Has the income gradient in child health evolved over birth cohorts?

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Research has established a clear income gradient in child health: the children of richer families tend to be healthier than their less advantaged counterparts. Other work has established change in the magnitude of SES- adult health gradients over birth cohorts in light of rising social and economic inequality, but has not examined potential trends in the meaning of income for child health. Growing and narrowing disparities across families imply that some social and demographic patterns may have strengthened the income gradient in child health while others may act to offset growing inequality. In light of these competing possibilities, I use data from the 1982-2012 National Health Interview Surveys (NHIS) to examine trends in the association between family income and child health for children born between 1965 and 2012. These analyses highlight the ways in broader social patterns shape children's outcomes that have implications for inequality across the life course.

Children born at different points in the twentieth century grew up in varied social contexts. A growing concentration of resources among advantaged families has left rich and poor children facing "divergent destinies" (McLanahan, 2004, 2013). For example, widening socioeconomic disparities in the resource allocation, such as in child-related spending (Kornrich and Furstenberg, 2013) and parent-child time (Sandberg and Hofferth 2001, 2005) have emerged. Such inequalities are of particular concern because they may have consequences across the life course. Indeed, early evidence indicates that social mobility may have decreased alongside recent rising inequality (Beller 2009; Mitnik, Cumberworth, and Grusky 2012). Children born into humble beginnings are likely to remain there throughout their lives.

Child health is a barometer of life chances, as it is a key aspect of wellbeing in its own right and a determinant of later life outcomes (Haas 2006; Palloni 2006). Moreover, child health is partly a product of a family's economic resources. Children of richer parents enjoy better health than those from humbler origins: a well-established "income gradient" in child health demonstrates that a percentage increase in income is associated with higher birth weight, better general health status, and lower prevalence of specific conditions (Brooks-Gunn and Duncan 1997; Case, Lubotsky, and Paxson 2002; Currie 2009).[1] The health protectiveness of income is non-linear across the economic spectrum, with diminished returns at higher levels of income and a pronounced income effect on the health of poorer children (Evans, Wolfe, and Adler 2012). Though a sizeable literature generally examines the income gradient in child health cross-sectionally (e.g. Case et al. 2002) or within one cohort (e.g., Fletcher and Wolfe 2013), the magnitude of the gradient may not be fixed; it may have changed with shifts in social inequality.

That is, changes in family structure and parent-child dynamics may have strengthened the association between family income and offspring health. I list a selection of these family trends and their

[1] Conversely, a child's health status may affect parental ability to work and, therefore, negatively affect family income. However, this reverse process does not account for the entirety of the income-child health association. See Case and Paxson 2006 for an overview of this possibility.

hypothesized effect on the income gradient in child health in Table 1. Increases in maternal age, for example, have disproportionately occurred among socioeconomically advantaged women (McLanahan 2004), and older maternal age promotes child health and wellbeing (Hofferth 1987; Lopez Turley 2003; Rosa, Fitzgerald, and Carlson 1982). Importantly, not all changing family characteristics are expected to operate in the same direction; narrowing disparities have the potential to offset the inequality-widening consequences of widening disparities in family formation. The expansion of access to health services (Currie, Decker and Lin 2008), general public health improvements (Cutler and Miller 2004) and a disproportionate increase in educational attainment for poorer women (Duncan et al. 2013) are two forces that may have offset rising inequalities.

There is evidence of change in other socioeconomic gradients in adults (Pappas et al. 1993), with strengthening associations between individuals' income and their own health. Few studies, however, have examined how trends in the changing income gradient in child health (see Currie, Decker, and Lin 2008 for an exception). This gap in the literature falls at a critical juncture for highlighting implications of macrosocial inequality trends for children's life chances and the durability of the mechanisms that link parental economic circumstance to child health.

In light of this important gap and mixed suggestive evidence, analyses use data from the National Health Interview Surveys (NHIS) to investigate whether the relationship between family income and child health has evolved across recent birth cohorts in light of these competing possibilities. I pay particular attention to age patterns over time as the potential strengthening of the income gradient over childhood has been the focus of substantial debate (e.g., Allin and Stable 2012; Chen et al. 2006; Currie and Stable 2003). Additionally, I measure how a number of evolving family patterns have the potential to account for the trends I observe.

Data and Methods

Data are drawn from the 1982-2012 waves of the National Health Interview Survey (NHIS). These data include children born between 1965 and 2012, permitting an examination of a wide range of cohorts at different ages across childhood. The NHIS is an annual cross-sectional snapshot of the health of the United States population. The survey samples households and asks detailed questions about the health of all members of the household, providing a representative snapshot of the non-institutionalized adult population, including that of children 0-16 years of age. A knowledgeable adult, generally a child's parent, provides health and demographic information for minors living in the household (National Center for Health Statistics 2012). Additional information about NHIS design and questionnaires can be found elsewhere (National Center for Health Statistics 2012).

Key variables

Health. My primary dependent variable is the child's subjective health status. Parents (generally mothers) report their child's general health status (1= "poor," …, 5= "excellent"). Although imperfect, parental reports of subjective health status provide a more conservative assessment of health status than self- and teacher-reported measures, as parents tend to rate their child's health lower than the child him/herself (Johnson et al. 2010).

A subjective measure of child health has two advantages. First, as a global measure of wellbeing, it is likely less sensitive to changes in morbidity and diagnosis patterns. Second, subjective health is measured fairly consistently over the course of the study period, despite a major NHIS redesign in 1997. Although child subjective health is available prior to 1982, I do not include these earlier waves because they measure health on a four-point rather than five-point scale, rendering the measures incomparable. Third, subjective health also captures both underlying conditions as well as the parent and/or child's experience of health or illness. This property of subjective health allows more stability in the measure despite the advent of new medical treatments over the course of the twentieth century.

Income. I focus on family income as my main predictor of child health. The NHIS asks respondents to report their incomes categorically in $1,000, $5,000, or $10,000 intervals (depending on where their income falls and the survey year) with the highest level top-coded. As my research question implies a continuous measure of income and because the use of categorical income may lead to spurious results (Case, Paxson, and Vogl 2007), I follow the precedent of prior work and convert income to a continuous measure. Alternative specifications yield substantively similar results.

I draw a group-specific mean from the Current Population Survey (CPS)[2] that corresponds to the NHIS income category to transform the categorical income measure into a continuous measure. That is, for each NHIS income category, I calculate the mean family income for the CPS household head who matches the NHIS reference person in terms of education (less than high school, high school diploma, some college, and bachelor's degree or higher), sex (in line with Case et al. (2012), I use the male if both the reference person and spouse reported income), and year (1982, …, 2012). The constructed income measure maps fairly closely on annual CPS estimates of family income. This correction is in line with Case, Lubotsky, and Paxson (2002) and Currie, Decker and Lin (2008), which allows my results to be compared to prior income gradient research that also draws data from the NHIS.

Analytic Strategy

I stratify the sample by age, given the strong evidence concerning an increasing effect of parental socioeconomic status on health (Case, Lubotsky, and Paxson 2002) but decreasing development gradient

[2] I use data from the Integrated Public Use Microdata Series Current Population Survey (IPUMS-CPS)., These files have been partially harmonized by staff at the University of Minnesota Population Center. Assumptions concerning harmonization can be found on the IPUMS-CPS website (https://cps.ipums.org).

(Kalil, Corey, and Ryan 2012) over childhood. I break the sample into the following age groups categories: 0–3 years, 4–8 years, 9–12 years, and 13–16 years. These age categories roughly correspond to key developmental points as well as critical schooling and human capital acquisition ages. Consistent with a life course perspective (Elder, Johnson and Crosnoe 2003), the timing of these health shocks relative to school entry may have lingering consequences throughout the child's lifetime (Jackson 2010). Additionally, there is evidence that income is increasingly linked to children's health as they age (Case, Lubotsky, and Paxson 2002; Currie and Stable 2006; Case, Lee, and Paxson 2008). As not all cohorts are observed at the same ages, age-stratified analyses help to tease apart some age trends from cohort trends.

To estimate trends, I use a number of estimation strategies. To get an overall sense of patterns, I first regress child subjective health on (logged) parental income with only the basic child controls *separately* for each cohort. This produces a unique coefficient for each age band (0-3 years,...,13-16 years) for each birth cohort (1965, …, 1982). Although a considerable amount of work estimates the income gradient in child health via ordered logistic regression, these initial models are estimated via ordinary least squares (OLS) regression. Ordinal logistic models yield substantively similar estimates, but are not presented as (i) a Brant test indicates that the proportional odds assumption underlying order logistic models is violated, and (ii) the coefficients are more directly comparable across models, as logistic coefficients depend on the degree of residual variation in models (Allison 1999; Mood 2010).

I then test these trends more directly. First, I estimate mixed effects models in which intercepts and income slopes can vary across birth cohorts. I add family characteristics (see the list in Table 1) to the model to examine if a range of changing family characteristics that have strengthened or narrowed disparities across the income distribution can account for observed patterns. Finally, as a robustness check, I adopt a strategy similar to Lynch (2006) that views individuals as falling into a cohort-by-period context. This modeling approach allows me to account for age and cohort processes simultaneously.

Preliminary Results

Preliminary results indicate the association between family income and child health. Figure 1 illustrates the results from the age-stratified cohort-specific regressions of subjective health on logged family income and a range of child-level control variables. The figure plots income coefficients from separate regressions of child subjective health on (logged) income and controls within each cohort. As noted above, higher levels of subjective health correspond to better health. Each of the age-specific loess-smoothed lines indicate that family income has generally become a weaker predictor of children's health over successive birth cohorts.

Substantial variation, however, underlies this broader pattern. Income's association with health remained fairly stable (or slightly strengthened) for the youngest children (aged 0-3 years) until mid-1990s, when it rapidly dropped. This shift roughly coincides with welfare reform and the introduction of

state children's health insurance programs (SCHIP). Across the cohorts examined, the income gradient nearly halved. That is, for children born in the most recent years, each percentage change parental income is only as half as health-protective compared to those born in the early 1980s. Children beginning their schooling (aged 4-8) also see a decline in the relative importance of income for their health, but this decide is stronger across older cohorts; the most recent cohorts only experience a weak decline in the relative importance of income for health.

A different basic pattern emerges for older children. At ages 9-12, children belonging to older cohorts experienced a rapid decrease in the importance of income for their health that leveled off around 1980 before weakening again for those born between the mid-1980s and early 1990s (before leveling off again). Across birth cohorts, adolescents (13-16 years old) faced a fairly consistent decrease in the income gradient with declines of varying intensity that slowed down and potentially reversed for children born around 1990 or later. In addition to highlighting that within-ages the income gradients evolved over birth cohorts, there is some evidence of changing patterns across ages as well. Across cohorts, the magnitude of difference narrowed.

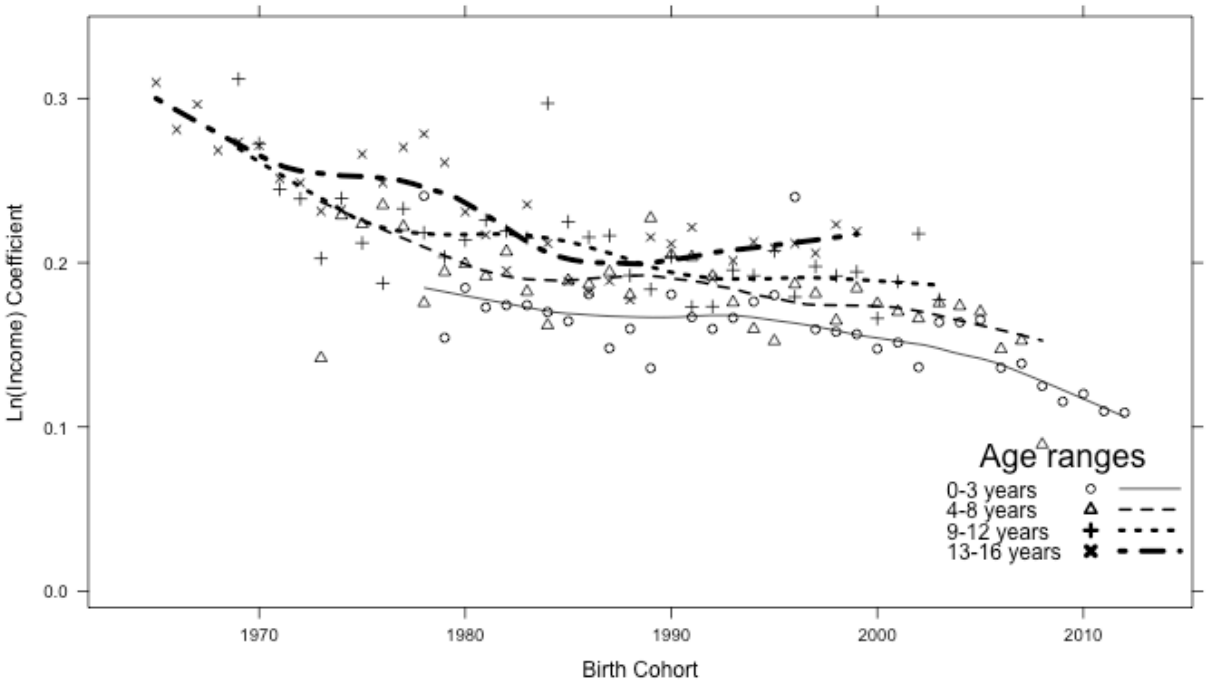
Although these trends are only suggestive, they indicate that the income gradient halves across the half century examined: For children born in the most recent years, each percentage change parental income is only as half as health-protective compared to those born in the 1960s. This pattern reveals that macrosocial patterns may have countervailing microsocial implications, especially in light of advances in nutrition, health access for the most vulnerable members of society, and other enacted policies. Taken together, these analyses illuminate changing influences on child wellbeing over the last fifty years.

TABLES AND FIGURES

Table 1. Family-level changes and their hypothesized effect on the association between family income and child subjective health

Change	Disparities across income distribution widened or narrowed?	Implication for income gradient
Empirically testable in present analysis:		
Marital patterns		
Increase in divorce and non-marital arrangements	Widened; disproportionate gains among lower income families	Increased gradient
Educational assortative mating	Widened; human, social, and cultural capital increasingly concentrated	Increased gradient
Increased parental age	Widened; disproportionate increases in parental age among richer families	Increased gradient
Increased access to health insurance	Narrowed; reduced disparities in access to health care	Decreased gradient
Increased female educational attainment	Narrowed; greater gains in educational attainment among lower income women decreased disparities	Decreased gradient
Increased women's (dual parent) workforce participation	Mixed; gains occurred at both ends of the economic spectrum	Unknown
Increased prevalence of multiracial families	Unknown; mixed evidence on trends racial trends in child health	Unknown
Not empirically testable in present analysis*:*		
Increased parent-child interactions	Widened; disproportionate gain among advantaged families	Increased gradient
Increased child-oriented spending	Widened; larger absolute and relative increases for richer families	Increased gradient
Rising health care costs	Widened; economic resources now important for providing health care access	Increased gradient
Rising income-based residential segregation	Widened; increasing disparity in exposure to neighborhood risk factors	Increased gradient
Welfare reform	Mixed; some policies have benefited low income children, while others have deepened risks of poverty	Unknown
Other social programs	Narrowed; nutritional supplemental programs have provided increased food security	Decreased gradient
Birthweight	Narrowed; evidence that socioeconomic disparities in birthweight narrowed	Decreased gradient

Figure 1. Loess-smoothed trends in the income gradient from within-cohort regressions



Note: Ln(income) coefficients derived from age-specific within-cohort regressions of child subjective health (1-5) on logged income, sex, race/ethnicity, region, and family size
Data: 1982-2012 National Health Interview Study (NHIS)