women and White men had the lowest. In bivariate analysis, ethnicity, living arrangements, use of medications for diabetes, having a diabetes-related healthcare visit in the past year, and duration of diabetes were significantly associated with glycemic control. In multivariate analysis (model 1), being Native American, having low income without Medicaid, and being married were associated with poor glycemic control. Adding health characteristics (model 2), longer diabetes duration and diabetes medication therapy were significant predictors. These data indicate that older ethnic minorities in rural communities are at increased risk for diabetes complications and need diabetes management strategies to improve glycemic control. (*Ethn Dis.* 2005;15:656–663)

Key Words: African Americans, Elderly, Diabetes, Ethnicity, Glycosylated Hemoglobin, Health Disparities, Native Americans, Rural

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Introduction

The prevalence of diabetes has increased dramatically in the last two decades[1] and now affects as many as 18 million Americans.[2] Diabetes is the sixth leading cause of death in the United States and greatly increases the risk of complications such as cardiovascular disease, nephropathy, blindness, and lower extremity amputation.[2] Diabetes is particularly burdensome to older adults and ethnic minorities, including African Americans, Native Americans, and Hispanics.[2]

Recent evidence suggests that glycemic control greatly reduces the effects of diabetes.[3,4] However, evidence also suggests that ethnic minorities in general have poorer glycemic control, even among older adults, which may explain ethnic disparities in diabetes complications.[5–9] To date, few data exist on ethnic differences in glycemic control among older adults living in rural communities. Rural populations, particularly those who are members of ethnic minority groups, have difficulty accessing quality primary and specialty health care and have less access to diabetes self-management resources.[10–12] Mainous and colleagues,[13] in an analysis of data from National Health and Nutrition Examination Survey (NHANES) III, showed that rural residence was a significant predictor in the relationship between ethnicity and glycemic control, with African Americans in rural communities having poorer glycemic control than urban African Americans or rural or urban Whites. This analysis did not consider this relationship among older adults and was limited to African Americans and Whites.

To date, few data exist on ethnic differences in glycemic control among older adults living in rural communities.

The present study examines ethnic variation in glycemic control in a population-based sample of older adults with diabetes. The goals are to describe the level of glycemic control by ethnicity and gender and to consider whether health and healthcare characteristics account for ethnic differences in glycemic control. This analysis adds to the very limited comparative data on glycemic control for Native Americans.[14]

Methods

Design

The ELDER (Evaluating Long-term Diabetes Self-management Among Elder Rural Adults) Study was a population-based, cross-sectional survey that comprehensively assessed the self-care strategies of rural adults aged ≥65 years with diagnosed diabetes.[12,15,16] Participants were selected from two largely rural counties in central North Caro-

lina. In the 2000 US Census, 29% of the combined population ≥65 years for the two counties was either African American or Native American. Approximately 28% of persons over the age of 65 in these counties were below the poverty level. Economies have traditionally been based on subsistence and commercial agriculture, with rural manufacturing (eg, textiles, clothing, food processing) providing off-farm employment. Native Americans in the study counties do not have access to Indian Health Service facilities. The study was approved by the institutional review board of Wake Forest University School of Medicine.

Participant Recruitment and Selection

The ELDER Study recruited a random sample of community-dwelling older adults with diabetes, including African-American, Native-American, and White men and women. The sampling frame was Medicare claims records. Inclusion criteria were residence in the two study counties and at least two outpatient claims for diabetes (ICD-9 250) in 1998–2000. Random samples of men and women were selected. An interviewer contacted each participant to confirm diabetes status and ethnicity and assess eligibility (resident of study counties, age ≥65, English speaking, physically and mentally able to participate in survey), and willingness to participate in the study.

Of the 1,222 persons contacted, 313 were disqualified when initially contacted for recruitment because they reported that they did not have diabetes (n=118), lived out of study counties (n=51), lived in a nursing home (n=84), were <65 years of age (n=2), did not speak English (n=1), failed Mini-Mental State Exam (n=5), or were deceased (n=52). We were unable to assess the eligibility of an additional 122 persons because a surrogate refused their participation in the study (n=48) or reported they were physically (n=8) or mentally (n=14) unable to respond to eligibility questions; the remainder could not be located (n=52). For those who met the eligibility criteria at initial recruitment, 86 were not interviewed because they refused participation (n=74) or study staff determined that the participant was physically (n=6) or mentally (n=6) unable to participate at the time the interview was attempted. The final sample included 701 individuals. The overall response rate for eligible participants was 89% (701/787). Three participants were excluded from this analysis because they did not fit the three ethnic categories. The sample sizes for analyses varied because of missing data among interview items.

Data Collection

Participant in-home interviews were conducted from May through October 2002. Interviews were completed in ≈1.5 hours and collected information on personal and health characteristics, diabetes self-care behaviors, as well as formal and informal support.

Glycemic control was assessed by measurement of HbA1C from fingerstick blood samples collected in a capillary tube, stored in the AccuBase A_{1c} kit (Diabetes Technologies, Inc., Thomasville, Ga) and shipped to Premiere Laboratories, Inc. (Kansas City, Mo) for HbA1C assessment with high-performance liquid chromatography (HPLC) analysis. A second tube was collected for blinded quality control on a random sample of 10% of participants. The intraclass coefficient between blind replicates (n=68 pairs) was 0.996 (95% CI 0.994–0.998). The AccuBase kit blood collection system produces results that agree with venous HbA1C values (R^2=98.7%),[17] is superior to methods that use dried blood samples on filter paper,[18] and is stable when stored and shipped at a variety of temperatures.[19,20]

Measures

For descriptive purposes, HbA1C values were considered to be continuous, and were categorized into three groups (<7%, 7%–<8%, and ≥8%). These values are consistent with recommendations for diabetes management in place when the data were collected, with <7% representing the goal of glycemic control and ≥8% representing a take-action range.[21]

Personal characteristics included ethnicity (African American, Native American, White), gender, formal education (less than high school, high school or equivalent, at least some college), and living arrangements (living alone, living with others and married, living with others and unmarried). The categorical variable, poverty status, combined information on Medicaid status and household income from all sources in 2001. The Medicaid group included all participants who reported receiving Medicaid. The "no Medicaid, lower income" group included all others who reported an income <$25,000. The "no Medicaid, higher income" group included all others reporting incomes ≥$25,000.

Four diabetes-related measures were included. Diabetes duration was calculated by using current age minus age of first diagnosis by a healthcare professional. Body mass index (BMI) (kg/m^2) was divided into three categories (<25 was considered underweight or normal, 25–<30 was overweight, ≥30 was obese). Diabetes therapy included the categories "no medication," "oral agent only," and "insulin with or without oral agent." Self-reported visit to a doctor for diabetes care in the past year was a dichotomous response.

Analytic Strategy

Personal and health characteristics were summarized by using counts and percentages, or means and standard deviations; ethnic differences were evaluated for statistical significance by using chi-square tests or t tests for categorical and continuous variables, respectively. The HbA1C values were summarized overall and by gender/ethnic groups by using counts and percentages, or means

and 95% confidence intervals. For use as a continuous variable, HbA1C values were log-transformed; the means and confidence intervals were back-transformed for presentation as geometric means and corresponding confidence intervals.

For regression analyses, HbA1C values were dichotomized as <7 and ≥7%.[22] Bivariate associations between the dichotomized HbA1C outcome and independent variables were evaluated for statistical significance by using chi-square tests or *t* tests for categorical and continuous variables, respectively. Two multiple logistic regression models were used to evaluate potential predictors of HbA1C ≥7%. Model 1 contained personal characteristics only (gender, ethnicity, living arrangements, level of education, and poverty status); model 2 included all of the covariates from model 1 and health characteristics (diabetes duration [log scale], diabetes medication group, BMI group, and doctor visit for diabetes care).

For each model, significance tests were performed for gender x ethnicity interactions, controlling for all independent variables in the model. If a gender x ethnicity term was significant ($P \leq .05$), then significance tests were performed among the three ethnic groups for all pairwise comparisons of odds ratios for HbA1C ≥7% in females versus males. If a gender x ethnicity term was nonsignificant, then the interaction term was dropped from the model, and significance tests were performed for main effects of gender and ethnicity. If an ethnicity term was significant, then significance tests were performed for all pairwise comparisons among the three ethnic groups. Pairwise comparison results for the effects of all potential predictors having >2 groups were evaluated by using Bonferroni method. All analyses were performed by using SAS Statistical Software version 8.02 (SAS Institute Inc, Cary, NC).

RESULTS

Demographic and health characteristics of the sample are summarized in Table 1. The sample was 31.5% African American, 26.0% Native American, and 42.6% White. Approximately equal numbers of men and women were seen overall and in each ethnic group. The average age (± SD) was 74.1 (± 5.4) years and did not differ across ethnic groups. Most of the sample had not completed high school. Ethnic differences in education were significant, with Whites having achieved higher levels of education. More than two thirds lived with other persons. African Americans were more likely to live with others despite being unmarried, while Whites were more likely to live with others and be married. Eighty-one percent were either on Medicaid or not on Medicaid but had an annual household income <$25,000; significant ethnic differences were seen in poverty status. Most respondents used medications to control their diabetes: 60.2% used oral medications only, and another 27.6% used insulin with or without oral medications. Whites were over-represented in the groups with no medication or oral agents only, while African Americans were more likely to be on insulin. Respondents reported an average duration of diabetes of 12.4 (± 11.0) years, with no significant ethnic differences. Close to 80% were overweight or obese, with ethnic differences. Heart disease, eye disease (from diabetes), and stroke were the most commonly reported health conditions.

Table 2 presents gender and ethnic comparisons of levels of glycemic control. Overall, 63.6% of the sample had HbA1C <7%. The geometric mean HbA1C was 6.7% (95% CI 6.6–6.8). Native American men had the highest proportions with HbA1C ≥7% (49.4%) and ≥8% (24.7%). Among women, Native Americans similarly had the highest proportions with HbA1C ≥7% (40.7%) and ≥8% (19.8%). Overall, African-American women and White men had the highest proportions with HbA1C <7, and White women and men had the lowest geometric mean HbA1C compared with elders of the same gender in other ethnic groups.

In bivariate analysis (Table 3) HbA1C ≥7% was associated with two demographic characteristics, ethnicity ($P=.019$) and living arrangements ($P=.041$). This level of glycemic control was also associated with the use of medications for diabetes ($P<.0001$) and with having had a diabetes-related healthcare visit in the previous year ($P=.0006$). Diabetes duration was significantly greater among those with HbA1C ≥7.0 (14.9 ± 10.6 years) compared to those with HbA1C <7.0% (11.0 ± 11.0 years) ($P<.0001$).

In multivariate analyses using only demographic variables, poor glycemic control (HbA1C ≥7%) was associated with being Native American compared with both White and African American, having income <$25,000 and not being on Medicaid compared to having income >$25,000, and living with others and being married versus living alone (Table 4). When health characteristics were added to the model, only the contrasts between Native American and African American, between Native American and White, and between the same two poverty status groups remained significant. Additional significant predictors were longer diabetes duration and diabetes therapy. Participants on oral agents versus those on no medication had increased odds (OR 7.7; 95% CI 2.7–21.8) of having poor glycemic control relative to those on no medication. Those on insulin with or without oral agents had greater odds than those on no diabetes medication (OR 15.9; 95% CI 5.4–47.2) and than those on oral medications alone (OR 2.1; 95% CI 1.4–3.1).

Table 1. Demographic and health characteristics of ELDER participants, overall and by ethnic group

	Overall (Count [%] or Mean ± SD) (n=693)	Ethnic Groups (Count [%] or Mean ± SD)			P value
		AA (n=218)	NA (n=180)	W (n=295)	
Demographic					
Gender					.71
Female	340 (49.1)	102 (30.0)	91 (26.8)	147 (43.2)	
Male	353 (50.9)	116 (32.9)	89 (25.2)	148 (41.9)	
Age (years)	74.1 ± 5.4	74.2 ± 5.4	73.8 ± 5.4	74.2 ± 5.5	.65
Formal education (n=692)					<.0001
Less than high school	450 (65.0)	155 (34.4)	150 (33.3)	145 (32.2)	
High school	143 (20.7)	43 (30.1)	20 (14.0)	80 (55.9)	
At least some college	99 (14.3)	19 (19.2)	10 (10.1)	70 (70.7)	
Living arrangements					<.0001
Living alone	214 (30.9)	66 (30.8)	57 (26.6)	91 (42.5)	
Living with others – not married	141 (20.4)	67 (47.5)	42 (29.8)	32 (22.7)	
Living with others – married	338 (48.8)	85 (25.2)	81 (24.0)	172 (50.9)	
Poverty status (n=665)					<.0001
On Medicaid	235 (35.3)	90 (38.3)	96 (40.9)	49 (20.9)	
No Medicaid, household income <$25,000	302 (45.4)	95 (31.5)	61 (20.2)	146 (48.3)	
No Medicaid, household income ≥$25,000	128 (19.3)	22 (17.2)	20 (15.6)	86 (67.2)	
Health					
Diabetes therapy					.021
No medication	85 (12.3)	19 (22.4)	24 (28.2)	42 (49.4)	
Oral agent only	417 (60.2)	126 (30.2)	102 (24.5)	189 (45.3)	
Insulin with or without oral agents	191 (27.6)	73 (38.2)	54 (28.3)	64 (33.5)	
Diabetes duration (years)	12.4 ± 11.0	13.2 ± 12.1	11.8 ± 9.9	12.3 ± 10.8	.42
Body mass index (kg/m^2) (n=662)					.0001
Normal or underweight (<25)	135 (20.4)	27 (20.0)	38 (28.2)	70 (51.9)	
Overweight (≥25 and <30)	256 (38.7)	84 (32.8)	49 (19.1)	123 (48.1)	
Obese (≥30)	271 (40.9)	95 (35.1)	83 (30.6)	93 (34.3)	
Seen doctor for diabetes care in the past year (n=688)					.0090
Yes	293 (42.6)	110 (37.5)	70 (23.9)	113 (38.6)	
No	395 (57.4)	105 (26.6)	109 (27.6)	181 (45.8)	
Health Conditions					
Heart disease					.0004
Yes	317 (45.7)	79 (24.9)	101 (31.9)	137 (43.2)	
No	376 (54.3)	139 (37.0)	79 (21.0)	158 (42.0)	
Eye disease (due to diabetes)					<.0001
Yes	280 (40.4)	99 (35.4)	93 (33.2)	88 (31.4)	
No	413 (59.6)	119 (28.8)	87 (21.1)	207 (50.1)	
Stroke					.037
Yes	176 (25.4)	54 (30.7)	58 (33.0)	64 (36.4)	
No	517 (74.6)	164 (31.7)	122 (23.6)	231 (44.7)	
Neuropathy					.10
Yes	155 (22.4)	40 (25.8)	38 (24.5)	77 (49.7)	
No	538 (77.6)	178 (33.1)	142 (26.4)	218 (40.5)	
Kidney disease					.85
Yes	77 (11.1)	24 (31.2)	22 (28.6)	31 (40.3)	
No	616 (88.9)	194 (31.5)	158 (25.7)	264 (42.9)	
Thrombosis/blood clots					.036
Yes	58 (8.4)	11 (19.0)	22 (37.9)	25 (43.1)	
No	635 (91.6)	207 (32.6)	158 (24.9)	270 (42.5)	
Extremity amputation (due to diabetes)					.41
Yes	20 (2.9)	9 (45.0)	4 (20.0)	7 (35.0)	
No	673 (97.1)	209 (31.1)	176 (26.2)	288 (42.8)	

AA=African American; NA=Native American; W=White.

DISCUSSION

These analyses show that almost 40% of older adults with diabetes in this rural population have glycemic control values above levels recommended by the American Diabetes Association.[21] The proportion with poor glycemic control is even higher for minority elders, particularly Native Americans. When demographic characteristics are considered alone (model 1),

Table 2. HbA1C Values* and percentages among glycemic control groups for the ELDER sample, overall and by gender and ethnic groups

	African American		Native American		White		
	Men *n*=116	Women *n*=102	Men *n*=89	Women *n*=91	Men *n*=148	Women *n*=147	Overall *n*=693
	Count (%) or Mean (95% CI)	Count (%) or Mean (95% CI)	Count (%) or Mean (95% CI)	Count (%) or Mean (95% CI)	Count (%) or Mean (95% CI)	Count (%) or Mean (95% CI)	Count (%) or Mean (95% CI)
HbA1c group							
HbA1c <7%	71 (61.2)	73 (71.6)	45 (50.6)	54 (59.3)	101 (68.2)	97 (66.0)	441 (63.6)
HbA1c 7 to <8%	22 (19.0)	14 (13.7)	22 (24.7)	19 (20.9)	26 (17.6)	34 (23.1)	137 (19.8)
HbA1c ≥8%	23 (19.8)	15 (14.7)	22 (24.7)	18 (19.8)	21 (14.2)	16 (10.9)	115 (16.6)
HbA1c values (%)*	6.9 (6.7, 7.2)	6.7 (6.4, 6.9)	6.9 (6.6, 7.2)	6.7 (6.5, 7.0)	6.6 (6.5, 6.8)	6.5 (6.4, 6.7)	6.7 (6.6, 6.8)

* HbA1C values were log-transformed for analyses and back-transformed for presentation.

ethnicity, poverty status, and living arrangements are significant independent predictors of glycemic control. When demographic and health characteristics are considered simultaneously (model 2), living arrangements are no longer statistically significant, but ethnicity, poverty status, treatment regimen, and duration of diabetes were significant independent predictors of glycemic control. Native Americans were at higher risk for poorer control compared with both Whites and African Americans.

These findings contrast with those of the Health ABC study of older adults,[6] which found a substantially greater proportion of older adults with poor glycemic control. These differences may be due to changes in medical practice, particularly availability of oral hypoglycemic agents, in the five years between data collection for Health ABC and for the ELDER study. In that time, considerable progress was made in development and clinical application of different classes of oral agents that help to achieve glycemic control alone, as well as in combination with insulin.[9]

The Third National Health and Nutrition Examination Survey results provide additional comparison. Like the ELDER sample, more aggressive diabetes treatment was associated with poorer glycemic control.[8] Racial disparities in glycemic control remained while controlling for a wide variety of covariates. While the association between poorer control and insulin or oral agents versus diet alone might appear

Table 3. Bivariate associations between HbA1C ≥7% and categorical demographic and health characteristics (*N*=693 unless otherwise noted)

	HbA1C=7.0% *n* (%)	*P* Value
Ethnic group		
White	97 (32.9)	.019
African American	74 (33.9)	
Native American	81 (45.0)	
Gender		
Female	116 (34.1)	.23
Male	136 (38.5)	
Living arrangements		
Living alone	65 (30.4)	.041
Living with others – not married	49 (34.8)	
Living with others – married	138 (40.8)	
Formal education (*n*=692)		
Less than high school	168 (37.3)	.39
High school	54 (37.8)	
At least some college	30 (30.3)	
Poverty status (*n*=665)		
On Medicaid	83 (35.3)	.070
No Medicaid, household income <$25,000	120 (39.7)	
No Medicaid, household income ≥$25,000	36 (28.1)	
Diabetes therapy		
No medication	5 (5.9)	<.0001
Oral agent only	139 (33.3)	
Insulin with or without oral agents	108 (56.5)	
Body mass index (*n*=662)		
Underweight or normal (BMI <25)	45 (33.3)	.67
Overweight (BMI ≥25 and <30)	90 (35.2)	
Obese (BMI ≥30)	102 (37.6)	
Diabetes-related care visit in past year (*n*=688)		
Yes	128 (43.7)	.0006
No	122 (30.9)	

When demographic characteristics are considered alone (model 1), ethnicity, poverty status, and living arrangements are significant independent predictors of glycemic control.

Table 4. Multivariate associations between HbA1C ≥7% and demographic and health characteristics

Variables	Model 1: Demographic Only (*n*=664)		Model 2: Demographic + Health (*n*=633)	
	OR (95% CI)	*P* value	OR (95% CI)	*P* value
Ethnicity		0.023		0.029
African American vs White	1.0 (0.7, 1.5)	0.95	0.9 (0.6, 1.4)	0.57
Native American vs White	1.7 (1.1, 2.6)	0.015	1.6 (1.0, 2.6)	0.045
Native American vs African American	1.7 (1.1, 2.6)	0.017	1.9 (1.2, 3.0)	0.011
Gender (female vs male)	0.9 (0.7, 1.4)	0.77	0.9 (0.6, 1.3)	0.56
Formal education		0.5		0.37
High school vs less than high school	1.2 (0.8, 1.9)	0.31	1.3 (0.8, 2.1)	0.24
At least some college vs less than high school	0.9 (0.5, 1.6)	0.79	0.9 (0.5, 1.6)	0.72
At least some college vs high school	0.7 (0.4, 1.3)	0.32	0.7 (0.4, 1.3)	0.22
Poverty status		0.029		0.048
No Medicaid, <$25,000 vs on Medicaid	1.2 (0.8, 1.7)	0.45	1.2 (0.8, 1.9)	0.39
No Medicaid, ≥$25,000 vs on Medicaid	0.6 (0.3, 1.1)	0.082	0.6 (0.3, 1.2)	0.14
No Medicaid, ≥$25,000 vs no Medicaid, <$25,000	0.5 (0.3, 0.8)	0.0084	0.5 (0.3, 0.9)	0.016
Living arrangements		0.021		0.075
Living w/others and unmarried vs living alone	1.2 (0.7, 1.9)	0.53	1.0 (0.6, 1.7)	0.99
Living w/others and married vs living alone	1.8 (1.2, 2.7)	0.0065	1.6 (1.0, 2.6)	0.04
Living w/others: married vs unmarried	1.5 (0.9, 2.5)	0.083	1.6 (1.0, 2.8)	0.076
Diabetes duration (log years)	—	—	1.3 (1.1, 1.6)	0.0015
BMI (kg/m^2)	—	—		0.94
Overweight vs underweight or normal	—	—	1.0 (0.6, 1.7)	0.9
Obese vs underweight or normal	—	—	1.1 (0.7, 1.8)	0.75
Obese vs overweight	—	—	1.1 (0.7, 1.6)	0.81
Diabetes therapy	—	—		<.0001
Oral agent only vs no medication	—	—	7.7 (2.7, 21.8)	.0001
Insulin with or without oral agents vs no medication	—	—	15.9 (5.4, 47.2)	<.0001
Insulin with or without oral agents vs oral agent only	—	—	2.1 (1.4, 3.1)	0.0005
Diabetes-related care visit in past year (yes vs no)	—	—	1.3 (0.9, 1.9)	0.14

BMI=body mass index.

contradictory, it reflects the current standard of care in which pharmacologic interventions are reserved for cases in which behavioral self-management alone is inadequate to achieve glycemic control.[21]

The ELDER sample consists of older adults. Some reduction in ethnic disparities in glycemic control may be seen when one examines only older adults. Because of the severity of diabetes complications in minority populations,[22,23] we would expect that the minority participants represent survivors and may have better glycemic control than non-survivors. Because Whites typically have a later age at diagnosis and lower rates of complications, less diabetes-related mortality would be expected among Whites than among minorities at the same age. Thus, the ethnic disparities in glycemic control among surviving older adults should be lower than among a younger sample, as shown by comparisons with NHANES.

This study is one of the first to examine glycemic control among older Native Americans compared to other ethnic groups. The results indicate that glycemic control is worse in Native Americans than other groups studied. This finding contrasts with that of Zhang et al among male Veterans Health Administration (VHA) patients with a mean age of 66 years.[14] They found HbA1C levels for Native Americans were not significantly different from non-Hispanic Whites. However, their sample included a small number of Native Americans, participants were younger, and all had access to VHA health benefits. Further investigation of the disparity observed in the present study between Native American and other rural elders is warranted.

The average HbA1C among Native Americans in the present study is considerably lower than that observed in other studies from different Native American groups. Roubideaux and colleagues analyzed cross-sectional data for a sample of 9,626 individuals from the Indian Health Services Diabetes Care and Outcomes Audit data set for 1997.[24] They found mean glycosylated hemoglobin of 8.8% ± 2.2. Hu et al found a similar glycemic level, median of 8.4%, in data collected from 1989 to 1995 in the Strong Heart Study.[25] These data come from different Native Americans (Indian Health Service, tribes, urban health programs), and they predate the present study by at least five years. Therefore, the better glycemic control in the present study may be due to a variety of factors, including the improvements in oral agents now available.

Although more than a quarter of all older adults live in rural areas,[26] few studies have focused on diabetes and its management in rural communities. The constraints of rural areas put older rural adults with diabetes at a cumulative disadvantage relative to their suburban and urban counterparts. In general, rural elderly populations have higher rates of poverty and lower rates of education.[26] They have to travel greater distances to obtain goods and services necessary for self-management (eg, comprehensive grocery selection and pharmacies).[27] Specialty medical care relevant to diabetes is less available,[12] and the quality of primary care for diabetes is also lower.[11] Minority status adds another source of disparities. Minority patients are economically and educationally disadvantaged, have poorer quality of communication with physicians than Whites, are treated by physicians with training and resources inferior to those treating White patients, and receive an inferior level of preventive diabetes care relative to White patients.[28–30]

Unlike most studies focused on ethnicity and rurality, the ELDER study included White and minority diabetes patients living in the same rural communities. Thus, while these groups of patients may differ in some respects, many of the environmental factors are held constant. For example, public transportation systems are limited, few diabetes education programs are available, and all residents must travel distances to receive specialty care. Thus, ethnic differences in glycemic control in this rural population suggest that further research into the cause of these disparities is needed.

This study has a number of strengths, including the large and ethnically diverse sample, the high response rate, and extensive data on demographic, health, and healthcare characteristics. It also has several limitations. It was conducted in a single rural area and thus better represents the rural South than other rural areas of the United States. Data were gathered by self-report, except for HbA1C. This measure relied on a fingerstick method rather than the more common venous blood draw. However, the data collection and analysis technique has been extensively tested for use in field studies such as ELDER and found to be very comparable to the more conventional technique. Collection of data in the home allowed for inclusion of persons regardless of mobility or access to medical care. The study design is cross-sectional, so causality cannot be assessed.

In summary, this analysis shows a level of glycemic control better than that found in earlier national studies. This finding may be due to high rates of oral diabetes medication use, but ethnic disparities remain. Poverty and disease-related factors appear to account for most of these disparities, but ethnic disparities, particularly among Native Americans, persist. Further research is needed to explain and effectively address these disparities among older adults from different ethnic groups.

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