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The Role of Physical Activity and Sedentary Behaviors in Explaining the Association between Acculturation and Obesity among Mexican-American Adults

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Abstract

Purpose—We investigated associations of acculturation with various types of activity (moderate-vigorous leisure-time physical activity (LTPA), moderate-vigorous work- and transportation-related physical activity and sedentary activity), and whether these activities mediated the acculturation-obesity association among Mexican-Americans.

Design—Cross-sectional.

Setting—National Health and Nutrition Examination Surveys 2007–2010.

Subjects—Mexican-American NHANES participants aged 20 years (n=1,902).

Measures—Demographic characteristics, physical activity, sedentary behavior, acculturation and body mass index.

Analysis—Multinomial logistic regression was used to estimate associations of acculturation with categories of self-reported activity. Path analysis was used to test whether the activity measures mediated acculturation-obesity associations.

Results—In adjusted models, compared to US-born Mexican-Americans, foreign-born Mexican-Americans living in the US <10 years were significantly less likely to be in the highest LTPA and sedentary activity categories, and more likely to be in the highest total and transportation activity categories. Foreign-born Mexican-Americans living in the US ≥10 years were significantly less likely to engage in high sedentary activity but more likely to engage in high transportation

activity. Sedentary behavior was the strongest mediator of the acculturation-obesity association, accounting for 40.7% and 57.1% of the total effect of acculturation on obesity among foreign-born Mexican-Americans living in the US < 10 years and ≥ 10 years, respectively, compared to US-born Mexican-Americans.

Conclusion—Reducing sedentary behavior may lower the negative impact of acculturation on obesity.

Keywords

physical activity; obesity; sedentary; Mexican-Americans; acculturation

Indexing Key Words

Manuscript format: quantitative research; Research purpose: descriptive, modeling/relationship testing; Study design: cross-sectional; Outcome measure: biometric; Setting: national; Health focus: fitness/physical activity, obesity; Strategy: behavior change, culture change; Target population age: adults; Target population circumstances: all education and income levels, Hispanic/Latino

PURPOSE

A growing body of evidence suggests the burden of obesity in the US is not shared equally across the population.¹ Several studies have reported large disparities in the prevalence of obesity between racial and ethnic groups², and marked heterogeneity has been observed within groups as well.^{3, 4} Among Hispanic adults, the burden of obesity has been shown to differ by level of acculturation, i.e., the process of adaptation to a new culture by adoption of new attitudes, behaviors and beliefs.^{5–7} Compared to US-born Mexican-Americans, foreign-born Mexican-Americans generally have lower body mass index (BMI) regardless of socioeconomic status.^{8–11} In addition, foreign-born Mexican-Americans who are more acculturated are more likely to be obese than those who are less acculturated.^{8, 11–13}

These differences in obesity by acculturation are believed to be explained by changes in lifestyle behaviors such as physical activity, as Hispanic immigrants adapt to US society.^{14, 15} However, despite having higher obesity prevalence, the existing literature shows leisure-time physical activity (LTPA) is also higher among more acculturated Hispanics.^{14, 15} One potential explanation for this counterintuitive finding is that acculturation is associated with other activity-related behaviors that may be related to obesity. For example, as foreign-born Hispanics become more acculturated, occupational- and transportation-related physical activity has been shown to decrease.^{14, 15} In addition to these changes in physical activity that occur with acculturation, increasing sedentary behavior, defined as time spent sitting,¹⁶ may account for acculturation-related differences in obesity outcomes. However, to our knowledge, the association of acculturation and sedentary behavior has not been previously examined. Furthermore, little is known about the extent to which different types of physical activity and sedentary behaviors mediate the association between acculturation and obesity.

This study used data from a nationally representative sample of Mexican-American adults to 1) examine the associations of acculturation with transportation-related physical activity, work-related physical activity, LTPA, total physical activity (transportation+work+LTPA), and sedentary behavior and 2) quantify the extent to which these various types of activity mediate the association between acculturation and obesity. We hypothesized that while higher acculturation would be associated with higher LTPA, it would also be related to lower transportation and work activity, and higher sedentary activity. We further hypothesized that the various types of physical activity and sedentary behaviors would mediate associations of acculturation with obesity. A better understanding of the factors that contribute to the burden of obesity among Hispanics is essential for improving health promotion and prevention efforts.

METHODS

Design

This study used data on self-identified Mexican-American participants from the 2007–2010 National Health and Nutrition Examination Survey (NHANES). NHANES is a cross-sectional study examining health and nutrition in children and adults in the US,¹⁷ that employed a complex, multi-stage stratified probability cluster sample design to obtain a nationally representative sample of the non-institutionalized US civilian population.

Sample

Hispanic NHANES participants were categorized as Mexican-American or other Hispanic. Since previous research has suggested heterogeneity in the relationship between acculturation and weight by Hispanic background,^{3, 18} data on Mexican-American and other Hispanic participants were not combined in these analyses. In addition, due to the uncertainty regarding country of origin in the other Hispanic category, these participants were excluded from these analyses.

Of the 2,173 Mexican-American participants ages 20 years and older, those with missing data on body mass index (BMI) (n=110), physical activity variables (n=2), acculturation variables (n=74) and other key covariates (n=85) were excluded; thus these analyses are based on data from 1,902 participants with complete data on the variables of interest.

Measures

Obesity—Measured height (m) and weight (kg) were used to calculate BMI (kg/m^2). Participants with a BMI $\geq 30 \text{ kg}/\text{m}^2$ were classified as obese.

Acculturation—A combination of self-reported nativity (US-born versus foreign-born) and length of residence in the US (for foreign-born Mexican-Americans) was used as a proxy measure of acculturation.¹⁹ This measure has been previously used to examine the association between acculturation and health behaviors.²⁰ Participants were categorized as foreign-born with <10 years of residence in the US, foreign-born with ≥ 10 years in the US, and US-born (reference group).

Physical activity and sedentary behavior—The physical activity questionnaire used in NHANES is based on the Global Physical Activity Questionnaire developed by the World Health Organization.²¹ The Global Physical Activity Questionnaire has been shown to be of moderate validity compared to accelerometer measured physical activity, and to have acceptable short- and long-term reliability.²² Participants were asked whether they use a bicycle or walk for transportation, whether they participated in moderate or vigorous work-related physical activity, and whether they participated in moderate or vigorous leisure-time physical activity (LTPA). Moderate and vigorous intensity for work and leisure-time physical activity information were ascertained separately, but were combined for these analyses to create moderate-vigorous variables for LTPA and work-related activity. Those who reported participating in any of these activities were asked how many minutes per day in a typical day and how many days per week in a typical week they performed each activity. For the individual measures of transportation- and work-related activity, groups of activity levels were created for each type of activity based on the observed distribution of the data. Transportation activity was categorized into none (0 minutes/week); medium (>0 to <60 minutes/week); and high (≥60 minutes/week). Similarly, work activity was categorized into none (0 minutes/week); medium (>0 to <480 minutes/week); and high (≥480 minutes/week). For LTPA, participants were categorized into 3 groups based on a weekly amount and whether they met the recommendations for weekly activity²³: met recommendation (≥75 minutes of vigorous activity or ≥150 minutes of moderate activity or ≥150 minutes of combined moderate and vigorous activity); some (>0 minutes of activity but less than recommendations); and none (0 minutes of activity). Participants were also asked how many minutes of sedentary behavior they engaged in per week (i.e., time spent sitting, but not including sleep). Time spent in sedentary activity per week was classified into tertiles: low (<840 minutes); medium (≥840 to <1680 minutes); and high (≥1680). To create the measure of total activity, participants were categorized into 3 groups based on a weekly amount of the combined physical activity measures (LTPA+transportation+work) and whether they met the recommendations for weekly activity²³: met recommendation (≥75 minutes of vigorous activity or ≥150 minutes of moderate activity or ≥150 minutes of combined moderate and vigorous activity); some (>0 minutes of activity but less than recommendations); and none (0 minutes of activity).

Covariates—Variables that could potentially confound associations of acculturation and physical activity with obesity were added to the multivariable models including age, gender, education, employment status, and total energy intake. Age was modeled continuously, and an age-squared term was added to all models to account for the non-linear relationship between age and obesity. Educational attainment was dichotomized as having less than a high school diploma or GED versus a high school diploma/GED or more. Employment status was also dichotomized as employed versus unemployed. Total energy intake (kcal) was modeled continuously and measured in NHANES based on one food frequency questionnaire and on one 24-hour dietary recall assessment.

Analysis

Unadjusted means or frequencies and standard errors for all covariates were computed by level of acculturation. Separate multinomial (polytomous) logistic regression models were

used to estimate relative risk ratios (RRR) for each of the activity outcomes by level of acculturation. Specifically, we estimated the likelihood of engaging in some physical activity or meeting the physical activity recommendations related to LTPA and total activity (relative to performing no activity) and their associations with acculturation; We also estimated the likelihood of engaging in high or medium transportation-related physical activity, work-related physical activity, and sedentary activity (relative to no/low activity) by level of acculturation. All models were adjusted for age, age², gender, education, employment status, and total energy intake.

Mediation—Path analysis, a special type of structural equation modeling, was used to simultaneously test whether transportation-related physical activity, work-related physical activity, LTPA, and sedentary behavior mediated the association between acculturation and obesity. In the absence of unmeasured confounding, path analysis is well suited for multiple mediation analyses because it allows for the modeling of multiple regression associations simultaneously and can account for potential correlations between the mediators.²⁴ Figure 1 depicts the path analysis model that was used to estimate the extent to which the activity measures mediated associations of acculturation with obesity among Mexican-Americans. The arrows in Figure 1 represent regression equations used to assess mediation, and the coefficients represent regression coefficients used to separate the total effect (Figure 1a) into indirect (through the activity measures) and direct effects (independent of activity measures and measured confounders) of acculturation on obesity (Figure 1b).

Multiple probit regression associations were modeled to examine mediation by each activity measure evaluated in this study. Probit regression is a log-linear method comparable to logistic regression that is believed to be more accurate for mediation with a categorical outcome.²⁴ First, the association of acculturation with the potential activity mediators was assessed (a_1 through a_4 in Figure 1b). Activity measures were treated as ordinal dependent variables in these analyses. Next, the association of possible mediators with obesity was examined after accounting for level of acculturation and potential confounders (b_1 through b_4 in Figure 1b). All models were adjusted for age, age², gender, education, employment status, and total energy intake.

For each mediator, the indirect effect estimate of acculturation on obesity through each of the specific mediators is the product of the activity-specific a and b coefficients ($a_n * b_n$).²⁵ Each specific indirect effect was divided by its corresponding standard error to assess the statistical significance of the potential mediator. Because these activity variables may be correlated with each other independent of acculturation, residuals of certain mediators were allowed to co-vary. This was determined using modification indices, i.e., measures of the expected drop in chi-square if the parameter in question (in this case covariance of the residuals of two mediators) is freely estimated.²⁶ A modification index cutpoint >10 was used to determine which mediator covariances would be included. Using this cutpoint, we allowed the residuals of the following mediators to co-vary: transportation-related physical activity and LTPA; work-related physical activity and LTPA; and work activity with sedentary activity.

All analyses were adjusted for sampling weights to account for the complex sampling design. SAS version 9.3 (SAS Institute Inc., Cary, NC) was used to carry out the descriptive and regression analyses, and Mplus 6 (Muthen & Muthen, Los Angeles, CA) was used to conduct the multiple mediation analyses.

RESULTS

Descriptive Characteristics

Table 1 displays the distribution of activity types and demographic characteristics by level of acculturation. US-born Mexican-Americans engaged in more minutes per week of LTPA, and had the highest proportion of individuals meeting recommendations for LTPA relative to their foreign-born counterparts. However, US-born individuals were more likely to report having done no work- or transportation-related physical activity and reported fewer minutes of total activity, despite greater participation in LTPA. US-born Mexican-Americans also had the highest levels of sedentary activity. In contrast, foreign-born Mexican-Americans living in the US < 10 years had the highest proportion of individuals reporting meeting recommendations for total activity, and had the highest levels of work and transportation activity. These more recent immigrants also reported the least amount of sedentary activity relative to immigrants in the US for a longer period of time and relative to US-born individuals. Consistent with acculturation-related health patterns, US-born Mexican-Americans were the most obese, yet had the lowest proportion of individuals with less than high school education.

Multinomial Logistic Regression

Results from multivariable adjusted analyses confirmed most but not all descriptive findings (Table 2). Compared to the US-born, foreign-born Mexican-Americans living in the US < 10 years were more likely to engage in recommended levels of total activity (RRR: 1.62; 95% CI: 1.02, 2.57) and some physical activity (RRR: 1.79; 95% CI: 1.17, 2.72) relative to no activity, but were significantly less likely to perform the recommended amount of LTPA (RRR: 0.64; 95% CI: 0.42, 0.99). These more recent immigrants were also less likely to report high (RRR: 0.14; 95% CI: 0.08, 0.24) and medium amounts of sedentary activity (RRR: 0.44; 95% CI: 0.28, 0.69) compared with US-born Mexican-Americans. With respect to moderate-vigorous work activity and transportation activity, after covariate adjustment, foreign-born Mexican-Americans living in the US < 10 years were more likely to engage in high transportation activity (RRR: 1.67; 95% CI: 1.13, 2.49), but there were no longer any significant differences in high (RRR: 1.55; 95% CI: 0.95, 2.53) or medium (RRR: 1.12; 95% CI: 0.62, 2.03) levels of moderate-vigorous work activity versus none relative to US-born Mexican-Americans. Nevertheless, the point estimates were in the expected direction and suggestive of a difference in work-related activity between recent immigrants and US-born Mexican-Americans.

Immigrants in the U.S. for a longer period of time (i.e. living in the US ≥ 10 years) were more likely to engage in high transportation activity (RRR: 1.61; 95% CI: 1.02, 2.55), and less likely to engage in high (RRR: 0.26; 95% CI: 0.19, 0.34) and medium levels (RRR: 0.53; 95% CI: 0.37, 0.76) of sedentary activity than US-born Mexican-Americans. There

were no significant differences in moderate-vigorous work, LTPA or total activity, but the overall patterns were similar in direction (though weaker in magnitude) to findings observed for foreign-born Mexican-Americans living in the US < 10 years.

Mediation

The total effect of acculturation on obesity (i.e., the acculturation-obesity association prior to adjusting for mediators) was significant for foreign-born Mexican-Americans with <10 years residence in the US ($c = -0.27$; $SE = 0.09$; $p = 0.002$) and marginally significant for those with 10 years residence in the US compared to US-born Mexican-Americans ($c = -0.14$; $SE = 0.05$; $p = 0.05$).

Figure 2 displays the indirect and direct effects of time spent living in the US on obesity for foreign-born Mexican-Americans. Sedentary behavior was the strongest mediator, accounting for 40.7% ($a_4 * b_4 = -0.11$; $SE = 0.02$; $p = 0.02$) of the total effect of acculturation on obesity for foreign-born Mexican-Americans living in the US < 10 years and 57.1% ($a_4 * b_4 = -0.08$; $SE = 0.03$; $p = 0.005$) of the total effect for foreign-born Mexican-Americans living in the US 10 years (Figures 2a and 2b). The direct effect of acculturation on obesity (i.e., independent of all measured mediators and confounders) remained significant only for foreign-born Mexican Americans living in the US <10 years ($c' = -0.22$; $SE = 0.09$), compared with US-born Mexican-Americans.

DISCUSSION

This study examined associations of acculturation, using a combination of the proxy measures nativity and length of residence in the US, with various types of physical activity, sedentary activity, and obesity among Mexican-American NHANES participants. Findings of this study indicate that the relationship between acculturation and physical activity varied by the type of activity. Specifically, higher acculturation was associated with higher LTPA, lower transportation activity and lower total activity but also, with higher sedentary behavior. However, we found no association between acculturation and work activity in adjusted analyses. This study also simultaneously examined whether these activity measures mediated the association between acculturation and obesity. Sedentary behavior was found to be the strongest mediator of the acculturation-obesity association.

These findings were generally consistent with previous research that has found similar results showing an increase in LTPA but decrease in occupational and transportation activity with increasing acculturation.^{14, 15} It has been suggested that these activity patterns may be attributed to the adoption of beliefs about the benefits of engaging in LTPA²⁰ and greater access to employment opportunities that do not involve manual labor, with increasing acculturation.²⁷ Changes in occupational status with increasing acculturation could result in decreased occupational physical activity, accompanied by an increase in sedentary activity depending on the nature of the job being performed. Also, with longer time in the U.S., immigrants may also rise in socioeconomic status and accumulate material wealth such as car ownership, which would influence not only occupational physical activity but also transportation activity. Our findings were independent of employment status (employed vs. unemployed), but we were unable to assess occupational status more precisely to better

capture the change in types of occupation that may occur with acculturation. In addition, given the cross-sectional nature of NHANES, we were not able to assess changes in the acculturation-activity association over time and within the same individual to better determine the mechanism through which acculturation influences different types of physical activity.

A major strength of this study was the evaluation of different activity measures as potential mediators linking higher acculturation to higher obesity. We found that sedentary behavior was the strongest mediator of the association between acculturation and obesity when comparing foreign-born Mexican-Americans with <10 years and 10 years residence in the US compared to those who were US-born. Acculturation research has largely focused on leisure-time physical activity rather than sedentary activity.¹⁶ However, the existing literature on demonstrates a consistent relationship between higher sedentary activity and a greater risk of obesity.^{28–32} Moreover, high levels of sedentary activity are significantly associated with weight gain independent of physical activity.^{33–37} Given that US-born Mexican-Americans had the highest prevalence of obesity despite having the highest levels of LTPA, future research should consider the role of sedentary behaviors, independent of leisure-time physical activity, in the development of obesity in Mexican-Americans.

Although sedentary activity was a significant mediator, it did not completely explain the association between acculturation and obesity. Previous research has shed light on acculturation-related differences in other health behaviors, which may be relevant to obesity. For example, some studies have shown that Hispanics who are less acculturated consume healthier foods (i.e., fruits, vegetables) compared to more acculturated individuals.^{38, 39} Therefore, although increasing sedentary behavior is likely contributing to a reduction in energy expenditure as individuals acculturate, higher consumption of energy-dense foods may be concomitantly promoting greater caloric intake, thus increasing the likelihood of obesity. Our findings persisted even with adjustment for total energy intake. However, given the potential for measurement error in dietary assessments, it is possible that the impact of energy imbalance via high caloric intake was underestimated. It is also possible that other unmeasured factors accounted for the significant estimated direct effect of acculturation on obesity. Additional studies will be required to assess the relative contributions of other health-related factors to acculturation differences in obesity.

This study is not without limitations. NHANES data are cross-sectional, which precludes examination of changes in physical activity and sedentary behaviors that occur in the same individual over time. It also limits our ability to definitively assess our hypothesized causal mediation model. Another limitation is that the assessment of causal mediation relies on assumptions relating to unmeasured confounding⁴⁰ that cannot be tested using these data. We adjusted for several major confounders, but other unmeasured confounders may be biasing our assessment of mediation. Our study was also limited by the measures of acculturation available. Although length of residence in the US is a common proxy of acculturation,^{10, 15} it does not capture all the aspects of cultural adaptation that may influence health.⁴¹ Finally, the estimates of activity were based on self-reported measures rather than objective measures of activity. Previous studies have shown that levels of self-reported physical activity tend to differ from physical activity objectively measured with

accelerometers or doubly labeled water.^{42, 43} Over-reporting of physical activity levels and under-reporting of sedentary behavior can impact results by misrepresenting the actual activity performed by individuals. However, no studies to our knowledge have shown that misreporting differs by level of acculturation, so it is not clear whether any misclassification that would arise would impact the associations between acculturation and LTPA or sedentary behavior.

This study contributes to the existing literature on activity and obesity outcomes in Mexican-American adults by investigating various types of physical activity and sedentary behaviors as potential mediators of the association between acculturation and obesity. Our findings highlight the role of sedentary behavior in driving this association independent of sociodemographic characteristics and total energy intake. Also, LTPA was weak in recent immigrants who were newly acculturated. Therefore, in developing interventions for Hispanic subpopulations, it will be important to understand the reasons for the rise in sedentary activity and lack of LTPA in recent immigrants, and to identify more specific determinants. Interventions aimed at reducing sedentary behavior may have the potential to forestall the development of obesity in Mexican-American immigrants as they acculturate to U.S. society.

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SO WHAT? Implications for Health Promotion Practitioners and Researchers

What is already known on this topic?

Among Mexican-Americans, higher acculturation is associated with an increased likelihood of being obese. However, leisure-time physical activity also increases with higher acculturation. Research on whether various types of activity and sedentary behavior are mediators of the acculturation and obesity association in Mexican-American adults is limited.

What this study adds?

Sedentary behavior was the strongest mediator of the acculturation-obesity association when comparing foreign-born Mexican-Americans living in the US <10 years and 10 years to US-born Mexican-Americans.

What are the implications for health promotion practice or research?

Understanding the determinants and mechanisms contributing to the rise in sedentary behavior will be essential for intervention development focused on reducing sedentary behaviors in Mexican-Americans. Interventions to reduce sedentary behavior in Mexican-Americans immigrants may forestall the adverse trajectories of obesity development among foreign-born individuals as they acculturate to U.S. society.

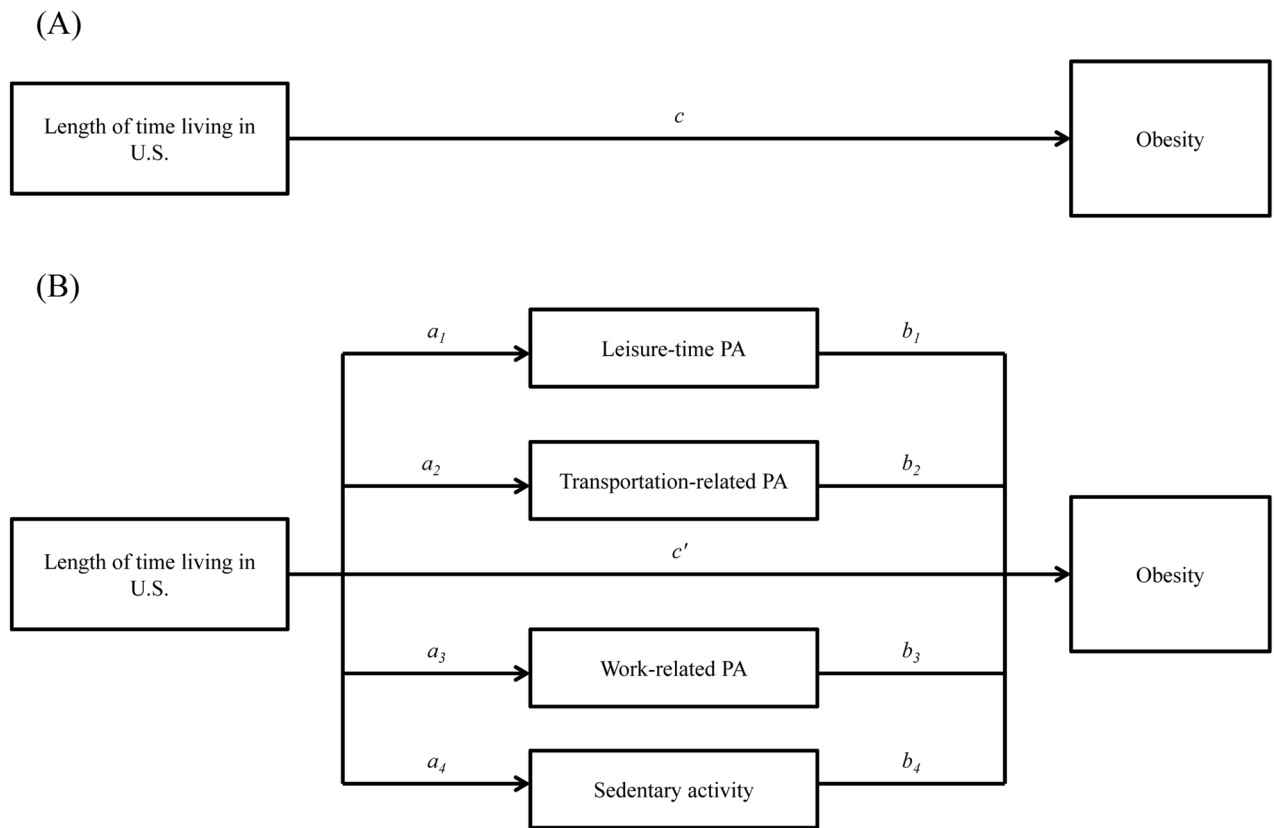


Figure 1. Proposed Mediation of the Association between Time Spent Living in the U.S. and Obesity. A: Total effect of time spent living in the U.S. on obesity. B: Hypothesized indirect effect of time spent living in the U.S. on obesity through activity mediators and residual direct effects.

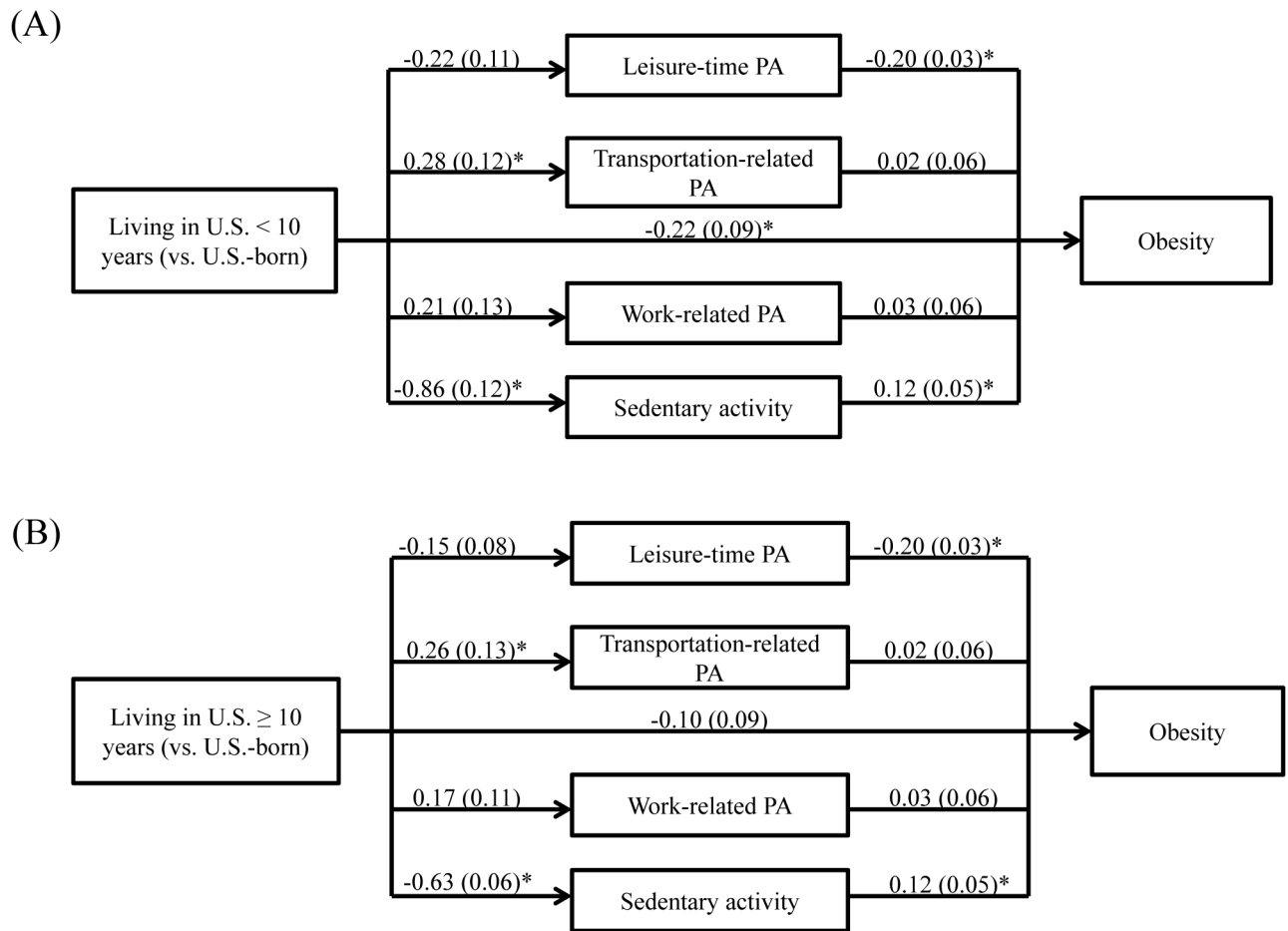


Figure 2. Beta Coefficients (standard error) used to Assess Mediation of Association of Time Spent Living in the U.S. with Obesity. Models were adjusted for age, age², gender, education, employment status and energy intake. * $p < .05$.

Table 1

Participant Characteristics Overall and by Time Spent Living in the U.S. among Mexican-Americans: National Health and Nutrition Examination Survey, 2007–2010

Characteristic	Total (n= 1902)		Foreign-Born (< 10 Yrs)* Mexican-Americans (n=324)		Foreign-Born (10 yrs)† Mexican-Americans (n=814)		U.S.-Born Mexican-Americans (n=764)	
	Mean or % (SE)‡	Mean or % (SE)	Mean or % (SE)	Mean or % (SE)	Mean or % (SE)	Mean or % (SE)	Mean or % (SE)	
<i>Physical & Sedentary activity</i>								
<i>Moderate-Vigorous LTPA§, %</i>								
Weekly Activity (min/week)	120.8 (7.8)	96.7 (11.1)	90.9 (10.3)	156.9 (15.8)				
None, %	57.9 (2.3)	60.7 (3.4)	64.5 (3.4)	51.1 (2.8)				
Some , %	10.7 (1.1)	9.8 (2.0)	10.8 (1.6)	11.0 (1.7)				
Met Recommendations#, %	31.4 (1.8)	29.5 (3.3)	24.8 (2.7)	37.9 (3.0)				
<i>Moderate-Vigorous Work Activity</i>								
Weekly Activity (min/week)	532.4 (36.7)	673.3 (80.6)	569.3 (56.5)	437.0 (56.6)				
None, %	57.3 (1.7)	48.1 (3.4)	58.4 (2.7)	60.6 (2.9)				
Medium, % (>0 to <480 min/week)	14.2 (1.1)	15.5 (3.4)	12.1 (1.5)	15.4 (1.6)				
High, % (480 min/week)	28.5 (1.5)	36.5 (3.0)	29.5 (3.0)	24.0 (1.9)				
<i>Transportation Activity</i>								
Weekly Activity, (min/week)	126.3 (17.5)	195.1 (39.6)	140.8 (23.9)	82.8 (11.6)				
None, %	69.7 (2.9)	61.9 (4.0)	67.0 (2.7)	75.5 (3.6)				
Medium, % (>0 to <60 min/week)	3.7 (0.5)	3.2 (0.8)	3.9 (1.0)	3.8 (0.8)				
High, % (60 min/week)	26.6 (2.9)	34.9 (3.6)	29.1 (2.9)	20.6 (3.5)				
<i>Total Activity</i>								
Weekly Activity (min/week)	779.5 (52.9)	965.1 (79.2)	801.1 (74.7)	676.8 (68.8)				
None, %	27.7 (2.6)	17.7 (2.3)	29.9 (3.4)	30.4 (3.1)				
Some , %	12.0 (0.8)	14.3 (2.2)	11.4 (1.5)	11.4 (1.2)				
Met Recommendations#, %	60.3 (2.7)	68.0 (2.9)	58.8 (3.8)	58.2 (3.6)				
<i>Sedentary Activity</i>								
Weekly Activity (min/week)	1798.4 (68.3)	1146.6 (48.0)	1410.9 (58.3)	2421.9 (113.5)				
Low, % (840 min/week)	38.0 (1.6)	54.9 (3.5)	48.3 (2.4)	21.7 (1.8)				

Characteristic	Total (n= 1902)		Foreign-Born (< 10 Yrs)* Mexican-Americans (n=324)		Foreign-Born (> 10 yrs) [†] Mexican-Americans (n=814)		U.S.-Born Mexican-Americans (n=764)	
	Mean or % (SE) [‡]	Mean or % (SE)	Mean or % (SE)	Mean or % (SE)	Mean or % (SE)	Mean or % (SE)	Mean or % (SE)	
Medium, % (>840 to 1680 min/week)	30.8 (1.4)	31.5 (3.2)	31.4 (2.1)	29.9 (2.1)				
High, % (>1680 min/week)	31.2 (2.0)	13.6 (2.1)	20.3 (2.2)	48.5 (2.9)				
Obesity, % (BMI ^{**} >=30 kg/m ²)	41.5 (2.0)	33.0 (3.2)	42.0 (2.6)	45.1 (2.0)				
Energy intake (kcal)	2142.2 (28.3)	2183.9 (86.5)	2075.3 (27.8)	2179.8 (54.3)				
<u>Demographic characteristics</u>								
Age, years	40.3 (7.5)	32.5 (0.8)	45.1 (1.2)	39.8 (1.0)				
Male, %	52.4 (1.2)	55.3 (3.3)	52.4 (2.4)	51.1 (1.7)				
Less than high school, %	51.2 (1.7)	62.9 (4.0)	71.6 (2.5)	28.7 (2.0)				
Employed, %	63.6 (2.1)	72.1 (3.2)	64.8 (3.3)	58.8 (2.4)				

* Less than 10 years in the U.S.

[†] 10 years or more in the U.S.

[‡] Standard error

[§] LTPA=leisure-time physical activity

//// Some: >0 minutes of activity but less than recommendations

Meeting recommendations is defined as reporting either 150 minutes of moderate-intensity activity or 75 minutes of vigorous-intensity activity or a combination of vigorous- and moderate-intensity activity totaling to 150 minutes

** BMI=body mass index

Table 2

Associations of Physical and Sedentary Activity with Time Spent Living in the U.S. among Mexican-Americans: National Health and Nutrition Examination Survey, 2007–2010*

Years in the US	Moderate-Vigorous Work Activity		Transportation Activity		Moderate-Vigorous Leisure-time Activity		Total Activity		Sedentary Activity	
	High [†] vs. None	RRR (95% CI)	High [§] vs. None	Medium// vs. None	Met Recommendations# vs. None	Some Physical Activity** vs. None	Met Recommendations# vs. None	Some Physical Activity** vs. None	High ^{††} vs. Low ^{§§}	Medium ^{‡‡} vs. Low ^{§§}
Foreign-born < 10 years	1.55 (0.95, 2.53)	1.12 (0.62, 2.03)	1.67 (1.13, 2.49)	0.82 (0.38, 1.78)	0.64 (0.42, 0.99)	0.79 (0.49, 1.29)	1.62 (1.02, 2.57)	1.79 (1.17, 2.72)	0.14 (0.08, 0.24)	0.44 (0.28, 0.69)
Foreign-born 10 years	1.42 (0.92, 2.19)	0.98 (0.62, 1.54)	1.61 (1.02, 2.55)	1.23 (0.55, 2.78)	0.75 (0.54, 1.05)	0.89 (0.59, 1.35)	1.30 (0.80, 2.14)	1.03 (0.73, 1.46)	0.26 (0.19, 0.34)	0.53 (0.37, 0.76)
U.S.-born	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

* Multinomial logistic regression models adjusted for age, age², gender, education, employment status and total energy intake, estimating the relative risk ratio of engaging in medium or high activity relative to none (outcome referent), some activity or meeting physical activity recommendations relative to no activity (outcome referent), and the relative risk of engaging in high or medium sedentary activity relative to low sedentary activity (outcome referent) associated with time spent living in the US versus being U.S-born (exposure referent).

[†] High: 480 minutes/week

[‡] Medium: >0 to <480 minutes/week

[§] High: 60 minutes/week

// Medium: >0 to <60 minutes/week

Meeting recommendations is defined as reporting either 150 minutes of moderate-intensity activity or 75 minutes of vigorous-intensity activity or a combination of vigorous- and moderate-intensity activity totaling to 150 minutes

** Some: >0 minutes of activity but less than recommendations

^{††} High: >1680 minutes/week

^{‡‡} Medium: >840 to 1680 minutes/week

^{§§} Low: 840 minutes/week

//// RRR=relative risk ratio