The Educational Gradient in Health among Children in Immigrant Families

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Educational inequality in the health of U.S. children—what social scientists refer to as the "educational gradient" in health—is present at birth for virtually every marker of health, and increases throughout childhood. However, a puzzling contradiction to this pattern has been observed among the growing population of youth in immigrant families. Some evidence suggests an ambiguous relationship between education and health among immigrant families, with a flat relationship between maternal education and maternal health behaviors and children's birth outcomes, and a stronger relationship as children become adolescents. Does an educational gradient in health emerge among children in immigrant families during childhood and adolescence? To date, we lack a prospective examination of how the gradient changes from birth throughout childhood and adolescence among this population. Moreover, while the dominant explanation for a weaker gradient among children with immigrant parents centers on the family setting, we know little about family-level dynamics among the same immigrant families as children age. Using national, longitudinal data from the Fragile Families and Child Well-Being Study, we examine the association between maternal education and children's health (measured by mothers' ratings) over the early life course (birth through age 15) among children of immigrants and children of native-born parents, and consider whether changes in children's economic status and family composition contribute to the educational gradient, or lack thereof, in child health. Analyses reveal that: (1) maternal education is strongly predictive of health, even among children of immigrants; (2) immigrant status does not appear to be protective for health within educational groups, as evidenced by poorer health among children of immigrants whose mothers have the lowest level of education, as compared to children of natives; (3) children in the least-educated immigrant families are experiencing better health trajectories as they age than children in similar native-born families; and (4) accounting for economic conditions and family composition does not reduce the size of the gradient over time.

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Abstract:

Educational inequality in the health of U.S. children—what social scientists refer to as the "educational gradient" in health—is present at birth for virtually every marker of health, and increases throughout childhood. However, a puzzling contradiction to this pattern has been observed among the growing population of youth in immigrant families. Some evidence suggests an ambiguous relationship between education and health among immigrant families, with a flat relationship between maternal education and maternal health behaviors and children's birth outcomes, and a stronger relationship as children become adolescents. Does an educational gradient in health emerge among children in immigrant families during childhood and adolescence? To date, we lack a prospective examination of how the gradient changes from birth throughout childhood and adolescence among this population. Moreover, while the dominant explanation for a weaker gradient among children with immigrant parents centers on the family setting, we know little about family-level dynamics among the same immigrant families as children age. Using national, longitudinal data from the Fragile Families and Child Well-Being Study, we examine the association between maternal education and children's health (measured by mothers' ratings) over the early life course (birth through age 15) among children of immigrants and children of native-born parents, and consider whether changes in children's economic status and family composition contribute to the educational gradient, or lack thereof, in child health. Analyses reveal that: (1) maternal education is strongly predictive of health, even among children of immigrants; (2) immigrant status does not appear to be protective for health within educational groups, as evidenced by poorer health among children of immigrants whose mothers have the lowest level of education, as compared to children of natives; (3) children in the least-educated immigrant families are experiencing better health trajectories as they age than children in similar native-born families; and (4) accounting for economic conditions and family composition does not reduce the size of the gradient over time.

The Educational Gradient in Health among Children in Immigrant Families

Introduction

Socioeconomic disparities in the health of U.S. children—what social scientists refer to as the "SES gradient" in health—are present at birth for virtually every marker of health, and increase throughout childhood (Adler et al. 1994; Currie and Stabile 2003; Finch 2003). Pronounced inequalities in health so early in life have important effects throughout the life course, given the strong effects of child health not only on health later in life, but also on educational achievement and attainment (Conley and Bennett 2000; Jackson 2009), earnings and labor force participation (Currie and Stabile 2006; Palloni 2006). However, a puzzling contradiction to this pattern has been observed among the growing population of youth in immigrant families—those who are foreign-born or have a foreign-born parent—who make up roughly 25% of United States children and adolescents ages 18 and below (Migration Policy Institute 2016). Some evidence suggests an ambiguous relationship between socioeconomic status and health among immigrant families, with a flat relationship between maternal education and maternal health behaviors, children's birth outcomes and overweight/obesity around the time of school entry (Balistreri and Van Hook 2009; Goldman et al. 2006; Jackson, Kiernan and McLanahan 2012), and an emerging gradient among adolescents in immigrant families (Jackson 2011). A simultaneous literature documents an "epidemiological paradox" of favorable health among immigrants and their babies, despite a greater likelihood of socioeconomic disadvantage than the native-born population (Abraido-Lanza et al. 1999; Markides and Coreil 1986).

Evidence—though equivocal—of weaker educational gradients among young children in immigrant families, combined with evidence of a stronger relationship as children become adolescents, suggests that an educational gradient in health may emerge during childhood or adolescence among children with immigrant parents. To date, however, we lack a prospective, life

course examination of how the influence of SES on health—that is, the size of the gradient—

changes from birth into adolescence among children in immigrant families. Moreover, while the

dominant explanation for a weaker gradient among children of immigrants centers on the family

setting, we know little about whether changing family-level dynamics as children age—especially

economic conditions and family composition that vary by nativity—contribute to health inequality

between children in immigrant and native-born families. Using national, longitudinal data from the

Fragile Families and Child Well-Being Study, we examine the association between maternal

education and children's health over the early life course among children of immigrants and children

of native-born parents, and consider whether trajectories of children's economic status and living

arrangements contribute to the educational gradient in child health.

Background

The Educational Gradient in Child Health

There is a well-established socioeconomic gradient in health among U.S. adults, whereby

higher levels of education and income strongly predict better health, whether health is measured

with respect to chronic conditions, disability, or acute illness (Lynch 2003; Marmot et al. 1991; Smith

2007; Winkleby et al. 1992). Maternal education is particularly strongly associated with children's

development, providing parents and children with access to services and networks that facilitate

social mobility (Harding, Morris, and Hughes 2015; Kalil, Ryan and Corey 2012; Petersen et al. 2000)

and acting as a strong predictor of two of the most important family resources for children's

development: economic resources and family structure (McLanahan 2004). While research on the

educational gradient in health has disproportionately focused on adults, there are also strong

gradients among children. Children in highly educated and higher-income families have lower levels

of infant mortality and better parent-rated health than their peers, as well as substantially fewer

chronic physical conditions (e.g., asthma and diabetes) (Case, Lubotsky and Paxson 2002; Finch 2003). This relationship holds for all racial and ethnic groups among native-born children, though disparities are weaker among Hispanics and Asians (Kimbro et al. 2008).[1]

Though there is less evidence on how the influence of education on child health extends beyond birth and varies across developmental stages, existing evidence falls roughly into two categories—evidence for a stronger influence of education (and socioeconomic status more broadly) in the "sensitive period" of early childhood, and evidence for a risk accumulation model in which the influence of education is not visible until later ages. In support of the sensitive period hypothesis, living in a poor family during early childhood is more strongly related to academic achievement than exposure to poverty in middle childhood (Duncan et al. 1998; Duncan, Ziol-Guest and Kalil 2010). In addition, some evidence suggests that socioeconomic differences in health are less pronounced in later childhood than in earlier childhood, perhaps due to the offsetting influence of settings beyond the family (West 1997; West and Sweeting 2004; Chen et al. 2002). This evidence would predict either parallel or converging health trajectories between educational groups as children age, as depicted in Figures 1A and 1B. However, there is also evidence that the influence of SES on the health of the total population of U.S. children increases with age (Case, Lubotsky and Paxson 2002; Chen et al. 2006), an increase driven by the occurrence of more health problems among lower-SES children, rather than by their differential response to a health problem (Currie and Stabile 2003). In this scenario, educational differences in health would diverge with age, as shown in Figure 1C.

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[1] It is also important to point out that, though race is highly correlated with socioeconomic resources, abundant evidence documents an independent association between race and health. At all levels of socioeconomic status, black children are more likely than both their white and nonwhite peers to be born with a low birth weight, to have asthma and other chronic physical health conditions, and to be overweight or obese (Currie 2005; Lu and Halfon 2003; McDaniel, Paxson and Waldfogel 2006).

The Complicating Role of Immigrant Status

Challenging evidence that parental education and health go hand in hand is the weaker relationship between education and health among immigrant adults than among native-born adults (Goldman et al. 2006; Kimbro et al. 2008) and among the Hispanic population as a whole, net of nativity (Balistreri and Van Hook 2009). Weaker educational gradients in birth outcomes are also observed among babies born to immigrant vs. native-born mothers (Jackson, Kiernan and McLanahan 2012). A separate, though related, literature documents what is sometimes referred to as an "immigrant paradox:" despite a sometimes higher likelihood of low SES, immigrant mothers have healthier behaviors and there is also evidence of better health among these women and their babies, as compared to non-Hispanic white mothers (Jasso et al. 2004; Landale, Oropesa and Gorman 1999).

The existing literature suggests two possible patterns among immigrant families as their children age. First, the educational gradient in health may be weaker, and remain so with age, among children in immigrant families. One driver of weaker social gradients in health among children in immigrant families could be mothers' health behaviors. Foreign-born Hispanic mothers, for example, are more likely than native-born mothers to avoid smoking, to breastfeed and to fully immunize their children (Anderson et al. 1997; Kimbro et al. 2008). In some cases, the healthiest behaviors and outcomes are observed among the most socioeconomically disadvantaged immigrant families (Balistreri and Van Hook 2009; Jackson, Kiernan and McLanahan 2012), consistent with the idea of a "paradox" of favorable health outcomes among socioeconomically disadvantaged immigrants compared to their native-born peers (Hummer et al. 1999; Markides and Coreil 1986; but see Padilla et al. 2002). Healthier behaviors among socioeconomically disadvantaged immigrant mothers, as well as other factors such as selective migration, could produce a weaker gradient with age among children of immigrants. Figures 2A and 2B depict this possibility, whereby there are

smaller educational differences in health among children in immigrant families than among those in native-born families, and those differences either remain stable or decrease with age. In this scenario, research on the immigrant paradox would predict that the educational gradient in health is weaker among children of immigrants because of healthier patterns among lower-educated immigrant mothers. Immigrant status is not a proxy for maternal education, but a weaker educational gradient may be driven by lower-educated families.

Second, it is possible that the educational gradient is initially weaker among children in immigrant families, but increases as children age. Figure 2C depicts this possibility, whereby educational differences in health increase/diverge. Existing cross-sectional evidence suggests that while immigrant mothers and children should exhibit healthier outcomes than their peers from later generations (Gordon-Larsen, Adair and Popkin 2003; Popkin and Udry 1998), this advantage should decline with time, producing convergence between children of immigrants and natives as educational differences in behaviors and circumstances emerge *within* immigrant families (e.g, Akresh 2007; Antecol and Bedard 2006; Franzini et al. 2001; Marmot and Syme 1976). In this scenario, the pace of health decline is expected to be faster among immigrants and their children than among native-born mothers and their children, which may produce educational divergence among children of immigrants. This pattern may be driven by a process of "unhealthy acculturation," whereby immigrants—perhaps especially lower-educated immigrants—may adopt behaviors that more closely resemble those of their similarly educated native-born peers (Antecol and Bedard 2006). Changing access to healthy foods, as well as changes in family and peer networks in households, communities and the workplace may lead to changes in health behaviors and overall well-being (Akresh 2007; Franzini et al. 2001). In order to distinguish acculturative changes specific to immigrant families from developmental changes that occur among all children with age, it is important to examine age patterns among both children of immigrants and natives (Fuligni 2001).

In addition, this scenario may also lead to converging health *across* nativity groups—that is, the health of children of less-educated immigrant mothers may converge with the health of children of less-educated U.S.-born mothers. Some evidence documents an educational gradient in health-related outcomes among adolescents and adults in immigrant families, whereby these adolescents with college-educated mothers have a lower BMI than those with the most poorly-educated parents, as well as a significantly slower pace of weight gain during the transition to adulthood (Jackson 2011). A lack of an educational gradient among infants in immigrant families, combined with the presence of a gradient by the time they become adolescents, would be consistent with the possibility that the educational gradient in health among children in immigrant families emerges during childhood or adolescence.

The Role of Changing Economic Conditions and Family Composition

The dominant explanation put forth for the possibility of declining health and increasing inequality as children in immigrant families age emphasizes changing social relationships, particularly deteriorating kin and non-kin environments due to processes of acculturation that lead immigrants' circumstances to more closely resemble those of their native-born peers (e.g., Finch, Frank and Vega 2004). Most existing research relies on markers such as English language ability or years in the U.S. to proxy for acculturation (see Lara et al. 2005). Despite substantial variation in the economic conditions and family composition of immigrant and native-born families, little is known about how these differences, as well as changes in these circumstances as children age, may explain an educational gradient in health among children of immigrants. The connection between education and health may remain stable over time among children of immigrants if increasing economic resources enable the maintenance of better health. Alternatively, the educational gradient in child health may become more pronounced as children age if educational differences in family structure

and composition in immigrant families begin to more strongly resemble patterns among native-born families. Longitudinal data will afford examination of the extent to which time-varying patterns of economic conditions and family composition, which we will consider as indicators of acculturation, explain age patterns in the educational gradient in child health among immigrant families.

Economic Circumstances. First, it is possible that the economic circumstances of children in immigrant families improve over time. Research on earnings growth and social mobility among immigrants suggests that foreign-born adults experience earnings growth with increasing time in the U.S. (Akresh 2008; Akresh 2011; Duleep 2002). There is ample evidence that education strongly predicts income (e.g., Goldin and Katz 1999), and that chronic exposure to poverty is negatively associated with cognitive development, learning and long-term economic status (Wagmiller et al. 2006). Children in low-educated immigrant families may be less likely to experience chronic economic disadvantage than their native-born peers if they experience economic mobility as they age. In this case, consistent with the scenario of parallel educational trends in Figure 2A, an initially weaker educational gradient in health may remain weaker over time because improving economic resources allow immigrant parents to provide a healthier environment for their children. Simultaneously, however, children in immigrant families may be more likely to experience economic disadvantage at a young age, during a more sensitive period of development. Early-life exposure to economic disadvantage may have a more durable impact on health than exposure at later ages (Jackson 2010; Palloni 2006; Torche 2011), potentially offsetting or weakening any positive health effects of economic mobility as children age. In addition, the greater need among immigrants to support extended family in both the United States and the country of origin (e.g., Portes, Haller and Guarnizo 2002) may contribute to the dilution of economic resources in the immediate family unit as children age. In that case, the educational gradient in child health among children in immigrant families may increase with age, consistent with the scenario of divergence in Figure 2C.

Family Composition. Occurring alongside improvements in economic circumstances may be changes in family and household composition among some immigrant families. Children in immigrant families are more likely than their peers in native-born families to live with two parents (Landale, Oropesa and Bradatan 2006) and to live with extended family members in both "vertical" (e.g., grandparent) and "horizontal" (e.g., other extended kin) arrangements (Glick, Bean and Van Hook 1997; Landale, Thomas and Van Hook 2011). As children age, however, processes of acculturation may lead patterns of family dissolution in immigrant families may become more similar to those in the overall population (Landale, Thomas and Van Hook 2011), in which half of all children will experience residence in a single-parent (usually mother-headed) family (Heuveline, Timberlake and Furstenberg 2003). These patterns may become unequally distributed by education in immigrant families, given the strong relationship between education and family structure and parental living arrangements, union dissolution and single motherhood (e.g., Edin, Kefalas and Reed 2004; Ellwood and Jencks 2004; McLanahan 2004; McLanahan and Percheski 2008). Because children in single-parent households may receive fewer resources in the form of money and time, and because family structure and instability in family structure is strongly associated with children's development (e.g., Amato 2005; McLanahan, Tach and Schneider 2013), an increasing likelihood of unstable family structure among lower-educated immigrant families may lead the educational gradient in child health to increase with age in immigrant families. That is, we would observe the pattern of divergence depicted in Figure 2C, partly driven by changes in family composition among low-educated immigrant families.

Data

Data for this research come from the Fragile Families and Child Well-Being Study (FFS), a representative survey of a national population in the United States, containing rich longitudinal

information on children's family environments, health and development, as well as an oversample of disadvantaged and ethnic minority families. The FFS follows 5,000 children who were born between 1998 and 2000 in large U.S. cities. Births to unmarried parents are oversampled, and parents (mothers, and most fathers) were interviewed in the hospital around the time of the child's birth. Additional interviews were conducted at ages one, three, five, nine and 15. We use data through age 15. With the use of survey weights, FFS data represent births in large U.S. cities (those with populations greater than 200,000).

FFS data are excellent for the purposes of this research, given the inclusion of socioeconomically disadvantaged populations as well as repeated measures of family socioeconomic conditions, child health, and family circumstances. In addition, the FFS is currently the only national and longitudinal birth cohort study in the United States that permits prospective observation of children from birth through age 15.[2] The FFS sample of immigrant and native-born mothers is very similar to national samples (vital statistics), as are multivariate relationships between our variables of interest. In addition, the FFS is likely to be more representative of immigrant and native-born mothers than other surveys. By using a hospital-based sampling frame, FFS response rates are higher than those in surveys that interview parents at home, or that sample from birth records. Baseline response rates were between 75% (unmarried fathers) and 87% (unmarried mothers), while subsequent response rates were 91 % (age 1), 88 % (age 3), 87 % (age 5), 76 % (age 9) and 77% (age 15) for mothers who completed the baseline interview and were eligible (focal child not deceased or adopted). Our analytic sample consists of 3,862 children, with information provided from interviews with mothers until age 9, and then interviews with primary caregivers at

[2] For example, the Early Childhood Longitudinal Study-Birth Cohort tracks children from birth only through kindergarten entry. The National Longitudinal Survey of Youth 1979 (NLSY79) Children and Young Adults collects information on children born only to NLSY79 mothers.

age 15. In our age 15 sample, children whose primary caregivers were not mothers (12.1 percent) were excluded.

Measures

Nativity and Race/Ethnicity. All FFS children are native-born, but parents can be foreign-born, permitting separation of children of immigrants (those with foreign-born mothers) and children of natives (those with U.S.-born mothers). We also measure race/ethnicity, given pronounced racial and ethnic differences in children's health (Flores, Olson and Tomany-Korman 2005; Flores and Tomany-Korman 2008). Though sample sizes do not permit disaggregating by children's race and ethnicity, we measure four categories: non-Hispanic white, non-Hispanic black, Hispanic, and other (which includes Asian respondents and others who do not identify as white, black or Hispanic).

Maternal Education. We focus on maternal education, separating mothers with less than a high school education, a high school diploma, some college, and a college diploma or higher. We treat maternal education as a time-varying variable because a non-negligible proportion of mothers in the sample upgrade their education after their child is born. For example, while 26% of native-born mothers have some college education around the time of children's birth, by age 15 close to 40% of mothers have some college. Relatedly, as Table 1 shows, the proportion of native-born mothers with less than a high school education declines from 21% at birth to 11% by age 15. Educational continuation also occurs to a less pronounced degree among immigrant mothers. These patterns of educational continuation are in keeping with national statistics (Denice 2017). Results do not differ when we use a time-constant measure of maternal education at baseline.

Child Health. The focal measure of child health is *mothers' rating of children's health* on a four-point scale ranging from fair/poor (1) to excellent (4). Child health is measured at ages one, three,

five, nine and 15. Previous work has shown that foreign-born Hispanics tend to report poorer

health, even after adjusting for clinical measures of physical and mental health (Franzini and Eugenia

Fernandez-Esquer 2004), but that controlling for the language of the interview explains much of this

difference (Viruell-Fuentes et al. 2011). While subject to some biases, parent and self-ratings of

health are strongly predictive of clinical measures of physical and psychological health, as well as

mortality (Boardman 2006; Idler and Benyamini 1997). Parents' ratings of their children's health are

strongly correlated with measures of children's chronic conditions and their effects, including the

number of hospitalization episodes, the numbers of school days missed and the number of chronic

conditions (e.g., Case, Lubotsky and Paxson 2002; Currie and Stabile 2003). In addition, parents'

ratings of their children's health do not vary systematically with parents' own health status (Dadds et

al. 1995), and are highly correlated with physician assessments of children's health (Case, Lubotsky

and Paxson 2002). It is possible that low-SES children are more likely to have undiagnosed

conditions, which may lead to an underestimate of poor health among this group of children, and an

underestimate of the educational gradient in child health.

Economic Conditions. In order to measures changes in children's economic conditions as

an indicator of acculturation, we use a time-varying continuous measure of the household poverty

ratio (adjusted for household size and the number of children) at ages zero, one, three, five, nine and

15 to measure family income. In supplementary analyses, we also examine binary measures that

create thresholds for children living in or near poverty (e.g, below 200% of the federal poverty line)

vs. those with a higher income, and the results do not change.

Family Composition. We use three time-varying measures of family composition. First, at

ages zero, one, three, five, nine and 15 we measure children's parental living arrangements,

differentiating between children who live with their biological father (mother married or cohabiting

with biological father), and those who do not. Alternative measures of living arrangements,

including a binary measure of family structure (mother married vs. unmarried), do not yield

substantively different findings. We also measure time-varying grandparent co-residence and the

number of children under age 18 in the household.

Other Measures. We measure several sociodemographic markers: mothers' age at birth, the

child's sex, low birthweight status, and whether the mother interview was conducted in Spanish

(time-varying). We also measure the number of well-visits since birth at age one as well as maternal

health behaviors strongly related to prenatal health exposures and children's health: the timing of

prenatal care initiation (first and second trimester), maternal smoking during pregnancy and

breastfeeding.

Missing Data and Estimation. For missing observations on study variables due to item

nonresponse, we create 20 multiply imputed (MI) data sets using a multivariate normal model.

Because the study variables are related not only to our study objectives, but also to the likelihood of

having a missing value, we account for all of the variables described above in our MI procedure

(Allison 2001). We estimate all models in Stata 15 using national sampling weights that adjust for

sample design, non-response at baseline, and attrition on observed characteristics over the waves, as

well as make the FFS sample representative of births occurring in large U.S. cities.

Analytic Plan

The analysis proceeds in several steps. First, in order to examine the educational gradient

among children of immigrants and natives across age, we estimate growth curve models that predict

baseline levels of health (intercepts), as well as the rate of change in health with age (slopes). We

begin with the following model:

$$Y_{ti} = \alpha_i + \beta_i (A-1)_{ti} + \gamma_i (A-1)_{ti}^2 + \epsilon_{ti}$$
$$\alpha_i = \alpha_0 + \alpha_1 E_{ti} + \alpha_2 X_{ti}$$
(1)

$$\beta_i = \beta_0 + \beta_1 E_{ti}$$
$$\gamma_i = \gamma_0 + \gamma_1 E_{ti}$$

Y_{ti} is the health of child i at time t, α_i is the intercept—child health at age 1 when all other covariates

are set to 0—, β_i and γ_i are the linear and the quadratic slopes associated with centered age (*A-1*)

for child i at time t, E_{ti} indicates maternal education, and X_{ti} is the set of time-constant covariates.

ϵ_{ti} is the error term. We regress the intercepts and slopes for health on maternal education and

sociodemographic measures in order to reveal group differences in the means of the intercepts and

slopes. We convert our study sample to person-year data (N=17,464 person-years) and estimate

robust standard errors that adjust for clustering at the individual level. Age is the basis for time,

whereby each child contributes up to five observations (ages 1, 3, 5, 9 and 15) to the estimation. We

estimate models that include a linear, quadratic and cubic term for age, and present quadratic models

because adjusted R^2 values, combined with patterns of coefficient significance, generally suggest a

preferable fit.

We estimate separate models for the children of immigrants and the children of native-born

mothers in order to avoid confounding acculturative changes specific to a particular nativity group

with developmental changes that occur among all youth (Fuligni 2001). We compare coefficients

across models using a standard Wald test of equality (George and Lynch 2003), which is equivalent

to estimating a full interaction model with interactions between nativity and all variables. Following

the advice of von Hippel (2009), we stratify by nativity in the imputation process in order to reduce

the possibility of attenuation bias in the interaction coefficients.

We begin by estimating Equation 1, including all measures except for economic conditions

and family composition. This approach reveals stability or change in the gradient as children age,

allowing us to examine nativity differences in patterns of child health across age. Of particular

interest are the coefficients for α_1, β_1 and γ_1, which indicate the educational gradient in children's

health at age 1 (intercepts) and between ages 1-15 (slopes). Do trajectories remain stable, converge

or diverge over time across educational groups? If educational differences are weaker at baseline

among children of immigrants than among children of natives, then α_1—indicating the association

between maternal education and child health at age 1—should be smaller at all educational levels for

this group. If educational differences decrease as children of immigrants age, predicted trajectories

from the linear and quadratic slopes should converge as children age (as in Figure 2B). Convergence

may also occur between nativity groups, making the educational gradient similar between children of

immigrants and natives (i.e., similarity between Figures 1B and 2B). Alternatively, if educational

differences increase among children of immigrants, then β_1 and γ_1 should yield predicted

trajectories that diverge with age (consistent with Figure 1C).

Next, in order to examine the contribution of economic conditions and family composition

to the size of the educational gradient among children of immigrants and children of natives, we

extend equation 1 to include the time-varying measures of household poverty ratio, presence of the

biological father, grandparent co-residence and number of children (F_{ti}) and estimate the following

model:

$$
\begin{aligned}
Y_{ti} &= \alpha_i + \beta_i (A-1)_{ti} + \gamma_i (A-1)_{ti}^2 + \epsilon_{ti} \\
\alpha_i &= \alpha_0 + \alpha_1 E_{ti} + \alpha_2 X_{ti} + \alpha_3 F_{ti} \\
\beta_i &= \beta_0 + \beta_1 E_{ti} + \beta_2 F_{ti} \\
\gamma_i &= \gamma_0 + \gamma_1 E_{ti} + \gamma_2 F_{ti}
\end{aligned}
\tag{2}
$$

Here, we allow for these economic and family composition measures (F_{ti}) to also interact with age,

so that we can capture any temporal changes in the association between these family measures and

health. If immigrant families experience increases in economic status, the educational gradient may

remain stable or decline among children of immigrants (as in Figures 2A and 2B). If the family

composition of children of immigrants more closely resembles that of native-born families as

children age, especially among low-educated families, then educational differences among this group

may increase (Figure 2C). A reduction of the educational gradient among children of immigrants after accounting for family circumstances would be consistent with the possibility that time-varying measures of economic conditions and family composition are capturing the process of acculturation.

Results

Descriptive Patterns

Table 1 presents weighted descriptive statistics for the children of immigrants (Panel A) and natives (Panel B). The distribution of immigrant status in the FFS reflects the urban composition of the target population, with 36.5% of children having an immigrant mother. More immigrant mothers have less than a high school education at baseline than their U.S. born peers (36.3% vs. 20.5%). However, children of immigrants are equally likely to have a mother with a college degree. The ample variation in education levels among immigrant mothers is consistent with evidence that many contemporary migrants possess high levels of education (e.g., Jackson, Kiernan and McLanahan 2012). As described earlier, a non-trivial fraction of mothers change their educational status between (children's) ages 1 and 15.

Examining average health levels at each age suggests that, while children of natives experience a decline in health with age, children of immigrant experience a slight increase in health between ages 1 and 15. Children of natives are more likely to have mothers who smoke during pregnancy, have a low birthweight, and are less likely to be breastfed. However, in the earliest years of life, children of natives receive better maternal health ratings than children of immigrants. This advantage disappears by age 15 because of the general decline in health among children of natives.

Inspecting the time-varying measures of family circumstances in Table 1 suggests that children of immigrants do experience increasing economic resources as they age (these differences are not significant from children of natives, however). The likelihood of having the biological father

present also declines among children of immigrants by age 15 (from 87% at birth to 70% at age 15), though differences between children of immigrants and natives remain significant. The likelihood of grandparent co-residence is more stable and is consistently slightly higher among children of immigrants. The number of children in the household also increases slightly more among children of immigrants, from 2.1 at age 0 to 2.5 at age 15.

The Educational Gradient in Levels of Child Health

Table 2 presents results from growth curve models that predict parent-rated health from maternal education. We estimate separate models for children of immigrants and children of natives, with Panel A including all controls except for the measures of economic conditions and family composition, and Panel B including those measures. The "Intercept (α)" columns show the relationship between each predictor and child health at age 1, while the "Slope (β)" and "Slope (γ)" columns show each predictor's relationship to health trajectories between ages 1 and 15, with separate columns for linear and quadratic slopes.

Examination of the intercepts in Panel A reveals the first key finding: at age 1, there is a strong educational gradient in child health among *both* children in native and immigrant families. First, among children of natives, those whose mothers have a high school education are 0.110 points healthier, on average, than their peers in the lowest-educated families, while the difference between those with a college degree and those with less than high school is 0.252 points. Relatedly, the difference between children whose mothers have high school and college is about 0.15 points (0.110 vs. 0.252). In contrast, the educational gradient among children of immigrants is primarily a difference between those whose mothers have less than high school and their peers in all other educational groups. Coefficients for children whose mothers have high school, some college or college education are quite small (0.340. 0.350. and 0.369, respectively). Referencing the children of

lowest-educated mothers (also the largest group, as shown in Panel B of Table 1), however, makes

the educational gradient at age 1 significantly stronger among children of immigrants than among

children of natives. Children of immigrant mothers with a high school education are 0.338 points

healthier, on average, than their peers in the lowest-educated families, while this difference among

children of natives is 0.106 points, and the difference between nativity groups is significant.

Similarly, the gap between those whose mothers have some college and those with less than high

school is 0.350 among children of immigrants, but 0.166 among children of natives. This finding of

a stronger gradient among children of immigrants is consistent with evidence that there is substantial

heterogeneity across child outcomes in the shape of the educational gradient among immigrant

families (Jackson, Kiernan and McLanahan 2012). In addition, previous evidence establishes an

educational gradient in overweight/obesity among Hispanic children of immigrants, albeit a weaker

one than among children of natives (Balistreri and Van Hook 2009).

The Educational Gradient in Trajectories of Child Health

Providing evidence for changes in the size of the educational gradient with age requires

examination of not only the intercepts (differences at age 1) but also the slopes. For most

educational groups, the relationship between education and health does not change in size after age

1, either within or across nativity groups. Beginning with children of natives, examination of the

slopes shows that children become less healthy with age, on average, as indicated by the negative

coefficients for the linear slopes (β). Because we also need to take the quadratic slope into account,

the magnitude of these relationships over time is easiest to visualize in the form of predicted values

that depict trajectories for a child with otherwise average characteristics. Figure 3 displays the

predicted health scores between ages 1 and 15 among children of natives, disaggregated by maternal

education and based on the coefficients in Panel A of Table 2—all other sample characteristics are

held constant at the grand mean of a merged sample of children of natives and immigrants. Figure 3 displays largely parallel declining trajectories of health among children of natives as they age, suggesting stability in the relationship between education and health among this group. This finding is consistent with the scenario predicted by Figure 1A.

Among children of immigrants, there is a stronger pattern of converging health between educational groups than among children of natives—consistent with the scenario predicted by Figure 2B. Health convergence among children of immigrants is driven by the different pattern observed with age between those in least educated families and their peers in families with higher levels of education. Figure 4 shows this pattern visually.

Figure 5 shows differences in the predicted health of children and natives and immigrants, within each educational group. That is, it shows within-education nativity differences in health. Figure 5 shows that differences in the predicted health of children of immigrants and natives are significant at ages one and three among those in least educated families (also see Appendix Table 1). Children of immigrants whose mothers have less than a high school education have worse health than children of natives in the same educational group during early childhood, and this differences becomes non-significant as children age. Predicted nativity differences in health within other educational groups are non-significant. This figure highlights the important finding that immigrant status is not protective for health within educational groups.

The Contribution of Family Circumstances to the Educational Gradient

Panel B of Table 2 includes time-varying measures of family circumstances—economic conditions, the presence of the biological father, grandparent co-residence and number of children in the household. The inclusion of these measures, which we treat as indicators of acculturation, reduces the educational gradient at age 1 for the children of natives, but not for the children of

immigrants. Health trajectories for both children of natives and immigrants are unaffected by these measures. Among children of natives, there continues to be a general decline of health with age for all children. Among children of immigrants, the pattern of health convergence with age persists, driven by the trajectory of improving health among children in the lowest-educated families concurrently with declining health among children in higher-educated families. Among children of immigrants, the gradient at age 1 is largely a gap between those in the lowest-educated families and those in other educational groups. By age 9, however, this gap diminishes, with those in the lowest-educated group improving relative to their peers in more educated families. Figure 6 (and Appendix Table 2) show these predicted differences between children of natives and immigrants as they age, within educational groups. Until age 9, differences between nativity groups are significant among children in the lowest-educated families. By age 9, differences between nativity groups in each level of maternal education are no longer significant.

Finally, Table 2 (Panel B) also permits inspection of the association of the time-varying measures of economic circumstances and family composition with child health. Among children of natives, household poverty and the presence of the biological father are significantly positively associated with health at age 1. Moreover, the number of children in the household is significantly negatively associated with health, while there is no significant association between grandparent co-residence and children's health. These associations do not change as children grow older, given that the slopes are not statistically significant from 0. Among children of immigrants, economic conditions and family composition are not significantly associated with health at either age 1 or between ages 1-15, and the point estimates for these coefficients are smaller than among children of natives. While this finding implies that the health of children in immigrant families may be less impacted by family circumstances, differences in the coefficients between children of natives and immigrants for these variables are not statistically significant.

Overall, analyses of the educational gradient over time by nativity reveal that: (1) maternal education is strongly predictive of health, even among children of immigrants; (2) immigrant status does not appear to be protective for health within educational groups, as evidenced by poorer health among children of immigrants whose mothers have the lowest level of education, compared to children of natives; (3) children in the least-educated immigrant families are experiencing better health trajectories as they age than children in similar native-born families; and (4) the inclusion of time-varying measures of economic conditions and family composition does not reduce the size of the gradient over time.

Additional Analyses

We perform several supplementary analyses to those shown above. First, because FFS children come from an urban sample that is disproportionately likely to experience family instability, we compare FFS findings to those with data from the birth cohort of the Early Childhood Longitudinal Study (ECLS-B). FFS data are desirable for this analysis because children are followed through age 15, while ECLS-B stops at age 5. However, analyses with the same measures through age 5 with ECLS-B children reveal substantively very similar findings, with an educational gradient among both children of immigrants and natives, and a pattern of declining health with age. The similarity of the findings across two national samples suggests that the results are not unique to U.S. children living in urban areas.

Second, because the majority of existing research on this topic has examined the Hispanic population in the U.S., we restrict analyses among children of immigrants to Hispanics. Though small sample sizes preclude us from presenting these results, the findings are very similar. Third, we stratify the children of immigrants by mothers' years in the U.S. and find that the results are more pronounced among children whose mothers arrived to the U.S. in the last ten years. Because of

small sample sizes and because the pattern of results is similar for those with more years in the U.S., we do not present these estimates. Finally, we examine the influence of selective attrition on our results because of the possibility that lower-educated and less healthy respondents may be more likely to drop out. For example, the finding that children of immigrants in the lowest-educated families experience an improvement in health over time may be driven by a higher likelihood of attrition among the least healthy and most disadvantaged children. We find that attrition is more common among children of immigrants than among children of natives—for example, 44% of children of immigrants in the lowest-educated families are no longer in the survey at age 15, compared to 27% of children of natives. However, we find no systematic evidence across nativity/educational groups that children who drop out are less healthy than their peers. We also estimate models with a control variable indicating the number of times a child attrited up to age 15, and find virtually identical results.

Conclusions

The starting point for this paper is the seemingly flat or ambiguous relationship between education and health among the growing population of U.S. youth in immigrant families. Longstanding debates about the "immigrant paradox" suggest that a weaker relationship between education and health among immigrants would be driven by favorable health outcomes among the most socioeconomically disadvantaged immigrants (Hummer et al. 1999; Markides and Coreil 1986). However, despite evidence of healthier birth outcomes among children in immigrant families, little is known about the life course relationship between education and health as this large population of U.S. children age into adolescence. Do health trajectories remain stable, converge or diverge over time across educational groups in ways that are similar or different by nativity? In addition, do families' economic circumstances and living arrangements vary substantially enough by nativity over

time to explain any observed patterns?   Using national, longitudinal data from the Fragile Families and Child Well-Being Study, we examine the evolution of the educational gradient among children of immigrants and natives between birth and adolescence, and consider whether economic circumstances and family composition explain the gradient over time.

The findings reveal, first, that there is a significant educational gradient in health among both the children of immigrant and native-born parents. Maternal education matters for children's health, even among children of immigrants. As early as age 1, education has a strong association with health among children in immigrant families, and at lower levels of education this association is significantly stronger than among children in native-born families at early ages. Importantly, the educational gradient among children of immigrants reflects a difference between those in the lowest educated families and those in all other educational groups. Young children of immigrants with less educated mothers have worse health than their peers with more highly educated mothers, both within and across nativity groups. This finding is not consistent with the idea of an immigrant health paradox, whereby children of immigrants with low levels of education would exhibit better health than might be expected given their lack of resources.

Relatedly, health declines as children age, and there is no evidence that this is not the case for children in immigrant families (with the important exception of children in the lowest-educated families). In fact, the children of immigrants are in poorer health, on average, than the children of natives, despite initially favorable birth outcomes such as birthweight, as well as exposure to healthier behaviors in utero. Children of immigrants whose mothers have less than a high school education have worse health than children of natives whose mothers also have less than a high school education. This finding suggests that, among mothers who have a low level of education, there is no protective effect associated with being an immigrant. This finding is also not consistent with the predictions of the immigrant health paradox.

Third, despite their health disadvantage at the youngest ages, children in the least-educated immigrant families experience better health trajectories as they age. The gradient at age 1 among children of immigrants is largely a gap between those in the lowest-educated families and those in other educational groups. By age 9, however, this gap reverses, with those in the lowest-educated groups improving relative to their peers in more educated families. This finding is not consistent with a hypothesis of "unhealthy acculturation" that would lead to declining health with age for children in immigrant families. Rather, it is consistent with healthy acculturation as children in the most educationally disadvantaged families age toward adolescence. While it is possible that these results are influenced by changes in the way that immigrant parents rate their children's health as they spend more time in the U.S., there is no evidence to suggest that such changes should be uniquely observed among the most disadvantaged families.

Controlling for economic conditions and family composition does not reduce the size of the educational gradient among children of immigrants, and in fact yields the largest association between maternal education and health trajectories among these children. Despite variation in the economic conditions and family composition of children in immigrant vs. native-born families, the educational gradient in children's health is largely insensitive to accounting for these variables. Given that the association between education and health remains stable across age for all educational groups except the lowest-educated group, it is not surprising that accounting for time-varying family circumstances does not alter the results for higher-educated respondents.

The merits of the data and approach used here should be weighed against some limitations. First, the empirical approach used here does not permit causal claims. Though we observe a rich set of individual, family and household characteristics, these findings are upper-bound estimates of the effects of education on child health. Second, though it would be useful to disaggregate the children of immigrants by ethnicity, sample sizes do not permit this analysis. Sensitivity analyses that limit

this sample to Hispanic children yield nearly identical findings, which suggests that these patterns are not unique to one population. However, it is not possible to consider potentially important variation with age across specific ethnic or nationality groups.

These limitations notwithstanding, the findings suggest that the relationship between education and health is present for children in both immigrant and native-born families, and that among the children of immigrant this difference is driven—at least during the early childhood years—by those in the lowest-educated families and their higher-educated peers. These results are not consistent with cross-sectional research on the immigrant health paradox, mainly focused on adults or infants. In general, the results suggest that the development of children in immigrant families is neither uniformly favorable nor unfavorable, and that—contrary to perceptions of favorable health among immigrant families as paradoxical—education may confer protective effects on health via similar mechanisms for all children. The case of children in the lowest-educated immigrant families—who are the only group to experience improvements in health with age—is important for examination in future research. Given the greater likelihood of these children to live in poor and single-parent families, it is unclear why they would experience improvements in health relative to their peers. Attrition analyses suggest that this pattern is not driven by selective attrition out of the sample by the healthiest children in this group, and this pattern is not sensitive to a control variable for the language of the interview. However, it is possible that children in the lowest-educated immigrant families are selective in ways that are not observable in the data. For example, the most disadvantaged immigrant families may become better able to access important safety net services as children age, or they may build protective networks of kin and non-kin support that they lacked around the time of children's birth. Our results are consistent with the possibility that the lowest-educated immigrant families experience "healthy acculturation" that produces convergence with the health of their peers in both other educational groups and with the children of

natives. While accounting for several indicators of acculturation (such as economic mobility and changing family composition) does not explain the pattern that we observe as these children age, it is possible that a more thorough accounting of the changes that children experience in their family, peer and local environments may go further in explaining the paradoxical "healthier turn" among a highly disadvantaged group of children.

REFERENCES

Abraido-Lanza, A. F., Dohrenwend, B. P., Ng-Mak, D. S., & Turner, J. B. 1999. "The Latino mortality paradox: A test of the "salmon bias" and healthy migrant hypotheses." *American Journal of Public Health* 89:1543–1548

Adler, Nancy E., Thomas Boyce, Margaret A. Chesney, Sheldon Cohen, Susan Folkman, Robert L. Kahn and S. L. Syme. 1994. "Socioeconomic Status and Health: The Challenge of the Gradient." *American Psychologist* 49:15-24.

Akresh, Ilana R. 2007. "Dietary Assimilation and Health among Hispanic Immigrants to the United States." *Journal of Health and Social Behavior* 48:404.

------.2008. "Occupational Trajectories of Legal US Immigrants: Downgrading and Recovery." *Population and Development Review* 34:435-56.

------.2011. "Wealth Accumulation among U.S. Immigrants: A Study of Assimilation and Differentials." *Social Science Research* 40:1390-401.

Allison, Paul D., 2001. *Missing data* (Vol. 136). Sage publications.

Amato, Paul R. .2005. "The Impact of Family Formation Change on the Cognitive, Social, and Emotional Well-being of the Next Generation." *The Future of Children* 15:pp. 75-96.

Anderson, L. M., D. L. Wood and C. D. Sherbourne. 1997. "Maternal Acculturation and Childhood Immunization Levels among Children in Latino Families in Los Angeles." *Am J Public Health* 87:2018-21.

Antecol, Heather and Kelly Bedard. 2006. "Unhealthy Assimilation: Why do Immigrants Converge to American Health Status Levels?" *Demography* 43:337.

Balistreri, Kelly S. and Jennifer Van Hook. 2009. "Socioeconomic Status and Body Mass Index among Hispanic Children of Immigrants and Children of Natives." *American Journal of Public Health* 99:2238-46.

Boardman, Jason. 2006. "Self-Rated Health among US Adolescents." *Journal of Adolescent Health* 38:401-8.

Case, Anne, Darren Lubotsky and Christina Paxson. 2002. "Economic Status and Health in Childhood: The Origins of the Gradient." *American Economic Review* 92:1308-34.

Chen, Edith, Karen A. Matthews, and W. Thomas Boyce. 2002. "Socioeconomic differences in children's health: how and why do these relationships change with age?." *Psychological Bulletin* 128(2): 295-329.

Chen, Edith, Andrew D. Martin and Karen A. Matthews. 2006. "Socioeconomic Status and Health: Do Gradients Differ within Childhood and Adolescence?" *Social Science & Medicine* 62:2161-70.

Conley, Dalton and Neil G. Bennett. 2000. "Is Biology Destiny? Birth Weight and Life Chances." *American Sociological Review* 65:458-67.

Currie, Janet. 2005. "Health Disparities and Gaps in School Readiness." *Future of Children* 15:117-38.

Currie, Janet and Mark Stabile. 2003. "Socioeconomic Status and Child Health: Why is the Relationship Stronger for Older Children?" *The American Economic Review* 93:1813-23.

------.2006. "Child Mental Health and Human Capital Accumulation: The Case of ADHD." *Journal of Health Economics,* 25:1094-118.

Dadds, Mark R.; Stein, Ruth E. K. and Silver, Ellen Johnson. 1995. "The Role of Maternal Psychological Adjustment in the Measurement of Children's Functional Status." *Journal of Pediatric Psychology* 20(4): 527–44.

Denice, Patrick. 2017. "Back to School: Racial and Gender Differences in Adults' Participation in Formal Schooling, 1978–2013." *Demography* 54(3): 1147-1173.

Duleep, Harriet O. 2002. "Insights from Longitudinal Data on the Earnings Growth of U.S. Foreign-Born Men." *Demography* 39:485-503.

Duncan, Greg J., W. J. Yeung, Jeanne Brooks-Gunn and Judith R. Smith. 1998. "How Much does Childhood Poverty Affect the Life Chances of Children?" *American Sociological Review* 63:pp. 406-423.

Duncan, Greg J., Kathleen M. Ziol-Guest and Ariel Kalil. 2010. "Early-Childhood Poverty and Adult Attainment, Behavior, and Health." *Child Development* 81:306-25.

Edin, Kathryn, Maria J. Kefalas and Joanna M. Reed. 2004. "A Peek Inside the Black Box: What Marriage Means for Poor Unmarried Parents." *Journal of Marriage and Family* 66:1007-14.

Ellwood, David T. and Christopher Jencks. 2004. "The Uneven Spread of Single-Parent Families: What do we Know? Where do we Look for Answers? " Pp. 3-77 in *Social Inequality,* edited by Kathryn M. Neckerman. New York: Russell Sage Foundation.

Finch, Brian K. 2003. "Early Origins of the Gradient: The Relationship between Socioeconomic Status and Infant Mortality in the United States." *Demography* 40:675-99.

Finch, Brian K., Reanne Frank and William A. Vega. 2004. "Acculturation and Acculturation Stress: A Social-Epidemiological Approach to Mexican Migrant Farmworkers' Health." *International Migration Review* 38:236-62.

Flores, Glenn Lynn Olson, and Sandra C. Tomany-Korman. 2005. "Racial and ethnic disparities in early childhood health and health care." *Pediatrics* 115(2): e183.

Flores, Glenn and Sandra C. Tomany-Korman. 2008. "Racial and ethnic disparities in medical and dental health, access to care, and use of services in US children." *Pediatrics* 121(2): e286-e298.

Franzini, Luisa and Maria E. Fernandez-Esquer. 2004. "Socioeconomic, Cultural, and Personal Influences on Health Outcomes in Low Income Mexican-Origin Individuals in Texas." *Social Science & Medicine* 59:1629-46.

Fuligni, Andrew J. 2001. "A Comparative Longitudinal Approach to Acculturation among Children in Immigrant Families." *Harvard Educational Review* 71:566-79.

George, Linda K. and Scott M. Lynch. 2003. "Race Differences in Depressive Symptoms: A Dynamic Perspective on Stress Exposure and Vulnerability." *Journal of Health and Social Behavior* 44:353-69.

Glick, Jennifer E., Frank D. Bean and Jennifer V. W. V. Hook. 1997. "Immigration and Changing Patterns of Extended Family Household Structure in the United States: 1970-1990." *Journal of Marriage and the Family* 59:177-91.

Goldin, Claudia and Lawrence F. Katz. 1999. "The returns to skill in the United States across the twentieth century." National bureau of economic research Working Paper. No. w7126.

Goldman, Noreen, Rachel T. Kimbro, Cassio M. Turra and Anne R. Pebley. 2006. "Another Hispanic Paradox: Differences in Socioeconomic Gradients in Health between White and Mexican-Origin Populations." *American Journal of Public Health*.

Gordon-Larsen, P., Adair, L.S. and Popkin, B.M., 2003. "The relationship of ethnicity, socioeconomic factors, and overweight in US adolescents." *Obesity*, *11*(1):121-129.

Harding, J.F., Morris, P.A. and Hughes, D., 2015. "The relationship between maternal education and children's academic outcomes: A theoretical framework." *Journal of Marriage and Family*, *77*(1):60-76.

Heuveline, Patrick, Jeffrey M. Timberlake and Frank F. Furstenberg. 2003. "Shifting Childrearing to Single Mothers: Results from 17 Western Countries." *Population and Development Review* 29:47-71.

Hummer, Robert A., Monique Biegler, Peter B. De Turk, et al. "Race/Ethnicity, Nativity, and Infant Mortality in the United States." *Social Forces* 77(3): 1083–1117.

Idler, Ellen L. and Yael Benyamini. 1997. "Self-Rated Health and Mortality: A Review of Twenty-Seven Community Studies." *Journal of Health and Social Behavior* 38:21-37.

Jackson, Margot I. 2009. "Understanding Links between Adolescent Health and Educational Attainment." *Demography* 46:671-94.

------.2010. "A Life Course Perspective on Child Health, Cognition and Occupational Skill Qualifications in Adulthood: Evidence from a British Cohort." *Social Forces* 89:89-116.

------.2011. "Nativity Differences in Youths' Weight Trajectories: Foreign-Born Integration during the Transition to Adulthood." *Social Science Research* 40(5): 1419-1433.

Jackson, Margot I., Kathleen Kiernan and Sara McLanahan. 2012. "Immigrant-Native Differences in Child Health: Does Maternal Education Narrow or Widen the Gap?" *Child Development.*

Jasso, Guillermina, Massey, Douglas S., Rosenzweig, Mark R., Smith, James P. 2004. "Immigrant Health – Selectivity and Acculturation." In: Anderson, Norman B., Barney Cohen, Randy A., Cohen, Barney (Eds.), Critical Perspectives on Racial and Ethnic Differences in Health in Late Life. National Academy Press, Washington, DC, pp. 227–266.

Kalil, Ariel, Rebecca Ryan and Michael Corey. 2012. "Diverging Destinies: Maternal Education and the Developmental Gradient in Time with Children." *Demography* 49(4): 1361-1383.

Kimbro, Rachel T., Sharon Bzostek, Noreen Goldman and Germán Rodríguez. 2008. "Race, Ethnicity, and the Education Gradient in Health." *Health Affairs* 27:361-72.

Landale, Nancy S., R. Salvador Oropesa, and Bridget K. Gorman. 1999. "Immigration and infant health: Birth outcomes of immigrant and native-born women." *Children of immigrants: Health, adjustment and public assistance*: 244-85.

Landale, Nancy S., R. S. Oropesa and Cristina Bradatan. 2006. "Hispanic Families in the United States: Family Structure and Process in an Era of Family Change." Pp. 138-79 in *Hispanics and the Future of America,* edited by Marta Tienda and Faith Mitchell. Washington, D.C.

Landale, Nancy S., Kevin J. A. Thomas and Jennifer V. Hook. 2011. "The Living Arrangements of Children of Immigrants." *The Future of Children* 21:pp. 43-70.

Lara, Marielena, Cristina Gamboa, M. I. Kahramanian, Leo S. Morales and David E. Hayes Bautista. 2005. "Acculturation and Latino Health in the United States: A Review of the Literature and its Sociopolitical Context." *Annual Review of Public Health* 26:367-97.

Lu, Michael C. and Neil Halfon. 2003. "Racial and Ethnic Disparities in Birth Outcomes: A Life-Course Perspective." *Maternal and Child Health Journal* 7:13-30.

Lynch, Scott M. 2003. "Cohort and Life-Course Patterns in the Relationship between Education and Health: A Hierarchical Approach." *Demography* 40:309-31.

Markides, K. S., & Coreil, J. 1986. "The health of Hispanics in the Southwestern United States: An Epidemiologic Paradox." *Public Health Reports* 101: 253–265

Marmot, M. G., G. Davey Smith, S. Stansfeld, C. Patel, F. North, J. Head, I. White, E. J. Brunner and A. Feeney. 1991. "Health Inequalities among British Civil Servants: The Whitehall II Study." *Lancet* 337:1387-93.

Marmot, Michael. 2001. "Inequalities in Health." *The New England Journal of Medicine* 345:134-6.

McDaniel, Marla, Christina Paxson and Jane Waldfogel. May 2006. "Racial Disparities in Childhood Asthma in the United States: Evidence from the National Health Interview Survey, 1997 to 2003." *Pediatrics* 117:e868-77.

McLanahan, Sara and Christine Percheski. 2008. "Family Structure and the Reproduction if Inequalities " *Annual Review of Sociology* 34:257-76.

McLanahan, Sara. 2004. "Diverging Destinies: How Children are Faring Under the Second Demographic Transition." *Demography* 41:pp. 607-627.

McLanahan, Sara, Tach, Laura, Schneider, Daniel. The causal effects of father absence. Annual Review of Sociology. 2013; 39(1).

Migration Policy Institute. 2016. "Children in Immigrant Families." Accessed here: https://www.migrationpolicy.org/programs/data-hub/charts/children-immigrant-families

Padilla, Yolanda C., Jason D. Boardman, Robert A. Hummer, and Marilyn Espitia. 2002. "Is the Mexican American "epidemiologic paradox" advantage at birth maintained through early childhood?" *Social Forces* 80(3): 1101-1123.

Palloni, Alberto. 2006. "Reproducing Inequalities: Luck, Wallets, and the Enduring Effects of Childhood Health." *Demography* 43:587-615.

Petersen, Trond, Ishak Saporta and Marc-David L. Seidel. 2000. "Offering a Job: Meritocracy and Social Networks." *The American Journal of Sociology* 106:pp. 763-816.

Popkin, Barry M., and J. Richard Udry. 1998. "Adolescent obesity increases significantly in second and third generation US immigrants: the National Longitudinal Study of Adolescent Health." *The Journal of nutrition* 128(4): 701-706.

Portes, Alejandro, William J. Haller, and Luis Eduardo Guarnizo. 2002. "Transnational entrepreneurs: An alternative form of immigrant economic adaptation." *American Sociological Review*: 278-298.

Smith, James P. 2007. "The Impact of Socioeconomic Status on Health Over the Life-Course." *Journal of Human Resources* XLII:739-64.

Torche, F., 2011. "The effect of maternal stress on birth outcomes: exploiting a natural experiment." *Demography*, *48*(4):1473-1491.

Van Hook, Jennifer, Frank D. Bean and Jeffrey Passel. 2005. "Unauthorized Migrants Living in the United States: A Mid-Decade Portrait." *Migration Policy Institute Memo.*

Viruell-Fuentes, Edna A., Jeffrey D. Morenoff, David R. Williams and James S. House. 2011. "Language of Interview, Self-Rated Health, and the Other Latino Health Puzzle." *American Journal of Public Health* 101:1306-13.

von Hippel, Paul. 2009. "How to Impute Interactions, Squares and Other Transformed Variables." *Sociological Methodology* 39(1): 265-291.

Wagmiller, Robert L., Jr, et al. The Dynamics of Economic Disadvantage and Children's Life Chances. American Sociological Review. 2006; 71(5):847–866.

West, Patrick. 1997. "Health inequalities in the early years: is there equalisation in youth?." *Social science & Medicine* 44(6): 833-858.

West, Patrick, and Helen Sweeting. 2004. "Evidence on equalisation in health in youth from the West of Scotland." *Social science & Medicine* 59(1): 13-27.

Winkleby, M. A., D. E. Jatulis, E. Frank and S. P. Fortmann. 1992. "Socioeconomic Status and Health: How Education, Income, and Occupation Contribute to Risk Factors for Cardiovascular Disease." *American Journal of Public Health* 82:816-20.

Table 1: Weighted Descriptive Statistics, FFS (N=3,862)

	A: Children of Natives (63.6%)					B: Children of Immigrants (36.4%)				
	Age 1	Age 3	Age 5	Age 9	Age 15	Age 1	Age 3	Age 5	Age 9	Age 15
Maternal Health Rating of Child	3.600	3.547	3.571	3.463	3.388	3.307 a	3.267 a	3.401 a	3.351 a	3.340
Maternal Education										
College or More	0.215	0.225	0.228	0.249	0.288	0.192	0.226	0.220	0.248	0.280
Some College	0.259	0.291	0.332	0.397	0.398	0.152 a	0.148 a	0.144 a	0.218 a	0.249 a
HS	0.321	0.303	0.278	0.224	0.201	0.294	0.278	0.259	0.257	0.214
Less than HS (reference)	0.205	0.181	0.162	0.130	0.112	0.363	0.349	0.377	0.277	0.256
Mother's Race										
Non-Hispanic White (reference)	0.362					0.171				
Hispanic	0.184					0.499 a				
Non-Hispanic Black	0.438					0.165				
Other	0.016					0.166				
Income and Faimily Compostion										
Poverty Ratio	2.740	2.974	2.582	2.739	3.013	2.737	2.968	2.579	2.929	3.282
Bio-Father Co-residence	0.675	0.612	0.527	0.481	0.378	0.868 a	0.824 a	0.745 a	0.762 a	0.696 a
Grand-parental Co-residence	0.178	0.136	0.090	0.094	0.105	0.184	0.127	0.118 a	0.127 a	0.141 a
Number of Kids at Home	2.313	2.297	2.462	2.737	2.547	2.100 a	2.125 a	2.383	2.699	2.543
Onset of Prenatal Care										
First trimester (reference)	0.839					0.767				
Second trimester	0.128					0.167 a				
Third or Never	0.033					0.066				
Doctor Visit Frequency By Age 1										
Less than Three Times (reference)	0.056					0.067				
Three or More Times	0.944					0.933				
Other Child and Mother Measures										
Child's Sex	0.537					0.587 a				
Low Birthweight Dummy	0.103					0.051 a				
Age of Mother at Birth	26.541					28.099 a				
Prenatal Smoking Dummy	0.166					0.030 a				
Breastfeeding at Age 1	0.569					0.807 a				
Spanish Language Interview	0.013	0.013	0.010	0.009	0.008	0.386 a	0.318 a	0.334 a	0.310 a	0.293 a

a denotes significant differences between children of natives and children of immigrants at the same age, at $p<0.05$

Maternal Education, Mother's Race, Child's Sex, Low Birthweight, Prenatal Smoking, Prenatal Care, Breastfeeding are measured at Age 0

Table 2: Growth Curve Estimates of the Educational Gradient in Parent-Rated Health, by Nativity

	A						B					
	Children of Natives			Children of Immigrants			Children of Natives			Children of Immigrants		
	Intercept (α)	Slope (β)	Slope (γ)	Intercept (α)	Slope (β)	Slope (γ)	Intercept (α)	Slope (β)	Slope (γ)	Intercept (α)	Slope (β)	Slope (γ)
Intercept	3.703***	0.003	-0.001+	3.535***	0.022	-0.001	3.716***	-0.008	-0.001	3.610***	-0.000	-0.000
	(0.083)	(0.011)	(0.001)	(0.200)	(0.017)	(0.001)	(0.087)	(0.016)	(0.001)	(0.207)	(0.035)	(0.002)
Mother Education (ref. Less than HS)												
Mother HS	0.110**	-0.032*	0.002*	0.340***a	-0.060*	0.002	0.099**	-0.033*	0.002*	0.334***a	-0.059*	0.002
	(0.037)	(0.014)	(0.001)	(0.078)	(0.030)	(0.002)	(0.037)	(0.014)	(0.001)	(0.079)	(0.030)	(0.002)
Mother Some College	0.166***	-0.028*	0.002+	0.350***a	-0.032	0.001	0.143***	-0.028*	0.002+	0.341***a	-0.031	0.001
	(0.037)	(0.013)	(0.001)	(0.076)	(0.025)	(0.002)	(0.037)	(0.013)	(0.001)	(0.079)	(0.026)	(0.002)
Mother College or More	0.252***	-0.017	0.001	0.369***	-0.033	0.001	0.198***	-0.027	0.001	0.376***	-0.035	0.001
	(0.046)	(0.014)	(0.001)	(0.087)	(0.028)	(0.002)	(0.052)	(0.017)	(0.001)	(0.101)	(0.035)	(0.002)
Mother Race (ref. Mother non-Hispanic White)												
Mother Black	-0.141***			-0.074			-0.083***			-0.052		
	(0.023)			(0.081)			(0.024)			(0.082)		
Mother Hispanic	-0.101***			-0.063			-0.073*			-0.045		
	(0.029)			(0.079)			(0.029)			(0.078)		
Mother Other Race	-0.133+			-0.094			-0.076			-0.095		
	(0.078)			(0.083)			(0.078)			(0.084)		
Poverty Ratio							0.014*	0.002	-0.000	-0.004	0.001	0.000
							(0.006)	(0.002)	(0.000)	(0.010)	(0.004)	(0.000)
Live with Bio-Father							0.089**	0.007	-0.000	0.021	0.012	-0.001
							(0.027)	(0.010)	(0.001)	(0.069)	(0.024)	(0.002)
Live with Grandparent(s)							0.043	0.000	0.000	-0.012	-0.018	0.001
							(0.033)	(0.014)	(0.001)	(0.071)	(0.029)	(0.002)
Number of Kids							-0.023*	0.004	-0.000	-0.023	0.006	-0.000
							(0.010)	(0.004)	(0.000)	(0.023)	(0.009)	(0.001)
Adjusted R-squared		0.033			0.093			0.043			0.093	
N (Person)		3077			785			3077			785	
N (Person-years)		13,675			3,127			13,675			3,127	

Cluster robust standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

a denotes significant differences between children of natives and children of immigrants, at p<0.05

Other covariates are mother's age at birth, timing of onset of prenatal care, doctor's visit frequency, smoking during pregnancy, breastfeeding, low birthweight, child sex, Spanish interview (TVC)

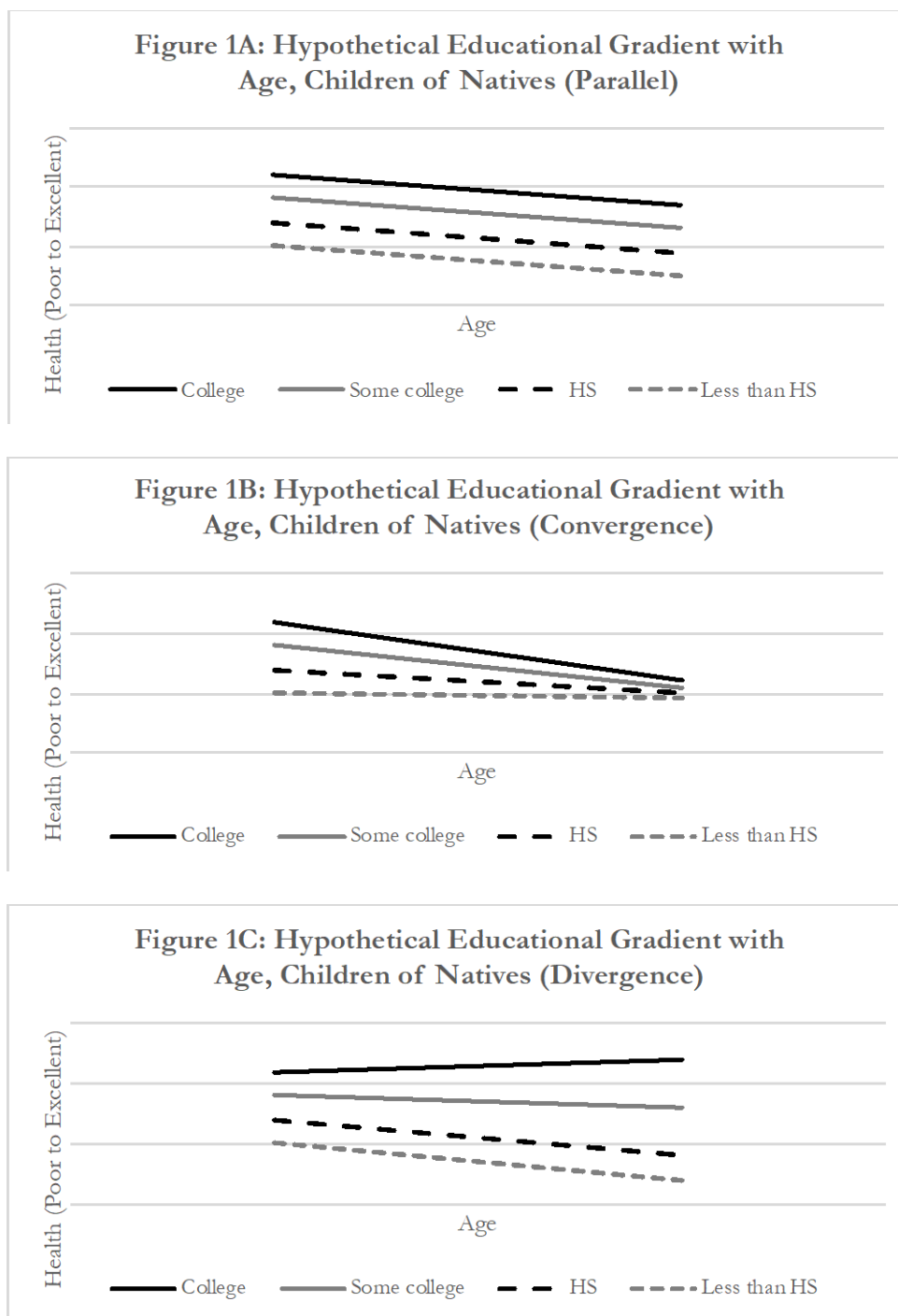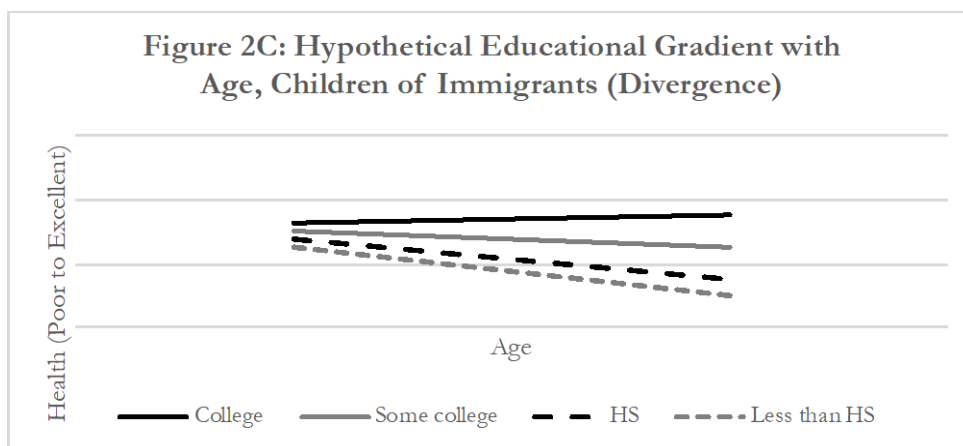**Figure 1: Hypothetical Educational Health Gradients among Children of Natives**
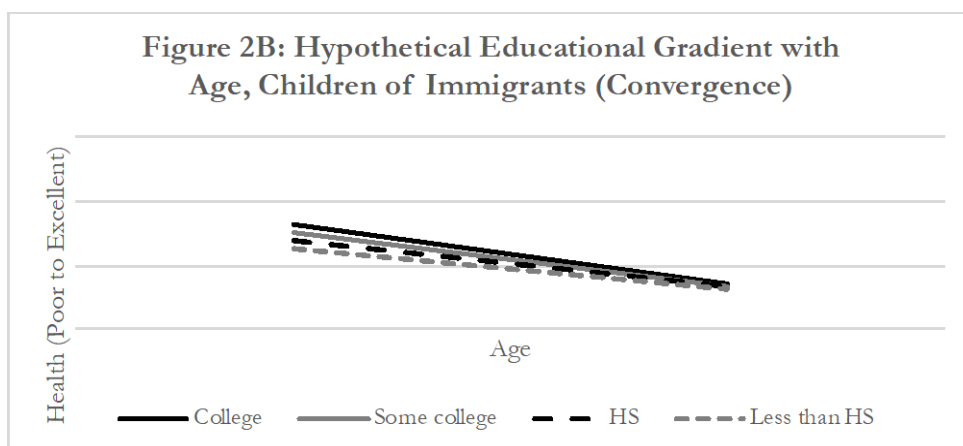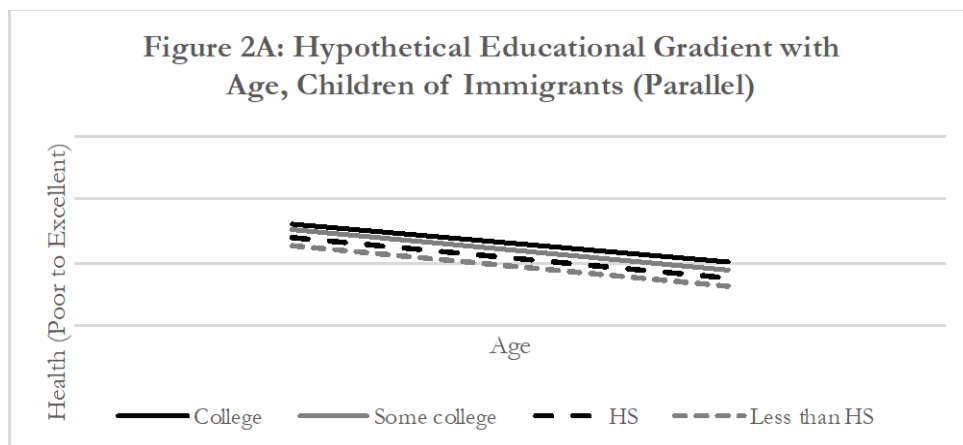

Figure 1A: Hypothetical Educational Gradient with Age, Children of Natives (Parallel)

Figure 1B: Hypothetical Educational Gradient with Age, Children of Natives (Convergence)

Figure 1C: Hypothetical Educational Gradient with Age, Children of Natives (Divergence)

Figure 2: Hypothetical Educational Health Gradients among Children of Immigrants

Figure 2A: Hypothetical Educational Gradient with Age, Children of Immigrants (Parallel)

Figure 2B: Hypothetical Educational Gradient with Age, Children of Immigrants (Convergence)


Figure 2C: Hypothetical Educational Gradient with Age, Children of Immigrants (Divergence)

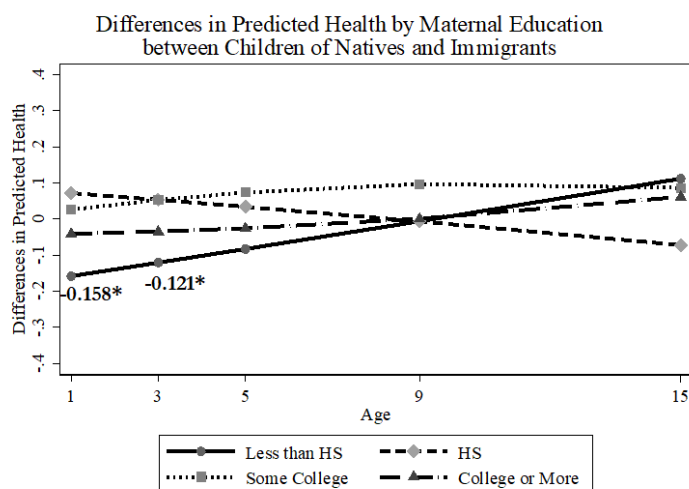## Figure 3: Trajectories of Health among Children of Natives
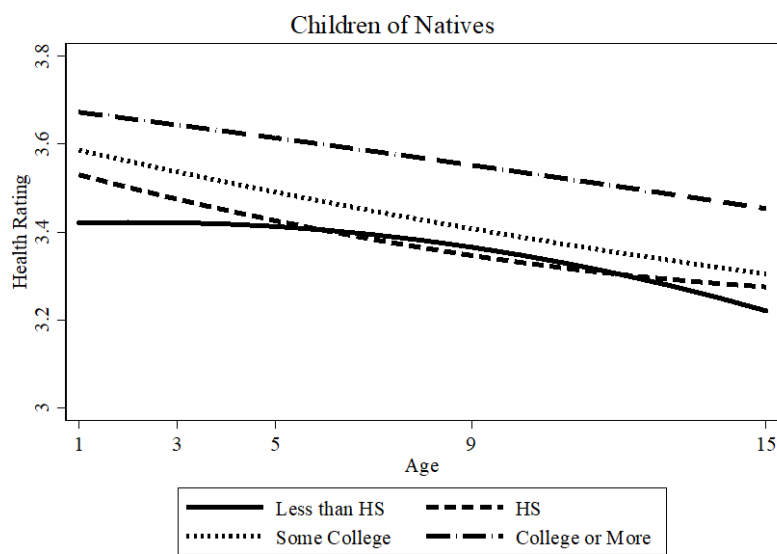
Note: This figure shows average trajectories of health ratings by levels of maternal education among children of natives. This figure is estimated from coefficients in Panel A (Children of Natives) of Table 2. All variables except for age and maternal education are held constant at the grand mean of a merged sample of children of natives and immigrants.

Figure 4: Trajectories of Health among Children of Immigrants
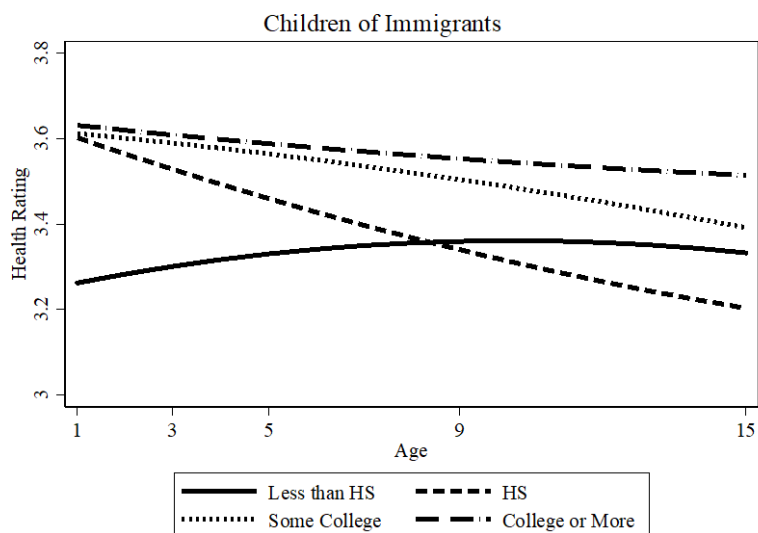
Note: This figure shows average trajectories of health ratings by levels of maternal education among children of immigrants. This figure is estimated from coefficients in Panel A (Children of Immigrants) of Table 2. All variables except for age and maternal education are held constant at the grand mean of a merged sample of children of natives and immigrants.
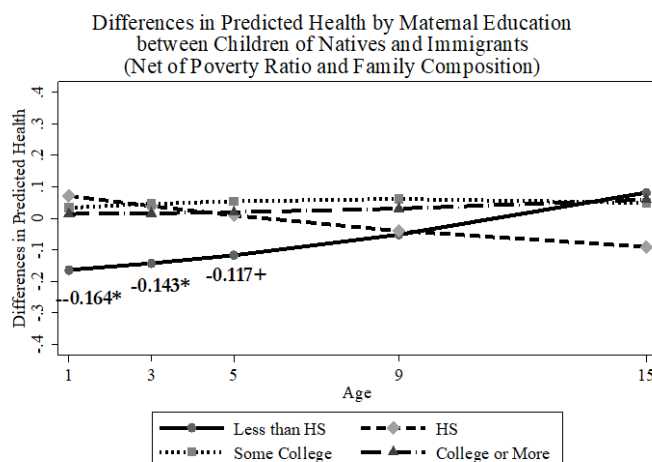
Figure 5: Differences in Predicted Health Ratings by Maternal Education between Children of Immigrants and Natives

Differences in Predicted Health by Maternal Education
between Children of Natives and Immigrants

* p<0.05, + p<0.1
Note: This figure shows nativity differences in predicted health ratings among children with the same levels of maternal education. The differences between the trajectories in Figure 3 and 4 correspond to these differences. Positive differences indicate that children of immigrants are healthier, and negative differences indicate that children of natives are healthier. See Appendix Table 1.

Figure 6: Differences in Predicted Health Ratings by Maternal Education between Children of Immigrants and Natives

Differences in Predicted Health by Maternal Education
between Children of Natives and Immigrants
(Net of Poverty Ratio and Family Composition)

* p<0.05, + p<0.1
Note: This figure shows nativity differences in predicted health ratings among children with the same levels of maternal education, net of family income and family composition. Positive differences indicate that children of immigrants are healthier, and negative differences indicate that children of natives are healthier. See Appendix Table 2.

Appendix 1: Predicted Health Differences between Children of Immigrants and Natives

	Age 1		Age 3		Age 5	Age 9	Age 15
Less than HS	-0.158	*	-0.121	*	-0.083	-0.006	0.112
HS	0.072		0.053		0.034	-0.007	-0.072
Some College	0.026		0.053		0.074	0.097	0.086
College or More	-0.041		-0.035		-0.026	0.001	0.061

* p<0.05, + p<0.1

Note: Nativity differences in predicted health rating among children with the same levels of maternal education. The differences between the trajectories in Figure 3 and 4 correspond to these differences. Positive differences indicate that children of immigrants are healthier, and negative differences indicate that children of natives are healthier. The table corresponds to Figure 5.

Appendix 2: Predicted Health Differences between Children of Immigrants and Natives

	Age 1		Age 3		Age 5		Age 9	Age 15
Less than HS	-0.164	*	-0.143	*	-0.117	+	-0.052	0.081
HS	0.071		0.039		0.009		-0.040	-0.091
Some College	0.034		0.045		0.054		0.061	0.049
College or More	0.014		0.016		0.019		0.031	0.059

* p<0.05, + p<0.1

Note: Nativity differences in predicted health rating among children with the same levels of maternal education. Positive differences indicate that children of immigrants are healthier, and negative differences indicate that children of natives are healthier. The table corresponds to Figure 6.