Heterogeneity in Management of Diabetes Mellitus Among Latino Ethnic Subgroups in the United States

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Background: **Recent debate suggests that general racial/ethnic categories may obscure potentially important subgroup differences within minority groups. The purpose of this study was to examine the quality of diabetes care among ethnic subgroups of the Latino population in the United States while accounting for aspects of acculturation and access to care.**

Methods: **We evaluated adults (≥18 years old) with previously diagnosed diabetes in the 2003 National Health Interview Survey (n = 2136; United States population estimate = 13,471,587). The Latino subgroups (n = 373; United States population estimate = 1,556,259) were Mexicans, Puerto Ricans, and Other Latinos. Through a series of logistic regressions we examined ethnic group and quality of care for diabetes while controlling for demographics, access to care, and acculturation.**

Results: **Among Latinos, 43% conducted their interview in Spanish and 59% were immigrants to the United States. Ethnic group differences were apparent in the analyses. In a logistic regression analysis including all Latinos, with Puerto Ricans as the reference group, Mexicans (odds ratio, 0.24; 95% CI, 0.07–0.85) and Other Latinos (odds ratio, 0.15; 95% CI, 0.04–0.58) were significantly less likely to have only one doctor for their diabetes care. Mexicans were less likely than Puerto Ricans (odds ratio 0.39; 95% CI, 0.18- 0.84) to know about glycosylated hemoglobin. Similarly, among Latino immigrants, Mexicans (odds ratio, 0.13; 95% CI, 0.02–0.81) and Other Latinos (odds ratio, 0.09; 95% CI, 0.01–0.63) were significantly less likely than Puerto Ricans to have only one doctor for their diabetes care and management. Measures of acculturation and immigration were not independent predictors of diabetes quality of care.**

Conclusions: **Differences in diabetes management exist between Latino ethnic subgroups; treating Latinos in the United States as one homogenous category may be a barrier to the appropriate provision of care. (J Am Board Fam Med 2007;20:598–605.)**

Diabetes is a common disease that has substantial morbidity and mortality and has reached epidemic proportions in the United States.[1] Appropriate ongoing diabetes management and treatment has been shown to successfully decrease the deleterious outcomes of the disease.[2] Reducing health disparities in diabetes care is an important issue facing the United States.[3]

US Census estimates from 2005 report that Latinos constitute 14% of the nation's population.[4] Among these, 64% have Mexican backgrounds whereas 10% are Puerto Rican. Latinos have a higher prevalence of diabetes, more complications, and worse outcomes than non-Latino whites.[5–9] Quality of care for diabetes among Latinos continues to lag behind that for non-Latino whites.[10] Recent projections continue to predict an increasing prevalence of diabetes, particularly for Latinos.[11] The US Census indicates that 14.5% of adult US residents are foreign born.[12] These immigrants, particularly minorities, may require targeted interventions and modifications to the standard health care delivery system than might others in their ethnic group who are born in the United States. Recent debate has highlighted that homog-

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enous groupings using general racial/ethnic categories may obscure potentially important subgroup differences within minority groups.[13] Some data has indicated the importance of considering both immigration and country of origin when discussing the Latino population.[14,15] Classifying diverse groups (eg, Puerto Rican, Mexican) into one monolithic group with shared language (Spanish) may obscure important cultural and socioeconomic differences that impact health beliefs, behaviors, and access to care.[13,16]

Differences in diabetes prevalence and care among ethnic subgroups are associated with the degree of acculturation.[17,18] For example, Latinos who are less acculturated to the majority US culture tend to have a higher prevalence of diabetes and more complications.[17,19] Latinos with low levels of acculturation were more likely to be without a routine place for health care, have no health insurance, and have low levels of education.[17]

It is unclear whether ethnic subgroup differences are simply representations of differences in acculturation or access to care or whether ethnic subgroup membership has important implications for diabetes management. The purpose of this project was to examine diabetes management among ethnic subgroups of the Latino population in the United States while accounting for aspects of acculturation and access to care.

Methods

Design

We conducted an analysis of the 2003 National Health Interview Survey (NHIS). The NHIS is one of the principal sources of information about the health of the civilian, noninstitutionalized population of the United States and is one of the major data collection programs of the National Center for Health Statistics. Although the NHIS has been conducted continuously since 1957, the content of the survey has been updated every 10 to 15 years. The NHIS is a cross-sectional household interview survey that uses a complex survey design that allows for estimates of the civilian, nonistitutionalized population of the US.

The 2003 NHIS is the most recently available data for the NHIS that included the questions needed to differentiate ethnic subgroups and evaluate acculturation factors and diabetes management. The data were weighted to make population estimates of people in the United States. The NHIS has been used to examine health care issues regarding both Hispanic subgroups as well as people who are foreign born and living in the United States.[15,20]

Subjects

The subjects analyzed in this project were adults (≥18 years old) with previously diagnosed diabetes (n = 2136). This unweighted sample size represents a population of 13,471,587.

Variables

Race/Ethnicity

The NHIS provides data via several questions to classify the population into race/ethnicity categories. First, people were asked to identify their race. Only people identifying a primary race group were used in the analysis. Second, in a separate question, people were asked if they considered themselves to be of Hispanic ethnicity. The term Hispanic or Latino describes a population with a common cultural heritage and most often a common language, but it does not refer to a race or a common ancestry.[21,22] Because there may be some cultural, religious, and genetic differences, some measures of Latino ethnicity have used self-reports to indicate the person's geographic region of origin. People who identified themselves as having Latino ethnicity were asked to identify the group that represented their Latino origin or ancestry. The racial/ethnic categories with sufficient numbers to be used in this study were (1) non-Latino white, (2) non-Latino black, (3) Mexican, (4) Puerto Rican, and (5) other Latino.

Acculturation Factors

Acculturation is an indication of the cultural change of people in a minority to the majority culture. Acculturation measures vary widely in what is conceptualized to indicate the construct. Several indicators that have been previously used as proxies were available from the NHIS.[23,24] Spanish language use has been used as a proxy. Being born outside the United States and, among immigrants, years in the United States and US citizenship were assessed.

Diabetes Management

Measures of ongoing diabetes management include self-care as well as care provided by health care

professionals. The measures include (1) the patient has a continuity provider for diabetes; (2) the patient has seen a dietitian for diabetes in the past 12 months; (3) self-monitoring of blood glucose; (4) self-monitoring of foot ulcers; (5) knowledge of glycosylated hemoglobin (HbA1c); (6) check for foot ulcers by a health professional during the past 12 months; (7) examination for retinopathy by a health professional during the past 12 months; (8) cholesterol check by a health professional during the past 12 months; and (9) blood pressure check by a health professional during the past 12 months.

Demographic and Access to Care Characteristics

We assessed the following access to care as well as demographic characteristics of the respondents: (1) sex; (2) age; (3) body mass index computed as weight (kg)/height^2 (m); (4) annual household income; (5) education; (6) health insurance; (7) usual source of care; (8) occasions during the past 12 months when accessing needed medical care was delayed; (9) getting care was delayed because they could not afford health services (among individuals who reported delay in getting needed care); (10) the number of physician visits during the last 12 months; and (11) the number of overnight hospital stays during the past 12 months.

Analysis

Because this survey is based on a complex sampling design that makes it representative of the noninstitutionalized US population, we are able to make nationally representative estimates. We used SUDAAN software (RTI International, Research Triangle Park, NC) to account for the weighting and complex sampling design.

We computed χ^2 analyses for bivariate relationships between race/ethnicity and demographic, access to care, acculturation factors, and diabetes management variables. We computed χ^2 values for the entire set of racial/ethnic groups and for the subset of Latinos alone. Non-Latino whites and non-Latino blacks were examined in the bivariate analysis to provide a context for the Latino subgroups.

We conducted multivariate analyses to evaluate the relationships between Latino ethnic subgroups and the effect of acculturation factors on diabetes management while adjusting for patient characteristics, access to care, and socioeconomic status. These analyses were restricted to Latinos in an effort to examine the importance of ethnic subgroup status to other patient characteristics. Specifically, we focused on 3 variables that indicate continuity of care and the patient's knowledge of their disease and receipt of recommended tests received outside of primary care. We calculated the relative likelihood of having only one doctor for diabetes care, knowledge of HbA1c, and having an examination for retinopathy within the previous year. Included in our forced inclusion logistic regressions as independent variables were the following characteristics: Latino subgroup, sex, age, family annual income ($<$\$20,000 vs $\geq$\$20,000), education, health insurance, usual place to receive medical care, whether the interview was conducted in English rather than Spanish, and whether the respondent was born in the United States. We did not include how long the respondent has lived in the United States because that item was asked only of people who were foreign born. Consequently, we conducted a separate set of regressions among immigrants, keeping the same set of variables but substituting whether the person had lived in the United States for $<$15 years for US born. To investigate the role of US citizenship in these analyses, a third set of regressions were conducted among immigrants and constructed with the replacement of US citizenship for time in the United States. We excluded Puerto Ricans in this third set of regressions because they are US citizens.

Results

The demographic and access to care characteristics of non-Latino white and non-Latino black groups are presented for comparison to the Latino ethnic subgroups (Table 1). More than a third of the participants from each of the Latino ethnic groups conducted their interview in Spanish; less than 50% of the participants from each of the groups was born in the United States. The non-Latino white group had higher annual income and education than did the minority groups. The Latino ethnic subgroups also had lower percentages of members having health insurance than did the non-Latino whites.

In the investigation into the bivariate relationships between racial/ethnic group and diabetes quality of care measures (Table 2), the Latino subgroups were substantially lower than the non-Latino whites, although none of the ethnic groups

Table 1. United States Population Estimates, Sample Number, and Percentages (Standard Error) of Various Demographic and Access to Care Characteristics for Each Ethnic Population*

	Non-Latino White	Non-Latino Black	Mexican	Puerto Rican	Other Latino	All Races χ^2 *P*	Latinos Only χ^2 *P*
United States population estimate	9,790,959	2,124,369	963,740	282,473	310,046		
Unweighted sample (n)	1,345	418	227	60	86		
Acculturation (% [SE])							
Interview conducted in English	99.8%	100.0%	57.2%	66.4%	49.5%	<.001	.221
	(0.11)	(0.0)	(3.61)	(6.28)	(7.30)		
Born in United States	95.7%	92.7%	49.0%	31.3%	25.1%	<.001	.002
	(0.66)	(1.70)	(3.64)	(7.25)	(7.16)		
US citizen	98.4%	97.5%	65.4%	100.0%	75.56%	<.001	<.001
	(0.47)	(0.77)	(3.39)	(0.00)	(5.25)		
≥15 years in US (if not US born)	71.6%	82.9%	77.5%	82.5%	82.2%	.757	.770
	(8.19)	(5.60)	(5.26)	(6.34)	(5.00)		
Social demographics (% [SE])							
Age (≥45 years)	87.4 (1.15)	81.2 (2.24)	74.0 (3.06)	80.3 (5.95)	86.4 (4.23)	.001	.074
Male	51.0 (1.64)	43.7 (2.91)	51.0 (3.79)	50.2 (6.76)	47.0 (5.91)	.305	.853
Annual family income ≥$20,000	76.1 (1.29)	58.9 (3.10)	60.4 (3.65)	60.3 (6.68)	46.7 (7.12)	<.001	.227
Education: high school grad or less (no college)	52.9 (1.54)	63.2 (3.10)	73.1 (3.91)	76.9 (6.45)	66.0 (7.32)	<.001	.533
BMI ≥ 30	51.7 (1.61)	58.1 (2.77)	47.5 (3.83)	50.5 (6.31)	48.3 (6.78)	.194	.923
Access to health care (% [SE])							
Have health insurance	93.8 (0.84)	92.1 (1.31)	74.0% (3.15)	83.2 (6.16)	84.3 (4.53)	<.001	.117
Have usual place for care when sick	97.2 (0.56)	96.7 (1.04)	90.9 (2.31)	87.7 (5.29)	91.3 (4.06)	.034	.851
Never had to delay care	90.8 (0.87)	89.9 (1.64)	82.4 (2.55)	92.0 (3.46)	94.7 (2.36)	.012	.005
Among people who had delayed care, lack of money was not a reason	57.2 (5.09)	47.3 (9.27)	43.1 (7.16)	48.3† (21.6)	84.7 (14.4)	.279	.223
Had a physicians office visit during past year	96.8 (0.65)	96.8 (0.92)	93.4 (1.87)	94.2 (2.91)	92.4 (3.40)	.398	.914
No overnight hospital stays during past year	76.0 (1.46)	72.8 (2.51)	87.3 (2.37)	80.8 (4.54)	77.7 (5.64)	.003	.167

*χ^2 *P* values are calculated across all ethnic groups and among Latino groups only (Mexicans, Puerto Ricans, and Other Latinos).
†Estimate should be used with caution because there are fewer than 30 people in the cell and thus it does not meet the standard of reliability or precision.
BMI, body mass index; SE, standard error.

(including non-Latino whites) had a high proportion of respondents who had heard of HbA1c. Similarly, more than two-thirds of all of the ethnic groups did not check their blood glucose at least once per day.

In the unadjusted regression models including all Latinos, with Puerto Ricans as the reference group, ethnic group was generally not a significant factor relating to the quality of care measures (Table 3). However, other social factors were generally significant. In the adjusted logistic regression analyses, ethnic group became more significant and other factors become nonsignificant (Table 4). Compared with Puerto Ricans, Mexicans and other Latinos were significantly less likely to have only one doctor for their diabetes care and management. Mexicans were less likely than Puerto Ricans to know about HbA1c, whereas people with at least a college education were more likely than less-educated people to know about HbA1c. In terms of receipt of eye exams during the previous year, ethnic subgroup was not a significant variable. Two factors were significant predictors of receipt of eye exams. People with health insurance were more likely to have had an eye examination during the previous year than people without health insurance, and people who answered the survey in Spanish were less likely to have an eye examination during the previous year than were those who answered in English. Birth in the United States versus birth

Table 2. Various Diabetes Management Issues for Each Ethnic Population*

	Non-Latino White	Non-Latino Black	Mexican	Puerto Rican	Other Latino	All Races χ^2 *P*	Latinos Only χ^2 *P*
Seeing one doctor for diabetes care	84.6 (1.17)	85.4 (1.88)	77.4 (3.15)	89.5 (4.27)	73.0 (5.12)	.042	.046
Seen a nurse/dietician in past year	42.1 (1.57)	51.9 (2.92)	49.4 (4.42)	49.1 (7.20)	36.1 (6.17)	.018	.228
Does not check blood glucose at least 1 time per day	63.9 (2.05)	69.7 (3.89)	67.0 (5.85)	69.6 (8.45)	85.30 (7.72)	.181	.198
Checks feet for sores 1 or more times per week	76.9 (1.33)	78.2 (2.30)	74.8 (3.18)	68.0 (8.24)	78.19 (4.98)	.740	.555
Has not heard of HbA1c	58.7 (1.70)	65.5 (2.75)	75.8 (3.70)	63.6 (6.84)	76.5 (5.34)	<.001	.289
Doctor checked feet for ulcers during past year	68.8 (1.42)	80.4 (2.14)	68.5 (3.28)	77.3 (5.95)	63.1 (5.12)	<.001	.229
Had exam for retinopathy during past year	65.5 (1.52)	70.8 (2.97)	54.7 (4.02)	67.2 (6.61)	67.9 (6.63)	.028	.089
Had cholesterol check during past year	81.7 (1.20)	79.2 (2.39)	72.8 (3.74)	66.7 (8.34)	78.0 (5.26)	.089	.510
Had blood pressure check during past year	94.2 (0.87)	92.8 (1.42)	85.3 (2.46)	91.7 (3.80)	90.8 (3.44)	.034	.203

*Data shown as % (standard error). χ^2 *P* values are calculated across all ethnic groups and among Latino groups only (Mexicans, Puerto Ricans, and Other Latinos).
HbA1c, glycosylated hemoglobin.

outside of the United States was not a significant predictor in any of these regressions.

In the second set of logistic regression analyses, which included only Latino immigrants, used time in the United States as an acculturation variable, and used Puerto Ricans as the reference group, Mexicans (odds ratio [OR], 0.13; 95% CI, 0.02–0.81) and other Latinos (OR, 0.09; 95% CI, 0.01–0.63) were significantly less likely to have only one doctor for their diabetes care and management. In addition to ethnic subgroup, people who had a place to which they usually go when they are sick are more likely to have only one doctor for their diabetes care and management (OR, 6.36; 95% CI, 1.38–29.33). There were no significant differences between Latino groups regarding their knowledge about HbA1c; however, individuals with at least a college education were more likely than less-edu-

Table 3. Unadjusted Logistic Regression Models Calculating the Relative Likelihood of a Latino Having One Doctor for Diabetes Care, Knowing About Glycosylated Hemoglobin, or Having Had an Exam for Retinopathy Within the Previous Year

	Has Only One Doctor	Knows About HbA1c	Retinopathy Examination
Latino group			
Mexican	0.40 (0.15 to 1.08)	0.56 (0.28 to 1.12)	0.59 (0.30 to 1.15)
Puerto Rican	1.0	1.0	1.0
Other	**0.32 (0.11 to 0.89)**	0.54 (0.25 to 1.17)	1.03 (0.44 to 2.39)
College education			
No	1.0	1.0	1.0
Yes	1.17 (0.89 to 1.56)	**2.38 (1.93 to 2.93)**	**1.42 (1.13 to 1.79)**
Health insurance			
No	1.0	1.0	1.0
Yes	**2.70 (1.82 to 3.99)**	**1.77 (1.13 to 2.76)**	**3.40 (2.31 to 5.01)**
Usual place for care			
No	1.0	1.0	1.0
Yes	**11.26 (6.12 to 20.73)**	1.18 (0.63 to 2.19)	**3.09 (1.68 to 5.66)**
Interview language			
English	1.0	1.0	1.0
Spanish	**0.51 (0.33 to 0.80)**	**0.36 (0.24 to 0.54)**	**0.63 (0.44 to 0.91)**

Data shown as odds ratio (95% confidence interval).
HbA1c, glycosylated hemoglobin.

Table 4. Adjusted Logistic Regression Models Calculating the Relative Likelihood of a Latino Having Only One Doctor for Diabetes Care, Knowing About Glycosylated Hemoglobin, or Having had an Exam for Retinopathy Within the Previous Year

	Has Only One Doctor for Diabetes Care	Knows About HbA1c	Retinopathy Examination
Latino group			
Mexican	**0.24 (0.07 to 0.85)**	**0.39 (0.18 to 0.84)**	0.77 (0.35 to 1.67)
Puerto Rican	1.0	1.0	1.0
Other	**0.15 (0.04 to 0.58)**	0.50 (0.21 to 1.19)	1.07 (0.42 to 2.70)
College education			
No	1.0	1.0	1.0
Yes	1.19 (0.47 to 3.02)	**2.68 (1.35 to 5.34)**	0.76 (0.37 to 1.54)
Health insurance			
No	1.0	1.0	1.0
Yes	1.40 (0.50 to 3.95)	1.65 (0.75 to 3.66)	**2.12 (1.10 to 4.10)**
Usual place for care			
No	1.0	1.0	1.0
Yes	**8.88 (2.73 to 28.89)**	1.09 (0.28 to 4.21)	1.12 (0.44 to 2.83)
Interview language			
English	1.0	1.0	1.0
Spanish	0.51 (0.23 to 1.13)	1.01 (0.43 to 2.35)	**0.41 (0.19 to 0.88)**

All models were also adjusted for sex, age, family income, and immigrant status, which were not significant predictors in the full models. Data shown as odds ratio (95% confidence interval). HbA1c, glycosylated hemoglobin.

cated people to know about HbA1c (OR, 4.29; 95% CI, 1.48–12.41), as were individuals with health insurance (OR, 2.83; 95% CI, 1.01–7.95). In terms of the receipt of eye exams during the previous year, neither acculturation variables nor ethnic subgroup were significant variables.

Puerto Ricans are US citizens and were therefore excluded from the next set of regressions that investigated the role of citizenship in predicting diabetes management issues (having only one doctor, knowing about HbA1c, and having an eye examination). Citizenship was not a significant predictor in any of the 3 regressions. As before, having a usual place of care was a significant predictor of having one doctor for diabetes care and management (OR, 7.54; 95% CI, 1.34–42.46); having a college education was a significant predictor of knowing about HbA1c (OR, 4.33; 95% CI, 1.24–15.08); and having health insurance was a significant predictor of having an eye examination during the previous year (OR, 2.73; 95% CI, 1.08–6.87).

Discussion

The results of this study suggest that grouping Latinos in the United States into one large homogenous category may obscure differences between ethnic subgroups in relation to the quality of care for diabetes. Although common demographic and access to care variables were significant independent predictors of diabetes management, ethnic subgroup was also a significant independent predictor, with Puerto Ricans having the best management. Except for Spanish language, which was a significant predictor in only 1 of the 9 regressions, measures of acculturation and immigration were not significant independent predictors of diabetes quality of care once we accounted for ethnic subgroup and access to care variables.

Some barriers to care and health beliefs in the Latino population may influence the primary care provider's ability to deliver care.[10,25] These include language, income, having a usual provider, and beliefs about illness and the role of medications. However, the current findings reinforce the importance of not conceptualizing minority populations according to simple and general categorizations. As shown previously with South Asians in England, where Pakistanis, Indians, and Bangladeshis exhibited differences,[18] the current results suggest that Latino ethnic subgroup differences are important in diabetes quality of care. Cultural differences between ethnic subgroups are important and, when

planning health care services for underserved groups, necessitate an understanding of the composition and geographic heritage of the local minority population. In particular, Puerto Ricans seem to have better diabetes management than the other Latino groups. This may be because Puerto Rico is a commonwealth of the United States, which carries more implications for integration in US society than just citizenship. In addition to cultural differences, ancestry, particularly among Latinos, seems to have relevance for health care delivery because of differences in genetic admixture. A recent study focusing on asthma found that ancestry informative markers showed a greater-than-expected degree of association between pairs of ancestry informative markers on different chromosomes in Mexicans and Puerto Ricans; this provides evidence for population substructure and/or recent admixture, particularly as it was associated with asthma.[26] Consequently, the delivery of appropriate care to help Latino patients manage a chronic disease like diabetes must entail an understanding of literacy issues, religiosity, beliefs regarding health and illness, socioeconomic constraints, and potential genetic differences among groups of different ancestries.

Although acculturation has been previously linked to diabetes and diabetes outcomes in Latino populations, the present set of variables used to operationalize acculturation did not have significant independent associations with quality of care once ethnic subgroup was entered into the models. Previous studies on acculturation and diabetes in Latinos have not accounted for ethnic subgroups; this accounts for our new findings.[15,19] On the other hand, it is possible that the variables that we used to measure acculturation were too crude and simplistic to appropriately represent nuances of culture.

There are several limitations to this study. First, the data set is cross-sectional, which limits the ability to make inferences about causality. The NHIS data do, however, allow us to make population estimates for conditions for subgroups of the US population. Secondly, although we were able to separate out several Latino ethnic subgroups, because of small numbers of people with diabetes we were unable to split the population into every ethnic subgroup that the NHIS collected (eg, Dominicans, Cubans), and therefore were forced to clump the smaller groups into an "Other Latino" group. Thus, some group differences may have been missed. Third, the question regarding the assessment of physician-diagnosed diabetes, which was the basis for people being in the study, did not discriminate between those told that they had type 1 or type 2 diabetes. However, the quality of care questions were applicable to individuals with either type 1 or type 2 diabetes.

We attempted to assess the receipt of HbA1c tests by the patients during the previous 12 months. Unfortunately, in this self-report design, we were unable to use this variable because it was only asked of individuals who reported having heard of HbA1c, thereby yielding very small sample sizes among some of the Latino subgroups. Finally, although Latinos are dispersed throughout the United States, some groups are more likely to be in certain regions and urban or rural areas than others. Unfortunately, the 2003 NHIS did not contain information that allowed us to evaluate the rural/urban residence of the respondents.

In conclusion, ethnic subgroups of the US Latino population with diabetes differ in their quality of care for this chronic disease. Future planning of health services for the Latino population, which is both growing in the United States and has a high rate of diabetes, will need to consider the composition of the local population in terms more specific than just "Latinos."

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