Do Acculturation and Family Cohesiveness Influence Severity of Diabetes Among Mexican Americans?

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Objective: The goal of the study was to evaluate the effect of family cohesiveness, acculturation, socioeconomic position, and cardiovascular risk factors on severity of diabetes among Mexican Americans.

Design and Study Population: The cross-sectional study involved a consecutive sample of 275 Mexican Americans under treatment for type 2 diabetes recruited from two medical clinics on the north side of Fort Worth, Texas. Recruitment and data collection took place during a span of 24 months from December 2001 to December 2003.

Main Outcome Measures: Hemoglobin A1C levels, available from medical charts, were used to indicate diabetes severity. Cases were defined as individuals with poorly controlled or severe diabetes based upon abnormally high hemoglobin A1C ($\geq$7.0). Controls were defined as individuals with well-controlled or mild-moderate diabetes as reflected in a normal hemoglobin A1C ($<$7.0). A face-to-face questionnaire was administered to study participants to collect data on protective factors related to family cohesiveness and acculturation, demographic and socioeconomic variables, and cardiovascular risk factors.

Results: The results suggest that several variables were associated with severity of diabetes, including, receipt of food stamps, having spent childhood in Mexico, and current smoking status. Other variables representing acculturation and family cohesiveness, separately or combined, approached statistical significance.

Conclusions: Even though acculturation and family cohesiveness as schemas were not statistically significant because of small sample size, they highlight the importance of building more sophisticated models for testing their association with severity of diabetes. (*Ethn Dis.* 2006;16:452–459)

Key Words: Acculturation, Diabetes, Family Cohesiveness, Hispanics, Mexican Americans

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INTRODUCTION

Diabetes mellitus is one of the most prevalent chronic diseases in the United States, and it affects the Hispanic population disproportionately. The prevalence of type 2 diabetes among persons who are 45–75 years of age is three times higher in Hispanics than in non-Hispanic Whites.[1] According to the American Diabetes Association,[2] 2 million (8.2%) Hispanics age $\geq$20 years have diabetes. The public health burden of diabetes within the Hispanic population can increase with the growth of the Hispanic population in the United States. In particular, Hispanics are the fastest growing ethnic group in Texas, representing $>$35% of the total population. In Tarrant County, Texas, which includes the city of Fort Worth, the Hispanic community makes up nearly 21% of the population, an increase from 12% in 1990. A community study conducted in Fort Worth by the public health department showed that type 2 diabetes was the most prevalent chronic disease observed among Hispanic households, which suggests that the disproportionate burden of diabetes among Hispanics found at the national level is occurring at the local level.

Many long term and acute complications are associated with diabetes and

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can be reduced with effective management of diabetes and adequate medical care. Evidence suggests Hispanics are at particular risk of complications. Wu and colleagues demonstrate that Hispanics are at increased risk of developing retinopathy, hypertension, dyslipidemia, stroke, myocardial infarction, kidney disease, and amputations.[3] Chawla and colleagues assert that Hispanic patients who suffer from diabetes face difficulties in managing their condition, such as limited medication use and inadequate monitoring of blood glucose levels, pointing out that noncitizens are significantly less likely to have a usual source of health care.[4] Further, Hispanics are more likely to have higher rates of disability and death related to diabetes[5,6] and poorer health.

Multiple factors influence the prevalence and severity of diabetes among Hispanics in the United States. Genetics and heredity are often mentioned in attempting to explain causes of increased diabetes among Hispanics; however, acculturation and socioeconomic position appear to contribute to disparities in diabetes prevalence.[7] Influential factors such as low family cohesiveness

and high level of acculturation are negatively associated with health behaviors and health outcomes.[8,9] Studies relating family factors to diabetes are needed in the Hispanic population. The possible connection between severity of diabetes and family cohesiveness and acculturation is essential in planning and implementing interventions to improve diabetes control and management.

We describe the relationship between severity of diabetes and a series of hypothesized protective social factors related to family cohesiveness and acculturation, taking into account demographic and socioeconomic variables as well as cardiovascular risk factors in a sample of Mexican Americans with type 2 diabetes in Fort Worth, Texas. Hemoglobin A1C levels indicated diabetes severity. The study evaluated social factors related to family cohesiveness and acculturation as individual variables and as a combination of family cohesiveness and acculturation indices (or scales), in addition to assessing the impact of demographic variables (age, sex, marital status), socioeconomic position (employment status, household income, education, and receipt of food stamps), and cardiovascular risk factors (family history of diabetes, physical activity, smoking behavior, and BMI).

METHODS

This cross-sectional study was a project of the University of Texas Health Science Center at Fort Worth (UNTHSC) approved by the institutional review board of UNTHSC and the JPS Health System. Mexican Americans under treatment for type 2 diabetes (non-insulin dependent) were recruited at two medical clinics on the north side of Fort Worth, Texas, to participate in the study. Individuals were asked by their physicians to voluntarily participate in the study. Individuals with insulin-dependent di-

abetes and non-Hispanic individuals were excluded. A consecutive volunteer sample was drawn from the moment the study fieldwork was launched and continued until the end of the project. Recruitment of study participants and collection of the relevant data took place during a span of 24 months from December 2001 to December 2003. Data were obtained from a sample of 296 eligible study participants between the ages of 21 and 82 who had been treated for type 2 diabetes. Hemoglobin A1C levels were available from medical charts for 275 of the 296 eligible study participants. The 21 individuals excluded from the study because of missing data were comparable to the 275 individuals for whom data were available. Unfortunately because of time and logistic limitations, we could not reach the originally planned sample size to allow for an overall power of the sample of 80%.

Levels of hemoglobin A1C were used as a measure of diabetes severity because it is regarded as a reliable and objective measurement of blood glucose level. It captures an individual's blood glucose level and its fluctuations over a three-month period of time. For individuals with diabetes, a range between 4.0 and 6.9 indicates good control of blood glucose and levels ≥ 7.0 are considered high. In this study, individuals with a confirmed diagnosis of diabetes were classified into one of two categories of disease severity based on their hemoglobin A1C levels. Cases were defined as individuals with poorly controlled or severe diabetes based upon an abnormally high hemoglobin A1C (≥ 7.0). Controls were defined as individuals with well-controlled or mild-moderate diabetes as reflected in a normal hemoglobin A1C (< 7.0).[10–15]

A face-to-face questionnaire was administered to study participants to collect data on a series of protective and risk factors. The questionnaire comprised standardized questions to collect information on protective factors related

to family cohesiveness and acculturation as individual variables or as indices, demographic and socioeconomic variables, and cardiovascular risk factors. The demographic, socioeconomic, and cardiovascular risk factor questions employed in the questionnaire were previously used in the National Health and Nutrition Examination Surveys and in previous research studies, as were the questions representing the constructs of acculturation and family cohesiveness.[16–18]

Trained research assistants administered the questionnaire in an interview with study participants. In the course of the interview, study participants could refuse to answer any of the questions. The interview consisted of completion of the consent form, administration of the questionnaire, and provision of a $20 cash incentive in appreciation for their participation.

Data were obtained from questions related to five sets of predictor variables. The first two sets of variables reflected social and economic factors that were hypothesized to be related to diabetes severity. These variables included age, sex, marital status, employment status, spouse's employment status, household income, education, and receipt of food stamps. The third set of predictor variables represented cardiovascular risk factors. Although data were collected on a breadth of information related to smoking behaviors, physical activity, and family health history, the analysis described in this article focuses on whether study participants currently smoked, had a low or high level of physical activity, and had a family history of diabetes. Body mass index (BMI) was also calculated based on weight and height measurements collected. The last two sets of predictor variables were associated with the constructs of protective social factors as measured by acculturation (low level) and family cohesiveness (high level).[17,18] The variables representing acculturation included country of birth, country where spent childhood, country

in which attended school, nationality of friends, language preference in reading and speaking, years of residence in the United States, and feeling pride in Hispanic heritage. For family cohesiveness, the variables included frequency of family activity, frequency of family members discussing problems with each other, and how often family members feel close to each other.[18] The variables representing acculturation and family cohesiveness were evaluated individually and as combinations of the variables to represent indices of low to high level of acculturation and low to high level of family cohesiveness, respectively. Low levels of acculturation to US culture and high family cohesiveness were hypothesized to be protective factors for the purpose of the analysis.

The analytic plans included descriptive, univariate, stratified, and multivariate analyses to evaluate the association between the outcome variable (hemoglobin A1C) and each set of predictor variables. In the descriptive phase, frequencies were obtained for all variables. To conduct univariate analyses, continuous variables were categorized by using the median or other percentiles as cut-off points.[19] Cases were compared to controls with odds ratios as a measure of association. The exact 95% CI was calculated for the odds ratio, and the Fisher exact test was used to assess for the statistical significance of the association.[19,20] A comparison of each variable with each other was also carried out to find which were associated with the outcome and with each other as they may have confounding effects.[21] Stratified analyses were conducted by comparing cases to controls for exposure to each factor and stratifying by each potential confounder or effect modifier. The Mantel-Haenszel stratified odds ratio and 95% CI were calculated to assess potential confounding effects. The Breslow-Day test for homogeneity was conducted to assess if any significant interaction is present.[19,20] When a significant interaction was found,

multivariate analysis was conducted separately for each of the noninteracting categories of the variable in question.[21] Multiple logistic regression analysis was used to assess the association of each predictor variable and the outcome variable, namely severe diabetes, adjusting for possible confounders simultaneously (age, sex, and other socioeconomic factors).[21] The adjusted odds ratio was used as a measure of association along with its 95% CI.[19,20]

The strategy for analysis of variables related to the constructs of acculturation and family cohesiveness involved development of indices (to define combinations of low vs high; low acculturation and high family cohesiveness being the protective factors) in addition to investigating the individual effects of each variable. For each construct, individual variables and combinations of variables were tested to determine which better predicted diabetes severity. The combinations formed were based on previous work.[16–18] Several indices were developed for both acculturation and family cohesiveness. The acculturation index that best predicted diabetes severity included the following four variables: nationality of friends (Mexico 1, United States 2); language preference in reading (Spanish 1, English 2); language preference in speaking (Spanish 1, English 2); and country in which they attended school (Mexico 1, United States 2). The family cohesiveness index that best predicted diabetes severity included the following variables: how often the family has activities together (often 1, seldom 2); how often family members discuss problems together (often 1, seldom 2); and how often family members feel close to each other (often 1, seldom 2). Crude and adjusted odds ratios were computed to evaluate the effect of each individual variable and selected indices upon diabetes severity. Adjusted odds ratios were obtained by using Mantel-Haenszel stratified analysis and multiple logistic regression.

RESULTS

Data were analyzed for the 275 study participants for whom hemoglobin A1C data were available. Out of 275 participants, 194 were classified as persons with severe diabetes and 81 persons were classified as having nonsevere diabetes. Women made up 68% of the sample. The ages of study participants ranged from 21 to 82, the mean age was 52, and the mode age was 68. Twenty-eight percent of study participants were married, and 25% were employed. Approximately 18% of the sample received food stamps, and 13% had incomes ≤$5000 per year.

The body mass index (BMI) for the study population was 17–60 kg/m^2, and the mean BMI was 32 kg/m^2. More than 82% of study participants reported they had family members with diabetes. A total of 146 study participants reported having ever smoked, however, only 36 were currently smokers. Regarding level of physical activity, among those who responded 41% reported low levels, and 53% reported medium to high levels of physical activity.

All study participants were Mexican American (self-reported). The number of years lived in the United States ranged between 1 and 82, and the mean number of years residing in the United States was 30. Sixty-three percent of study participants reported their place of birth as Mexico, whereas, 32% of study participants reported their place of birth as the United States. Mexico was reported as the place where their childhood was spent among 68% of study participants. Fifty-two percent of study participants reported having attended school in Mexico, while 33% reported having attended school in the United States. Among the study participants who attended school in Mexico, 87% had <12 years of schooling, 5% had finished high school, and 8% had one year of college. Among those who attended school in the United States,

Table 1. Crude and adjusted odds ratios (95% CI) of severe diabetes by demographic and socioeconomic variables among Mexican American study participants attending two medical clinics in Fort Worth, Texas from December 2001 to December 2003

	Severe Diabetes		Non-Severe Diabetes			
	n	%	*n*	%	Crude OR (95% CI)	Adjusted OR (95% CI)*
Sex						
Female	126	65	61	73	.7 (.4–1.2)	.9 (.4–2.2)
Male	67	35	22	27	1	1
Age						
21–40	28	15	16	20	1	1
41–60	114	61	42	52	1.6 (.8–3.2)	1.8 (.4–4.8)
≥61	44	24	23	28	1.1 (.5–2.5)	1.6 (.4–5.6)
Marital status						
Married	54	28	25	30	.9 (.5–1.6)	.9(.5–1.7)
Unmarried	139	72	58	70	1	1
Currently employed						
Yes	44	23	26	31	.6 (.4–1.1)	.7 (.4–1.3)
No	148	77	57	69	1	1
Spouse employed						
Yes	69	44	34	52	.7 (.4–1.3)	.6 (.4–1.1)
No	89	56	32	48	1	1
Education						
Low (<6th grade)	116	60	44	53	1.4 (.8–2.3)	1.5 (.9–2.7)
High (>6th grade)	76	40	39	47	1	1
Income						
≤$5,000	23	15	13	18	1	1
$5,001–$10,000	54	35	24	33	1.3 (.6–2.9)	1.4 (.6–3.7)
$10,001–$15,000	42	27	22	31	1.1 (.5–2.6)	1.1 (.5–2.5)
≥$15,001	35	23	13	18	1.5 (.6–3.9)	1.5 (.6–3.0)
Receive food stamps						
Yes	44	23	7	8	3.2 (1.4–7.5)†	3.8 (1.5–9.6)†
No	149	77	76	92	1	1

* Adjusted odds ratio has been adjusted for age, sex, and individual confounders.
† Statistically significant.

76% had <12 years of schooling (19% of those reported having had no schooling), 21% had a high school diploma, 3% had some college, and 19% reported having had no schooling. Nearly 60% reported having mainly or exclusively Hispanic friends, while the remaining 40% reported that they have Hispanic and American friends. More than 50% of the sample reported Spanish as the language preference for reading and speaking.

Approximately 86% of study participants reported having activities with their families. Approximately 80% of study participants reported discussing problems with their families. Additionally, most (90%) study participants reported feeling close to their families.

Table 1 illustrates associations between diabetes severity and demographic and socioeconomic factors. An association was found between receiving food stamps and severity of diabetes. Those who receive food stamps were 3.8 times more likely to have severe diabetes (CI 1.5–9.6). No other association shown in Table 1 was statistically significant. Table 2 describes the association between CVD risk factors and diabetes severity. Respondents who reported currently smoking were 3.2 times more likely to have severe diabetes (CI 1.1–10.0). Family history of diabetes, level of physical activity, and BMI were not associated with severity of diabetes. Results of acculturation and family cohesiveness variables predicting severity of diabetes (as individual variables) are shown in Table 3. Having spent childhood in Mexico was the strongest variable associated with severity of diabetes. Having spent childhood in Mexico was associated with 20% more likelihood of having severe diabetes (CI 1.2–1.4). Other variables marginally statistically significant for predicting severity of diabetes included being educated in Mexico (OR 1.4, CI 1.0–2.5), preference for speaking Spanish (OR 1.7–CI 1.0, 3.0), and having been born in Mexico (OR 1.7, CI 1.0–3.0). Among the variables representing family cohesiveness, a low level of spending time together was shown to be borderline significant (OR 1.7, CI 1.0–2.9).

In Table 4, associations between diabetes severity and indices for family cohesiveness and acculturation are illustrated using previous analytical frameworks developed by Balcázar and colleagues.[8,17] These analytical frameworks were used in this study to contrast family cohesiveness with acculturation indices with and without stratification

Table 2. Crude and adjusted odds ratios (95% CI) of severe diabetes by cardiovascular disease risk factors among Mexican American study participants attending two medical clinics in Fort Worth, Texas from December 2001 to December 2003

	Severe Diabetes		Non-Severe Diabetes		Crude OR (95% CI)	Adjusted OR (95% CI)*
	n	%	*n*	%		
Family history of diabetes						
Yes	159	84	68	82	1.1 (.6–2.2)	1.1 (.5–2.4)
No	31	16	15	18	1	1
Physical activity						
Low	82	45	31	44	1.3 (.7–2.2)	1.1 (.6–2.0)
High	99	55	40	56	1	1
Currently smoking						
Yes	30	23	6	11	2.4 (.9–6.1)	3.2 (1.1–10.0)†
No	99	77	47	89	1	1
BMI‡						
Normal (<25.0)	27	15	9	11	1	1
Overweight (25.0–29.9)	61	33	27	34	1.4 (.6–3.7)	1.5 (.6–3.7)
Obese (≥30.0)	96	52	44	55	1.1 (.6–1.8)	1.1 (.6–2.1)

* Adjusted odds ratio has been adjusted for age, sex, and individual confounders.
† Statistically significant.
‡ BMI (body mass index)=weight/height^2.

Table 3. Crude and adjusted odds ratios (95% CI) of severe diabetes by acculturation and family cohesiveness variables among Mexican American study participants attending two medical clinics in Fort Worth, Texas, from December 2001 to December 2003

	Severe Diabetes		Non-Severe Diabetes		Crude OR (95% CI)	Adjusted OR (95% CI)*
	n	%	*n*	%		
Birthplace						
Mexico	124	67	50	63	1.2 (.7–2.1)	1.7 (1.0–3.0)
United States	60	33	30	38	1	1
Childhood place						
Mexico	137	71	51	61	1.5 (.9–2.6)	1.2 (1.1–1.4)†
United States	56	29	32	39	1	1
Education place						
Mexico	105	64	38	54	1.4 (.8–2.5)	1.4 (1.0–2.5)
United States	60	36	32	46	1	1
Nationality of friends						
Mexico	116	60	41	49	1.6 (.9–2.6)	1.2 (.9–1.6)
United States	76	40	42	51	1	1
Language preference-reading						
Spanish	112	60	41	51	1.4 (.9–2.4)	1.3 (.8–2.4)
English	76	40	40	49	1	1
Language preference-speaking						
Spanish	121	63	42	51	1.7 (1.0–2.8)	1.7 (1.0–3.0)
English	71	37	41	49	1	1
Family spends time together						
Low (seldom)	89	46	28	34	1.7 (1.0–2.9)	1.7 (1.0–2.9)
High (often)	103	54	55	66	1	1
Family discusses problems together						
Low (seldom)	94	49	41	49	1.0 (.6–1.6)	1.0 (.6–1.7)
High (often)	98	51	42	51	1	1
Family feels close with each other						
Low (seldom)	57	30	19	23	1.4 (.8–2.6)	1.5 (.9–2.7)
High (often)	135	70	64	77	1	1

* Adjusted odds ratio has been adjusted for age, sex, and individual confounders.
† Statistically significant.

Table 4. Crude and adjusted odds ratios (95% CI) of severe diabetes by acculturation and family cohesiveness indices among Mexican American study participants attending two medical clinics in Fort Worth, Texas, from December 2001 to December 2003

	Severe Diabetes		Non-Severe Diabetes		Crude OR (95% CI)	Adjusted OR (95% CI)*
	n	%	*n*	%		
Low family cohesiveness/high acculturation	70	43	24	34	1	1
Low family cohesiveness/low acculturation	5	3	2	3	.8 (.1–4.7)	.8 (.1–4.8)
High family cohesiveness/high acculturation	84	51	38	54	.7 (.4–1.3)	.7 (.4–1.3)
High/family cohesiveness/low acculturation	5	3	6	9	.2 (.0–1.0)	.3 (.0–1.0)
Low family cohesiveness/high acculturation	70	43	24	34	1.4 (.8–2.5)	1.4 (.8–2.5)
All other combinations of family cohesiveness and acculturation	94	57	46	66	1	1
Low level of education						
Low family cohesiveness/high acculturation	47	49	12	39	1.6 (.7–3.5)	1.5 (.7–3.5)
High family cohesiveness/low acculturation	48	51	19	61	1	1
High level of education						
Low family cohesiveness/high acculturation	23	33	12	31	1.1 (.5–2.6)	1.1 (.5–2.5)
High family cohesiveness/low acculturation	46	67	27	69	1	1

* Adjusted by age and sex.

of level of education. This analytical method has not been empirically tested in previous studies of acculturation and diabetes among Hispanics.[22] The results, although not statistically significant, are worth describing and were in the direction expected relative to the potential protective effect of low acculturation and high family cohesiveness. When the high family cohesiveness and low acculturation index was compared to the reference group (low family cohesiveness and high acculturation index), this protective index was marginally associated with the lowest likelihood to be classified as having severe diabetes (OR 0.2, CI .0–1.0). Stratification by level of education showed a statistically insignificant trend toward higher likelihood of having severe diabetes for those respondents who had low level of education and who reported low family cohesiveness and high level of acculturation.

DISCUSSION

The major interest of this study was to test the hypothesis associated with the protective effects of low acculturation and high family cohesiveness as important social constructs in addition to demographic, socioeconomic, and life-style risk factors influencing diabetes severity and control of the disease among Hispanics.[23–25] The results showed that a combination of factors including lifestyle behaviors, economic factors, and descriptors of acculturation level were related to severity of diabetes. Those who smoke were nearly three times more likely to have severe diabetes. Since most of population of this study fall in the highly acculturated category, the inference may be made that more acculturated Hispanics are more likely to smoke.[8,18] Additionally, those who received food stamps were nearly four times more likely to have severe diabetes. We must further explore how receiving public aid (food stamps) can have a role in affecting the severity of diabetes as an economic indicator of low socioeconomic status.

The findings of this study indicate childhood spent in Mexico was a statistically significant variable associated with diabetes severity. Preference for speaking Spanish and respondents who were born and educated in Mexico (variables associated with low acculturation status) were marginally associated with diabetes severity. The family variable "family spends time together" was also marginally significant. Unfortunately, we cannot establish how these descriptive traits of acculturation and family cohesiveness can be used to establish effective interventions to improve diabetes control in Hispanics of Mexican origin without further information. More complex relationships between acculturation and family cohesiveness as scales were explored in order to establish how protective factors could be associated with severity of diabetes beyond descriptive acculturation and family traits.[26–33]

Results of these more complex relationships with scales were not statistically significant, although trends were observed in the expected direction.[8,18] This study also found no significant associations with regard to education, however, whether low family cohesiveness and high acculturation have greater

The results [of this study] showed that a combination of factors including lifestyle behaviors, economic factors, and descriptors of acculturation level were related to severity of diabetes.

negative effects on the severity of diabetes among those respondents with low education (less than sixth grade) requires further testing. In this study, 160 respondents (58%) had less than sixth grade level of education. Level of education and its potential interaction with family cohesiveness and acculturation[9] must be further studied to develop a better understanding of how protective factors are affected by confounders such as level and place of education among Mexican Americans when addressing severity of diabetes.

Limitations of cross-sectional studies include the lack of ability to evaluate frequency of exposure to disease. Most patients in this study were overweight or obese (70%); however, we cannot say for sure that BMI contributed to the disease because temporality of the exposure and the outcome is difficult if not impossible to establish. The findings from this study have limited generalizability, since the population was not randomly selected and not representative of the Hispanic population of Fort Worth, Texas. Additionally, the two clinics where the study population was recruited from do not tend to treat highly acculturated Hispanics who are in middle or upper middle class; hence, the findings may not apply to other Hispanic populations. The sample size originally calculated for the study was 300 participants, but the final sample size was 296 participants; 275 of them had the outcome variable, and 70% had severe diabetes. These changes to the original planned sample size decreased the overall power of the sample from 80% to 67.5%.[34,35]

Another limitation is that during the interview many of the questions asked depended on respondents' recall, and some answers may have been inaccurate because of passage of time and a perceived pressure to give the proper answer. Several questions included choices in responses using the Lickert-type or multiple-choice scale, and respondents may feel confused or burdened by having

to answer them.[36] Finally, the study would have benefited from the inclusion of a control group composed of a non-diabetic sample of participants.

Scientific evidence suggests that some risk factors for diabetes, including obesity, and lifestyle factors such as physical activity, dietary patterns, cigarette smoking, and alcohol use,[2,32,37–46] are potentially modifiable. Future research must consider these modifiable factors in light of new and complex postulated relations between acculturation and family variables.

Including questions regarding history of disease in the interview asking respondents how long ago they had been diagnosed with type 2 diabetes, and whether they had the disease for an extended period of time before they were diagnosed, could provide an insight into any potential associations between severity of disease and long-term control. Also the interview could inquire about a patient's diabetes education and evaluate any possible links between patient education and awareness and severity of disease.[47–49]

In conclusion, improved management and control of diabetes, as well as other debilitating chronic diseases in Mexican Americans, are dependent on further research considering effects of change in Hispanic family relations and support, acculturation, socioeconomic factors including level of education, and genetic contributions to the health of Mexican Americans.

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