

## **The Intragenerational Dynamics of Health and Skill Development**

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Using data from the United Kingdom, I propose to investigate how the relationship between child health and skill development, both cognitive and non-cognitive, evolves over the early life course. Although a strong relationship has been uncovered between health during childhood and educational attainment during adulthood, existing research on the social consequences of poor health rarely offers a longitudinal window into children's lives. As a result it cannot reveal when and how children's health influences their participation and success in social institutions. I use rich longitudinal data to examine the intragenerational dynamics of health and skill development. Specifically, I examine whether and how changes in children's health are related to changes in cognitive and non-cognitive achievement. A key goal is to account for the reality that health is not static: studying movement in and out of compromised health during the schooling process, as well as the frequency and severity of health problems, affords a more thorough understanding of when and how health matters.

### **Reciprocal Relationships between Health and Socioeconomic Attainment**

Children's environments are strongly linked to their social and economic success as adolescents and adults (Heckman 2006; Shonkoff and Phillips 2000). There are long-lasting consequences associated with the quality of children's socioeconomic environments (Hayward and Gorman 2004; Hobcraft 2004), family settings (McLanahan and Sandefur 1994), and local contexts, especially neighborhoods and schools (Cunha et al. 2006; Sampson et al. 2008). These consequences span a troubling array of social problems, including joblessness, crime, poor health, lack of education and teen pregnancy. Disparities in skill development, both cognitive and non-cognitive, have received substantial attention as the primary channel through which negative environments adversely impact social, physical and economic success during adulthood (Farkas 2003; Heckman 2008). Children who live in disadvantaged environments are

less likely to enter school adequately prepared (Carneiro and Heckman 2003); these students in turn remain less likely to demonstrate strong performance and attain educational credentials.

Attention to the short and long-term consequences of children's socioeconomic and family circumstances remains essential, given their role as the primary social units in children's lives. Recent evidence, however, points to the far-reaching consequences of another circumstance, one that is partly a product of children's social and economic environments: their health. Early-life health, whether measured physically or psychologically, is an important contributor to future mortality (Bengtsson and Lindstrom 2003), educational achievement and attainment (Conley and Bennett 2000; Jackson 2009a), and earnings and labor force participation (Currie and Stabile 2006). Research on the social and economic consequences of poor health is complicated by the fact that health is not a permanent state. Despite the reality that children's experiences vary and exert their influence cumulatively over time, childhood is often represented as a static period. Researchers studying the consequences of early-life health most often empirically define "childhood" as the period during infancy or at one point in adolescence. These characterizations establish useful relationships and are sometimes the only possibility afforded by available data. By aggregating many developmentally important years, however, we miss the opportunity to fully understand when, how and for whom early-life health matters.

Research that does consider the early life course in its entirety highlights the importance of a longitudinal consideration. Case et al. (2005), for example, find that health during both infancy and adolescence has lasting associations with the socioeconomic status of a British cohort in middle age, and that the timing of a health problem in the early life course is important: having a chronic condition at age 7 is more strongly associated with educational attainment at age 16 than is having a chronic condition at age 16. Jackson (2009b) finds that children in persistently poor health face the most severe educational detriment during the schooling process and as adults; by mid-adulthood, gaps in attainment are largest between the healthiest and most persistently unhealthy children. These findings suggest that researchers

studying the effects of childhood health should consider not only the presence of health conditions, but also their frequency and severity.

## **DATA, MEASURES AND METHODOLOGY**

**Data.** I will use data from the U.K. National Child Development Study (NCDS), which provides information on the same individuals at birth, and again at ages 7, 11, 16, 23, 33, 42 and 46. The survey follows members of the cohort born in one week in 1958 and is ongoing, with the most recent wave (age 46) conducted in 2004. It began with the goal of understanding the causes and consequences of child development, and collects information on health, cognitive and social development, educational progress, income, and family relationships. NCDS data have been used extensively to study the transition to adulthood (Case et al. 2005; Cherlin et al. 1991; Schoon et al. 2002).

**Measures.** These data are quite valuable for the questions considered in this article, in that they permit examination of health during the entirety of childhood, as well as examination of its consequences throughout childhood, during the transition to adulthood and into mid-adulthood.

*Health.* Given my focus on how changes in health lead to changes in skill development, my primary measures of health will be during the school-age years. I will create age-specific measures of health status by aggregating specific conditions.<sup>1</sup> Measures will indicate whether a physician diagnosed the child as having any *physical or mental/emotional* health problem at age 7, 11 or 16. The measures will further account for the persistence of poor health; at each age children with health problems as multiple ages will be distinguished (birth/early childhood and age 7; ages 7 and 11).

*Skill Development.* I focus on cognitive and non-cognitive skill development, given the demonstrated importance of disparities in skill development in explaining relationships between early-life

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<sup>1</sup> Physical and mental conditions are diagnosed during a medical exam and reflect a slight, moderate or severe condition that impedes normal functioning (versus no condition). Physical health conditions include genetic conditions, physical abnormalities (e.g., spinal or limb disfiguration) and systemic abnormalities (e.g., heart or blood conditions). Mental health conditions include mental retardation, emotional and behavioral problems. In the NCDS, 3% of children had a physician-diagnosed health condition at only age 7. This number gradually increases over the course of childhood, to 4% at only age 11 (5% who also had a limitation at age 7), and 10% at age 16. 1% of children had a health limitation throughout the entirety of childhood.

health and socioeconomic attainment. Health, determined in part by social background, may play a role in “deflecting” people onto particular paths of cognitive development, independent of their social background. First, I examine measures of children’s *cognitive performance* at each observed age in the schooling process: 7, 11, and 16. At each age, the NCDS administers standardized assessments of reading and mathematics achievement. Scores will be converted to  $z$ -scores to measure children’s performance relative to the sample mean at each age. Secondly, I examine measure of *non-cognitive skill*, which are known to be correlated with socioeconomic attainment (see Farkas 2003). Few studies have examined the relationship between children’s health and non-cognitive skill development. Measures of non-cognitive skill will include children’s degree of conscientious work habits, as measured by their organization, discipline and attendance in school, as well as children’s disruptiveness in school (following Farkas 2003).

I will also include a rich set of measures of children’s family and socioeconomic environments throughout childhood, to capture factors correlated with both children’s health and skill development.

**Analytic Plan.** My focus will be on how changes in children’s health status relate to changes in their cognitive and non-cognitive skill development. To examine this question I will use two methods. First, I will estimate the relationship between changes in children’s health status and changes in skill using latent growth curve techniques. Growth curve models provide the advantage of modeling not only cross-sectional variation in an outcome, but also variation in its growth or decline over time, within the same individuals (Bollen and Curran 2006). An unconditional model estimates an individual-specific ( $i$ ) and time-specific ( $t$ ) trajectory of skill (measured continuously), ( $y$ ), as a function of an individual-specific intercept ( $\alpha$ ), and individual and time-specific slopes ( $\beta$ ) and errors ( $\varepsilon$ ).  $\lambda$  is a constant:

$$y_{it} = \alpha_i + \lambda_t \beta_i + \varepsilon_{it}$$

The second level of the growth model allows children’s skill trajectories to vary as a function of not only time, but of covariates that vary across, but not within, individuals. This amounts to equations for the random intercepts and slopes:

$$\alpha_i = \alpha_0 + \alpha_1 x_{1i} + \alpha_2 x_{2i} + \dots + \alpha_k x_{ki} + u_i$$

$$\beta_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \dots + \beta_k x_{ki} + v_i$$

where  $x_1$  through  $x_k$  are time-invariant measures (e.g., race/ethnicity, sex) that predict group differences in starting points ( $\alpha$ ) and the growth factor ( $\beta$ ).  $u_i$  and  $v_i$  are individual error terms.

Latent growth curve techniques will provide an estimate of how health and skill development co-evolve. They are still subject to bias from unobserved heterogeneity, however; differences in skill development may reflect not only differences in health, but also in the quality of parents' health-related behaviors around their children. Although I am able to measure many characteristics of children's home environments, some important unobserved differences between children will remain. As a supplement to the latent growth curve analysis I will estimate models with individual fixed effects to ask: net of unobserved, time-invariant differences between children, do changes in health predict changes in cognitive and non-cognitive skill?

$$\log\left[\frac{p_{ih}}{1-p_{ih}}\right] = \beta_0 + \beta_1 X_{ih} + \mu_i$$

where  $X_{ih}$  is a vector of child-specific observed characteristics (including health) that vary over time, and  $\mu_i$  is a individual-specific fixed effect. This modeling strategy will control for the linear and additive effect of factors that do not vary within children, even if they are not observed in the data.

## OVERALL CONTRIBUTIONS

Using nationally representative, longitudinal data, I examine the extent to which inequalities in skill development during the early life course are not only produced in part by inequalities in health, but also change along with changes in health status. This research will deepen our understanding of the negative social consequences of child health.

## REFERENCES

- Bengtsson, Tommy and Martin Lindstrom. 2003. "Airborne Infectious Diseases during Infancy and Mortality in Later Life in Southern Sweden, 1766-1894." *International Journal of Epidemiology* 32:286-94.
- Bollen, Kenneth A. and Patrick J. Curran. 2006. *Latent Curve Models: A Structural Equation Perspective*. Hoboken, N.J.: John Wiley and Sons, Inc.
- Carneiro, Pedro and James J. Heckman. 2003. "Human Capital Policy." Pp. 77-237 in *Normal 0 Inequality in America: What Role for Human Capital Policies?* edited by James J. Heckman, Alan B. Krueger and Benjamin M. Friedman. Cambridge: MIT Press.
- Case, Anne, Angela Fertig and Christina Paxson. 2005. "The Lasting Impact of Childhood Health and Circumstance." *Journal of Health Economics*, 24:365-89.
- Cherlin, AJ, FF Furstenberg Jr, L. Chase-Lansdale, KE Kiernan, PK Robins, DR Morrison and JO Teitler. 1991. "Longitudinal Studies of Effects of Divorce on Children in Great Britain and the United States." *Science* 252:1386-9.
- Conley, Dalton and Neil G. Bennett. 2000. "Is Biology Destiny? Birth Weight and Life Chances." *American Sociological Review* 65:458-67.
- Cunha, Flavio, James J. Heckman, Lance Lochner and Dimitry V. Masterov. 2006. "Interpreting the Evidence on Life Cycle Skill Formation." Pp. 697-812 in *Handbook of the Economics of Education*, vol. Volume 1, edited by Erik A. Hanushek and F. Welch. Amsterdam: North-Holland.
- Currie, Janet and Mark Stabile. 2006. "Child Mental Health and Human Capital Accumulation: The Case of ADHD." *Journal of Health Economics*, 25:1094-118.

- Farkas, George. 2003. "Cognitive Skills and Non-Cognitive Traits and Behaviors in Stratification Processes." *Annual Review of Sociology* 29:541-62.
- Hayward, Mark D. and Bridget K. Gorman. 2004. "The Long Arm of Childhood: The Influence of Early-Life Social Conditions on Men's Mortality." *Demography* 41:87-107.
- Heckman, James J. 2006. "Skill Formation and the Economics of Investing in Disadvantaged Children." *Science* 312:1900-2.
- 2008. "Schools, Skills and Synapses." *Economic Inquiry* 46:289-324.
- Hobcraft, John N. 2004. "Parental, Childhood, and Early Adult Legacies in the Emergence of Adult Social Exclusion: Evidence on what Matters from a British Cohort." Pp. 63-92 in *Human Development Across Lives and Generations: The Potential for Change*, edited by P. L. Chase-Lansdale, Kathleen Kiernan and Ruth J. Friedman. New York: Cambridge University Press.
- Jackson, Margot I. 2009a. "Understanding Links between Adolescent Health and Educational Attainment." *Demography* 46(4).
- 2009b. "Children's Health, Academic Experiences and Qualifications in Adulthood: The Case of Great Britain." *Working Paper*.
- McLanahan, Sara and Gary Sandefur. 1994. *Growing Up with a Single Parent: What Hurts, what Helps*. Cambridge: Harvard University Press.
- Sampson, Robert J., Patrick Sharkey and Stephen W. Raudenbush. 2008. "Durable Effects of Concentrated Disadvantage on Verbal Ability among African-American Children." *Proceedings of the National Academy of Sciences* 105:845-52.

Schoon, Ingrid, John Bynner, Heather Joshi, Samantha Parsons, Richard D. Wiggins and Amanda

Sacker. 2002. "The Influence of Context, Timing, and Duration of Risk Experiences for the Passage from Childhood to Midadulthood." *Child Development* 73:1486-504.

Shonkoff, Jack P. and Deborah A. Phillips. 2000. *From Neurons to Neighborhoods: The Science of Early Childhood Development*. Washington, D.C.: National Academy Press.