GENERATION, ACCULTURATION AND WEIGHT:
OVERWEIGHT AMONG THE CHILDREN OF IMMIGRANTS

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Introduction

When immigrants and their children come to the US they enter an environment in which poor nutrition, low levels of physical activity and the prevalence of obesity and overweight has reached alarming levels. For example, in the past 25 years the prevalence of overweight and obese children quadrupled, increasing from roughly four to sixteen percent (1). Following the guidelines of the Centers for Disease Control and Prevention (2), the term "obesity" is defined here as having a body mass index (BMI) at or exceeding the 95th percentile within age- and gender-specific groupings, and "overweight" as between the 85th and 95th percentiles. Overweight and obesity among children has been linked to a number of health problems including hypertension, elevated blood pressure, and diabetes that track into adulthood (3, 4). The children of immigrants, the fastest growing segment of US society under age 18 (5), may be particularly vulnerable to poor health because more than half are living in families with low incomes (6). In addition, a large portion of immigrants are Hispanic, and Hispanic children have been disproportionately affected by the obesity epidemic. Among children ages 6-11 in 2003/2004, 22.5% of Mexican-Americans versus 17.7% of non-Hispanic whites were classified as overweight (7), and 42.9% of Mexican-American children compared with roughly a third (36.9 %) of non-Hispanic white children were overweight.

The high and growing levels of overweight among Hispanic children are often attributed to acculturation, a process involving exposure to U.S. advertising, American youth culture, and school environments. A common finding emerging from research on adult immigrant health is that health outcomes of immigrants are better than natives when they first arrive in the U.S. (especially after adjusting for socioeconomic differences), but are likely to deteriorate with

increased time and generations in the United States (8-10). Although selective migration may account in part for immigrants' initial healthy outcomes (11), the dominant hypothesis is that exposure to American environment (e.g. fast food industry and advertising, availability of cheap, pre-packaged food, reliance on cars) leads to the "Americanization" of health behaviors involving diet, exercise, and smoking, which in turn leads to overweight and obesity (12-14).

While overweight appears to increase among adult immigrants with increasing exposure to U.S. society (15), the relationship between exposure to the U.S. and childhood overweight is much less clear. A majority of the research on overweight among children from immigrant families has focused on adolescents (16, 17), and has not included key parental nativity characteristics such as generation or age at entry. For instance, Gordon-Larsen and her colleagues (16), found the likelihood of being overweight is higher for U.S.-born adolescents than foreign-born adolescents, but the study did not differentiate US-born children with native-born parents from US-born children with foreign-born parents. To assess whether the same process occurs among children, we examine levels of overweight among the children of immigrants and children of natives, with a direct focus on parental duration in the U.S. and English proficiency as measures of acculturation. English proficiency is the most commonly-used indicator of acculturation in research on immigrant health (18). Speaking one's native language at home is an important dimension of ethnic cultural identification and may reflect attachment to and active maintenance of cultural norms (19).

Methods

We used the Early Childhood Longitudinal Study (ECLS-K), a nationally representative sample of US kindergartners, to track children's BMI from kindergarten through 8th grade. The

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ECLS-K sample uses a dual-frame multistage sampling strategy. The first stage consisted of selecting roughly 100 Primary Sampling Units (PSUs) based on counties or groups of counties, followed by the selection of 1,000 public and private schools within the PSUs. This dataset is particularly well suited for studying overweight among children because weight and height (the two necessary measures of BMI) are assessed up to six times throughout the course of the survey. In addition, these data are measured by the interviewer, and are not based on parent's reports, which may be biased. Further, the ECLS-K data are particularly well suited for studying the children of immigrants because Asian and Pacific Islander children were oversampled, and the sample was freshened to include children who may have attended kindergarten outside of the U.S. The ECLS staff interviewed parents who spoke languages other than English by translating the parent questionnaire into Spanish, Chinese, Lakota, and Hmong.

To capture exposure to the US we classified children in the study according to their parents' generational status. Children of US-born natives were distinguished from children of the 1.0 generation (children whose immigrant parent came to the US after age 12 as adolescents or as adults), and children of the 1.5 generation (whose immigrant parent arrived as children younger than age 12). Children who were born abroad of citizen parents are included with children of natives. Our sample consists of a cohort of roughly 20,000 kindergartners, among which 14% (n≈3,670) are children born to more recently arrived immigrants (the 1.0 generation) and 3 %(n≈720) were born to more settled immigrant parents (the 1.5 generation). Immigrant parents in the sample come from diverse areas of the world (e.g., Mexico (32%), Philippines (7%), El Salvador (4%), Dominican Republic (3%), Germany (3%), India (2%), Vietnam (2%), Laos (1%), and China (1%)). We created a scale based on four

measurements of parent's ability to speak, read, write and understand English that ranged from 1 (very well) to 4 (not well at all). We reverse coded each item, summed, and divided by four to obtain a continuous measure of parent's total English ability. We ranked and divided children into terciles of low (parent's English ability on this scale ranged from 1 to 2.33, n≈1,100), medium (parent's English ability ranged from 2.34 to 3.67, n≈1,220) and high parental English ability (they indicated that they perform very well on all measures of English proficiency, n≈1,350).

Prior research on child obesity has established body mass index (weight/height^2) as a suitable adiposity index for children (20). BMI is also a preferred measure because height and weight are easy to obtain with a reasonable degree of accuracy across different settings. In the ECLS-K, children's height and weight were assessed by ECLS-K staff at each wave of data collection and recorded using a Shorr Board and a digital scale. We used height and weight measurements that were collected from the children during the spring of kindergarten and first grade, and during the fall of third, fifth and eighth grades. Algorithms provided by the Centers for Disease Control and Prevention based on 2000 growth charts are used to classify any outliers in weight or height. We use the CDC guidelines to classify children with a **BMI** $\geq$85th percentile for their gender-specific **BMI-**for-age as overweight or obese (21).

We generated weighted mean levels of overweight across each grade level to examine the relationship between child overweight and parental age at arrival in the US and parent's English language ability. Due to the stratified sample we adjust standard errors with cross sectional survey weights supplied by NCES. We also produced odds ratios of the relative risk of overweight for each parental nativity group and language ability net of race/ethnicity, parent's

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county of origin (measured as mother's country of origin in the case of two foreign born parents) and parent's socioeconomic status. SES is measured here as a standardized scale created by NCES based on parent's education, 1998 GSS occupational prestige score and household income. All estimates are produced separately by gender. Multiple imputation techniques are used to handle missing data on the covariates however, listwise deletion produces similar results.

Results

Table 1 presents the mean level of overweight by grade and gender for children of the 1.0 generation, children of the 1.5 generation and children of natives. In addition, we present the mean levels of overweight for the children of immigrants by parents English language ability. We find that indicators of acculturation do not appear to be related to overweight among the children of immigrants. Rather, the children of the newest, least acculturated immigrants tend to be the most at risk of obesity, particularly among boys. Sons of natives are the least likely to be overweight or obese while the sons of the 1.0 generation are the most likely. As early as kindergarten, 33% of the sons of immigrants and 29% of the daughters of 1.0 generation immigrants are overweight or obese compared with 26% of the sons and 25% of the daughters of natives. By eighth grade, the percentage increases to 48% among the sons of the 1.0 generation compared to only 35% among the sons of natives (Table 1).

Among children of immigrants, those whose immigrant parents have low and medium levels of English proficiency weigh more than those whose parents have high English proficiency. This difference is particularly large for boys. This suggests that obesity among children of immigrants derives from parents' lack of experience in the United States rather than

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from acculturation. However, these differences may be attributable to differences in parent's

socioeconomic characteristics. For example, children of immigrants may be more likely to be

overweight because they are more likely to be poor (22).   To assess this possibility, we regress

the dichotomous indicator of child overweight on parental nativity status, parental country of

origin, child race/ethnicity and parent's socioeconomic status (SES) at each grade level.

The top panel of Table 2 presents the odds ratios of parental nativity status with

children of natives as the referent category with separate models for each grade. Among sons

of the 1.0 generation, the odds of being overweight are 1.3 times as large as for sons of natives

in Kindergarten. The odds of overweight increase to 1.7 by the fifth grade, and then dip slightly

to 1.3 by eighth grade. Among girls, differences appear in later grades. By eighth grade the

daughters of the 1.0 generation are 27% less likely to be overweight than the daughters of

natives, net of SES, country or origin and race/ethnicity.

Restricting the analyses to the children of immigrants (bottom panel Table 2), we found

some evidence that those whose parents have low English proficiency weigh more than those

whose parents have high English proficiency, but mostly among boys.

Discussion

Children of the newest, least acculturated immigrants tend to be more likely to be

overweight or obese, particularly among boys. This suggests that newly-arrived immigrant

parents may have difficulties protecting their children from the risk of obesity. One reason is

that newly-arrived immigrant parents are often poor and face economic challenges that make it

difficult to provide children adequate supervision, healthy food, and opportunities for physical

activity. Moreover, newly-arrived immigrants may be unfamiliar with U.S. foods and grocery

stores, unaware of the health risks of American junk food, and less aware of opportunities for their children to participate in sports and other after-school activities.   In addition, immigrant parents may be less concerned about the health risks of obesity in children because many immigrants originate from countries in which food insecurity and stunting poses significant health risks to children. They may be unaccustomed to protecting children from the opposite problem that comes from overeating. Although obesity has become a global epidemic (23), child and adult obesity rates remain lower in many immigrant-sending countries such as Mexico, India, and China than among their co-ethnics in the United States (24, 25).

A shortcoming of this work is that we use the data in a cross sectional format rather than following individual children over time. Nevertheless, the research results presented here provides a clear depiction of patterns in overweight and acculturation for a single cohort of children as they age from kindergarten to eighth grade. This work is therefore likely to inform future work that takes advantage of the longitudinal sample.

Child obesity has far-reaching negative consequences for adult health, mortality, and status attainment, and may hinder immigrants' future social and economic incorporation. Preventing child obesity among this growing population will require a careful analysis of how programs targeted to all families might differ among immigrant families with various socio-cultural characteristics and life circumstances. A possible solution may include an emphasis on diet and health issues in literacy classes or immigrant assistance centers that serve newly arrived immigrant families. Reaching immigrant parents and communicating with them about diet and physical activity in culturally-appropriate ways is likely to be challenging, but may be an important first step in the effort to improve children's health.

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Table 1. Mean Level of overweight (BMI ≥85th percentile) by grade, parental nativity and language proficiency, US boys and girls k-8th grade (standard errors).

	Grade Level				
BOYS	Kinder-garten	First Grade	Third Grade	Fifth Grade	Eighth Grade
Parental Nativity					
Children of 1.0 Generation	0.326	0.356	0.461	0.549	0.475
	(0.015)	(0.021)	(0.022)	(0.028)	(0.029)
Children of 1.5 Generation	0.321	0.298	0.385	0.445	0.363
	(0.028)	(0.039)	(0.038)	(0.054)	(0.049)
Children of Natives	0.256	0.257	0.340	0.399	0.346
	(0.005)	(0.006)	(0.007)	(0.015)	(0.012)
Parent's English Ability					
Low	0.369	0.390	0.501	0.568	0.481
	(0.025)	(0.029)	(0.028)	(0.030)	(0.036)
Medium	0.338	0.352	0.447	0.553	0.473
	(0.022)	(0.037)	(0.030)	(0.041)	(0.044)
High	0.281	0.287	0.380	0.449	0.399
	(0.021)	(0.031)	(0.031)	(0.050)	(0.053)
GIRLS					
Parental Nativity					
Children of 1.0 Generation	0.277	0.280	0.336	0.355	0.367
	(0.018)	(0.018)	(0.018)	(0.027)	(0.025)
Children of 1.5 Generation	0.263	0.246	0.291	0.327	0.399
	(0.030)	(0.032)	(0.038)	(0.050)	(0.053)
Children of Natives	0.250	0.254	0.331	0.387	0.379
	(0.007)	(0.008)	(0.009)	(0.014)	(0.015)
Parent's English Ability					
Low	0.286	0.284	0.350	0.434	0.428
	(0.024)	(0.025)	(0.024)	(0.038)	(0.040)
Medium	0.281	0.286	0.348	0.292	0.360
	(0.023)	(0.031)	(0.035)	(0.045)	(0.041)
High	0.260	0.248	0.280	0.319	0.326
	(0.026)	(0.026)	(0.030)	(0.041)	(0.042)

Source: Early Childhood Longitudinal Study, Kindergarten Cohort. Means are weighted and standard errors are adjusted for complex sample design using given year cross sectional Taylor series weights. Sample sizes are rounded in accordance with NCES restricted data use agreements. Kindergarten (N=20,000), First Grade (N=16,730); Third Grade (N=14,470); Fifth Grade (N=11,260); and Eigth Grade (N=9,360).

Table 2. Odds ratios of overweight (BMI ≥85th percentile) among boys and girls by measure of parental acculturation, ECLS-K.

	Kinder-garten	First Grade	Third Grade	Fifth Grade	Eighth Grade
Parents' Generation					
Boys					
Children of 1.0 Generation	1.336 **	1.288 *	1.389 **	1.681 **	1.341 *
Children of 1.5 Generation	1.298	1.079	1.118	1.185	0.947
(Children of Natives)					
Girls					
Children of 1.0 Generation	1.034	1.081	0.912	0.67 *	0.732 *
Children of 1.5 Generation	1.054	0.993	0.768	0.658 †	0.957
(Children of Natives)					
Parent's English Language Ability					
Boys					
Low	1.388 †	1.392	1.503 †	1.727 *	1.097
Medium	1.281	1.272	1.255	1.73 *	1.276
(High)					
Girls					
Low	0.929	1.005	1.307	1.219	1.126
Medium	1.067	1.174	1.486 †	0.855	1.02
(High)					

Note: Reference category in parentheses. All estimates are derived from the logistic regression of overweight on independent variable of focus, controlling for socioeconomic status, race/ethnicity, and parental country of origin.
*** p<.001, ** p<.01, p<.05, † p<.10