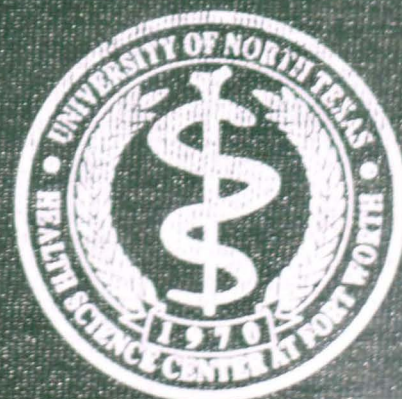




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Type 2 diabetes is prevalent among Mexican Americans. Tight glycemic control helps delay diabetic complications. This project aims to identify characteristics that contribute to poor glycemic control in this population. Mexican/Mexican American type 2 diabetics completed questionnaires measuring acculturation and psychosocial factors. This data was analyzed to assess the relationship of the factors and glycemic control as measured by HemoglobinA1C. Results demonstrated that subjects who felt that diabetes interfered with daily life and were dissatisfied with their physician's answers to diabetes questions had poor glycemic control. Significant differences between acculturation groups' responses to psychosocial measures were also found. Further studies may more accurately define the influence of acculturation on glycemic control in this population.

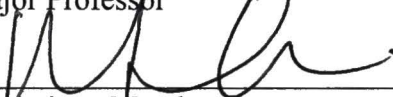
THE INFLUENCE OF ACCULTURATION AND PSYCHOSOCIAL FACTORS ON
GLYCEMIC CONTROL IN MEXICANS AND MEXICAN AMERICANS WITH
TYPE II DIABETES

Sarah Ross, B.S.

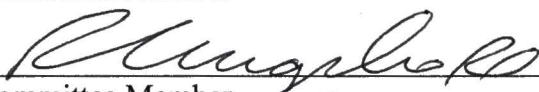
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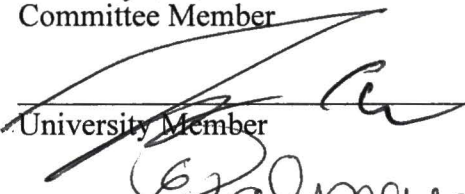
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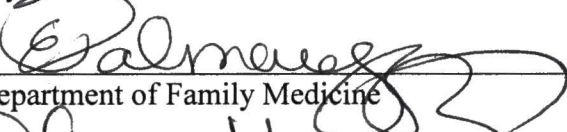
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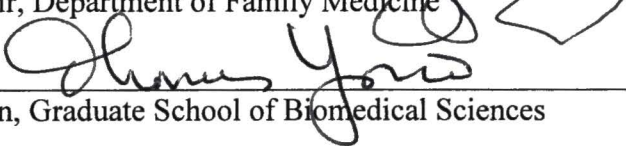
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THE INFLUENCE OF ACCULTURATION AND PSYCHOSOCIAL FACTORS ON
GLYCEMIC CONTROL IN MEXICANS AND MEXICAN AMERICANS WITH
TYPE II DIABETES

THESIS

Presented to the Graduate council of the
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By

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INTRODUCTION

Background

According to the American Diabetes Association, diabetes adversely affects the health of 20.8 million people in the United States, or 7% of the population.¹ It remains the leading cause of adult blindness, kidney failure, and non-traumatic lower extremity amputation; and significantly increases the risk of coronary artery disease, stroke, and peripheral vascular disease.² A significant number of deaths in the United States each year have been attributed to diabetes with 224,092 diabetes-related deaths in 2002.³ The prevalence of type 2 diabetes mellitus in the United States is highest among minorities.^{1, 4} Hispanics are the largest minority group in the United States, with almost two-thirds identified as Mexican Americans.⁵

In addition to increased prevalence, risk of diabetes complications, severity of hyperglycemia and mortality are higher in Mexican American diabetics when compared to non-Hispanic whites.⁶⁻⁸ Blood glucose monitoring is also lower in Mexican Americans compared with non-Hispanic whites and blacks.⁹ It is well known that proper self-management of diabetes leads to glycemic control, which helps prevent or prolong complications in diabetic patients.³ With the multitude of Mexican American diabetics requiring care, primary care physicians need a better understanding of factors that contribute to poor adherence and poor glycemic control in this population. Genetics, education, socioeconomic health disparities, lifestyle, environment and culture may all

affect diabetes self-management and control in Mexican Americans.¹⁰ Data from the Third National Health and Nutrition Examination Survey showed that in type 2 diabetics under 65 years of age who did not qualify for Medicare, only 66% of Mexican Americans had health insurance coverage, compared to 91% of Whites and 89% of blacks.¹¹ While some have reported no major differences between groups in access to a source of medical care,^{11, 12} others have shown that Mexican Americans were less likely to have a usual place of care or to have visited a physician in the past year.¹³ Additionally, Mexican Americans may be less educated and have lower income which correlate to decreased access to care.^{12, 13} While Mexican American patients may have a physician, they may not have the insurance or resources to pay for care. However, having money and access to medical care does not dictate adherence and good health. A study of type 2 diabetics showed no relationship between glycemic control and socioeconomic status or access to medical care in any racial or ethnic group.⁹

This study focuses on acculturation and psychosocial factors as they relate to diabetes self-care. The long term goal of this project is to provide information that will assist in the development of new programs or approaches for helping Mexicans and Mexican Americans with type 2 diabetes mellitus control their diabetes. The objective of this investigation is to identify the characteristics of Mexicans and Mexican Americans living with type 2 diabetes that contribute to poor glycemic control.

Patient adherence with diabetes self-management tasks

Achieving good control of diabetes, and thus decreasing the risk of diabetic complications, depends upon proper management by the physician and adherence to the treatment plan by the patient. Adherence with diabetes treatment plans continues to be a difficult issue in all patient groups and thus far studies have not shown any significant ethnic or racial differences in adherence to diabetes related tasks.¹⁰ Lack of resources is a key determinate of patient adherence, often affecting minority groups. The importance of patient education regarding diabetes, risk factors, prognosis and treatment options is well recognized, though educational programs alone have failed to produce long term positive outcomes.¹⁴ In addition, the search for successful management techniques for diabetic patients has begun to shift toward the evaluation of the patient-physician relationship, and the patient's health beliefs. This relationship may be affected by the level of acculturation of the patient. Acculturation, or adoption of mainstream culture, may affect adherence to medical treatment plans.^{15, 16}

The demands of managed care has put significant strain on the patient-physician relationship, driving the exploration and development of ancillary health services to help physicians better meet patient needs.¹⁷ The issues involved in the successful management of diabetes have begun to shift from the traditional, rigid concepts of physician-directed compliance to a more collaborative relationship between the patient and physician, an approach anticipated to lead to increased patient self-responsibility.¹⁵ The non-traditional approach of patient-centered care redefined the roles of physician and patient, so that the patient became the primary decision-maker working toward their own

established goal in collaboration with the physician as the partner in their care. However, patients have often had difficulty adhering to strict treatment recommendations,^{18, 19} thus increasing the likelihood of developing diabetes-related complications. For many patients, the demands of their regimen and the presence of diabetic complications interfered with daily activities and impacted quality of life. Given the complex nature of the disease and the variability in the capacity to cope with its ramifications on a daily basis, it is not surprising that widespread individual differences existed in psychosocial adaptation to diabetes. Researchers have measured wide variations across a range of psychological distress, varying abilities to follow prescribed treatment regimen, difficulties maintaining appropriate lifestyle changes and variability in maintaining a satisfactory quality of life.¹⁵ While having diabetes is psychologically stressful, studies have concluded that psychopathology and family dysfunction is no more common among diabetes as patients with other chronic conditions. However, diabetics are at risk for decreased physical and emotional well being secondary to poor adaptation.²⁰

The diabetes treatment regimen is generally multidimensional including medications, monitoring, and lifestyle changes.¹⁹ Because of the complexity and time demands poor adherence to diabetes regimen may not be unexpected and has been of special interest in diabetes research.²¹ However, there has been a growing realization that the study of adherence in diabetes presents several unique conceptual and methodological problems. For example, it has not always been possible to assess adherence because patients have not received explicit prescriptions but general instructions such as "try to exercise more." Diabetes research has shared similar characteristics with other chronic

illnesses. The problems of obtaining valid measures of self-care and behavior by necessity have often relied on self-reported data.²² Adherence is not directly measured in this study, but is inferred through assessment of glycemic control. Because the HbA1C level can be described as an 'average' blood glucose level over the previous 3 months it is a good measure of current glycemic control.²³ Assuming the patient is adequately managed and appropriately treated by their physician HbA1C is a good indirect measure of patient adherence with medication and self-management tasks.

Psychosocial Factors

Other reasons for non-adherence may be explained by social and psychological characteristics. The instrument used in this study, the Multidimensional Diabetes Questionnaire (MDQ), was specifically developed to measure variables influencing health perceptions and behaviors in diabetics. These variables include interference, social support, perceived severity, positive-reinforcing behaviors, misguided-reinforcing behaviors, self-efficacy, and outcome expectancies. These factors make up a complex interrelated network affecting patients' health status.

Interference of diabetes in the patient's daily life examines the social consequences of diabetes, such as preventing the patient from traveling or attending a party. Perceived severity of diabetes determines if the patient believes that diabetes has serious consequences to which he is susceptible. These two variables are closely related to quality of life and diabetics have reported lower quality of life compared to non-diabetics.²⁴ Studies have shown improved glycemic control with improved quality of life

as well as no relationship between the two.²⁴⁻²⁶ A potential problem with these two desirable goals is that patients may not perceive immediate benefits to improved glycemic control, making them less willing to follow complex diabetes regimens.²⁶ Having an active coping style has been shown to have a positive effect on glycemic control in diabetic patients, and self-efficacy can lead to improved quality of life.^{27, 28} The diagnosis of a chronic illness like diabetes is psychologically taxing and coping strategies, optimism, and confidence are needed to combat depression. Diabetics have been affected by depression and Latino patients whose diabetes caused decreased daily functioning were more depressed in one study.²⁹ However, positive outcome expectancies or hoping for the best in the face of chronic illness has been shown to decrease depression.³⁰ Psychosocial interventions have been shown to improve depression, with self-management interventions improving quality of life for diabetic patients.³¹

Social support is defined as the patient's perception of the amount of help received from family and friends to complete diabetes self-care responsibilities. The MDQ also addresses encouragement or hassling from patients' significant other. Positive-reinforcing behaviors encompass congratulations and encouragement while misguided-reinforcing behaviors refer to nagging and hassling about diabetes tasks. Many diabetes studies have examined social and family support. Abundant studies of children and adolescents with type 1 diabetes focus on the importance of support from parents. In adults with type 2 diabetes, family support is still an important mediator of patient adherence. Diabetic patients with a supportive family are less depressed, have

fewer emotional problems, and have a better time adapting to diabetes.^{29, 32} Family cohesion, flexibility and high marital satisfaction were correlated with good glycemic control in one study, though the relationship did not hold when controlling for duration of disease.³² A study of type 2 diabetics examining family environment found that patients with rigid control in their family had significantly lower scores of adherence to medication.³³ In a study of Hispanic diabetic patients, good family cohesiveness was associated with good diet and exercise.³⁴ Another study of older Hispanics with diabetes found that better family support and greater self-efficacy were associated with fewer perceived barriers to follow recommendations for diet and exercise.^{35, 36} Also, older Hispanics with diabetes living with family members in addition to a spouse had higher levels of self-care.³⁶ Interventions aimed at improving family support by educating family, and helping them cope with stress or diabetes related conflicts have had a positive effect on HbA1C, diabetes knowledge, and family climate.¹⁴

Regarding social support, some have reported social support as a determinant of adherence to medicine, diet, and exercise in type two diabetics,^{33, 37} while others have found no relationship to diabetes self-care tasks.³⁸ A study of insulin-dependant diabetics found that those with good social support had better health related quality of life.²⁷ Mexican American diabetics have shown significant gender differences with respect to perceived social support for diet, with men reporting more support than women.³⁹

Few studies have used more objective measures, such as HbA1C, but self-efficacy or confidence in ability to perform the medically recommended tasks or behaviors has

been shown to have a positive effect on HbA1C. A prospective study of Japanese diabetics examined psychosocial factors and HbA1C values at six and twelve months. They found that self-efficacy improved adherence, and adherence had a direct association with future HbA1C. Social support, diabetes-related distress, daily burden, and emotion-focused coping all influenced future HbA1C indirectly through self-efficacy.⁴⁰ Others have also found that self-efficacy had a significant positive association with adherence to diet, exercise, and blood glucose testing.³⁷ An empowerment-based psychosocial intervention for type 2 diabetics aimed at improving patient coping skills, motivation, and self-efficacy was modestly successful at improving HbA1C levels, and also had a favorable effect on quality of life scores.⁴¹ Another educational intervention aimed to improve self-care abilities specifically in Mexican American type 2 diabetics and showed improved HbA1C and improved adherence in the intervention group.⁴²

Outcome expectations are the patient's belief that a given behavior will lead to a specific outcome. A study of adult diabetics found that the variable outcome expectancies was only moderately correlated with self-care activities, but was strongly correlated with self-efficacy.³⁷ This implies that the patient who believes that adherence to diabetes regimen will lead to desired outcomes is likely to adhere, but only when he is confident in his ability to do so. Diabetics who lack confidence in their self-care abilities are unlikely to perform appropriate behaviors even when they believe that those behaviors will have positive health outcomes.

Acculturation Factors

Additional factors that have contributed to poor patient-physician understandings are culturally bound attitudes and belief systems about diabetes and its management.

Acculturation is defined as adoption of the behaviors, attitudes, and values of the mainstream or dominant culture by an immigrant ethnic minority.¹⁶ It is a complex variable dependant upon factors such as language, ethnic identity, time and number of generations living in the United States, ethnic interactions, and cultural exposure.

Adoption of and belief in culture specific values is a factor effecting acculturation that is important but difficult to measure and often not included in acculturation scales.^{16, 43} A major focus of acculturation research has been the study of differences between Mexican Americans and Anglo Americans. Cultural factors may have positive or negative impacts on patients' health. In Mexican Americans acculturation influences health in various ways, from decreased access to health services with lack of acculturation to changes in lifestyle that may come with increased acculturation.¹⁶ Moreover, acculturation is an important factor influencing patient adherence and the patient-doctor relationship among Hispanic patients.⁴⁴

Cultural factors influence patient perceptions and assumptions about illnesses, their causes and treatments, as well as when, where and from whom to seek help.⁴⁵ In Latinos, beliefs regarding diabetes are as varied as the population. Reported Latino beliefs for the causes of diabetes have ranged from being consistent with medical knowledge to abstract concepts such as *susto*, a phenomenon difficult to translate which can be described as emotional distress or fright.⁴⁶⁻⁴⁹ How cultural beliefs relate to

adherence is unclear. Regardless of medical accuracy, better cultural knowledge about diabetes causes has been linked with better diabetes control in Mexicans.⁴⁸ In another study, Mexican Americans with diabetes who described their own behavior as the cause of their diabetes did not rate themselves as more adherent.⁴⁶ Patients who strive for glycemic control still have difficulties being completely adherent and adapt their self-care to their life situations. A study of generally adherent Mexican Americans with type 2 diabetes mellitus probed for the reasons behind self adaptation of prescribed treatment plans. The factors identified include belief in the power of modern medicine, a desire to act and feel 'normal', the desire to avoid physical symptoms, and limited economic resources. These factors determined patients' daily decisions regarding self-care.⁵⁰

Acculturation in Mexican Americans with type 2 diabetes has been addressed through data from two major projects in addition to other studies. Data from the San Antonio Heart Study (1979 – 1982) showed that Mexican American men and women with increase acculturation had decreased prevalence of diabetes and obesity.⁵¹ While data from the Hispanic Health and Nutrition Examination Survey (1982 – 1984) showed that the prevalence of diabetes in Mexican Americans was significantly higher than non-Hispanic whites, acculturation among Mexican Americans had no effect on diabetes prevalence.⁵² Diabetes was associated with higher acculturation in a population of Mexican Americans in Arizona.⁵³ Two studies compared natives in Mexico City to Mexican Americans in Texas and found that diabetes was more prevalent among Texas residents who were also found to have less physical activity and more fat in their diet.^{54, 55} A study comparing Spanish speaking and English speaking patients with type 2 diabetes

found no relationship between language and glycemic control. However Spanish speaking patients were less like to be treated with insulin and less likely to understand their prescriptions.⁵⁶ In a different study, Spanish speaking Mexican American women were the least likely to check blood sugars at home, have their eyes checked, or loose weight compared to other groups.⁵⁷ Two studies of pregnant Hispanics have noted that the risk of gestational diabetes increases with increase acculturation.^{58, 59} Finally, a study of Mexican Americans that included HbA1C and acculturation measurements reported no statistically significant correlation.³⁹

Acculturation and diabetes has also been examined in other minorities. In a study of Native Americans in Canada the non-acculturated group showed the lowest prevalence of diabetes and the lowest HbA1C levels compared with more acculturated tribes.⁶⁰ Conversely, lack of acculturation was associated with increased prevalence of diabetes in Arab Americans.⁶¹

Research regarding the relationship between factors contributing to Mexican American acculturation and medical conditions other than diabetes has also been conflicting. With respect to heart disease US-born Spanish speaking patients have an increased 10 year mortality risk when compared to US-born English speaking patients and Mexico-born patients.⁶² Both US-raised and Mexico-raised Mexican Americans have worse cardiovascular risk profiles than non-Hispanic whites.⁶³ According to the San Antonio Heart Study US-born diabetic Mexican Americans had a 66% greater risk of all-cause mortality and a 66% greater risk of cardiovascular mortality than non-Hispanic whites with diabetes. Mexico-born diabetics had similar all cause and cardiovascular

mortality compared to Whites.⁶⁴ However, another study of stroke patients found no significant ethnic differences between Mexican Americans and non-Hispanic whites for other atherosclerosis and cardiovascular risk factors.¹² In a study of Hispanics in Dallas those with middle to high levels of acculturation were at greatest risk for hypertension.⁶⁵

Studies have described increased prevalence of obesity and inactivity⁶⁶⁻⁶⁹ as well as better diet and exercise habits^{51, 67, 70} among acculturated Mexican Americans. Other researchers comparing acculturation factors and obesity or physical activity have had inconclusive results.^{71, 72} One study of data from the San Antonio Heart Study and the Mexico City Diabetes Study estimated that the increase in obesity accounts for approximately 28% of the increase in the incidence of diabetes in Mexican Americans compared with Mexicans.⁷³ Being more acculturated was associated with eating fewer servings of fruits and vegetables per day among Mexican Americans by two separate studies.^{74, 75} In addition, Mexico-born individuals were shown to consume significantly less fat and significantly more fiber, vitamins, and minerals than did those born in the United States, regardless of language spoken.⁷⁶

Acculturation has notably been studied as it relates to various health conditions. However, limited research has examined the effects of acculturation factors on diabetes prevalence and none on diabetes control. This project will examine acculturation and various psychosocial factors as they relate to glycemic control in Mexicans and Mexican Americans. The goal is to identify the characteristics that contribute to poor adherence and poor glycemic control in this population.

Specific Aims

- 1) *To determine the relationship between acculturation factors and glycemic control among Mexicans and Mexican Americans with type 2 diabetes.* I hypothesize that higher acculturation scores will correlate with poor glycemic control.

- 2) *To determine the relationship between various psychosocial factors and glycemic control among Mexican Americans with type 2 diabetes.* The psychosocial factors include: interference, social support, severity, positive-reinforcing behaviors, misguided-reinforcing behaviors, self-efficacy, and outcome expectancies. I hypothesize that negative responses, for example expectance of poor outcomes, low self-efficacy, or perceptions of increased interference and severity, will correlate with poor glycemic control. In addition, I hypothesize that patients lacking social and family support will demonstrate poor glycemic control.

METHODS

Study Design

The University of North Texas Health Science Center as well as John Peter Smith Hospital Institutional Review Boards both approved this study. This observational cross-sectional study included 66 subjects. Hispanic/Latino adults of Mexican ancestry with a diagnosis of type 2 diabetes mellitus for at least one year were recruited from several Tarrant County clinics between July 2004 and July 2006. Exclusion criteria included, children less than 18 years of age, type 1 diabetics, and Hispanic/Latino patients of non-Mexican (i.e., Puerto Rican, Guatemalan, etc.) ancestry. Subjects were screened when they presented for their routine medical appointments. Once consent was obtained, participants completed validated surveys and medical chart audits were performed. Subjects had the option of conducting the interview in either Spanish or English. The survey instruments include a demographic questionnaire, a patient satisfaction questionnaire, the General Acculturation Index⁷⁷ and the Multidimensional Diabetes Questionnaire.⁷⁸ Glycemic control was measured using the most recent Hemoglobin A1C (HbA1C) value from patients' medical charts.

Dependent Variable

Hemoglobin A1C is a recognized measure of glycemic control and the American Diabetes Association's recommendation for target HbA1C in diabetics is <7.0%. Studies show that patients who achieve glycemic control or HbA1C <7.0% are unlikely to

develop long term microvascular complications. The non-diabetic range for HbA1C is 4.0-6.0%.²³ In this study the mean HbA1C was 8.0%. A mean division was used to create two groups for clinical comparison: poor glycemic control (HbA1C > 8.0%) and glycemic control (HbA1C ≤ 8.0%).

Independent Variables

Acculturation – Acculturation was measured using the General Acculturation Index (GAI), a five question survey which addresses five factors contributing to acculturation. The variables from the GAI include primary language spoken, primary language read, primary developmental sociocultural environment (PSE) of their country of origin, ethnicity of friends, and pride in ethnicity. Each factor is measured on a scale of 1-5 where lower scores correlate with a lesser degree of adaptation or acculturation to Anglo society. To obtain the GAI score, the answers are summed and divided by five. The acculturation measure used in this study is a bidimensional acculturation model allowing for biculturalism. The scale is able to differentiate five types of Mexican Americans based on level of acculturation. The General Acculturation Index was developed by Balcazar et al and had a Cronbach's reliability of $\alpha = 0.82$.^{43, 77} While the GAI is able to distinguish five types of Mexican Americans, the scores from the sample in this study lent themselves to three groups. These groups are labeled high, medium and low acculturation. None of the subjects in this study fell into category of "very anglicized" (GAI score of 5), and many were "bicultural". For purposes of interpretation the groups can be labeled very Mexican (low), Mexican-oriented bicultural (medium),

and Anglo-oriented bicultural (high). The five acculturation variables had bimodal distributions and a median division created a high and low acculturation group for analysis of individual acculturation variables.

Diabetes Beliefs and Perceptions – The Multidimensional Diabetes Questionnaire (MDQ) was used to assess personal beliefs and perceptions about diabetes.⁷⁸ The MDQ is a 41 item questionnaire divided into three sections. Section I measured perceived interference of diabetes with daily life, perceived severity of diabetes condition, and social support. Responses were recorded on a scale of 0-6 (0: not at all – 6: extremely). Cronbach's alphas for interference, severity, and social support were 0.91, 0.82, and 0.77 respectively. Section II assessed social incentives from patients' spouse or significant other related to patients' self-care activities. The scales include misguided-reinforcing behaviors (the extent to which a significant other hassles about diabetes self-management) and positive-reinforcing behaviors from a significant other, also measured on a scale of 0-6 (0: never – 6: all the time). Cronbach's alphas for section II were 0.88 and 0.70 respectively. Section III included two subscales that assessed diabetes related self-efficacy and outcome expectancies. Self-efficacy measured patients' confidence in self-care ability and was scored from 0: not at all confident to 100: very confident. Outcome expectancies measured patients' belief in effectiveness of self-care activities at achieving glycemic control and preventing complications. It was also scored from 0: not at all important to 100: very important. Cronbach's alphas for the two subscales in Section II were 0.89 and 0.86 respectively.

Patient Satisfaction – A Likert-scaled patient satisfaction questionnaire was also used. This questionnaire measured how often the patient (1) feels that their doctor listens to them (2) follows their doctors recommendations for diet and (3) exercise, (4) feels as healthy as others their same age, (5) feels comfortable attending their medical appointments, and (6) feels that their questions about diabetes are answered in a way they can understand. The answer options for each question are: never, rarely, sometimes, mostly, or all the time.

Covariates

A demographic questionnaire was used to obtain additional information. The demographic questionnaire includes age, gender, education, diabetes complications, family history of diabetes, years since diagnosis of diabetes, and frequency of physician visits and exercise. It also asks if the patient prays regularly or consults a *Naturista/Curandero*.

Statistical procedures

Descriptive statistical analysis was performed for continuous variables and percentages for categorical variables. Because almost all variables in this small dataset had a significant Kolmogorov-Smirnov test for normalcy, non-parametric statistical tests were used. A correlation matrix was constructed using a 1-tailed Spearman's Rho correlation. Only those variables that were significantly correlated with the General

Acculturation Index score were subjected to one-way analysis of variance by ranks using the Kruskal-Wallis test (the non-parametric alternative to the one-way ANOVA). Linear regression analysis was also performed using the low HbA1C group ($\leq 8.0\%$) as the referent group. All analyses were conducted at a statistical level of significance of 0.05. SPSS 14.0 was used for all analyses.

RESULTS

Demographic and Clinical Characteristics

Of the 79 eligible patients who were invited to participate, 66 (84%) gave written informed consent and completed the questionnaire; of the patients who declined participation all gave time constraints as their reason and would have otherwise participated. Table 1 shows the demographic and clinical characteristics of the 66 study participants. The mean age of participants was 61 years of age (SD: 11.5); the youngest was 32 years old and the oldest was 87 years old. Their mean duration of diabetes was 13.0 (SD: 5.2) years. The HbA1C levels ranged from 5.1 to 13.1% with a mean of 8.0% (SD: 1.7). HbA1C levels were not available for 2 of the 66 subjects. With respect to the General Acculturation Index score, 20 (30.3%) are categorized at high acculturation, with 20 (30.3%) at medium acculturation, and 26 (39.4%) at low acculturation. All of the 26 subjects in the low acculturation group were born and raised in Mexico. Of the 66 participants 44 (67%) had a spouse or significant other. Section II of the MDQ contains questions pertaining to support from the patients spouse or significant other and therefore N = 44 for the Section II variables (misguided-reinforcing behaviors and positive-reinforcing behaviors).

Correlation Matrix of Variables

HbA1C showed a significant correlation with four factors from the MDQ: interference ($r: 0.27; p<0.05$), severity ($r: 0.24; p<0.05$), misguided-reinforcing behaviors ($r: 0.31; p<0.05$), and self-efficacy ($r: -0.22; p<0.05$). HbA1C was positively correlated with number of complications due to diabetes ($r: 0.38; p<0.01$). HbA1C was also positively correlated with frequency of physician visits ($r: 0.26; p<0.05$). One of the patient satisfaction questions, patient feels questions are answered, was significantly negatively correlated with HbA1C ($r: -0.33; p<0.01$). The General Acculturation Index (GAI) score correlated significantly with misguided-reinforcing behaviors ($r: 0.35; p<0.01$), outcome expectancies ($r: -0.24; p<0.05$), patient follows recommendations for diet ($r: -0.21; p<0.05$), and patient feels questions are answered ($r: -0.34; p<0.01$). Figure 1 illustrates the significant associations that GAI score and HbA1C had in common. Significant correlations between the individual acculturation factors and the psychosocial factors related to HbA1C were also found and are outlined in Table 2. Additional significant correlations were found between MDQ and other variables, but are not reported here.

Analysis of variance

The two variables that were significantly correlated with both GAI score and HbA1C were subjected to one-way analysis of variance by ranks using the Kruskal-Wallis test. This test found a significant difference between mean ranks for high, medium and low acculturation groups with respect to misguided-reinforcing behavior (Chi-Square: 6.55; $p < 0.05$) and patient feels questions are answered (Chi-Square: 8.47; $p < 0.01$). Results are found in Table 3.

Logistic Regression Analysis

Table 4 shows the univariate regression analyses performed for each of the survey measures with HbA1C as the dependant variable. The reference categories for categorical variables are marked. Patients with poor glycemic control ($\text{HbA1C} > 8.0\%$) were compared to the group with good glycemic control ($\text{HbA1C} \leq 8.0\%$). Gender, number of diabetes complications, interference and patient feels questions are answered, were the variables that had a statistically significant influence on HbA1C ($p < 0.05$). Males were almost four times as likely as females to have poor glycemic control (OR: 3.93; CI: 1.36-11.29). Subjects who reported that diabetes interferes more with their daily life were more likely to be in the poor glycemic control group (OR: 1.40; CI: 1.05-1.87). Subjects with more diabetes complications were also more likely to be poorly controlled (OR: 1.81; CI: 1.10-2.95). Subjects who reported that their questions were satisfactorily answered were more likely to be well controlled (OR: 0.44; CI: 0.19-1.00). Patients with a higher GAI score were more likely to be in the poor glycemic control

group, though the result was not statistically significant (OR: 1.32; CI: 0.80-2.17). GAI score (continuous) and variables with $p \leq 0.20$ on univariate analysis were included in the multivariate model. Education was also included in the multivariate analysis as it is known to affect patient adherence.¹⁴ Results of the multivariate regression analysis are found in Table 5. Odds ratios were similar though the four variables found to be statistically significant predictors in univariate analysis lost their significance in the multivariate model.

DISCUSSION

In this study, the relationship between acculturation and glycemic control in Mexican and Mexican American diabetics was investigated. No significant correlation was found between General Acculturation Index (GAI) score measuring Mexican American acculturation and Hemoglobin A1C (HbA1C). Additionally, analyses of the acculturation variables individually did not show any relationship with HbA1C. This is consistent with two studies that specifically compared acculturation or language ability in Mexican American diabetics to HbA1C with inconclusive results.^{39, 56} Past studies comparing acculturation with diabetes prevalence in Latinos have mostly shown that acculturation has a negative effect, increasing diabetes among the more acculturated.^{53-55, 58, 59} The study reporting the opposite may be considered outdated as the data was collected from 1979 – 1982.⁵¹ Though acculturation was not directly correlated with glycemic control in this study, GAI scores and HbA1C have in common significant association with other key variables. Significant correlation are presented in a flow diagram (Figure 1) that illustrates the potential connection that acculturation may have in influencing glycemic control pathways associating acculturation with HbA1C.

Results indicate that Mexicans living in the United States and Mexican Americans who are less acculturated or more Mexican are more likely to feel that their questions are adequately answered. This finding is surprising considering the likely language barrier. Of the 26 subjects in the low acculturation group 20 reported that they could not speak any English. Perhaps because of the language barrier, patients' physicians take extra

measures to ensure that the patient understands instructions. Because of the extra effort that must be taken on the part of the physician team to communicate adequately, the report of satisfaction with answers to questions may reflect the patients' gratitude for the effort taken to accommodate them. Diabetics whose questions about diabetes are answered in a way that they can understand have better glycemic control. This pathway supports my hypothesis that Mexicans or Mexican Americans with low acculturation have better glycemic control. The result that subject scores for this scale were significantly different between the three acculturation groups (Table 3) helps validate these intriguing conclusions. Table 2 illustrates the acculturation factors that contribute to the relationship between GAI score and patient feels questions are answered. Four of the five acculturation factors including primary language spoken, primary language read, county of origin, and ethnicity of friends were also significantly correlated with patient feels questions are answered.

An interesting relationship was found surrounding the measure of misguided-reinforcing behavior. More acculturated subjects were more likely to report that their significant other hassles them about their diabetes self-care tasks. This hassling appears to have a negative effect on glycemic control, as those who report more hassling were more likely to have a high HbA1C. These relationships were not seen with the second variable for social incentives or positive-reinforcing behaviors. Though none of the correlations between GAI score or acculturation factors were significant all were a negative correlation, indicating that acculturated individuals may receive less encouragement in addition to more hassling from their significant other. However,

positive or encouraging behavior from a significant other did not have any positive effects on glycemic control. Moreover, misguided-reinforcing behavior was not found to be a significant predictor of HbA1C on odds ratio analysis. The relationship between misguided-reinforcing behaviors and acculturation was confirmed as the scores were significantly different between the three acculturation groups (Table 3). The acculturation factors that are important to the relationship between GAI score and misguided-reinforcing behaviors include primary language spoken, primary language read, and country of origin (Table 2). Ethnicity of friends was not significantly related to misguided-reinforcing behaviors, which is intuitive as associations with friends are separate from relationship with a spouse. Consistent with a previous study, this study also found gender differences with respect to support with women reporting lower scores for both misguided-reinforcing behavior and positive-reinforcing behavior compared to men (results not shown).³⁹

Table 2 illustrates additional associations pathways between individual acculturation factors and psychosocial factors related to HbA1C. With respect to primary language spoken, Spanish speakers reported increased interferences and increased severity of diabetes. Diabetics with higher scores for interferences and severity of diabetes were more likely to be poorly controlled, which contradicts my hypothesis that high acculturation correlates with poor control. Patients whose primary language read was English and who were born and raised in the United States reported visiting their physician more frequently, perhaps indicating that they have increased resources compared to foreign born patients who cannot read English. Country of origin was also

associated with self-efficacy with patients from Mexico reporting more confidence in their self-care abilities when compared with Mexican Americans born and raised in the United States.

The correlation found between acculturation and outcome expectancies may conflict with past findings. Patients who were more Mexican had higher expectations for the success of their diabetes related tasks. In other words they expressed more faith in modern medicine than their anglicized counterparts. This is interesting considering the articles reporting that some Mexicans and Mexican Americans have cultural beliefs regarding diabetes that conflict with modern medicine.^{46, 48}

This study also aimed to determine the relationship between various psychosocial factors and glycemic control in Mexican Americans. Several basic correlations were found, and four significant predictors of HbA1C were found. Patients reporting high perceived severity of diabetes may have an accurate perception as severity and number of diabetic complications were both related to high HbA1C. Patients with more diabetic complications were twice as likely to have poor glycemic control, which is precisely what good glycemic control aims to prevent. Those with poor glycemic control report more frequent physician visits, which may be secondary to more complications experienced by these patients. Patients who exhibit poor glycemic control feel that diabetes interferes with daily life almost 1.5 times more than patients with adequate glycemic control. Furthermore, men are 4 times more likely than women to have poor glycemic control.

Results of this study also demonstrate that as patients feel less satisfied with the feedback given by physicians, the more severe they perceive their diabetes to be and the

less likely they are to follow physician recommendations for diet to improve their health status. Furthermore, results show that patients who have poor glycemic control are half as likely to feel that their questions about their diabetes are adequately answered by their physician. Thus, it appears that the very patients who most need the information necessary for improved self-management are not adequately accessing it from their health care provider, and that higher acculturation makes them feel less satisfied with the information they are receiving. The correlation between high self-efficacy and glycemic control has been confirmed in other studies.^{40, 41} Patients who have confidence in their ability to follow their diabetes regimen are more likely to adhere.

A cultural confounder that may have affected these results is a Latino-specific factor called *simpatía*. *Simpatía* refers to maintenance of a pleasant demeanor, avoiding conflict, encouraging positive interactions, and being agreeable.⁷⁹ In this study the low acculturation group of Mexican/Mexican Americans had higher scores for measure of satisfaction in questions answered by their physician. This may be a display of *simpatía*, meaning that the Mexican patients may have reported being satisfied for the sake of pleasing the interviewer rather than reporting true feelings. This variable may also be responsible for the low score on misguided-reinforcing behaviors in Mexican patients who may not wish to share or admit to negative behavior from their spouse.

In conclusion, the results of this study suggest that acculturation was indirectly related to poor glycemic control in Mexican and Mexican American type 2 diabetics. Psychosocial factors related to perceptions, support and self-care were both directly and indirectly related to glycemic control. Perceived interference of diabetes in daily life was

a significant predictor of poor glycemic control. Moreover, these results highlight the importance of adequate communication between the physician and the patient as patient dissatisfaction can contribute to poor glycemic control. Interventions that assist Mexican American patients with adaptation to the complex diabetes regimen and reinforce self-efficacy, as well interventions that allow and encourage physicians to adequately address patient concerns may be helpful for improving long-term glycemic control in these type 2 diabetes patients.

Study Limitations – Limitations to this study include the small size and homogeneity of the sample population, potentially resulting in the non-significance of some of the results. While non-parametric statistics were appropriately used, these tests are less powerful. Potential confounding factors such as co-morbidities, socioeconomic status, and access to health care were not collected. Other limitations include the self-reported nature of the data collected and patients' understanding of the questions asked. As our study population is a clinic population results may not be generalizable to the general Mexican American population. Clinic patients may have better glycemic control, greater access to health care, or be more acculturated. Results involving the variable misguided-reinforcing behaviors are limited by the lower number of participating subjects that had significant others and were able to respond to the survey question. Correlations found with individual acculturation factors that were not found with GAI score alone are difficult to interpret, but may indicate associations with GAI score that would exist with a greater sample size.

Future Research – Future studies should more closely investigate misguided-reinforcing behaviors in relation to acculturation, diabetes severity, and self-management practices. This aspect of social support may have negative consequences. As men were more likely to have poorly controlled diabetes, future studies should further explore possible gender differences in acculturation factors as related to diabetes management and disease perception. Larger studies in Mexican American diabetics will assist in clarifying the relationship between acculturation and diabetic health status. Examining clinical measures in addition to HbA1C, such as blood pressure and cholesterol goals for diabetics would be appropriate. Moreover, studies that include education, health insurance, access to care, and socioeconomic status may be able to more accurately determine the relationship between acculturation and glycemic control.

APPENDIX
TABLES AND FIGURE

Table 1a. Population demographics		
N=66	n	%
<i>Gender</i>		
Males	27	40.9
Females	39	59.1
<i>Frequency of physician visits</i>		
Monthly	15	23.1
Every 3 months	41	63.1
Twice a year	9	13.8
<i>Frequency of exercise</i>		
Daily	28	43.1
Three times a week	10	15.4
Twice a week	4	6.2
Once per week	9	13.8
Never	14	21.5
<i>Consult a Naturista/Curandero</i>		
Yes	1	1.6
No	63	98.4
<i>Pray Regularly</i>		
Yes	58	87.9
No	8	12.1
<i>HbA1C (N=64)</i>		
Low ($\leq 8.0\%$)	37	57.8
High ($> 8.0\%$)	27	42.2

Table 1a. Population demographics cont.		
N=66	n	%
HbA1C (N=64)	8.0	1.7
General Acculturation Index Score^a	2.4	1.0
Age (yrs)	61	11.5
Years of education	6.3	4.5
Years since diagnosis of diabetes	13.0	9.2
Number of people living at home	3.0	1.7
Number of diabetes complications	1.1	1.2
Number of family members with diabetes	1.3	0.5
Pt. feels doctor listens^a	4.8	0.5
Pt. follows rec for diet^a	3.9	1.1
Pt. follows rec for exercise^a	3.5	1.2
Pt. feels as healthy as others same age^a	2.9	1.4
Pt. feels comfortable at med. apts.^a	4.8	0.6
Pt. feels questions answered^a	4.6	0.7
Interference*	2.5	1.8
Severity*	3.6	2.0
Social Support*	4.9	1.3
Positive-reinforcing behavior* (N=44)	4.3	1.7
Misguided-reinforcing behavior* (N=44)	2.0	2.2
Self-efficacy⁺	72.3	17.5
Outcome expectancies⁺	95.1	6.9
^a scale of 1-5, *scale of 0-6, ⁺ scale of 0-100		

Table 1b. ACCULTURATION FACTORS		
N=66	n	%
<i>Primary Language Spoken</i>		
Predominately Spanish	34	51.5
English or Both	32	48.5
<i>Primary Language Read</i>		
Predominately Spanish	29	47.5
English or Both	32	52.5
<i>Country of Origin</i>		
Predominately Mexico	27	40.9
Predominately USA	39	59.1
<i>Ethnicity of Friends</i>		
Predominately Hispanic	34	51.5
Non-Hispanic or Both	32	48.5
<i>Pride in Ethnicity</i>		
Very Proud	40	61.5
Less Proud	25	38.5
<i>General Acculturation Index Score</i>		
Low	26	39.4
Medium	20	30.3
High	20	30.3

Table 2 Spearman's Rho Correlations with Acculturation

Psychosocial and other factors correlated with HbA1C	HbA1C	General Acculturation Index Score	Primary Language Spoken	Primary Language Read	Country of Origin	Ethnicity of Friends	Pride in Ethnicity
Diabetes interference in daily life	0.27*	—	-0.28*	—	—	-0.22*	—
Perceived severity of diabetes	0.24*	—	-0.32**	—	—	—	—
Misguided-reinforcing behavior	0.31*	0.35**	0.38**	0.48**	0.36**	—	—
Self-efficacy in diabetes care	-0.22*	—	—	—	-0.22**	—	—
Frequency of physician visits	0.26*	—	—	0.24*	0.25*	—	—
Patient feels questions are answered	-0.33**	-0.34**	-0.24*	-0.31**	-0.31**	-0.27*	—
Number of diabetes complications	0.38**	—	—	—	—	—	—

— no significant correlation, * $p < 0.05$, ** $p < 0.01$

Table 3. Kruskal-Wallis Analysis of Variance	<i>Misguided-reinforcing behavior (N=44)</i>			<i>Pt. feels questions answered (N=66)</i>		
<i>General Acculturation Index Score</i>	N	Mean Rank	<i>p</i>	N	Mean Rank	<i>p</i>
<i>High</i>	20	17.28	0.04	26	37.92	0.01
<i>Medium</i>	14	27.25		20	35.60	
<i>Low</i>	10	26.30		20	25.65	

Table 4. Univariate Regression Analyses predicting glycemic control according to Mexican/Mexican American's characteristics, with HbA1C $\leq$ 8.0% as the Referent Group

	Odds Ratio	95% CI	p
Gender			
Male	3.93	1.36–11.29	0.01
Female ^a	—	—	—
Frequency of physician visits			
Monthly	6.30	0.93–42.73	0.06
Every 3 months	2.33	0.43–12.70	0.33
Twice a year ^a	—	—	—
Pray Regularly			
Yes	1.95	0.35–10.92	0.45
No ^a	—	—	—
Primary Language Spoken			
Predominately Spanish	0.71	0.26–1.92	0.50
English or Both ^a	—	—	—
Primary Language Read			
Predominately Spanish	0.80	0.28–2.26	0.67
English or Both ^a	—	—	—
Country of Origin			
Predominately Mexico	0.65	0.24–1.78	0.40
Predominately USA ^a	—	—	—
Ethnicity of Friends			
Predominately Hispanic	0.92	0.34–2.47	0.92
Non-Hispanic or Both ^a	—	—	—
General Acculturation Index Score			
Low	0.42	0.12–1.45	0.17
Medium	0.53	0.15–1.94	0.34
High ^a	—	—	—
General Acculturation Index Score	1.32	0.80–2.17	0.29
Age	0.98	0.94–1.03	0.40

^areference category

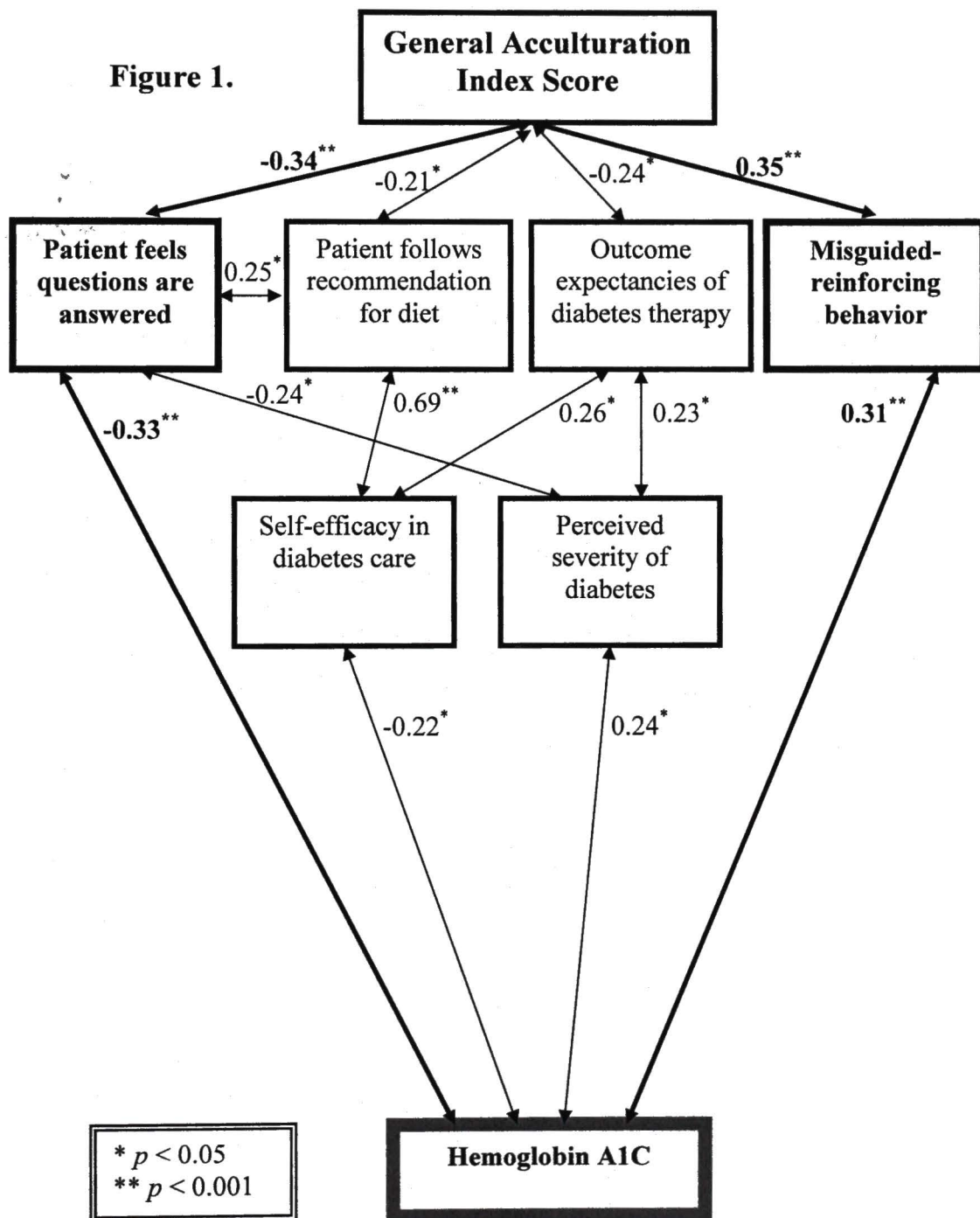
Table 4. Univariate Regression Analyses predicting glycemic control according to Mexican/Mexican American's characteristics, with HbA1C $\leq$ 8.0% as the Referent Group cont.

	Odds Ratio	95% CI	<i>p</i>
<i>Pt. feels doctor listens</i>	0.62	0.24–1.59	0.32
<i>Pt. follows rec for diet</i>	0.90	0.58–1.41	0.65
<i>Pt. follows rec for exercise</i>	0.73	0.48–1.13	0.16
<i>Pt. feels as healthy as others same age</i>	0.94	0.65–1.36	0.73
<i>Pt. feels comfortable at med. apts.</i>	0.71	0.30–1.64	0.42
<i>Pt. feels questions answered</i>	0.44	0.19–1.00	0.05
<i>Interference</i>	1.40	1.05–1.87	0.02
<i>Severity</i>	1.32	0.99–1.75	0.06
<i>Social Support</i>	1.05	0.70–1.57	0.83
<i>Positive-reinforcing behavior</i>	1.28	0.83–1.97	0.27
<i>Misguided-reinforcing behavior</i>	1.30	0.97–1.74	0.08
<i>Self-efficacy</i>	0.98	0.95–1.01	0.17
<i>Outcome expectancies</i>	0.98	0.91–1.06	0.61
<i>Years of education</i>	0.96	0.85–1.08	0.47
<i>Years since diagnosis of diabetes</i>	1.04	0.99–1.11	0.13
<i>Number of people living at home</i>	0.85	0.63–1.17	0.32
<i>Number of diabetes complications</i>	1.81	1.10–2.95	0.02
<i>Number of family members with diabetes</i>	1.14	0.39–3.31	0.82

Table 5. Multivariate Regression Analyses predicting glycemic control according to Mexican/Mexican American's characteristics, with HbA1C ≤ 8.0% as the Referent Group

	Odds Ratio	95% CI	p
Gender			
Male	3.86	0.65–22.96	0.14
Female ^a	—	—	—
General Acculturation Index Score	1.28	0.37–4.44	0.70
Pt. follows rec for exercise	0.91	0.49–1.68	0.76
Pt. feels questions answered	0.69	0.19–2.55	0.57
Interference	0.87	0.44–1.74	0.70
Severity	1.27	0.68–2.37	0.46
Misguided-reinforcing behavior	1.21	0.82–1.79	0.35
Self-efficacy	0.98	0.93–1.03	0.33
Years of education	0.98	0.75–1.26	0.85
Years since diagnosis of diabetes	0.97	0.87–1.09	0.62
Number of diabetes complications	1.10	0.42–2.89	0.85
^a reference category			

Figure 1.



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