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Birthweight of Children of Immigrants by Maternal Duration of Residence in the United States

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Abstract

A large literature on immigrant health in the U.S. has shown that immigrants tend to be healthier and live longer than both individuals who remain in their countries of origin and natives of their host countries who are of the same race or ethnicity. However, this immigrant health advantage appears to diminish with duration of residence in the U.S. Few studies of the effects of immigrants' exposure to the U.S. have focused on perinatal health. This study used three contemporary national datasets to describe patterns in infant birthweight by maternal duration of residence in the U.S. For both immigrants overall and Hispanic immigrants in particular, rates of low birthweight appeared to decline over the first few years in the U.S. and increase thereafter. This curvilinear association was robust across the three datasets and deviates somewhat from the prevailing notion that health declines monotonically over time. Additionally, we found no evidence that prenatal substance use increased with duration of residence in the U.S.

Keywords

birthweight; low birthweight; USA; immigration; acculturation

Introduction

A large literature on immigrant health in the U.S. has shown that immigrants tend to be healthier and live longer than both individuals who remain in their countries of origin and natives of their host countries who are of the same race or ethnicity (see Jasso et al., 2004). However, this immigrant health advantage appears to diminish with duration of residence in the U.S. (e.g., Cho et al., 2004; Goel et al., 2004; Uretsky & Mathiesen, 2007). Although the vast majority of studies investigating this issue have focused on U.S. populations, negative associations between duration of residence and health have also been found in Canada (e.g.,

McDonald & Kennedy, 2004; Newbold, 2005) and Australia (e.g., Chiswick et al., 2008; Julian & Easthope, 1996).

Acculturation theory, which has dominated research on immigrant health trajectories, considers the interaction between one's culture of origin and that of the host country. Many scholars have described the acculturation process, noting that it is complex and not uniformly experienced (e.g., Lara et al., 2005; Portes & Rumbaut, 2001) and that it cannot be characterized by a single or simple measure (e.g., Berry, 2003). The process is assumed to be bi-directional, with no pre-determined winner in the tension between the old and new cultures. Endpoints of acculturation can be the preservation of the culture of origin, acceptance of the new culture in lieu of the old, integration of the two cultures, or marginalization through rejection by members of either or both cultures. In practice, however, as evidenced by most indicators of acculturation used in the empirical literature (language acquisition, generational status, and age at immigration, all of which are highly associated with duration of residence in the host country), the process is assumed to follow a route of gradual acceptance of the new culture, with the protective effects of the country of origin dissipating over time (see Jasso et al., 2004). That is, the process is generally presumed to be monotonic and assimilative in nature.

Many studies of acculturation focus on individuals' health behaviors, finding that more acculturated immigrants engage in higher rates of drug use, alcohol abuse, cigarette smoking, and unhealthful eating patterns (see Lara et al., 2005). Others have considered pathways other than behavioral changes, hypothesizing that prolonged or cumulative exposure to discrimination or other potentially health-compromising social contexts takes a more direct toll on immigrants' health (Nazroo, 2001; Reijneveld, 1998; Singh & Siahpush, 2002; Uretsky & Mathiesen, 2007).

Studies on health declines among immigrants have focused primarily on adults, and those have focused primarily on Hispanics, who represent the largest immigrant subgroup in the U.S. Dey et al. (2006) reported that Hispanic immigrants living in the U.S. for fewer than five years have lower rates of obesity, hypertension, diabetes, and cardiovascular disease than Hispanic immigrants living in the U.S. for more than five years. Antecol and Bedard (2006) described similar patterns for self-reported general health and activity limitations among Hispanic immigrants, even when controlling for socioeconomic status; the patterns were less consistent among white immigrants and not apparent among black immigrants. Both of these studies used data from the National Health Interview Survey (NHIS), a large nationally-representative study of the U.S. population. Kaestner et al. (2009), using data from the National Health and Nutrition Examination Survey, found that 45 to 60 year old Mexican immigrants have lower allostatic load scores (biological markers of stress) upon arrival than U.S.-born Mexican Americans, non-Hispanic whites, and non-Hispanic blacks, and that this health advantage is attenuated with duration of residence in the U.S. (measured in 10 year increments).

Findings from the above studies are consistent with acculturation theory and suggest a monotonic association between duration of residence in the U.S. and poor health; that is, the longer immigrants have been in the host country (almost always the U.S., in studies to date), the worse their health. However, Jasso et al. (2004) uncovered a curvilinear association using the NHIS and considering self-rated health as well as seven different chronic conditions. Jasso and colleagues' finding, which is also consistent with acculturation theory in its general formulation, suggests that improvements in health occur among immigrants soon after arrival followed by steady deterioration after five years in the U.S. The authors found that the initial improvements in adult health do not appear to reflect language

acquisition or changes in reference frames (i.e., initially comparing oneself to individuals in the country of origin but eventually using U.S. residents as the comparison).

Few studies of the effects of immigrants' exposure to the U.S. have focused on perinatal health. A simple look at U.S. natality statistics reveals clear evidence of the “epidemiologic paradox”—a term coined by Markides and Coreil (1986)—in the context of birth outcomes of foreign-born Hispanic (particularly Mexican) versus U.S.-born non-Hispanic white women. That is, birth outcomes of foreign-born Hispanic mothers are on par with, if not more favorable than, those of native-born non-Hispanic white mothers despite the relative socioeconomic disadvantages of the former as compared to the latter. Numerous studies have compared birth outcomes of foreign-born mothers to those of native-born mothers of the same race or ethnicity—arguably a more appropriate comparison—and have uniformly found the former to be more favorable than the latter (e.g., Cho & Hummer, 2001; David & Collins, 1997; Landale, Oropesa, & Gorman, 1999; Landale, Oropesa, Llanes, & Gorman, 1999; Singh & Yu, 1996).

As far as we know, only three studies to date have investigated associations between mothers' duration of residence and the health of their U.S.-born infants, despite the facts that: (1) some of the key behaviors thought to be affected by acculturation (e.g. diet and smoking) are important predictors of birth outcomes (in particular, birthweight), (2) the maternal-child link is potentially important for understanding patterns in immigrant health across generations, and (3) the share of children in the U.S. born to immigrant mothers is very large, with one quarter of births in the U.S. in 2008 taking place to women born outside of the 50 U.S. states or DC (Martin et al., 2008).

Landale, Oropesa, and Gorman (2000), using pooled origin/destination data from the Puerto Rican Maternal and Infant Health Study, found that maternal duration of residence in the mainland U.S. is positively associated with infant mortality, controlling for an extensive set of individual and family characteristics. As such, their results are consistent with the general findings in the literature. While the focus on Puerto Ricans migrants is very interesting and important, the perinatal health profiles of this group stand in stark contrast to those of other Hispanics. In particular, even among those who self-report as white, Puerto Rican mothers have rates of low birthweight and infant mortality that are much higher than those of non-Hispanic whites and most other Hispanic subgroups (Reichman & Kenney, 1997). Therefore, findings vis-à-vis Puerto Ricans cannot be generalized to immigrants, Hispanic immigrants, or other Hispanic subgroups. Particularly relevant for the present study, the authors imposed a linear functional form on the association between duration of residence and infant mortality in their analyses (i.e., they included a continuous variable for years in U.S. in their model); as such, potential non-monotonic relationships between duration and infant mortality, such as those found by Jasso et al. (2004) for duration and adult health, may be obscured.

Urquia et al. (2010) investigated the association between maternal duration of residence (in five-year increments) and both preterm birth and small-for-gestational age using natality data from metropolitan areas of Ontario, Canada. They controlled for socioeconomic characteristics and found that duration of residence was independently associated with increases in preterm birth, but not in small-for-gestational age. Recent immigrants were at lower risk of preterm birth compared to a mostly Canadian-born population, but immigrants became at higher risk after 10 years of stay in Canada.

Ceballos and Palloni (2010), in a study of two urban community samples of Mexican-origin mothers, found a curvilinear association between duration and adverse birth outcome (defined as the birth being less than 2500 grams *and* small for gestational age *and* less than

37 weeks gestation). Having spent 3 or fewer years or 13 or more years in the U.S. was associated with less favorable birth outcomes compared to having spent 4 to 12 years in the U.S. The authors were able to replicate the general finding using the National Survey of Family Growth (NSFG) Cycle V, for slightly different duration intervals (0–6 and 11+ years). While the study was based on clinic-based samples or retrospective reports of birth outcomes from the NSFG, used fairly crude duration intervals, and did not investigate duration effects specifically on birthweight, it is nevertheless informative and suggests that the association between duration in the U.S. and infant health is complex.

To date, no study has investigated associations between immigrant duration of residence in the U.S. and low birthweight using nationally representative data with fine-grained measures of duration of residence. The consideration of short duration intervals is critical given evidence that associations might not be monotonic. In this paper, we use three contemporary national datasets, two of which are nationally representative and the other of which is representative of births in large U.S. cities, to investigate associations between maternal duration of residence in the U.S. and their infants' birthweight. We investigate these associations for all immigrants as well as for Hispanic immigrants and when possible, Mexican immigrants. Disaggregating immigrant subgroups as much as possible is important, as there is evidence of heterogeneity in health behaviors within the U.S. immigrant population (e.g., Zsembik & Fennell, 2005).

We focus on the question of whether associations between duration and birthweight mirror those that have been found between duration and adult health. We also explore whether the associations between duration and birthweight are consistently negative as empirical research on acculturation has often assumed, or whether the relation is more complex, as is suggested by the findings of Jasso et al. (2004) for adult health in the U.S. Our goal is to describe patterns in birthweight by duration of residence rather than to uncover the mechanisms that explain those patterns. We assess the extent to which the observed patterns are consistent with the prevailing notion—adopted and vastly simplified from acculturation theory—that immigrants' health deteriorates with duration of residence in the U.S.

Data

Since U.S. natality files do not include measures of the length of time immigrant mothers have spent in the U.S., we used data from the Early Childhood Longitudinal Study-Kindergarten and Birth Cohorts (ECLS-K and ECLS-B, respectively) and the Fragile Families and Child Wellbeing birth cohort study (FF). The ECLS-K is a longitudinal cohort study based on a nationally representative sample of approximately 21,000 kindergarteners in 1998–1999. The ECLS-B is a longitudinal birth cohort study based on a nationally representative sample of approximately 10,000 children born in 2001 and followed until the end of first grade. All ECLS-K and ECLS-B sample sizes were rounded as required by the National Center for Education Statistics (NCES) to protect subject confidentiality. The FF study follows a representative cohort of 4,898 children born between 1998 and 2000 in U.S. cities with over 200,000 people. An advantage of using birth cohort studies and a cohort study of young children is that the problem of selective return migration on the basis of health and of differential mortality was minimized (because so little time elapsed between an individual becoming part of the population of interest and the sampling for the study). Because the two nationally representative studies, ECLS-B and ECLS-K, include only moderately sized samples of immigrants, we used each to validate the findings from the other. We also drew on the FF study – an urban sample of new parents and their children – because of its very well measured markers of prenatal health and health behaviors. Prenatal health behaviors are not available at all in ECLS-K, as the sample for that study was drawn from a kindergarten cohort and prenatal behaviors were not retrospectively assessed, and the

relevant measures in ECLS-B are not nearly as comprehensive as those in FF. The study was approved by the Institutional Review Boards of Columbia University and Robert Wood Johnson Medical School.

Measures

The questions about duration of residence in the U.S. are worded somewhat differently in the three data sets, but all are objective and allowed for the construction of a standardized measure of years of residence. In ECLS-B and ECLS-K, respondents were asked, “How old were you when you first moved to the U.S.?” In FF, they were asked, “In what year did you first come to the U.S. to live?” These questions were combined with information about the year of birth of the child to create a duration measure, which was then collapsed into 3 to 5 year intervals. We used 3 year intervals for relatively recent arrivers to identify whether the initial post-migration improvement in health that Jasso et al. (2004) uncovered for adults is also apparent for infants born to immigrant women. The datasets contain highly comparable, generally identical, sociodemographic information that was used to construct measures of maternal age, parity (number of live births), marital status, educational attainment, and income. We included these measures in regression analyses because they are associated with birth outcomes and may also be associated with duration. FF and ECLS-B measures are based on data that were collected around the time of the birth (at, just before, or during the child's first year of life). ECLS-K measures are based on data collected when the child was age 5 (and a measure of parity is not available in this dataset). For ECLS-K respondents, maternal age at the time of the child's birth was constructed by subtracting the child's age from the mother's age at the time of the interview. The ECLS-B income variable has 13 categories, whereas ECLS-K and FF data include continuous income variables. All income measures used in our analyses pertain to total household income over the past year, collapsed to seven categorical variables.

The FF study contains detailed information about health behaviors during pregnancy. In particular, respondents were asked in a postpartum survey about cigarette smoking, alcohol consumption, and illicit drug use during the index pregnancy, and additional information about these behaviors during the prenatal period was abstracted from their hospital medical records. Following Arendt et al. (1999) and Reichman et al. (2009), we considered that the mother engaged in a given behavior if she reported in the postpartum interview that she had engaged in that behavior during the pregnancy *or* if there was indication in her or her infant's medical record that she had engaged in that behavior (e.g., illicit drug use was coded as positive if there was documentation that the infant was born addicted to cocaine, even if the mother reported in the postpartum survey that she had never used illicit drugs during the pregnancy).

Measures of prenatal smoking and alcohol in ECLS-B are from respondents' birth certificate files, in which alcohol consumption is notoriously underreported (it has since been removed from the U.S. standard certificate of live birth for this reason) and drug use is not available at all. In addition, there are no postpartum self-reports of prenatal behaviors in ECLS-B with which to augment the birth certificate data since the first survey took place when the children were nine months old and only contemporaneous maternal behaviors were assessed at that time. For these reasons, we relied primarily on the FF data for analyses of prenatal behaviors.

We focused on birthweight (grams) and low birthweight (<2500 grams) as outcomes. Low birthweight is the second leading cause of infant mortality in the U.S. after birth defects, is associated with long-term health and developmental problems among infants who survive, and is extremely well-measured and reliably recorded (Reichman, 2005).

We removed observations for which nativity status could not be determined (49 observations in FF, <50 observations in ECLS-B, and approximately 6200 observations in ECLS-K), and then removed observations for which duration of residence in the U.S. at the time of the birth could not be determined (approximately 350 observations in ECLS-B and 300 observations in ECLS-K). After that, we removed births that occurred outside the U.S. or for which the country of birth could not be determined (approximately 300 observations in ECLS-K). The sample loss in ECLS-K was primarily due to attrition between the first and fourth waves of study, when the immigration questions were asked. Additional sample was lost due to missing values on covariates (13 observations in FF, <50 in ECLS-B, and approximately 350 observations in ECLS-K). We applied city-level weights to the FF sample, making it representative of births in the cities from which the observations were drawn. For both ECLS-B and ECLS-K, we applied child-level replicate weights, which adjusted for the sampling design, non-response, and sample attrition to make the data nationally representative.

We computed the proportions of low birthweight to all immigrants and to Hispanic immigrants by duration of residence in the U.S. (in 2–5 year bands, with finer distinctions in the early range to explore changes in outcomes immediately after arrival). Sample sizes limited our ability to consistently estimate duration effects for other immigrant subgroups, although we did estimate models for Mexican-only immigrants. Then we estimated Ordinary Least Squares (OLS) regression models (for birthweight) and logistic regression models (for low birthweight) to model the associations between maternal duration of residence in the U.S. and those outcomes, controlling for the sociodemographic factors listed above. We also examined associations between duration of residence in the U.S. and maternal prenatal health behaviors using the FF data.

Results

Consistent with national statistics, foreign-born mothers were much more likely than native-born mothers to be of Hispanic origin and they were less likely to be non-Hispanic black or non-Hispanic white (Table 1). They were also much more likely to have very limited education (less than high school). The immigrant birth outcome advantage is clear and substantial in the urban FF sample (3.6% low birthweight among immigrant mothers compared to 8.1% low birthweight among U.S. born mothers) but less apparent in ECLS-B and ECLS-K, in which children born to immigrant mothers had only slightly lower rates of low birthweight than native born mothers. The corresponding figures for low birthweight from 2001 U.S. natality data were 6.5% among immigrant mothers and 8.0% among U.S. born mothers (authors' own calculations).

All three datasets revealed two important compositional changes that have taken place among immigrant mothers over time: The proportion of immigrants who were of Hispanic origin increased sharply, and the average educational attainment of immigrants dropped precipitously. Specifically, there was more than a doubling of the proportion of immigrant mothers without a high school degree. These compositional differences are important to take into account when interpreting associations between duration in the U.S. and health outcomes.

Figures 1a and 1b through 3a and 3b display, in graphical form, the proportions of infants born low birthweight to immigrant mothers and to Hispanic immigrant mothers by maternal duration of residence in the U.S., using FF, ECLS-B, and ECLS-K, respectively. The corresponding data are presented in tabular form in Appendix Table 1. The observed duration associations were curvilinear and quite consistent across datasets. For both

immigrants overall and for Hispanic immigrants, rates of low birthweight appeared to improve over the first few years and then subsequently deteriorate.

Among all immigrants, the lowest rates of low birthweight occurred to those who were in the U.S. between 3 and 10 years (3–5 years for FF and ECLS-B and 6–10 for ECLS-K). There were no statistically significant differences across duration intervals in FF, the smallest of the three datasets. In ECLS-B, differences in low birthweight between the mothers in the 3–5 year interval and those in the 0–2, 11–15, 16–20, and 21+ intervals were statistically significant. In ECLS-K, the only statistically significant difference in low birthweight was between the 6–10 and 16–20 year intervals. Among Hispanic immigrants, a curvilinear pattern was also apparent, though smaller sample sizes attenuated statistical significance.

Each of the datasets revealed an anomalous group that deviated from the general curvilinear association between duration and birthweight and had a much higher rate of low birthweight than any other duration group. In FF and ECLS-B, the anomalous group was mothers who resided in the U.S. between 11 and 15 years (although not among Hispanics in FF). In ECLS-K, the anomalous group was mothers who had been in the U.S. between 16 and 20 years. These intervals corresponded to mothers who arrived in the U.S. between 1983 and 1990 (FF and ECLS-B) and between 1973 and 1977 (ECLS-K). The arrival cohort with the worst outcomes in both FF and ECLS-B corresponded to that with the best outcomes in ECLS-K. This remained the case even when sampling weights were not applied (results not shown), so this peculiarity was not an artifact of weights. The reasons for this inconsistency across the different datasets are not apparent. Given the small sample within any given duration period, we also caution against reading too much into pairwise comparisons across duration intervals. We point out discrepancies across datasets because we think they need to be acknowledged but we are much more confident in the general curvilinear pattern of infant health by duration, which was consistent across the three datasets.

While the sample of Mexican immigrants was too small for meaningful analysis in FF, it was marginally sufficient in both ECLS-B and ECLS-K (N = approximately 650 in each) for estimating duration effects. We found that for Mexican immigrants to the U.S., the relationship between duration of residence and low birthweight was identical to that for all Hispanics, including the anomalous groups (results not shown).

From OLS and logistic regression models for birthweight and low birthweight, respectively, we found that the favorable effects of living in the U.S. for a few years relative to having just arrived remained even after controlling for age, race, marital status, parity (not available in ECLS-K), education, and income (Tables 2–4; omitted duration categories were those with lowest rate of low birthweight—3–5 years for FF and ECLS-B and 6–10 years for ECLS-K). This pattern was apparent in all three datasets. The improvement in birth outcomes over the first few years was statistically significant in the large ECLS datasets but not in FF. Similar patterns existed for Hispanic and Mexican immigrants, although statistical significance was greatly reduced due to the smaller sample sizes (not shown).

Next, we investigated whether prenatal health behaviors were associated with duration of residence in the U.S., as would be predicted by acculturation theory. In other words, we looked for evidence that changes in prenatal behaviors with increased duration in the U.S. mirrored the observed patterns in birth outcomes with increased duration of residence. As noted above, the FF study includes rich measures of prenatal cigarette smoking, alcohol consumption, and illicit drug use. Table 5 shows FF estimates from analyses of substance use by duration in the U.S. What was perhaps most striking was the very low prevalence of substance use, including smoking, among immigrants at most duration intervals. Even

among immigrants in the U.S. for more than 15 years, rates of substance use were much lower than they were among native-born mothers.

We found no evidence that prenatal substance use increased with duration of residence in the U.S. This lack of association runs counter to acculturation theory. Moreover, to the extent that behaviors were associated with duration, as was the case for alcohol consumption during pregnancy, the pattern was opposite of that for duration and low birthweight. That is, alcohol consumption appeared to increase for a few years after arrival to the U.S. and decline thereafter. Alcohol consumption during pregnancy among mothers who resided in the U.S. for 3 to 5 years (the immigrant group with the *best* birthweight outcomes in FF) was almost 7 times as high as among recent and long-term immigrants (the groups with the worst birthweight outcomes). These results were robust to numerous alternative definitions of prenatal substance use. We also found that including the measures of prenatal substance use as control variables did not appreciably change the observed patterns between duration of residence and birthweight, using either FF (with its rich measures) or ECLS-B for which the only available and valid measure of prenatal substance use was smoking (results not shown).

All low birthweight infants are preterm, growth retarded, or both. We conducted supplementary analyses that investigated these more specific outcomes (not shown). Specifically, we investigated whether the observed patterns for birthweight and low birthweight also existed for gestational age (GA, in weeks), small-for-gestational age (SGA, $< 10^{th}$ percentile in sex-specific birthweight for gestational age), and preterm birth (< 37 weeks gestation). We used ECLS-B to conduct these analyses because gestational age is not available in ECLS-K or for the full FF sample (results not shown). We found that the curvilinear pattern was apparent for both SGA and preterm birth (but not for GA), with the most favorable duration interval again at 3–5 years. We caution against reading too much into these supplemental findings as gestational age is much less well-measured than birthweight, particularly for Hispanic women and women who are not proficient in English (Reichman & Schwartz-Soicher, 2007). These supplemental findings suggested that the observed duration effects on birthweight operated through both length of gestation and fetal growth, underscoring that acculturation is no doubt a multifaceted process.

Discussion

The primary aim of this study was to investigate the associations between immigrant mothers' duration of residence in the U.S. and their infants' birthweight using national population-based data. This question is a twist on the more typically-asked question of how duration of residence in the U.S. is associated with immigrants' own health trajectories and it has important implications for understanding immigrant health across generations.

We found, for both immigrants overall and Hispanic immigrants in particular and using smaller duration intervals than most other studies, that rates of low birthweight appeared to decline over the first few years in the U.S. and increase thereafter. This curvilinear association was robust across three national datasets and deviates somewhat from the common notion of a monotonic negative association between duration of U.S. residence and health. Although differences in birthweight and low birthweight across duration intervals were often not statistically significantly different from one another, the consistent pattern across three national probability samples and the fact that the same pattern has been found for adult health suggest that the curvilinear pattern should not be dismissed.

We did not find evidence that duration in the U.S. was associated with prenatal smoking, alcohol use, or illicit drug use, suggesting that the adoption of host country patterns in substance use are not important contributors to health declines among relatively young

immigrant women. We found that immigrant mothers—even those who arrived in the U.S. 15 or more years prior to giving birth—had very low rates of prenatal substance use, in both absolute terms and relative to the native-born.

As in virtually all previous studies of changes in immigrant health over time, our analyses were based on cross-sectional data. In other words, rather than observing changes in individuals' health over time, we inferred patterns from differences in outcomes across individuals with different durations of residence. The possibility that duration effects were confounded with cohort differences is real (see Jasso et al., 2004), and as we indicated earlier in this paper, there were marked compositional differences across immigrant cohorts among women giving birth in the U.S. Antecol and Bedard (2006) also found evidence that the health of successive immigrant cohorts has worsened, which might attenuate negative associations between duration and birth outcomes. In other words, observed effects of duration on birthweight might be suppressed by differential immigrant selectivity in health over time. That said, it is unlikely that the compositional shift explains the consistent U-shaped association between duration and birth outcomes that we observed.

We were not able to assess the extent to which differential return migration, a very salient issue in the literature on health differences between immigrant and native born adults at older ages, may account for the observed patterns of birthweight by duration of residence. Although this remains a possible explanation, we are not aware of any evidence that among immigrant women of reproductive age who are in poor health, recent arrivers disproportionately return to their country of origin while longer-term residents disproportionately choose to stay in the U.S. (though see Ceballos & Palloni, 2010 for a plausible counter argument).

Another source of potential selectivity is related to the “healthy immigrant effect” wherein immigrants tend to be particularly healthy compared to those from sending countries who do not migrate (Jasso et al., 2004; Landale, Oropesa, & Gorman, 2000; Palloni & Morenoff, 2001; Singh & Siahpush, 2001). The relevant issue for our analyses of duration effects involves the extent to which immigrants' health advantage reflects within-individual variation in health over time (as opposed to more favorable health endowments overall). If individuals choose to migrate when they are particularly healthy, declines in health with duration in the U.S. (as we observed with longer durations) could in part reflect regression to the mean. While this scenario is not consistent with the improvements in health at short durations we observed, we cannot rule out that this type of selectivity plays a role. It was not possible for us to directly explore this possibility without pre- and post-migration panel data on birth outcomes. A related limitation of our study is that although the three national studies sampled births without regard to immigration status, they may nevertheless underrepresent undocumented immigrant mothers, who have been shown to have higher rates of low birthweight than legal immigrant mothers (Kelaher & Jessop, 2002). As such, the findings pertain to mothers who would agree to participate in national surveys.

The broad implication of the apparent curvilinear pattern between duration and health, as found in this study and in Jasso et al. (2004), is that health consequences of acculturation may not always be negative. Most empirical studies of acculturation and health have found evidence of declines in immigrant health with duration of residence in the U.S., which is consistent with a scenario in which immigrants arrive protected by favorable health habits but slowly adopt the less healthful behaviors of their new neighbors and, once here, are exposed to health compromising social contexts that erode their health over time. However, this story does not explicitly address at what point, or after what duration of residence in the U.S., health and health behaviors begin to deteriorate and at what point harmful social contexts start to take their toll. The prevailing assumption seems to be that duration is

always negatively associated with health and that deterioration in health begins soon after arrival.

The observed non-monotonic association between immigrant women's duration of residence in the U.S. and their birth outcomes—characterized by initial, but short-lived, improvements followed by declines thereafter—is not inconsistent with acculturation theory in its general formulation. Rather, it underscores that the acculturation process is dynamic and complex and suggests that cultural differences and exposures in the host country may be experienced differently over time. For example, new immigrants may reap benefits from greater economic opportunities, improved prenatal nutrition through participation in government programs, or better health care in the U.S. They may be favorably predisposed to the new culture, often having explicitly chosen to migrate, and may use conditions in their country of origin as a frame of reference for their own well-being. Over time, immigrants may begin to change their behaviors (possibly adopting less healthful ones), alter their frames of reference (although, as noted earlier, Jasso et al. 2004 did not find evidence that reference frame changes are an important factor), or internalize discrimination in ways that exact a toll on their health. While this study laid a foundation by establishing some basic facts about the associations between maternal duration of residence in the U.S. and their infants' health, different approaches are needed to advance our understanding of the processes by which acculturation affects both the health of immigrants themselves and that of their children.

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Appendix

Table 1

Distributions of Birthweight and Low Birthweight by Duration of Residence in U.S. in FF, ECLS-B, and ECLS-K

FF	All Immigrants N = 813			Hispanic Immigrants N = 561		
Years in U.S.	**% Sample**	**Mean BW**	**% LBW**	**% Sample**	**Mean BW**	**% LBW**
0–2	20	3129	3.6	24	3050	2.1
3–5	18	3347	2.0	18	3455	1.9
6–10	26	3180	2.4	26	3167	0.6
11–15	16	3582	5.1	16	3584	1.4
16–20	10	3398	3.5	9	3429	0.0
21+	10	3323	3.8	7	3289	6.4
ECLS-B	**N = 2500**			**N = 1000**		
Years in U.S.	**% Sample**	**Mean BW**	**% LBW**	**% Sample**	**Mean BW**	**% LBW**
0–2	20	3210	6.2	22	3244	6.2
3–5	16	3345	5.2	15	3403	4.1
6–10	22	3293	5.4	23	3330	4.4
11–15	15	3170	10.0	17	3186	9.1
16–20	11	3288	5.9	10	3340	5.5
21+	15	3183	10.3	13	3177	13.3

ECLS-K		N = 1850			N = 940	
Years in U.S.	% Sample	Mean BW	% LBW	% Sample	Mean BW	% LBW
0–2	20	3301	9.5	23	3360	6.3
3–5	19	3355	5.9	22	3389	4.9
6–10	20	3398	3.3	19	3440	2.8
11–15	16	3339	6.3	15	3331	8.1
16–20	10	3254	13.6	9	3242	14.4
21+	14	3414	6.2	11	3344	4.7

Notes: Based on weighted data. ECLS-K and ECLS-B sample sizes are rounded as required by NCES to protect subject confidentiality;

FF = Fragile Families and Child Wellbeing Study. BW = Birthweight in grams. LBW = Low birthweight.

Bibliography

Antecol H, Bedard K. Unhealthy assimilation: why do immigrants converge to American health status levels? Demography. 2006; 43:337–360. [PubMed: 16889132]

Arendt RE, Singer LT, Minnes S, Salvator A. Accuracy in detecting prenatal drug exposure. Journal of Drug Issues. 1999; 29:203–214.

Berry, JW. Conceptual approaches to acculturation. In: Chun, KM.; Organista, PB.; Marin, G., editors. Acculturation: advances in theory, measurement and applied research. American Psychological Association; Washington, DC: 2003. p. 17-37.

Ceballos M, Palloni A. Maternal and infant health of Mexican immigrants in the USA: the effects of acculturation, duration, and selective return migration. Ethnicity and Health. 2010; 15:377–396. [PubMed: 20509058]

Chiswick BR, Lee YL, Miller PW. Immigrant selection systems and immigrant health. Contemporary Economic Policy. 2006; 26:555–578.

Cho Y, Hummer R. Disability status differentials across fifteen Asian and Pacific Islander groups and the effect of nativity/duration. Social Biology. 2001; 48:171–195. [PubMed: 12516223]

Cho Y, Frisbie WP, Hummer RA, Rogers RG. Nativity, duration of residence, and the health of Hispanic adults in the United States. International Migration Review. 2004; 38:184–211.

David RJ, Collins JW. Differing birth weight among infants of U.S.-born blacks, African-born blacks, and U.S.-born whites. New England Journal of Medicine. 1997; 337:1209–1214. [PubMed: 9337381]

Dey AN, Lucas JW. Physical and mental health characteristics of US- and foreign-born adults, United States, 1998-2003. Advance Data from Vital and Health Statistics. 2006; 369:1–20. [PubMed: 16541709]

Goel MS, McCarthy MP, Phillips RS, Wee CC. Obesity among U.S. immigrant subgroups by duration of residence. Journal of the American Medical Association. 2004; 292:2860–2867. [PubMed: 15598917]

Jasso, G.; Massey, D.; Rosenzweig, M.; Smith, J. Immigrant health: selectivity and acculturation. In: Anderson, N.; Bulatao, R.; Cohen, B., editors. Critical perspectives on racial and ethnic differences in health in late life. The National Academy of Sciences; Washington, D.C.: 2004. p. 227-266.

Julian, R.; Easthope, G. Migrant health. In: Grbich, C., editor. Health in Australia. Prentice Hall; Sydney: 1996. p. 103-125.

Kaestner R, Pearson JA, Keene D, Geronimus AT. Stress, allostatic load, and health of Mexican immigrants. Social Science Quarterly. 2009; 90:1089–1111. [PubMed: 21165158]

Kelaher M, Jessop DJ. Differences in low-birthweight among documented and undocumented foreign-born and US-born Latinas. Social Science & Medicine. 2002; 55:2171–2175. [PubMed: 12409130]

Landale, NS.; Oropesa, RS.; Gorman, BK. Immigration and infant health: birth outcomes of immigrant and native-born women. In: Hernandez, DJ., editor. Children of immigrants: health, adjustment and public assistance. National Academy Press; Washington, DC: 1999. p. 244-285.

Landale NS, Oropesa RS, Llanes D, Gorman BK. Does Americanization have adverse effects on health? stress, health habits, and infant health outcomes among Puerto Ricans. Social Forces. 1999; 78:613–641.

Landale NS, Oropesa RS, Gorman BK. Migration and infant death: assimilation or selective migration among Puerto Ricans? American Sociological Review. 2000; 65:888–909.

Lara M, Gamboa C, Kahramanian MI, Morales LS, Bautista DEH. Acculturation and Latino health in the United States: a review of the literature and its sociopolitical context. Annual Review of Public Health. 2005; 26:367–397.

Markides KS, Coreil J. The health of Hispanics in the southwestern United States: an epidemiologic paradox. Public Health Reports. 1986; 101:253–265. [PubMed: 3086917]

Martin JS, Hamilton BE, Sutton PD, Ventura SJ, Mathews TJ, Osterman MJK. Births: final data for 2008. National Vital Statistics Reports. 2010; 59(1) Available at: http://www.cdc.gov/nchs/data/nvsr/nvsr59/nvsr59_01.pdf [Accessed March 5, 2011].

McDonald TM, Kennedy S. Insights into the `healthy immigrant effect': health status and health service use of immigrants to Canada. Social Science & Medicine. 2004; 59:1613–1627. [PubMed: 15279920]

Nazroo J, Karlsen S. Ethnic inequalities in health: social class, racism, and identity. Research Findings of the Economic & Social Research Council. Sep.2001 10 2001.

Newbold KB. Self-rated health within the Canadian immigrant population: risk and the healthy immigrant effect. Social Science & Medicine. 2005; 60:1359–1370. [PubMed: 15626530]

Palloni A, Morenoff J. Interpreting the paradoxical in the Hispanic paradox. Annals of the New York Academy of Sciences. 2001; 954:140–174. [PubMed: 11797855]

Portes, A.; Rumbaut, RG. Legacies: the story of the immigrant second generation. University of California Press; Berkeley: 2001.

Reichman NE. Low birth weight and school readiness. The Future of Children. 2005; 15:91–116. [PubMed: 16130543]

Reichman NE, Corman H, Noonan K, Dave D. Infant health production functions: what a difference the data make. Health Economics. 2009; 18:761–782. [PubMed: 18792077]

Reichman, NE.; Kenney, G. The effects of parents' place of birth and ethnicity on birth outcomes in New Jersey. In: Espenshade, Thomas J., editor. Keys to successful immigration: implications of the New Jersey experience. The Urban Institute Press; Washington DC: 1997. p. 199-230.

Reichman NE, Schwartz-Soicher O. Accuracy of birth certificate data by risk factors and outcomes: analysis of data from New Jersey. American Journal of Obstetrics and Gynecology. 2007; 197(1): 32.e1–8. http://www.ncbi.nlm.nih.gov/pubmed/17618747. [PubMed: 17618747]

Reijneveld SA, Schene AH. Higher prevalence of mental disorders in socioeconomically deprived areas of the Netherlands: community or personal disadvantage? Journal of Epidemiology and Community Health. 1998; 52:2–7. [PubMed: 9604034]

Singh GK, Siahpush M. All-cause and cause-specific mortality of immigrants and native born in the United States. American Journal of Public Health. 2001; 91:392–399. [PubMed: 11236403]

Singh GK, Siahpush M. Ethnic-immigrant differentials in health behaviors, morbidity, and cause-specific mortality in the United States: an analysis of two national data bases. Human Biology. 2002; 74:83–109. [PubMed: 11931581]

Singh GK, Yu SM. Adverse pregnancy outcomes: differences between US- and foreign-born women in major US racial and ethnic groups. American Journal of Public Health. 1996; 86:837–843. [PubMed: 8659659]

Uretsky M, Mathiesen S. The effects of years lived in the United States on the general health status of California's foreign-born populations. Journal of Immigrant and Minority Health. 2007; 9:125–136. [PubMed: 17111215]

Urquia ML, Frank JW, Moineddin R, Glazier RH. Immigrants' duration of residence and adverse birth outcomes: a population-based study. British Journal of Obstetrics and Gynecology. 2010; 117:591–601.

Zsembik B, Fennell D. Ethnic variation in health and the determinants of health among Latinos. Social Science and Medicine. 2005; 61:53–63. [PubMed: 15847961]

- We find that associations between duration of residence in the U.S. and birthweight of immigrants' children are not monotonically negative as theories suggest.
- There appears to be an initial improvement in birthweight during the first few years that immigrants spend in the U.S., followed by a later decline.
- The findings are consistent across 3 national studies, for all immigrants and for Hispanic immigrants, and for birthweight and low birthweight.
- There does not appear to be a convergence over time in the prenatal health behaviors (smoking, drinking, drug use) of immigrant and native born mothers.

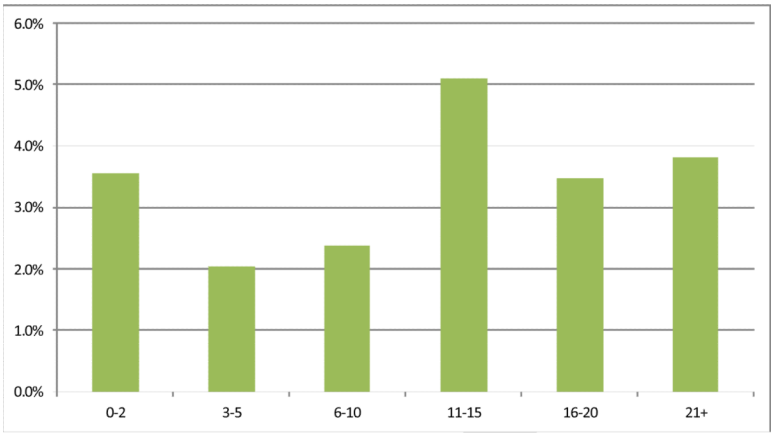

Figure 1a.
Percent Low Birthweight by Duration Of Residence in the U.S. – Fragile Familes

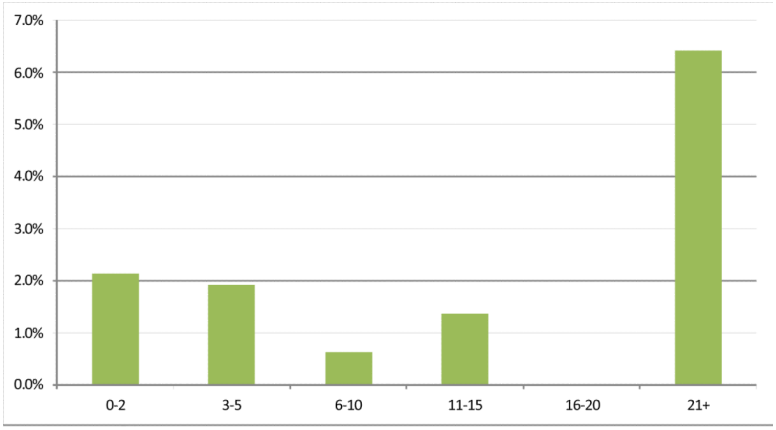

Figure 1b.
Percent Low Birthweight by Duration Of Residence in the U.S. – Fragile Familes, Hispanics Only
Note: Based on weighted data.

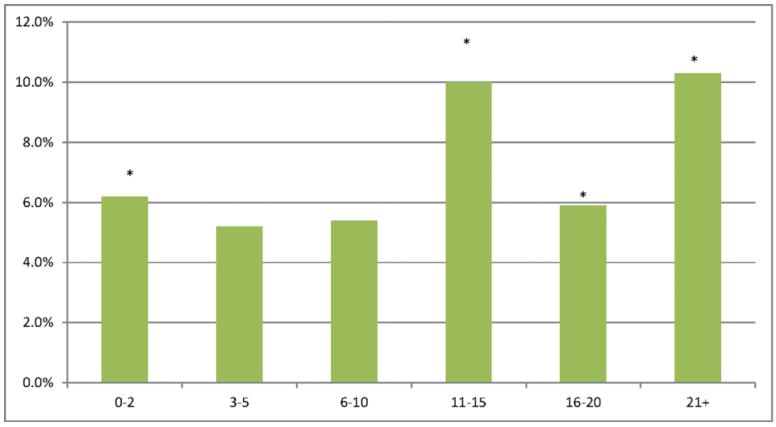

Figure 2a.
Percent Low Birthweight by Duration Of Residence in the U.S. – ECLS-B

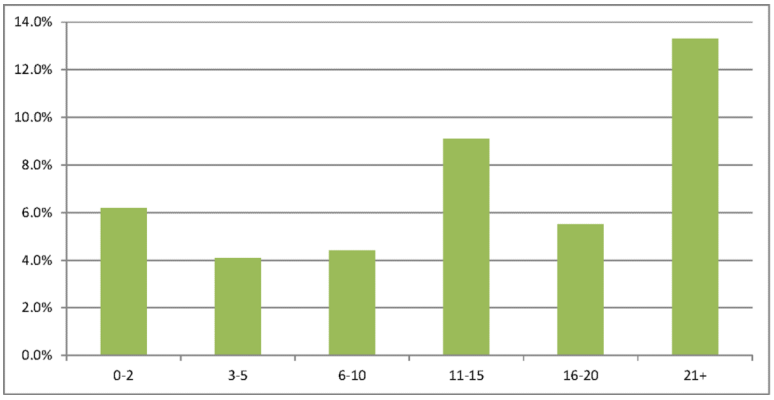

Figure 2b.
Percent Low Birthweight by Duration Of Residence in the U.S. – ECLS-B, Hispanics Only
Notes: Based on weighted data. Asterisks indicate that a given proportion is significantly different from the lowest proportion of low birthweight.

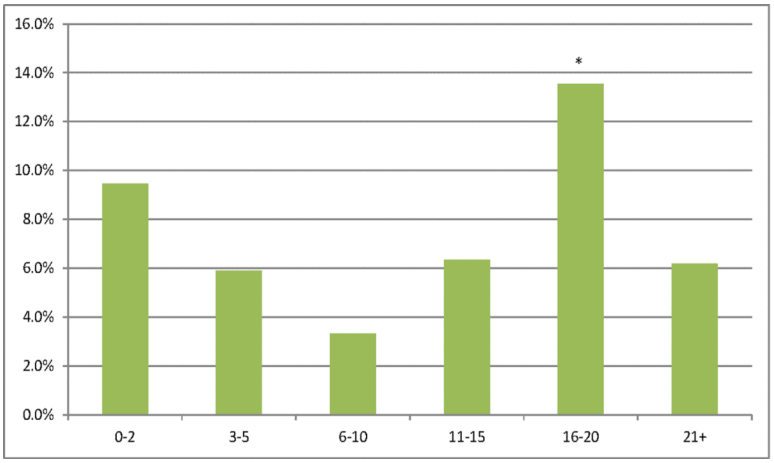

Figure 3a.
Percent Low Birthweight by Duration Of Residence in the U.S. – ECLS-K

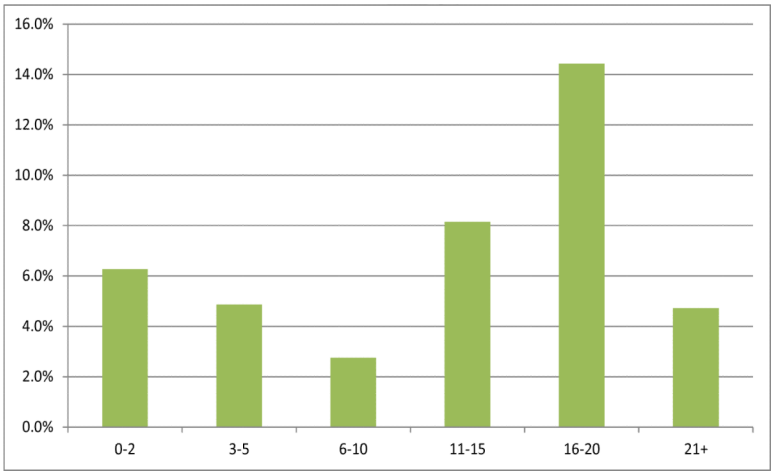

Figure 3b.

Percent Low Birthweight by Duration Of Residence in the U.S. – ECLS-K, Hispanics Only
Notes: Based on weighted data. Asterisk indicates that proportion is significantly different from the lowest proportion of low birthweight.

Table 1

Characteristics of FF, ECLS-B, and ECLS-K Analysis Samples

			Years in U.S. (foreign-born only)					
	Native Born	**Foreign Born**	**0–2**	**3–5**	**6–10**	**11–15**	**16–20**	**21+**
Fragile Families (N)	4051	847	168	149	224	135	83	88
Age (%)								
<20	16	6	11	6	6	5	7	0
35+	13	15	6	16	16	7	8	36
Non-Hispanic white (%)	37	10	6	21	13	5	1	9
Non-Hispanic black (%)	42	17	8	17	12	30	16	14
Hispanic (%)	19	54	73	55	57	46	56	36
Other race/ethnicity (%)	2	19	13	8	16	19	26	40
< High school (%)	30	47	51	51	53	49	42	24
High school (%)	29	19	25	14	15	28	8	16
Some college (%)	22	13	12	9	9	13	34	14
College graduate (%)	19	21	13	25	23	9	16	46
Birthweight (grams)	3414	3205	3404	3365	3353	3582	3398	3323
Low birthweight (<2500 g) (%)	8.1	3.6	3.6	2.0	2.4	5.1	3.5	3.8
ECLS-B (N)	8200	2500	500	400	550	350	250	400
Age (%)								
<20	8	6	8	7	6	7	7	0
35+	17	18	10	12	20	23	27	25
Non-Hispanic white (%)	70	12	13	9	8	12	10	21
Non-Hispanic black (%)	16	7	6	7	6	6	10	9
Hispanic (%)	10	65	65	67	69	68	64	50
Other race/ethnicity (%)	4	14	12	15	14	13	18	17
< High school (%)	16	41	49	47	46	40	32	18
High school (%)	33	25	22	27	28	26	23	25
Some college (%)	23	14	12	9	9	15	22	26
College graduate (%)	27	17	14	14	15	16	21	28
Birthweight (grams)	3292	3249	3210	3345	3293	3170	3288	3183

			Years in U.S. (foreign-born only)					
	Native Born	**Foreign Born**	**0–2**	**3–5**	**6–10**	**11–15**	**16–20**	**21+**
Low birthweight (<2500 g) (%)	7.6	6.9	6.2	5.2	5.4	10	5.9	10.3
ECLS-K (N)	12230	1850	370	360	380	300	180	260
Age (years)								
<20	11	10	14	7	5	9	7	0
35+	13	13	6	7	12	13	21	28
Non-Hispanic white (%)	74	16	11	11	11	9	21	39
Non-Hispanic black (%)	15	6	6	5	6	4	9	6
Hispanic (%)	8	62	68	67	62	62	53	47
Other race/ethnicity (%)	3	17	15	17	22	22	16	8
< High School (%)	9	34	43	41	35	40	26	11
High School (%)	31	25	27	23	27	26	27	21
Some college (%)	34	21	16	14	20	17	31	41
College graduate (%)	25	19	14	22	18	17	15	27
Birthweight (grams)	3357	3317	3300	3355	3398	3339	3254	3414
Low birthweight (<2500 g) (%)	7.6	7.3	9.5	5.9	3.3	6.3	13.6	6.2

Notes: All figures are weighted. FF = Fragile Families and Child Wellbeing Study. ECLS-B = Early Childhood Longitudinal Study-Birth Cohort. ECLS-K = Early Childhood Longitudinal Study-Kindergarten Class of 1998–99 ECLS-K and ECLS-B sample sizes are rounded as required by the National Center for Education Statistics (NCES) to protect subject confidentiality.

Table 2

Multivariate Associations Between Duration of Residence in U.S. and Birthweight, Fragile Families and Child Wellbeing Study

	All Immigrants (N = 813)		Hispanic Immigrants (N = 561)	
	Birthweight (OLS coeff.)	Low Birthweight (Odds ratio)	Birthweight (OLS coeff.)	Low Birthweight (Odds ratio)
Years in U.S.				
0–2	−247.67	1.78	−282.31	1.01
6–10	−204.74	1.37	−176.09	0.15**
11–15	13.17	4.25	133.32	0.79
16–20	−68.95	1.48	−145.01	(omitted)
21+	−82.36	4.55	42.61	7.07
Age (years)				
< 20	−478.25*	21.42***	−272.84	0.16
35+	−256.49	1.65	−663.48	0.03**
Race/ethnicity				
Non-Hispanic black	123.55	0.57	NA	NA
Hispanic	25.07	0.25	NA	NA
Other	201.79	1.07	NA	NA
Married	148.69	0.03***	50.85	0.00***
Parity	87.70**	1.19	32.88	1.51**
Education				
< High school	323.59*	0.03***	282.00	0.01***
High school	189.72	0.08***	−132.52	0.03***
Some college but not graduate	109.99	0.04***	126.00	0.03***
Annual household income ($)				
0–10,000	−398.59*	8.30	−642.55**	0.47
10,001–20,000	−152.54	1.11	−323.59	0.06
20,001–30,000	−19.22	5.84	−154.19	0.10
30,001–40,000	201.05	0.37	238.92	0.04
40,001–50,000	153.05	11.31	173.84	0.33
50,001–75,000	−335.05**	2.58	−293.00	2.76
Constant	3174.87	NA	3555.58	NA

Notes: Based on weighted data.

* p<0.1,

** p<0.05,

*** p<0.01

Table 3

Multivariate Associations Between Duration of Residence in U.S. and Birthweight, ECLS-B

	All Immigrants (N = 2500)		Hispanic Immigrants (N = 1000)	
	Birthweight (OLS coeff.)	Low Birthweight (Odds ratio)	Birthweight (OLS coeff.)	Low Birthweight (Odds ratio)
Years in U.S.				
0–2	−80.09*	1.28	−85.77	1.55
6–10	56.64	1.03	76.96	0.94
11–15	−133.16**	2.10***	−146.66*	2.27***
16–20	−5.93	1.08	15.90	1.16
21+	−99.34	1.97***	−141.02	2.93***
Age (years)				
< 20	−5.13	0.95	−12.49	1.14
35+	−13.31	1.47**	−35.18	1.53
Race/ethnicity				
Non-Hispanic black	−16.47	1.98**	NA	NA
Hispanic	57.59	1.52*	NA	NA
Other	−89.19**	1.67**	NA	NA
Married	22.03	0.80	18.35	0.77
Education				
< High school	107.46**	040***	124.42*	0.37***
High school	22.36	0.78	54.02	0.76
Some college but not graduate	107.46**	0..52***	134.07*	0.38**
Annual household income ($)				
0–10,000	−124.87*	1.77	−69.42	1.19
10,001–20,000	−67.37	1.17	−4.81	0.84
20,001–30,000	−39.77	1.14	3.83	0.84
30,001–40,000	−24.55	0.86	40.27	0.50
40,001–50,000	−42.91	1.37	5.31	1.15
50,001–75,000	62.32	0.65	106.12	0.36
Constant	3358.48	NA	3224.14	NA

Notes: Based on weighted data. Sample sizes rounded as required by NCES to protect subject confidentiality.

* p<0.1,

** p<0.05,

*** p<0.01

Table 4

Multivariate Associations Between Duration of Residence in U.S. and Birthweight, ECLS-K

	All Immigrants (N = 1850)		Hispanic Immigrants (N = 940)	
	Birthweight (OLS coeff.)	Low Birthweight (Odds ratio)	Birthweight (OLS coeff.)	Low Birthweight (Odds ratio)
Years in U.S.				
0–2	−108.24**	3.43***	−80.64	3.32*
6–10	−62.34	2.23*	−52.94	2.36
11–15	−59.71	2.12*	−99.33	4.07**
16–20	−166.84**	5.30***	−218.80**	8.49***
21+	−50.66	2.82**	−76.06	2.08
Age (years)				
< 20	−215.28***	1.14	−194.01***	0.70
35+	78.13	0.99	45.19	1.05
Race/ethnicity				
Non-Hispanic black	−253.74***	1.28	NA	NA
Hispanic	−119.52**	0.99	NA	NA
Other	−258.13***	2.41**	NA	NA
Married	91.37**	0.60**	74.94*	0.52**
Parity	NA	NA	NA	NA
Education				
< High school	111.07*	1.31	158.40*	0.77
High school	14.04	1.17	41.75	0.74
Some college but not graduate	36.94	1.22	105.90	0.44
Annual household income ($)				
0–10,000	15.28	1.06	100.37	0.36
10,001–20,000	4.41	1.43	78.20	0.63
20,001–30,000	−85.20	2.41**	−17.56	1.34
30,001–40,000	−32.18	2.22*	102.38	1.14
40,001–50,000	−136.59	3.13**	−134.88	2.57
50,001–75,000	−56.22	1.63	−37.26	1.18
Constant	3451.97	NA	3257.04	NA

Notes: Based on weighted data. Sample sizes rounded as required by NCES to protect subject confidentiality.

* p<0.1,

** p<0.05,

*** p<0.01

Table 5

Age-Adjusted Rates of Maternal Prenatal Substance Use by Duration of Residence in the U.S., Fragile Families and Child Wellbeing Study

	Foreign Born				Native Born*			
Duration	**Smoking**	**Drinking**	**Drug use**	**N**	**Smoking**	**Drinking**	**Drug use**	**N**
0–2 years	0.8	2.3	0.1	168	20.1	13.7	6.9	4051
3–5	5.5	17.4	7.3	149	19.8	14.6	6.9	4051
6–10	2.3	15.9	0.0	224	19.3	15.7	7.0	4051
11–15	0.6	8.6	0.5	135	18.9	16.5	7.0	4051
16–20	6.9	3.0	1.2	83	20.0	14.1	6.9	4051
21+	2.4	3.2	0.2	88	17.5	19.7	7.1	4051

*Native born figures are adjusted to the mean age of immigrants within each duration interval.