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Does the immigrant advantage in overweight/obesity persist over time in Mexican-American youth? NHANES 1988–1994 to 2005–2014

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Abstract

Objectives—To examine whether the relationship between nativity and overweight/obesity has changed over time among Mexican-American children and to investigate the implications of this pattern on overweight/obesity disparities relative to non-Hispanic Whites.

Methods—Using cross-sectional data from Mexican-Americans and non-Hispanic white children ages 4–17 years participating in the National Health and Nutrition Examination Surveys (1988–1994 (N=4,720) and 2005–2014 (N=7,275)), we used log-binomial regression to calculate prevalence ratios (PR) of overweight/obesity by nativity status adjusting for sociodemographic covariates, survey period and a nativity by survey period interaction. In a separate covariate-adjusted model, we also tested a 3-level ethnicity-nativity by survey period interaction that included non-Hispanic Whites.

Results—In 1988–1994, foreign-born Mexican-Americans had significantly lower prevalence of overweight/obesity compared to U.S.-born Mexican-Americans (PR=0.75, 95% CI: 0.61, 0.94). However, by 2005–2014, the nativity gap in overweight/obesity closed (PR=0.94; 95% CI: 0.84, 1.07). Moreover, while foreign-born Mexican-Americans had the lowest levels of overweight/obesity in 1988–1994, by 2005–2014, foreign-born and U.S.-born Mexican-Americans had comparable estimates, both significantly higher than that of non-Hispanic Whites.

Conclusions—Although overweight/obesity disparities between Mexican-Americans and non-Hispanic Whites had previously been specific to U.S.-born Mexican-Americans, disparities in recent years have extended to foreign-born Mexican-Americans.

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Conflict of Interest: None

Keywords

Nativity; Overweight/Obesity; Mexican-American; Hispanics/Latinos; Childhood Obesity

Introduction

In the U.S., Mexican-American children are disproportionately affected by childhood obesity. A study using 2009–2010 data from the National Health and Examination Survey (NHANES) found that among children and adolescents aged 2–19 years, 39.4% of Mexican-Americans were overweight and 21.2% were obese compared to 27.9% and 9.8% among non-Hispanic Whites, respectively.¹ Moreover, Mexican-American youth have been shown to have faster increases in body mass index (BMI) during adolescence and into adulthood compared to youth from other Latino backgrounds.² Childhood obesity has been shown to increase the risk of chronic diseases later in life, including the carryover of obesity into adulthood.³ Thus, identifying mechanisms to explain the obesity epidemic in Mexican-American children is warranted.

Characterizing heterogeneity of obesity prevalence among Mexican-American children is also important because it allows for more strategic targeting of policies and interventions. In studies conducted in Mexican-American adults, foreign birth has been associated with a lower prevalence of obesity than being born in the U.S.^{4,5} However, much less is known about patterns in Mexican-American children and adolescents. Of the few studies conducted in younger samples, results have been mixed. While some studies have shown that foreign-born Mexican-American children have lower overweight/obesity prevalence than U.S.-born Mexican-American children,⁶ other studies have shown inverse⁷ or null⁸ patterns.

A possible reason for these mixed findings could be that the relationship between nativity (foreign-birth vs U.S.-birth) and obesity may be changing over time, particularly for immigrants from countries with an emerging obesity epidemic. Mexico, the largest immigrant sending country to the U.S.,⁹ is one such country where obesity and obesity-promoting diets are on the rise.¹⁰ According to a study released in 2013 by the United Nations Food and Agricultural Organization, Mexico surpassed the U.S. in obesity prevalence,¹¹ having experienced the most rapid increase in obesity ever documented worldwide.¹² Between 1999 and 2006, overweight/obesity prevalence in school-aged Mexican children (5–11 years of age) rose by an alarming 40%.¹³ While obesity continues to adversely impact U.S. children as well, especially minorities like Mexican-Americans, there is some evidence that estimates may be leveling off.¹ Taken together, these circumstances suggest that foreign-born Mexican-American children may no longer exhibit a health advantage with respect to overweight/obesity compared to U.S.-born Mexican-American children. Thus, the aim of this study was to test the hypothesis that the relationship between nativity and overweight/obesity has changed over time among Mexican-American children. In other words, do immigrant children of Mexican origin still exhibit an advantage with respect to overweight/obesity prevalence compared to the U.S.-born in recent years? This is the first study, to our knowledge, to investigate this phenomenon in Mexican-American children, and to characterize secular trends in

overweight/obesity by nativity status in this population. In a secondary analysis, we also evaluated the implications of this pattern on disparities in overweight/obesity relative to non-Hispanic Whites over time.

Methods

Data came from NHANES, a series of repeated cross-sectional surveys conducted by the U.S. Centers for Disease Control and Prevention (CDC). NHANES uses a complex, multi-stage sample design and is intended to be nationally representative of the U.S. non-institutionalized population. Survey participants completed in-home interviews followed by medical and laboratory examinations in mobile examination centers. We used data from NHANES III (1988–1994) and 5 pooled survey cycles from the continuous NHANES (2005–2014) to represent the two survey periods under study over 20 years apart. Children and adolescent NHANES participants aged 4 to 17 years provided documented assent, and parental permission was obtained for those younger than 18 years. The research ethics boards of the National Center for Health Statistics approved all protocols.

These analyses were restricted to Mexican-Americans and non-Hispanic White children aged 4–17 years. Out of the 13,294 Mexican-Americans and non-Hispanic white children who attended the clinical examination in NHANES III and the continuous NHANES (2005–2014), those who reported being pregnant (N=19) and who had missing BMI values (N=1,280) were excluded from analysis. Our final analytic sample included 6,288 Mexican-Americans and 5,707 non-Hispanic White children across the two survey periods (2,706 Mexican-Americans and 2,014 non-Hispanic White children in 1988–1994; 3,582 Mexican-Americans and 3,693 non-Hispanic White children in 2005–2014).

Overweight/obesity status

Anthropometric body measurements were taken by trained technicians at the NHANES Mobile Examination Center (MEC). Height and weight were measured with participants wearing standard MEC examination gown and slippers. BMI was calculated by dividing weight (kg) by height squared (m²), and overweight/obesity was defined as a BMI at or above the age- and sex-specific 85th percentile based on the CDC's BMI-for-age growth charts (yes/no).¹⁴

Nativity

Mexican-American children were subdivided into two groups based on their country of birth. Mexican-American children who were not born in the U.S. were considered foreign-born and those born in the U.S. were U.S.-born.

Covariates

All covariates were derived from self-reported data during in-person household interviews administered in English or Spanish. For children ages 4–11 years, covariate data were provided by a proxy. Householder information was captured through an in-person interview with the NHANES-designated "householder" and linked to the child in question. Covariates included child's age (continuous), child's sex (male, female), householder marital status

(categorized as ‘married’ if the householder reported being married or living with a partner, and ‘unmarried’ if the householder reported being widowed, divorced, separated, or never married), and householder education (<12th grade, completed 12th grade or greater).

Statistical analyses

All analyses were conducted using Stata software, version 14.1 (Stata Corp, College Station, Texas). We used multiple imputation to account for missing data for householder education and marital status (n=461). For all analyses, appropriate sampling weights were incorporated to produce national population estimates and to account for unequal probabilities of selection, non-response, and non-coverage. The SVY module was used with Taylor series linearization methods to adjust for the complex survey design. Weighted proportions and means were used to characterize the analytic sample by ethnicity-nativity groupings (foreign-born Mexican-Americans, U.S.-born Mexican-Americans, and non-Hispanic Whites) within each survey period (1988–1994 and 2005–2014). Differences were evaluated using the t-statistic and p-values < 0.05 were considered statistically significant.

Multivariable log-binomial models were used to first estimate prevalence ratios (PR) of overweight/obesity comparing foreign-born to U.S.-born Mexican-American children (referent), adjusting for age, sex, and survey period (Model 1). To investigate whether the relationship between nativity and overweight/obesity differed over time, we tested an interaction between nativity and NHANES survey period (2005–2014 vs 1988–1994 (ref)). A p-value < 0.1 was considered a statistically significant interaction. Model 2 further adjusted for householder education and marital status. In a second set of models, we included non-Hispanic White children and replaced the 2-level nativity variable with a 3-level ethnicity-nativity variable (non-Hispanic Whites as the referent). We similarly tested its interaction with NHANES survey period to determine whether disparities in overweight/obesity among foreign-born and U.S.-born Mexican-American children compared to non-Hispanic Whites had changed over time. In sensitivity analyses, we further examined whether the patterns we report differed by sex and for children (4–11 years) compared to adolescents (12–17 years).

Results

Table 1 presents the sample characteristics by ethnicity-nativity groupings and by NHANES survey period. In 1988–1994, U.S.-born Mexican-American children had the highest prevalence of overweight/obesity (35.9%), while foreign-born Mexican-American (27.9%) and non-Hispanic White (26.3%) children had estimates comparable to each other. Although overweight/obesity prevalence increased over time for all groups, the magnitude of increase was largest for foreign-born Mexican-American children (16.2 percentage points). As a result, by 2005–2014, U.S.-born and foreign-born Mexican-American children had similar estimates of overweight/obesity (44.4% and 44.1%, respectively) which were considerably higher than for non-Hispanic Whites (33.0%). Over time, all groups of children increasingly lived in homes where the householder had more education. Nevertheless, Mexican-American children, regardless of nativity, continued to live in households with lower householder education than non-Hispanic Whites.

Age- and sex-adjusted (Model 1) and covariate-adjusted models (Model 2) estimating PR of overweight/obesity status by nativity among Mexican-American children are shown in Table 2. Because there was evidence that the interaction between nativity and survey period was statistically significant ($P = 0.069$), we present results stratified by survey period. Confirming the patterns we report in Table 1, in 1988–1994, foreign-born Mexican-American children had significantly lower prevalence of being overweight/obesity compared to U.S.-born Mexican-American children (Model 1: PR = 0.77, 95% CI: 0.61, 0.96). In contrast, in 2005–2014, there was no longer evidence of a difference in overweight/obesity by nativity (Model 1: PR = 0.95; 95% CI: 0.84, 1.07). After further adjustment for the householder's marital status and education (Model 2), the results remained quantitatively similar (1988–1994: PR = 0.75, 95% CI: 0.61, 0.94; 2005–2014: PR = 0.94, 95% CI: 0.84, 1.07). In sensitivity analyses, we found that these patterns were also present for both boys and girls and for children and adolescents to a similar degree (data not shown).

We next investigated how changes in the relationship between nativity and overweight/obesity may have influenced disparities relative to non-Hispanic Whites over time. There was borderline evidence of heterogeneity by survey period only in the disparity between foreign-born Mexican-Americans and non-Hispanic Whites (P -interaction=0.12). For ease of interpretation, Figure 1 displays predicted probabilities estimated from stratified multivariable log-binomial regression models of overweight/obesity by survey period that included non-Hispanic Whites. In 1998–1994, U.S.-born Mexican-American children had a predicted probability of overweight/obesity that was statistically significantly higher by 5 percentage points than for non-Hispanic Whites, whereas estimates for foreign-born Mexican-American children were similar to non-Hispanic Whites. Although predicted probabilities of overweight/obesity substantially increased for all ethnicity-nativity groups in 2005–2014 compared to 1988–1994, this increase was most pronounced in foreign-born Mexican-American children who experienced an 8 percentage-point increase over this timeframe. As a result, in 2005–2014, the estimates for foreign-born Mexican-Americans surpassed those of non-Hispanic White children and approached estimates found among U.S.-born Mexican-Americans.

Lastly, in a sensitivity analysis using the available data on length of time in the U.S. from 2005–2014, we examined whether newer immigrants (<5 years living in the U.S.) continued to retain an advantage with respect to overweight/obesity compared to the U.S.-born. Our findings indicated that the prevalence of overweight/obesity among the newest immigrants did not differ from estimates found for the U.S.-born (Supplemental Table 1).

Discussion

Our study showed that while foreign-born Mexican-American children aged 4–17 years previously exhibited an advantage with respect to overweight/obesity relative to U.S.-born Mexican-Americans, that advantage is no longer present in recent years. This finding supports our hypothesis that the relationship between nativity and overweight/obesity has changed over time in this population. Furthermore, although disparities in childhood overweight/obesity between Mexican-Americans and non-Hispanic Whites had previously

been specific to U.S.-born Mexican-Americans, disparities in recent years have extended to foreign-born Mexican-Americans.

Few studies have examined differences in overweight/obesity by nativity or by immigrant generation in Mexican-American children or adolescents. One study also using NHANES data found a significantly higher prevalence of overweight/obesity in U.S.-born Mexican-American children compared to foreign-born children, but used data from earlier years (1988-2004).⁶ Another study that reported findings to the contrary - that foreign-born Mexican-American children had a higher prevalence of overweight/obesity than U.S.-born children - used data from later years (2006-2008) and among youth living in California.⁷ Despite what seem like mixed findings, these studies nevertheless corroborate our results and support our hypothesis that the relationship between nativity and overweight/obesity has changed over time. Only one other study has evaluated heterogeneity in associations between nativity and weight outcomes over time, but it was in adults.¹⁵ Moreover, while several published studies have documented trends in overweight/obesity by race/ethnicity among children and adolescents in the U.S.,^{1,16,17} none have distinguished trends by nativity, and none have evaluated whether the overweight/obesity advantage that appears to characterize immigrants has changed over time.

Our study was not designed to uncover the reasons why foreign-born Mexican-American children in our study no longer possessed an overweight/obesity advantage, but the following are potential explanations. The recent, yet rapid, nutrition transition in Mexico may be partly accountable. In prior decades, Mexican children migrating to the U.S. were leaving an environment that was considerably less obesogenic than the one they were migrating to. As a result, Mexican children likely engaged in healthier behaviors potentially contributing to their healthy weight advantage relative to their U.S.-born peers. Findings from nutrition surveys in Mexico support the idea that diets were indeed healthier then.¹⁰ However, over the course of two decades, macro-level factors such as the development and assertive marketing of inexpensive, convenient, and foods high in calories, agricultural subsidies, and wide secular changes in work, lifestyles, and transportation have been operating in Mexico contributing to the emergence of the obesity epidemic there.¹⁸ In recent years, the proportion of overall daily energy intake from sugar-sweetened beverages in Mexican adolescents and adults exceeded that of the U.S.¹⁹ This transition to a diet high in calories and processed foods and increasingly sedentary lifestyles in Mexico, exacerbated by exposure to the obesogenic environment in the U.S., is potentially placing foreign-born Mexican-American children at further risk for weight gain and obesity.

Another contributing factor that may explain why foreign-born Mexican-Americans were more overweight/obese in recent years relates to changing selection migration dynamics. Individuals that choose to and are able to migrate are thought to be healthier relative to their native populations, and are thus selected for their ability to better cope with the rigors of the migration process. The health selection hypothesis has been offered as an alternative explanation for the health advantage that immigrants appear to exhibit despite their low socioeconomic status.²⁰ It is possible that while healthier, less obese children may have constituted the immigrant streams of 20 years ago, this pattern of health selection may have shifted over time. However, support for the existence of health selection as an explanation

for the immigrant health advantage is mixed, and is it less likely to operate in children.²⁰ Thus, while we cannot discount the role of changes in the health selectivity of immigrant children over time as an explanation for our findings, it is likely that other factors are contributing to the patterns we report.

The higher prevalence of overweight/obesity among foreign-born Mexican-Americans in the most recent NHANES survey years may also be due to the fact that these children had been living in the U.S. for a longer period of time than foreign-born Mexican-Americans sampled in NHANES III. Longer length of time in the U.S. has been associated with more obesity in immigrant adults.²¹ Unfortunately, because data on length of time in the U.S. were unavailable in NHANES III for Mexican-American children, we were unable to determine whether the higher prevalence of overweight/obesity in foreign-born Mexican-Americans in 2005–2014 relative to 1988–1994 could be due to differences in average length of time in the U.S. among immigrants across the two time periods. However, in a sensitivity analysis of only the 2005–2014 data, we found that the newest immigrants (<5 years living in the U.S.) did not possess an advantage with respect to overweight/obesity compared to the U.S.-born. This suggests that foreign-born Mexican-American children may be migrating to the U.S. with estimates of overweight/obesity similar to that of U.S.-born children. Nevertheless, because we could not determine whether the distributions of length of time in the U.S. differed among immigrants between the two survey periods, we cannot discount its role in contributing to our findings.

Regardless of the reasons underlying the considerable increases in overweight/obesity among foreign-born Mexican-American children, these findings have negative implications for their health prospects, as well as those of U.S.-born Mexican-Americans, as they age into adulthood. Childhood obesity is a risk factor of chronic disease development in adulthood such as diabetes, cardiovascular disease and coronary heart disease, and several cancers.²² With overweight/obesity on the rise among foreign-born Mexican-Americans, and remaining high among U.S.-born Mexican-Americans, this has the potential to further exacerbate disparities in cardiometabolic disorders between Mexican-Americans and non-Hispanic Whites. Furthermore, since a high proportion of Latinos lack health insurance,^{23–25} there is a great likelihood that chronic diseases are likely to be both undiagnosed and severe. Although the affordable care act decreased the proportion of uninsured Mexican-Americans from 43% to 32% from 2011 to 2015,²⁵ a large proportion continue to remain uninsured. Furthermore, Mexican-Americans are less likely to be insured compared to non-Hispanic Whites.²⁵ Altogether, these health-related issues pose a major threat to the health of the next generation of Mexican-Americans.

These findings support the need to increase health surveillance among foreign-born Mexican-American children. Although Latinos tend to have, on average, lower all-cause mortality and higher life expectancy, despite a lower socioeconomic status, as compared to non-Hispanic Whites,²⁶ this may no longer be the case for foreign-born Mexican-American children. Given the long-term consequences of childhood obesity, health practitioners should be encouraged to regularly screen all Mexican-American children for overweight/obesity. Additionally, interventions and policies targeting overweight/obesity in Mexican-American

children should consider improving health care access, utilization of health care services, and increased screening for overweight/obesity, particularly among the foreign-born.

Our study has some limitations. Since longer length of residence in the U.S. has been previously associated with higher obesity in foreign-born adults,²¹ the increasing trends in overweight/obesity among foreign-born Mexican-American children may reflect the fact that children sampled in 2005–2014 had been living in the U.S. for a longer period of time compared to children sampled in NHANES III (1988–1994). Unfortunately, we could not directly test this hypothesis since data on length of time in the U.S. was not collected for children in NHANES III. This would have helped us to better evaluate the role of length of U.S. residence on the overweight/obesity trends we reported for the foreign-born Mexican-American children. We also may have been under-powered to detect statistically significant interactions between nativity and survey period (and by ethnicity-nativity and survey period) at P-value thresholds <0.05. The sample size for the foreign-born subjects in the later survey period was small even though several NHANES survey cycles were pooled to improve power. Nevertheless, the magnitude of the estimated difference in the nativity gradient across the survey periods is indicative of an important and concerning trend that should be replicated in other datasets. Given the cross-sectional nature of our study, conducted only on the U.S. side of the border, we were also unable to observe how overweight/obesity developed longitudinally, and we could not directly investigate the reasons underlying the increasing trends in overweight/obesity among foreign-born Mexican-Americans. Longitudinal studies that follow cohorts of children in Mexico migrating to the U.S. are necessary to better identify the causal mechanisms driving overweight/obesity in foreign-born Mexican-American children.⁷ Our study also has several strengths. It is the first to evaluate the relationship between nativity and overweight/obesity in Mexican-American children across 20 years using nationally representative data. In addition, while most studies base participants' height and weight data on self-report, data from NHANES are based on information collected during the clinical examination.

In summary, our results provide evidence that the advantage previously held by foreign-born Mexican-American children with respect to overweight/obesity is no longer present in recent years. Although disparities in childhood overweight/obesity between Mexican-Americans and non-Hispanic Whites had previously been specific to U.S.-born Mexican-Americans, disparities in recent years have extended to foreign-born Mexican-Americans. This trend is cause for alarm given the long-term health consequences of childhood obesity, and the challenges this poses for efforts to address health disparities. Although national trends in overweight/obesity are rarely disaggregated by nativity, closer surveillance of the health of foreign-born population Mexican-American children is clearly warranted.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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What is already known about this subject

- In adults, research has shown that foreign-born Mexican-Americans have a lower prevalence of obesity compared to U.S.-born Mexican-Americans.
- Of the few studies in Mexican-American children, results have been mixed and have primarily been conducted at a single point in time.

What this study adds

- This study examines whether the association between nativity status and overweight/obesity in Mexican-American children has changed over a period of over 20 years.
- This study's findings indicate that although foreign-born Mexican-American children had a lower overweight/obesity prevalence compared to their U.S.-born counterparts in 1988-1994, this advantage was no longer present in recent years as a result of the alarming increase in overweight/obesity in this particular population.

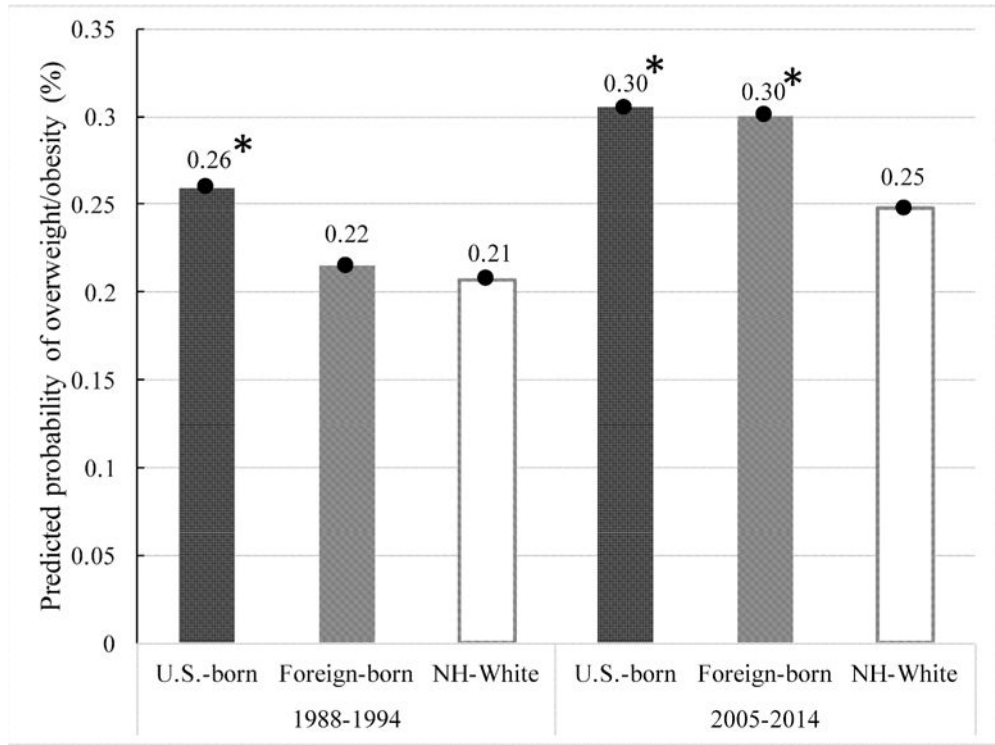


Figure 1. Predicted probabilities of overweight/obesity in U.S.-born and foreign-born Mexican-American and non-Hispanic (NH) white children (ages 4–17) by survey period. Predicted probabilities estimated from log-binomial regression models stratified by survey period and adjusted for age, sex, householder marital status, and householder education. Estimates correspond to the mean age of the sample (age = 10.5 years). Asterisks (*) indicate statistically significant differences among U.S.-born and foreign-born Mexican-Americans vs. non-Hispanic Whites within each survey period. Data source: NHANES

Characteristics of foreign-born and U.S.-born Mexican American and non-Hispanic White children aged 4–17 years, National Health and Nutrition Examination Surveys 1988–1994 and 2005–2014 (N = 11,995)

Table 1

| | 1988–1994 (N = 4,720) | | | 2005–2014 (N = 7,275) | | | P |
|--|---------------------------------------|--|-------------------------------|---------------------------------------|--|-------------------------------|--------|
| | U.S.-Born Mexican-Americans (N=2,257) | Foreign-Born Mexican-Americans (N=449) | Non-Hispanic Whites (N=2,014) | U.S.-Born Mexican-Americans (N=3,064) | Foreign-Born Mexican-Americans (N=518) | Non-Hispanic Whites (N=3,693) | |
| Overweight/obesity, [§] % | 35.9 | 27.9 | 26.3 | 44.4 | 44.1 | 33.0 | <0.001 |
| Age (y), mean ± SE | 9.9 (0.1) | 11.6 (0.2) | 10.4 (0.1) | 9.9 (0.1) | 12.2 (0.2) | 10.7 (0.1) | <0.001 |
| Female, % | 49.5 | 50.5 | 47.8 | 49.0 | 46.4 | 48.8 | 0.571 |
| Householder education, % | | | | | | | <0.001 |
| Less than 12th grade | 56.0 | 80.8 | 16.8 | 49.7 | 73.8 | 10.8 | |
| High school degree or greater | 44.0 | 19.2 | 83.2 | 50.3 | 26.2 | 89.2 | |
| Householder marital status, ^a % | | | | | | | 0.008 |
| Unmarried | 24.0 | 14.8 | 17.1 | 22.4 | 15.1 | 18.9 | |
| Married | 76.0 | 85.2 | 82.9 | 77.6 | 84.9 | 81.1 | |

SE, standard error; y, years

Data are weighted means or proportions, as indicated

[§]Overweight/obesity was defined as having a body mass index at or above the age- and sex-specific 85th percentile based on the Center for Disease Control and Prevention's BMI-for-age growth charts

^aHouseholder marital status was categorized as married if the householder reported being married or living with a partner and unmarried if the householder reported being widowed, divorced, separated, or never married

Table 2

Prevalence ratios of overweight/obesity by nativity status stratified by NHANES survey period (1988–1994 and 2005–2014) among Mexican-American children aged 4–17 years (N = 6,288)

| NHANES survey period | Model 1 | | Model 2 | |
|----------------------|---------|-----------|---------|-----------|
| | PR | (95% CI) | PR | (95% CI) |
| 1988–1994 | | | | |
| U.S.-born | ref | -- | ref | -- |
| Foreign-born | 0.77 | 0.61 0.96 | 0.75 | 0.61 0.94 |
| 2005–2014 | | | | |
| U.S.-born | ref | -- | ref | -- |
| Foreign-born | 0.95 | 0.84 1.07 | 0.94 | 0.84 1.07 |

NHANES, National Health and Nutrition Examination Survey; PR, prevalence ratios; CI, confidence intervals

Estimates were derived from log-binomial regression models. Results from models stratified by NHANES survey period presented for ease of interpretation (p-interaction: nativity*survey period = 0.069)

Model 1: Adjusted for age (continuous) and sex (male/female)

Model 2: Adjusted for age (continuous), sex (male/female), household marital status (married/unmarried), and household education (<12th grade/ 12th grade (high school diploma, includes GED))