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Big Boys and Little Girls

Gender, Acculturation, and Weight Among Young Children of Immigrants

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ABSTRACT

Prior research has consistently found a negative association between immigrant health and acculturation, so it is surprising that research has yet to show a clear association between children's weight and parental acculturation. We theorize that social isolation shelters children of immigrants from the U.S. obesigenic environment, but this protective effect may be offset by immigrant parents' limited capacity to identify and manage this health risk in the United States. We further theorize that these factors are likely to affect boys more than girls. To test these ideas, we analyzed data from the Early Childhood Longitudinal Study Kindergarten Cohort (N = 20,147 children). Having a parent who grew up abroad was used as an indicator of foreign place of socialization, and having parents with low English proficiency was used as an indicator of social isolation. Consistent with our hypotheses, boys whose parents were raised outside the United States weighed more and gained weight faster than any other group, including children of natives and girls in immigrant families. But within this group of boys, sons of non-English-speaking parents gained weight more slowly than sons of English-speaking 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.

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Introduction

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 (e.g., Cho et al. 2004; Hummer et al. 2007; Landale, Oropesa, and Gorman 2000; Rumbaut and Weeks, 1989; Martin, Hamilton and Sutton 2006). The standard understanding of immigrant health credits traditional cultural practices and positive health selection for immigrant's initial good health and blames exposure to American society for their subsequent decline in health. 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: place of socialization and 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 neglects the influence of foreign place of socialization, defined here by whether parents moved to the U.S. after childhood. Many immigrants originate from less developed countries with different health risks and much lower levels of obesity than in the United States. Socialization in these places might reduce immigrants' ability to identify and stave off the risk of overweight among children. For example, immigrants who grew up in these contexts may be less aware or cognizant of the risks of obesity, engage in child feeding practices that overlook or encourage overeating, and fail to provide opportunities for their children to participate in sports and other activities. Consistent with these ideas,

our findings suggest that foreign place of socialization influences children's weight in the opposite direction as social isolation.

Gender differences also help explain the non-existent association between parental acculturation and children's weight. Just as place of socialization may affect parent's ability to manage health risks, it may also influence how parents treat their sons versus daughters. Immigration and acculturation are highly gendered processes (Curran et al. 2006; Hagan 1998; 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 and Flippen 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). As we show, these differences have profound implications for health among the sons and daughters of immigrants.

Prior Research on Children's Weight

Using the guidelines for children provided by the Center for Disease Control, we define the term "overweight" as having a body mass index (BMI) at or exceeding the 95th percentile within age- and gender-specific groupings (of a standard population of children taken from the 1970s and '80s), and "at-risk-for-overweight" as between the 85th and 95th percentiles. In the United States, the prevalence of overweight and at-risk-for-overweight children has quadrupled over the past 25 years (National Center for Health Statistics 2006), and the most recent estimates suggest that 36.2% of 6-11 year olds are either overweight or at-risk and 18.8% of this group is overweight.

Because of its direct linkages to health behaviors and the wider food environment, 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 greater levels of acculturation are thought to be associated with less-healthy diets, sedentary activity, and obesity (Blumenthal 2002; Carter 2002; Fried and Nestle 2002). This basic idea is backed up by research suggesting that 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 the research findings on weight among immigrant and native 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. Most studies of young children have examined the association of parental acculturation and parental generation with children's weight because parents control young children's activities and diet. Among pre-adolescent Hispanic children, children of immigrants weigh more than children of natives (Baker, Balistreri, and Van Hook 2009; Balistreri and Van Hook forthcoming), 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 to engage in vigorous physical activity than children of natives (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 Asian and Hispanic boys tend to weigh more than girls. Using a sample of children from the NHANES, Ogden and colleagues (2006) found that 27 percent of boys compared with 20 percent of girls ages 6-11 of Mexican descent (largely first and second generation

immigrants) were overweight in 1999-00 (Ogden et al. 2006). Using data from the Add Health and NHANES surveys, Popkin and Udry (1998) found that Hispanic immigrant adolescent boys were more likely to be overweight or at-risk-for-overweight than girls (26% vs. 23%). This study also found that, regardless of generational status, Asian boys were more likely to be overweight or at-risk than Asian girls. 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; Sundquist and Winkleby 2000), adults in both more and less economically developed countries (Case and Menendez 2006; Monterio et al. 2004; Yach, Stuckler, and Brownell 2006), and children in Mexico (Hernandez et al. 2003; Leatherman and Goodman 2005; Martorell et al. 2000).

We seek to explain these surprising results by distinguishing between two aspects of parental acculturation. Whereas parent's place of socialization is likely to influence their ability to identify and manage the risk of obesity, parents' level of social isolation is related to their exposure to the U.S. obesigenic environment. We theorize that these have opposite effects on children's weight and are more important for boys than girls.

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 like overweight than other parents because they are less aware of the risks and opportunities available to their children in the United States. 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. Children learn gender roles by age 6 (Kohlberg 1966). Further intensification of gender ideologies carries on into middle childhood (Maccoby 1998) and

adolescence as these represent important periods in creating a self identity (Erikson 1968). It is likely that lifelong dietary preferences and behaviors are also formed in childhood. Obesity in middle childhood and adolescence tracks strongly into adulthood (Whitaker et al. 1997). It is probably not an accident that food companies deliberately target children in order to secure life-long brand loyalties (Nestle 2000).

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, Baker, and Altman 2009). In addition, many immigrants originate from countries in which food insecurity and under-nutrition 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 is backed by research showing that socioeconomic status (SES) tends to be associated with overweight among women in less-developed countries (Monteiro et al. 2004), and in Mexico, children's weight increases with mother's education (Hernandez et al. 2003). Most likely, the positive SES gradient in less developed countries owes to group differences in requirements for physical activity in daily living and food availability (Monteiro et al. 2004), but attitudes about overweight may also 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 with the means 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 to classify their overweight children, especially sons, as overweight compared to more acculturated or native parents (Ariza et al. 2004; Maynard et al. 2003; Olvera et al. 2005). In addition, recently-published research suggests that less-acculturated immigrant families themselves may operate in ways that promote a “food culture” that leads to overweight. A study on Hispanics found that less acculturated Hispanic parents in the U.S. 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 U.S. (Kaiser et al. 2001). This may link back to patterns established in origin countries. A study examining rural Mexican children in Mexico found that children were largely responsible for structuring and choosing the foods they ate (Garcia, Kaiser, and Dewey 1990).

Moreover, 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 et al. 2006), and are more likely to grant greater freedom and higher status to boys (Martinez 1999). Qualitative research on Asian and West Indies parents similarly find that boys tend to be valued more and hold a higher status relative to 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 U.S. in 2004 (USDHS 2006) were ranked much lower on the gender empowerment measure (a commonly used measure created by the UNDP (1995) that focuses on women's economic, political, and professional participation relative to men) than the U.S. Most immigrant sending countries are ranked in the 40s and 50s while the U.S. is ranked 15th globally (UNDP 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 from messages and norms that contribute to obesity in the United States. We refer to this aspect of acculturation as social isolation when indicators of acculturation like English proficiency are low and social integration when they are high.

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 even 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 may expose parents to messages that increase the risk of obesity but also educates 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. Since immigrant parents tend to grant more freedom to boys than girls, social integration may be especially detrimental for boys. Research examining immigrant families 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; Bulcroft et al. 1996; 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 parents' lack of English proficiency (Suárez-Orozco and Qin 2006; Hondagneau-Sotelo 1994). Female family members disproportionately bear the brunt of these burdens with daughters receiving more responsibilities and more difficult responsibilities than sons (Valenzuela 1999).

These gendered parenting practices may be accentuated by perceptions of threat in the United States. Dion and Dion (2001) note that gender-related socialization is especially prevalent if parents' perceive the host society's culture as threatening their own. Portes and Rumbaut (2001) examine immigrant parents of adolescents and find that they often associated becoming Americanized as negative, with 80 percent of their sample stating that they were worried that their children were receiving 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. In addition, girls (and women) are often considered the "keepers of culture," and hence are more likely to be monitored and enculturated in an attempt to preserve the immigrants' culture in American society (Billson 1995). This focus on preserving culture and avoiding threats 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 to continue speaking their parents' native tongue compared to boys (Portes and Rumbaut 2001; Dion and Dion 2001; Yip and Fuligni 2002; Qin-Hilliard 2003).

Heavy parental monitoring tends to keep girls away from the lure of the street and focused on other activities (Suárez-Orozco and Qin 2006). For example, immigrant girls engage in less risky behaviors and outperform boys educationally. Portes and Rumbaut (2001) examined second generation youths from various Hispanic, Asian, and Caribbean backgrounds and found that boys were less engaged, had lower grades, showed less effort, and had lower education and occupational goals. 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 men on health behaviors such as drinking, smoking, and illicit drug use (Lara et al. 2005).

Overall, these ideas suggest that gendered parenting practices such as described above may lead to slower rates of social integration and beneficial outcomes for girls compared to boys. These gender differences are likely to grow as children approach adolescence. Among Asians and Hispanics, patterns of socialization change as children grow older. Specifically, when children reach the “age of reason”, at about 6 years old, children are given greater responsibilities. These responsibilities are often gender specific, and gender socialization becomes increasingly more pronounced (Halgunseth et al. 2006; Kim and Wong 2002).

The Present Study

To assess these ideas, we analyzed data from the Kindergarten Cohort of the Early Childhood Longitudinal Study (ECLS-K), a longitudinal survey of children followed from kindergarten through fifth grade. The arguments outlined above lead to two hypotheses, which we call the “place of socialization hypothesis” and the “social isolation hypothesis”.

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, we would expect children with parents who grew up outside the United States to be the heaviest in kindergarten and to gain weight the fastest during elementary school. In addition, the greater status given to boys could result in heavier sons of immigrants who were socialized abroad compared to daughters. To test these ideas, we compare children by the generational status and age at arrival of their parents. Immigrant parents who arrived in the US in adolescence or adulthood are classified as the “1.0 generation”, while those who moved to the United States as children are the “1.5 generation”. Children of the 1.0 and 1.5 generations are both compared to the 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. Given the greater enculturation of girls compared to boys, we would further expect this relationship to be stronger for boys than girls among the children of immigrants.

As implied by our discussion above, 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 strong or consistent relationship between acculturation and the prevalence of overweight in children. To assess this possibility, we examine the effects of social isolation separately by parent's 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

Data from the Early Childhood Longitudinal Study Kindergarten Class of 1998-99 (ECLS-K) was used. 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 (1998–1999 through 2003–2004 school years). 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. The ECLS staff also interviewed parents who spoke languages other than English by translating the parent questionnaire into Spanish, Chinese, Lakota, and Hmong.

Like many longitudinal data collections, the ECLS-K has some missing values¹. Of the 99,083 child year records available contributed by 20,147 children, 19% of the child year records were missing on height and weight assessment, 17% were missing on key information on parent's nativity status, and 14% were missing on parental English proficiency, for a total of 35% of person year records missing on key information. These data are assumed to be missing at random (MAR), hence multiple imputation is an appropriate method for handling missing values (Acock 2005). Five datasets were created and analyzed 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. Results from the multiply imputed data were compared to results from the non-imputed data and were similar, further suggesting the data are MAR. The analytic sample excludes Native American children, Pacific Islander children, and children of two or more races who were not of Hispanic descent. For the multivariate analyses, each child can contribute up to six measurements of BMI resulting in multiple records per child.

Measures

BMI. Height and weight measures were collected from the children during the spring and fall of kindergarten and first grade, and during the fall of third and fifth grades, resulting in up to six BMI measurements per child. For the descriptive analyses, children were classified as "overweight" if they had 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 (Kuczmarski, Ogden, and Guo 2000). In kindergarten, 28 percent of boys and 26 percent of girls were classified as overweight

¹ Early childhood represents a relatively mobile time in a child's life. Following all movers in the original fall kindergarten sample was deemed too expensive and difficult to accomplish. As such, a sampling frame was developed to follow only a sub-sample of movers. In order to obtain an adequate depiction of language minority students, children who were classified as such were oversampled in the mover sub-sample. Fortunately for our interests this includes many of the children in immigrant families. For a more detail discussion of the ECLS-K methodology see Tourangeau, Le, and Nord 2005.

or at-risk-for-overweight¹. Although raw BMI has been recommended for assessing changes in adiposity among children (Cole et al 2000), percentile BMI was used because the purpose of the study is to compare girls and boys, and percentile BMI adjusts for gender differences in children's development.

Generational Status/Place of socialization. Children with at least one foreign-born parent were classified as the children of immigrants and the remaining were classified 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 immigrants.

Because childhood is a critical socialization period, immigration scholars commonly distinguish between those who arrived before adolescence (about age 12) and were socialized primarily in the United States (the 1.5 generation) and those who arrived at older ages and were socialized primarily in their country of origin (the 1.0 generation) (e.g., Rumbaut 1994; Portes and Rumbaut 2000). Therefore, children of immigrants were subdivided into two groups: 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 parents who arrived between ages 0 and 11). Among those with one foreign-born parent, information on age-at-arrival came from the interview with the immigrant parent. For children with two foreign-born parents, information on age at arrival came from the mother's interview. No distinctions were made between foreign-born and U.S.-born children because so few (271) were born abroad.

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 (Blank and Torrecilha 1998; Burr and Mutchler 1993a; Burr and Mutchler 1993b; Kamo and Zhou 1994). Speaking one's native

¹ These figures are similar to estimates of based on the NHANES (pooled 1999/00, 2001/02, 2003/04, and 2005/06 surveys). Among five-year-olds in the NHANES, 30 percent of boys and 26 percent of girls were classified as overweight or at-risk.

language at home is an important dimension of ethnic cultural identification and maintenance (Bean and Stevens 2003) and 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 ability to speak, read, write, and understand someone speaking English using a likert scale ranging from 1 (very well) to 4 (not well at all). These three measures were then reverse coded, averaged, and centered to create a parental English proficiency scale.

Control variables. Control variables included the child's birth weight (in pounds, centered); family structure (child lives with two biological parents versus other family arrangement); maternal employment (dichotomous variable 1=mother works 35 hours or more per week 0=otherwise); child's general health status as reported by a parent (measured on a scale of five from 1 = excellent to 5 = poor, centered); number of siblings (ranging from 0 to 14, centered); mother's age (in years, centered); 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). Race and ethnicity controls are also employed using three dichotomous variables (black, Hispanic, Asian, with whites as the reference group). In supplementary analyses, we also controlled for parental country of origin (distinguishing among the ten largest sending countries versus all others). See table 1 for descriptive statistics on all measures in the model for the analytic sample; all means in the table are shown in their uncentered form with the exception of socioeconomic status.

[Table 1 here]

Analysis

Growth curve modeling techniques were used 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. Growth curve models are well suited for modeling baseline levels and the direction and magnitude of change in a developmental outcome measure such as BMI (Heo et al

2003). 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. The first equation estimates the associations of child-level factors with the children's baseline BMI in kindergarten (the "intercept" model), while the second equation estimates their associations with growth in BMI (the "slope" model). A second growth curve model was estimated 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. Our preliminary analysis indicated that the interaction between language and gender was significant only for children of the 1.0 generation, so we ultimately estimated these models separately by generation. To help interpret the interaction effects, graphs were used to display predicted kindergarten weight and annual weight gain by acculturation and gender.

RESULTS

Descriptive Analysis

Consistent with the place of socialization hypothesis, sons of immigrants, especially boys whose parent(s) moved to the U.S. as adolescents or adults, weigh significantly more than sons of natives (Table 2). That is, boys with 1.0 generation parents are the most likely to be overweight or at-risk for overweight, boys with native parents are the least likely, and boys with 1.5 generation parents tend to fall in between (i.e., they do not weigh significantly more than sons of natives). By contrast, generational status is not associated with kindergarten weight status among girls. Also consistent with both hypotheses, gender differences in kindergarten weight are significant for children of the 1.0 generation and 1.5 generation, and tend to be greatest for children of the 1.0 generation when

examining the more serious “overweight” category. There are no significant gender differences among children of natives.

[TABLE 2 ABOUT HERE]

Examining change from kindergarten to fifth grade, we find that for all groups (boys and girls of all generational groups), overweight and at-risk-for-overweight increases with grade. But boys tend to gain weight faster than girls, particularly among children of the 1.0 and 1.5 generations. Thus, gender differences in overweight and at-risk-for-overweight widen the most for children of the 1.0 and 1.5 generations and remain small and non-significant among children of natives.

Overall, the descriptive results strongly suggest that gender moderates the association between generational status and weight. Sons of immigrants appear to be at the greater risk for overweight in kindergarten and rapid weight gain during elementary school, while daughters of immigrants weigh about the same as daughters of natives at all grade levels. But these patterns may be attributable to differences in children’s health and family characteristics. For example, children of immigrants may be more likely to be overweight because they are more likely to be poor (Van Hook, Brown, and Kwenda 2004). To assess this possibility, we turn next to the multivariate analyses.

Multivariate Models

We estimate 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 race/ethnicity, socioeconomic status, health, birth weight, mother's employment, family structure, mother’s age, and number of siblings (Table 3, Model 1). We exclude health, mother’s employment, mother’s age, number of siblings, and family structure from the growth equation since they are not significant predictors of weight gain. Consistent with prior research (Ogden et al. 2006), we find that non-Hispanic black and Hispanic children weigh more in kindergarten (i.e., have significantly higher baseline percentile BMI)

than non-Hispanic white children, while Asian children weigh less. Non-Hispanic blacks also gain weight faster than non-Hispanic whites. Mother's full-time employment is associated with higher kindergarten weight. Socioeconomic status is negatively associated with kindergarten weight (this is marginally significant) and weight gain. Birth weight is associated with higher kindergarten weight but slower growth. Finally, number of siblings is associated with lower kindergarten weight.

To test the hypothesized ideas about place of socialization and gender, we include 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 are significant as predictors of both kindergarten weight and weight gain. To help interpret the interaction effects, we generate predicted values of kindergarten percentile BMI (Figure 1a) and annual gain in percentile BMI (Figure 1b) by generational status and gender.

[FIGURES 1a AND 1b ABOUT HERE]

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 ($b=4.96$, $p < 0.001$). Sons of the 1.5 generation are also marginally significantly heavier than sons of natives ($b=3.14$, $p < 0.10$), but their coefficient is smaller than for sons of the 1.0 generation. 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, it appears that children of natives may gain more weight than children of immigrants (the opposite pattern from boys), but this association is not significant. Overall, gender differences in kindergarten and over time 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 pattern was consistent across groups. For all groups, boys tend to weigh more and gain more weight than girls, particularly among children whose parents were socialized abroad.

Overall, the results of the growth curve analysis are consistent with the descriptive results and the place of socialization hypothesis. Sons of the 1.0 generation begin kindergarten heavier and gain weight faster than daughters of any generation and boys in native families. Our second hypothesis addresses the potentially opposite role of another indicator of low acculturation, social isolation, which we tap into with an indicator of parental English proficiency. Including this term in the model (Model 2) reduces the strength of the baseline coefficients for all children of immigrants. Nevertheless, the results still indicate that sons of the 1.0 generation are significantly heavier and gain weight faster than sons of natives. English proficiency itself is associated with lower weight in kindergarten (contrary to the social isolation hypothesis), but is weakly (and not significantly) associated faster weight gain (somewhat consistent with the social isolation hypothesis). The weak support for the social isolation hypothesis may derive from the fact that English proficiency is highly correlated with generational status. Including both terms in the model introduces a lot of collinearity.

To better assess the association of English with children's weight while holding constant generational status, we estimate growth curve models for children of immigrants only, both generations together and then separately for the children of the 1.0 and 1.5 generations. To further test our gender hypothesis, we include interaction terms between gender and English proficiency. The results are displayed in Table 4. In a supplementary analysis, we also control for parental country of origin and obtain nearly identical results as shown in Table 4. 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 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 the children of the 1.5 generation) both the main effect and gender interaction with English proficiency are significant for baseline and growth. Figure 2 displays the predicted kindergarten weight (Figure 2a) and annual growth (Figure 2b) for three parental English proficiency levels by gender for children of the 1.0 generation only. High proficiency is defined as one standard deviation above the mean, average is the mean, and low is one standard deviation below the mean. We do not display the results for the 1.5 generation because the relationship between parental English language proficiency and weight are not significant.

As expected by both hypotheses, the influence of acculturation (whether indicated by generation or 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, support for the social isolation hypothesis is mixed. The hypothesis is not supported for kindergarten-aged children; boys whose parents who are the least proficient in English weigh the most in kindergarten (Figure 2a). But the social isolation hypothesis is supported in the case of weight gain. Boys whose parents are highly proficient in English gain more weight than boys whose parents have low English proficiency (Figure 2b). Comparing the growth trajectories among sons of the 1.0 generation, we see 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 (see Figure 3). This is consistent with the idea that sons of parents who are socially isolated tend to gain weight more slowly than boys whose parents are socially integrated in American society.

DISCUSSION

In 2008 the Census Bureau made headlines when it announced that by the year 2050 the United States was expected to be a minority majority country, with 54% of the population belonging to a racial/ethnic minority group. The groups projected to increase the most, Hispanics and Asians, are currently dominated by immigrants. The large volume of migration to the U.S., 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 (Deckelbaum and Williams 2001; Dietz 1998; Strauss and Pollack 2003). Beyond its impact on physical health, obesity is related to difficulties in social adjustment, poor mental health, and lower academic achievement and thus has wide-ranging implications for children's quality of life and productivity as adults (Datar 2004; Strauss and Pollack 2003; Cawley 2004).

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 is consistent with other research on Hispanic and Asian adolescents in the United States (Popkin and Udry 1998) but differs from most other research results on adults in the U.S. and other countries. As noted earlier, prior research almost invariably finds that females are at higher risk of overweight 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 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 use theory and prior research about beliefs about gender and weight in sending countries (Hondagneu-Sotelo 1994) and perceived threat of the receiving areas (Parrado et al. 2005; Portes and Rumbaut 2001) to develop two hypotheses: the social isolation hypothesis and place of socialization hypothesis.

The place of socialization hypothesis predicts that children of parents who were socialized abroad will be at the greatest risk for being overweight due to parents' unfamiliarity with opportunities and risks in the United States. Boys in these families are predicted to be at even greater risk because their parents may have gendered beliefs and parenting practices that are more likely to indulge boys. Consistent with this idea 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 are not significantly different than daughters of natives. These findings, particularly those concerning children as young as kindergarteners, suggest that parents socialized abroad may have difficulties protecting their children from the risk of overweight. One idea is that immigrant parents may be more permissive regarding food consumption, as suggested by research showing that middle-class parents in Mexico are likely to indulge their children with food, especially the boys (Brewis and Schmidt 2003; Hernandez et al. 2003). Another possibility is that immigrant parents may be unaware of the health risks associated with child

overweight, junk food, and inactivity, or may have different perceptions of a healthy weight, particularly in the case of boys (Ariza et al 2004; Maynard et al 2003; Olvera et al. 2005). Still 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 finding is consistent with the results of a study of Mexican-origin children conducted by Oria and Sawyer (2007). They found that native children ages 6-12 were more likely to be overweight than immigrants, but found no differences among pre-school children. 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. As discussed earlier, 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. English language proficiency was measured at a single time point even though it is likely to improve. It would have been interesting to assess whether increases in English proficiency are associated with increases in children's weight, but this was not possible. The ECLS-K asks detailed language questions in kindergarten but does not repeat these at later interviews. Finally, the research fails to identify or measure possible mechanisms related to parenting 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, being from nutritionally poor environments may result in natural selection favoring genes that store energy as fat or metabolize energy slower (Roseboom et al. 2001). Other research shows an association between growth stunting (an indicator of poor nutrition in childhood) and adult obesity in countries undergoing a nutrition transition (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, but it may be preferable to examine each ethnic group separately (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. Prior research that examines how the health of immigrants

changes over time has found fairly consistent results by ethnicity, suggesting an immigrant effect rather than an immigrant effect for certain ethnicities (Cho et al. 2004; Frisbie, Cho, and Hummer 2001).

We conclude with a suggestion for future theoretical development. The results presented here clearly challenge the conventional model 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 the 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 (e.g., Johansson and Mosk 1987; McKeown 1976; Preston 1976), and we suggest 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 like 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 like 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 like infant mortality (which is more common in sending countries). Clearly more research is required to test these ideas.

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Table 1. Descriptive Statistics of the Analytic Sample

	Kindergarten ¹ n=20,147		Person-Record n=99,083	
	Mean	SE	Mean	SE
Mean Percentile BMI (range 0-100)	61.40	0.389	62.25	0.106
% Girls	48.0	0.40	48.5	0.16
% Children of the 1.0 Generation	12.6	0.60	14.8	0.13
Girls	5.9	0.33	7.2	0.09
Boys	6.6	0.36	7.6	0.09
% Children of the 1.5 Generation	3.3	0.19	4.0	0.09
Girls	1.7	0.12	1.7	0.07
Boys	1.6	0.14	1.7	0.06
% Children of Natives	85.2	0.67	81.5	0.15
Girls	40.9	0.48	39.9	0.16
Boys	44.4	0.56	42.0	0.18
Mean Parental English Proficiency (range 1-4)	3.78	0.014	3.76	0.003
Mean Child's Age (months)	68.50	0.071	88.46	0.069
% White	65.6	1.32	65.3	0.11
% Black	16.8	1.16	15.0	0.11
% Hispanic	14.5	0.81	12.9	0.08
% Asian	3.2	0.21	6.8	0.16
Mean Child's Health (range 1-5)	1.70	0.011	1.73	0.002
% Mothers Employed Full-time	44.7	0.65	46.6	0.17
Mean Socioeconomic Status (centered)	-0.03	0.018	-0.01	0.003
Mean Birth weight (lbs)	7.37	0.015	7.42	0.006
% Two Parent Family	74.7	0.82	76.2	0.14
Mean Mother's age (years)	32.98	0.096	33.40	0.023
Mean Number of Siblings	1.45	0.015	1.51	0.004

¹ Kindergarten values are weighted using the survey weights

Table 2. Percentage at-risk for overweight and overweight by generation and gender

	Kindergarten	First Grade	Third Grade	Fifth Grade
Percent At-Risk for Overweight (BMI >= 85th percentile)				
Children of the 1.0 Gen.				
Boys	33% †	36% †	45% †	51% †
Girls	28%	27%	34%	35%
Difference	5% *	9% *	12% *	16% *
Children of the 1.5 Gen.				
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%
Percent Overweight (BMI >= 95th percentile)				
Children of the 1.0 Gen.				
Boys	19% †	22% †	30% †	32% †
Girls	12%	12%	17%	18%
Difference	7% *	10% *	13% *	14% *
Children of the 1.5 Gen.				
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 < 0.05)

† significantly different from children of natives within gender (p < 0.05)

Table 3. Growth Curve Model of the Association of Gender and Generational Status with Percentile BMI

	Model 1				Model 2			
	Kindergarten Percentile BMI		Annual Growth		Kindergarten Percentile BMI		Annual Growth	
Intercept	59.16	***	1.05	***	63.38	***	0.89	***
Girl	0.11		-0.31	***	0.12		-0.31	***
Child of 1.0 Gen.	4.96	***	0.45	*	2.56	*	0.64	*
X Girl	-2.75	*	-0.71	***	-2.75	*	-0.71	***
Child of 1.5 Gen.	3.14	†	0.25		2.58		0.29	
X Girl	-1.98		-0.50		-1.89		-0.51	
English Proficiency (White)	---		---		-1.72	***	0.13	
Black	1.68	**	0.43	***	1.93	**	0.41	***
Hispanic	3.50	***	0.13		3.33	***	0.14	
Asian	-6.97	***	0.11		-6.53	***	0.07	
Health	-0.09		---		-0.10		---	
Mother' Employment	0.91	***	---		0.92	***	---	
Socioeconomic Status	-0.44	*	-0.47	***	-0.29		-0.50	***
Birth weight	1.98	***	-0.10	***	1.99	***	-0.10	***
Two Parent Family	-0.57		---		-0.57		---	
Mother's age	-0.03		---		-0.03		---	
Number of siblings	-0.76	***	---		-0.79	***	---	

† p < .10; * p < .05; ** p < .01; *** p < .001

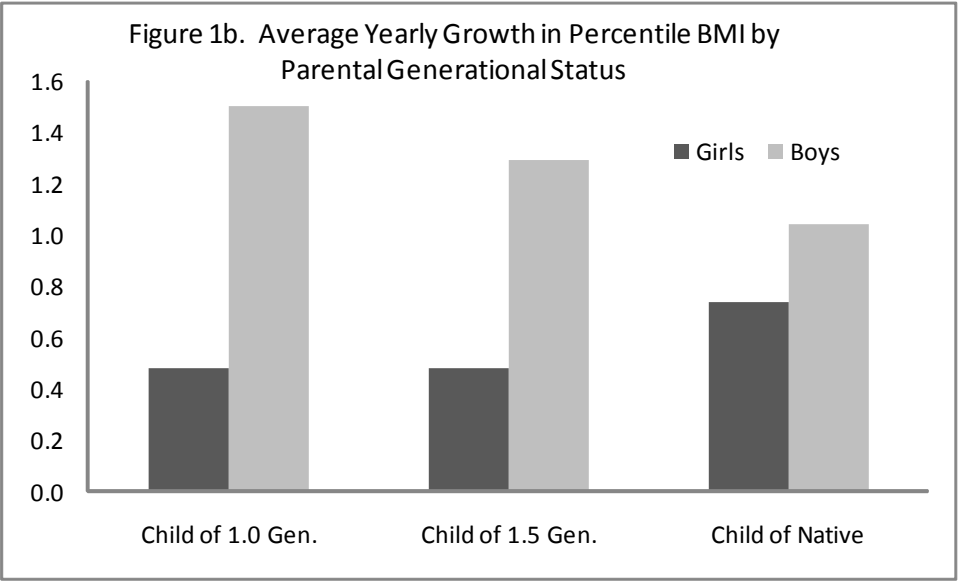
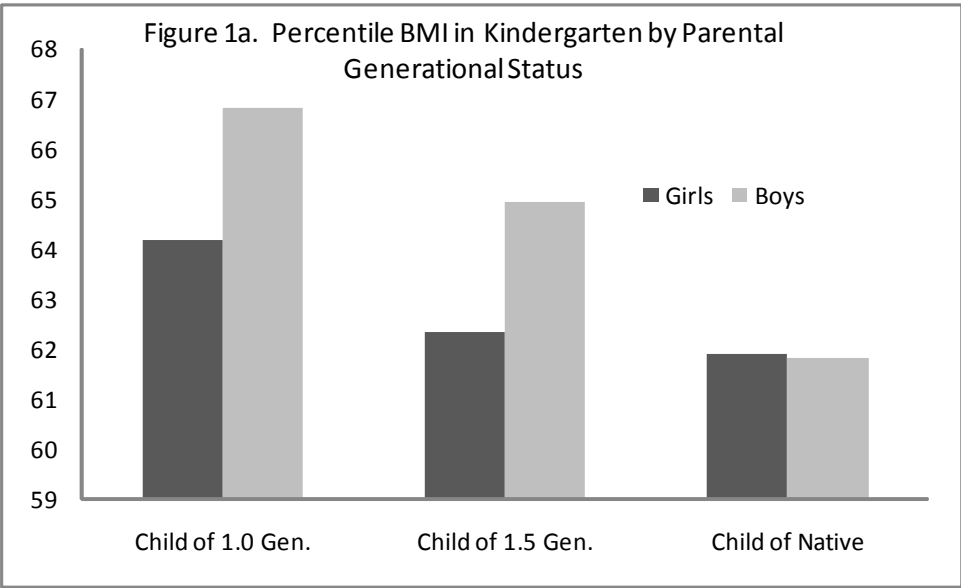
N = 99,083 person records

Table 4. 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		Annual Growth		Kindergarten Percentile BMI		Annual Growth		Kindergarten Percentile BMI		Annual Growth	
Intercept	65.41	***	1.64	***	66.11	***	1.79	***	62.01	***	1.78	**
Girl	-2.56	**	-1.00	***	-2.37	*	-1.11	***	0.54		-1.72	*
English Proficiency	-1.92	**	0.26	*	-1.82	*	0.38	*	-0.62		-0.35	
X Girl	2.10	*	-0.29	†	2.58	*	-0.46	*	-2.19		0.93	
(White)												
Black	-2.68		0.51		-2.84		0.20		-4.94		1.58	
Hispanic	1.99		-0.41	†	2.45		-0.46	†	-1.75		-0.17	
Asian	-8.16	***	-0.08		-8.84	***	-0.11		-5.14		-0.78	
Child's Health	-0.21		---		-0.28		---		0.22		---	
Mother' Employment	0.64		---		0.35		---		2.07	†	---	
Socioeconomic Status	-0.24		-0.41	***	-0.14		-0.37	**	-0.30		-0.59	†
Birth weight	1.72	***	-0.10	†	1.67	***	-0.11	*	2.07	**	-0.08	
Two Parent Family	-0.56		---		-0.98		---		1.16		---	
Mother's age	0.01		---		0.06		---		-0.25		---	
Number of siblings	-0.57	*	---		-0.48	†	---		-1.08		---	

† p < .10; * p < .05; ** p < .01; *** p < .001

Person-records: 18,861 children of immigrants; 14,669 children of the 1.0 generation; 3,962 children of the 1.5 generation



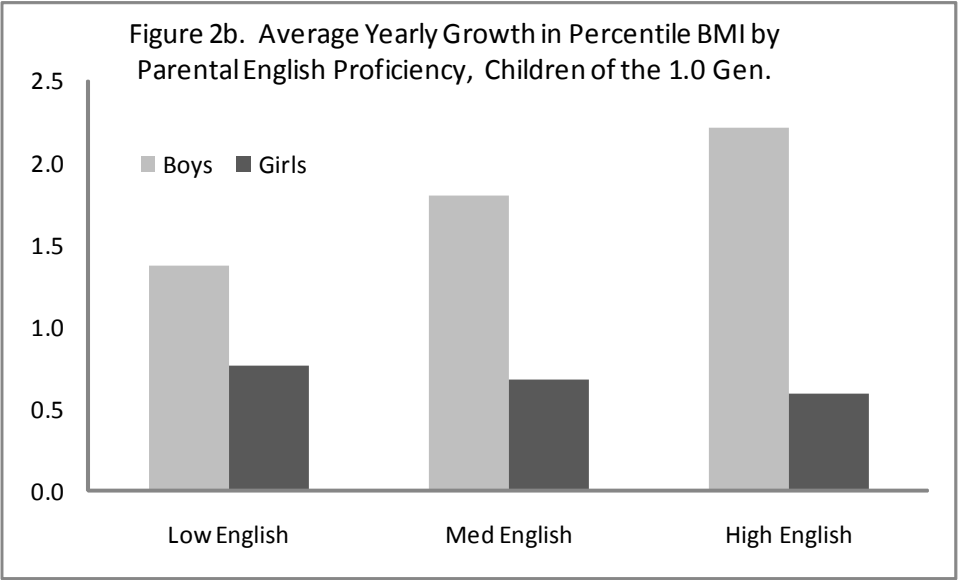
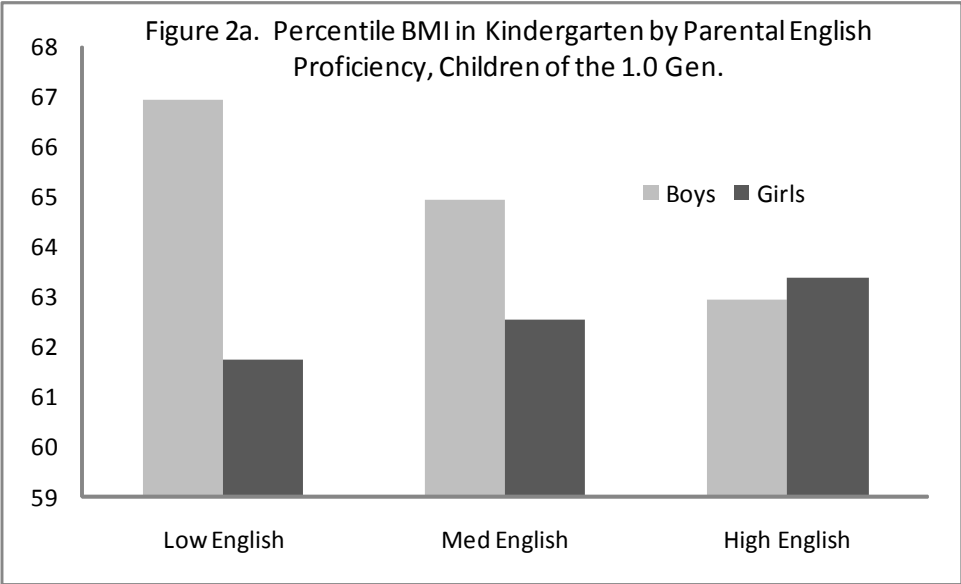
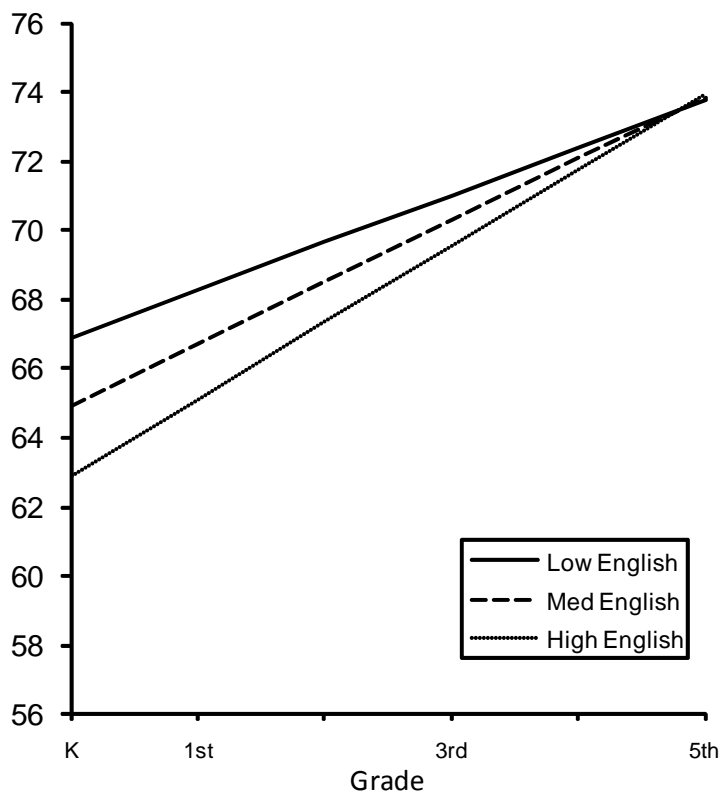


Figure 3. Percentile BMI Growth Curve by Parental English Proficiency, Sons of the 1.0 Generation



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