

Healthy, Wealthy, and Wise?: The Relationship Between Child Health and Human Capital Development

Janet Currie
Columbia University and NBER

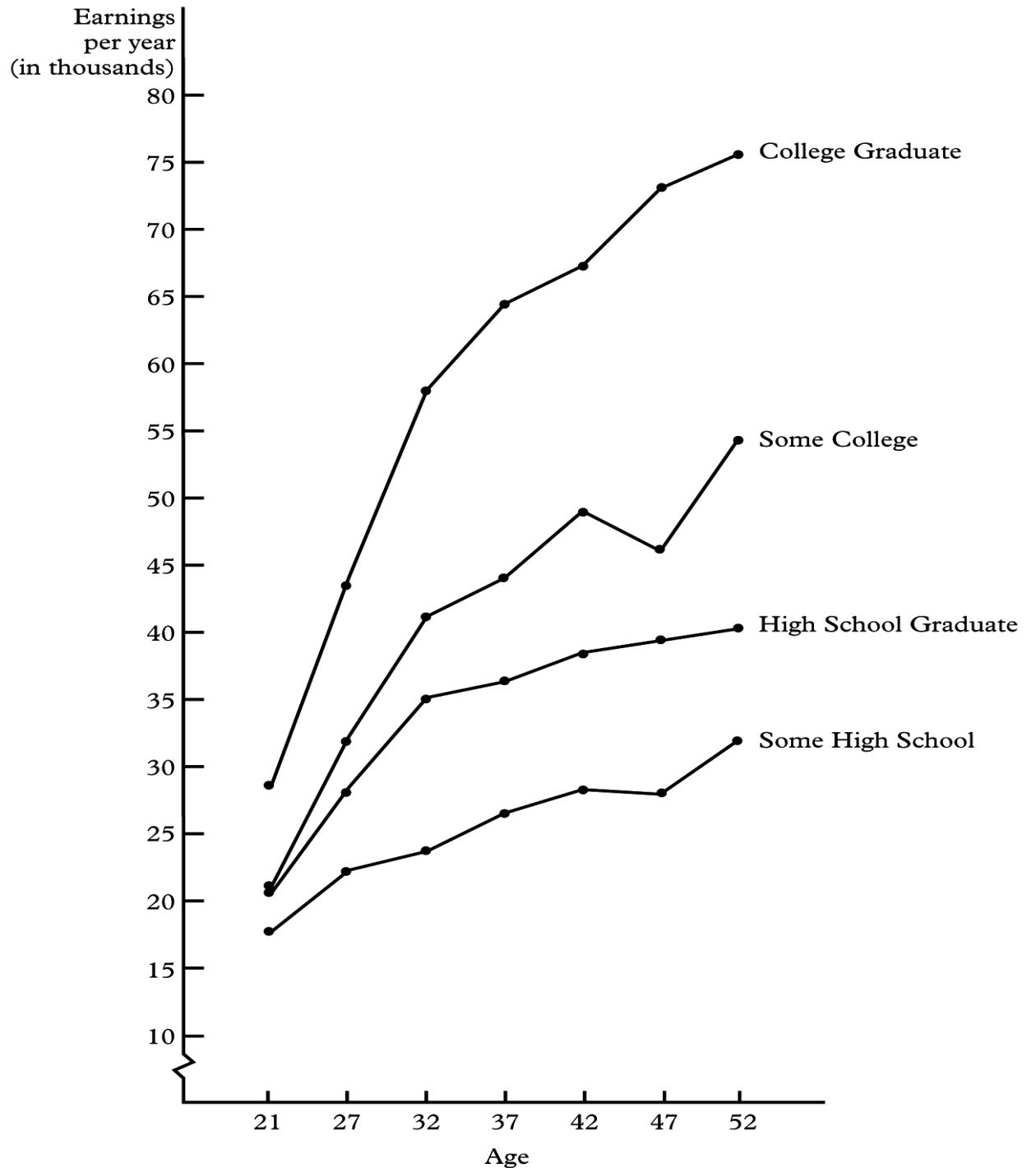
The phrase “human capital” often means “education.”

- Following Becker and Mincer, education is viewed as a form of capital because investments in education lead to increases in productivity and in wages.

- Empirically, the relationship between education and wages is one of the most robust and stable findings in all of economics.

Earnings, Full-Time, Year-Round Male Workers, 1999

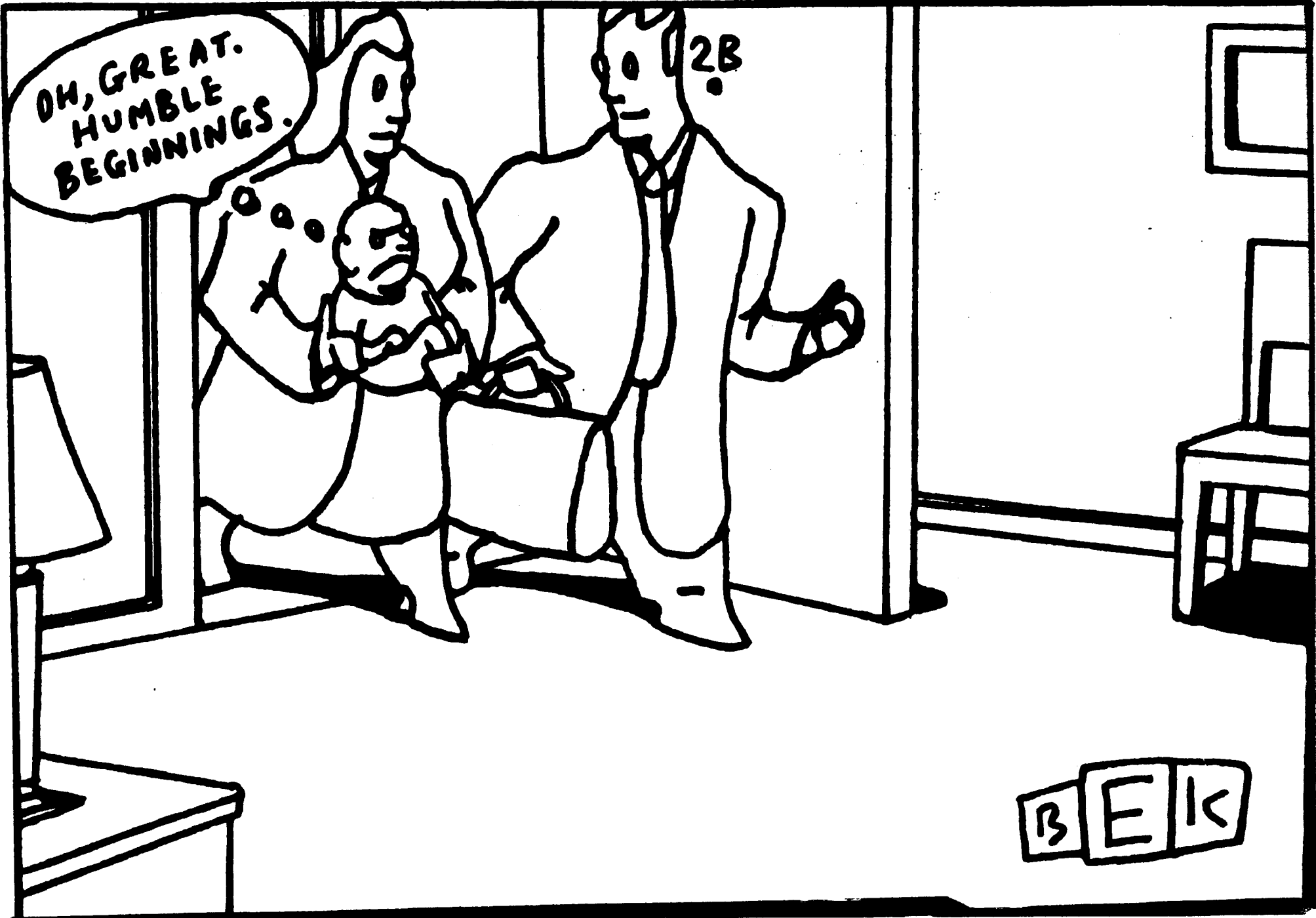
Source: Ehrenberg and Smith



But what determines Human Capital?

Family background!

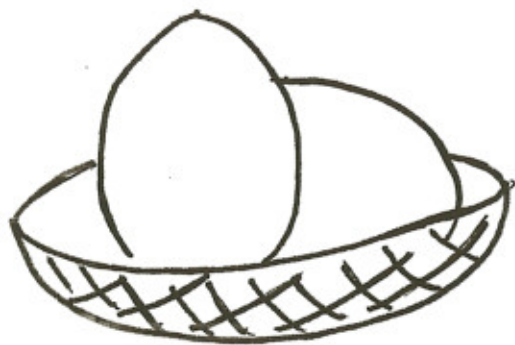
And human capital of parents is one of the most important determinants of family background.



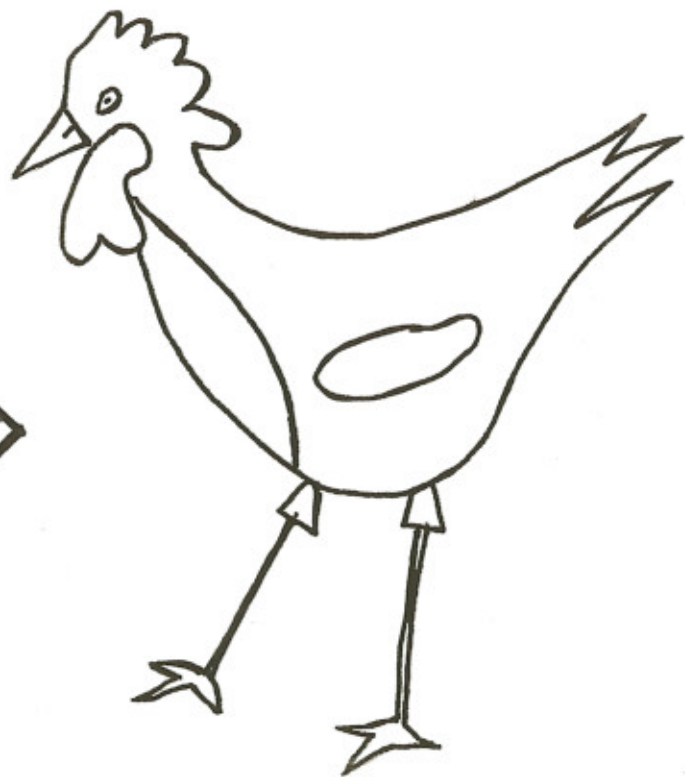
OH, GREAT.
HUMBLE
BEGINNINGS.

?

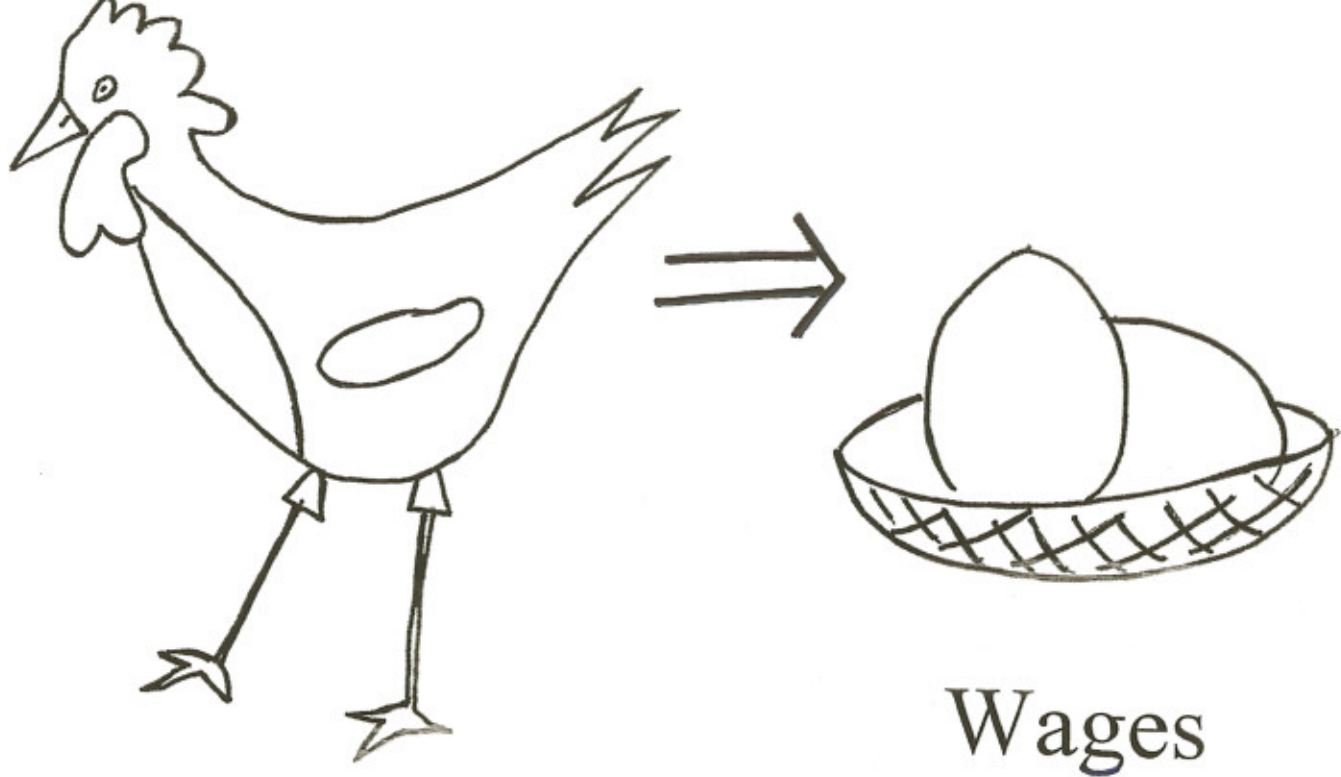
B E K



Wages



Human Capital



Human Capital

Wages

What Are the Mechanisms?

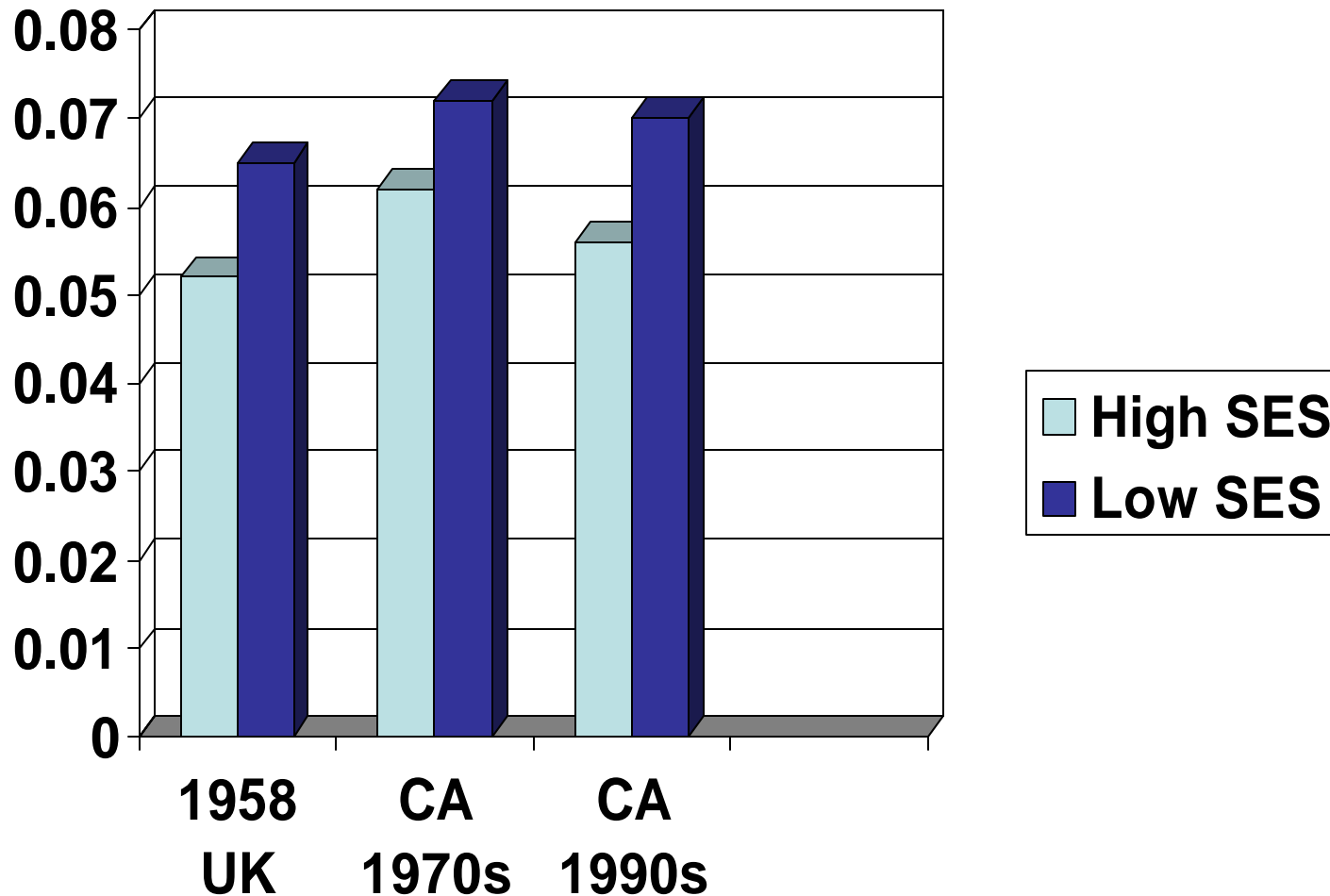
- intervention to reduce the transmission of poverty from one generation to the next requires an answer.
- to what extent are deficits in the health of parents and children responsible for patterns of human capital accumulation?

Parent Education and Income and Child Health

- Differences in child health are apparent at birth.
- e.g. in rate of low birth weight (birth weight less than 2500 grams).
- And initial differences in health grow over time.

SES Difference in Low Birth Weight

Note: In CA SES=zip income at birth, in UK SES defined using Father occupation.



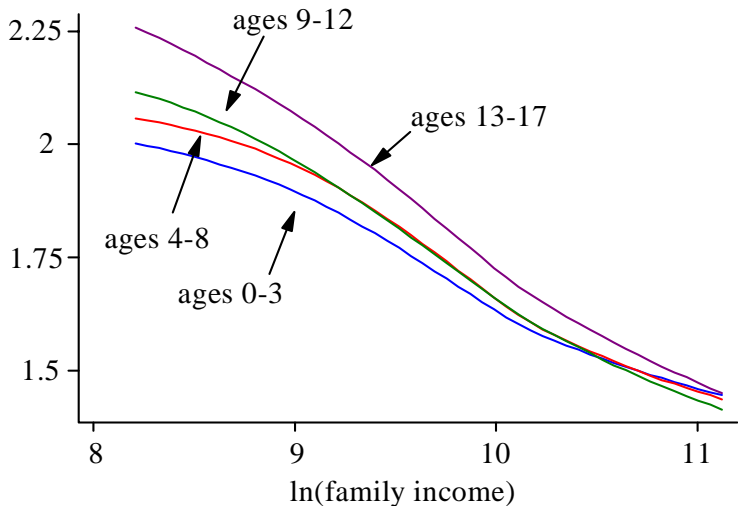
Child health on family income

1=excellent, 5=poor

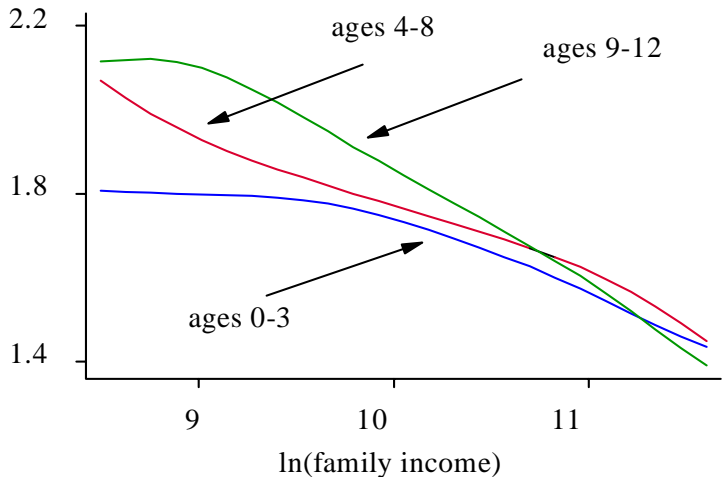
U.S. National Health Interview Survey

Source=Case, Lubotsky, Paxson (2003)

NHIS

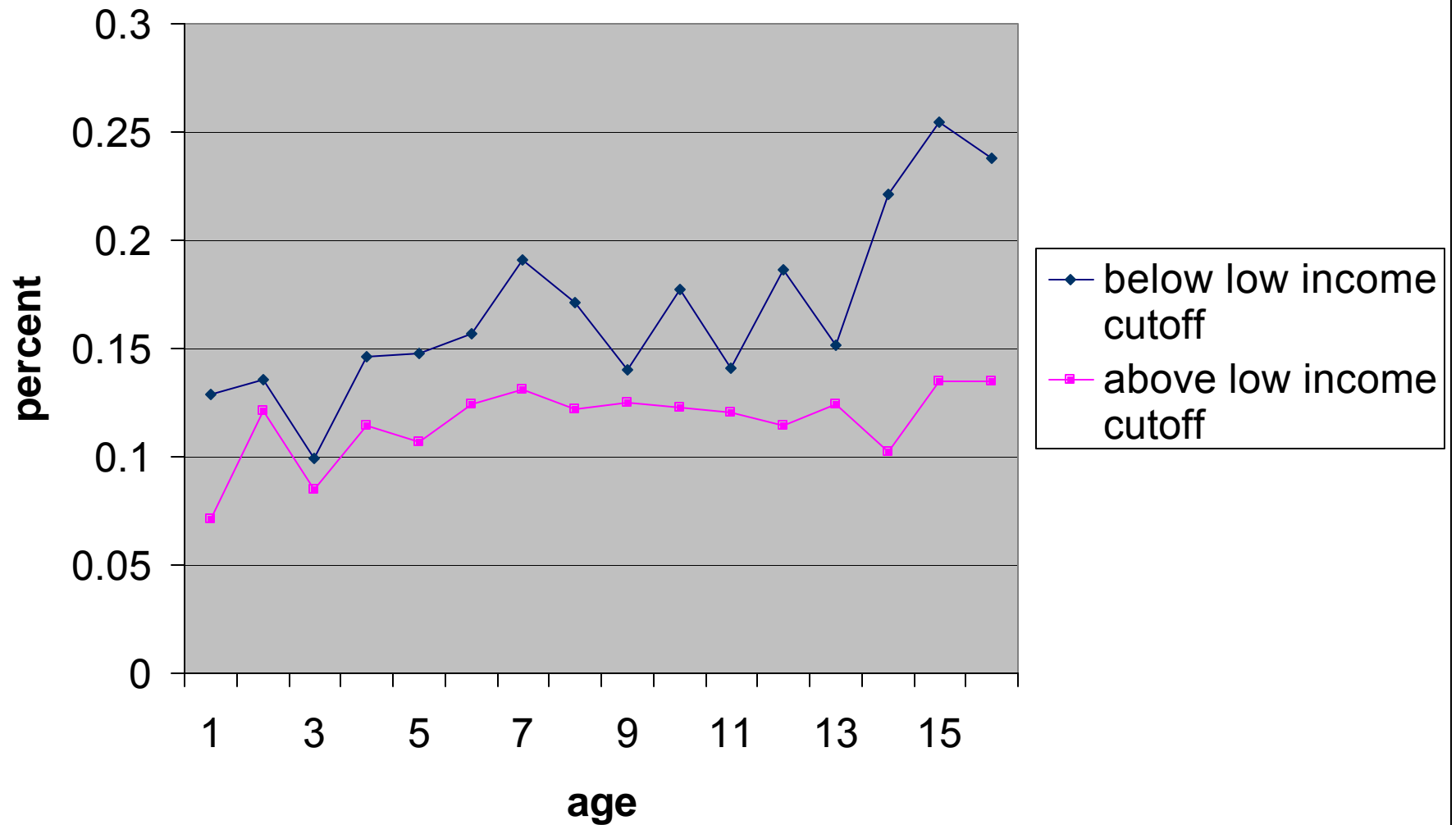


PSID



Source: Case, Lubotsky, Paxson (2003)

NLSCY (Canada): Poor Health by SES



The Steepening of the Health-Income Gradient with Child Age
A Comparison of Canada and the U.S., Health Status Ordered Probits
 (1=excellent, 5=poor)

	Age: 0 to 3	4 to 8	9 to 12	13 to 17
U.S.: Case, Lubotsky, Paxson (2003)				
In(Income)	-0.183	-0.244	-0.286	-0.323
	[.008]	[.008]	[.008]	[.008]
Canada: NLSCY (2003)				
In(Income)	-0.151	-0.216	-0.259	-0.272
	[.026]	[.019]	[.024]	[.040]

Notes: Standard errors in parentheses. Regressions for NLSCY also include: year effects, ln(fam size), age dummies, sex, mom age at birth, father present, etc.

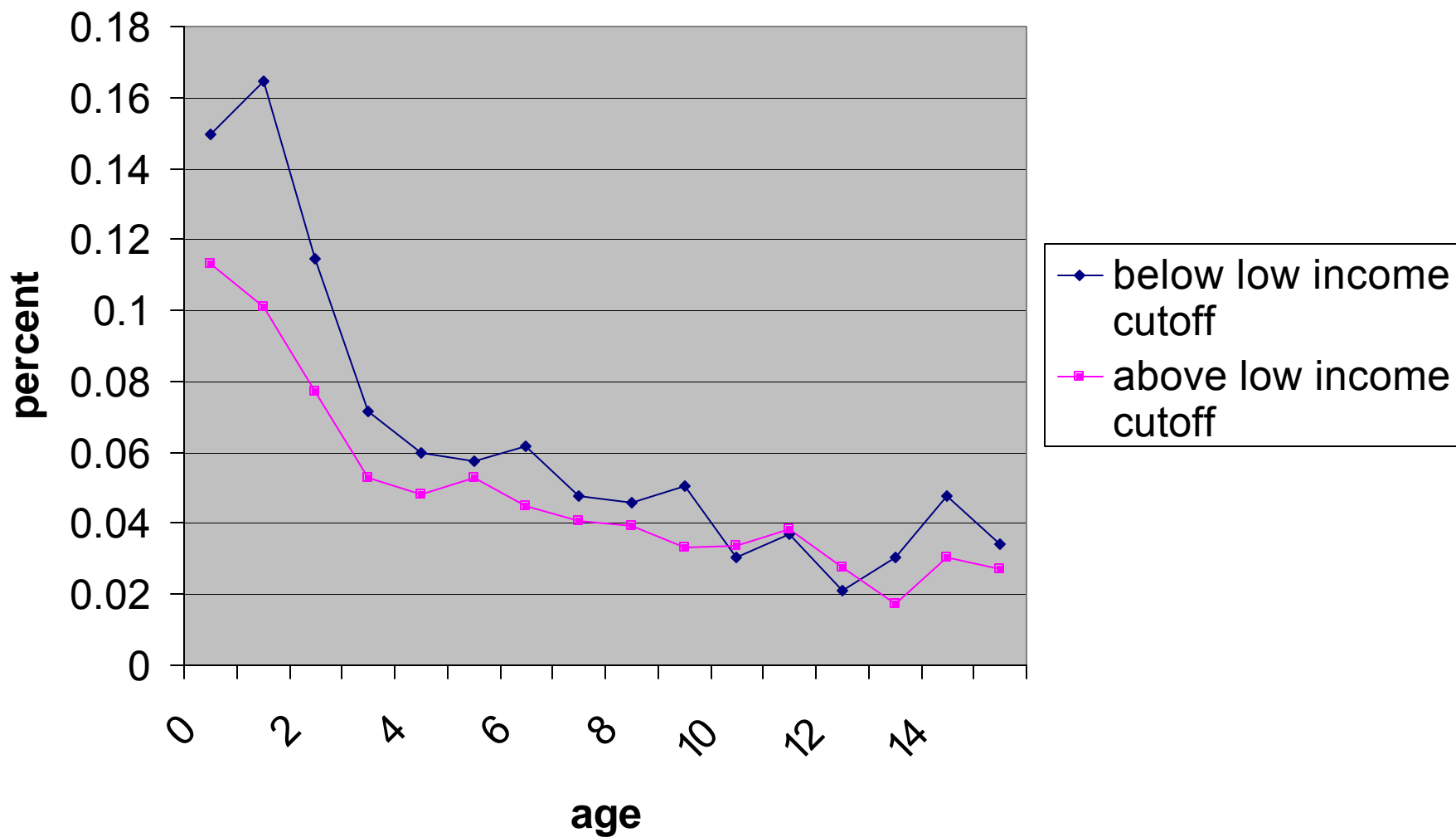
Source: Currie and Stabile (2003).

The similarities between Canada and the U.S. suggest that access to health insurance is NOT the driver for the steepening gradient.

In Canada, rich and poor children recover from any given diagnosis to about the same extent after four years.

The problem is that poor children are subject to more negative health events.

NLSCY (Canada): Hospitalizations by SES



The data on important classes of health shocks are very poor, and generally not recorded in the same surveys that track measures of SES and child outcomes.

E.g. injuries (intentional and unintentional) are the leading cause of death among children 1-14, but there is little information about accidents that do not lead to deaths, about gradients by SES (parent information is not on the death certificate), or about direct effects of educational attainments.

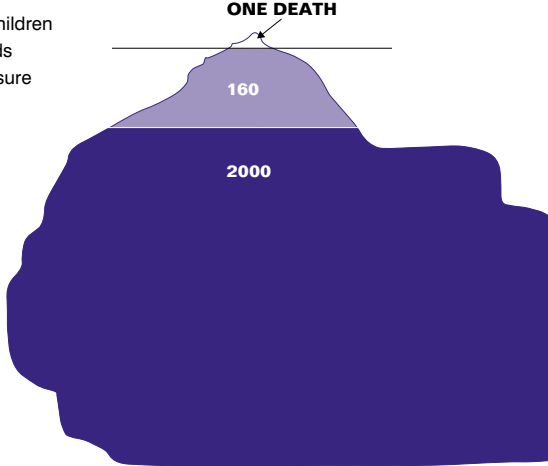
Deaths per 100,000 Due to Injuries Children 1-14, 1991-1995

	Total Death Rate	Accidents as Share of Deaths (%)	Traffic Deaths	Boys Rate	Girls Rate
Sweden	5.2	33	2.5	5.9	4.4
UK	6.1	29	2.9	7.7	4.3
Italy	6.1	28	3.3	8.1	4.1
Netherlands	6.6	30	3.4	8.3	4.8
France	9.1	41	3.8	11	7
Canada	9.7	44	4.3	11.9	7.4
U.S.	14.1	49	5.8	17.5	10.4

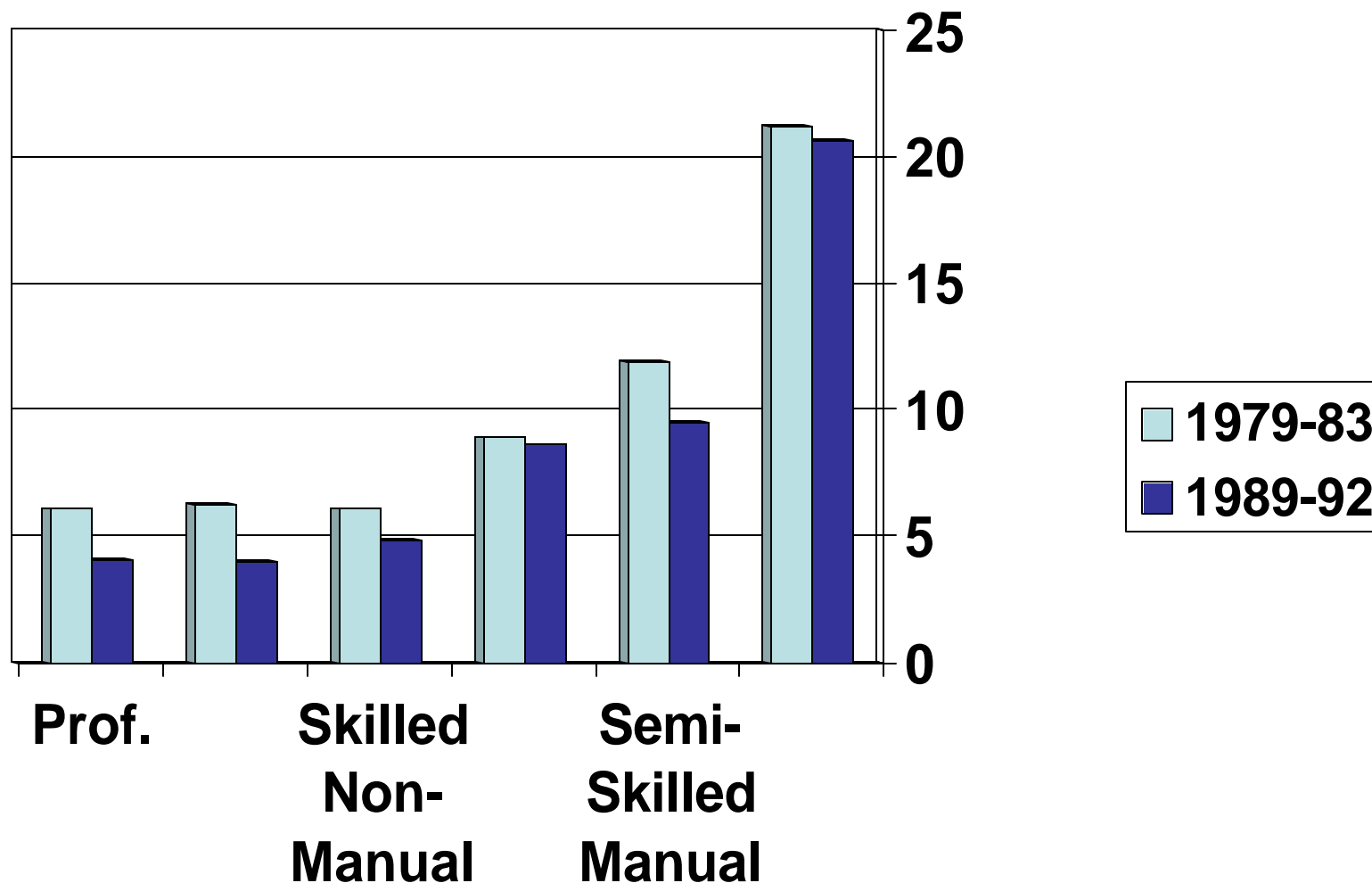
Source: Unicef, 2000.

For every one death among children aged 0 to 14 in the Netherlands during 1991-95 (home and leisure accidents) there were:

- 160 hospital admissions
- 2,000 accident and emergency department visits



Parental Occupation and Child Injury Deaths per 100,000 Children 0-15, England and Wales



Source: Unicef, 2000

Similarly, there is little data on mental health problems.

Because they strike people of working age (vs. the elderly) mental health problems account for the largest share of days lost due to health problems in the U.S. Many mental health problems have their roots in childhood.

ADHD is the most common child mental health problem. Estimated prevalence (from screeners that assess symptoms vs. diagnoses) is 6.52% among poor children compared to 3.85% among non-poor children (Cuffe et al., 2004).

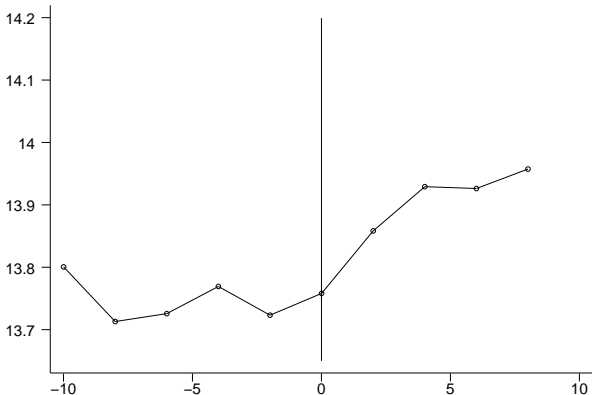
So...

Parent income and education are strongly related to child health, and the relationship strengthens as the child ages.

Can changing parental income or education affect child health?

The problem is that women with more education are likely to have many other advantages, so it is difficult to determine the causal effect of education.

Currie and Moretti (2003) document a large increase in the number of colleges between 1960 and 1980 and find that if a woman lived in a county with a college when she was 17, she was more likely to go to college.



**Avg. years education 1st time mothers 24+
Before & after opening of 4-year college**
Source: Currie and Moretti, 2003

The Effects of Mother's Education on Infant Health
Data=U.S. Vital Statistics, IV Estimates Using College Openings
as IV. Mother's 24-45 years old at time of birth.

	Coeff. Estimate	Mean of Dep. Var.
1. Low Birth Weight	-0.0098 [.0038]	0.049
2. Preterm Birth	-0.01 [.0044]	0.069
3. Prenatal Care 1st trimester	0.0234 [.0055]	0.921
4. Smoked During Pregnancy	-0.0583 [.0118]	0.078

Notes: Std. errors in brackets. Models include mother age, cohort, county*year-of-child's birth. Each row is from a separate regression.

Source: Currie and Moretti, 2003.

Note that there are some contrary findings with respect to the effects of maternal education on infant health.

- McCrary and Royer (2005) examine effects of compulsory schooling laws in TX and find little effect on child outcomes. However, it is difficult for them to untangle the effects of child age from the effects of compulsory schooling laws.

What is the Link Between Child Health and Educational Attainment?

- review evidence regarding general health measures
- review evidence regarding specific health measures

Using data from the 1999 PSID, James Smith shows that a retrospective question about health during childhood is remarkably predictive of future outcomes.

(What was your general health status when you were ≤ 16 years old? 1=excellent, 5=poor)

**Predicting Adult Education and Earnings Using Child Health.
PSID 1999, 25-47 Year Old Children of Original Respondents**

	OLS	Sib-FE	OLS	Sib-FE
	Education	Education	Ln(Earnings)	Ln(Earnings)
Health in Childhood	0.356	0.111	0.138	0.251
Excellent/Very Good	[4.40]	[1.12]	[3.07]	[3.69]
Parent's Income 1-16	0.01	...	0.002	...
	[10.7]		[4.29]	

Source: Smith (2005). Models also control for mother and father education, race/ethnicity, age, age squared.

Age 1999 squared. T-statistics in brackets. Income in \$10,000.

Several studies examine long-term effects of LBW.

e.g. Currie and Moretti (2005) examine birth records in California. Mothers are linked to their own mothers (the grandmothers). We compare the effect of LBW of the mother and income of the grandmother on the education of the mother.

Effect of Mother's Low Birth Weight and Income at Time of Own Birth on Mother's Education at Time of her Child's Birth - California

	All OLS	All - Fixed Effects	White OLS	White FE	Black OLS	Black FE
<u>Outcome=Mother's education at time of child's birth in years.</u>						
Mom's Birth SES (1000's \$)	0.017 [.001]	0.007 [.001]	0.02 [.001]	0.008 [.001]	0.011 [.001]	0.009 [.002]
Mother LBW	-0.214 [.007]	-0.097 [.008]	-0.229 [.008]	-0.092 [.009]	-0.207 [.013]	-0.114 [.016]

Notes:

Mom SES @ birth = median family income in zipcode of hospital of birth.

Mean (std.) are \$10,096 (3,254) in \$1970.

All regressions include race, year of child's birth, mother's age, and parity of the child.

Standard errors in brackets.

Source: Currie and Moretti, 2005

Effect of Mother's Low Birth Weight and Income at Time of Own Birth on Mother's Education at Time of her Child's Birth - California

	All OLS	All - Fixed Effects	White OLS	White FE	Black OLS	Black FE
<u>Outcome=Mother's education at time of child's birth in years.</u>						
Mom's Birth SES (1000's \$)	0.017 [.001]	0.007 [.001]	0.02 [.001]	0.008 [.001]	0.011 [.001]	0.009 [.002]
Mother LBW	-0.214 [.007]	-0.097 [.008]	-0.229 [.008]	-0.092 [.009]	-0.207 [.013]	-0.114 [.016]

Notes:

Mom SES @ birth = median family income in zipcode of hospital of birth.

Mean (std.) are \$10,096 (3,254) in \$1970.

All regressions include race, year of child's birth, mother's age, and parity of the child.

Standard errors in brackets.

Source: Currie and Moretti, 2005

Currie and Hyson (1999), Currie and Thomas (2001), Case, Fertig, and Paxson (2005) use data from the 1958 British Birth Cohort Study

- all children born in one week in March 1958
- followups at 7, 11, 16, 23, 33, 44
- detailed measures of family background, school quality.

Effects of Low Birth Weight on Math Scores at Age 7 (z-scores) in the 1958 British Birth Cohort Data

	Males	Females
LBW	-0.21 [.081]	-0.21 [.075]
High SES	0.078 [.033]	0.14 [.034]
Low SES	-0.016 [.033]	-0.078 [.034]

Notes:

High SES is defined as before. Low SES is semi-skilled manual or low-skilled father.

Source: Currie and Hyson (1999)

Table 1: Effect of Test Scores at Age 7 on the Probability of Writing O-levels in the 1958 British Birth Cohort (NCDS)

	English O-level	English O-level	English O-level	Math O-level	Math O-level	Math O-level
Mathematics at 7 (z score)	0.078 [.004]	0.059 [.004]	0.058 [.004]	0.099 [.005]	0.073 [.005]	0.073 [.005]
Score * Father Low SES	-0.011 [.007]	-0.01 [.006]	-0.011 [.006]	-0.009 [.008]	-0.008 [.007]	-0.011 [.007]
Score * Father High SES	0.057 [.007]	0.041 [.007]	0.042 [.007]	0.035 [.008]	0.017 [.007]	0.018 [.007]
Background up to age 7	yes	yes	yes	yes	yes	yes
School Quality 7, 11 & 16		yes	yes		yes	yes
Background at 11, 16			yes			yes

Notes:

Linear probability models, standard errors in parentheses. High SES if father was professional, supervisory, or skilled non-manual worker. Eighteen percent of all children and 35% of high SES children wrote O-levels.

Source (Currie and Thomas, 2001).

Table 2. Education and Childhood Characteristics, Men and Women

	<i>Dependent Variable:</i>			
	Total O-levels passed by age 16 (OLS)	Indicator: Passed O-level exam by age 16 (probit)		Completed Education Index (ordered probit)
		English	Math	
Ln(family income) at age 16	0.636 (0.129)	0.103 (0.025)	0.084 (0.020)	0.231 (0.063)
Indicator: moderate prenatal smoking	-0.280 (0.060)	-0.036 (0.011)	-0.044 (0.008)	-0.149 (0.029)
Indicator: heavy prenatal smoking	-0.437 (0.067)	-0.058 (0.012)	-0.064 (0.009)	-0.225 (0.033)
Indicator: variable prenatal smoking	-0.452 (0.093)	-0.088 (0.016)	-0.045 (0.013)	-0.237 (0.046)
Indicator: low birth weight	-0.464 (0.091)	-0.076 (0.016)	-0.057 (0.012)	-0.225 (0.046)
# chronic conditions, age 7	-0.310 (0.057)	-0.072 (0.015)	-0.050 (0.013)	-0.291 (0.035)
# chronic conditions, age 16	-0.184 (0.040)	-0.058 (0.010)	-0.029 (0.008)	-0.202 (0.025)
Height at age 23 (meters)	1.840 (0.329)	0.252 (0.063)	0.228 (0.051)	1.395 (0.168)

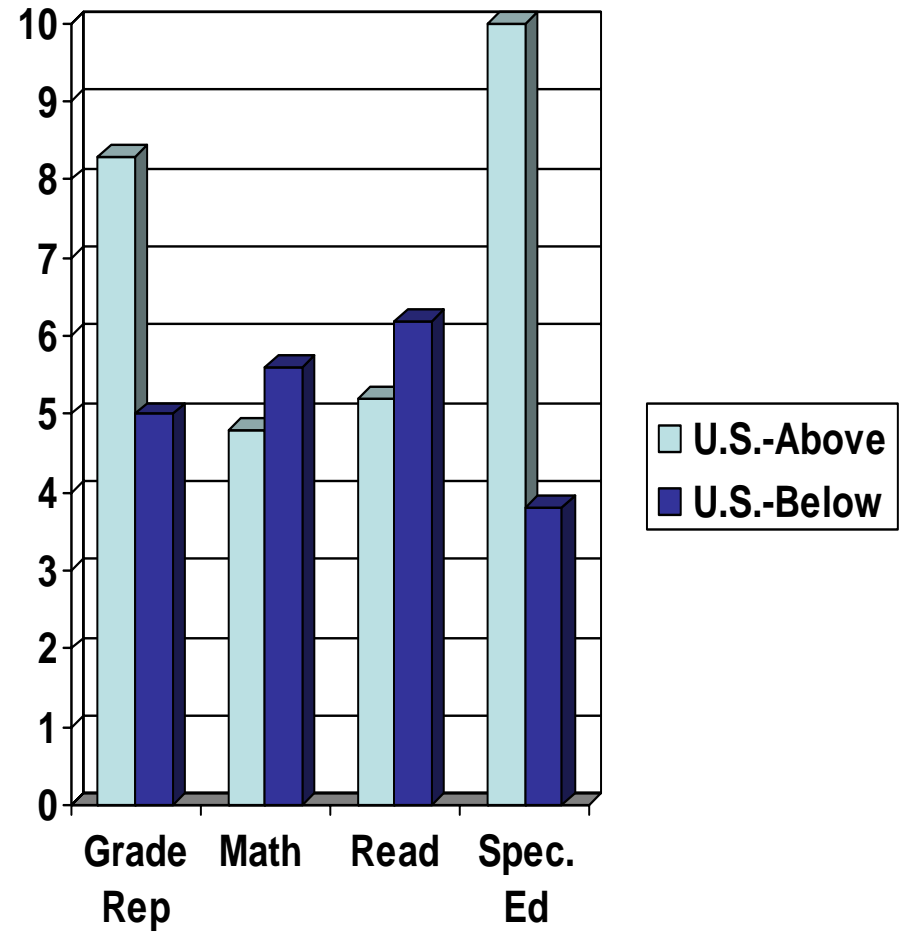
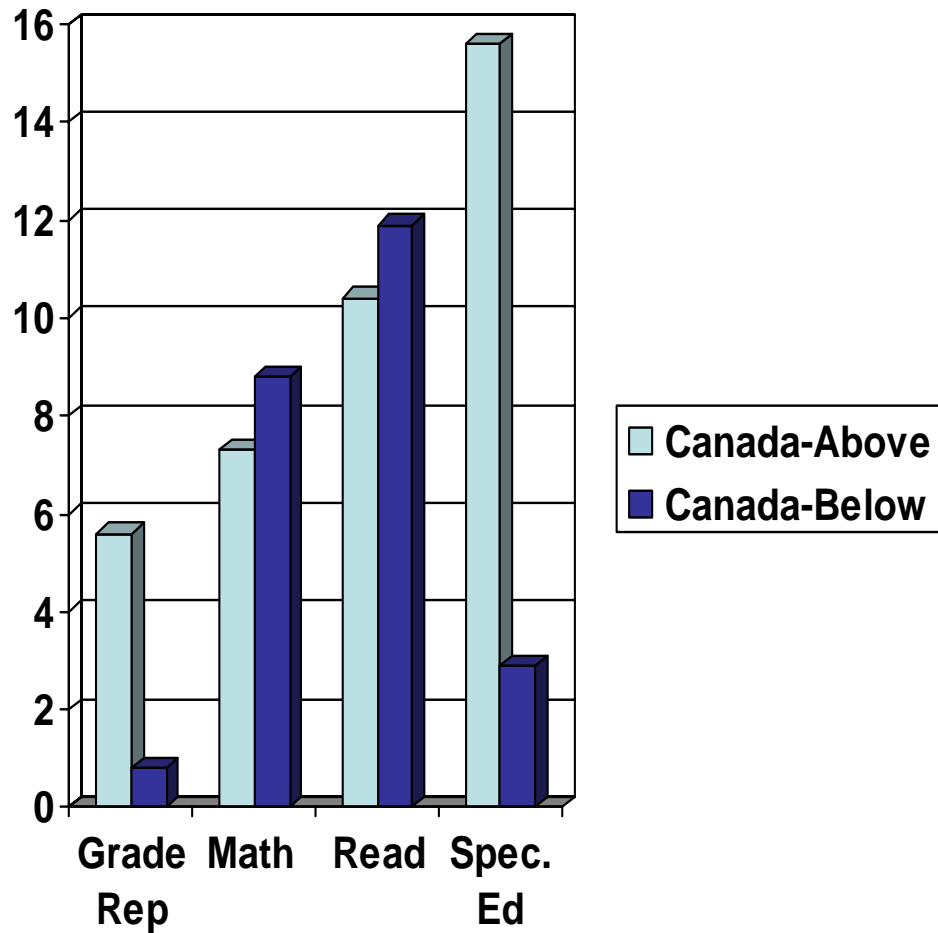
So child health does seem to have significant effects on educational attainment.

But can we identify specific conditions that have these impacts?

In work with Mark Stabile (2006) we examine the effects of ADHD in Canada and the U.S.

Use the NLSY and NLSCY and estimate models with household fixed effects (e.g. sibling comparisons) to try to control for other family background factors.

Mean Differences Between Children Above and Below the 90th Percentile of an ADHD Screener Score



Source: Currie and Stabile (2004)

**Effects of ADHD Screener Score > 90th Percentile
in 1994 on Outcomes in 1998.**

Household Fixed Effects Models, NLSY & NLSCY

	[1]	[2]	[3]	[4]
<u>Canada</u>	Grade Rep.	Math	Reading	Special Ed.
Hyperactivity Score	0.064	-9.468	-5.930	0.381
	[2.89]	[2.59]	[2.01]	[4.92]
Observations	3923	2208	2208	1357
R-squared	0.85	0.9	0.9	0.96
 <u>U.S.</u>				
Hyperactivity Score	0.07	-3.989	-5.778	0.121
	[2.68]	[1.46]	[1.98]	[2.00]
Observations	3241	2501	2501	1401
R-squared	0.76	0.86	0.86	0.84

Notes: Robust t-statistics in brackets.

Source: Currie and Stabile, 2005.

What about other specific conditions?

To have major effects on gaps in educational achievement, a health condition must have large effects on affected children, affect large numbers of children, affect low-SES children disproportionately.

Health has many domains (mental, chronic conditions, environmental exposures, nutrition, injuries).

I examine a representative condition from each domain.

Summary of Effects of Health on School Readiness

	Overall Prevalence	Poor vs. Non-Poor Rate	Effect
ADHD	4.19% boys, 1.77% girls (Cuffe et al. 2004).	6.52 vs. 3.85% (Cuffe et al. 2004)	.26 SD reduction in PIAT Math, .32 SD reduction in PIAT reading in adolescent children (Currie and Stabile, 2004).
Asthma	13% diagnosed 6% attack in past 12 mo. (Bloom, 2003).	15.8 vs. 12 (Bloom, 2003). 33.2 vs. 20.8% have limitations (Akinbami et al.)	Doubles odds of behavior problems (Bussing et al., 1995). 7.6 days absent vs. 2.5 for non-asthmatic children, 9% have learning disabilities vs. 5% non-asthmatic, 18% repeated grades vs. 12% non-asthmatic (Fowler et al., 1992). Not clear that asthma has causal effect, except for behavior.
Lead Poisoning	2.2% have blood lead above CDC standard in 99/00 (CDC web site).	~60% of children w confirmed high lead levels are Medicaid eligible (Meyer et al. 2003).	Increase from 10 to 20 microg/DL reduces IQ scores by 2-5 points (c.f. Pocock et al. 1994). Children with high bone lead 4X more likely to be delinquent (Needleman, 2002) though studies of behavior problems likely over-estimate effects of lead.
Anemia	9% toddlers iron deficient, 3% anemic (Looker et al. 1997).	Poor children 50% more likely to be deficient (Looker et al. 1997).	Long-term supplementation of anemic children improves cognitive functioning, but no evidence that supplementation of iron deficient children has effects. Given low rates of anemia, effects on disparities in school readiness may be small.
Injuries	Deaths for 0-4 in 1998: Unintentional=13.4 per 100,000; Intentional=3.7 per 100,000 (Currie and Hotz, 2004).	Poor children 2-5X more likely to die (National Safe Kids Campaign, 1998).	Effects unknown.

Caveats:

In many cases poor children with a specific condition have worse outcomes, but the causal link is unclear.

Even conditions that have severe negative effects on affected children may not explain large SES gaps.

E.g. Suppose a test has mean 50 and standard deviation of 15. If ADHD lowers test scores by $\sim .33$ SD, and 4% of non-poor have ADHD compared to 6% of poor children.

Then if ADHD prevalence were the only difference between poor and non-poor children, the average test score of non-poor children would be 49.8, while the average

test score of poor children would be 49.7.

For non-poor children the mean score would be: $[(.96*50)+(.04*45)]=49.8$, and for poor children the mean score would be: $[(.94*50)+(.06*45)]=49.7$.

So for health to explain gaps, it must be the case that:

- poor children often have multiple health problems.
- health problems have greater impact on poor than on non-poor children.
- the distinction between “poor” and “excellent” health captures more than the presence or absence of specific chronic conditions.

Directions for Future Research:

- An operational global definition of child health.
- Investigation of how child health may be modified by changes to family circumstances.
- Investigations of the mechanisms underlying transmission of health from one generation to the next.

Conclusions:

A literature about “health capital” has developed which is largely parallel to the literature on education as human capital. But the two types of capital are intimately related.

Eventual educational attainment can be predicted early in life. Health may be one of the more important factors predicting future attainments and the attainments of children.