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## Big Boys and Little Girls: Gender, Acculturation, and Weight among Young Children of Immigrants

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### Abstract

Previous research fails to find a consistent association between obesity and acculturation for children. We theorize that social isolation shelters children of immigrants from the U.S. “obesigenic” environment, but this protective effect is offset by immigrant parents’ limited capacity to identify and manage this health risk in the United States. We further theorize that these factors affect boys more than girls. We use data from over 20,000 children in the Early Childhood Longitudinal Study Kindergarten Cohort and find that boys whose parents were raised outside the United States weighed more and gained weight faster than any other group. However, within this group, sons of low English-proficient parents gained weight more slowly than sons of English-proficient parents. The results thus suggest that two dimensions of low acculturation—foreign place of socialization and social isolation—affect children’s weight gain in opposite directions and are more important for boys than girls.

### Keywords

Children of immigrants; gender; obesity; acculturation

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Research consistently demonstrates that newly-arrived immigrants enjoy better health than similar natives and that immigrants’ health advantage deteriorates with increasing duration in the United States and greater levels of acculturation (Cho et al. 2004; Hummer et al. 2007; Landale, Oropesa, and Gorman 2000). The standard understanding of immigrant health credits traditional cultural practices and positive health selection for immigrants’ initial good health and blames exposure to American society for their subsequent decline. However, these ideas are inconsistent with a growing body of evidence showing no clear association between children’s weight and parental acculturation. This is surprising, especially since obesity is more common in the United States than in many sending countries (Van Hook and Balistreri 2007), and acculturation is widely thought to be associated with precisely the health behaviors that lead to obesity, that is, a high-calorie diet and sedentary activity.

To help explain this anomaly, we demonstrate that it is important to distinguish between two dimensions of acculturation: (1) place of socialization and (2) level of social integration in the host society. The health assimilation model focuses primarily on the level of social isolation versus integration of immigrants, but it neglects the influence of foreign place of socialization, defined here by whether parents moved to the United States after childhood. Many immigrants originate from less-developed countries with much lower levels of obesity than in the United States. Socialization in these places might reduce immigrants’ ability to

identify and offset the risk of overweight among children. For example, immigrant parents may be less aware of the risks of obesity, engage in child-feeding practices that overlook or encourage overeating, or fail to provide opportunities for their children to participate in sports and other activities.

We also suggest that gender differences help explain the nonexistent association between parental acculturation and children's weight. Just as place of socialization may affect parents' ability to manage health risks, it may also influence how parents treat their sons versus daughters. Immigration and acculturation are highly gendered processes (Parrado, Flippen and McQuiston 2005; Suárez-Orozco and Qin 2006; Hondagneu-Sotelo 1994). Gender roles and hierarchies are likely to be more patriarchal in sending countries, and these tendencies may be reinforced following immigration (Parrado et al. 2005). For example, immigrant parents may be slower to recognize the risks of obesity for their sons than their daughters. Also, immigrant girls often experience much more parental control and supervision, while boys are allowed more privileges at home and freedom outside the home (Suárez-Orozco and Qin 2006).

## PRIOR RESEARCH ON CHILDREN'S WEIGHT

The Center for Disease Control and Prevention defines the term "overweight" as having a body mass index (BMI) at or exceeding the 95th percentile within age- and gender-specific groupings, and "at-risk-for-overweight" as between the 85th and 95th percentiles. In the United States, the prevalence of overweight children and those at risk for overweight has quadrupled over the past 25 years (National Center for Health Statistics 2006), and the most recent estimates suggest that 18.8 percent of 6 to 11 year old children are overweight and another 17.2 percent are at risk of being overweight.

Because of its direct linkages to health behaviors, overweight is a pertinent health outcome for assessing how acculturation may be linked to health. The basic idea, termed the negative health assimilation hypothesis, is that unfavorable health trajectories result from a cultural change involving either the erosion of protective social environments among immigrants, or the adoption of American risk behaviors that place health at greater jeopardy, or both. Applied to weight, exposure to the American environment and acculturation are thought to be associated with less-healthy diets, sedentary activity, and obesity (Carter 2002; Fried and Nestle 2002). This is supported by research that suggests the likelihood of being overweight or obese increases with the time in the United States among adult immigrants (Antecol and Bedard 2006), and is higher among native-born than foreign-born adolescents (Popkin and Udry 1998). Another study of adolescents found that immigrants would weigh more if they were more acculturated (Gordon-Larsen et al. 2003).

However, irregularities in research findings about children cast doubt on the idea that acculturation uniformly increases the likelihood of being overweight. Among Mexican-origin adolescents, Gordon-Larsen and colleagues (2003) fail to find a significant positive relationship between generational status and overweight. Among pre-adolescent Hispanic children, children of immigrants weigh more than children of natives (Baker, Balistreri, and Van Hook 2009; Balistreri and Van Hook 2009), particularly among boys (Van Hook, Baker, and Altman 2009). Similarly, a recent study found that U.S. children of immigrants, particularly Hispanic children of immigrants, are less likely than children of natives to engage in vigorous physical activity (Singh et al. 2008). Finally, a review of studies on dietary acculturation showed no clear positive associations between children's diets and indicators of parental acculturation (Arredondo et al. 2006).

Another perplexing finding is that boys tend to weigh more than girls among Asians and Hispanics. Ogden and colleagues (2006) found that 27 percent of boys compared with 20

percent of girls age 6 to 11 of Mexican descent (largely first and second generation immigrants) were overweight in 1999–2000 (Ogden et al. 2006). Popkin and Udry (1998) found that Hispanic immigrant adolescent boys were more likely than girls to be overweight or at risk for overweight (26% vs. 23%), and Asian boys were always heavier than girls regardless of generation. This is highly unusual given that prior research almost invariably finds that females are at higher risk of overweight than males, including among Hispanic, black, and non-Hispanic white adolescents (Gordon-Larsen et al. 2004); immigrant adults in the United States (Antecol and Bedard 2006; Kahn, Sobal, and Martorell 1997); adults in both more and less economically developed countries (Monterio et al. 2004; Yach, Stuckler, and Brownell 2006); and children in Mexico (Hernandez et al. 2003; Martorell et al. 2000). We seek to explain these surprising results by distinguishing between two aspects of parental acculturation: (1) place of socialization and (2) social integration.

### Place of Socialization, Gender, and Weight

Parents who were socialized in a different culture may be less effective at protecting their children from health risks such as overweight. In general, socialization in childhood influences life-long lifestyle patterns, beliefs, and values. Childhood is a critical period during which ideas about gender and health are formed, and these intensify in middle childhood (Maccoby 1998). Immigrants who were raised abroad may be unfamiliar with U.S. foods and grocery stores, unaware of the health risks of American junk food, and uninformed about opportunities for their children to participate in sports and other after-school activities (Van Hook et al. 2009). In addition, many immigrants originate from countries in which food insecurity and undernutrition pose significant health risks to children and overweight is much less prevalent than in the United States (Van Hook and Balistreri 2007; Popkin and Doak 1998), so they may be unaccustomed to protecting their children from overeating. Parents who were raised outside the United States may even have different perceptions of what a healthy weight is for children. This notion is supported by research showing that socioeconomic status (SES) tends to be positively associated with overweight in less-developed countries (Hernandez et al. 2003; Monteiro et al. 2004). Attitudes about overweight may partially underlie this pattern. In environments in which food sources are less secure (such as in some less-developed countries), overweight can be a marker of status, or at least is not perceived as unhealthy. Parents may therefore use their resources to indulge their children (Doak et al. 2005), which some argue has been occurring among middle-class parents in Mexico (Melgar-Quinonez and Kaiser 2004). Immigrants may bring such inclinations with them to the United States.

These ideas are further supported by research on immigrant families in the United States suggesting that less acculturated parents are less likely, compared to more acculturated or native parents, to classify their overweight children, especially sons, as overweight (Maynard et al. 2003; Olvera, Suminski, and Power 2005). In addition, recently published research suggests that less acculturated immigrant families themselves may promote a “food culture” that contributes to obesity. One study found that less acculturated Hispanic parents in the United States were more likely to encourage their children to eat more or “clean their plates” (Arredondo et al. 2006). Another study found that child-led snacking is common among Mexican American preschool-aged children living in the United States (Kaiser et al. 2001).

Immigrant parents who were socialized abroad may be particularly likely to indulge boys. Hispanic parents tend to be more permissive and indulgent regarding behavior within the home than other groups (Halgunseth, Ispa, and Rudy 2006), and are more likely to grant greater freedom and higher status to boys (Martinez 1999). Qualitative research on Asian and Caribbean parents similarly finds that boys hold a higher status than girls and therefore are more likely to be indulged (Kim and Wong 2002; Waters 1999). Preference for boys

may originate from immigrants' cultures of origin. All of the top ten immigrant sending countries to the United States in 2004 (U.S. Department of Homeland Security 2006) were ranked much lower on the gender empowerment measure—which summarizes women's economic, political, and professional participation relative to men—than the United States (United Nations Development Programme 2008). Although little is known about gender-specific feeding practices among immigrant parents, it seems plausible that immigrant parents, particularly those who were socialized abroad, may treat sons differently than daughters in ways that lead to especially high levels of overweight among boys.

### **Social Isolation, Gender, and Weight**

Although we theorize that one dimension of low acculturation—socialization outside the United States—is related to a higher likelihood of being overweight, another dimension is likely to be associated with lower levels of overweight, just as hypothesized in the health assimilation model. Children of less acculturated parents, particularly those whose parents do not speak English, may be sheltered or socially isolated from messages and norms that contribute to obesity in the United States. When immigrants come to the United States, they enter an environment in which they and their children are inundated with advertisements and opportunities to purchase food that is of low nutritional quality. For example, a study conducted by the Kaiser Family Foundation found that children ages 2–7 view an average of twelve television commercials for food each day, and children ages 8–12 view nearly twice as many (Ganz et al. 2007). Contact with American peers is also important. Children (especially those who are culturally different) often desperately want to fit in with their peers with respect to clothing, language, and other elements of nonmaterial and material culture, including food. This theme appears in a recent memoir of a Vietnamese immigrant (Nguyen 2007). However, isolation within ethnic communities and households may protect immigrant children from these influences by reducing exposure to American advertising and media, creating markets for ethnic foods, and reducing children's desire to fit in by seeking American foods.

Of course, language barriers also block messages about health and nutrition. For example, a Canada-based team of public health specialists conducted a major review of interventions designed to reduce overweight among children and found that none were aimed at children of immigrants (Flynn et al. 2006). In the face of language barriers, non-English-speaking parents may not obtain accurate or complete information from doctors or teachers. Children of non-English-speaking parents (who usually learn English faster than their parents) often act as “language brokers,” interpreting for their parents in meetings with doctors, teachers, and others. But health officials worry about the quality of information that children translate to their parents in a medical setting (Morales and Hanson 2005). Thus, it is possible that social integration or English ability may expose parents to messages that increase the risk of obesity but also educate them about those risks. On balance, however, social integration is still likely to be related to higher levels of overweight among children since public health messages about diet and exercise are dwarfed by those selling junk food in the United States (Nestle 2000).

Just as parents' place of socialization can have different effects for boys versus girls, so can social integration. Research has consistently found that immigrant parents place more restrictions on their daughters compared to their sons. Daughters are often not allowed to go to parties, spend time with friends after school, or participate in after-school programs, while sons are given more freedom to choose their activities (Halgunseth et al. 2006; Portes and Rumbaut 2001; Suárez-Orozco and Qin 2006; Dion and Dion 2001). Interestingly, these findings cut across ethnic groups, receiving regions, and time (Suárez-Orozco and Qin 2006). In addition, immigrants' daughters may be more restricted than sons due to additional family obligations. Children in immigrant families bear greater household responsibilities

due to less parental time at home and parental lack of English proficiency (Suárez-Orozco and Qin 2006; Hondagneau-Sotelo 1994). Female family members, especially daughters, disproportionately bear the brunt of these burdens (Valenzuela 1999).

These gendered parenting practices may be accentuated by perceptions of threat, especially to one's culture (Dion and Dion 2001). Portes and Rumbaut (2001) find that immigrant parents of adolescents often view becoming Americanized as negative, with 80 percent of their sample stating that they were worried that their children were experiencing negative influences from their school. This finding cut across ethnic groups (including European immigrant parents) and socioeconomic status, suggesting that nearly all immigrant parents perceive that the American environment poses threats to their children. This leads some immigrant parents to be even stricter with their daughters than they would have been in their country of origin (Suárez-Orozco and Qin 2006). This idea is supported by evidence showing that girls have a stronger ethnic identity that incorporates their parents' country of origin and are more likely than boys to continue speaking their parents' native language (Portes and Rumbaut 2001; Dion and Dion 2001).

The heavy parental monitoring that girls experience may have beneficial effects (Suárez-Orozco and Qin 2006). For example, immigrant girls engage in less risky behaviors and outperform boys educationally. Portes and Rumbaut (2001) found that among children of immigrants, boys were less engaged, had lower grades, showed less effort, and had lower educational and occupational goals than girls. Similarly, health research has found that the effect of acculturation on health behaviors differs by gender. In these studies, lower acculturation had a much stronger protective effect for Latina women compared to Latino men on health behaviors such as drinking, smoking, and illicit drug use (Lara et al. 2005).

## THE PRESENT STUDY

The arguments outlined above lead to two hypotheses concerning place of socialization and social isolation. The place of socialization hypothesis points to immigrant parents' lack of experience with the health risks in the U.S. environment in general, and with overweight among children in particular, as contributing to children's weight gain. According to this idea, children with parents who grew up outside the United States weigh more than other children. This is especially likely among boys. To test these ideas, we compare children by the generational status and age at arrival of their parents. We refer to immigrant parents who arrived in the United States in adolescence or adulthood as the "1.0 generation," and we refer to those who moved to the United States during childhood as the "1.5 generation." We compare children of both the 1.0 and 1.5 generations to children of natives.

The social isolation hypothesis suggests that the threats to children's health come from outside the home and are due to greater exposure to and adoption of American lifestyles. Therefore, indicators of social integration, especially English language usage and proficiency, would be expected to be positively associated with weight, particularly among boys.

Of course, both hypotheses could be supported simultaneously. If different indicators of acculturation affect children's weight differently, this could help explain why prior research has not found a consistent relationship between acculturation and the prevalence of overweight in children. To assess this possibility, we examine the effects of social isolation separately by parental generational status. For example, if sons of the 1.0 weighed more than sons of the 1.5 generation or sons of natives, this would support the place of socialization hypothesis. And if sons of English-speaking immigrants weighed the most or gained the most weight within the 1.0 generation, this would support the social isolation hypothesis as well.



## METHODS

### Data and Sample

We used data from the Early Childhood Longitudinal Study Kindergarten Class of 1998-1999 (ECLS-K). Conducted by the National Center for Education Statistics, the ECLS-K followed a nationally representative sample of roughly 21,000 children from kindergarten through fifth grade. The survey collected information on the children from parents, teachers, and school administrators. A unique feature of the ECLS-K is that it oversampled Hispanic and Asian children.

Like many longitudinal data collections, the ECLS-K has some missing values. Of the 99,083 child-year records available contributed by 20,150 children, 19 percent of the child year records were missing on height and weight assessment, 17 percent were missing on key information on parent's nativity status, and 14 percent were missing on parental English proficiency, for a total of 35 percent of person-year records missing on key information. We assume these data are missing at random, so multiple imputation is an appropriate method for handling missing values (Acock 2005). We created five data sets and analyzed them using the MIM command in Stata 9.0. Values for variables with missing information were not generated for children who were ineligible to participate in that wave. We compared results from the multiply imputed data to results from the nonimputed data, and we found them to be similar. The analytic sample excludes Native American children, Pacific Islander children, and children of two or more races who were not of Hispanic descent.

### Measures

**Body mass index**—Height and weight measures were collected from the children during the spring and fall of kindergarten and first grade, and the fall of third and fifth grades, resulting in up to six body mass index (BMI) measurements per child. For the descriptive analyses, children were classified as “overweight” if they had a BMI at or exceeding the 95th percentile within age- and gender-specific groupings, and “at-risk-for-overweight” as between the 85th and 95th percentiles (Kuczmarski, Ogden, and Guo 2000). Percentile BMI compares children today against a standard population of children taken from U.S. surveys and vital statistics from the 1970s and 1980s (Kuczmarski et al., 2002), a time period prior to the rapid increase in overweight among children. Thus the measure does not recalibrate over time as overweight becomes more prevalent. In kindergarten, 28 percent of boys and 26 percent of girls were classified as overweight or at-risk-for-overweight.<sup>1</sup> Although raw BMI has been recommended for assessing changes in adiposity among children (Cole et al. 2000), we used percentile BMI because the purpose of the study is to compare girls and boys, and percentile BMI adjusts for gender differences in children's development. The mean percentile BMI in the kindergarten sample is 61.4.

**Generational status/place of socialization**—Parents' nativity and age at arrival was used as a proxy for place of socialization. We classified children with at least one foreign-born parent as the children of immigrants, and we classified the remaining as children of natives (Hernandez and Charney 1998). Although somewhat controversial, children born in Puerto Rico or with Puerto Rican-born parents were treated as children of immigrants because, as migrants, they may undergo the same kind of cultural change as do immigrants. We further distinguished between children of the 1.0 generation (children of parents who arrived in the United States at age 12 or after) and children of the 1.5 generation (children of

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<sup>1</sup>These figures are similar to other estimates. Among five-year-olds in the National Health and Nutrition Examination Survey (pooled 1999/2000, 2001/2002, 2003/2004, and 2005/2006 surveys), 30 percent of boys and 26 percent of girls were classified as overweight or at risk.

parents who arrived between ages 0 and 11). For children with two foreign-born parents, information on age at arrival came from the mother's interview. About 13 percent of the sample are children of the 1.0 generation, and 3 percent are children of the 1.5 generation.

**Social isolation/integration**—Parental English proficiency was used as a proxy for social integration. English language use is the most commonly used indicator of acculturation in studies of immigrant incorporation in the health (Arcia et al. 2001) and family literature (Burr and Mutchler 1993; Kamo and Zhou 1994). Speaking one's native language at home is an important dimension of ethnic cultural identification and maintenance (Bean and Stevens 2003), and it may reflect attachment to and active maintenance of cultural norms in the host society. In the fall kindergarten wave, parents were asked to assess their own ability to speak, read, and write English on a scale ranging from "very well" (coded 1) to "not well at all" (4). These three measures were then reverse-coded, averaged, and centered to create a parental English proficiency scale with a noncentered mean of 3.76.

**Control variables**—Control variables included the child's birth weight (in pounds, centered; noncentered mean is 7.4); family structure (a binary measure indicating whether the child lives with two biological parents, coded 1 [75%], versus other family arrangement, coded 0); maternal employment (a binary measure indicating whether the mother is employed 35 hours or more per week, coded 1 [45%], versus not, coded 0); child's general health status as reported by a parent (measured on a scale of five from excellent, coded 1, to poor, coded 5, centered; noncentered mean is 1.75); number of siblings (ranging from 0 to 14, centered; noncentered mean is 1.45); mother's age (in years, centered; noncentered mean is 33); and family socioeconomic status, a standardized scale based on up to five measures of SES (each parent's education and occupational prestige score and household income, centered). We also include race and ethnicity controls, including three dichotomous variables: black (17%), Hispanic (14%), Asian (3%), with whites as the reference group (67%). In supplementary analyses, we also controlled for parental country of origin, distinguishing among the ten largest sending countries versus all others.

## Analysis

We used growth curve modeling techniques to assess the associations of gender and generation on BMI from kindergarten through fifth grade, and, among children of immigrants, the influence of gender and language. The models simultaneously estimated effects for level-1 units (the multiple observations for each child across age) and level-2 units (the children). The level-1 model fitted BMI as a function of age across the observations for each child, and the level-2 model fitted the level-1 intercepts and coefficients across all individuals as a function of children's fixed characteristics (Heo et al. 2003). We estimated a second growth curve model for children of immigrants only. Both models included all the control variables as well as an indicator of acculturation (generation or language) and the interaction between acculturation and gender. To help interpret the interaction effects, we present graphs that show predicted kindergarten weight and annual weight gain across levels of acculturation and gender.

## RESULTS

### Descriptive Analysis

Consistent with the place of socialization hypothesis, sons of immigrants—especially boys whose parent(s) moved to the United States when they were adolescents or adults (1.0 generation)—weigh significantly more than sons of natives, with children of the 1.5 generation falling in between the children of the 1.0 generation and natives (Table 1). By

contrast, generational status is not associated with weight status among girls at any grade. Also consistent with both hypotheses, gender differences are significant for children of the 1.0 and 1.5 generations, and they tend to be greatest for children of the 1.0 generation when examining the more serious “overweight” category. The gender differences among children of the 1.0 and 1.5 generations increase with grade level, largely as a function of the rapid weight gain among boys and a slower weight gain among girls. The gender differences among children of natives are small to nil at every grade and are never significant.

### Multivariate Models

We estimated a growth curve model to assess the association of gender and parents’ place of socialization with percentile BMI (in kindergarten and monthly gain) net of the controls (Table 2, model 1). To test the hypothesized ideas about gender and place of socialization, we included interaction terms between gender and generation in the model, thus allowing the estimated relationship of generational status with weight to vary by gender. These interaction terms were significant as predictors of both kindergarten weight and weight gain. To help interpret the interaction effects, we generated predicted values of kindergarten percentile BMI (Figure 1a) and annual gain in percentile BMI (Figure 1b) by generational status and gender.

Consistent with our descriptive findings and the place of socialization hypothesis, generational status is negatively associated with kindergarten weight among boys (Figure 1a). Sons of the 1.0 generation are significantly heavier than sons of natives ( $b = 4.96, p < .001$ ), and sons of the 1.5 generation are marginally significantly heavier than sons of natives ( $b = 3.14, p < .10$ ). We find similar patterns for weight gain. Boys in immigrant families gain significantly more weight than girls in immigrant families, particularly among children of the 1.0 generation, and sons of the 1.0 generation gain significantly more weight than sons of natives (Figure 1b). Among girls, daughters of natives appear to gain more weight than daughters of immigrants (opposite from boys), but this association is not significant. Overall, gender differences are greatest for children of the 1.0 generation, lower for children of the 1.5 generation, and smallest for children of natives.

To check the robustness of these results, we re-estimated the models separately by broad race-ethnic groups (Hispanics, Asians, blacks, and non-Hispanic whites). Although the significance levels vary across models (as one would expect, given variations in sample sizes), the gender and generation pattern described above was consistent across groups.

To test our second hypothesis, which addresses the potentially opposite role of social isolation, another indicator of low acculturation, we included a measure of parental English proficiency in the model (Table 2, model 2). Including this term reduces the strength of the baseline coefficients for all children of immigrants, but the difference between sons of the 1.0 generation and sons of natives remains significant. English proficiency itself is associated with lower weight in kindergarten (contrary to the social isolation hypothesis), and it is unrelated to weight gain. The lack of support for the social isolation hypothesis may derive from the fact that English proficiency is highly correlated with generational status.

To better assess the association of English with children’s weight while holding constant generational status, we estimated growth curve models for children of immigrants and by immigrant parent’s generation, including interaction terms between gender and English proficiency (Table 3). In a supplementary analysis, we also controlled for parental country of origin and obtained nearly identical results. Consistent with results from the full sample, parents’ English proficiency (main effect) is associated with lower kindergarten weight but faster growth for all children of immigrants. In addition, the gender interaction is significant for predicting kindergarten weight, but it is only marginally significant for predicting weight



gain. These patterns by English proficiency and gender are largely driven by children of the 1.0 generation. For these children (but not children of the 1.5 generation) both the main effect and gender interaction with English proficiency are significant for baseline and growth. Figures 2a and 2b display the predicted kindergarten weight (Figure 2a) and annual growth (Figure 2b) for three parental English proficiency levels (determined by one standard deviation below or above the mean).

As expected by both hypotheses, the influence of acculturation (here indicated by language) is much stronger for boys than girls (Figures 2a and 2b). English proficiency is not related to either kindergarten weight or weight gain for girls (this was tested by switching girls to the reference category). For boys, the social isolation hypothesis is supported in the case of weight gain (Figure 2b), but it is not supported for kindergarten-aged children (Figure 2a). Predicting growth trajectories for sons of the 1.0 generation, we find that boys with English-proficient parents start out weighing less in kindergarten but catch up to their peers with non-English-proficient parents by fifth grade. This is consistent with the idea that sons of parents who are socially isolated tend to gain weight more slowly than sons of parents who are socially integrated in American society.

## DISCUSSION

The large volume of migration to the United States, coupled with the fact that immigrants have higher fertility than natives, calls for a better understanding of the health of children of immigrants (U.S. Census 2008). One particularly important health indicator for children is weight. Childhood obesity is an increasingly prevalent health condition that has serious implications for health in adulthood. Overweight children are more likely than normal-weight children to have hypertension, elevated blood pressure, cancer, and diabetes.

We find strong evidence that sons of immigrants who moved to the country as adults are at the greatest risk. They weigh more in kindergarten and gain more weight over time than sons of natives and all groups of girls. This finding is consistent with other research on Hispanic and Asian adolescents in the United States (Popkin and Udry 1998), but it differs from most other research results on adults in the United States and other countries, where females weigh more than males. The gender difference we see among young children of immigrants therefore does not appear to represent a simple importation of gender differences from immigrant sending countries, nor a simple replication of patterns seen among adult immigrants. Rather, they appear to be unique among young children in immigrant families.

These findings also differ from research on other health outcomes. For example, among adults, the relationship between acculturation and drinking, smoking, and illicit substance abuse is stronger for women than men (Lara et al. 2005; Lopez-Gonzalez, Aravena, and Hummer 2005). In contrast, we find that indicators of acculturation are strongly associated with weight for boys but not for girls. One should not expect consistency in the literal sense across these studies because they differ with respect to age and health outcome. A more flexible approach is required that seeks to identify how gender roles and ideologies translate into gender differences in the levels of exposure and resistance to specific health risks in the United States. Taking such an approach here, we developed two hypotheses: the social isolation hypothesis and place of socialization hypothesis.

We find that sons of the 1.0 generation begin elementary school significantly heavier *and* gain more weight during elementary school than sons of natives. On the other hand, daughters of this generation weigh less and have slower weight gain than sons, and they are not significantly different than daughters of natives. This supports our place of socialization hypothesis, which states that parents socialized abroad may have difficulties protecting their

children from the risk of overweight and that boys will be more at risk due to gendered beliefs and parenting practices that are more likely to indulge boys. Immigrant parents may be more permissive regarding food consumption (Brewis and Schmidt 2003), may be unaware of the health risks associated with junk food and inactivity, or may have different perceptions of a healthy weight, particularly in the case of boys (Maynard et al. 2003; Olvera et al. 2005). Another possibility is that immigrant parents face structural challenges (e.g., poor neighborhoods, busy schedules, language barriers) that make it difficult for them to provide children adequate supervision, healthy food, and opportunities for physical activity. Regardless of the explanation, the results suggest a certain degree of vulnerability among immigrant families that ultimately has negative consequences for health among boys.

The social isolation hypothesis predicts that parents who were least proficient in English would have the lowest kindergarten weight and the slowest growth, and that these results would be stronger for boys than girls. This hypothesis is not supported in the case of kindergarten weight, but is consistent with our findings about weight gain and gender. Although boys with the most integrated immigrant parents weigh the least in kindergarten, their faster growth results in them catching up by fifth grade. This suggests that the relationship between social integration and overweight may reverse directions as children grow older, particularly among boys who are likely to have more freedom than girls. Language barriers may block both harmful and beneficial health messages. On balance, the beneficial messages may outweigh the harmful ones among the youngest children of English-speaking parents.

Although this is the first study to systematically examine gender differences in body weight among young children of immigrants, the research is limited in several ways. First, the results are primarily descriptive. Although the findings concerning acculturation and the timing and emergence of gender differences are suggestive about the sources of immigrant boys' weight problems, the indicators of place of socialization and social integration are crude. More direct measures of parents' ideas about gender and weight would be helpful. Also, parents' social isolation was treated as if it were fixed in time. Because of data limitations, English language proficiency was measured at a single time point even though it is likely to improve. Finally, the research fails to identify or measure possible mechanisms related to parents and peers that may mediate or moderate the relationships among generation, language usage, gender, and children's weight. It would be particularly interesting to assess how feeding practices among immigrant families or leisure physical activity is associated with the gender of the child.

Another limitation was that the results refer to generational and language differences for the entire population of kindergarteners as they progress to fifth grade. Immigrants make up a relatively diverse group of people originating from several different countries with their own cultural practices and genetic predispositions to develop overweight. For example, living in nutritionally poor environments may result in natural selection favoring genes that store energy as fat or metabolize energy more slowly (Roseboom et al. 2001; Popkin, Richards, and Montiero 1996). We attempt to take into account some of this variation by controlling for broad race-ethnic groups and country of origin (i.e., Mexican, Vietnamese, etc.). Sample size issues and lack of detail about ethnicity for the native-born population proves to be a hindrance for these types of analyses. In any case, it seems unlikely that genetic variation in the tendency to gain or retain weight would explain our results, since these genetic tendencies are unlikely to differ across generational status or language differentially by gender.

We conclude with a suggestion for future theoretical development. The results presented here clearly challenge the conventional understanding of immigrant health. The health

acculturation model emphasizes the degree to which immigrants are exposed to bad health habits or stressful situations in the host society, which is largely a function of social integration. But it underemphasizes immigrants' resistance to health risks in the host society, which is likely to be shaped by sending country characteristics and place of socialization. It may therefore be fruitful to think about immigrant health through the lens of the exposure/resistance framework.

The concepts of resistance and exposure have long been used by historical demographers to interpret mortality decline (Johansson and Mosk 1987; McKeown 1976; Preston 1976), and we suggest that they can be applied to changes in health and mortality in migratory populations. When people move, they are exposed to a new set of health risks. At the same time, they carry a set of traits that make them more or less resistant to those new health threats. Although the concepts of exposure and resistance have typically been thought about in biological terms (i.e., describing the relationship between humans and pathogens), these concepts could be applied to health conditions such as obesity that are caused and spread through the transmission of habits and lifestyles (Christakis and Fowler 2007). Resistance to these types of health problems may be cultural in the sense that it constitutes a set of health beliefs and practices that, for immigrants, are shaped by the health conditions and cultural repertoires in sending countries. It is possible that immigrants have higher biological and cultural resistance to illnesses that are more common in their countries of origin, but lower resistance to less-common diseases such as obesity. If this were true, this would help explain why generational status is negatively associated with overweight among children (which is uncommon in most sending countries), but positively associated with other outcomes such as infant mortality (which is more common in sending countries). Clearly more research is required to test these ideas.

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## Biography

**Jennifer van Hook** is associate professor of sociology and demography at the Pennsylvania State University. Her research focuses on immigrant incorporation for a wide variety of demographic and socioeconomic outcomes, including welfare receipt, poverty, food insecurity, health, household and family structure, and school segregation. Much of her research focuses on the linkages between these outcomes and the contexts of immigration and settlement.

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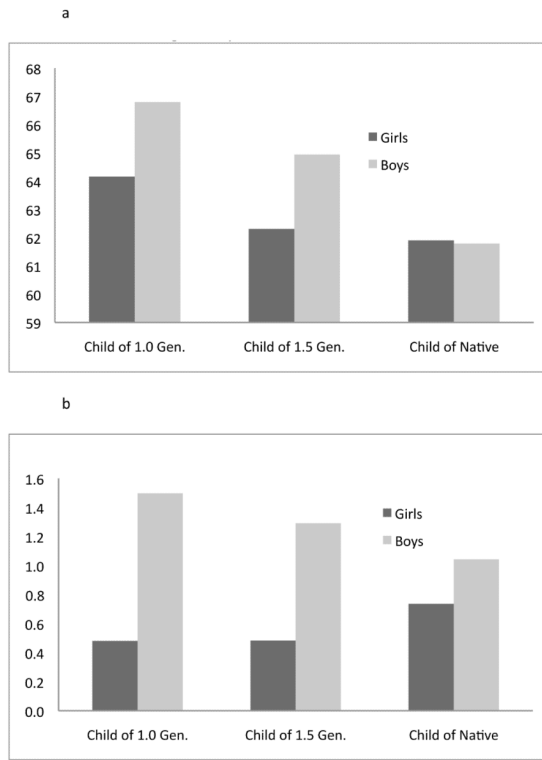
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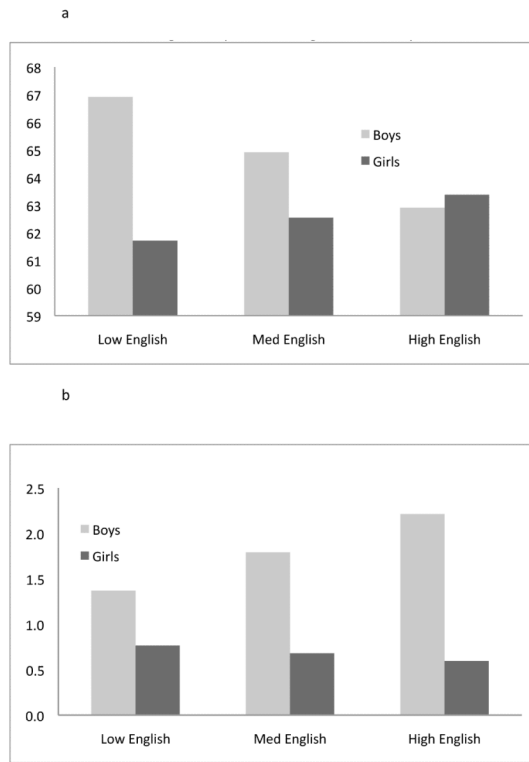
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**Figure 1.**  
a. Percentile BMI in Kindergarten by Parental Generational Status  
b. Average Yearly Growth in Percentile BMI by Parental Generational Status



**Figure 2.**  
 a. Percentile BMI in Kindergarten by Parental English Proficiency, Children of the 1.0 Generation  
 b. Average Yearly Growth in Percentile BMI by Parental English Proficiency, Children of the 1.0 Generation

**Table 1**

Percentage At-risk for Overweight and Overweight by Generation and Gender

	Kindergarten	First Grade	Third Grade	Fifth Grade
<b>Percent At-Risk for Overweight (BMI <math>\geq</math> 85<sup>th</sup> percentile)</b>				
Children of the 1.0 generation				
Boys	33% †	36% †	45% †	51% †
Girls	28%	27%	34%	35%
Difference	5% *	9% *	12% *	16% *
Children of the 1.5 generation				
Boys	37% †	35% †	42%	56%
Girls	25%	23%	26%	36%
Difference	12% *	12% *	15% *	20% *
Children of the natives				
Boys	25%	25%	34%	40%
Girls	25%	25%	33%	38%
Difference	0%	0%	1%	1%
<b>Percent Overweight (BMI <math>\geq</math> 95<sup>th</sup> percentile)</b>				
Children of the 1.0 generation				
Boys	19% †	22% †	30% †	32% †
Girls	12%	12%	17%	18%
Difference	7% *	10% *	13% *	14% *
Children of the 1.5 generation				
Boys	17% †	22% †	26%	32%
Girls	12%	13%	15%	25%
Difference	5%	10%	11% *	8%
Children of the natives				
Boys	11%	13%	19%	22%
Girls	11%	12%	17%	19%
Difference	0%	1%	2%	4%

\* Significant gender difference within generation ( $p < .05$ )† Significantly different from children of natives within gender ( $p < .05$ )

**Table 2**

Growth Curve Model of the Association of Gender and Generational Status with Percentile BMI

	Model 1		Model 2	
	Baseline	Growth	Baseline	Growth
Intercept	61.791 ***	.087 ***	63.377 ***	-.026 ***
Girl	.113	-.025 ***	.119	-.025 ***
Child of 1.0 generation	5.003 ***	.038 *	2.559 *	.053 *
× Girl	-2.745 *	-.059 ***	-2.748 *	-.059 ***
Child of 1.5 generation	3.150 †	.021	2.578	.024
× Girl	-1.994	-.042	-1.887	-.042
English proficiency	-	-	-1.721 ***	.011
(Reference = White)				
Black	1.461 *	.036 ***	1.927 **	.034 ***
Hispanic	3.437 ***	.011	3.329 ***	.012
Asian	-6.967 ***	.009	-6.528 ***	.006
Health	-.093	-	-.099	-
Mother's employment	.903 ***	-	.916 ***	-
Socioeconomic status	-.386 †	-.039 ***	-.289	-.039 ***
Birth weight	1.986 ***	-.009 ***	1.988 ***	-.041 ***
Two-parent family	-.571	-	-.571	-
Mother's age	-.033	-	-.032	-
Number of siblings	-.726 ***	-	-.787 ***	-

99,050 person-year records

†  
 $p < .10$ \*  
 $p < .05$ \*\*  
 $p < .01$ \*\*\*  
 $p < .001$



**Table 3**  
Growth Curve Models of the Association of Gender and English Language Proficiency with Percentile BMI

	All children of immigrants		Children of the 1.0 generation		Children of the 1.5 generation	
	Kindergarten Percentile BMI	Monthly Growth	Kindergarten Percentile BMI	Monthly Growth	Kindergarten Percentile BMI	Monthly Growth
Intercept	65.822 ***	.136 ****	64.914 ****	.149 ****	71.758 ****	.148 **
Girl	-2.557 **	-.083 ***	-2.368 *	-.093 ***	.544	-.143 *
English Proficiency	-1.918 **	.021 *	-1.822 *	.032 *	-.615	-.029
× Girl	2.096 *	-.024 †	2.577 *	-.038 *	-2.191	.077
(Reference = White)						
Black	-2.680	.043	-2.841	-.038 †	-4.941	-.015
Hispanic	1.987	-.034 †	2.450	.017	-1.749	.132
Asian	-8.159 ***	-.007	-8.842 ***	-.009	-5.145	-.065
Child's Health	-.210	-	-.279	-	.215	-
Mother's Employment	.643	-	.352	-	2.070 +	-
Socioeconomic Status	-.240	-.034 ***	-.145	-.031 **	-.303	-.049 †
Birth weight	1.718 ***	-.008 +	1.673 ****	-.009 *	2.068 **	-.007
Two-parent Family	-.557	-	-.976	-	1.158	-
Mother's age	.013	-	.057	-	-.246	-
Number of siblings	-.574 *	-	-.478 †	-	-1.080	-
Person-records	18,660		14,700		3,960	

†  $p < .10$

\*  $p < .05$

\*\*  $p < .01$

\*\*\*  $p < .001$