Ethnic Disparities in Health-Related Quality of Life Among Older Rural Adults with Diabetes

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Diabetes mellitus disproportionately affects ethnic minorities and has serious economic, social, and personal implications. This study examines the effect of diabetes disease burden and social resources on health-related quality of life (HRQOL) among older rural adults with diabetes. Data come from a population-based cross-sectional survey of 701 adults (age ≥65 years) with diabetes in North Carolina from three ethnic groups: African American, Native American, and White. HRQOL was assessed using the 12-item short-form health survey (SF-12). Mean scores were 35.1 ± 11.4 and 50.5 ± 10.8 for the physical and mental components of the SF-12, respectively. In bivariate analyses, scores were significantly lower for Native Americans than Whites for both components. In multivariate analyses, higher physical HRQOL was associated with male sex, greater mobility ability, fewer chronic conditions, exercising vs not exercising, fewer depressive symptoms, and not receiving process assistance. Higher mental HRQOL was associated with greater mobility ability, fewer chronic conditions, and a high school education or more. Diabetes appears to have a substantial effect on physical HRQOL. Physical disability associated with diabetes may have a greater impact in the rural environment than in other areas. Aspects of rural social milieu may help to keep mental HRQOL high, even in the face of severe chronic disease. Ethnic differences in HRQOL are largely accounted for by diabetes disease burden and, to a lesser extent, social resources. Strategies to reduce diabetes-related complications (long term) and assist mobility (short term) may reduce ethnic disparities in HRQOL. (*Ethn Dis*. 2007;17:471–476)

Key Words: African Americans, Diabetes, Quality of Life, Native Americans, Rural, Minority Health

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Introduction

Diabetes mellitus is a chronic disease with serious economic, social, and personal implications. Diabetes disproportionately affects older adults and ethnic minorities, including African Americans and Native Americans.[1] The health-related quality of life (HRQOL) of persons with diabetes has been shown to be lower than that of the general population.[2,3] The reasons for reduced HRQOL may be twofold. First, diabetes, and particularly the complications of diabetes, results in reduced physical functioning that can affect patients' abilities to continue normal activities. Second, diabetes is primarily a self-managed disease. It requires a change in patients' lifestyles to monitor diet, engage in physical activity, use medications, monitor blood glucose, and receive regular medical monitoring from primary care providers as well as a variety of specialists. Therefore, the burden associated with self-management has the potential to lower patients' HRQOL.

Previous research suggests two major influences on HRQOL: burden of disease and social resources that can be used to manage the disease. Aspects of the burden of disease that have been linked to HRQOL include glycemic control, duration of disease, and complications and comorbidities associated with diabetes.[3–7] Social resources that have been linked to HRQOL include education, marital status, and social support.[6,8–9] Demographic covariates that can affect the relationship between burden of disease and social resources with HRQOL include age, sex, and ethnicity.[6,9–11]

Previous research suggests two major influences on HRQOL: burden of disease and social resources that can be used to manage the disease.

No studies have specifically assessed the HRQOL of rural elderly persons with diabetes. Overall, rural populations face obstacles in diabetes self-management that can either directly or indirectly affect HRQOL that are not present for their urban counterparts. Elderly living in rural communities may have particular difficulty in modifying their lifestyle to self-manage diabetes because of more limited access to medical specialists, difficulties in finding places to exercise or special foods, and limited diabetes education resources.[12–15]

In this article, we examine two research questions: What are the contributions of burden of disease, social resources, and ethnicity to HRQOL in older rural adults with diabetes? Do the contributions of burden of disease and social resources differ for mental HRQOL and physical HRQOL?

Methods

The ELDER (Evaluating Long-term Diabetes self-management among Elder Rural Adults) Study was a population-based cross-sectional survey that comprehensively assessed self-management strategies of a random sample of community-dwelling, rural adults aged ≥65 years with diagnosed diabetes.[16,17] Participants were selected from two largely rural counties in central North Carolina with a high proportion of ethnic minorities and persons living below the poverty level. The study was approved by the Institutional Review Board of Wake Forest University School of Medicine.

The sample was stratified by sex and ethnicity (African Americans, Native Americans and Whites). 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. 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.

Sampling and recruitment have been described previously.[16] The final sample included 701 individuals. The overall response rate for eligible participants was 89% (701/787). A total of 665 participants were used for this analysis, excluding three who did not fit the ethnic categories and the remainder due to missing data.

Face-to-face interviews, 1.5 hours in length, were conducted by local, trained interviewers between May and October, 2002. Interview data were recorded on paper forms, data-entered into EpiInfo (version 6.0, CDC, Atlanta, GA) and analyzed using SAS Statistical Software (version 8.02, SAS Institute, Inc., Cary, NC).

Measures

HRQOL was assessed using the Medical Outcomes Trust 12-Item Short-Form Health Survey (SF-12). The SF-12 was selected over the longer SF-36 to reduce participant burden. The SF-12 has been shown to have clinical meaning in assessing psychological factors affecting HRQOL and to provide more information about functional health status that disease-specific questionnaires lack.[18,19]

Two summary measures, the Physical Component Summary (PCS-12) and the Mental Component Summary (MCS-12)[2,20] were constructed. Regression weights and constants for scoring were derived from data from a sample of the general US population; both scales were transformed to have a mean of 50, standard deviation of 10, and range of zero to 100 in the general US population.[2] Higher scores reflect higher HRQOL.

Glycemic control was assessed by measurement of HbA1C from finger-stick blood samples as described previously.[17] Number of long-term health conditions was the total number of conditions reported in response to questions about eleven specific conditions, and to an open-ended query about any other long-term health condition. Diabetes was not counted as a condition. Body mass index (kg/m^2) was classified into ordered categories of underweight (BMI<18.5), normal (≥18.5 and < 25.0) overweight (≥25.0 and < 30.0), Class I obesity (≥30.0 and <35.0), Class II obesity (≥35.0 and <40.0) and Class III obesity (≥40.0) (NIH 1998).

Mobility was assessed using the mobility scale of the Medical Outcomes Study (MOS) Physical Functioning Measure, which has values of two to ten, with higher scores indicating greater mobility.[21] It is based on two questions: whether the participant needs help when traveling about the community and whether the participant is in bed most of the time. Physical activity was defined as ordered categories: not an exerciser (exercised never or less than once per week in the past year), an exerciser but did not exercise in the past week, an exerciser who exercised one to four days in the past week, or an exerciser who exercised five to seven days in the past week.

Depressive symptoms were assessed by the CES-D, a 20-item self-report depression symptom scale developed by the Center for Epidemiologic Studies.[22] The response categories were modified from the original Likert scale to "yes" and "no" responses (values 1 and 0, respectively; range of total scores 0–20)[16] based on the validation of this modification for this population by Blazer and colleagues.[23,24]

Social resources were assessed using two proxy measures, marital status and household size, and five constructed measures of diabetes-related assistance, defined as follows. Participants were asked if they had received assistance during the past year in five functional domains related to self-management: material assistance, information assistance, teaching assistance, process assistance (eg, did anyone help you get to the doctor for diabetes care?), or participatory assistance (eg, did anyone exercise with you?). Each of these five functional domains is composed of four to six primary questions regarding the nature of the assistance received, along with sub-questions addressing the source of the assistance (spouse, friend, social service personnel, etc.) and whether or not payment was provided. Each primary question was defined by the sub-questions as portraying informal assistance (1) or no informal assistance (0); these were averaged to obtain overall scores, ranging zero to one and representing the mean of the non-missing primary questions within that domain. Assistance was considered informal if it was unpaid. Primary questions skipped as being inappropriate (eg, "assistance for giving insulin injection," if the participant did not use insulin), were considered no assistance (0). If more than 25% of the primary questions were missing within a domain, the domain score was defined as missing.

Statistical Analysis

Demographic covariates, burden of disease, and social resources were summarized using counts and percentages, or means and standard deviations.

Associations between MOS Physical Component (PCS-12) and Mental Component (MCS-12) summary scores, and the demographic covariates, burden of disease, and social resources measures, were evaluated for statistical significance using simple and multiple linear regression. In these analyses, all categorical explanatory variables were coded using the usual "class" statement in SAS to handle dependencies among the categories of a variable. In the simple linear regression models, variables evaluated as predictors of PCS-12 and MCS-12 summary scores were age, sex, ethnicity, education, poverty status, exercise, duration of diabetes, type of diabetes medication, HbA1C, number of chronic conditions, mobility ability, BMI, CES-D (PCS-12 models only), marital status, household size, and assistance classifications (participatory, teaching, informational, process, and material). Age, sex, ethnicity, and marital status were included in all multiple regression models. All other covariates were selected from the remaining potential predictors using a forward stepwise procedure. $P\leq.05$ was used to add terms, and $P>.1$ was used to remove terms from the model at each step. If main effects for both sex and ethnicity were statistically significant, then a sex x ethnicity interaction was evaluated for inclusion, and subsequently evaluated for exclusion using the same procedure. Pairwise comparison results for the effects of potential predictors having >2 groups were evaluated using Bonferroni's method. For the computed models, we examined residual plots (vs predicted and vs continuous independent variables), the univariate distributions of the residuals themselves, as well as partial leverage plots for all continuous covariates. There were no apparent problems. We did a formal collinearity assessment in the multiple regression analyses. There was no evidence of even modest effects from collinearity, including no indication of variance inflation (all variance inflation factor values were less than 1.5).

Table 1. Bivariate associations between the physical component summary score of the SF-12 and demographic, disease-related, and social resource characteristics among ELDER participants

Variable or Contrast	*n*	Estimate	SE	95% CI	*P*-value
Age (decades)	665	−0.67	0.81	−2.27, 0.92	.41
Sex (men vs women)	665	5.84	0.85	4.17, 7.52	<.0001
Ethnicity	665				<.0001
Native American vs White		−4.81	1.08	−6.94, −2.69	<.0001
African American vs White		−1.26	1.02	−3.27, 0.75	.22
Education	664				<.0001
> High school vs < high school		4.20	1.28	1.69, 6.71	.0011
High school vs < high school		4.75	1.09	2.62, 6.89	<.0001
Poverty status	639				<.0001
No Medicaid, ≥ $25,000 vs Medicaid		8.72	1.23	6.31, 11.13	<.0001
No Medicaid, < $25,000 vs Medicaid		3.71	0.97	1.81, 5.60	.0001
Exercise	661				<.0001
Exerciser 5–7 days vs not an exerciser		8.92	1.19	6.58, 11.26	<.0001
Exerciser 1–4 days vs not an exerciser		7.19	1.29	4.66, 9.72	<.0001
Exerciser 0 days vs not an exerciser		0.93	1.08	−1.20, 3.06	.39
Log duration of diabetes	665	−0.70	0.39	−1.47, 0.07	.076
Diabetes medication	665				.0004
Insulin with or without pills vs no meds		−3.65	1.51	−6.61, −0.69	.016
Pills only vs no meds		0.30	1.37	−2.39, 2.99	.82
HbA1C	660	−0.33	0.34	−0.99, 0.34	.34
Number of chronic conditions	665	−2.38	0.18	−2.74, −2.03	<.0001
Mobility ability	665	2.12	0.13	1.86, 2.37	<.0001
BMI	634				<.0001
Class III obese vs normal/underweight		−7.82	2.08	−11.89, −3.74	.0002
Class II obese vs normal/underweight		−4.12	1.76	−7.58, −0.66	.02
Class I obese vs normal/underweight		−0.79	1.33	−3.40, 1.82	.55
Overweight vs normal/underweight		0.89	1.24	−1.54, 3.32	.47
CES-D score	664	−1.02	0.11	−1.24, −0.80	<.0001
Married (yes vs no)	665	3.48	0.87	1.77, 5.19	<.0001
Number in household	665				.0004
Three or more vs one		−2.40	1.24	−4.83, 0.03	.053
Two vs one		2.02	1.01	0.04, 4.01	.045
Participatory assistance	659	−5.11	1.79	−8.63, −1.60	.0044
Teaching assistance	665	−9.84	3.72	−17.15, −2.53	.0084
Informational assistance	664	−6.94	4.46	−15.69, 1.82	.12
Process assistance	665	−12.51	1.27	−15.00, −10.03	<.0001
Material assistance	665	−17.03	4.89	−26.64, −7.42	.0005

RESULTS

The sample was 31.3% African Americans, 42.7% White, and 26.0% Native American, with 48.6% women. The mean age (± S.D.) was 74.0±5.4 years. Most (64.9%) had not completed high school. Eighty-one percent were either receiving Medicaid or not receiving Medicaid but had an annual household income <$25,000. Seventy percent had two or more persons living in the home; 50.4% were married. Most used medications to control their diabetes: 61.1% used oral medications only and another 26.8% used insulin with or without oral medications. Respondents reported an average 6.5 (± 4.2) prescription drugs and 4.7 (± 2.2) other chronic conditions. Mean duration of diabetes was 12.5 (± 11.1) years. Almost half

Table 2. Bivariate associations between the mental component summary score of the SF-12 and demographic, disease-related, and social resource characteristics among ELDER participants

Variable or Contrast	N	Estimate	SE	95% CI	*P*-value
Age (decades)	665	0.54	0.77	−0.98, 2.05	.49
Sex (men vs women)	665	1.39	0.84	−0.25, 3.03	.098
Ethnicity	665				.0010
Native American vs White		−3.83	1.03	−5.85, −1.81	.0002
African American vs White		−1.86	0.98	−3.78, 0.05	.056
Education	664				<.0001
> High school vs < high school		6.15	1.20	3.79, 8.52	<.0001
High school vs < high school		4.03	1.02	2.02, 6.04	<.0001
Poverty Status	639				<.0001
No Medicaid, ≥ $25,000 vs Medicaid		6.60	1.19	4.28, 8.93	<.0001
No Medicaid, < $25,000 vs Medicaid		3.20	0.93	1.37, 5.04	.0006
Exercise	661				<.0001
Exerciser 5–7 days vs not an exerciser		5.78	1.18	3.47, 8.09	<.0001
Exerciser 1–4 days vs not an exerciser		3.64	1.27	1.14, 6.13	.0043
Exerciser 0 days vs not an exerciser		1.02	1.07	−1.08, 3.11	.34
Log duration of diabetes	665	−0.99	0.37	−1.72, −0.26	.0082
Diabetes medication	665				.0076
Insulin with or without pills vs no meds		−2.70	1.44	−5.52, 0.12	.061
Pills only vs no meds		0.28	1.30	−2.28, 2.84	.83
HbA1C	660	−0.23	0.32	−0.86, 0.40	.48
Number of chronic conditions	665	−1.56	0.18	−1.92, −1.20	<.0001
Mobility ability	665	1.31	0.14	1.04, 1.58	<.0001
BMI	634				.21
Class III obese vs normal/underweight		−1.19	2.01	−5.13, 2.75	.55
Class II obese vs normal/underweight		0.07	1.70	−3.28, 3.41	.97
Class I obese vs normal/underweight		0.04	1.28	−2.48, 2.57	.97
Overweight vs normal/underweight		1.96	1.20	−0.38, 4.31	.10
Married (yes vs no)	665	1.84	0.83	0.20, 3.48	.028
Number in household	665				.24
Three or more vs one		−1.18	1.19	−3.51, 1.15	.32
Two vs one		0.66	0.97	−1.24, 2.56	.50
Participatory assistance	659	−1.86	1.69	−5.18, 1.47	.27
Teaching assistance	665	−8.07	3.54	−15.01, −1.12	.023
Informational assistance	664	1.77	4.24	−6.55, 10.10	.68
Process assistance	665	−6.51	1.26	−8.98, −4.03	<.0001
Material assistance	665	−11.12	4.66	−20.28, −1.96	.017

(48.6%) reported not exercising at least once a week in the past year and another 21.5% reported not exercising the previous week. Mean BMI was 29.7 (± 5.9); 19% were normal or underweight, 39% overweight, 26% class I obese, 9% class II obese, and 6% class III obese.

The mean score for the physical component of the SF-12 was 35.1 (± 11.4). In bivariate analyses (Table 1), higher physical HRQOL was associated with male sex, being White vs Native American, having a high school or greater education vs less than high school education, and not receiving Medicaid with income ≥ $25,000 or not receiving Medicaid with income <$25,000 vs receiving Medicaid. It was also associated with exercising 5–7 days or 1–4 days vs not being an exerciser, being on no oral diabetes medication vs being on insulin, having fewer chronic conditions, greater mobility ability, with Class III obesity, and with having fewer depressive symptoms. Higher physical HRQOL was associated with receiving less participatory, teaching, process, or material assistance.

The mean score for the mental component was 50.5 (± 10.8). In bivariate analyses (Table 2), higher mental HRQOL was associated with being White vs Native American, having a high school or greater than high school education vs having less than high school education, and not receiving Medicaid with income ≥ $25,000 or not receiving Medicaid with income <$25,000 vs receiving Medicaid. It was also associated with exercising 5–7 days or 1–4 days vs not being an exerciser, having fewer chronic conditions, and greater mobility ability. In addition, high mental HRQOL was associated with being married and with not receiving teaching, process, or material assistance.

In multivariate analyses (Table 3), higher physical HRQOL scores were associated with male sex, greater mobility ability, fewer chronic condition, exercising 5–7 days or 1–4 days vs not being an exerciser, fewer depressive symptoms, and not receiving process assistance. The R^2 for the model was 0.45. The sex x ethnicity interaction was not statistically significant.

Higher mental HRQOL scores were associated with greater mobility ability, fewer chronic conditions, and a high school education or more. The distribution of the mental component scores was skewed (median=52.7; interquartile range=43.0 to 59.3). However, no inferences for associations varied with logarithmic transformation of the score (results not shown). The R^2 for the model was 0.21. The sex x ethnicity interaction was not significant.

DISCUSSION

These analyses were designed to examine the influence of disease burden and social resources on HRQOL. While both types of factors were significantly related to HRQOL in bivariate analyses, the effects of social resources were minimized in multivariate analyses for both mental and physical HRQOL.

Table 3. Multivariate associations with physical and mental component summary scores of the SF-12 among ELDER participants

Variable or contrast	Estimate	SE	95% CI	*P*-value
Physical component (*n*=660)				
Age (decades)	0.29	0.64	−0.96, 1.55	.65
Sex (men vs women)	2.07	0.77	0.57, 3.57	.0071
Ethnicity				.076
Native American vs White	−1.88	0.84	−3.53, −0.22	.026
African American vs White	−0.39	0.80	−1.97, 1.19	.63
Married (yes vs no)	0.93	0.77	−0.59, 2.45	.23
Mobility ability	1.32	0.14	1.05, 1.59	<.0001
Number of chronic conditions	−1.46	0.17	−1.79, −1.12	<.0001
Exercise				.0011
Exerciser 5–7 days vs not an exerciser	2.87	1.00	0.91, 4.83	.0042
Exerciser 1–4 days vs not an exerciser	3.56	1.05	1.51, 5.61	.0007
Exerciser 0 days vs not an exerciser	0.46	0.87	−1.24, 2.16	.59
CES-D score	−0.22	0.10	−0.41, −0.03	.022
Process support	−4.09	1.16	−6.37, −1.81	.0004
Mental component score (*N*=664)				
Age (decades)	1.01	0.72	−0.41, 2.42	.16
Sex (men vs women)	−0.94	0.86	−2.63, 0.75	.28
Ethnicity				.59
Native American vs White	−1.00	0.99	−2.94, 0.94	.31
African American vs White	−0.59	0.93	−2.41, 1.23	.52
Married (yes vs no)	0.76	0.86	−0.93, 2.45	.38
Mobility ability	1.01	0.14	0.73, 1.29	<.0001
Number of chronic conditions	−1.19	0.18	−1.56, −0.83	<.0001
Education				.0002
> High school vs < high school	4.63	1.17	2.33, 6.93	<.0001
High school vs < high school	2.40	0.98	0.48, 4.33	.015

This is consistent with an overwhelming importance of the physical disease burden in determining HRQOL for persons with diabetes, as this disease leads to progressive impairments of key functions (eg, walking) in older adults. Alternatively, this may reflect the relatively limited social resources in this population. Almost two-thirds had less than a high school education, and a high percentage had low incomes.

This study allows comparison of two ethnic minority groups with Whites, all living in the same communities. While Native Americans had significantly lower HRQOL than Whites in the bivariate analyses, these differences were no longer significant in the multivariate models. This may indicate that ethnic differences in HRQOL reflect burden of disease and social resources. Therefore, efforts to reduce disease severity and bolster social resources should help to reduce ethnic disparities in HRQOL.

This study showed a substantial difference between physical and mental health indicators (35/50). This compares with differentials of 47/54 and 39/53 measured in the Medical Outcome Study (an observational study of adults with chronic conditions) for persons with minor medical problems and serious physical problems, respectively.[20] The same pattern of lower physical scores (58/78) was found in the Wisconsin Epidemiological Study of Diabetic Retinopathy for the SF-36.[5] In contrast, several other studies have shown that persons with diabetes have lower mental health HRQOL than physical health. In a study of adults 18–92 years with diabetes in a general US survey, Glasgow et al[6] found on the SF-20 a mean physical functioning score of 70.3, compared to a 59.7 for mental health HRQOL, probably reflecting the overall increased physical functioning in younger population.

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The difference between physical and mental HRQOL suggest diabetes and common comorbid conditions take a substantial toll on a person's ability to function. This is supported by the association of mobility ability and exercise practices with the PCS. The physical impairments may be a greater problem in rural than in urban and suburban communities. Because of the dispersed nature of rural communities, being able to walk and drive are crucial to carrying out one's daily activities. Limited access to sidewalks or public transportation may make persons using assistive devices to walk or no longer driving feel more impaired than those in more urban areas with the same reliance on assistive devices.

Aspects of rural living may keep mental health scores high, even in the face of serious chronic disease. Rural populations, particularly in the Southeast, have high rates of religiosity and religious participation.[25–26] Religiosity may provide a coping strategy for health deficits and provide social support and interaction. In addition, large families and the residential stability of rural communities also decrease isolation of older adults, relative to urban and suburban counterparts. Thus, the differences in impact of diabetes in the rural environment may reflect an exacerbation of the impact or perception of physical health deficits as well as a protective effect of the rural community against mental impact of diabetes on HRQOL.

Strengths of this study include the rural, ethnically diverse sample, large sample size, and high response rate. However, it may not be possible to generalize these findings to non-rural populations. These findings need to be verified in a higher SES population. Some of the diabetes-related data (eg, diabetes duration) were obtained by self-reports. However, analyses published elsewhere[17] indicate that the objective measure of diabetes status (HbA1C) is associated as expected with the self-report diabetes measures. Another limitation of this study is the use of the SF-12. Other studies have used the SF-36, or diabetes-specific HRQOL questionnaires.[18] The SF-36 would have produced similar physical and mental HRQOL summary scores, but would have allowed for other subscales of HRQOL to be examined. For purposes of reducing participant burden in a study concerned with overall reliability and validity, the SF-12 was an adequate substitution.

These findings suggest several measures to improve HRQOL. In the long term, a focus on preventing complications of diabetes that reduce mobility (eg, neuropathy, amputation, cardiovascular disease) may help promote better HRQOL for persons with diabetes in these rural communities. Greater access to health education programs could help provide elderly persons with education needed to improve self-management strategies to benefit their overall health and HRQOL. While such face-to-face programs are limited in rural areas, using such widely available resources as television to provide diabetes education could supplement existing resources. In the short term, programs that assist with mobility (eg, transportation and home retrofitting) might improve HRQOL.

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