Weight Control; Underserved Populations

Early Childhood Disadvantage for Sons of Mexican Immigrants: Body Mass Index Across Ages 2–5

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Abstract

Purpose. *To distinguish the origins of higher weight status and determine when and why intra- and interracial/ethnic disparities emerge.*

Design. *The study used a longitudinal analysis of the Early Childhood Longitudinal Study–Birth Cohort (ECLS-B).*

Setting. *The study was conducted in the United States.*

Subjects. *Participants were children of non-Hispanic white mothers and children of U.S.- and foreign-born mothers of Mexican origin from a nationally representative sample of children born in the year 2001 ($N \approx 3700$).*

Measures. *The Centers for Disease Control and Prevention growth charts determined sex- and age-specific weight status. Covariates were obtained from birth certificate records and parent interviews.*

Analysis. *Frequencies, growth curve trajectories, and ordinary least squares regression examined body mass index (BMI) and obesity across survey waves.*

Results. *Compared to their peers with non-Hispanic white mothers, children of Mexican-heritage mothers have higher average BMI and greater rates of obesity. The BMI of boys with Mexican-born mothers is higher relative to whites and children of U.S.-born Mexican mothers across early childhood, increasing sharply at about age 4.5 years. This divergence is driven by increases in the BMI of boys, as girls do not show the same growth. A number of measures, including descriptors of children's nutritional intake, lifestyle factors, and acculturation, do not explain the increased obesity rates among sons of Mexican mothers.*

Conclusion. *Despite favorable perinatal health and weight, Mexican-American sons of foreign-born mothers show disadvantages in BMI that emerge close to the start of kindergarten.*

Key Words: Obesity, Body Mass Index, Child, Mexican-Americans, Male, Prevention Research. Manuscript format: research; Research purpose: descriptive; Study design: nonexperimental; Outcome measure: biometric; Setting: national; Health focus: weight control; Strategy: policy; Target population age: youth; Target population circumstances: race/ethnicity

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PURPOSE

Obesity has become a major health concern as body mass levels have risen in the United States over the last several decades. The American Medical Association now recognizes obesity as a disease in hopes of bringing increased awareness and resources to the problem.[1] Childhood obesity is a particular concern because its rise and fall may determine the path to and away from obesity and chronic health problems at later ages: Children who are overweight or obese are more likely to become obese or have health problems in adulthood.[2,3]

Childhood obesity is also of public health import because it may help explain some of the sizable race/ethnic health disparities that persist throughout most of the life course. While nearly 17% of children and adolescents aged 2 to 19 in 2009–2010 were classified as obese, obesity rates were even higher among non-Hispanic black (24.3%) and Hispanic (21.2%) children. Within the Hispanic pan-ethnic group, Mexican-American children show a particularly high prevalence, with a 47% to 81% higher likelihood of being classified as obese relative to their non-Hispanic white counterparts.[4]

Researchers looking at childhood obesity are increasingly examining earlier ages to determine the origins of higher weight status.[5–7] Rates of obesity among preschool-aged children have doubled in recent decades, with nearly one in eight children aged 2 to 5 years in 2009–2010 having a body mass index (BMI) classified as obese.[8] Data from 2008–2011 suggest that the increase has stabilized or reversed among children aged 2 to 5 years in many U.S. states/territories, perhaps due to intervention efforts on the part of many agencies and organizations to improve nutrition and physical activity.[8,9] Despite this apparent progress, the prevalence of obesity is still nontrivial, and the obesity status of older cohorts of children still poses challenges to adult weight and health outcomes.

Early childhood also provides an opportunity to determine when and why inter- and intraracial/ethnic disparities emerge. Although the infant health outcomes, including birth weight, of many Latinos are better than expected given their low socioeconomic status (SES), which has been labeled a "Hispanic health paradox" (in perinatal outcomes),[10–13] children of Mexican immigrants have higher BMI than do white children of parents born in the United States as early as age 3 years.[14] Higher BMI, and especially very high BMI levels, may be a meaningful divergence from favorable perinatal health that sheds light on other crossover processes in which immigrant health declines over time (for adult health, see Cunningham et al.[15]; for child health, see Van Hook and Balistreri[16]).

Research has yet to fully explain these health disparities and, particularly, the timing and mechanisms of high BMI levels among children of Mexican immigrants. The timing is particularly important since Hispanic children show increased obesity much earlier than do black children.[17] However, our identification of this timing is constrained by the developmental context of early childhood. The Centers for Disease Control and Prevention (CDC) do not provide growth standards for overweight or obese until age 2 years[18]; for children younger than 2, researchers and clinicians use the term "high weight-for-length," rather than "obese" or "overweight" (for example, Ogden et al.[4]). We therefore consider birth weight and weight-for-length in infancy, but do not examine these measures as outcomes.

Across childhood, genetics and epigenetics, intrauterine exposures, birth weight, diet, energy expenditure, TV viewing, and other factors have been identified as determinants of child obesity levels.[19] In early childhood, birth weight, infant feeding patterns, taking a bottle to bed, mother's weight status, consumption of sugar-sweetened beverages, and sleep patterns have all been shown to have associations with children's weight status.[20–25] While Hispanic children have greater rates of most of these risk factors,[26] these mechanisms do not explain greater BMI among Hispanic or Mexican-American children compared to their white or black counterparts in early or midchildhood.[14,20,21]

More research is needed to understand how another possible set of mechanisms—measures of immigrant acculturation to societal values, health behaviors, and adaptation to U.S. life more broadly—may lead to the adoption of behaviors and risk factors associated with obesity. There is limited information on the role of family acculturation in shaping children's BMI, especially among ages 2 to 5, and the findings are not conclusive. Mother's age at migration does not appear to be associated with disparities between non-Hispanic white children of U.S.-born parents and Hispanic children of foreign-born parents, although living in an English-speaking household is associated with increased risk of obesity.[27,28]

Much of the literature examining childhood obesity controls for race/ethnicity, nativity, class, and gender, but does not explore their intersectionality, even though prior findings suggest that certain groups experience disproportionate risk factors and rates of obesity.

Our study aims to advance knowledge on obesity in early childhood, ethnic disparities in child obesity, and the crossover from advantaged perinatal health to disadvantaged health among children of Mexican immigrants. To our knowledge, this study is the first to chart BMI trajectories across early childhood (ages 2–5) for a nationally representative cohort. To accomplish these goals, this study examines BMI across ages 2 to 5 among a nationally representative group of white children of U.S.-born parents, children of Mexican heritage with U.S.-born parents, and second-generation Mexican-American children.

METHODS

Sample

We used data from the Early Childhood Longitudinal Study–Birth Cohort (ECLS-B), which follows a nationally representative sample of U.S.-born children from birth in 2001 until the start of kindergarten, up to 2007. We use information from waves 1, 2, 3, and 4, when children are approximately 9 months, 2 years, 4.5 years, and 5.5 years old, respectively. Of the ~7000 children that participated in wave 4, we analyze the ~3800 who are children of U.S.-born non-Hispanic white mothers, U.S.-born Mexican-heritage mothers, and foreign-born Mexican mothers. About 100 children (<3%) are missing for BMI at wave 4, leaving a sample of about 3700. All samples are rounded to the nearest 50 per the security requirements of the ECLS-B. The descriptive statistics for this sample are displayed in Table 1. Attrition rates across the ethnic groups were not significantly different. We retain as much information as possible for each analysis, so samples other than the 3700 were used for descriptive information from waves 2 and 3 and growth curve analyses. Wave 2 has fewer children because children under age 2 do not have a defined obesity status, and wave 3 has more children because wave 4 was conducted on an 85% subsample due to budget constraints. Growth curve analyses include any children with two or more points of information. Restricting descriptive statistics and growth curve analyses does not bring about any substantive differences.

Measures

Outcome. Our outcome of interest is BMI, a measure based on child height and weight collected by ECLS-B personnel. We also examine obese status, defined as at or above the 95th percentile of BMI for children of the same age and sex using CDC growth charts.[29] As mentioned above, age 2 years is the youngest we examine because most studies do not interpret higher weight-for-length for younger ages as indicative of obesity or overweight (for example, see Baird et al.[30]; see Moss and Yeaton[31] for a counterexample).

Race/Ethnicity and Nativity. As indicated above, we categorize children based on the ethnicity and nativity of their mothers. We include children with non-Hispanic white U.S.-born mothers,

Table 1
Descriptive Statistics*†

	Non-Hispanic White, U.S.-Born Mother	Mexican-Heritage, U.S.-Born Mother	Mexican-Heritage, Foreign-Born Mother
Population	79.22%	7.53%	13.24%
Wave 4 overweight (>85th percentile)	30.66%	40.16%	47.19%
Wave 4 obese (>95th percentile)	14.10%	22.85%	31.15%
Wave 4 body mass index	16.58	17.00	17.50
Age in months (wave 4)	64.68	64.71	64.85
Male	0.50	0.51	0.55
Socioeconomic status quintile (wave 4)			
1 (lowest)	0.09	0.23	0.65
2	0.16	0.29	0.22
3	0.22	0.25	0.08
4	0.25	0.16	0.05
5 (highest)	0.27	0.07	0.01
Region (wave 4)			
Northeast	0.16	0.00	0.02
Midwest	0.28	0.13	0.13
South	0.38	0.32	0.30
West	0.18	0.55	0.56
Urbanicity (wave 4)			
Urbanized area	0.61	0.78	0.88
Urbanized cluster	0.14	0.19	0.09
Rural	0.25	0.03	0.02
Birth order (1 = firstborn)	1.95	2.15	2.38
Birth weight			
Normal	0.82	0.85	0.85
Low	0.05	0.05	0.05
Very low	0.01	0.01	0.01
High	0.12	0.09	0.08
Weight-for-length in infancy (wave 1)			
<5%	0.07	0.06	0.07
5%–95%	0.79	0.75	0.72
>95%	0.14	0.19	0.22

* Source: Early Childhood Longitudinal Study–Birth Cohort.
† Accounts for complex sampling design. N ≈ 3700.

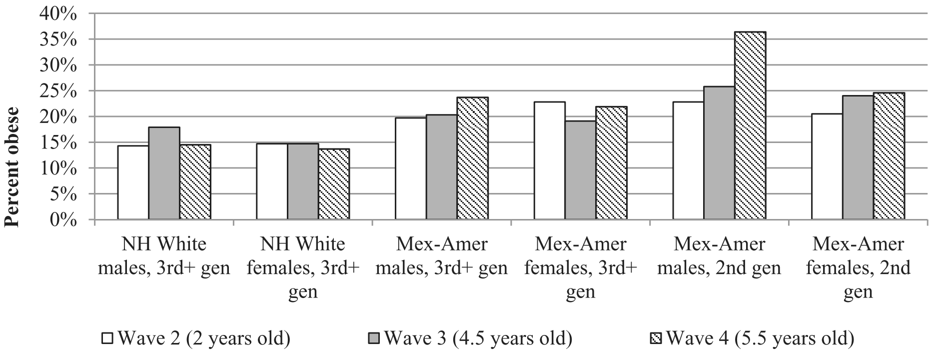
Mexican-heritage U.S.-born mothers, and Mexican-born mothers. To be concise, we refer to children of non-Hispanic white U.S.-born mothers as "white." We refer to children of Mexican heritage as Mexican-American, either second generation (Mexican-born mother) or third generation or more (U.S.-born mother).

Controls. Time-invariant control variables include child sex (1 = male), birth order (1 = firstborn), birth weight (very low < 1500 g; low > 1500 g and < 2500 g; normal > 2500 g and < 4000; and high > 4000 g), and weight-for-length percentile in infancy (collected at wave 1 and adjusted for age in months, categorized as between 5th and 95th, below 5th, and above 95th percentiles based on World Health Organization [WHO] growth charts). We use the WHO percentiles for infancy, as the CDC does not provide figures for children under the age of 2 years. We also use the following covariates collected at each wave, with the referent given as the first in each list of categories: child age in months, region (Northeast, South, West, and Midwest), urbanicity (urbanized area [population > 50,000], urbanized cluster [population > 2500 and <50,000], or rural [population < 2500]), and household SES quintiles (5 = highest, 4, 3, 2, and 1 = lowest). These quintiles were based on an ECLS-B–constructed continuous variable that averages standardized scores on mother's occupation and education, father's occupation and education, and household income.

Behavioral Risk Factors (Across the Study Period). As a possible explanation for ethnic disparities, we examine behavioral risk factors, including nutrition, practices around food, television watching, sleep, and mother's BMI. A measure of regular consumption of sugar-sweetened beverages is defined as drinking sodas, sports drinks, or fruit drinks that are not 100% fruit juice every day for the last 7 days (waves 3 and 4) or usually drinking these beverages with meals or snacks (wave 2). Frequent fast-food consumption is defined as eating a meal or snack from a fast-food restaurant four or more times per week at waves 3 and 4. At wave 1,

Figure 1

Percent Obese by Ethnicity and Sex, Waves 2–4



Source: Early Childhood Longitudinal Study–Birth Cohort. Note: Statistics account for complex sampling design. Wave 2 indicates N ≈ 3450; wave 3, N ≈ 4850; wave 4, N ≈ 3700; NH, non-Hispanic; Mex-Amer indicates Mexican-American; and gen, generation.

parents reported on breastfeeding and solid food consumption, and the data were used to create dichotomous measures of whether the child was breastfed for at least 6 months and if the child ate solid foods before 4 months. Data limitations prevent us from distinguishing exclusive breastfeeding. At waves 1 and 2, parents reported whether the child took a bottle to bed, a factor associated with increased likelihood of obesity.[32] Sleep curtailment has also been associated with higher weight among children, and indicators identified whether the child usually slept less than 10 hours or went to bed past 10 P.M. at waves 3 and 4.[22,24] A dichotomous variable of watching more than the recommended guideline of 2 hours of television per day was taken from waves 2, 3, and 4. Finally, mother's BMI was captured at each wave. This measure was created using the interviewer's weight measurements at each wave and mother's self-reported height in wave 1.

Additional Risk Factors in Preschool (Wave 3 Only). To further explore possible influences on BMI, analysis examined additional nutritional intake factors and child care variables at wave 3 (preschool). Additional variables represented parent-reported nutritional intake. Parents reported the frequency with which their children ate sweet snacks, salty snacks, fresh fruits, vegetables (other than french fries or fried potatoes), and 100% fruit juices in the last 7 days. Wave 3 child care measures included a dichotomous measure indicating if the child was in center care and a continuous measure representing the total number of hours per week spent in nonparental care.

Acculturation. Citizenship, household primary language, interview language, the mother's years in the United States, and a scale of English language abilities serve as proxies for acculturation. For mothers not born in the United States, citizenship is self-reported. A dichotomous variable captures this report, with U.S.-born individuals coded as citizens. Household primary language and interview language are both dichotomous variables (0 = English, 1 = non-English). Mother's years in the United States represented the difference between the age of the mother and the age she reported coming to the United States. We average the respondent's reports of how good her reading, writing, understanding, and speaking skills are with higher scores indicating more difficulties with English. Those reporting that English was the main household language were not asked this question, so they were given the lowest scores for all measures to represent no problems with English.

Preschool Household and Neighborhood Resources. Additional measures include zip code measures and household resources at wave 3. Zip code measures represent the characteristics of the child's residential area, as provided by the 2000 U.S. Census. Measures included the percentage distributions of race/ethnicity (white, black, and Hispanic), educational attainment (less than high school, high school diploma, some college, college degree or more), income levels (low income, below poverty), female household head, unemployment, housing vacancy, renter, and working class. Townsend and Carstairs indices captured broader measures of deprivation, with the former using unemployment, non–car ownership and non–home ownership, and overcrowding[33] to compute a score of material deprivation and the latter incorporating low social class, non–car ownership, overcrowding, and male unemployment.[34] Resources at wave 3 include the receipt of government benefits (Supplemental Nutrition Assistance Program or food stamps, Medicaid, Temporary Assistance for Needy Families/welfare, and Special Supplemental Nutrition Program for Women, Infants, and Children), health insurance, and assets (car ownership, investments, bank account, income-to-needs, and mother's education), and social resources (household size, receipt of parenting help or advice, and no emergency contact).

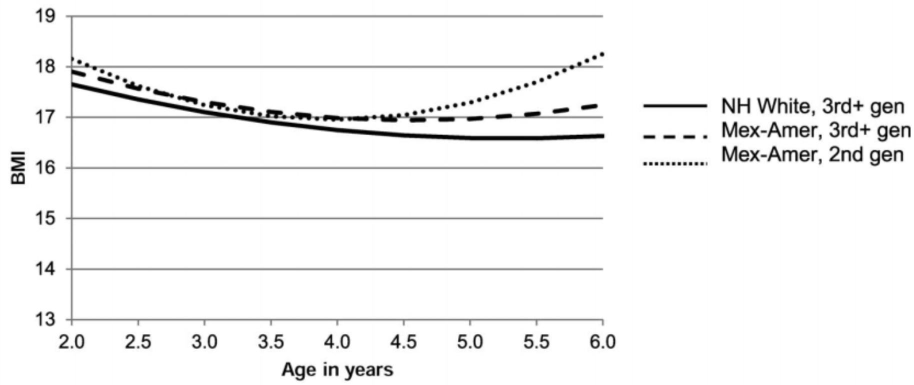
Analysis

We first examined wave-specific frequencies of BMI and obesity by gender in each of the ethnic groups (with no controls). We then estimated multivariate growth curve models by gender, examining trajectories of BMI over time after controlling for SES and health behaviors. This approach nests time points within children, with age and age squared as the level 1 units and the individual as the level 2 unit (see Van Hook and Balistreri[16]). To investigate how ethnic and nativity groups diverge over time, models include terms that interact with Mexican U.S.-born mothers and Mexican foreign-born mothers with age and age squared. Prior research has assessed associations with weight status for children over time,[35] but has not charted these trajectories. These growth curve models use time-varying covariates available at waves 2, 3, and 4

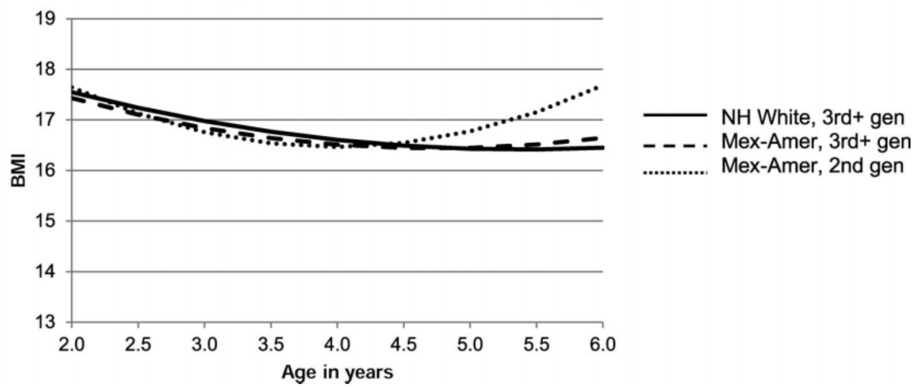
Figure 2

Male Body Mass Index (BMI) Trajectories by Ethnicity, Across Waves 2–4

A. Trajectories with no controls.



B. Trajectories controlling for time invariant and time-varying controls and risk factors.



Source: Early Childhood Longitudinal Study–Birth Cohort. Notes: Statistics account for probability weights and clustering in primary sampling units. Time-invariant covariates include birth order, birthweight, wave 1 weight for length, count of regular consumption of sugar sweetened beverages, count of fast food consumption 4 or more times per week, count of watching TV more than the recommended guideline, count of taking a bottle to bed, breastfeeding for 6 or more months, eating solid foods before 4 months of age, count of sleeping less than 10 hours, and count of bedtime later than 10 P.M. and time-varying variables include region, urbanicity, socioeconomic status quintile, and mother's BMI. N $\approx$ 2300 individuals or 5500 person-waves. NH indicates non-Hispanic; Mex-Amer indicates Mexican-American; and gen, generation.

(age, region, urbanicity, SES quintile, mother's BMI), time-invariant covariates that do not change over time (child sex, birth order, birth weight, weight-for-length at wave 1, breast-fed for 6 or more months, received solid food before 4 months), and time-invariant counts of risk factors that summed the number of waves at which the risk factor was present (sugar-sweetened beverage, fast food, too much television, bottle to bed, sleeping less than 10 hours, bedtime past 10 P.M.). While we include possible influences on BMI in these growth models, we do not examine preschool nutrition and child care because they are specific to the middle of the observation period. Multicollinearity prevents us from including acculturation alongside race/ethnicity and nativity categories and including the many possible SES household and neighborhood measures in the growth curve models. To analyze these factors, we perform descriptive statistics among boys of Mexican-origin mothers and regression analysis on sons of Mexican, Mexican-American, and white mothers.

We then present descriptive statistics comparing obese and average-weight boys with Mexican immigrant mothers on a range of factors, including the SES and health behaviors presented above as well as the preschool measures described above. We also present results from ordinary least squares regressions predicting wave 4 BMI controlling for wave 3 BMI, focusing on the ages when sons of Mexican immigrant mothers demonstrate the largest increase. Multicollinearity again prevents inclusion of all the different health behaviors, acculturation, and SES measures, but models with different specifications did not produce different results. All analyses account for complex sampling design using probability weights and jackknife replication weights provided by National Center for Education Statistics, except growth curve models that account for probability weights and clustering in primary sampling units. While some families live in the same zip codes, there is not enough clustering to allow for multilevel models nesting individuals in zip codes. Adjusting for complex sampling design accounts for clustering in counties, which were used as sampling units.[36]

RESULTS

Obesity statistics for each wave are presented in Figure 1. The percentage of obese children ranges from 14.3% (white males, wave 2) to 36.4% (second-generation Mexican-American males, wave 4). Non-Hispanic white sons and daughters of U.S.-born mothers show relatively similar prevalence rates across the three waves. Sons and daughters of U.S.-born mothers of Mexican heritage display higher rates of obesity, but these rates do not appear to change much over time. In contrast, sons of foreign-born Mexican mothers have a much higher obesity rate in wave 4; daughters do not show this increase.

Because of the sharp increase among sons of foreign-born Mexican mothers, we display multivariate, longitudinal analyses of males. We also analyzed girls, but there were no

Table 2
Descriptive Statistics of Sons of Mexican Immigrants, by Wave 4 Obesity Status†‡§

Population	Not Obese 64%	Obese 36%	Significant Difference
Behavioral risk factors			
Regular sugar-sweetened beverages	0.47	0.33	**
Fast food 4× per wk or more	0.20	0.20	
No. veggies per wk	8.84	9.23	
No. fruit per wk	12.59	12.35	
Juice per wk	12.23	12.23	
Sweet snacks per wk	6.57	4.78	
Salty snacks per wk	4.50	3.98	
Regular family dinner	4.69	4.48	
Bottle to bed (wave 2)	0.28	0.39	
Breast feed for 6 mo or more (wave 1)	0.43	0.49	
Solid food before 4 mo (wave 1)	0.14	0.20	
Watches too much TV	0.34	0.34	
Sleep 10 h or more	0.81	0.77	
Bedtime past 10 P.M.	0.05	0.03	
Mom body mass index	28.25	31.28	***
Controls			
Socioeconomic status quintile			
Quintile 1 (lowest)	0.56	0.74	***
Quintile 2	0.23	0.18	
Quintile 3	0.15	0.03	****
Quintile 4	0.05	0.05	
Quintile 5 (highest)	0.01	—	
Region			
Northeast	—	0.06	
Midwest	0.10	0.20	*
South	0.39	0.25	*
West	0.52	0.49	
Urbanicity			
Urbanized area	0.84	0.91	
Urbanized cluster	0.14	0.07	
Rural	0.03	0.03	
Mom married	0.68	0.50	*
Birth order (wave 1)	2.38	2.27	
Birth weight (wave 1)			
Average	0.87	0.74	**
Low	0.06	0.04	
Very low	0.01	0.00	*
High	0.06	0.21	***
Child care			
Center care	0.52	0.52	
No. child care hours	16.62	17.73	
Acculturation			
Respondent is citizen	0.18	0.09	*
HH primary language not English	0.92	0.97	
Interview not in English	0.81	0.87	
Years in United States (wave 1)			
More than 10	0.46	0.46	
5 to less than 10	0.20	0.22	
Less than 5	0.35	0.31	
Standard scale of English difficulties (wave 1)	2.00	2.42	*
Resources			
SNAP/food stamps	0.18	0.22	
Medicaid	0.46	0.51	
TANF/welfare	0.02	0.03	
WIC	0.72	0.73	
No health insurance for child	0.11	0.12	
Household owns car	0.87	0.82	

significant differences in the rate of change in obesity over time for the ethnic groups, with daughters of Mexican immigrants exhibiting a higher BMI at the start of the study period. The growth models in Figure 2 illustrate the interactions between ethnic/nativity group and age. Full tables are available upon request. Figure 2A shows trajectories over time for the ethnic groups, without any controls. These patterns should be interpreted within the developmental context of the normal J-shape in body mass gain across childhood.[29] According to the 50th percentile in the CDC growth charts, there is a decline in BMI from ages 2 years to about 5 (girls) or 6 (boys) years, when it begins to rise again. Although most groups evinced this general pattern, the apparent inflexion point where BMI starts rising again began to occur somewhat earlier for sons of Mexican mothers at around age 4.5 years, after which this group also had a higher baseline BMI than white boys. Mexican-American girls had higher BMI than white girls, but did not exhibit this additional jump around preschool age. Figure 2B illustrates trajectories after the inclusion of risk factors and controls that are time invariant or time varying. The inclusion of these covariates equalized BMI over the time period for Mexican-American sons with U.S.-born mothers, but the accelerated increase among sons of Mexican-born mothers remained.

Given the BMI risks identified among sons of Mexican-origin mothers, we investigated their demographic, health behavior, and acculturation profiles. Table 2 displays the results of *F*-tests comparing obese and nonobese members of this disadvantaged group. Obese sons were significantly more likely to be in the lowest SES quintile, have high birth weight, and have a mother with higher BMI. Contrary to expectations that obesity is related to increased acculturation, they also were more likely to have a mother with English difficulties and significantly less likely to have a mother that was a U.S. citizen (or married). Mothers also reported that obese sons drank *fewer* sugar-sweetened beverages than boys of normal weight. Despite these differences, the other indicators did not

Table 2, Continued

Population	Not Obese 64%	Obese 36%	Significant Difference
Household has investments	0.04	0.03	
Household has bank account	0.38	0.28	
Income-to-needs	1.21	1.05	
Mom educational attainment	10.75	10.08	*
Household size	5.35	5.36	
Received parenting help/advice	0.07	0.08	
No emergency contact	0.02	0.02	
Neighborhood characteristics by zip code			
White	0.43	0.41	
Black	0.11	0.13	
Hispanic	0.39	0.39	
Less than high school	0.31	0.33	
High school	0.25	0.25	
Some college	0.26	0.25	
College degree or more	0.18	0.17	
Low income	0.23	0.24	
Below poverty	0.16	0.17	
Female household head	0.61	0.60	
Unemployed	0.28	0.28	
Vacant	0.06	0.05	
Renting	0.42	0.44	
Working class	0.71	0.73	
Townsend index	3.42	3.75	
Carstairs index	2.95	3.22	

† Source: Early Childhood Longitudinal Study–Birth Cohort.
‡ Accounts for complex sampling design. Variables are from wave 3 except where noted. Dashes indicate cell sizes too small to estimate. N $\approx$ 250.
§ HH indicates household; SNAP, Supplemental Nutrition Assistance Program; TANF, Temporary Assistance for Needy Families; and WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.
**** $p < 0.001$.

reveal significant differences, though the small sample size may preclude significant findings for small effect sizes. While power analyses for adjusted Wald tests, which adjusted for complex sampling design, are not straightforward, a *t*-test with the sample sizes for these children and a power of .8 or higher should reveal effect sizes of .4 or greater.[37] In other words, to detect a small effect such as the difference in taking a bottle to bed in wave 2 (odds ratio = 1.6; Cohen's d = .26), our sample provides only a power of .5. Thus, there may be other small differences between obese and normal-weight sons of Mexican immigrants.

Additional analyses (available upon request) focused on ethnic differences in the period of steep BMI growth. These models predicted boys' BMI at wave 4 (about age 5.5) after controlling for BMI at wave 3 using ordinary least squares regression. Boys with Mexican-born mothers had significantly higher BMI compared to whites, which was reduced slightly after controlling for SES and birth weight, but persisted beyond the inclusion of behavioral risk factors, type and number of child care hours, and zip code characteristics. Despite the rich set of covariates available in these data, the mechanisms for the differences in BMI did not emerge.

DISCUSSION

This study makes several contributions to our understanding of child obesity. First, it highlights young Mexican-heritage sons of immigrant mothers as particularly susceptible to higher weight status in early childhood. This finding corresponds to the conclusions of Van Hook and Baker,[38] who investigated differences in the effect of acculturation on boys and girls aged 5 to 11 years. They found that boys with parents raised outside the United States weighed more and gained weight faster, but the same pattern did not emerge for girls. They were not able to test the mechanisms underlying the increased risk among Mexican-heritage boys in middle childhood, but the authors[38(p210)] posited that the additional risk may be due to "gendered beliefs and parenting practices that are more likely to indulge boys." Gender is important to understanding family functioning among immigrant families,[39] and boys generally take on less responsibility than do girls in Mexican immigrant households.[40] Mexican parents may view heavier weight status as more favorable or healthier, but a prior study showed that Mexican immigrants' beliefs, attitudes, and knowledge of weight status were similar, regardless of whether their preschooler was below or above the 95th percentile for BMI.[41] Future research should further examine how race/ethnicity, nativity, and gender combine to produce different dimensions of risk.

Second, our results establish early childhood as a critical period for the exacerbation of health disadvantage for Mexican-heritage sons of foreign-born mothers. While these children have displayed higher BMI across childhood ages, this study is, to our knowledge, the first to identify the timing of the further widening of the obesity disparity: about age 4.5 years. For many children, this timing coincides with the prekindergarten year, an age when most children enroll in center-based preschools and may experience corresponding changes in diet, exercise, and other health behaviors. Children from Mexican immigrant families are less likely to receive center-based care,[42] which could potentially spur divergent experiences at this age. At around the same age, children are aware of and begin to enact differences related to race, class, and gender,[43–45] which could shape the emergence of gender disparities in health behaviors.

Third, this study points to a complex web of factors that influences child health, which may require more detailed data collection methods. Other research has been unable to identify the mechanisms linking disadvantaged children to higher rates of obesity, and this study produced similar results, despite the focus on early childhood and the inclusion of a wealth of measures describing the children's nutritional intake and other lifestyle factors. However, our data are limited, and we do not have information on patterns of behavior that lead to increased weight gain, such as portion size or physical activity levels. An alternative explanation is inaccurate reporting. For example, mothers may underreport the eating habits of their sons because of social desirability or because they do not realize what they are eating. It is unlikely that reporting differences are due to language difficulties, since ECLS-B provided bilingual interviewers and both Spanish and English programs for computer-assisted personal interviewing, and no parents were unable to conduct an interview due to language difficulties.[36]

Nonetheless, the socioeconomic and language disadvantages associated with obesity among these young Mexican boys suggest that these families may experience hardships, such as discrimination or stigma, as opposed to experiencing simpler forms of negative "acculturation" in which being "culturally" closer to the mainstream is related to worse BMI outcomes.[46] The role of language may be particularly salient, as low-proficient English-speaking Mexican mothers have disproportionately more obese sons, a surprising finding that parallels that of Van Hook and Baker.[38] There is not a source to use to directly compare Mexican children of the same age in the same year to children in this study (that uses the same obesity thresholds), but similar estimates for Mexican children appear to be lower.[47] Further, unlike their adult counterparts, prior research identifies U.S. exposure as important for children of Mexican immigrants, as children in Mexico with a high propensity for immigration have lower BMI compared to both their Mexican counterparts with a lower propensity and Mexican-born children living in the United States.[48]

The mechanisms for the influence of parent acculturation—including the disadvantages that produce said acculturation[49]—on weight status among boys of Mexican heritage will be an important research target for the future. The more frequent occurrence of high birth weight (i.e., >4000 g) among Hispanics and the association between high birth weight and childhood body mass[50,51] suggest that these mechanisms are in place prior to birth, but continue to operate into early childhood since birth weight did not explain racial/ethnic differences in obesity in regression analyses. An additional consideration is gestational diabetes, unmeasured in the ECLS-B, since this condition is associated with increased risk of high birth weight and is more prevalent among Hispanic women.[52] Furthermore, the higher BMI of the Mexican mothers of obese sons points to family-level influences.

In conclusion, while this study does not solve the origin of the crossover between favorable perinatal health and weight and unfavorable body mass levels in early childhood, it does push its origin to earlier in childhood. Moreover, this study also contributes to mounting evidence of the existence of an additional obesity bump for second-generation Mexican-American boys around preschool age, suggesting that some aspects of Mexican-American health may be worse for the (male) children of immigrants than for third and subsequent generations. Future research should confirm the existence and improve understanding of this generational gap.

SO WHAT? Implications for Health Promotion Practitioners and Researchers

What is already known on this topic?

Hispanic children display greater rates of obesity than do their white counterparts. However, the causes and timing of the emergence of this disparity are as yet unknown.

What does this article add?

This study aims to advance knowledge on obesity in early childhood, ethnic disparities in child obesity, and the crossover from advantaged perinatal health to disadvantaged health among children of Mexican immigrants. To our knowledge, this is the first study to chart growth trajectories of body mass index across early childhood. We uncover a sharp increase in body mass index and obesity rates among sons of Mexican immigrants starting at about age 4.5 years.

What are the implications for health promotion practice or research?

Our results suggest that young sons of Mexican immigrants are particularly at risk for unhealthy weight status. Interventions should target this population prior to their increased risk at age 4.5 years.

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