ACCULTURATION AND THE PREVALENCE OF DIABETES IN ADULT LATINOS: NHANES 2007-2010

A THESIS
Submitted to
the Temple University Graduate Board

In Partial Fulfillment
of the Requirements for the Degree
MASTERS OF SCIENCE

By

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August 2013

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ABSTRACT

Background: Latinos are disproportionately affected by diabetes. Studies examining acculturation and diabetes prevalence among Latinos have used diverse operational definitions of acculturation and have reported conflicting results.

Objective: To examine the association between two acculturation measures—country of birth and predominant language spoken—with the prevalence of diabetes mellitus (DM) in adult U.S. Latinos.

Methods: We used data from the 2007-2008 and 2009-2010 National Health and Nutrition Examination Surveys , including Latinos aged 20-80 years old (n=3,214). We examined the association of country of origin (U.S.-born vs. non-U.S.-born) and predominant language spoken (English vs. Spanish) with diabetes. Covariates included in logistic regression analysis included, age, education, income, marital status, and BMI.

Results: After adjusting for age, education, income, and marital status, Latinos born in the United States and those speaking English as their predominant language demonstrated greater odds of having diabetes than their foreign-born and Spanish-speaking counterparts (OR 1.42, 95% CI 1.05-1.93 and OR 1.35, 95% CI 1.06-1.74, respectively). This positive association between acculturation and diabetes prevalence was mediated in part by body mass index.

Conclusion: Latinos with high levels of acculturation—defined by country of birth and predominant language spoken—have an increased risk of diabetes compared to those with low levels of acculturation. Further research should explore the complex underlying processes that explain differences in the odds of DM by acculturation status. Our findings may inform clinicians and public health professionals in implementing interventions to prevent diabetes in U.S. Latinos, who are at high-risk for this disease.

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CHAPTER 1
INTRODUCTION

Studies examining acculturation and diabetes prevalence among Latinos have used diverse operational definitions of acculturation and have reported conflicting results. (Mainous, Diaz, Saxena, & Geesey, 2007; Pérez-Escamilla, 2007). Differences in acculturation measures stem largely from the data sources used and the survey questions researchers consider proxies for acculturation—a complex process by which individuals of one culture adopt the attitudes, beliefs, values, and behaviors of another culture. The primary objective of our study is to use the most current national data to examine the association between two acculturation measures—country of birth and predominant language spoken—and the prevalence of diabetes mellitus (DM) in U.S. Latino adults. Our secondary aim is to determine to what extent this association may be mediated by body mass index. Our final objective is to explore whether the relationship between these acculturation measures and DM differs by ancestry (Mexican-American vs. non Mexican-American) and sex.

CHAPTER 2
BACKGROUND

Latinos in the United States have a higher lifetime risk of developing diabetes than any other racial or ethnic group (Narayan, Boyle, Thompson, Sorensen, Williamson, 2003). Using data from the National Health and Nutrition Examination Survey, the estimated prevalence of diabetes among Mexican-American adults—the largest subgroup of U.S. Latinos—is 20%, which is higher than that of non-Hispanic whites (11%) or blacks (19%) (Cowie et al., 2009). The prevalence of diabetes in the U.S. is expected to increase almost 200% over the next 40 years (Narayan, Boyle, Geiss, Saaddine, & Thompson, 2006), and this growing epidemic will continue to disproportionately affect Latinos (Mainous et al., 2007). The magnitude of the diabetes burden in U.S. Latinos, combined with this population's rapid growth (US Census, 2010, 2012), underscores the public health relevance of exploring factors related to diabetes risk in Latinos.

Acculturation has been broadly defined as a process whereby individuals from one culture adopt the behaviors, attitudes, and values of the prevailing culture in which they reside (Rogler, Cortes, & Malgady, 1991). Acculturation has been measured using validated instruments that explore this construct in-depth (Marin, Sabogal, Marin, Otero-Sabogal, & Perez-Stable, 1987), in addition to using widely available survey questions that serve as proxies for this complex sociological process. Country of birth and primary spoken language are common proxy measures that have been widely used in national studies exploring the relationship between acculturation and diabetes in Latinos (Keiffer, Martin, 1999; Mainous et al., 2006; Sundquist, 1999). Other studies on this topic have included either more in-depth survey measures of acculturation (Hazuda, 1988) or other proxy measures, such as years of U.S. residence (Kandula, , Diez-Roux, Chan, Daviglus, Jackson, Ni, & Schreiner, 2008) . The existing literature exploring acculturation and diabetes in Latinos have reported conflicting results, which in part stems from differences in the ways researchers have defined acculturation.

Some studies using data from diverse sources have reported a positive association between acculturation and diabetes. A cross-sectional analysis of data from the Multi-Ethnic Study of Atherosclerosis reported that higher levels of acculturation—measured by a composite score including nativity, language spoken at home, and years living in the U.S.—were associated with a greater prevalence of diabetes in non–Mexican-origin Latinos (Kandula, Diez-Roux,Chan, Daviglus, Jackson, Ni, & Schreiner, 2008). The same association was not found among Mexican-American Latinos in this study. Using data from the California Health Interview Survey, Rodriguez et al. also found a positive association between diabetes and acculturation in Latinos, as measured by years of U.S. residence (Rodriguez, Hicks, & López, 2012). Another cross-sectional analysis of the nationally-representative National Health Interview Survey data found a positive association between diabetes and years living in the United States among all immigrants, the majority of whom were Latinos (Oza-Frank, Stephenson, & Narayan, 2011).

Other studies have found either negative associations between acculturation and diabetes, or no association. The San Antonio Heart Study, which included only Mexican-Americans in Texas, found a lower prevalence of diabetes among the most acculturated participants compared to the least acculturated (Hazuda, 1988). This study assessed acculturation by three scales measuring the following constructs: functional integration with mainstream society, value placed on preserving Mexican culture, and attitudes toward traditional family and gender roles. The observed negative association between acculturation and diabetes was only significant for the functional integration measure. Using nationally-representative data from the National Health and Nutrition Examination Survey (NHANES), Sundquist et al. reported a higher prevalence of diabetes in Spanish-speaking, U.S.-born Mexican Americans than in English-speaking, U.S.-born Mexican Americans or those born in Mexico. However, these differences were not significant (Sundquist & Winkleby, 2000). Similarly, a study from the nationally-representative Hispanic Health and Nutrition Examination Survey found no significant differences in the prevalence of diabetes among Mexican Americans by language preference (Harris, 1991). Using more recent data from NHANES, Garcia et al. examined the prevalence of diabetes by acculturation status among Mexican-Americans, measured by nativity and primary language as proxies. This study found the highest diabetes prevalence among U.S.-born, English-speaking Latinos; but the lower prevalence of diabetes in those who spoke Spanish and were born in Mexico was not significantly different from the reference group (Garcia, Gold, Wang , Yang , Mao, 2012).

We examined the association between acculturation and diabetes among Latinos using two common acculturation proxies: country of birth and predominant spoken language. We explored this primary research question using the latest publicly-available NHANES data, which includes greater numbers of non Mexican-American Latinos beginning in

2007 (CDC, 2012a). This national sample of Latinos, therefore, includes a more diverse Latino population than previous NHANES studies on the topic. As a secondary objective, we sought to determine if the association between acculturation and diabetes in Latinos is mediated by body mass index. We also sought to examine if the primary relationship under study differed by ancestry (Mexican American vs. non Mexican American) or sex.

CHAPTER 3
METHODS

Dataset

We conducted a cross-sectional analysis of the National Health and Nutrition Examination Survey (NHANES) 2007-2010 data. NHANES is a program of studies designed to assess the health and nutritional status of a nationally representative sample of about 5,000 persons each year (children and adults). Children, adults, and households provided interview and examination consent forms. Interviews include demographic, socioeconomic, dietary, and health-related questions. Examinations consist of medical, dental, and physiological measurements, as well as laboratory tests. We merged interview and examination data for all participants within two survey epochs (2007-2008 and 2009-2010), and then appended the two merged datasets to include all participants from 2007-2010.

Participant Selection

From a total number of 20,686 NHANES participants during survey years 2007-2010, we included 3,214 Latinos aged 20-80 years Individuals with missing data for the acculturation variables were deleted: country of birth (n=4) and spoken language (n=3). We also excluded participants with missing data for our dependent variable, diabetes prevalence (n= 253). This accounted for 7% of the sample, which is below the threshold of ≤ 10% proposed by NHANES to impute missing data (CDC, 2012a). Our final analytic sample included 3,214 adult Latinos.

Definition of Variables

Dependent variable for diabetes prevalence

We derived our dependent binary variable for diabetes (DM) from participant responses to the question: "{Other than during pregnancy, {have you has SP}/{Have you/Has SP}} ever been told by a doctor or health professional that {you have/{he/she/SP} has} diabetes or sugar diabetes?" and their glycosylated hemoglobin (HbA1c) which measures the average level of blood glucose over the previous 3 months. A diagnosis of DM was defined by either of the following scenarios: 1) an answer of "yes" to the question above with any HbA1c value or missing data for HbA1c (i.e. diagnosed diabetes, n=445); or 2) an answer of "no" to the question above with an HbA1c value ≥ 6.5% (i.e. undiagnosed diabetes, n=134). We considered all other participants to not have diabetes.

Acculturation variables

Our binary variable for country of birth was derived from the following question: "In what country were you born?" Those who responded "Born in 50 US States or Washington, DC" were considered U.S. born, and those who reported being born in Puerto Rico, Mexico, other Spanish speaking country, or other non Spanish-speaking country (n=1) were considered foreign born. Our binary variable for predominant spoken language was based on the question: "What language(s) do you usually speak at home?" This question had the following response options: 1) Only Spanish; 2) More Spanish than English; 3) Both equally; 4) More English than Spanish; and 5) Only English. Participants who responded "Only English," "More English than Spanish," or "Both equally" were considered English speakers. We considered as Spanish-speakers those who responded "Only Spanish" or "More Spanish than English."

Covariates

We also examined seven characteristics of participants that might be related to both acculturation and diabetes. These characteristics, which were considered potential confounders, mediators, or effect modifiers, included the following: ancestry (Mexican-American vs. non Mexican-American), age, sex, educational attainment, household income (expressed as an income-to-poverty ratio), marital status, and body mass index (BMI). Participants' income-to-poverty ratio was calculated by dividing their annual household income by the federal poverty level, and was categorized into the following data-derived strata: ≤0.8, 0.81-1.33, 1.34-2.5, ≥2.51. An additional category "Missing" was created for participants missing income data (N=444). Educational attainment was defined by following categories that were derived from their distribution in the study population: < 9th grade, 9-11th grade, high school, and more than high school. Participants' body mass index (BMI) was calculated based on their measured weight and height (kg/m^2), and participants were grouped into the following categories, normal ($BMI<25\ kg/m^2$), overweight ($25\text{-}29.9\ kg/m^2$), and obese ($\geq 30\ kg/m^2$) (CDC, 2012b) .

Data analysis

All analyses were conducted using Stata SE, version 12.1 (College Station, Texas). For all statistical testing, we used Stata survey commands, which adjust variance estimates to account for the complex sample design of the NHANES (CDC, 2012a). We first used descriptive statistics characterize study cohort with respect to the outcome (diabetes), the primary predictor variables (nativity and predominant spoken language), and the covariates. We used chi-square tests to examine the bivariate association between all independent variables and the prevalence of diabetes. Chi-square tests were also used to examine the bivariate association between our acculturation measures (nativity and predominant spoken language) and the covariates. Using separate logistic regression models for each acculturation measure, we calculated the odds of participants having diabetes. These odds were adjusted in two successive models, adding groups of potentially confounding variables to the unadjusted model: Model 1 (Age); and Model 2 (Socioeconomic status; Model 1 + educational attainment, household income, and marital status). These socioeconomic variables were conceptually related and made *a priori*. We added these groups of covariates into successive models to demonstrate their impact on the association between our acculturation measures and diabetes. In a mediation analysis, we included BMI categories in Model 3 to determine the extent to which BMI mediates the primary relationship under study. All covariates were included in multivariate models as they appear in Table 1.

Motivated by existing literature on diabetes and acculturation in Latinos (Kandula, Diez-Roux, , Chan, Daviglus,Jackson, Ni, & Schreiner, 2008; Khan, Sobal, & Martorell, 1997; Sundquist & Winkleby, 2000), we conducted logistic regression models stratified by ancestry (Mexican American vs. non Mexican American) and sex. These models were adjusted for age and the socioeconomic variables described above. We included interaction terms representing the product of our acculturation measures and these potential effect modifiers in fully adjusted models. Our study protocol was deemed exempt from review by the Temple University Institutional Review Board.

CHAPTER 4
RESULTS

Overall, the crude prevalence of diabetes in our cohort was 12.2%. The majority of study participants were foreign born, spoke Spanish as their predominant language, and were of Mexican ancestry (Table 1). Over half of the study cohort was aged less than 40 years old, and one-third achieved more than a high school education. Over one third of our study population was obese (Table 1). There were no statistically significant ($p > .05$) bivariate associations between our acculturation variables (country of birth and predominant spoken language) and diabetes (Table 2). Bivariate analysis demonstrated strong associations between diabetes and the following participant characteristics: age, educational attainment, marital status, and BMI (Table 2). The following participant characteristics were significantly associated with both country of birth and predominant spoken language: age, educational attainment, , marital status, and BMI (Table 3). Older participants were less likely to be acculturated (U.S. born or predominantly English speaking), but were more likely to have DM; those with higher educational attainment were more likely to be acculturated, but less likely to have DM.

Unadjusted logistic regression models revealed no significant association between our acculturation measures and diabetes (Table 4). After adjusting for age and socioeconomic status, the positive association between acculturation measures and diabetes was significant (OR 1.42, 95% CI 1.05-1.93 for nativity; OR 1.35, 95% CI 1.06-1.74 for predominant language). Our mediation analysis adding BMI into fully adjusted models (Table 4, Model 3) revealed an attenuated association between acculturation measures and diabetes, suggesting that BMI partially mediates the primary relationship under study. Table 5 shows results from fully adjusted logistic regression models stratified by ancestry (Mexican American vs. non Mexican American) and sex to examine these factors as potential effect modifiers of the association between acculturation and diabetes. Although sex-stratified models reveal a stronger association between acculturation and diabetes in women than men, the sex*acculturation interaction terms were not statistically significant (data not shown). The ancestry*acculturation interaction was also not statistically significant in fully adjusted models (data not shown).

CHAPTER 5
DISCUSSION

We found a significant association between acculturation and diabetes in U.S. Latinos only after adjusting for age, educational attainment, household income, and marital status. Age and educational attainment were the primary covariates driving the positive confounding of the relationship between acculturation and diabetes in our fully adjusted models. The odds of having diabetes among U.S.-born vs. foreign-born Latinos and English-speaking vs. Spanish-speaking Latinos were not significant in bivariate analyses. Body mass index mediated the adjusted association between our exposures and outcome, at least in part. Our fully adjusted models stratified by ancestry and sex revealed that these factors do not moderate the relationship between acculturation and diabetes in U.S. Latinos.

The greatest strength of our study is that it uses the most recent national sample of U.S. Latinos, which includes larger numbers of non Mexican Americans than previous waves of NHANES. In contrast to many previous studies examining the association between acculturation and diabetes in Latinos, we classified individuals without doctor diagnosed diabetes who had a hemoglobin HBA1C value ≥6.5 as having previously undiagnosed diabetes—an approach that has been added to the traditional methods of fasting plasma glucose (FPG) and oral glucose tolerance testing (OGTT) for diagnosing diabetes (ADA, 2012). Those with undiagnosed diabetes constituted almost one-quarter of our sample with diabetes, suggesting that previous studies that could not capture undiagnosed diabetes for lack of participant biomarker data may have been biased by misclassification.

The cross-sectional nature of our analysis hinders the ability to draw causal inferences about the relationship between acculturation and diabetes. Our use of HBA1C as the sole diagnostic criterion for previously undiagnosed diabetes prevents us from comparing our prevalence estimates with previous studies that used FPG and/or OGTT. Our use of two proxy measures for acculturation represents a limited definition of a very complicated construct. Our data did not allow us to capture cognitive, emotional, or spiritual factors that are part of the acculturation process. Previous waves of NHANES included more questions related to acculturation that we could not include here, again limiting our ability to compare our results to those of previous NHANES studies. Previous studies using other data sources operationalized acculturation in even more diverse ways, which poses a challenge to situating our findings within the larger body of evidence on the topic.

Our study adds further evidence to an existing literature that reports a positive association between acculturation and diabetes in U.S. Latinos (Kandula, Diez-Roux, Chan, Daviglus, Jackson, Ni, & Schreiner, 2008; Oza-Frank et al., 2011; Rodriguez et al., 2012). The significant positive association we observed between acculturation measures and diabetes only emerged after adjusting for confounders, which implies a less robust association than one also seen in bivariate analysis. Indeed, our adjustment for confounders may in part explain the discrepancy between our findings and those reported in other studies on the topic. One study reporting a negative association between acculturation and diabetes in Latinos adjusted only for age but not educational attainment (Hazuda, 1988). Another study that reported no association between acculturation and diabetes in a national sample of Latinos did not perform multivariate analysis (Harris, 1991). Because age and educational attainment were the two main drivers of the confounding that rendered our positive association significant, excluding these factors may contribute to conflicting results.

The discrepancy between our findings and those of other NHANES studies on the same topic likely stem from different operational definitions of the exposure and outcome, or from their inclusion of only Mexican Americans (Garcia, Gold, Wang, Yang, Mao, 2012; Mainous et al., 2006; Sundquist & Winkleby, 2000) . Another possibility for conflicting reports of the association between acculturation and diabetes relates to the epoch in which this relationship was assessed. Previous studies examining this same research question date back to the 1980s, when the prevalence of diabetes and risk factors for the disease (e.g. obesity) were much lower in Mexico and other Latin American countries (Aschner, 2002; Burke, Williams, Haffner, Villalpando, & Stern, 2001; Danaei et al., 2011; Stern et al., 1992). It is possible, therefore, that the relationship between acculturation and diabetes in U.S. Latinos is dynamic, as the prevalence of obesity and diabetes increase throughout Latin America and impact foreign-born Latinos before emigrating from their home countries.

Previous studies have suggested that acculturation may affect women differently than men and Mexican Americans differently than other Latino subgroups (Kandula, Diez-Roux, Chan, Daviglus, Jackson, Ni, & Schreiner, 2008; Khan et al., 1997; Sundquist & Winkleby, 2000). As a result, we conducted multivariate analyses of the association between acculturation and diabetes separately by sex and ancestry. Our study found no significant difference in the relationship between acculturation and diabetes by either of these factors. Although our study population included larger numbers of non Mexican Americans than previous waves of NHANES, we still may have lacked adequate statistical power to test the interaction between acculturation and ancestry in our sample. Similar to previous studies (Khan et al., 1997; Sundquist & Winkleby, 2000), our sex stratified analyses revealed differences in the acculturation-diabetes relationship between women and men, but these differences were not statistically significant. Consistent with the two previous studies examining mediation by body mass index (BMI), we also found BMI to mediate the association between acculturation and diabetes (Hazuda, 1988; Kandula, Diez-Roux, Chan, Daviglus, Jackson, Ni, & Schreiner, 2008).

CHAPTER 6
CONCLUSIONS

The positive association we observed between acculturation and diabetes in U.S. Latinos may have implications for practice and policy. Clinicians caring for Latinos may consider performing more frequent diabetes screening and more intensive lifestyle counseling among Latinos with low levels of acculturation who have not yet developed diabetes. Our principal finding may also motivate clinicians to explore their Latino patients' acculturation experiences in an effort to inform their lifestyle counseling efforts and prevent diabetes in this high risk population. Given the positive association between acculturation and diabetes in Latinos, policymakers may consider expanding this population's options for insurance coverage. Granting Latinos with low levels of acculturation greater access to the U.S. healthcare system may provide clinical opportunities to prevent diabetes that would otherwise be unavailable.

Future research should include larger, more diverse samples of Latinos to explore similar research questions around acculturation and diabetes in this growing population. A recent study revealed significant heterogeneity in diabetes risk among Latino subgroups (Daviglus et al., 2012), which may in part stem from how these groups experience acculturation in the United States. Longitudinal studies would help determine if there is a causal relationship between acculturation and diabetes. Large survey studies should include validated instruments to measure acculturation, which would facilitate interpretation of study findings and facilitate comparisons among existing studies. Qualitative research exploring Latinos' acculturation narratives may provide an important complement to studies analyzing secondary data. Understanding the social context that surrounds acculturation and diabetes in U.S. Latinos may provide unique insights into how to prevent diabetes in this population.

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Table 1. Characteristics of adult U.S. Latinos, NHANES 2007-2010

Characteristics	N (%)[a]
All	3,214 (100)
Diabetes[b]	
Yes	579 (12.2)
No	2,635 (87.8)
Birth country	
U.S.	1,112 (36.0)
Non-U.S.	2,102 (64.0)
Predominant language	
English	1,337(43.1)
Spanish	1,877(56.9)
Ancestry	
Mexican	2,020 (63.2)
Non-Mexican	1,194 (36.8)
Age, years	
20-29	612 (26.6)
30-39	579 (25.8)
40-49	598 (21.5)
50-59	531 (12.8)
>60	894 (13.3)
Sex	
Male	1,496 (51.1)
Female	1,718 (48.9)
Education	
<9th grade	990 (26.0)
9th-11th grade	626 (20.7)
High school	611 (20.8)
>High school	979 (32.5)
Household income	
≤0.80	607 (20.3)
0.81-1.33	635 (19.5)
1.34-2.50	774 (24.9)
≥2.51	754 (22.9)
Missing[c]	444 (12.4)
Marital status	
Married	2,030 (63.9)
Widow/divorced/separated	687 (16.8)
Never married	496 (19.3)
Body mass index, kg/m^2	
≤25.0	678 (22.9)
25-25.9	1,234 (38.8)
≥30	1,257 (38.3)

TABLE 1, cont.

[a] Unweighted sample size and weighted percentage. Where unweighted sample size for a characteristic is < 3,214, subjects are missing data on that characteristic.

[b] Definition of diabetes includes both doctor diagnosed diabetes and undiagnosed diabetes (i.e. not doctor diagnosed and found to have HBA1C ≥6.5)

[c] Because of the large proportion missing data on this variable, analysis that adjust for this variable contain a dummy variable for this in the category of "missing data."

Table 2. Prevalence of diabetes by subject characteristics among adult U.S. Latinos, NHANES 2007-2010

Characteristic	Diabetes, %[a]	P-value[b]
Country of Birth		0.75
U.S.	12.6	
Non-U.S.	12.0	
Predominant language		0.50
English	11.7	
Spanish	12.6	
Ancestry		0.39
Mexican	12.6	
Non-Mexican	11.6	
Age, years		<.001
20-29	1.7	
30-39	4.5	
40-49	10.5	
50-59	27.6	
>60	36.1	
Sex		0.96
Male	12.2	
Female	12.2	
Education		<.001
<9th grade	18.5	
9th-11th grade	11.5	
High school	8.8	
>High school	9.7	
Household income[c]		0.20
≤0.80	10.0	
0.81-1.33	14.7	
1.34-2.50	11.8	
≥2.51	11.7	
Missing	13.7	
Marital status		<.001
Married	12.0	
Widow/divorced/separated	19.5	
Never married	6.7	
Body mass index, kg/m^2		<.001
≤25.0	4.4	
25-25.9	9.4	
≥30	19.3	

TABLE 2, cont.

[a] Weighted percentage of participants with diabetes in each strata of participant characteristic

[b] P-values are for the difference in diabetes prevalence across strata of the participant characteristic

[c] Household income was calculated by dividing participants' annual household income by the federal poverty level.

Table 3. Prevalence of being U.S. born and speaking predominantly English by subject characteristics among adult U.S. Latinos, NHANES 2007-2010

	U.S. Born, %[a]	P value[b]	English Speaking, %[a]	P value[b]
Ancestry		0.02		0.30
Mexican	39.7		41.6	
Non-Mexican	30.5		45.8	
Age, years		< .001		0.002
20-29	46.7		51.6	
30-39	35.1		43.1	
40-49	26.6		38.0	
50-59	33.1		38.9	
>60	36.5		38.4	
Sex				
Male	35.0	0.12	41.1	0.04
Female	37.6		45.2	
Education		< .001		< .001
<9th grade	10.1		11.4	
9th-11th grade	33.9		39.4	
High school	45.2		51.8	
>High school	52.9		65.4	
Household income[c]		< .001		< .001
≤0.80	31.5		33.9	
0.81-1.33	27.2		28.7	
1.34-2.50	34.6		43.4	
≥2.51	56.7		71.4	
Missing	24.2		28.1	
Marital status		< 0.001		0.008
Married	33.1		40.8	
Widow/divorced/separated	39.0		44.1	
Never married	44.6		49.8	
Body mass index, kg/m^2		< 0.001		0.003
≤25.0	36.2		44.6	
25-25.9	31.1		37.8	
≥30	41.7		47.7	

a All percentages are weighted

b P-values are for the difference in U.S.-born and English-speaking status across strata of the participant characteristic

c Household income was calculated by dividing participants' annual household income by the federal poverty level.

Table 4. Odds of diabetes among adult U.S. Latinos associated with markers of acculturation, NHANES 2007-2010[a]

	Unadjusted OR (95% CI)	Model 1[b] OR (95% CI)	Model 2[c] OR (95% CI)	Model 3[d] OR (95% CI)
Country of Birth				
Non-U.S.	1.0	1.0	1.0	1.0
U.S.	1.05 (0.77-1.43)	1.22 (0.90-1.65)	1.42 (1.05-1.93)	1.35 (1.00-1.83)
Predominant language				
Spanish	1.0	1.0	1.0	1.0
English	0.91 (0.69-1.20)	1.10 (0.87-1.39)	1.35 (1.06-1.74)	1.27 (0.97-1.67)

[a] Separate models examining two acculturation markers—birth country and predominant language. Each model contains only one acculturation measure as the primary independent variable.

[b] Adjusted for age

[c] Adjusted for age, educational attainment, household income, and marital status

[d] Adjusted for age, educational attainment, household income, marital status, and body mass index

Table 5. Adjusted odds of diabetes among adult U.S. Latinos associated with markers of acculturation by Mexican ancestry and sex, NHANES 2007-2010[a]

	Ancestry		Sex	
	Mexican Americans	**Non Mexican Americans**	**Male**	**Female**
Country of Birth				
Non-U.S.	1.0	1.0	1.0	1.0
U.S.	1.42 (1.07-1.89)	1.50 (0.79-2.83)	1.16 (0.79-1.71)	1.84 (1.28-2.65)
Predominant language				
Spanish	1.0	1.0	1.0	1.0
English	1.43 (1.01-2.01)	1.27 (0.93-1.75)	1.21 (0.84-1.75)	1.57 (1.12-2.20)

[a] Separate models examining two acculturation markers—birth country and predominant language. Each model contains only one acculturation measure as the primary independent variable and is adjusted for age, education, income, and marital status.

APPENDIX A
IRB EXEMPTION

Appendix A. IRB Exemption

Chad Pettengill <tud53748@temple.edu>   Mar 12
to Victor

Thanks for the synopsis. Your activity is not considered human subjects research because you are not using private identiable information (please refer to the attd worksheet). Consequently, an IRB app is not required.

thanks for contacting us,
Chad

...

forms question   Inbox x

Victor Alos <victor.alos@temple.edu>   Mar 11
to irb

I am a graduate student (MS epidemiology) currently taking the first 3 out of 6 credits of my thesis, Please let me know which forms do I need. My research involves analyzing publicly available data sets from the National Health and Nutrition Examination Survey. A description of my proposed study is provided below.

Thank you,
Victor Alos

The purpose of this study is to estimate the prevalence of diabetes among US Latinos by citizenship status. Mexican and non-Mexican Americans diabetes prevalence will be analyzed by citizenship status. A cross-sectional design study involving publicly available data sets from the National Health and Nutrition Examination Survey (NHANES 2007-2010) will be used. Persons twenty years and over will be included in the analysis of NHANES data. Subjects characteristics will be summarized as well as covariates such as citizenship status (yes, no), age, gender, poverty levels, years living in the US, country of birth and language spoken at home.

Continuous data on Hemoglobin A1c levels will be used to establish response variables non-diabetes, pre-diabetes, and diabetes categories. The following subject characteristics will be tabulated against exposure, i.e., citizenship status: age, gender, smoking, years living in the US, place of birth (US, non-US), and language spoken at home. Subjects' characteristics (age, gender), diabetes category, and citizenship status will be summarized in a table format. Three regression models will be presented to demonstrate the relationship between citizenship and diabetes, citizenship and diabetes controlled by covariates such as age, gender, smoking, years living in the US, and language spoken at home. Statistical tests will be done to identify confounders and mediators. Limitation of the study will be described. Implications of the study finding will be presented with emphasis on current legislation addressing health insurance coverage.

APPENDIX B
DATA ELEMENT LIST

Appendix B. Data element list

```
              storage  display     value
variable name   type   format      label      variable label
-------------------------------------------------------------------------------------------
seqn            long   %12.0g                 Respondent sequence number
surveyyr        byte   %8.0g       surveyyr1
                                              Survey year
intexam         byte   %23.0g      intexam1   Interview/examination status
gender          byte   %8.0g       gender1    Gender
age             byte   %8.0g                  Age
race_eth        byte   %10.0g      race_eth1
                                              Race/Ethnicity
ctryorigin      byte   %21.0g      ctryorigin3
                                              Country of birth
yrsinus         byte   %10.0g      yrsinus1   Length of time in US
educ_adult      byte   %15.0g      educ_adult1
                                              Education level for adults 20+
dmdmartl        byte   %8.0g                  Marital Status
incpov          double %10.0g                 Ratio of family income to poverty threshold
pregstatus      byte   %16.0g      pregstatus1
                                              Pregnancy status at exam
WTINT2YR        double %10.0g                 Full Sample 2 Year Interview Weight
WTMEC2YR        double %10.0g                 Full Sample 2 Year MEC Exam Weight
sdmvpsu         byte   %8.0g                  Masked Variance Pseudo-PSU
sdmvstra        byte   %8.0g                  Masked Variance Pseudo-Stratum
lang_hisp       byte   %25.0g      lang_hisp1
                                              Language usually spoken at home-Hispanics
```

```
dxdm            byte   %10.0g      dxdm2      Diagnosed diabetes

dxpredm         byte   %10.0g      selfpredm1

                                              Self-reported prediabetes

a1c             double %10.0g                 Hemoglobin A1C

bmi             double %10.0g                 Body mass index

marital         float  %15.0g      marital1   Marital status

bmicat          float  %10.0g      bmicat1    BMI categories

hispanic        float  %9.0g       hispanic1

                                              Hispanic/Latino origin

hispgroup       float  %10.0g      hispgroup1

                                              Hispanic subgroup

usaborn         float  %9.0g       usaborn1   Born in the U.S.

a1c_cat         float  %9.0g       a1c_cat1   A1C categories

normglyc        float  %9.0g       normglyc1

                                              Normoglycemic

dm              float  %9.0g       dm2        Diabetic

dmcat           float  %9.0g       dmcat1     Glycemic categories

agecat          float  %9.0g       agecat1    Age categories

age_cat         float  %9.0g       age_cat1   Age categories

incpov_cat      float  %9.0g       incpov_cat1

                                              Income to poverty ratio

educ            float  %9.0g       educ1      Educational attainment

lang_acc        float  %9.0g       lang_acc2

                                              Language spoken at home

yrsinus_cat     float  %9.0g       yrsinus_m2

                                              Years in U.S.

obesecat        float  %9.0g       obesecat1

                                              Obesity categories

agecat_m        float  %9.0g       agecat_m1
```

Age categories