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

Janet Currie
Columbia University and NBER

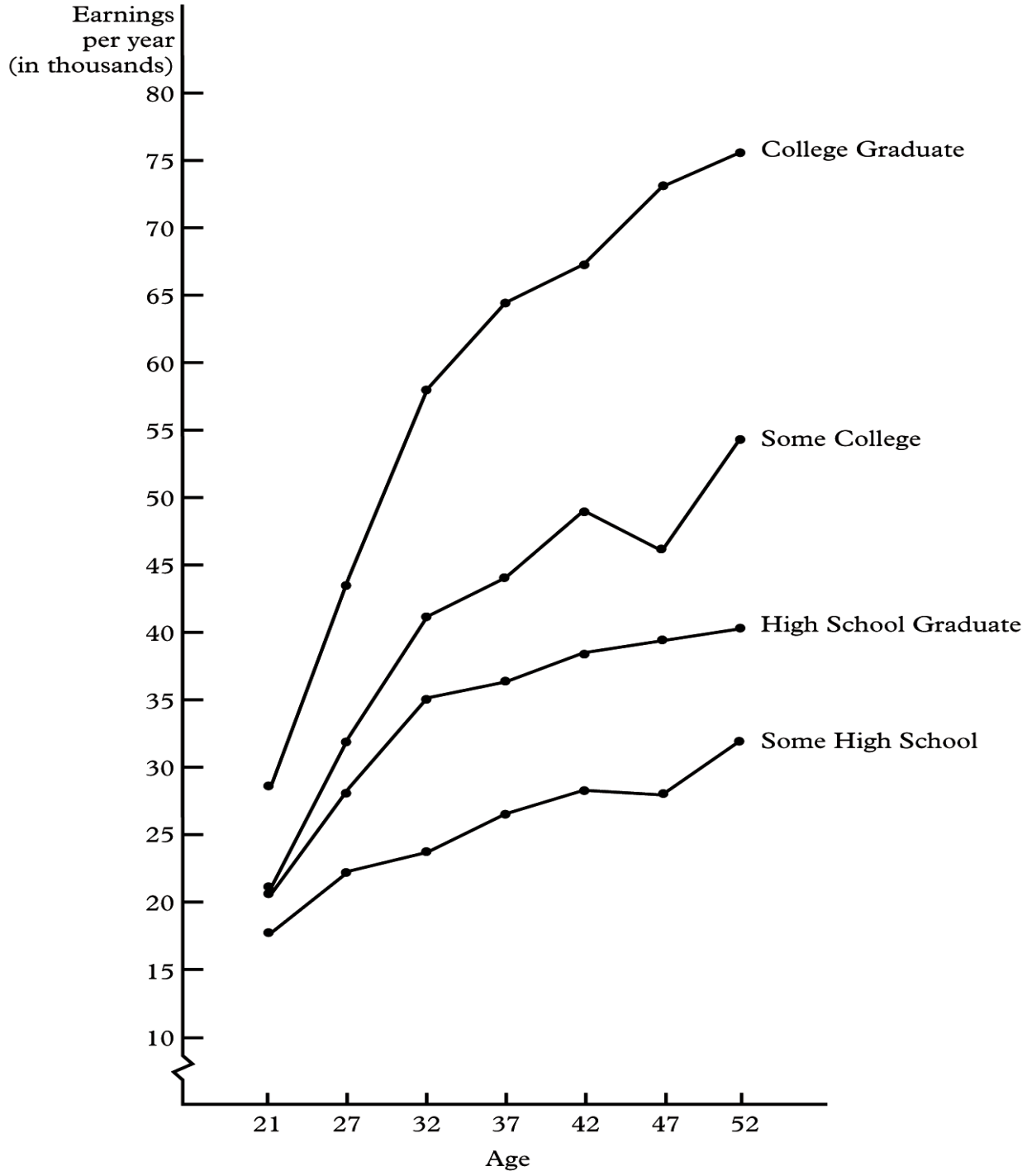
The phrase “human capital” often means “education.”

- 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

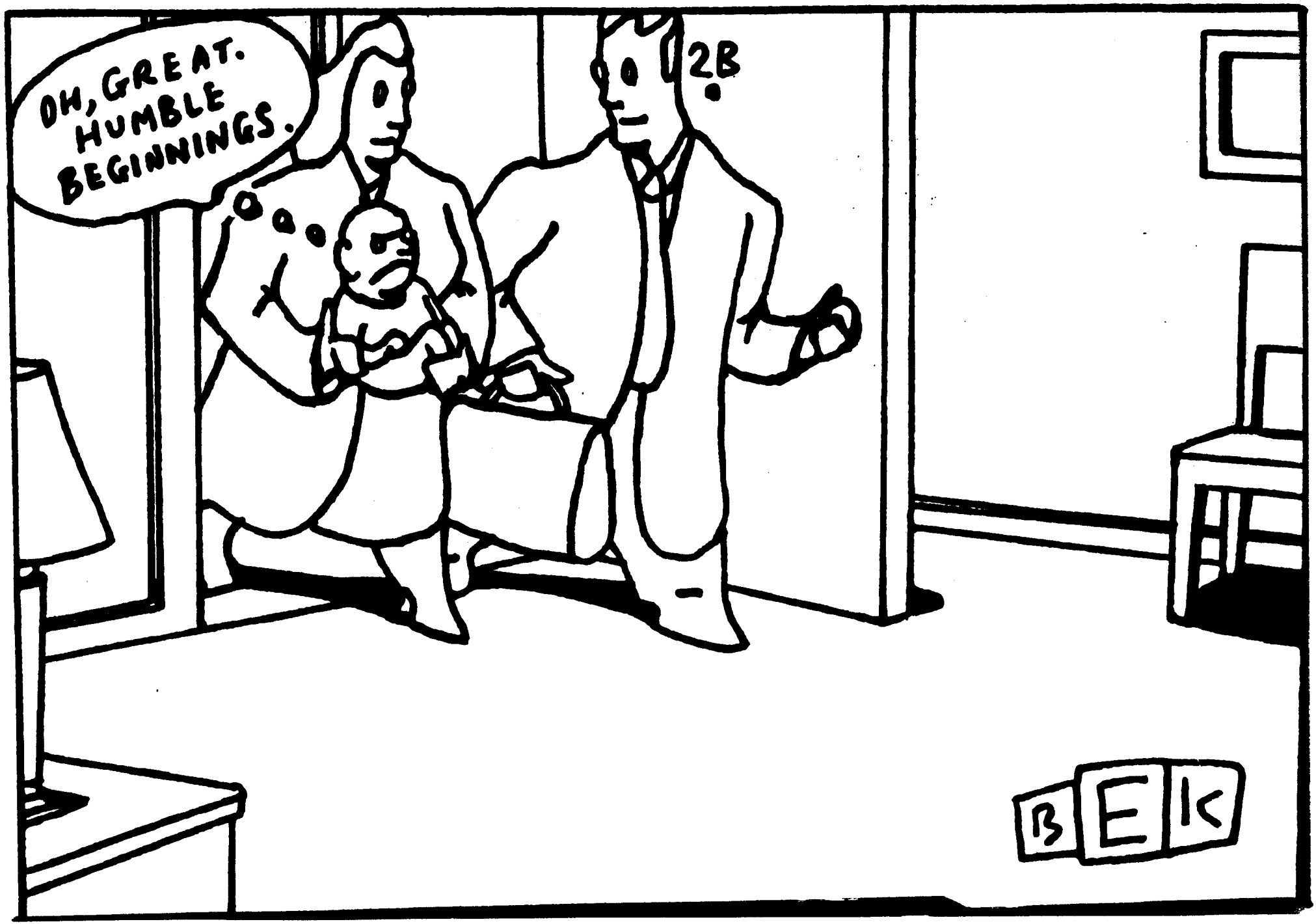
Source: Ehrenberg and Smith



But what determines Human Capital?

Family background!

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

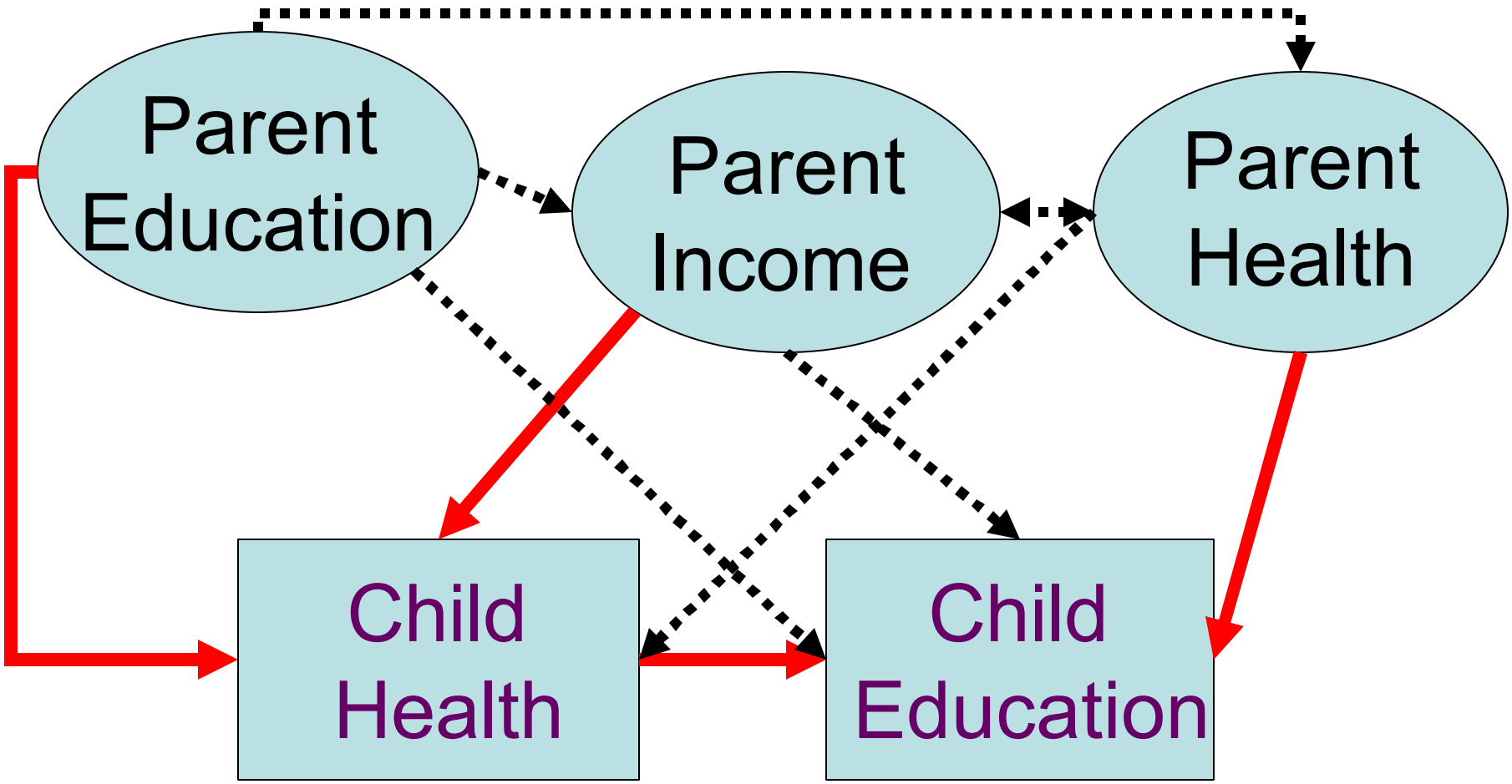

OH, GREAT. HUMBLE BEGINNINGS.
2B
B E IC

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?

Links Between Family Background and Child Health and Education



Parent Education and Income and Child Health

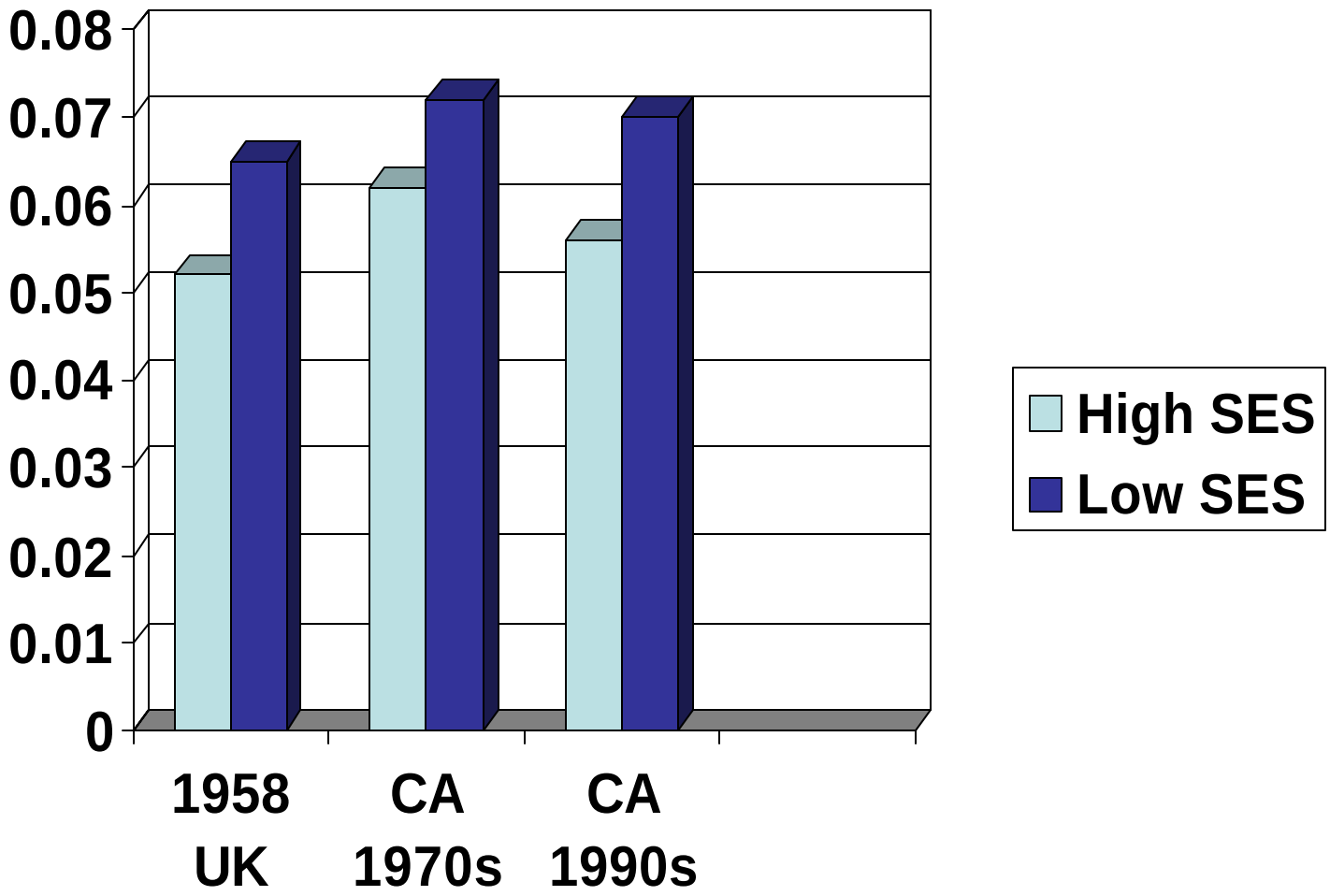
- Differences in child health are apparent at birth.

- e.g. in rate of low birth weight (birth weight less than 2500 grams).

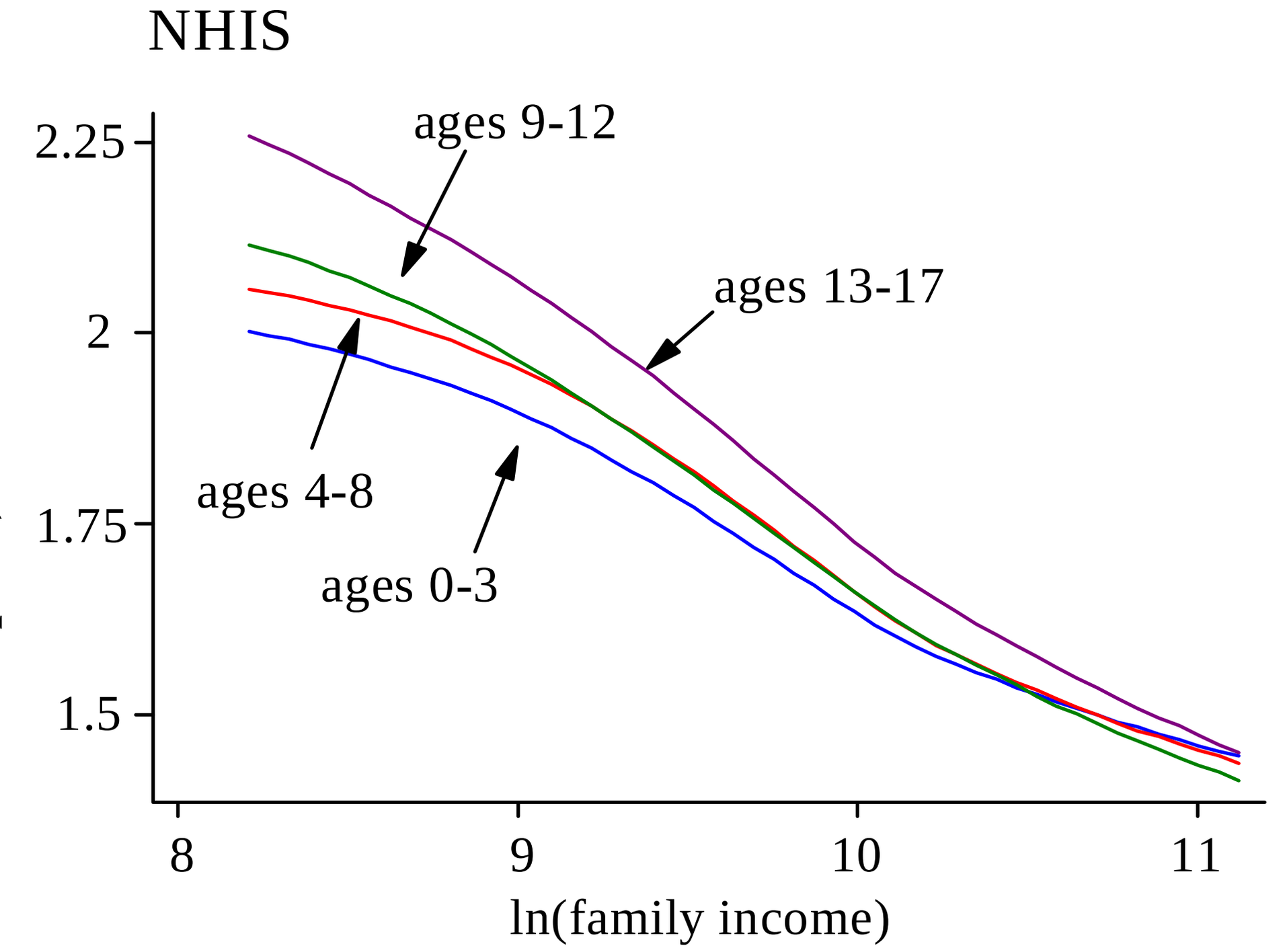
- And initial differences in health grow over time.

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)



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

Age:	**0 to 3**	**4 to 8**	**9 to 12**	**13 to 17(15)**
U.S.: Case, Lubotsky, Paxson, NHIS				
Ln(Income)	-0.183	-0.244	-0.268	-0.323
	[.008]	[.008]	[.008]	[.008]
Canada: Currie and Stabile, NLSCY				
Ln(Income)	-0.151	-0.216	-0.259	-0.272
	[.026]	[.019]	[.024]	[.040]
U.K.: Currie, Shields, Price, HSE				
Ln(Income)	-0.146	-0.212	-0.196	-0.174
	[.040]	[.028]	[.031]	[.034]

Notes: Standard errors in brackets. Regressions control for year effects, family size, sex, mother age at birth, father present, etc.

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.

The data on insults to health are poor, and often not recorded in the same surveys that track measures of SES and/or child outcomes.

Possible measures include:

- injuries
- hospitalizations
- chronic conditions

Injuries (intentional and unintentional) are the leading cause of death among children 1-14 in developed countries.

But there is little information about injuries that do not lead to death, about gradients by SES (parent information is often not included on death certificates), or about effects of injuries on the outcomes of surviving children.

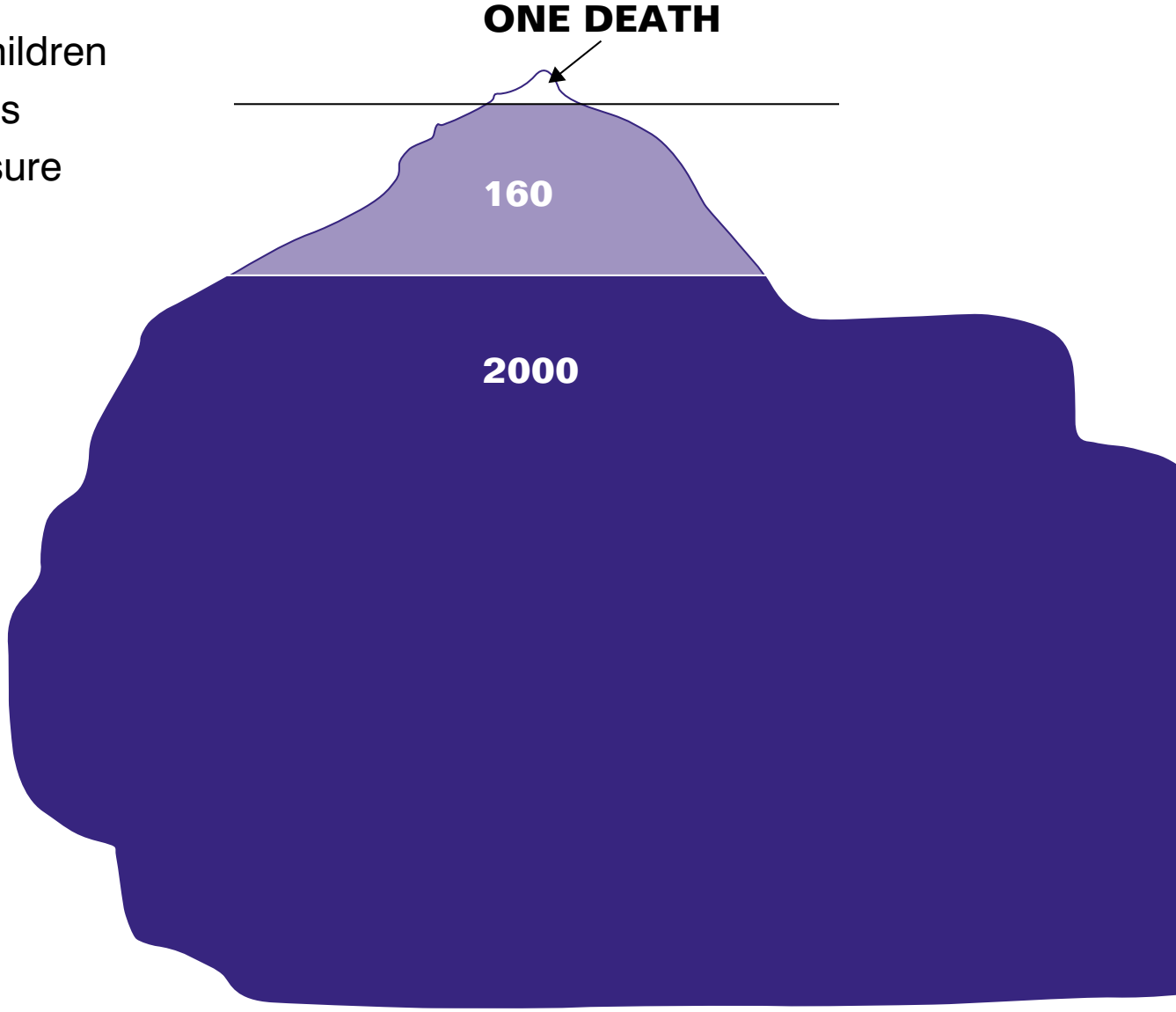
Deaths per 100,000 Due to Injuries
Children 1-14, 1991-1995

	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

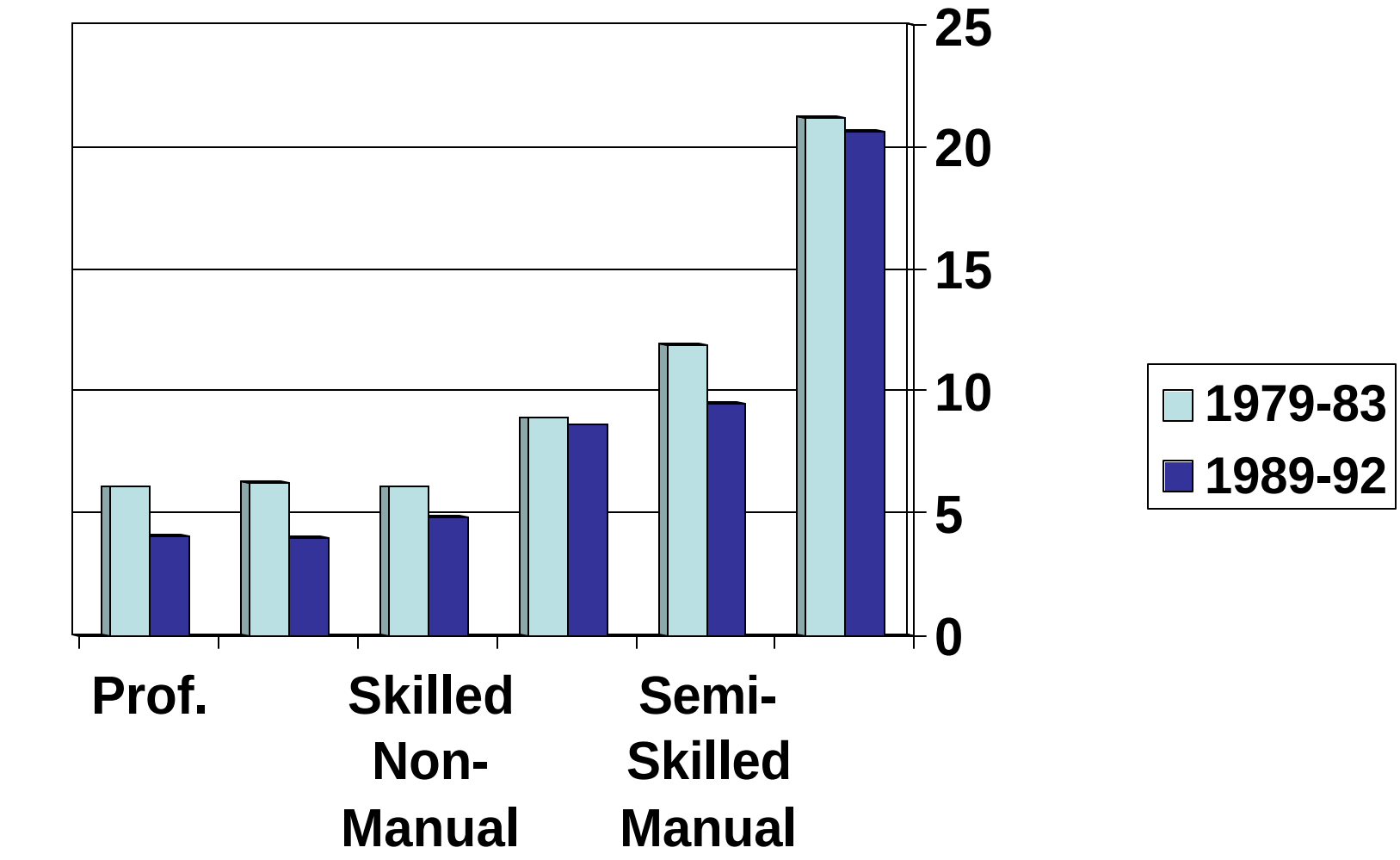
Source: Unicef, 2000.

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

Hospitalizations and chronic conditions are subject to reporting biases.

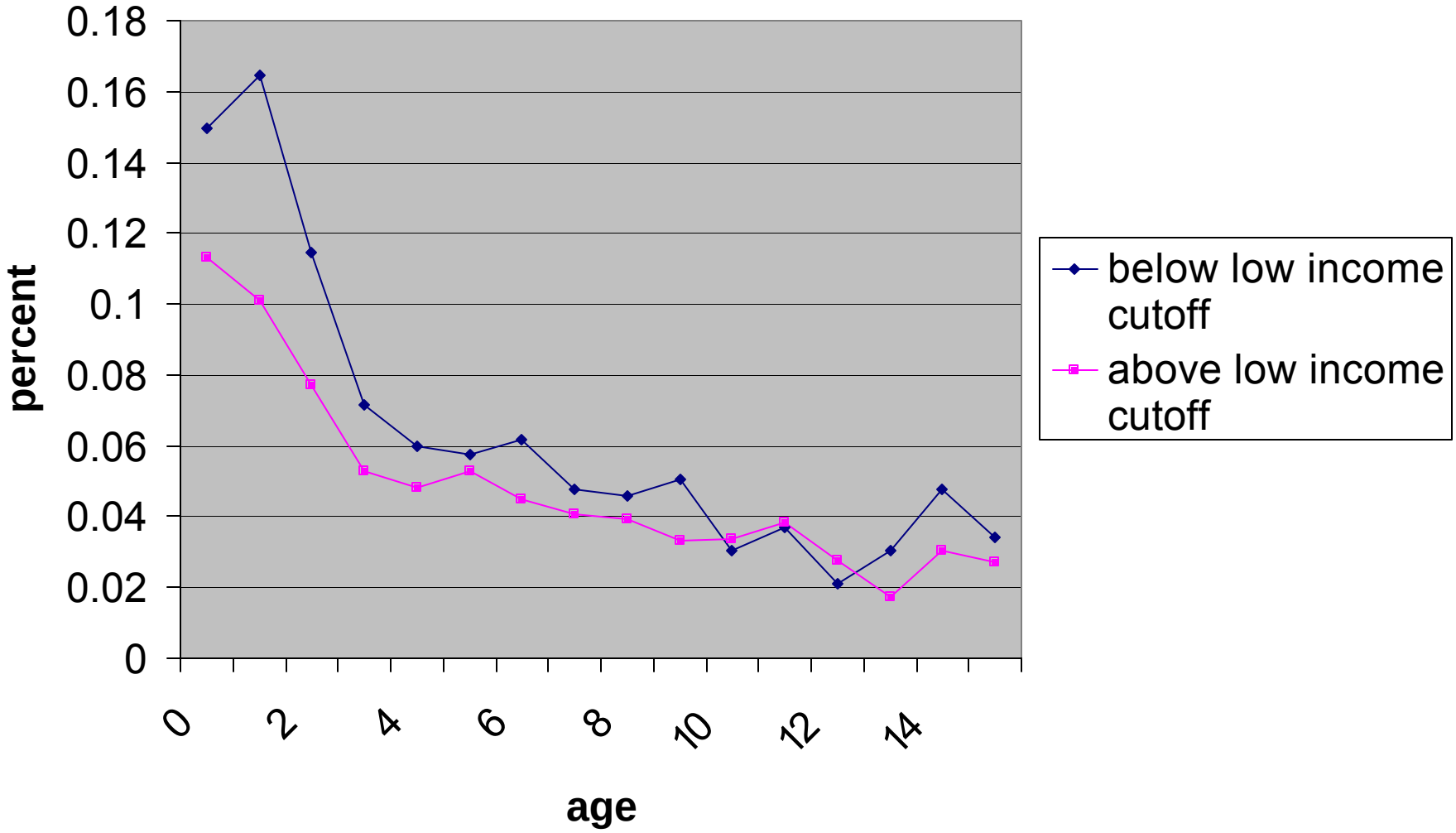
- e.g. in the U.S., children with better insurance or more likely to be hospitalized other things being equal. In countries with universal health care, more educated parents are still more likely to seek care for given conditions.

- one important exception may be mental illness, where higher SES parents may be more able to avoid the stigma of diagnoses by finding alternative ways to deal with their child.

- if parents do not seek care for child conditions, then chronic conditions may not be diagnosed.

- age patterns may be particularly sensitive to reporting biases if many conditions are diagnosed at school entry.

NLSCY (Canada): Hospitalizations by SES



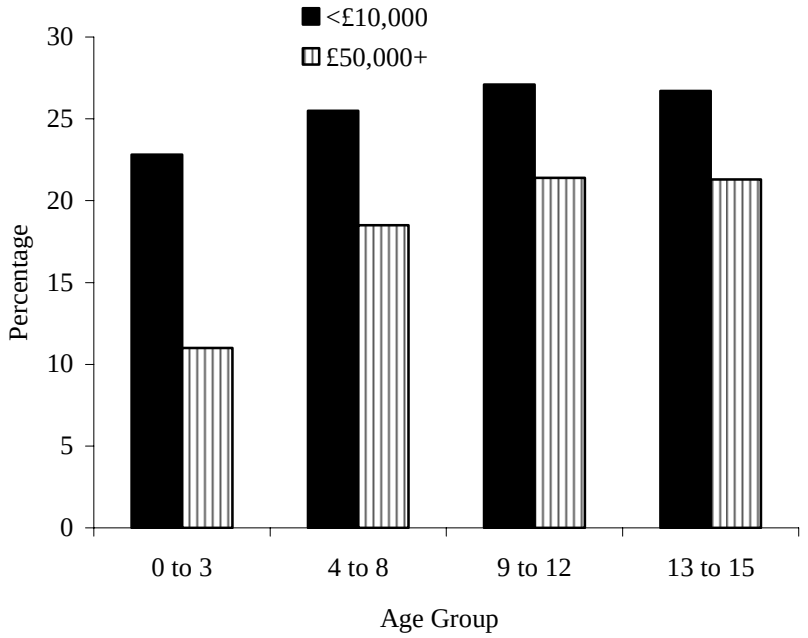
Currie, Price, and Shields find that the incidence of asthma and mental problems are the most sensitive to income.

In the U.S., Case, Lubotsky and Paxson show that a broader range of chronic conditions are sensitive to income (e.g. hearing, vision, and digestive problems).

These and many other conditions such as arthritis, cancer, or heart problems are not particularly sensitive to income in the U.K.

However, asthma and mental health problems are the most common chronic conditions of children so that overall the incidence of chronic conditions falls with income, even in the U.K.

The Incidence of Chronic Health Conditions Amongst Children in England by Income



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 conditions have their roots in childhood.

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

Recently Karen Linnet and a team of researchers at Arhus have used Danish registry data to show that children who are premature, low birth weight, and/or whose mothers smoked during pregnancy have a much higher risk of developing the disorder.

Studies of this type point to possible mechanisms for the link between SES and ADHD (HKD).

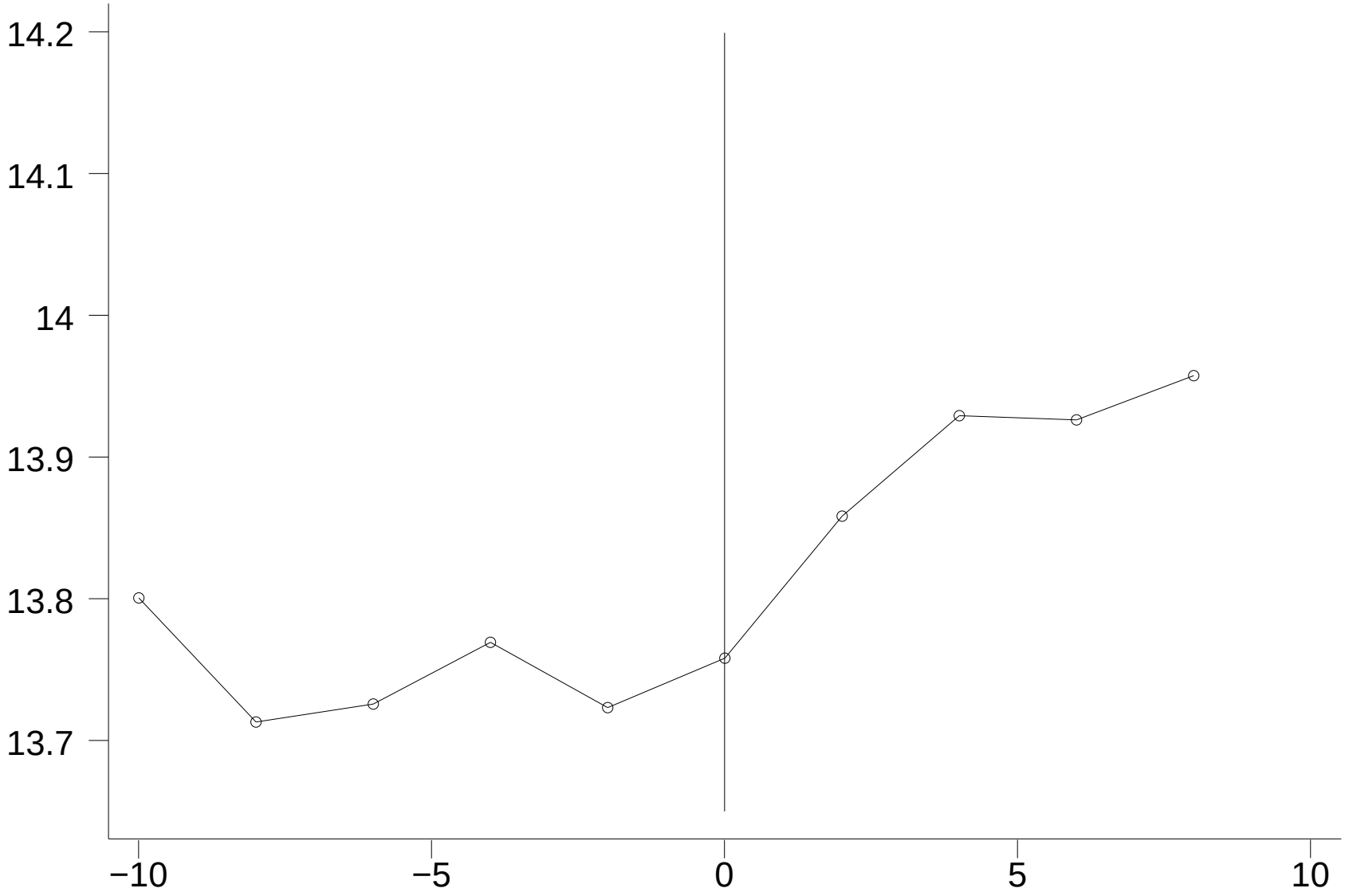
So...

Parent income and education are strongly related to child health. The relationship strengthens as the child ages (in the U.S. and Canada, but not the U.K.)

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	0.049
	[.0038]	
2. Preterm Birth	-0.01	0.069
	[.0044]	
3. Prenatal Care 1st trimester	0.0234	0.921
	[.0055]	
4. Smoked During Pregnancy	-0.0583	0.078
	[.0118]	

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 Education	Sib-FE Education	OLS Ln(Earnings)	Sib-FE 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.

So child health may have a significant effect on future outcomes.

But can we identify specific health conditions that have negative effects on future outcomes?

Many studies examine the long term effects of low birth weight.

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

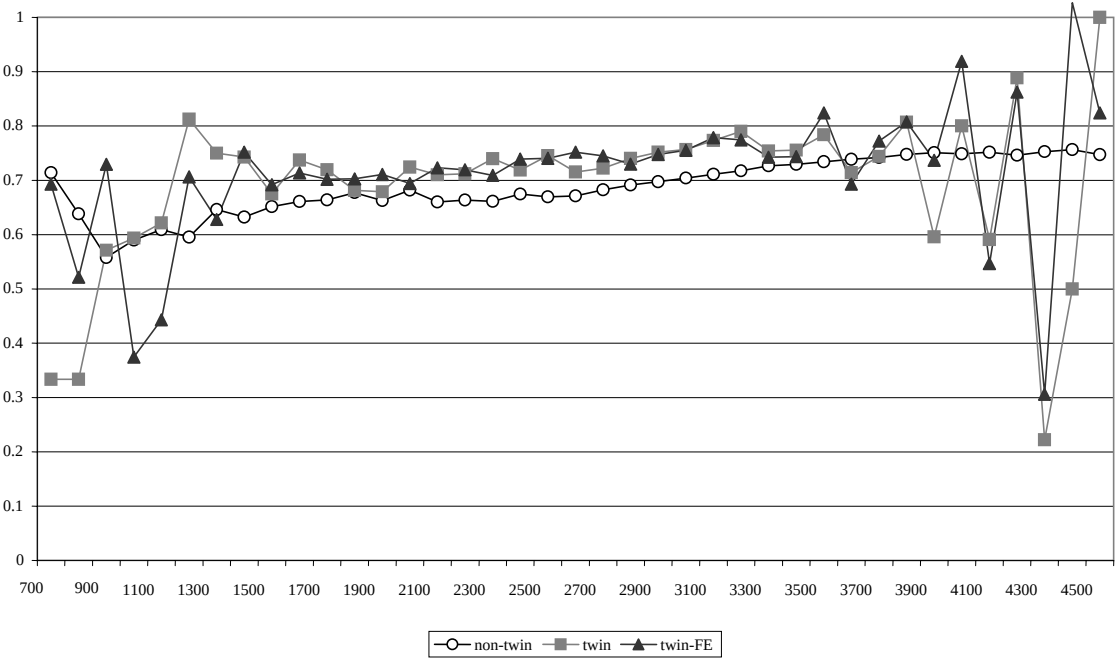
Notes:
High SES is defined as before. Low SES is semi-skilled manual or low-skilled father.
Source: Currie and Hyson (1999)

Several more recent studies use large “registry” data sets to try to get at the causal effects of birth weight by comparing twins or siblings (following an earlier twins study by Behrman and Rosenzweig, 2004).

Black, Devereux, and Salvanes, 2005 examine Norwegian twins. Find that twin FE models are similar to OLS: A 10% increase in birth weight leads to a 1 percentage point increase in the probability of graduating high school and a 1 percent increase in earnings.

Effects are surprisingly linear.

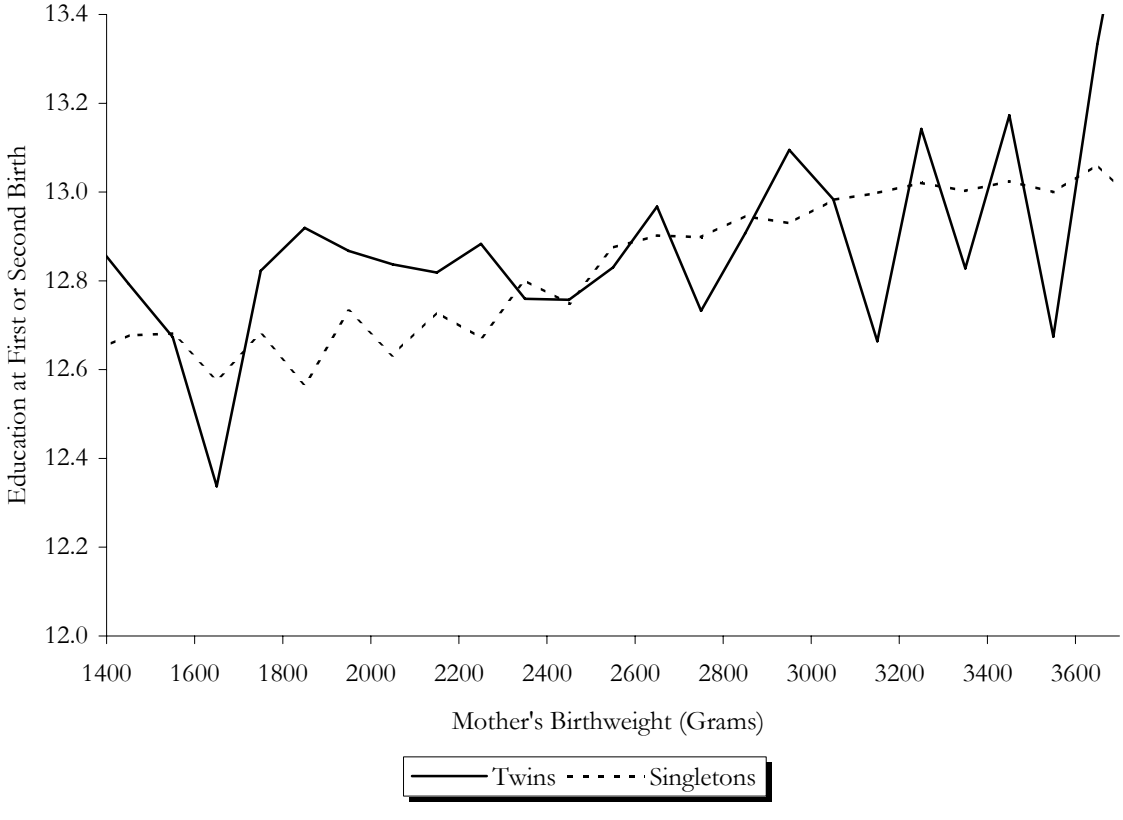
Figure 11
High School Graduation by Birth Weight



Oreopolous, Stabile, and Wald (2006) use similar data from the Canadian province of Manitoba. Find that sibs 1500-2500 grams are 8% less likely to reach grade 12 by age 17 than sibs who weighted over 3500 grams.

Royer (2005) examines birth certificate data for California. We know mother's education at the time she gave birth. If the mother was born in CA, we can locate her own birth certificate to find out her birth weight. Royer examines mothers who were twins. She finds that for each 1000 grams of birth weight there is a gain of .16 years of education.

Figure 3 - Cross-Sectional Relationship Between Birthweight and Education



Currie and Moretti (2005) also use CA birth records and link mothers to their own mothers (the grandmothers). We compare the effect of LBW of the mother and income of the grandmother (measured using median income in the grandmother's zip code of delivery) 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
Outcome=Mother's education at time of child's birth in years.						
Mom's Birth SES	0.017	0.007	0.02	0.008	0.011	0.009
(1000's $)	[.001]	[.001]	[.001]	[.001]	[.001]	[.002]
Mother LBW	-0.214	-0.097	-0.229	-0.092	-0.207	-0.114
	[.007]	[.008]	[.008]	[.009]	[.013]	[.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

Aside from low birth weight, there has been little study of the long term consequences of other specific health conditions.

Longitudinal data suggests that they could be important.

E.g. Case, Fertig, and Paxson use data from the 1958 British Birth Cohort to examine associations between various health problems in childhood and future educational attainments.

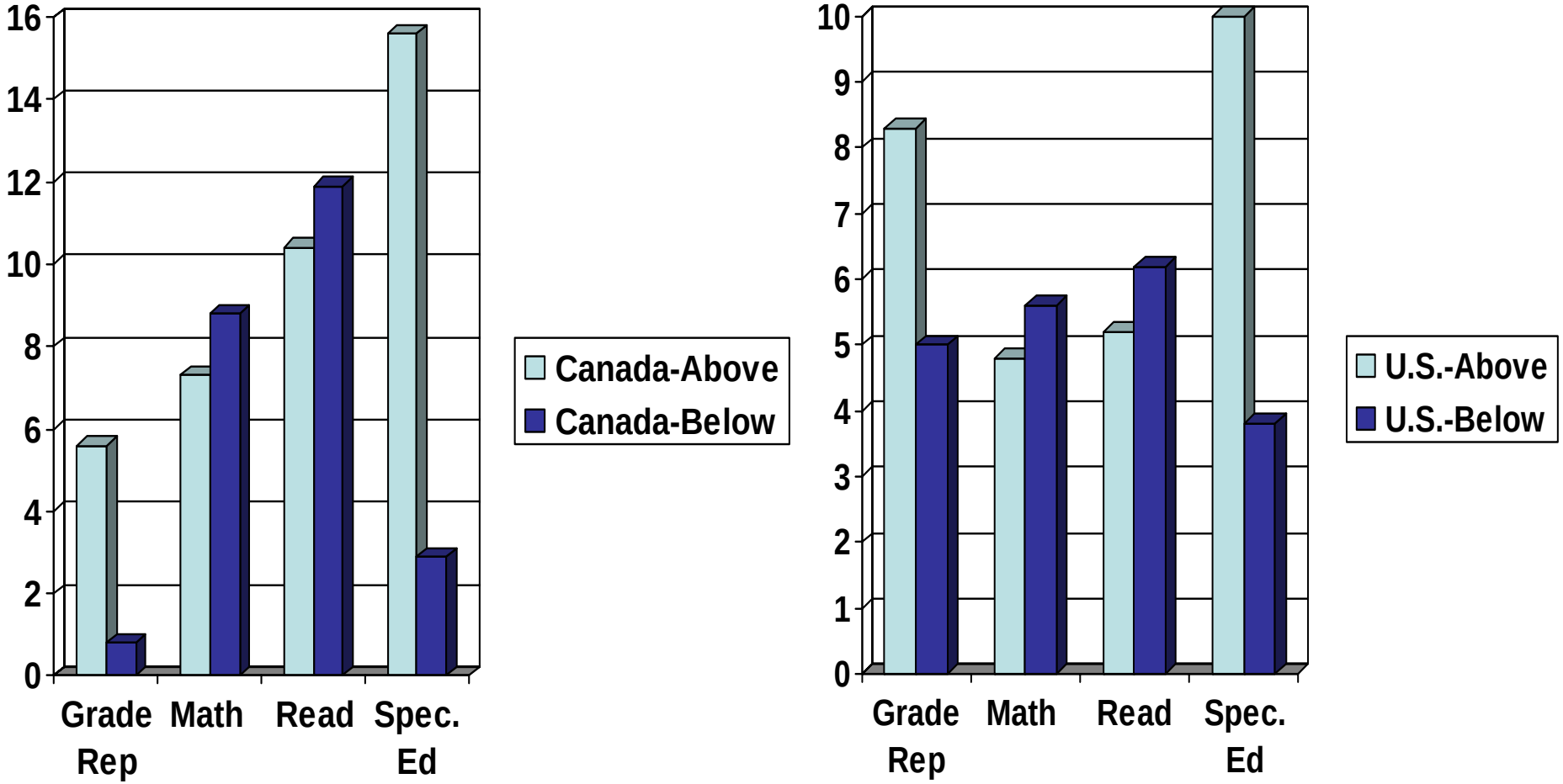
Table 2. Education and Childhood Characteristics, Men and Women

	Dependent Variable:			
	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)

Currie and Stabile (2006) use data from the U.S. (NLSY) and Canada (NLSCY) to examine the long term consequences of Attention Deficit Hperactivity Disorder (ADHD, or Hyperkinetic Disorder). This is the most common mental health disorder of childhood, affecting ~4-5% of children.

We estimate models with household fixed effects in order to compare siblings with different scores on a test for ADHD symptoms that was administered to all children.

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]
Canada	**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.S.				
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.

	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: Uninten-tional=13.4 per 100,000; Intention 3.7 per 100,000 (Currie and Hotz, 2004).	Poor children 2-5X more likely to die (National Safe Kids Campaign, 1998).	Effects unknown.

Most specific health conditions affect few children and so cannot by themselves explain gaps in achievement.

E.g. Assume a test with a mean of 50 and a SD of 15. If ADHD lowers scores by .33 SD and 4% and 6% of non-poor and poor children have ADHD, respectively then:

For non-poor the mean score would be
[.96*50 + .04*45]=49.8.
For poor 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.