Immigrant generation, race and ethnicity, and child health

Erin R. Hamilton*
Department of Sociology
University of California, Davis

Jodi Berger Cardoso
School of Social Work
University of Texas at Austin

and

Yolanda C. Padilla
School of Social Work
University of Texas at Austin

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*Please direct all correspondence to Erin R. Hamilton, Department of Sociology, University of California, Davis, 1282 Social Sciences & Humanities, One Shields Avenue, Davis, CA 95616, email erhamilton@ucdavis.edu, telephone (530) 217-3746, fax (530) 752-0783. We gratefully acknowledge the Data Resource Center for Child and Adolescent Health at Oregon Health and Science University for access to and help with the 2007 National Survey of Children's Health.

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Abstract
Extending past work documenting a health advantage for infants born to immigrant mothers, we examine immigrant generational status differences in seven health and development outcomes for children in four major U.S. racial/ethnic groups. Using nationally representative data for 64,509 3-17 year-old children from the 2007 National Survey of Children's Health, we document a graded pattern whereby the incidence of four commonly reported health problems increases across generation in every racial/ethnic group. The pattern persists in multivariate regression models accounting for differences in access to and use of health care (possibly resulting in under-diagnosis), socioeconomic status and family structure, parents' and home health, social support, and neighborhood conditions. The pattern is consistent with two possible explanations of health assimilation: one, that there is deterioration in the health of children across generations, or, two, that parental responses to and reporting of child health conditions change with longer time (across generations) in the United States following immigration.

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Introduction

Children of immigrants currently make up one in four of all children in the United States, and this proportion is expected to increase to one third by 2050 (Passel and Cohn 2008). Children of immigrants are more likely than children of natives to live in poverty, to experience food insecurity, and to live in crowded housing (Capps et al. 2004). At the same time, they are less likely than children of natives to receive public assistance or to have health insurance (Capps et al. 2004). Given the context of disadvantage this large and growing group faces, it is important to document and understand how children of immigrants are faring in terms of their health and development in comparison to children of native-born parents (Mendoza 2009).

In fact, despite their socioeconomic disadvantage, it is well-documented that children of immigrants are born with relatively good health compared to their children-of-U.S.-natives counterparts, a pattern observed across major immigrant groups (Frisbie and Song 2003; Guendelman et al. 1990; Hummer et al. 1999; Hummer et al. 2007; Landale et al. 2000). Given the socioeconomic disadvantage and limited access to health care for children of immigrants, particularly of relatively disadvantaged groups such as Mexican Americans, this health advantage has been referred to as an epidemiologic paradox (Markides and Coreil 1986). The epidemiologic paradox of good health at birth despite socioeconomic disadvantage may be due to a process of selective migration of healthy individuals or to cultural factors that protect mothers and their infants from the deleterious effects of socioeconomic disadvantage.

Although the epidemiologic paradox is well-documented at birth, there is less research on generational differences in the health of children (Biehl et al. 2002; Hernandez and Charney 1998; Mendoza 2009). This is in part due to data constraints. Chronic health issues and mortality

are rare in childhood, and there are few national surveys of children providing population-level health data with samples large enough to make reliable estimates for immigrant generation sub-groups within racial/ethnic or national origin groups.

Several studies have focused on Mexican American children to overcome these constraints. These studies suggest that for many health outcomes, there is a relative health advantage for children of immigrants (i.e., first and second generation children) but not for the third-plus (i.e., children of U.S.-born parents of Mexican descent) generation. For example, in a national, urban sample of U.S.-born Mexican American children, second generation children showed no difference in the prevalence of chronic conditions or asthma compared to non-Hispanic whites, but third-plus generation children were significantly more likely to have a chronic condition or asthma (Padilla et al. 2009). Among Mexican American children in the 1996 National Health and Nutrition Examination Survey, prevalence of asthma and accidents increases across generations, such that first generation Mexican American children have the lowest rates and the third-plus generation children have the highest rates (Mendoza and Dixon 1998). However, physician examinations of the presence of infections showed no difference across generations, and the prevalence of child anemia declined across generations, especially among older children (Mendoza and Dixon 1998). Moreover, studies of child overweight find no first-generation advantage, and many suggest that overweight is in fact more prevalent among children of immigrants than among children of U.S.-born parents (Hamilton, Teitler, and Reichman 2010; Van Hook and Baker 2010).

We build on this work by presenting a comprehensive account of child health across immigrant generations for four major U.S. racial/ethnic groups using data for more than 60,000 children from the 2007 National Survey of Children's Health. We estimate the prevalence of

seven child health and development measures for first, second, and third-plus generation Hispanic, white, black, and Asian children. We estimate multivariate regression models testing for a variety of explanations for generational and racial/ethnic group differences, including use and access to health care, socioeconomic status and family structure, parents' and home health, social support, and neighborhood environment. Our results show that there are strong generational status differences in childhood health. With only a few exceptions, there is a graded pattern whereby the incidence of poor health outcomes increases across generation for all groups. Racial and ethnic variation in these patterns is such that by the third-plus generation, Hispanic and black children have higher rates of most poor health outcomes than white or Asian children. We interpret these findings in light of the epidemiologic paradox and two explanations of health assimilation across immigrant generations.

Methods

Data. We use data from the 2007 National Survey of Children's Health (NSCH), a nationally representative, random-digit dial, computer-assisted telephone survey with an original sample of 91,642 0-17 year old children (Child and Adolescent Health Management Initiative 2007). The survey was sponsored by the U.S. Department of Health and Human Services' Maternal and Child Health Bureau and conducted by the National Center for Health Statistics. Respondents were the child's parent or primary caregiver, and the survey was administered in English, Spanish, and four Asian languages (see Blumberg et al. nd. for more information about the survey).

Our analytic sample includes 64,509 Hispanic, Asian, black, and white children between the ages of 3-17 who had full information on all outcome variables.[1] We excluded from the

[1] 13,600 children ages 0, 1, and 2 were not analyzed because they were asked different health questions. 5966 American Indian/Alaska Native, multiracial, and other race 3-17 year-old children were excluded from the analysis

analysis 1,350 children (1.7% of 3-17 year olds) whose race/ethnicity was missing, 53 children (<1%) whose immigrant generation was missing, and 6,164 children (8.7%) who were missing information on one or more of our outcome measures. We used multiple imputation to impute missing values on covariates; these are not substantially different from results on the sample with full data (n=56,687).

For confidentiality reasons, the NSCH coded Asian children as "other" race when they lived in states where Asians comprise less than 5% of the sample. These Asian children are therefore indistinguishable from children whose parents in fact report their race as "other" and from American Indian or Alaska Native (AIAN) children who are similarly coded as "other" race in states where AIAN children make up less than 5% of the sample. As a result, the Asian sample included in our analysis is only representative of Asians in the nine states where they comprised more than 5% of the state sample (in California, Hawaii, Maryland, Massachusetts, Nevada, New Jersey, New York, Virginia, and Washington). The data are representative of white, black, and Hispanic children at the state and national levels.

Measures. Immigrant generation is based on the child's and their parents' place of birth. Children born outside of the United States are first generation (i.e., immigrants). Children who were born in the United States to one or two parents born abroad are second generation (i.e., children of immigrants). Children who were born in the United States and whose parents were both born in the United States are third-plus generation. We are unable to distinguish between third and higher-order generations because grandparents' place of birth is not reported.

The generational status groups are analyzed within each of four major U.S. racial/ethnic groups: Hispanics, whites, blacks, and Asians. The child's race is reported by the respondent. As

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because these groups do not have substantial immigrant and second-generation groups and, in the case of multiracial and other race children, were too heterogeneous. It was not possible to determine the race/ethnicities of parents of multiracial children.

Hispanic ethnicity is reported separately from race, following standard practice, we group all Hispanics together regardless of race. More specific national-origin groups are not reported in the NSCH.

We analyze the seven, non-rare (occurring in more than 1% of children) physical and developmental health measures included in the National Survey of Child Health.[2] Asthma is based on whether a doctor or other health care provider has ever told the respondent that the child has asthma. Allergies (respiratory, food, or skin), headaches (frequent or severe), and ear infections (three or more) are based on a similar question, but are restricted to occurrences within the past year. Learning disabilities is based on whether a doctor, health professional, teacher, or school official has ever told the respondent that the child has a learning disability. A generic category called "developmental problems" is based on answers to two questions—whether the child has any kind of emotional, developmental, or behavioral problem for which they need treatment or counseling, and whether a doctor or other health care provider has ever told the respondent that the child has a developmental delay or disorder. Developmental delays or disorders include ADD/ADHD, autism, and other unspecified developmental problems. A final measure, overweight, is based on the respondent's reports of the child's height and weight, which were used to construct the child's body mass index (BMI). The height and weight reports were then compared to the Centers for Disease Control BMI age- and sex-specific distributions, with BMIs above the 95th percentile considered overweight. Two health conditions—overweight and headaches—were asked only of children of particular ages. Headaches were only asked of

[2] At this point we do not analyze parent-assessed health of the child because of concerns about the validity of this measure among Hispanics (Finch et al. 2002). Hispanic immigrants report worse health than their physicians do, possibly because of cultural differences in health assessment or because of difficulties translating the Likert-scale categories of "excellent" and "very good" health into meaningful equivalents in Spanish (Angel and Guarnaccia 1989). On the other hand, given our discussion at the end of the paper about assimilation to U.S. health norms of responding to and reporting child health conditions, a different pattern using parent-assessed health may be insightful. Looking into this possibility will be a next step.

children age 5 and older because headaches are rare in young children. Overweight is only asked of children age 10 and older because height and weight tend to be misreported, and overweight subsequently overestimated, in children under age 10 (Akinbami and Ogden 2009).

Covariates. Our models test five sets of potential explanations for generational status differences in child health outcomes. First, it is possible that generational differences reflect differential access to and use of health care, resulting in under-diagnosis of conditions among those with limited health care. Therefore, we include three measures of access to and use of health care. First, health insurance coverage is whether the respondent reports that the child has private, public (including Medicaid and S-CHIP), or no health insurance coverage at the time of the survey. Second, we measured the child's use of preventative care, distinguishing between children who did not see a doctor, nurse, or other health care provider in the past year for preventative care, versus children who saw a health care provider for preventative care one or more times. Third, we measured whether the child had difficulty obtaining health care, based on the respondent's answer to whether there was any time in the past year when the child needed health care but it was delayed or not received.

We tested three other measures of access to and use of health care, including whether the child has a usual source of care; whether the child's usual source of care is a doctor's office; and, as a measure of satisfaction of care, whether the respondent reported that doctors or health care providers never or only sometimes did any of the following: spent enough time with them, listened carefully, provided the specific information needed, or helped them feel like a partner in the child's care. None of these measures were associated with child health outcomes, nor did they mediate the association between race/ethnicity, generational status, and health.

We included four measures of the child's socioeconomic status and family structure. The first two are measures of socioeconomic status, which is associated with health in a graded fashion (Alder et al. 1994) and which is distributed unevenly by race/ethnicity and immigrant status (Capps et al. 2005; Hernandez 2004). The first is the household income-to-poverty ratio, distinguishing between households whose income is less than 100% of the federal poverty line, households whose income is between 100-400% of the federal poverty line, and households whose income is greater than 400% of the federal poverty line. In 2007, the federal poverty line for a family of four was $20,650, meaning that families of four in our three categories were earning less than $20,650, between $20,650 and $82,600, and above $82,600 (U.S. Department of Health and Human Services). The second is the respondent's education, distinguishing between less than high school, high school, and greater than high school. Two other measures of the child's home environment are the household/family structure, distinguishing between two-parent married biological or adoptive parents of the child, two-parent married step-family, single parent, and other family types (mostly foster and other non-parental care). Finally, we include the number of residential moves that the child has made in their lifetime as a measure of residential instability.

Research on the epidemiologic paradox at birth has argued that maternal health behaviors are a primary protective factor for the good health of infants (Reichman et al. 2008). One central question arising from the literature on the paradox in children is whether the good health behaviors of mothers continue to protect their children past infancy (Guendelman 1998). Thus, we included several measures of parents' health and behaviors. Two measures capture parents' general health and parents' mental health, both based on responses to Likert-scale questions of the parents' general health and mental health. Following standard practice, we measured whether

the parent has excellent, very good, or good general/mental health, as opposed to fair or poor health. A third measure is the number of days the parent exercises per week. For all three of these parent health variables (general health, mental health, and exercise), we used the mother's reports, and, when missing (as in the case of the child not living with their mother), we substituted fathers' reports. In cases where the child does not live with their mother or father, no report of (the caretakers') health or exercise was obtained; in these cases we imputed the value in order to avoid dropping these cases as missing and thereby losing this important group of children (who live in "other" family/household types). A fourth measure of the home health environment, which was asked for all children (not just those living with their parents), is whether anyone in the household smokes.

Two final groups of covariates are measures of the social environment in which the child lives. A second major category of protective factors thought to be important for the good health outcomes of immigrant children is the degree of social support available to recent immigrants (Finch and Vega 2003). Therefore we included two measures of social support available to the parent/caretaker and the child. The first is whether the respondent has someone that they turn to for day-to-day emotional help with parenthood or raising of the child. The second is whether the child regularly (weekly) attends religious services, versus never or irregularly, following research that shows that religious service attendance is an important social factor for health (Hummer et al. 1999).

The second group of covariates measuring the social environment includes three measures of the child's neighborhood, based on respondents' reports. All three are item-based scales measuring the characteristics of neighborhoods. The neighborhood resources scale is a standardized score ranging between 0-1 of positive, non-missing responses to whether the

neighborhood has sidewalks/walking paths, a park/playground, a recreation center/community center/boys' or girls' club, and a library/bookmobile. The neighborhood disorder scale is a standardized score ranging between 0-1 of positive, non-missing responses to whether the neighborhood has litter or garbage on the street, poorly kept/dilapidated housing, or vandalism such as broken windows or graffiti. Finally, the neighborhood support scale is the average response on a four-point scale of whether the respondent strongly agrees (=4) to strongly disagrees (=1) that people in the neighborhood help each other out, watch out for each other's children, can count on each other, and are trustworthy to help their child if the child were outside playing and got hurt or scared.

Analysis. We present age-standardized distributions of the prevalence of the seven health conditions by immigrant generation for each of the four racial/ethnic groups. We used direct age standardization because health conditions vary in their prevalence by age (e.g., the likelihood of ever being diagnosed with asthma increases with age, whereas ear infections (occurring in the past year) are more common in early childhood), and the groups have different age distributions. We also present distributions of all covariates in the models by immigrant generation within each of the four race/ethnic groups.

We then present results from a series of multivariate, logistic regression models testing for the roles of access to and use of health care, socioeconomic status and family structure, parents' and home health, social support, and neighborhood conditions in contributing to generational and racial/ethnic differences in each child health outcome. For all analyses, Stata's multiple imputation techniques were used to retain cases with missing data on covariates, and Stata's survey techniques were used to account for the sampling design of the NSCH. Stata/SE version 11 was used to conduct all analysis.

Results

Table 1 shows weighted, age-standardized percent distributions of the seven health conditions for the first, second, and third-plus generations by race/ethnicity, and Figure 1 illustrates these patterns. The data show a relatively consistent pattern of higher prevalence of health conditions in the second and third-plus generations. The pattern is consistent across groups for four common conditions in childhood: allergies, asthma, developmental problems, and learning disabilities, which affect 28%, 15%, 21%, and 10.6% of all children, respectively. For example, the proportion of children with allergies increases by 21% across the three generation groups (from 23.8% for first generation to 28.9% for third-plus generation) for white children; by 58% for Hispanic children; and by more than 300% for black and Asian children. For asthma, the prevalence more than doubles from the first to the third-plus generation for all groups. With only two exceptions (for developmental problems and learning disabilities among Asians), there is a graded pattern whereby the proportion with these conditions increases from the first to the second generation and from the second to the third-plus.

Table 1 about here, Figure 1 about here

A fourth condition that is prevalent among more than 15% of 10-17-year-olds, overweight, shows a graded pattern across the three generations for black children, but not for the other groups. For whites and Asians, the proportion of children who are overweight increases from the first to the second generation, but declines in the third-plus generation. For Hispanic children, the pattern is reverse: the proportion of children who are overweight is highest in the first generation, lower in the second, and lowest in the third-plus generation.

The pattern is less consistent for the two remaining conditions, which affect proportionally fewer children (5.2% report headaches and 4.8% report ear infections). Headaches

are most common among third-plus generation Hispanic, black, and Asian children, but there is no consistent pattern between the first and second generations. Headaches are least prevalent among third-plus generation white children, as compared to first and second generation white children. The prevalence of ear infections is highest in the third-plus generation of white and Asian children, but the prevalence decreases across generations for black children.

Table 2 about here

Table 2 shows weighted percent distributions of all of our covariates for first, second, and third-plus generation children by race/ethnicity. As opposed to generational patterns of health outcomes, there are no consistent generational patterns in our measures of the social conditions these children live in. Rather, generational patterns are differentiated by race/ethnicity, with a general pattern of worsening conditions for white and black children across generations, as opposed to improving conditions for Hispanic and Asian children across generations. For example, the proportion of white and black children living in poor households (i.e., below 100% of the federal poverty line) and the proportion of parents reporting poor health or mental health is higher in the third-plus generation than in the first generation, whereas the opposite is true for Hispanic and Asian children. Similarly, the proportion of respondents with a college-level education and the proportion of children with private health insurance decreases across generations for black and white children, but increases across generations for Hispanic and Asian children. These divergent patterns likely reflect the fact that third-plus generation white and black children are not directly comparable to third-plus generation Asian and Hispanic children, in that the latter will have a greater concentration of third-generation (Asian and Hispanic) children and the former will have a greater concentration of fourth-and-higher generation (white and black) children. The relatively advantaged characteristics of first and second generation

white and black children, compared to their third-plus generation counterparts, likely also reflects the higher socioeconomic status of the populations of origin (particularly of white immigrants) and a highly select pattern of migration out of those populations (Akresh and Frank 2008; Feliciano 2005).

The generational pattern of access to and use of health care is unique. With the exception of white children, among whom first generation children are relatively advantaged, Hispanic, black, and Asian first generation children are less likely than their second and third-plus generation counterparts to have any health insurance coverage. Hispanic and black first generation children are also less likely to have had preventative care in the past year and more likely than their later generation counterparts to have had difficulty obtaining care in the past year. Because most of the health outcomes we analyze are doctor-diagnosed (i.e., parents/caregivers are asked whether a doctor or other health care provider has ever told them that the child has a given condition), then these patterns of less access to and use of care among first generation children may suggest that their lower prevalence of health conditions is due to under-diagnosis (as opposed to lower prevalence). If under-diagnosis is driving the generational patterns, then we would expect to see no generational differences in health once their differences in access to and use of care is controlled for.

A final pattern worth noting is the racial/ethnic inequality revealed in these data. Whereas white and Asian children are relatively advantaged, Hispanic and black (particularly black third-plus generation) children are disadvantaged. Comparing children of all generations, Hispanic first generation children are by far the most disadvantaged group by these measures: more than half have no health insurance coverage, nearly four out of five live in poor households, more than half of their responding adults (i.e. parent or caretaker) have less than a high school

education, and their parents report the worst general and mental health. Although Hispanic immigrant mothers have very low rates of smoking, which is thought to be an important protective factor for their infants' health (Reichman et al. 2008), about one in five of first and second generation Hispanic children live in a smoking household, which is higher than most other first and second generation children. However, household smoking is highest among third-plus generation white, Hispanic, and black households.

Comparing just third-plus generation children, black children are the most disadvantaged in terms of poverty status, respondent education, single parent and other family types, parents' general and mental health, household smoking, emotional support, neighborhood support, and neighborhood disorder.

Table 3 about here

Turning now to the multivariate regression results, Table 3 shows odds ratios from logistic regression models predicting asthma. Each model tests how the odds of asthma for each race/ethnicity/generational group change when controlling for different sets of covariates. Third-plus generation whites are the omitted race/ethnic/generation group; the generational gradient is observed when odds ratios are smallest (closest to 0) for the first generation, largest (closest to 1 or greater than 1) for the third-plus generation, and in between for the second generation. We would expect the race/ethnicity/generational odds ratios to lose magnitude—i.e. move closer to 1—when the measured controls account for some portion of the race/ethnicity/generational difference.

Model 1 in Table 3 shows race/ethnic/generational differences in the odds of asthma, controlling only for age and sex. First generation white and Hispanic children have significantly lower odds of asthma, and third-plus generation Hispanic, black, and Asian children have

significantly higher odds of asthma, than third-plus generation white children. The odds ratios for the remaining groups are not statistically significantly different from third-plus generation white children. The generational gradient is observed for each group, as the odds ratios are smallest for the first generation, increase for the second, and are largest for the third-plus generation.

Models 2-6 test each of the sets of explanatory variables—access to and use of health care, socioeconomic status and family structure, parents' and home health, social support, and neighborhood conditions—and Model 7 includes all covariates. The models do a better job at explaining the racial differences among the third-plus generation than they do the first-generation advantage. The odds ratios for Hispanic and black third-plus generations decrease across models, particularly in Models 3, which control for socioeconomic status and home context, and 7, which includes all covariates. For example, whereas third-plus generation black children have 81% higher odds of asthma than third-plus generation white children in Model 1, controlling for all covariates in model 7 reduces this difference by more than half, to 31%. The difference in the odds of asthma for third-plus generation Hispanic children, relative to third-plus generation white children, declines from 57% in Model 1 to 33% in Model 7.

By contrast, the models do not do a good job explaining the lower odds of asthma for first generation children, relative to third-plus generation white children, or the elevated odds of asthma for third-plus generation Asian children. Across all models, first generation white and Hispanic children have about 60% lower odds of asthma than third-plus generation white children. Although not statistically significant in most models, the odds ratios for first generation Asian children are similar in size and relatively unchanged across models as well. The 3-to-1

odds of asthma among third-plus generation Asian children relative to third-plus generation white children are not explained by these models, either.

Model 2 tests the hypothesis that generational differences in the prevalence of health conditions reflects under-diagnosis due to differential access to and use of health care. If this were the case, then the odds ratios for first-generation children would move closer to 1 when controlling for measures of access to and use of care. They do not. The odds of asthma for first generation white, Hispanic, black, and Asian children barely change from Model 1 to Model 2. Model 2 does show that access to and use of health care matter for asthma. Children who have public insurance have 31% higher odds of asthma than children with private insurance, an association that disappears when socioeconomic status differentials are controlled for in Model 7 (i.e., the association is capturing the fact that low socioeconomic status children are more likely to have asthma and be enrolled in public health insurance, rather than a direct effect of public health insurance). Not having preventative care in the past year is associated with 31% reduced odds of asthma, which can be understood as either a health effect (children aren't going to the doctor because they are well) or as an under-diagnosis effect (children with asthma aren't being diagnosed because they aren't going to the doctor). Finally, difficulty obtaining needed care in the past year is associated with 54% increased odds of asthma, likely reflecting need (presence of symptoms) combined with an SES effect (difficulty obtaining care because of limited resources, which is associated with increased risk for asthma).

The remaining covariates are for the most part associated with asthma in the expected directions. In Model 3, measures of disadvantage are associated with increased odds of asthma; in particular, children have increased odds of asthma in single parent and other family types. In Model 4, parents' poor health and mental health reports are associated with increased odds of

asthma, as is household smoking. In Model 5, we see no association between our measures of social support and child asthma. In Model 6, neighborhood disorder is associated with higher odds of asthma, whereas neighborhood support is associated with lower odds of asthma. The one result that is inconsistent with our expectation is the above-one odds ratio for neighborhood resources, suggesting that additional resources (such as sidewalks or libraries) are associated with increased odds of asthma. This result may reflect the higher density of sidewalks, libraries, and other neighborhood resources in urban settings where the risk of asthma is also higher. In the full model, no health insurance, no preventative care, difficulty obtaining care, single parent and other families, parents' poor health report, and neighborhood resources are significantly associated with child asthma.

Table 4 about here

Table 4 presents results of the same set of models for the remaining six child health outcomes, with covariates not shown for the sake of space. Covariate associations with child health outcomes are in the expected directions and are generally consistent with what is shown for asthma (with some differences reflecting the nature of different conditions). Two general conclusions can be drawn from these results. First, the lower odds of allergies, developmental problems, and learning disabilities for the first and second generation (for most groups) are generally unexplained in these models. For example, the odds of allergies are about 50-60% lower for first generation Hispanic children, relative to third-plus white children, across all models. Second, the models do a better job explaining the third-plus generational racial differences in health. The odds ratios for developmental problems, ear infections, learning disabilities, and overweight for third-plus generation black and Hispanic children are reduced substantially in the models controlling for socioeconomic status.

Discussion

This analysis builds on work that documents an immigrant health advantage in birth outcomes by investigating generational differences in seven child health and development outcomes across four major U.S. racial/ethnic groups. For all groups, we find a robust generational status gradient in four common measures of child health: asthma, allergies, developmental problems, and learning disabilities. The prevalence of these conditions increases from the first to the second to the third-plus generation. The pattern is less consistent for ear infections, headaches, and overweight. Racial and ethnic variation in these patterns is such that by the third-plus generation, Hispanic and black children have higher rates of most poor health outcomes than white or Asian children. Racial disparities among the third-plus generation are in large part due to the relative socioeconomic disadvantage of Hispanic and black children. The relative advantage of first-generation and (some) second-generation children are largely unexplained by differences across groups in access to and use of health care, socioeconomic status and family structure, parents' and home health, social support, or neighborhood conditions. This advantage is paradoxical given that children of immigrants, particularly Hispanic immigrants, are socioeconomically disadvantaged compared to children of natives. Our results suggest that the epidemiologic paradox, which has been well documented at birth, persists into childhood for the first- and second-generations but disappears by the third-plus generation.

There are two general interpretations of the generational gradient observed for asthma, allergies, developmental problems, and learning disabilities. First is that there is deterioration in the relative health standing of children given longer (across-generation) time spent in the United States following immigration. The second is that there is change in the way that parents respond

to and report their children's health conditions given longer (across-generation) time spent in the United States since immigration.

The first interpretation, of deteriorating health, is consistent with two explanations of the epidemiologic paradox, the selective migration hypothesis and the protective culture hypothesis. According to the selective migration hypothesis, the difficult and costly process of migration selects on good health and other characteristics that might be associated with good health (such as a sense of personal efficacy, or control over one's life circumstances, which likely characterizes people who migrate and who closely manage their health) (Palloni and Arias 2001). Health selection among migrants has been documented in a national survey of legal permanent residents who positively compared their own health to the health of non-migrants in their country of origin (Akresh and Frank 2008). If migrants are selectively healthy, then immigrants in the United States will be disproportionately concentrated at the good end of the health distribution, resulting in an uneven distribution that may unravel over time as immigrants are exposed to similar conditions as non-immigrants in the country of destination. Through this exposure, a regression to the mean occurs and over time immigrants (and their descendents) will no longer be distinguishable from natives (Jasso et al. 2004). This selection-and-regression-to-the-mean process may account for the patterns observed in these data.

A different explanation of these patterns, but one that also assumes deterioration in health, is the protective culture hypothesis. The protective culture hypothesis proposes that immigrants are protected by a cultural orientation that proscribes good health behaviors and strong kin and non-kin social ties (Scribner 1996). Given exposure to deleterious socioeconomic and environmental conditions in the United States over time, this healthy cultural orientation may be undermined, resulting in the deterioration of immigrant (and their descendents') health.

Studies show that diet changes, and smoking and alcohol consumption increase, with time spent in the United States (Akresh 2009; Landale et al. 1999; Lopez-Gonzalez, Aravena, and Hummer 2005).

The protective culture explanation is often invoked to explain the relatively good health of socioeconomically disadvantaged groups, in particular Mexican Americans (Scribner 1996). The fact that we find a generational pattern that is consistent across groups of diverse cultural origins (actually, heterogeneous, panethnic groups) may undermine the argument that there is a protective cultural orientation that is specific to some immigrant groups. The fact that this pattern is observed across heterogeneous groups may argue instead for the common influence of the deleterious U.S. culture (or structural conditions) on the health of these groups.

The above explanations assume that the patterns documented in this analysis reliably measure the health status of children across immigrant generations. In other words, they take for granted that respondent reports of child health conditions accurately measure the presence or absence of those conditions. An alternative explanation is that the patterns reflect differences across generations in the diagnosis and reporting of child health conditions. We ruled out, to the best of our ability, the possibility that these differences are due to under-diagnosis as a result of differential access to and use of care. That is, controlling for health insurance coverage, use of preventative care, and difficulty in obtaining needed care, the generational gradient persisted. Therefore, assuming that children who present similar symptoms to health care providers are similarly diagnosed (that there is no difference in how health care providers diagnose children of different immigrant generations), the differences may arise in selective processes of who presents those symptoms to health care providers or in selective processes of who reports diagnoses in telephone-based surveys. The interpretations consistent with our findings would be

that, in the first case, immigrant parents (of first and second generation children) are less likely to seek health care in response to similar symptoms, and, in the second, that immigrant parents are less likely to report diagnoses to telephone surveyors, than U.S.-born parents.

It is worth noting that these explanations are not mutually exclusive: it is possible that the generational gradient reflects health deterioration and, at the same time, a process of changing responses to and reporting of health conditions. Both are consistent with a process of assimilation—one to the U.S. health distribution and the other to U.S. norms surrounding health practices. We are unable to test these hypotheses in our data, but both find support in the research literature. Deterioration in the relative health advantage of immigrants has been documented using objectively-measured health conditions. For example, among U.S.-born children, rates of infant mortality increase from the second to the third generation (Hummer et al. 1999). This pattern is consistent with the gradient documented in this analysis, and it could not be due to differential reporting, as infant mortality rates are estimated from linked birth and death certificates, with near universal registration. Longitudinal studies of immigrant health also document health deterioration, as in the case of increasing body mass indexes over time among adult immigrants (Antecol and Bedard 2006).

On the other hand, there is medical sociology literature documenting the social and cultural bases of understandings of health (Conrad and Barker 2010). For example, studies have shown that among individuals with similar doctor diagnoses there are systematic differences in how symptoms are perceived and reported across ethnic groups (Zola 1978). A study of immigrant and U.S.-born women of Mexican and Puerto Rican origin shows that reports of self-assessed health are inconsistent with doctor-assessed health (with doctors reporting better health than the individuals), and that the difference is greater among immigrants than it is among the

U.S.-born, suggesting that there may be a process of norming to U.S. standards of health assessment (Angel and Guarnaccia 1988). Norming to U.S. standards of health assessment, particularly in the case of increasing health-care-seeking responses to and reporting of health conditions across generations, may be understood in terms of medicalization, which is the process of defining an increasing array of life conditions in medical terms (Conrad 1992). While studies have revealed the social and historical processes underlying medicalization in Western societies, and medicalization is thought to be more advanced in the United States and other Western societies than it is in non-Western societies, there are few studies that examine how medicalized understandings of problems are exported or adopted in non-Western contexts, or, as in this case, by immigrant groups (Conrad 1992). The patterns documented in this paper are consistent with a process of medicalization among immigrant groups and their descendents, but additional research is required to support it.

The outlying patterns observed for overweight and ear infections may elucidate underlying processes. If, for example, ear infections are more consistently responded to and reported across immigrant generations than other conditions, then the fact that they do not reveal a pattern of worsening health may suggest that one is not occurring for the other conditions (but rather there is a process of health norming). The case of overweight is suggestive. Overweight is based on parental/caretaker reports of weight and height, with the problem designation made by the analyst based on the child's position within a national distribution. It would be interesting to observe whether a pattern of worsening health across generations would be observed if parents were asked to evaluate whether their child's weight status was a problem; some research suggests that indeed these kinds of evaluations are different for recent immigrants (Evans et al. 2009).

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Table 1. Weighted and age standardized percent distributions of health conditions for first, second, and third-plus generation children, by race/ethnicity

	White			Hispanic			Black			Asian			
	1st	2nd	3rd+	1st	2nd	3rd+	1st	2nd	3rd+	1st	2nd	3rd+	All
Allergies**	23.8	26.9	28.9	16.4	18.7	26.0	10.6	24.6	33.7	9.9	20.8	36.5	27.5
Asthma**	6.9	11.6	14.0	8.3	12.5	19.3	6.7	13.6	22.6	9.3	16.7	25.3	15.3
Developmental problem**	8.6	18.1	21.9	12.4	14.9	22.0	4.5	16.2	23.7	2.9	2.1	20.7	20.4
Ear infections**	2.4	3.3	4.8	5.7	6.3	4.9	7.2	5.0	4.5	0.5	0.5	3.2	4.8
Headaches**	8.0	4.8	5.4	2.3	2.1	6.8	0.1	4.2	6.0	0.0	3.7	3.8	5.2
Learning disability**	5.6	8.8	10.2	9.6	10.0	14.4	4.2	7.5	13.5	2.4	0.8	6.6	10.6
Overweight (>95% BMI**)	3.2	16.5	13.0	28.1	20.8	19.8	14.5	15.9	26.6	6.6	11.4	9.3	16.3
Unweighted N	558	2549	45482	937	3439	3654	157	578	6320	122	454	262	64509

*$p <$ .05, **$p<$.01 for differences across race/ethnicity/generation, on the basis of F-tests of equal means.

Source: 2007 National Survey of Children's Health

Table 2. Weighted percent distributions and means of demographic and social characteristics for first, second, and third-plus generation children, by race/ethnicity

	White			Hispanic			Black			Asian			
	1st	2nd	3rd+	1st	2nd	3rd+	1st	2nd	3rd+	1st	2nd	3rd+	All
Age (mean)**	11.6	10.1	10.5	11.6	9.6	10.2	13.2	10.0	10.7	11.8	9.2	10.1	10.4
Female (%)	52.4	44.6	48.2	48.0	48.0	51.4	47.0	49.9	49.5	45.5	54.8	53.8	48.7
Access to and use of health care													
Insurance coverage (%)**													
Private	86.2	83.5	76.8	19.6	31.6	57.1	40.8	57.6	38.7	61.8	81.9	95.7	64.3
Public	8.4	10.8	17.1	27.9	52.3	33.4	27.1	30.1	53.2	28.2	14.9	3.9	26.8
None	5.4	5.7	6.1	52.5	16.1	9.5	32.1	12.3	8.1	10.0	3.2	0.4	8.9
No preventative care in past year (%)**	10.2	9.8	13.9	24.5	14.1	14.9	14.1	6.2	10.0	15.2	15.9	13.9	13.5
Difficulty obtaining care in past year (%)**	4.0	5.6	6.1	11.3	7.7	9.2	12.1	10.1	9.1	3.7	1.8	6.4	7.0
Socioeconomic status and family structure													
Household income to poverty ratio (%)**													
<100	19.8	18.9	24.3	79.8	68.3	40.4	52.1	38.5	59.7	33.7	17.7	5.8	36.0
100-400%	34.5	28.3	37.7	13.6	22.7	34.2	39.3	30.4	26.1	32.4	24.7	40.6	33.1
>400%	45.7	52.8	38.0	6.6	9.0	25.4	8.6	31.1	14.2	33.9	57.6	53.6	30.9
Respondents' education (%)**													
<High school	1.6	2.7	5.8	52.4	45.9	10.9	15.0	7.2	13.0	2.2	6.9	0.1	12.8
High school or equiv	16.7	16.8	23.7	21.7	28.3	29.2	11.7	18.8	35.2	21.2	16.5	2.5	25.4
>High school	81.7	80.5	70.5	25.9	25.8	59.9	73.3	74	51.8	76.6	76.6	97.4	61.8
Family structure (%)**													
Two parent bio													
Two parent step	5.6	9.6	8.7	8.3	7.7	11.2	24.9	8.4	10.1	0.9	1.3	1.7	8.9
Single parent	10.9	7.9	13.1	19.4	16.8	28.5	25.6	23.7	45.8	12.2	3.0	14.9	19.1

Other	1.6	2.8	5.6	3.8	3.2	9.5	6.3	5.8	13.4	8.4	1.5	2.1	6.4
Number of residential moves in child's life (mean)**	3.1	1.7	1.8	2.5	2.4	2.4	2.1	1.7	2.4	1.7	1.4	0.9	2.0
Parents' and home health													
Parent's health good/fair/poor**	21.8	23.6	27.8	62.9	57.1	39.2	44.0	37.2	47.0	48.6	31.9	25.4	35.6
Parent's mental health good/fair/poor**	13.4	22.3	23.9	51.5	44.3	31.7	38.1	25.4	37.4	34.9	28.0	11.5	29.4
Number of days parent exercises per week (mean)**	2.6	2.6	2.9	2.1	2.3	2.9	2.6	2.7	2.7	2.6	2.3	2.2	2.8
Someone in household smokes (%)**	19.8	20.6	27.7	21.8	19.3	29.5	7.5	11.4	30.2	17.7	12.8	4.9	26.1
Social support													
Respondent has emotional support (%)**	88.2	91.1	93.8	70.4	73.8	88.6	81.8	84.9	87.7	84.6	73.1	92.2	90.9
Child attends religious services regularly (%)**	51.7	47.8	54.1	56.8	60.4	51.6	75.5	65.2	61.6	53.2	43.0	51.4	55.5
Neighborhood environment													
Support scale (mean)**	3.45	3.45	3.56	3.15	3.19	3.33	3.15	3.24	3.14	3.35	3.40	3.45	3.42
Resources scale (mean)**	0.81	0.82	0.74	0.67	0.73	0.79	0.82	0.87	0.79	0.89	0.86	0.82	0.75
Disorder scale (mean)**	0.07	0.10	0.11	0.16	0.16	0.17	0.09	0.14	0.22	0.11	0.15	0.16	0.14
Unweighted sample size	558	2549	45482	937	3439	3654	157	578	6320	122	454	262	64509

*$p <$ .05, **$p<$.01 for differences across race/ethnicity/generation, on the basis of F-tests of equal means or chi-square tests of equal distributions.

Source: 2007 National Survey of Children's Health

Table 3. Odds ratios from logistic regression models predicting asthma

	1	*2*	*3*	*4*	*5*	*6*	*7*
Race/ethnicity/generation (ref= white 3rd+)							
White 1st	0.42**	0.43**	0.43**	0.45**	0.42**	0.41**	0.44**
White 2nd	0.79	0.80	0.82	0.81	0.79	0.76	0.81
Hispanic 1st	0.44**	0.45**	0.40**	0.39**	0.44**	0.40**	0.42**
Hispanic 2nd	0.87	0.79	0.79	0.79	0.86	0.80	0.77*
Hispanic 3rd+	1.57**	1.50**	1.39*	1.49**	1.57**	1.47**	1.33*
Black 1st	0.76	0.75	0.68	0.77	0.77	0.69	0.70
Black 2nd	0.98	0.92	0.93	0.98	0.99	0.91	0.87
Black 3rd+	1.81**	1.61**	1.43**	1.67**	1.81**	1.62**	1.31**
Asian 1st	0.53	0.51	0.52	0.49	0.53	0.49	0.47
Asian 2nd	1.34	1.39	1.48	1.35	1.33	1.26	1.42
Asian 3rd+	3.63*	3.77*	3.93*	3.93*	3.64*	3.48*	3.85*
Access to and use of health care							
Health insurance coverage (ref=private)							
None		0.84					0.73*
Public		1.31**					1.00
No preventative care in past year		0.69**					0.68**
Difficulty obtaining needed care in past year		1.54**					1.35**
Socioeconomic status and family structure							
Household income to poverty ratio (ref=>400%)							
<100			1.21*				1.11
100-400%			1.07				1.03
Respondents' education (ref=>High school)							
<High school			0.95				0.94
High school or equiv			1.04				1.04
Family structure (ref=two parent bio)							
Two parent step			1.10				1.07
Single parent			1.49**				1.41**
Other			1.37*				1.41**
Number of residential moves in child's life			1.03*				1.02
Parents' and home health							
Parent's health good/fair/poor				1.32**			1.28**
Parent's mental health good/fair/poor				1.20*			1.12
Number of days parent exercises per week				1.01			1.01
Someone in household smokes				1.14*			1.08
Social support							
Respondent has emotional support					0.99		1.12

Child attends religious services regularly					0.97		1.05
Neighborhood environment							
Neighborhood resources scale						1.24*	1.27**
Neighborhood disorder scale						1.33*	1.20
Neighborhood support scale						0.85**	0.91
Demographic controls							
Sex female	0.69**	0.69**	0.68**	0.69**	0.69**	0.69**	0.68**
Age in years	1.03**	1.04**	1.03**	1.03**	1.03**	1.03**	1.03**
Sample size	64509	64509	64509	64509	64509	64509	64509

*p<.05, **p<.01 (two-tailed tests)

Source: 2007 National Survey of Children's Health

Table 3. Odds ratios of race/ethnicity/generational differences in six child health outcomes from seven multivariate logistic regression models (covariates not shown)

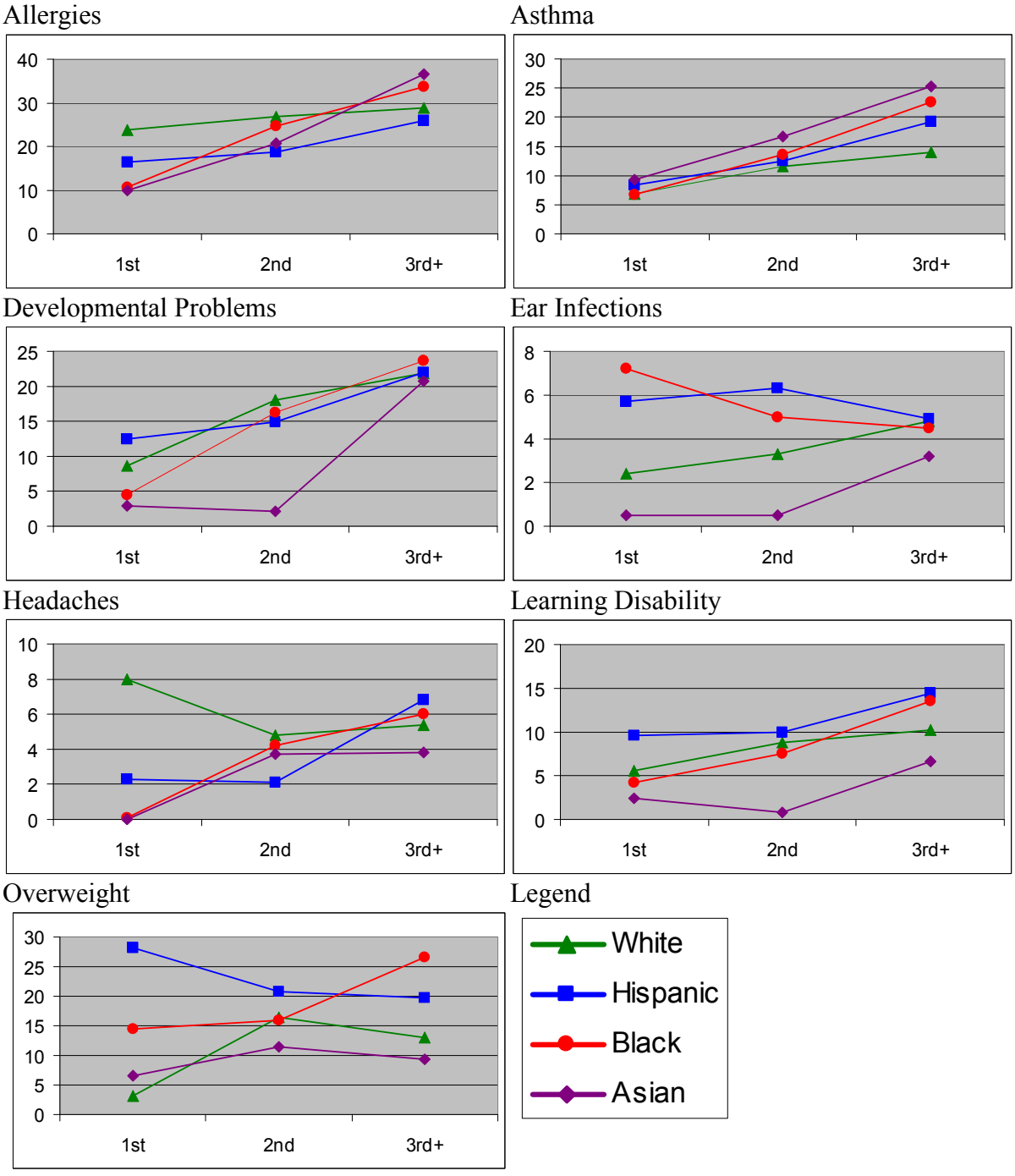
	1 Basic	*2 Health Care*	*3 SES and Family*	*4 Home health*	*5 Social support*	*6 Neighb-orhood*	*7 All*
Allergies							
White 1st	0.71	0.70	0.68*	0.73	0.70	0.71	0.71
White 2nd	0.90	0.89	0.88	0.91	0.90	0.90	0.88
Hispanic 1st	0.38**	0.44**	0.46**	0.32**	0.38**	0.36**	0.48**
Hispanic 2nd	0.52**	0.55**	0.63**	0.46**	0.52**	0.50**	0.60**
Hispanic 3rd+	0.97	0.98	0.98	0.93	0.97	0.94	0.95
Black 1st	0.30**	0.29**	0.30**	0.28**	0.29**	0.29**	0.28**
Black 2nd	0.79	0.77	0.78	0.76	0.79	0.77	0.74
Black 3rd+	1.23**	1.26**	1.24**	1.14*	1.23**	1.15*	1.17**
Asian 1st	0.16**	0.16**	0.16**	0.14**	0.16**	0.16**	0.15**
Asian 2nd	0.58**	0.60	0.58*	0.56*	0.58*	0.56*	0.57*
Asian 3rd+	0.99	0.97	0.94	1.01	0.99	0.97	0.92
Developmental problems							
White 1st	0.30**	0.33**	0.31**	0.34**	0.30**	0.30**	0.34**
White 2nd	0.79	0.84	0.85	0.82	0.77	0.76*	0.82
Hispanic 1st	0.46**	0.38**	0.34**	0.36**	0.41**	0.39**	0.34**
Hispanic 2nd	0.63**	0.45**	0.49**	0.51**	0.57**	0.54**	0.42**
Hispanic 3rd+	1.08	0.90	0.84	0.99	1.05	0.97	0.77*
Black 1st	0.25*	0.20**	0.19**	0.23*	0.24*	0.21**	0.18**
Black 2nd	0.74	0.60*	0.66	0.76	0.72	0.67	0.59*
Black 3rd+	1.11	0.79**	0.71**	0.95	1.08	0.92	0.61**
Asian 1st	0.17**	0.06**	0.07**	0.06**	0.07**	0.07**	0.06**
Asian 2nd	0.15**	0.16**	0.18**	0.15**	0.14**	0.14**	0.16**
Asian 3rd+	0.78	0.90	0.89	0.94	0.79	0.74	0.95
Ear infections							
White 1st	0.48	0.50	0.53	0.52	0.46*	0.47	0.54
White 2nd	0.78	0.82	0.87	0.83	0.76	0.77	0.85
Hispanic 1st	1.61	1.36	1.02	1.33	1.36	1.36	0.89
Hispanic 2nd	1.15	0.90	0.78	1.00	0.98	0.99	0.64*
Hispanic 3rd+	1.12	0.98	0.94	1.04	1.09	1.02	0.88
Black 1st	0.05**	0.04**	0.04**	0.05**	0.04**	0.04**	0.03**
Black 2nd	0.82	0.69	0.78	0.82	0.77	0.73	0.66
Black 3rd+	0.91	0.72**	0.63**	0.80	0.85	0.75*	0.56**
Asian 1st	0.26	0.24	0.25	0.24	0.24	0.25	0.23
Asian 2nd	0.09**	0.09**	0.10**	0.09**	0.08**	0.08**	0.09**
Asian 3rd+	0.31	0.35	0.37	0.34	0.32	0.30	0.37
Headaches							
White 1st	1.55	1.67	1.54	1.84	1.55	1.64	1.86
White 2nd	0.80	0.85	0.85	0.83	0.80	0.84	0.89
Hispanic 1st	0.37**	0.28**	0.25**	0.32**	0.37**	0.32**	0.24**
Hispanic 2nd	0.38**	0.31**	0.29**	0.33**	0.38**	0.35**	0.29**

Hispanic 3rd+	1.31	1.17	1.11	1.22	1.31	1.26	1.10
Black 1st	0.04**	0.03**	0.04**	0.02**	0.04**	0.04**	0.02**
Black 2nd	1.06	0.89	0.97	1.08	1.06	1.09	1.01
Black 3rd+	1.11	0.85	0.84	0.98	1.12	1.01	0.78
Asian 1st (dropped out)							
Asian 2nd	0.92	0.98	1.04	0.97	0.89	0.95	1.16
Asian 3rd+	0.76	0.80	0.91	0.91	0.77	0.76	0.92
Learning disability							
White 1st	0.64	0.71	0.67	0.72	0.62	0.63	0.75
White 2nd	0.92	0.99	1.01	0.95	0.90	0.90	0.99
Hispanic 1st	0.77	0.60*	0.51**	0.64*	0.68*	0.67*	0.49**
Hispanic 2nd	1.13	0.82	0.78	0.98	0.99	1.01	0.68**
Hispanic 3rd+	1.56**	1.31	1.28	1.46**	1.52**	1.44*	1.19
Black 1st	0.44	0.35	0.36	0.43	0.43	0.39	0.34
Black 2nd	0.81	0.66	0.74	0.84	0.78	0.75	0.67
Black 3rd+	1.35**	0.97	0.93	1.19	1.30**	1.16	0.82*
Asian 1st	0.15*	0.14*	0.16*	0.14*	0.15*	0.15*	0.14*
Asian 2nd	0.10**	0.11**	0.12**	0.10**	0.09**	0.10**	0.11**
Asian 3rd+	0.58	0.69	0.70	0.67	0.59	0.56	0.74
Overweight							
White 1st	0.16**	0.18**	0.18**	0.19**	0.16**	0.17**	0.20**
White 2nd	1.53	1.61	1.66	1.59	1.51	1.57	1.72
Hispanic 1st	2.64**	1.97*	1.42	2.42**	2.52**	2.34**	1.33
Hispanic 2nd	1.88**	1.53*	1.25	1.73**	1.78**	1.77**	1.21
Hispanic 3rd+	1.69**	1.52*	1.40	1.63*	1.67**	1.64**	1.39
Black 1st	0.88	0.74	0.74	0.71	0.87	0.86	0.58
Black 2nd	1.28	1.17	1.21	1.22	1.26	1.31	1.15
Black 3rd+	2.45**	1.97**	1.74**	2.15**	2.42**	2.31**	1.62**
Asian 1st	0.57	0.50	0.62	0.48	0.57	0.56	0.50
Asian 2nd	1.02	1.04	1.06	1.02	0.95	1.06	1.07
Asian 3rd+	0.20	0.22	0.25	0.25	0.20	0.21	0.28
Unweighted sample size	64509	64509	64509	64509	64509	64509	64509

*p<.05, **p<.01 (two-tailed tests)

Source: 2007 National Survey of Children's Health

Figure 1. Prevalence of Child Health Conditions across Generations and by Household Poverty Status* by Race/Ethnicity



Source: 2007 National Survey of Children's Health