



National Institutes of Health
Office of Behavioral and Social Sciences Research



Understanding the Relationship Between Years of Education and Longevity: Summary of June 4 Meeting

Robert M. Kaplan

Agency for Health Care Research and Quality
Population Health Roundtable
June 5, 2014



Goals of the workshop

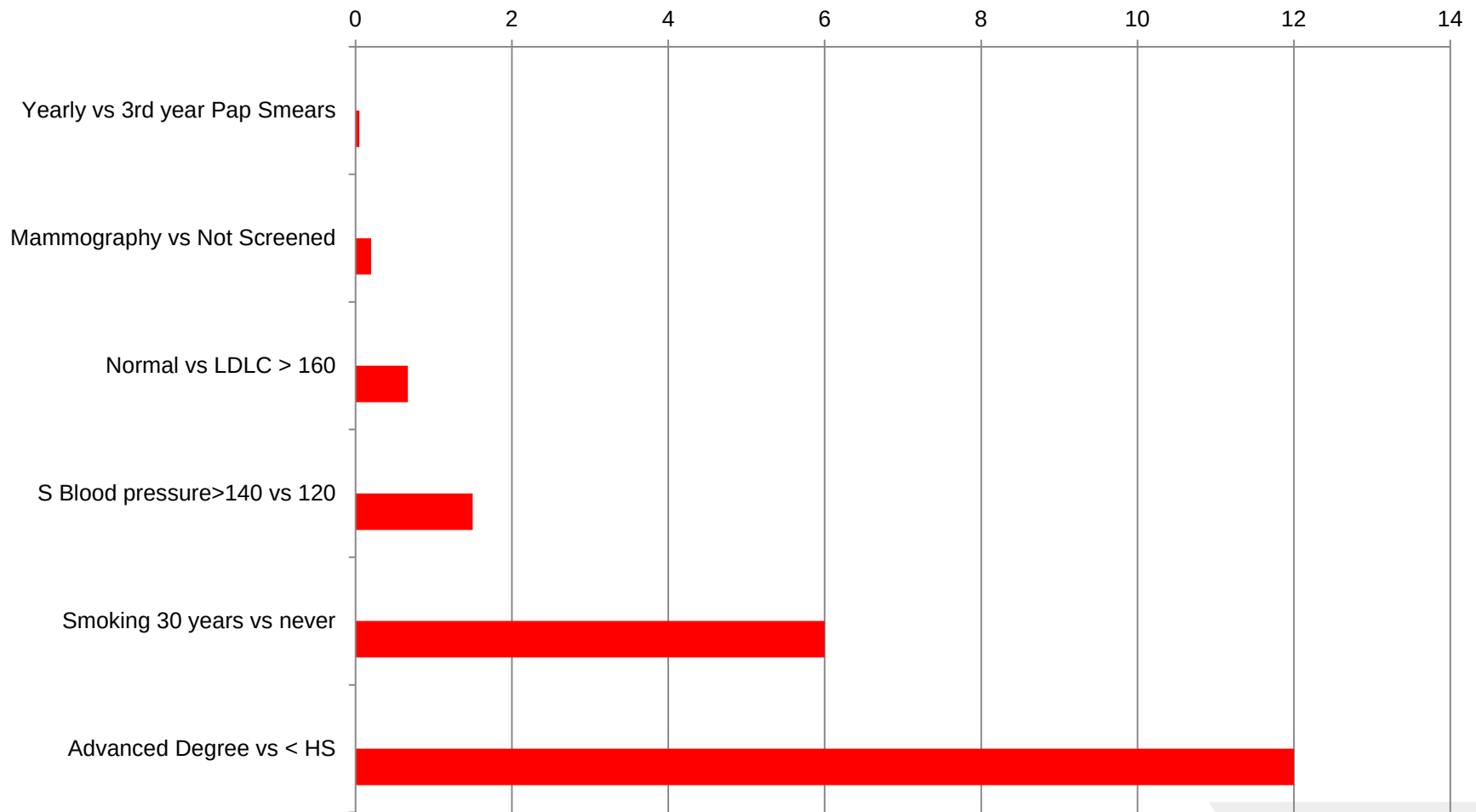
- Convene heterogeneous group of experts representing
 - Education
 - Economics
 - Sociology/demography
 - Epidemiology
 - Psychology
 - Medicine (Family Med, GIM, Pediatrics, Preventive Medicine, Psychiatry)
- Identify gaps in knowledge
- Stimulate interest by funding agencies

NIH: Steward of Medical and Behavioral Research for the Nation

“Science in pursuit of fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to enhance health, lengthen life and reduce illness and disability.”

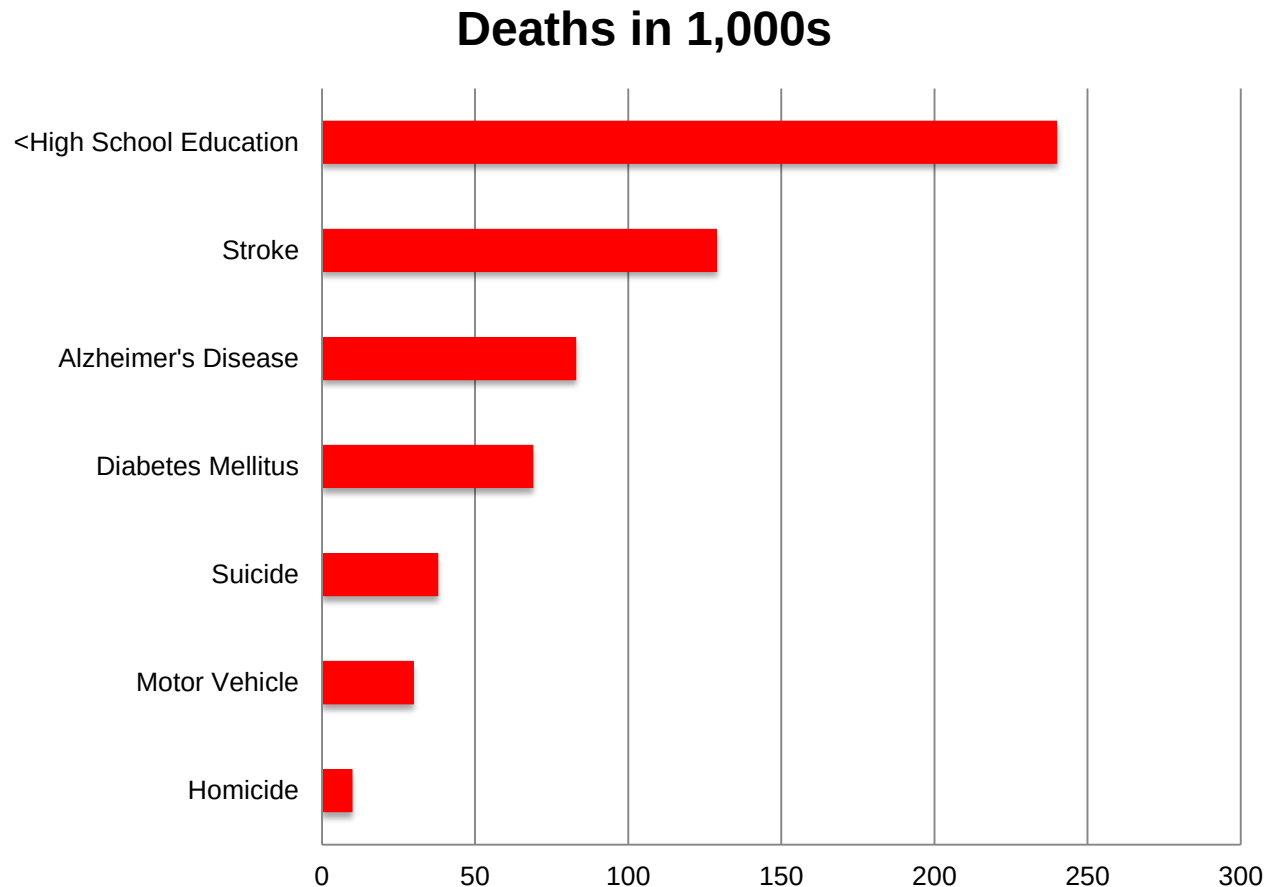


Quality-Adjusted Life Years By Risk Group



Data estimated from Whitehall 39 year follow-up: Clarke BMJ 2009;339:b3513

Deaths Associated With Low Education In Perspective



Death data from National Vital Statistics Report, 61 (4), May 8, 2013.
Education estimate from Galea et al AJPH, 2011

The Evolving Health Care System

From Neal Halfon, 2012

The First Era (Yesterday)

- Focused on acute and infectious disease
- **Germ Theory**
- Short time frames
- Medical Care
- Insurance-based financing
- Industrial Model
- **Reducing Deaths**

Health System
1.0

The Second Era (Today)

- Increasing focus on chronic disease
- **Multiple Risk Factors**
- Longer time frames
- Chronic Disease Mgmt & Prevention
- Pre-paid benefits
- Corporate Model
- **Prolonging Disability free Life**

Health System
2.0

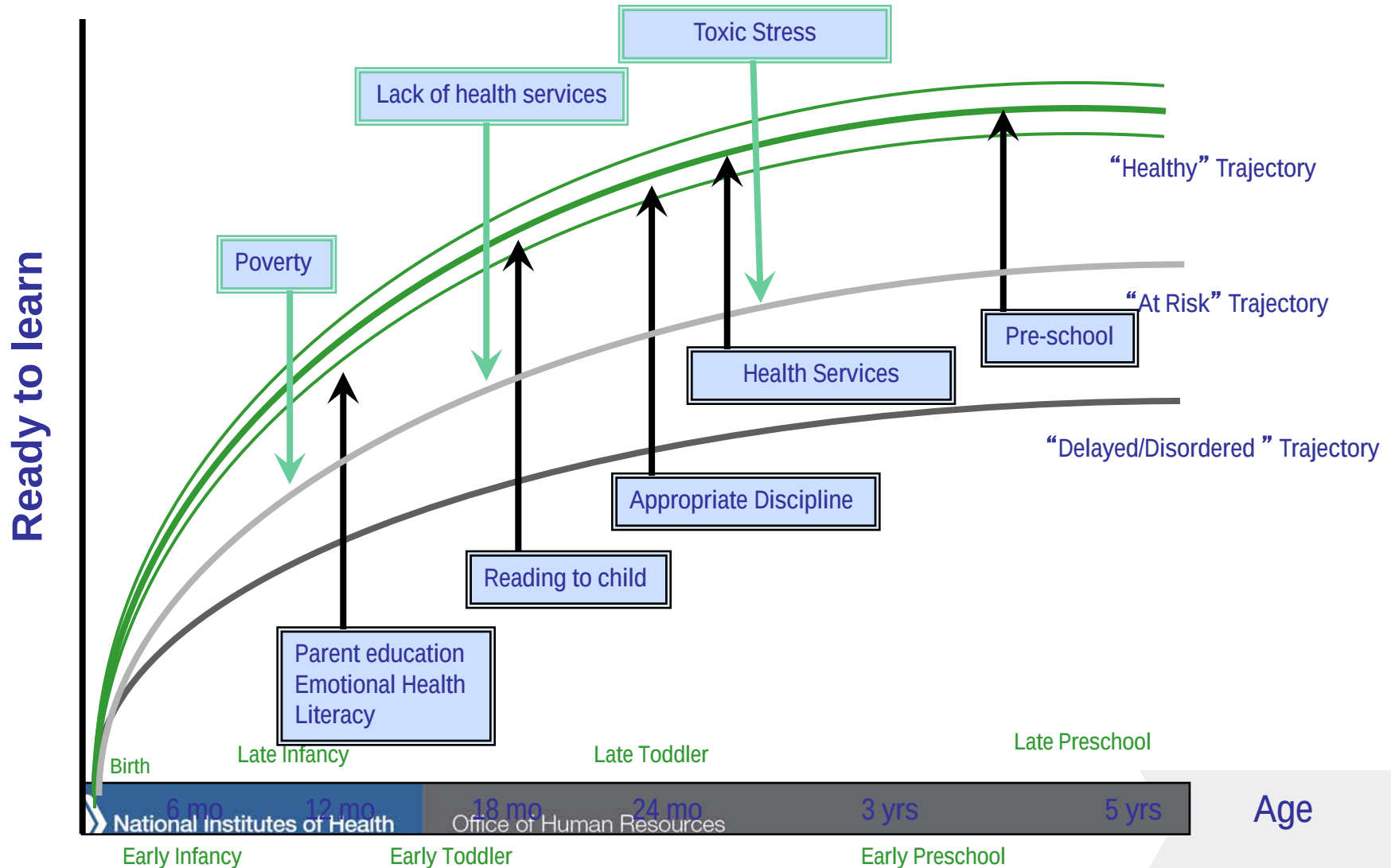
Breslow, L. "A Life in Public Health." 2004 Springer Publishing Co. NY, NY

The Third Era (Tomorrow)

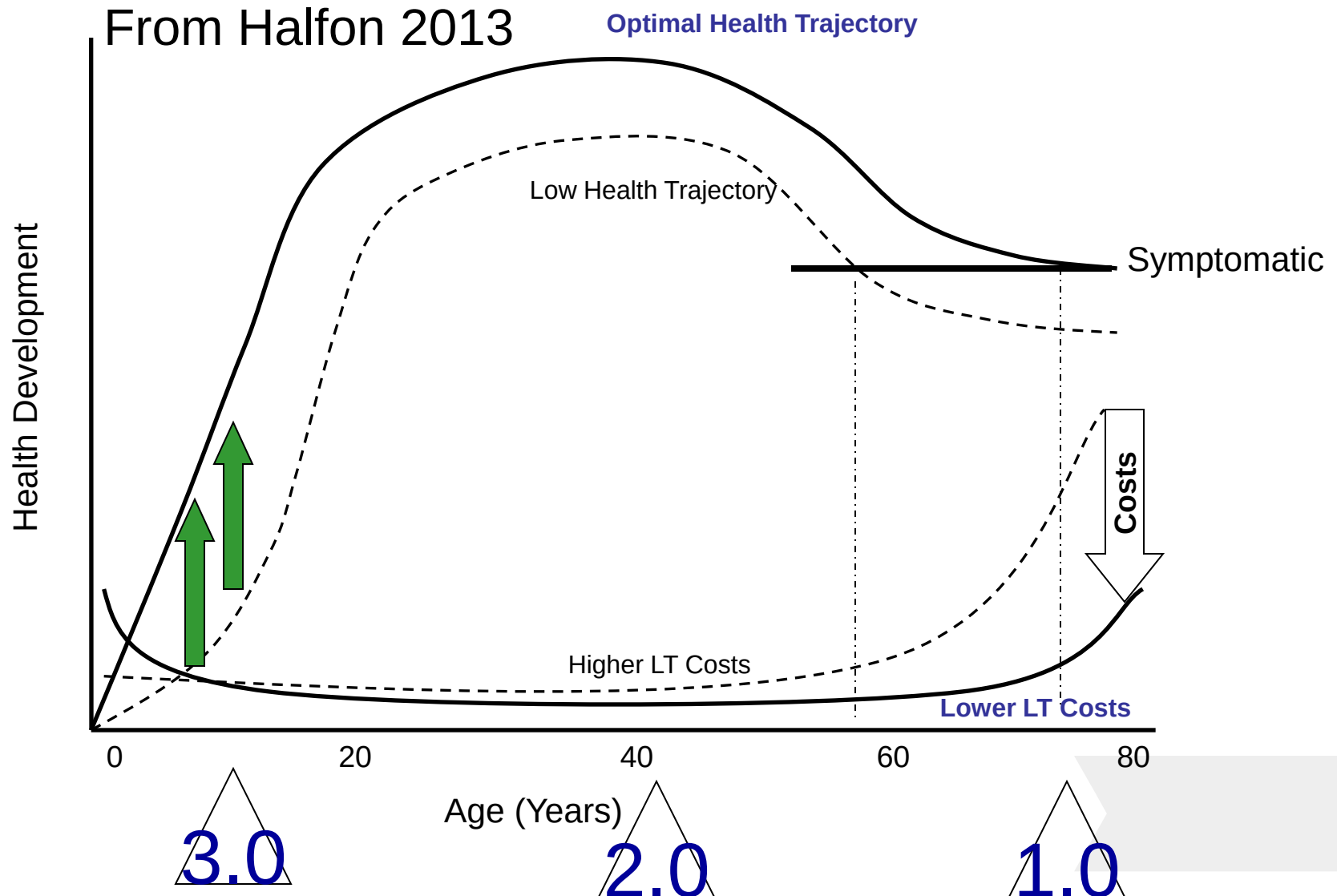
- Increasing focus on achieving optimal health
- **Complex Systems - Life Course Pathways**
- Lifespan/ generational
- Investing in population-based prevention
- Network Model
- **Producing Optimal Health for All**

Health System
3.0

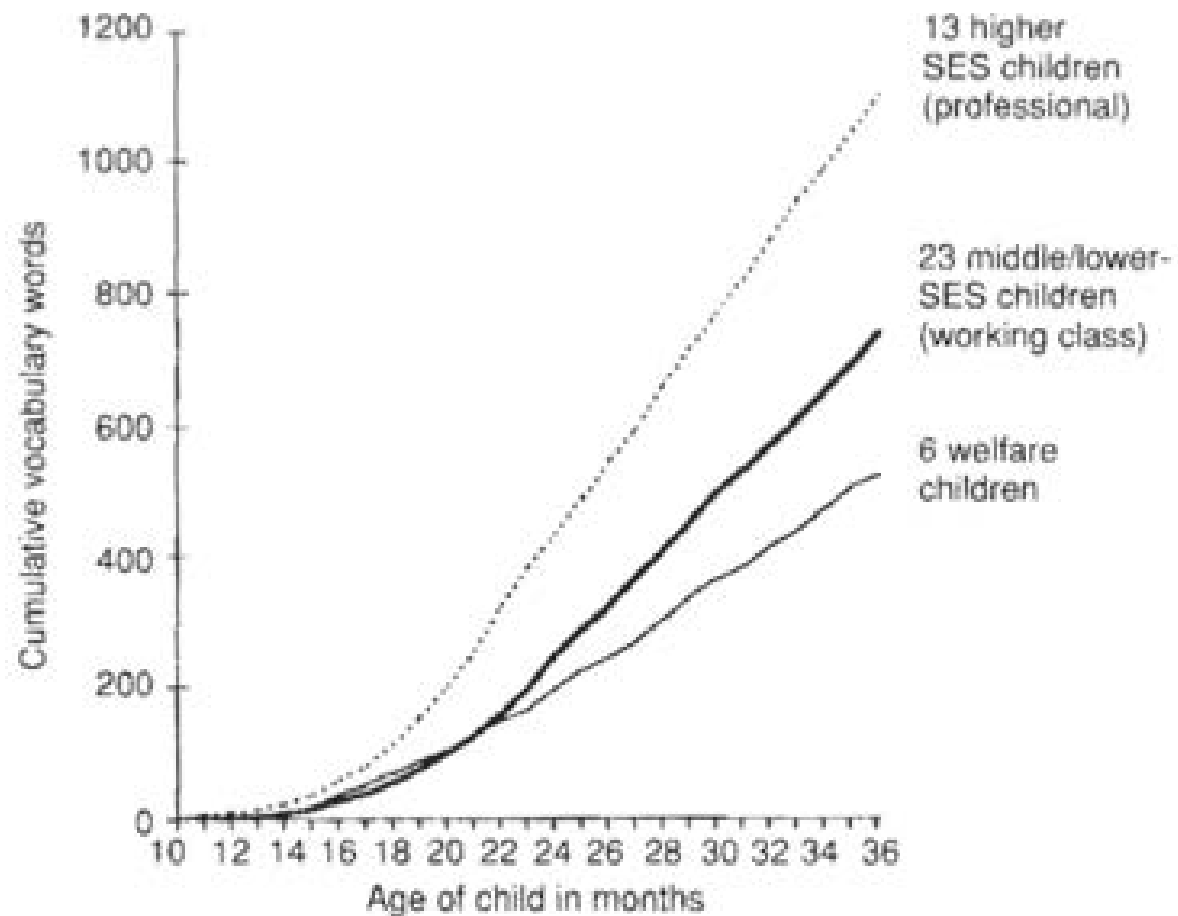
Life Course Health Development: Reducing Risk & Optimizing Protective Factors



Shifting the Health Development Curve to shift the Cost Curve

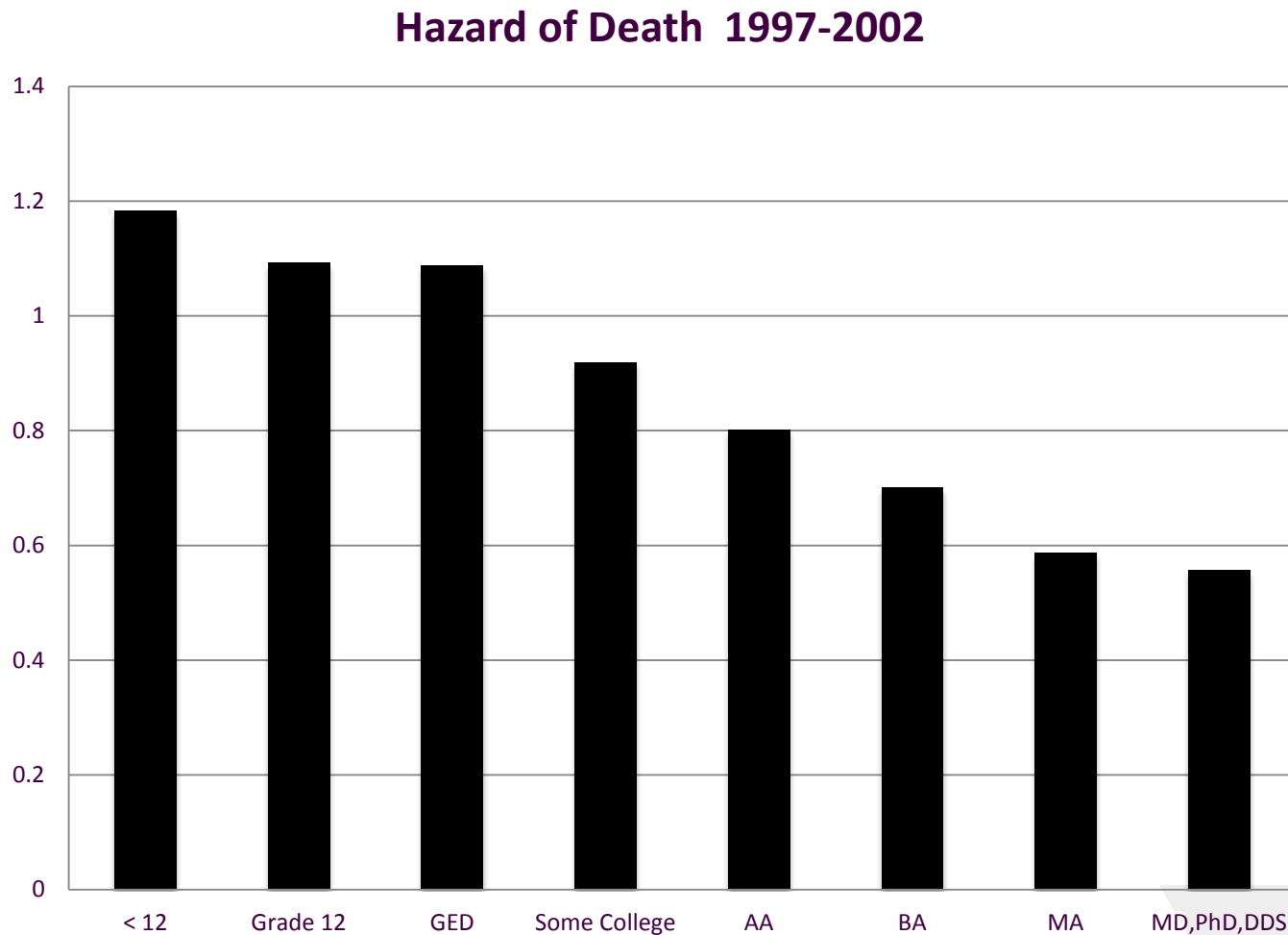


SES and vocabulary



From Flavio Chuna, University of Penn.

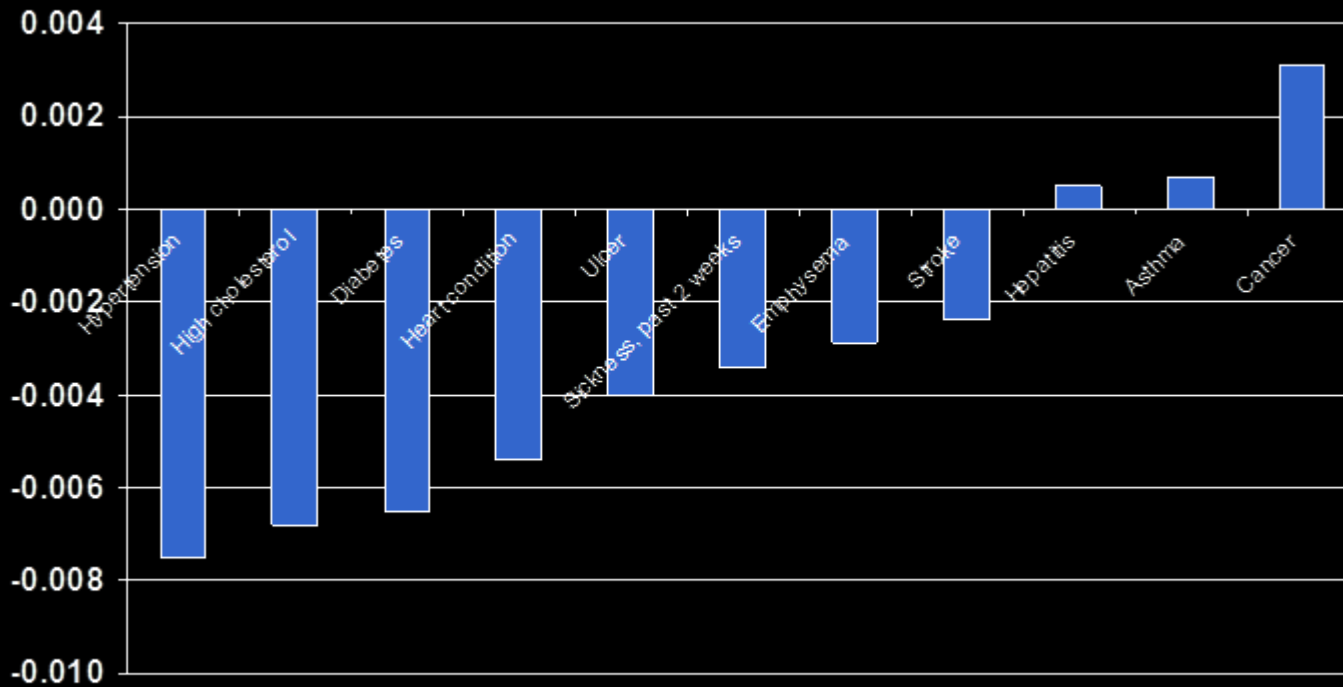
Hazard of premature death by years of education



Adapted from Rogers et al Biodemography and Social Biology, 56:80–99, 2010

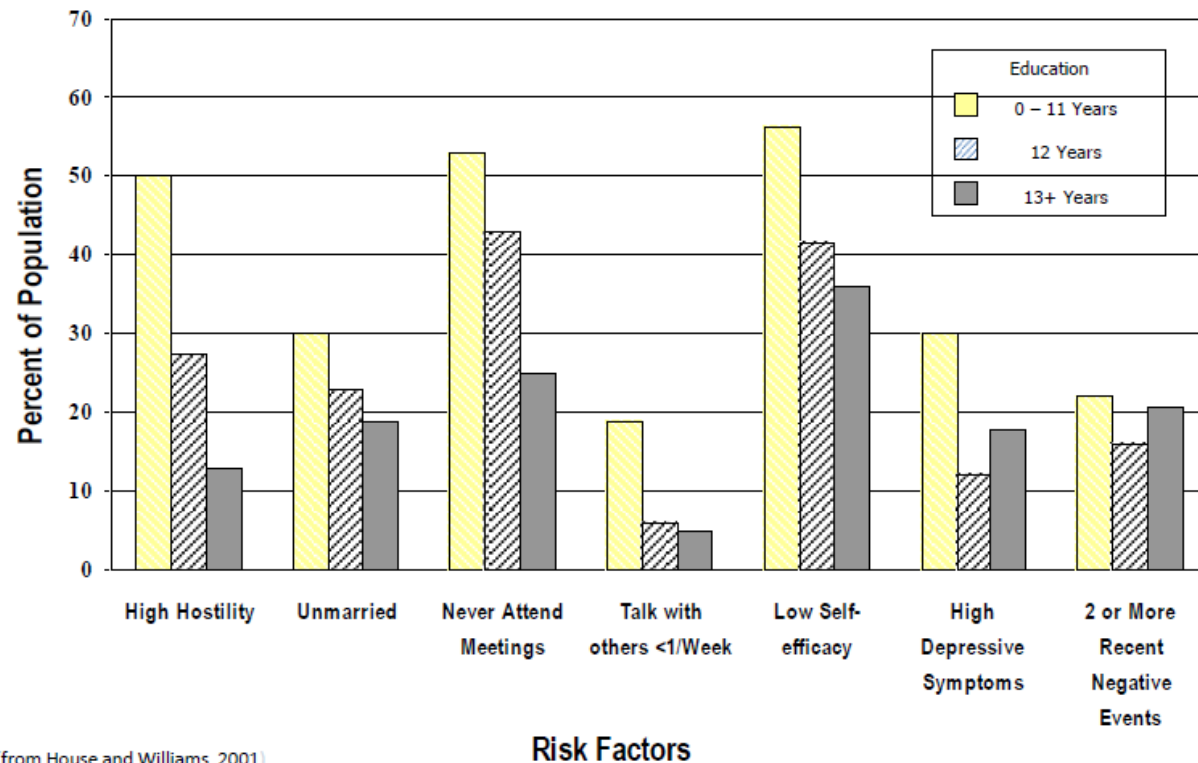
EDUCATION and MORBIDITY

Effect of Each Year of Education on Disease Prevalence
Cutler and Lleras-Muney (2008)



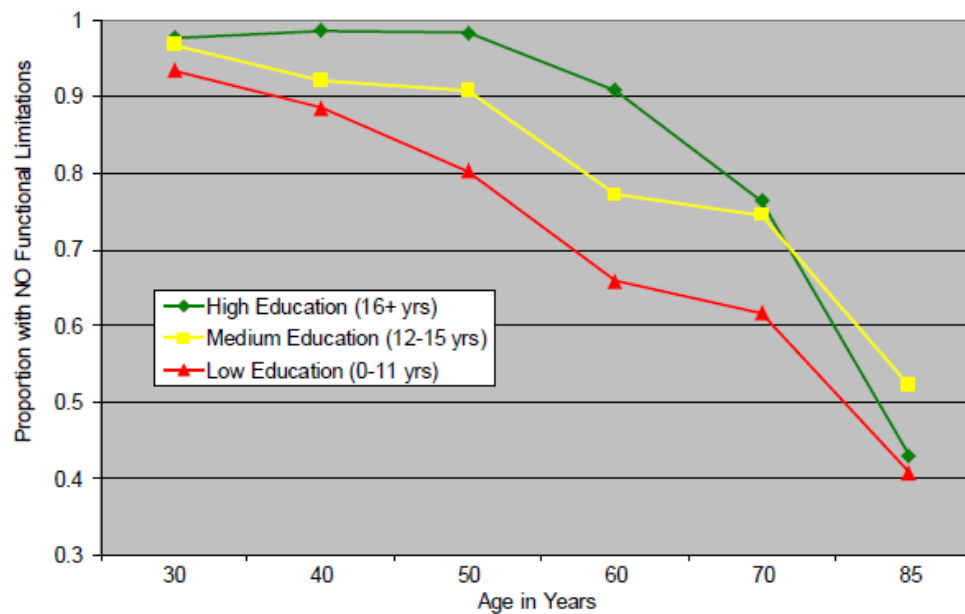
EDUCATION and MORBIDITY / RISK FACTORS

**Figure 4.6a Psychosocial Risk Factor Status in U.S. Residents,
Age 45-64, by Education**
ACL Study, 1986 and MMPI Standardization Study (for hostility)



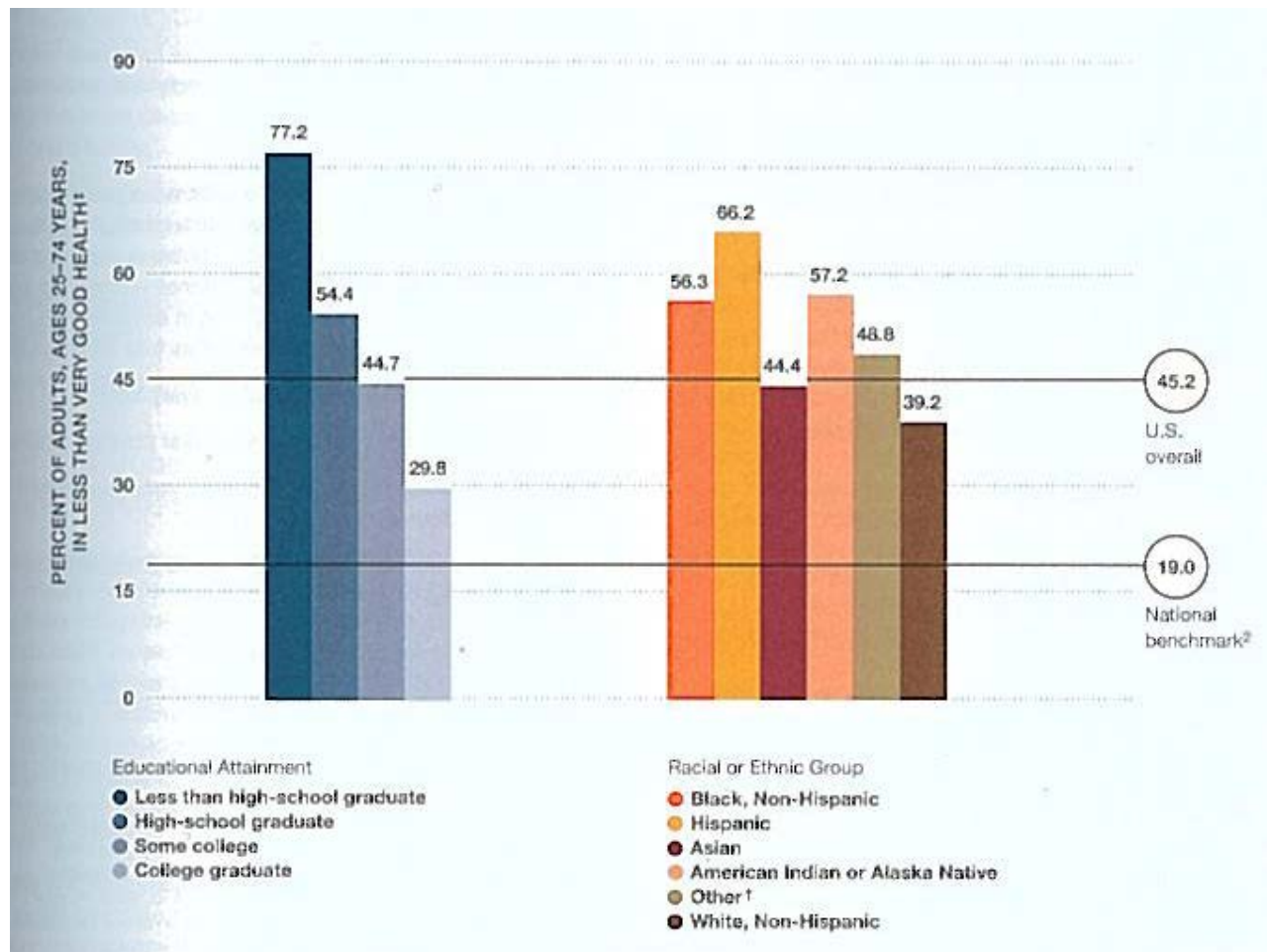
EDUCATION and FUNCTIONAL LIMITATIONS

**Figure 4.4. Functional Limitations by Education
ACL Study, 1986**

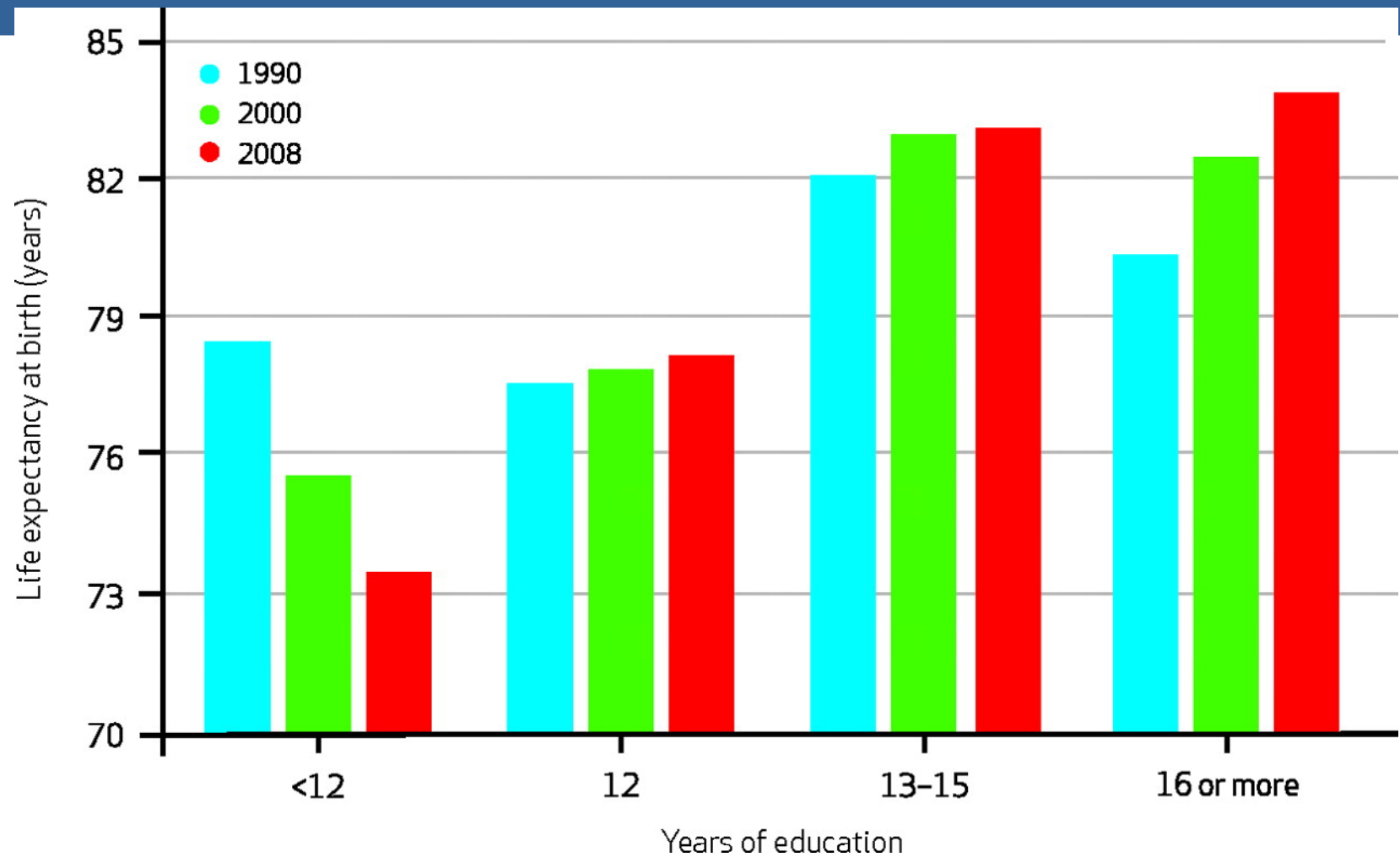


(from House et al, 1994)

EDUCATION and SELF-RATED HEALTH



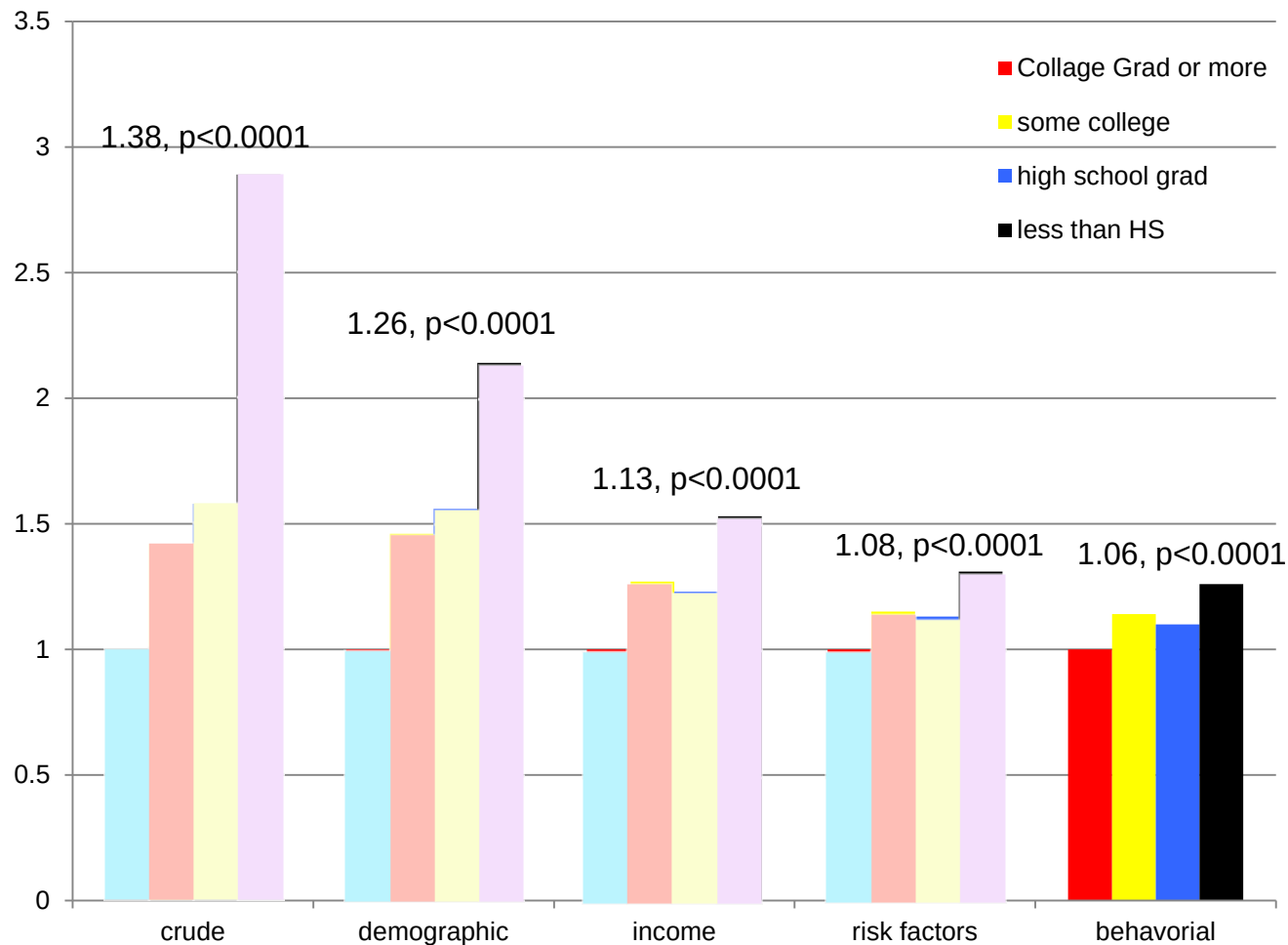
Life Expectancy At Birth, By Years Of Education At Age 25 For White Females,



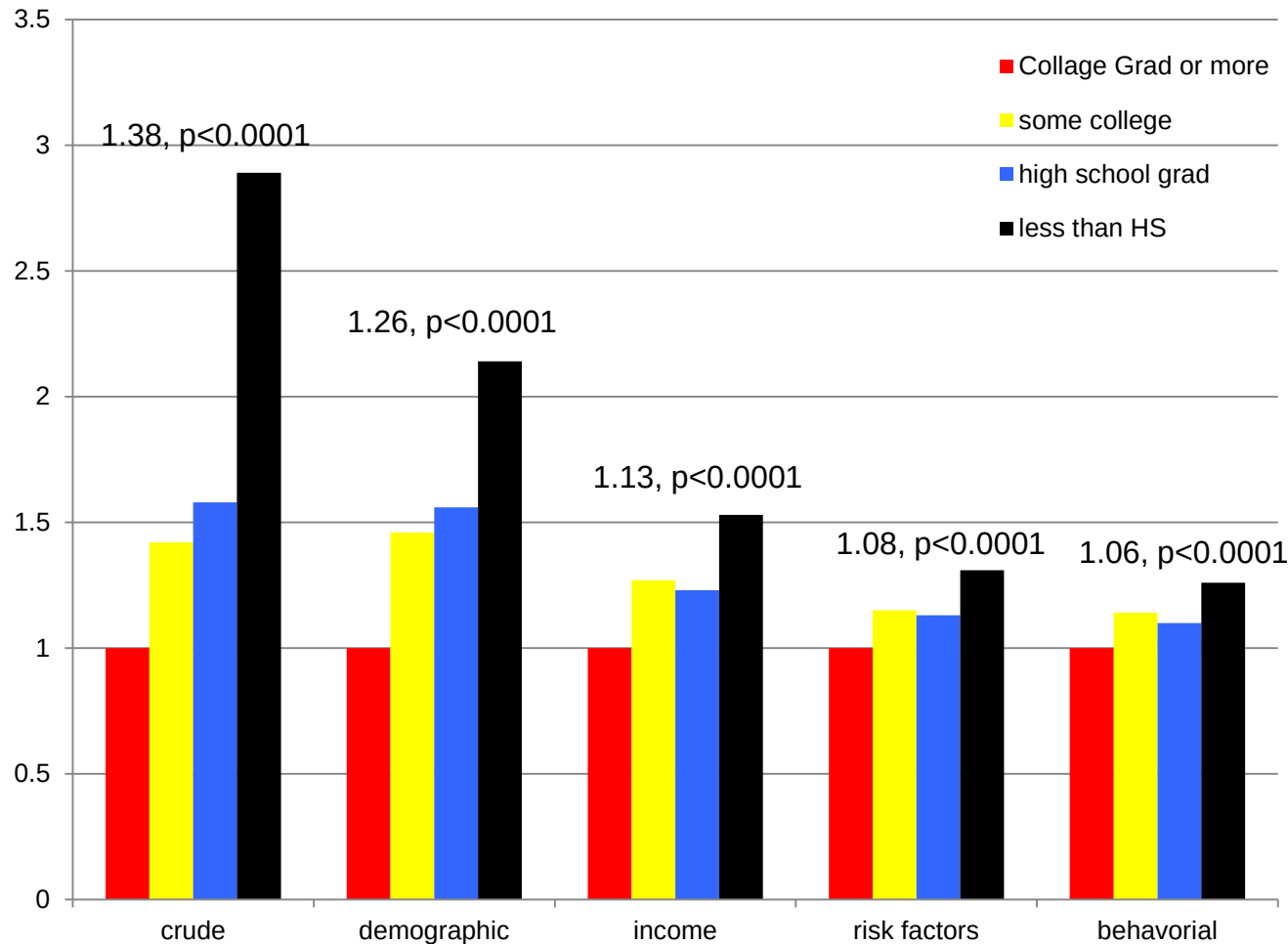
Olshansky S J et al. Health Aff 2012;31:1803-1813

HealthAffairs

Education and Longevity in the REGARDS Study With Adjustments (Kaplan & Howard, submitted)

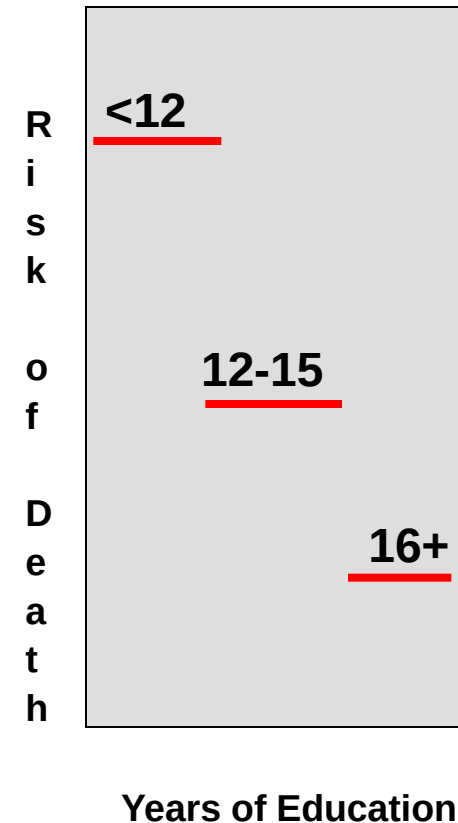


Education and Longevity in the REGARDS Study With Adjustments (Kaplan & Howard, submitted)

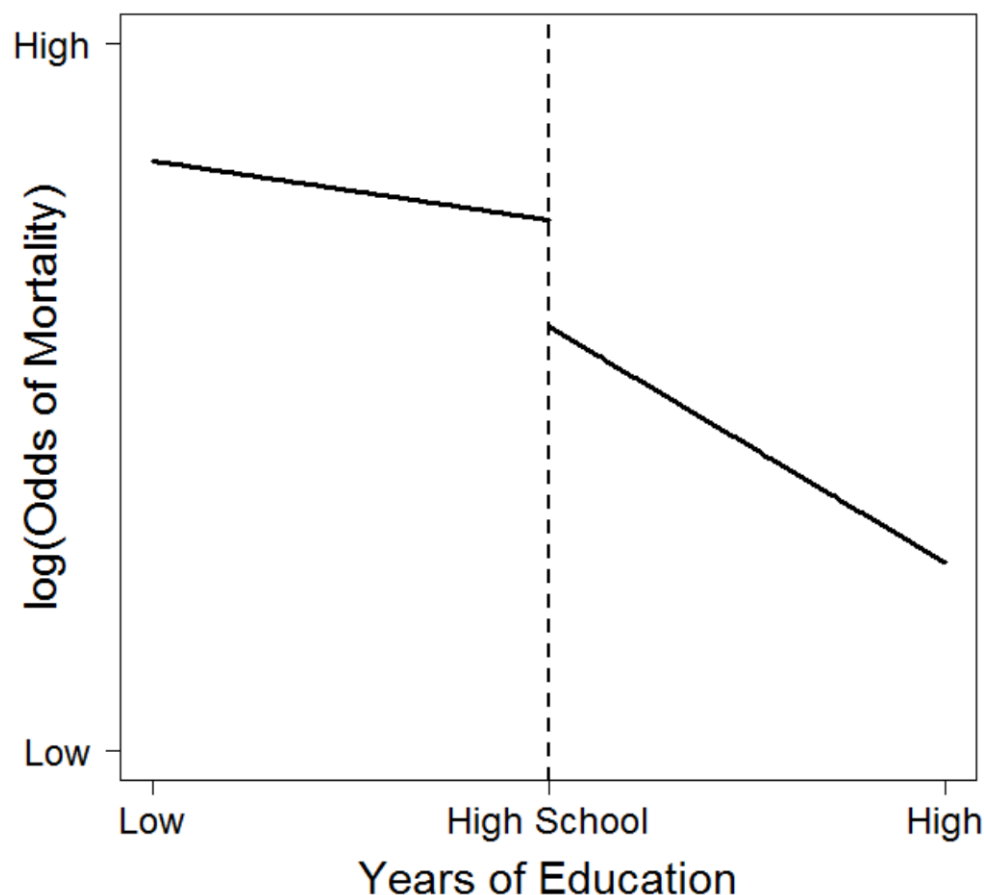


Best test until recently of functional form of the education-mortality relationship

- 🐮 Backlund et al. (1999): Among working-aged U.S. population, they found that a three category measure (<12, 12-15, 16+) best predicted adult mortality risk...high school and college degrees...a credential pattern
- 🐮 Data series centered mortality for the U.S. population in 1985, drawing on deaths through 1989
- 🐮 Model included a number of controls; hard to interpret



Montez, Hummer, and Hayward (2012)



- 🐮 National Longitudinal Mortality Study, 1979-2001, treated as cross-section (centered on 1990)
- 🐮 Examined group differences in functional form by gender, race, and age group
- 🐮 Tested 13 different forms: linear only, credentials only (piecewise), and possible combinations

Figure 1. Log-odds coefficients of the risk of adult mortality by educational attainment, Non-Hispanic Whites 1986-2006 (optimal functional form)

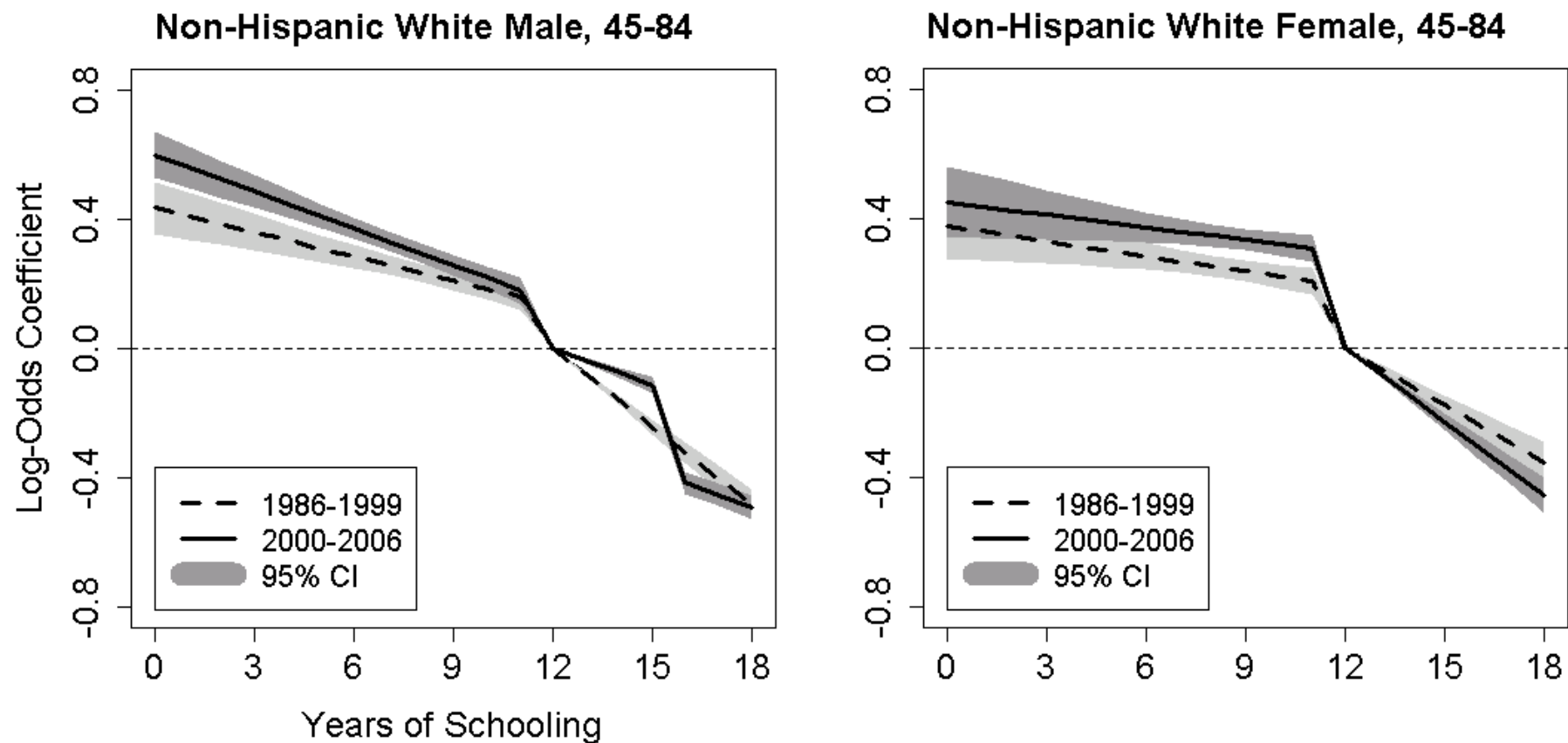
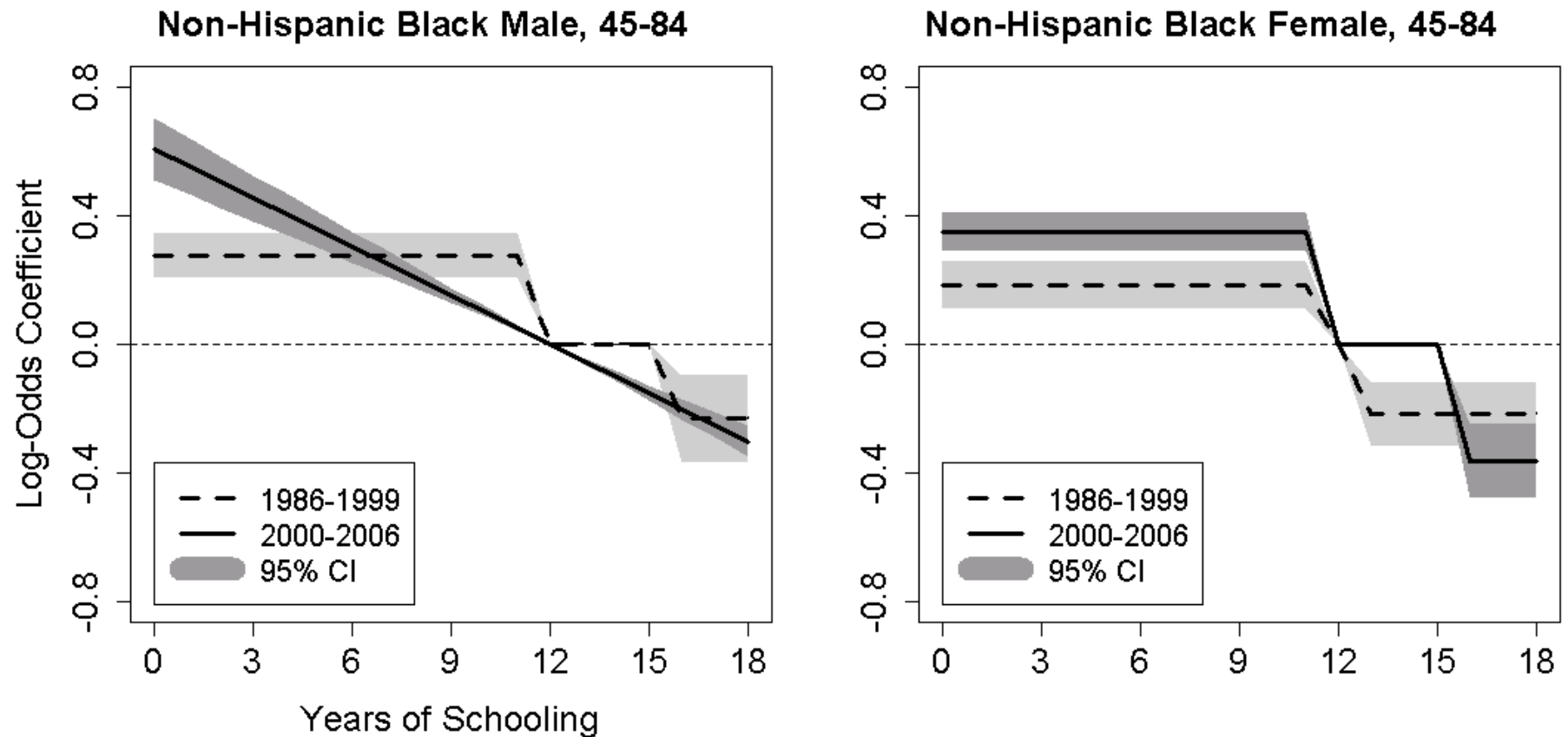


Figure 2: Log-odds coefficients of the risk of adult mortality by educational attainment, Non-Hispanic Blacks 1986-2006 (optimal functional form) (from Mark Hayward)



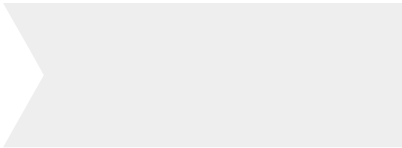
Discussion of changes in the association between education and mortality

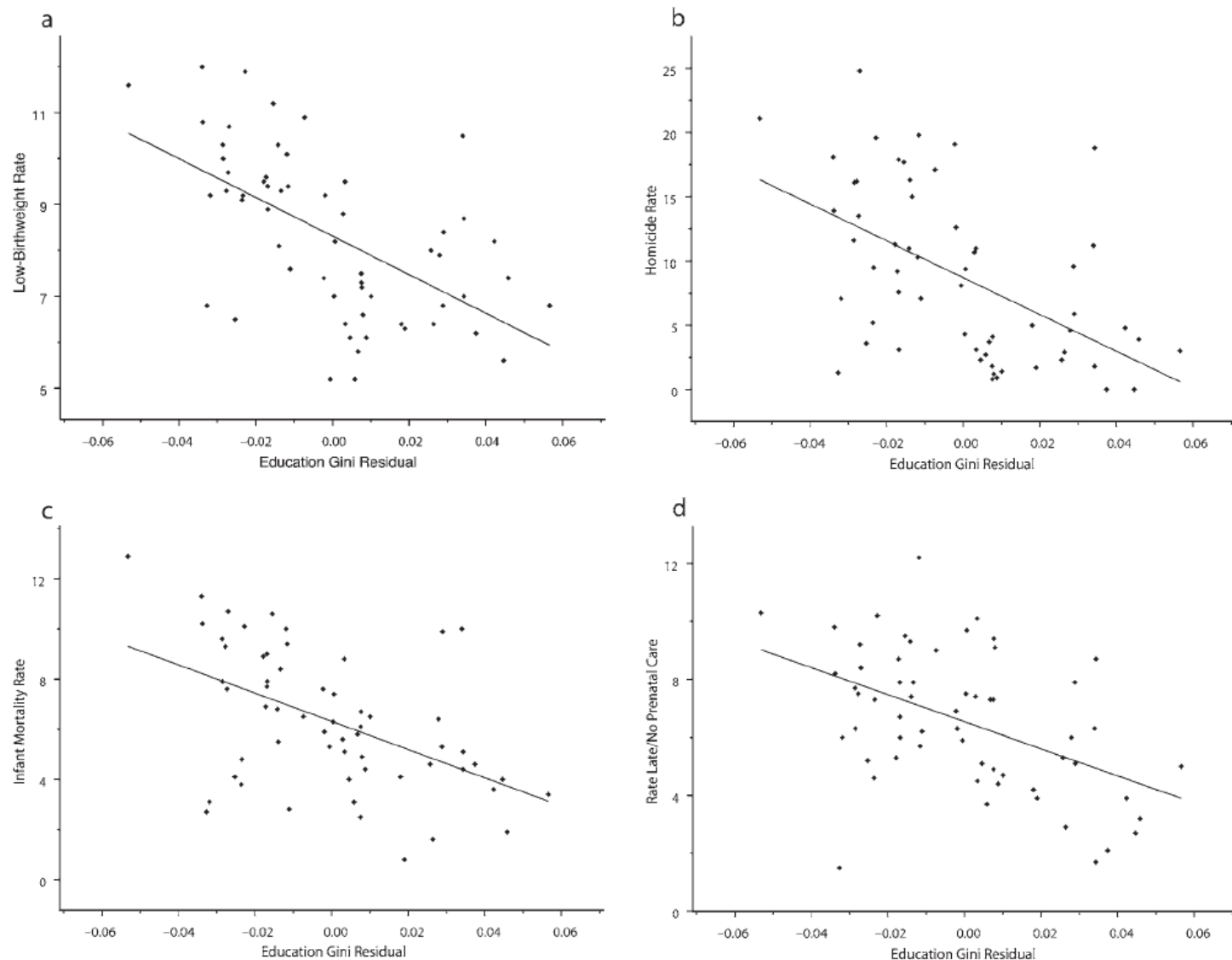
1960  1980s  Emergence of combined credentialist-exposure form

Modest educational gradient in mortality (but not for non-whites) Credentialist model established

1990-2000s

Changes in functional form reflect changes in the larger social environment that may have brought new mechanisms into play, operating at *different* parts of the educational distribution

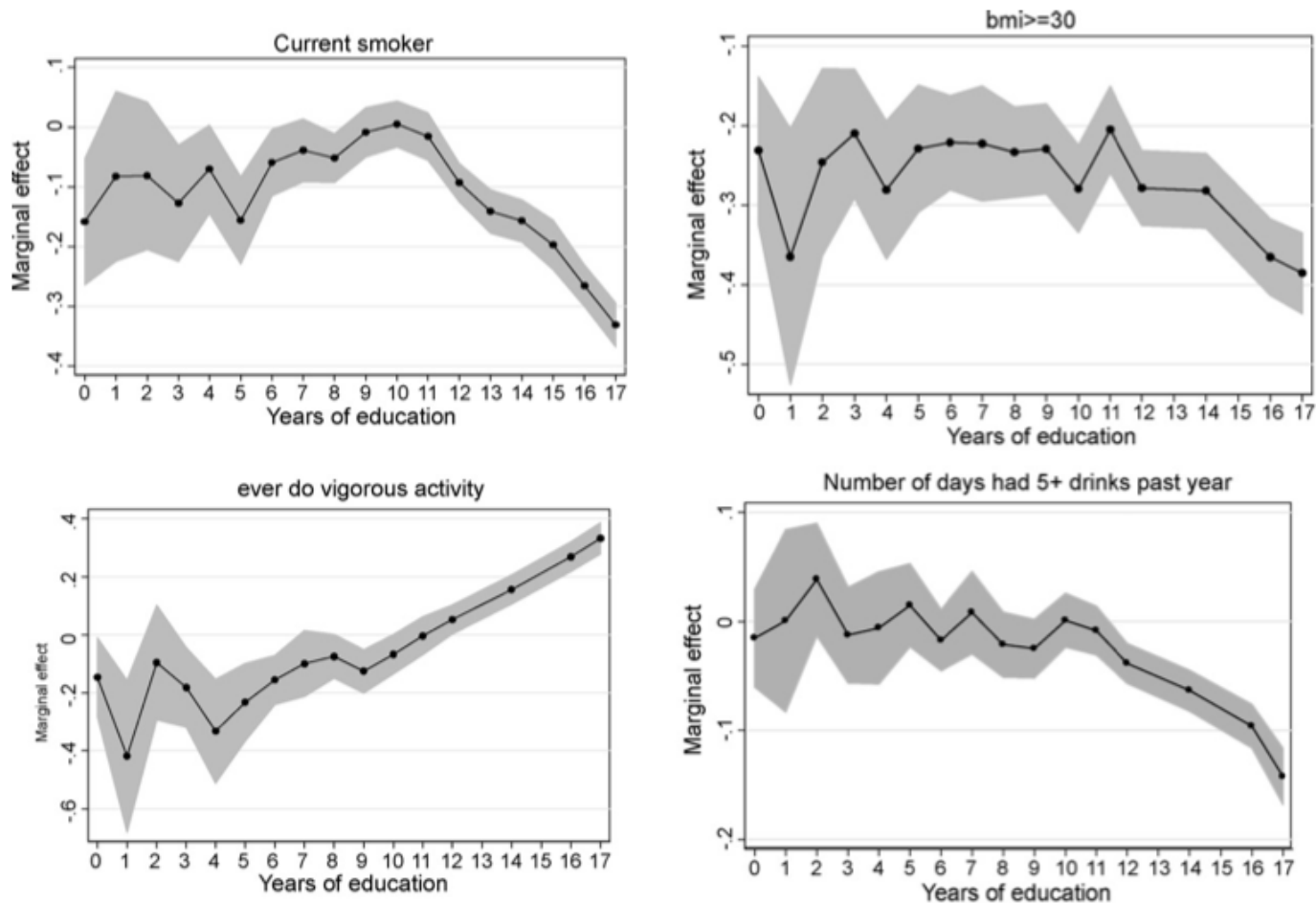




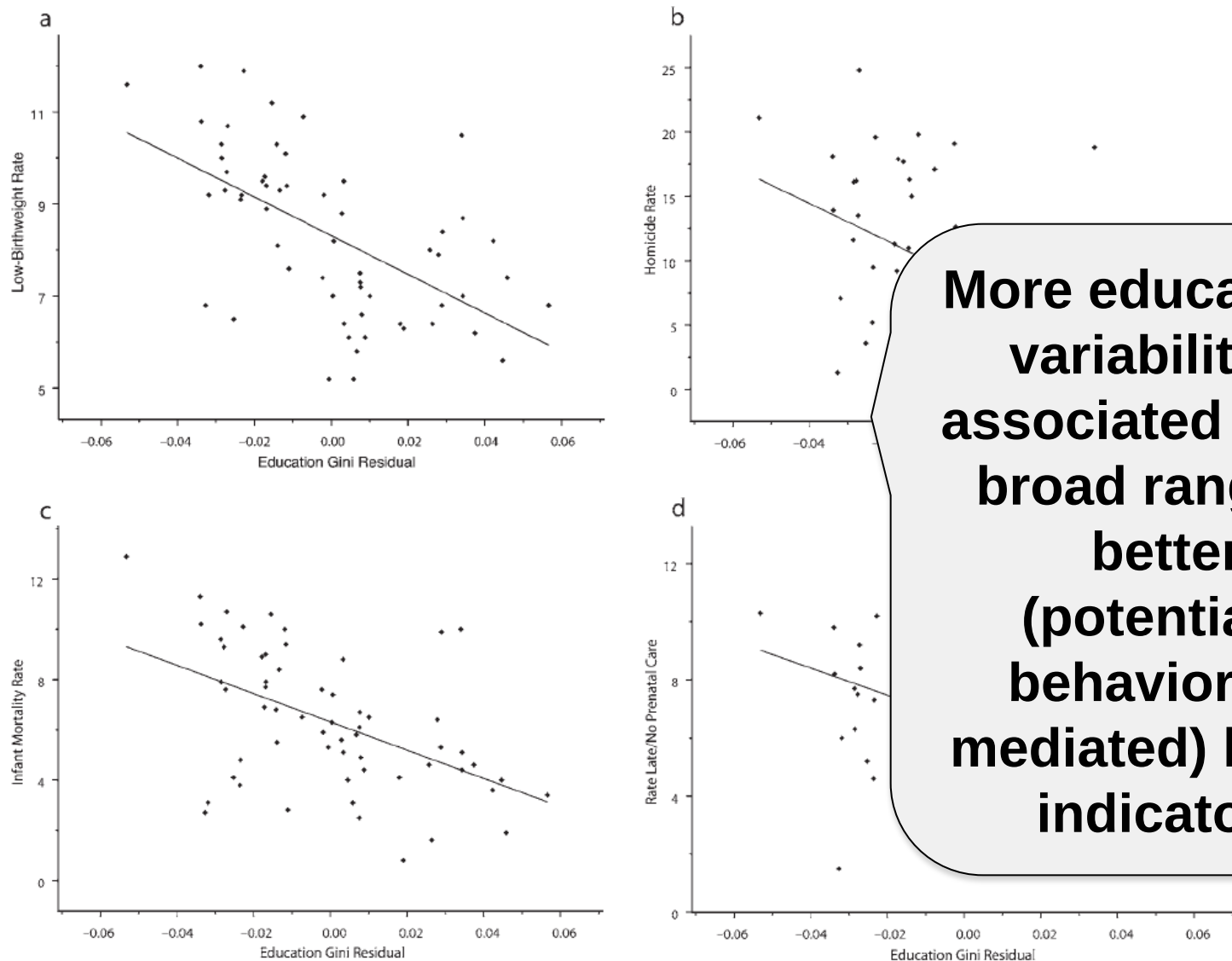
Note. A positive education Gini residual indicates a wider education distribution per level of mean education, and a negative education Gini residual indicates a narrower education distribution per level of mean education.

FIGURE 1—Scatter plots of the associations between education Gini residuals and 4 associated health indicators: (a) low-birthweight rate, (b) homicide rate, (c) infant mortality rate, and (d) late/no prenatal care rate..

Education and health: It may be related to behaviors



Cutler, D. M., & Lleras-Muney, A. (2010). Understanding differences in health behaviors by education. *Journal of Health Economics*, 29(1), 1–28.

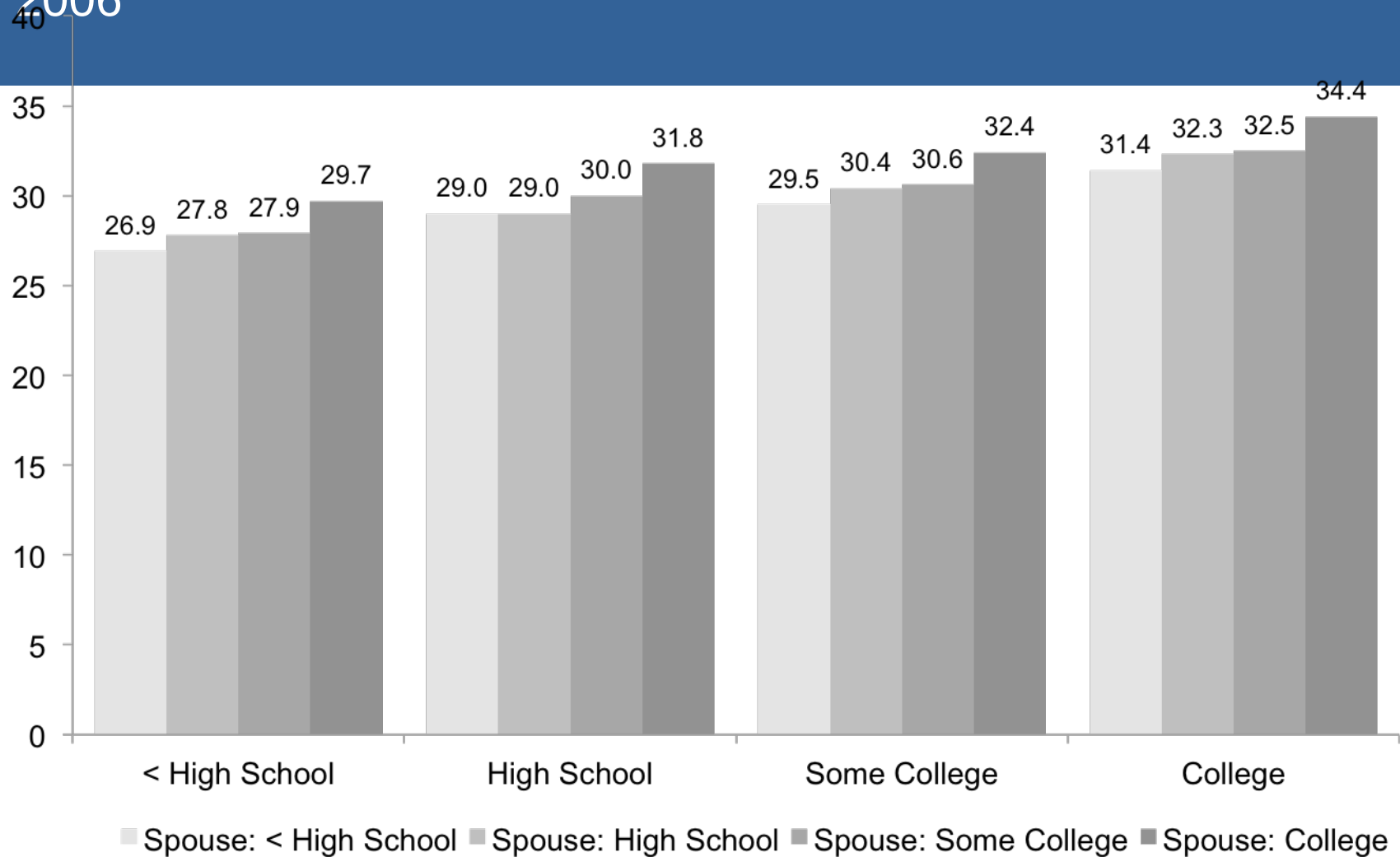


More educational variability is associated with a broad range of better (potentially behaviorally mediated) health indicators

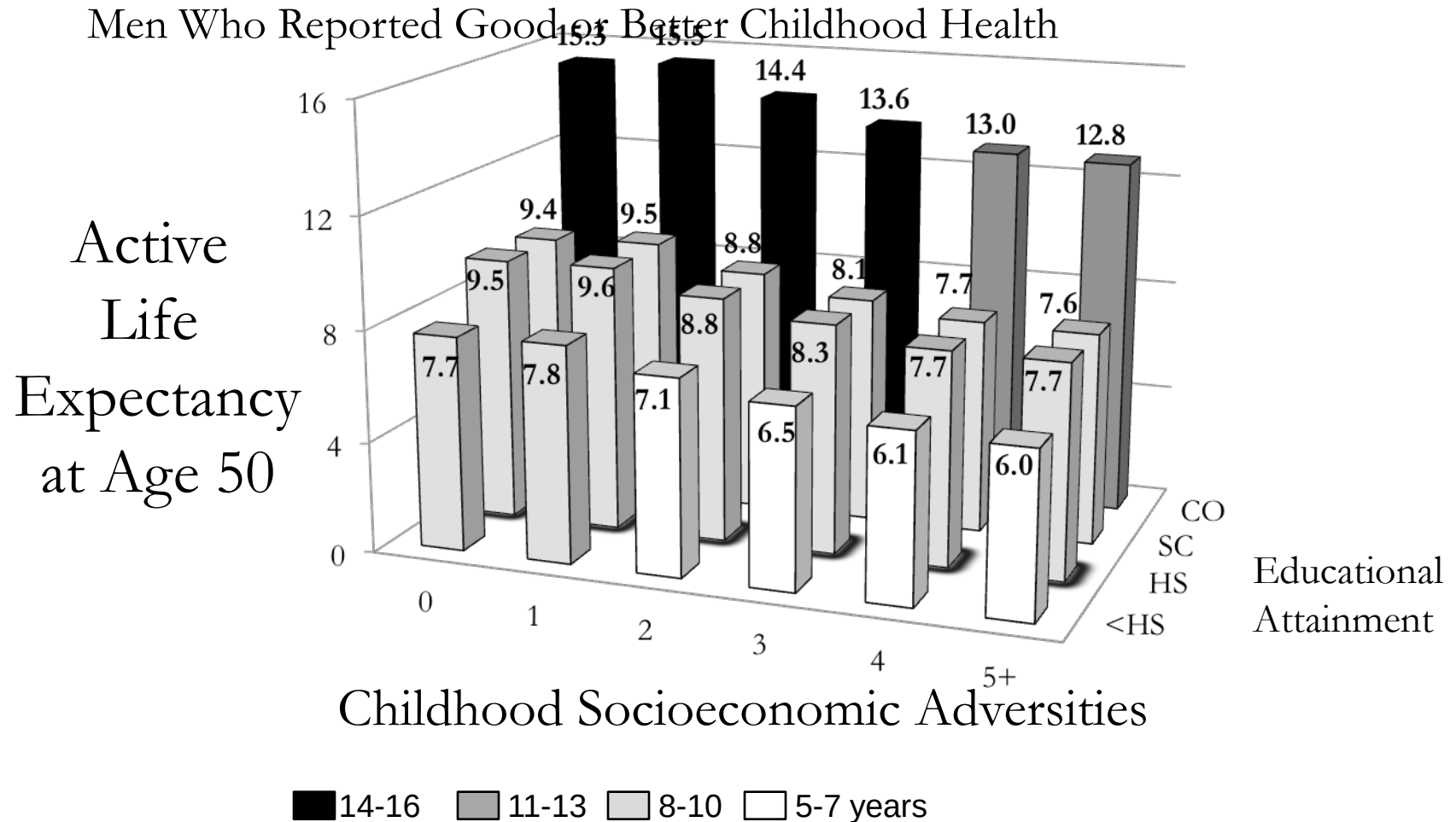
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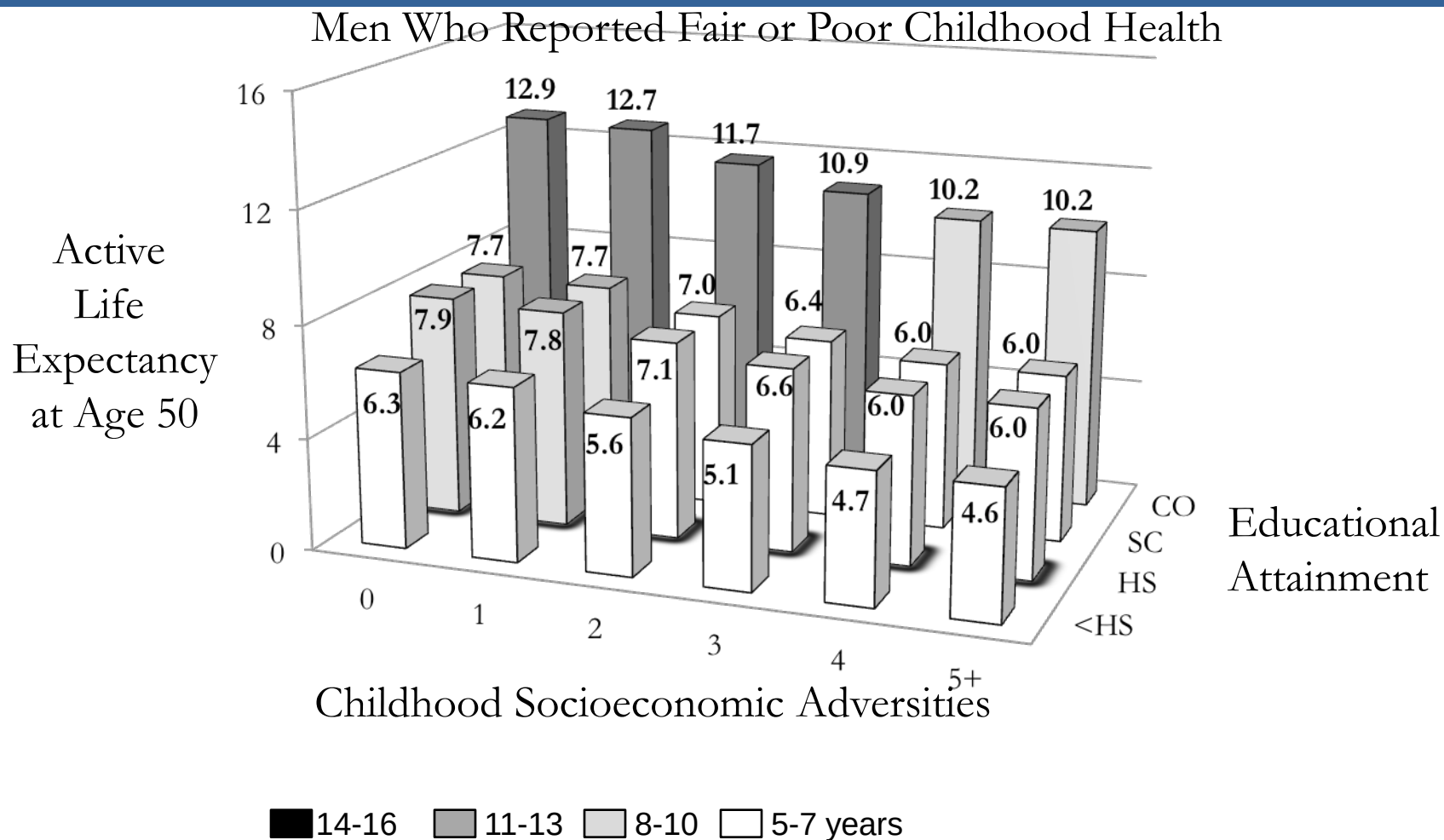
Fig 4. Life Expectancy (e_{55}) for Married Non-Hispanic White **Women** by Own and Spouse's Education: NHIS-LMF, 1986-2006



Active Life Expectancy for Non-Hispanic White Men Who Reported Good or Better Childhood Health

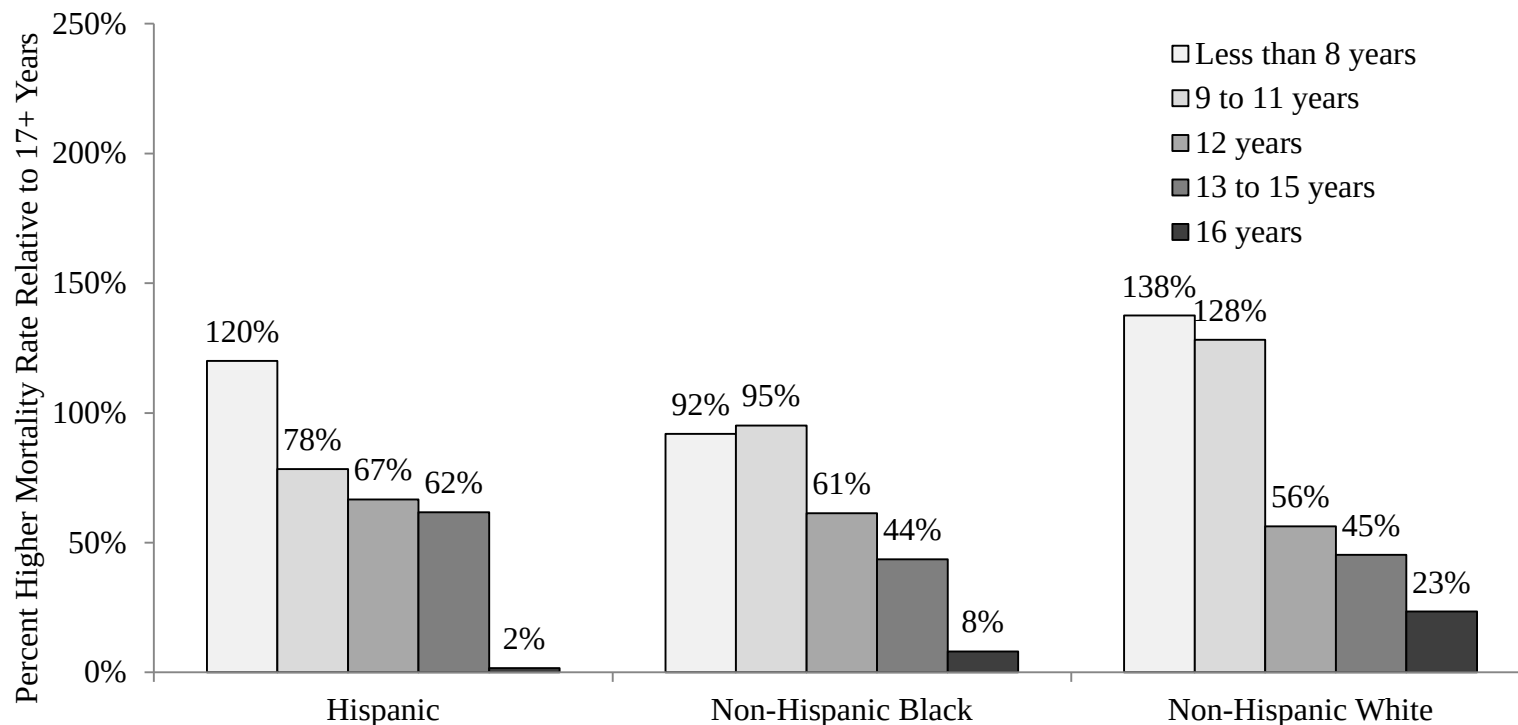


Active Life Expectancy for Non-Hispanic White Men Who Reported Fair or Poor Childhood Health



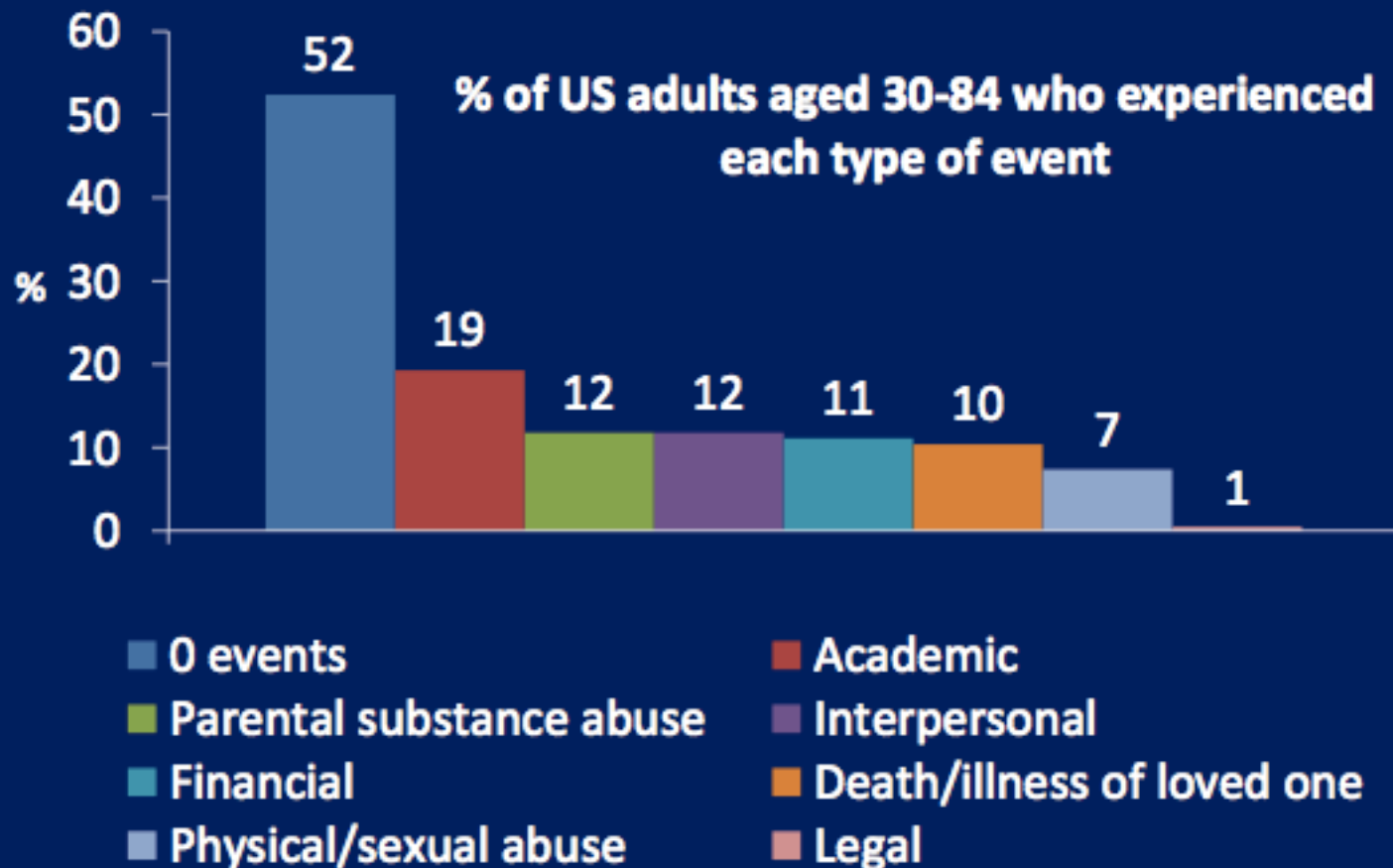
Educational Differences in US Women's Mortality Risk Compared to Those with 17+ Years, by Ethnicity

Figure 5. Percentage Increases in Mortality Rates Relative to Persons with 17+ Years of Education for US Women by Educational Attainment and Race/Ethnicity 1986-2002

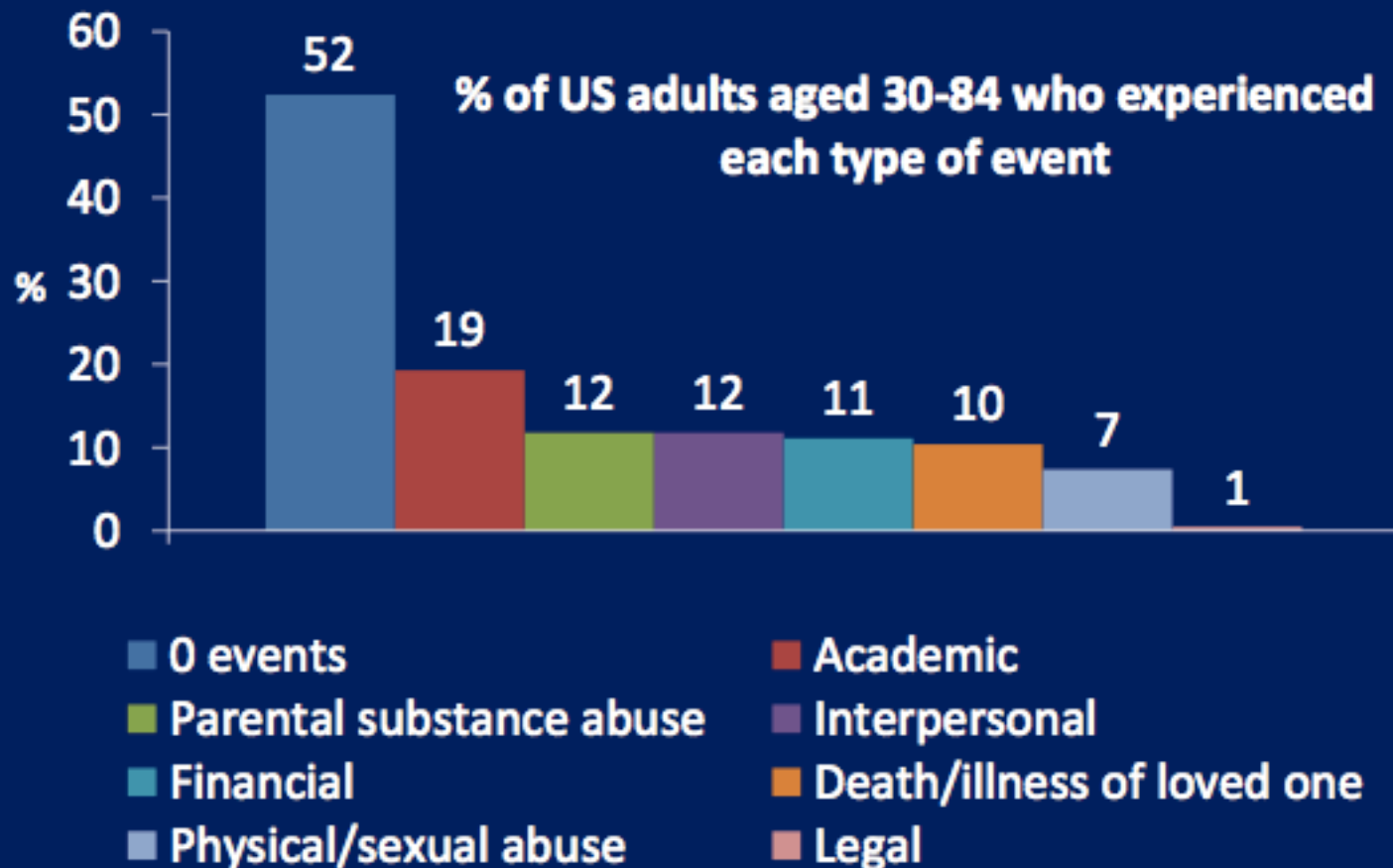


Source: Robert A. Hummer and Joseph T. Lariscy, "Educational Attainment and Adult Mortality," in *International Handbook of Adult Mortality*, ed. Richard G. Rogers and Eileen M. Crimmins (NY: Springer, 2001).

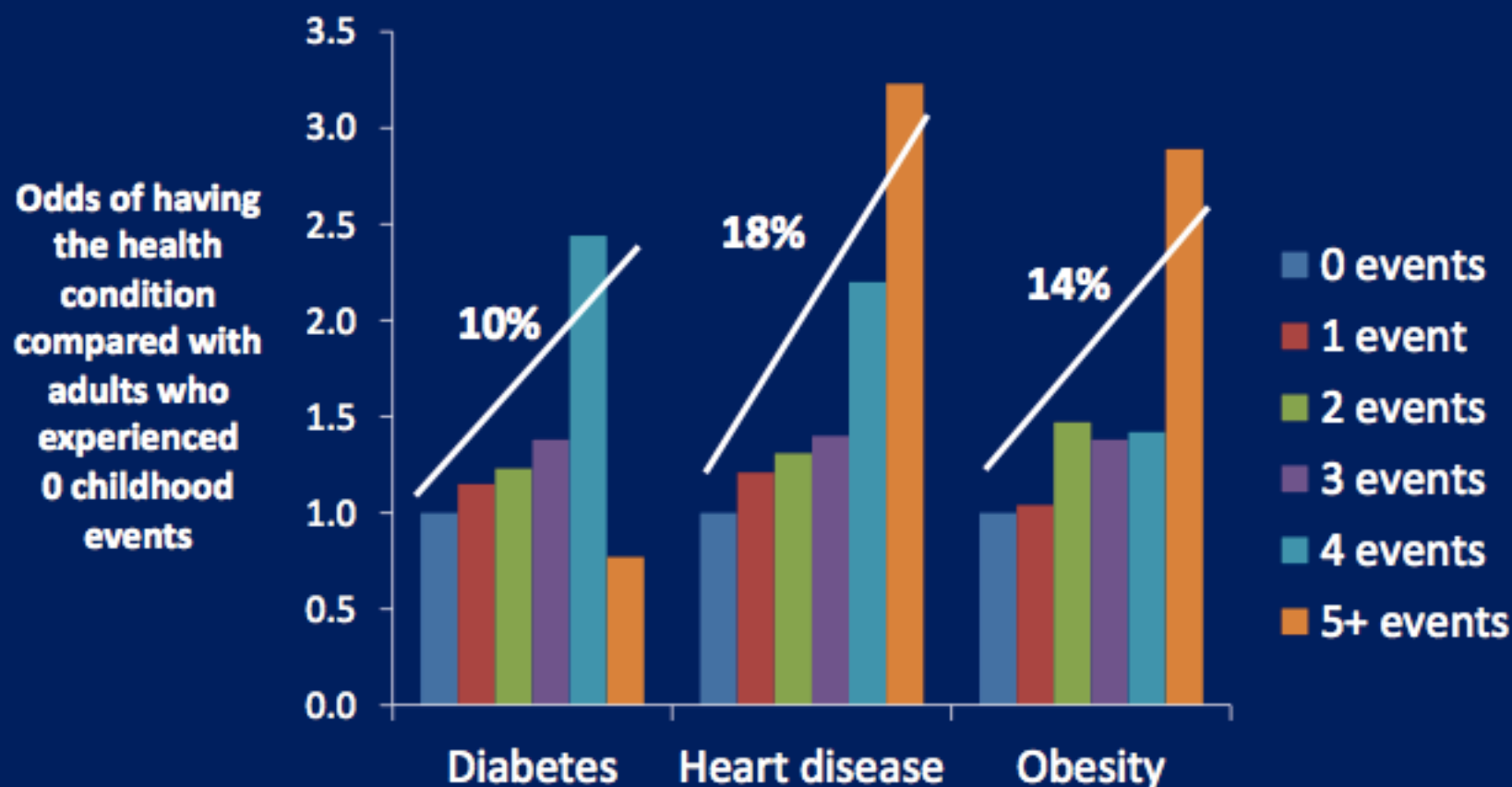
Almost 20% experience an academic event



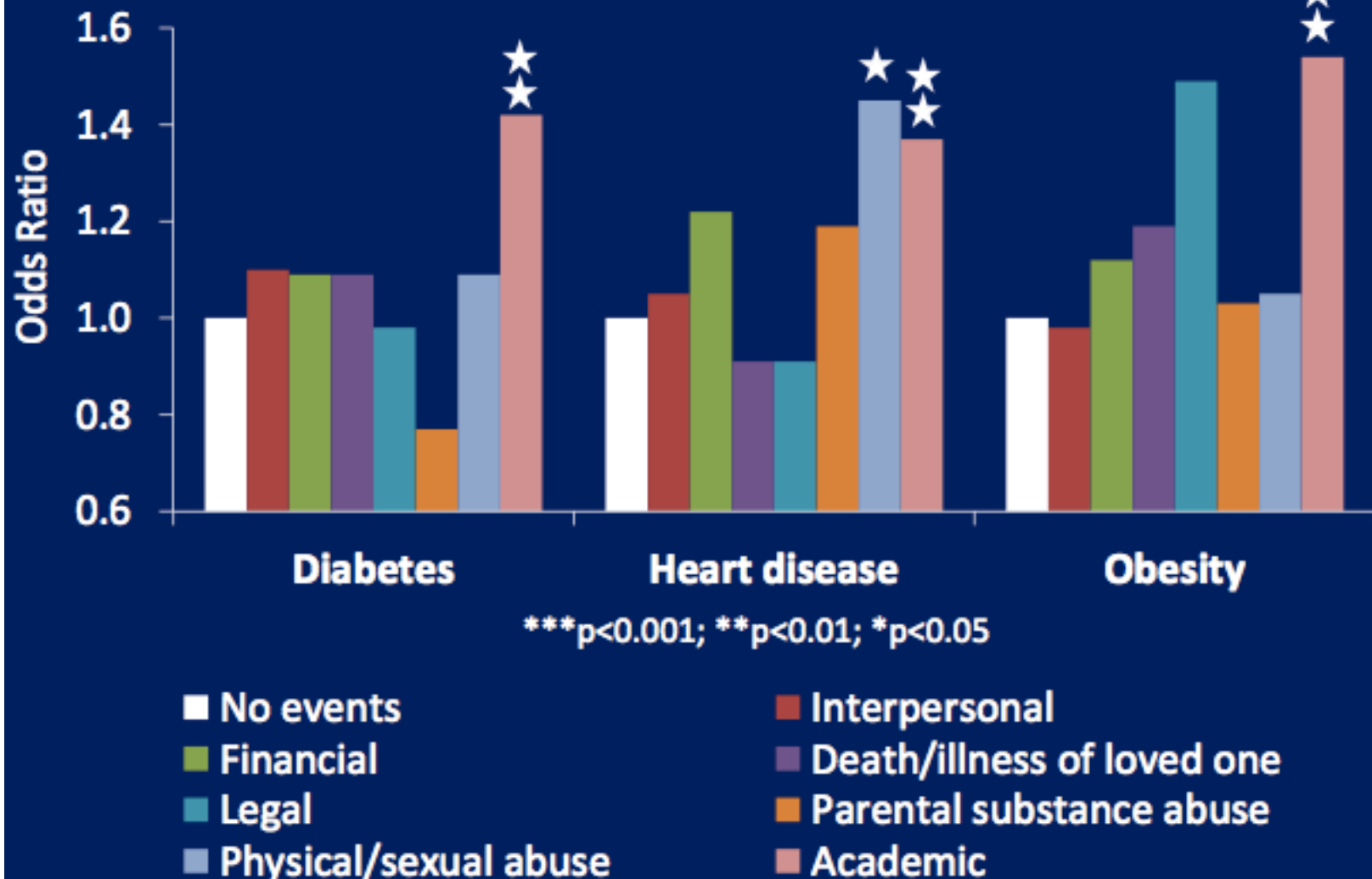
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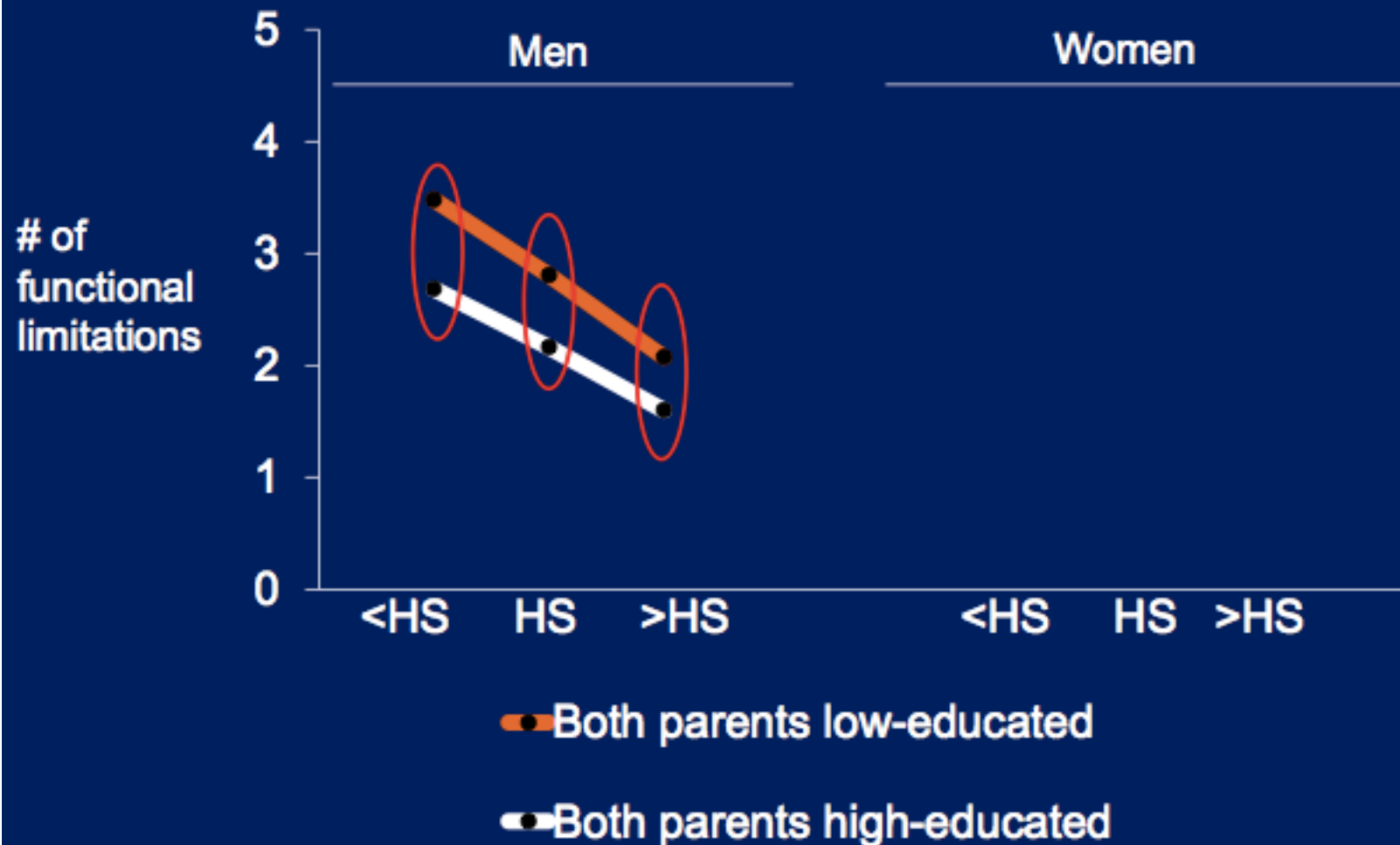
Adverse childhood events deteriorate adult health in a dose-response fashion



Academic events (& abuse) matter most



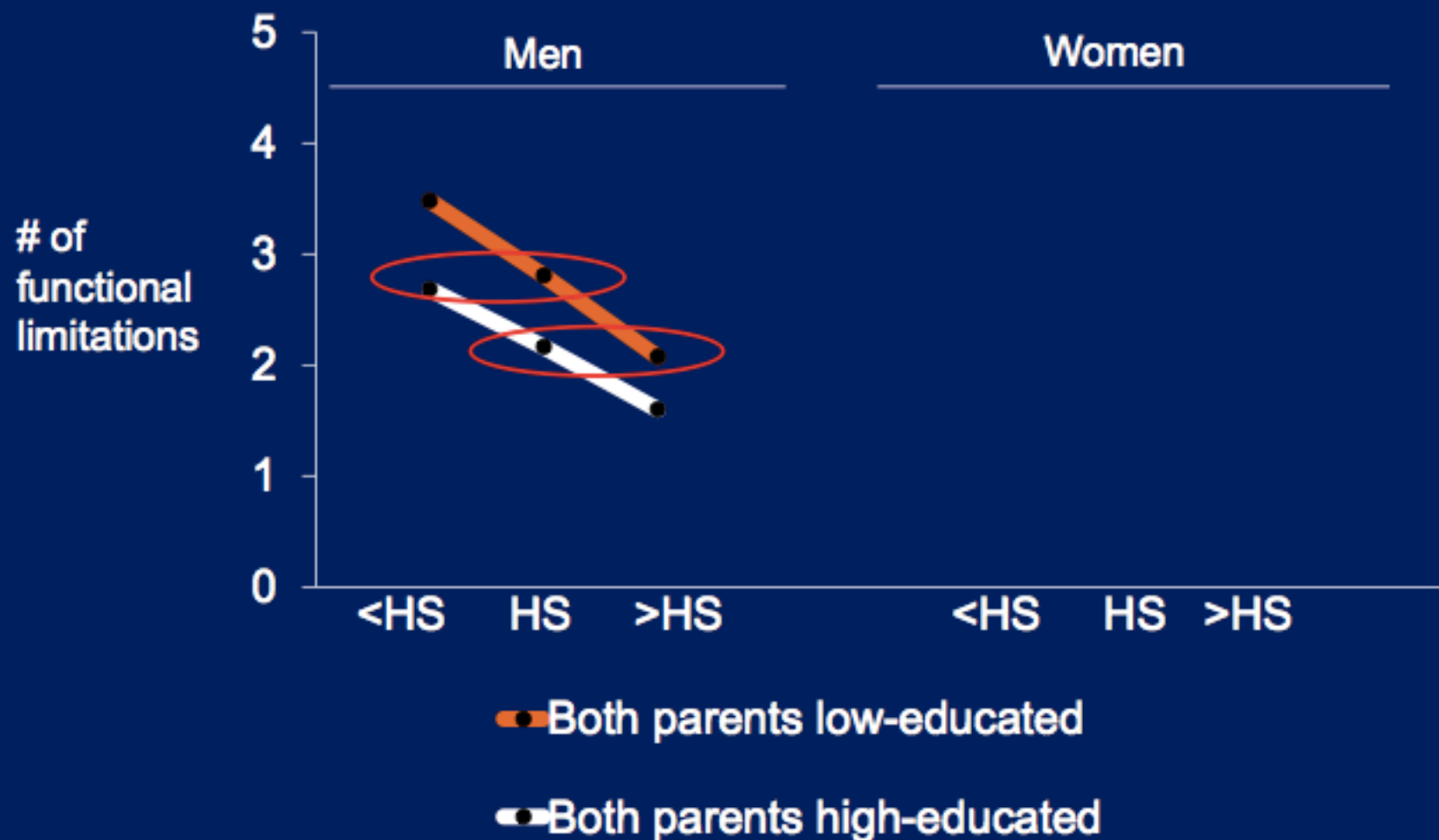
...as it does among men with low-educated parents



Data: 1994-2010 Health and Retirement Study; adults 50-100 years of age
Montez. 2013. "The Socioeconomic Origins of Physical Functioning among Older US Adults." *Advances in Life Course Research* 18:244-256

JK Montez

...as it does among men with low-educated parents



Natural Experiments

- Multiple intervention studies from US Dept. of Ed, Institute of Education Science. We need to explore whether they would be willing to add health measures to follow-ups
- Natural Experiments created by lottery selection in high profile charter schools. Students selected at random and those not selected become controls
 - Followed for educational performance
 - Health habits
 - Transitions to additional education
 - With appropriate permissions, can be linked to EHR



Unpacking the Relationship Between Education and Health

Potentially three RFAs: Basic Mechanisms

Neuroplasticity hypothesis:

Suggests interventions must be in the first 1,000 days of life

Personality hypothesis:

Conscientious people are more likely to live longer and complete more education

Habits hypothesis:

Education is associated with the development of better health habits

Current evidence does not clearly support any one hypothesis



Education and Health – Building New Data Infrastructure

RFA 2: Data Infrastructure Will Create New Opportunities

Examples of New Data That Are Becoming Available

Project TALENT:

Longitudinal study of 440,000 high school seniors who underwent extensive testing in 1960 and was followed for 20 years. Mortality analysis now planned

New data available from Society of Actuaries

Many states now are able to link school performance to detailed information about communities, teachers, and school characteristics

How Did We Do?

- Convene heterogeneous group of experts representing
 - Economics
 - Sociology/demography
 - Epidemiology
 - Psychology
 - Medicine (Family Med, GIM, Pediatrics, Preventive Medicine, Psychiatry)
 - A
- Identify gaps in knowledge
 - C+
- Stimulate interest by funding agencies
 - ??