

Risk and Resilience Pathways in Aging Health Disparities: A Research Agenda

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Supported by

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Overview

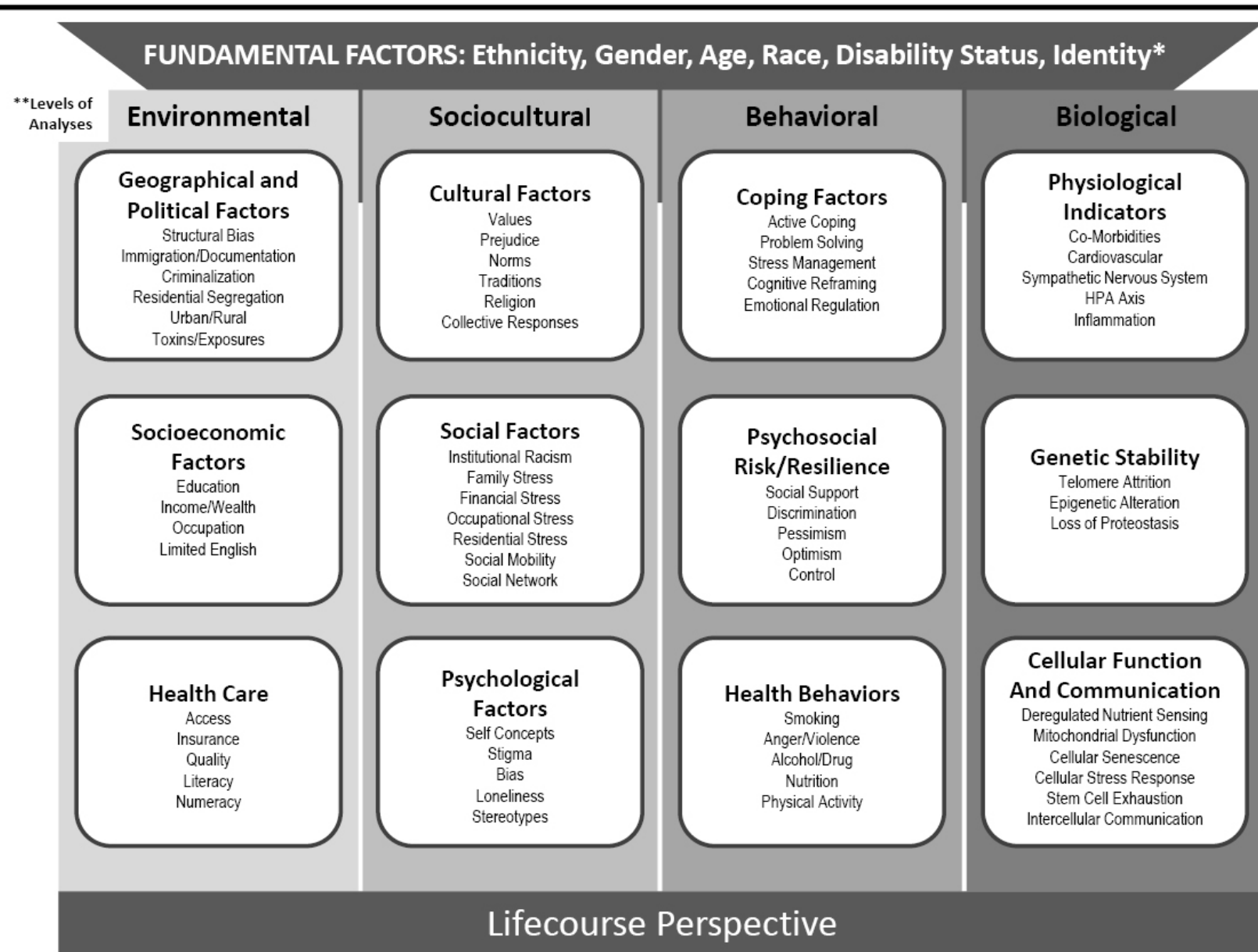
- What are the right questions to ask to address aging health disparities?
- Challenges & opportunities in health disparities research among older adults
 - Selection bias
 - Lifecourse models
- Risk
 - Race
 - Education
 - Place
- Resilience
 - Definition
 - U-shaped curve
- Implications for interventions & research agenda

What are the right questions?

- What are the *causal* factors?
- What are the *modifiable* factors?
- What interventions would have the biggest population impact?

- What is our framework?

NIA Disparities Research Framework Hill et al., 2015



Challenges & Opportunities

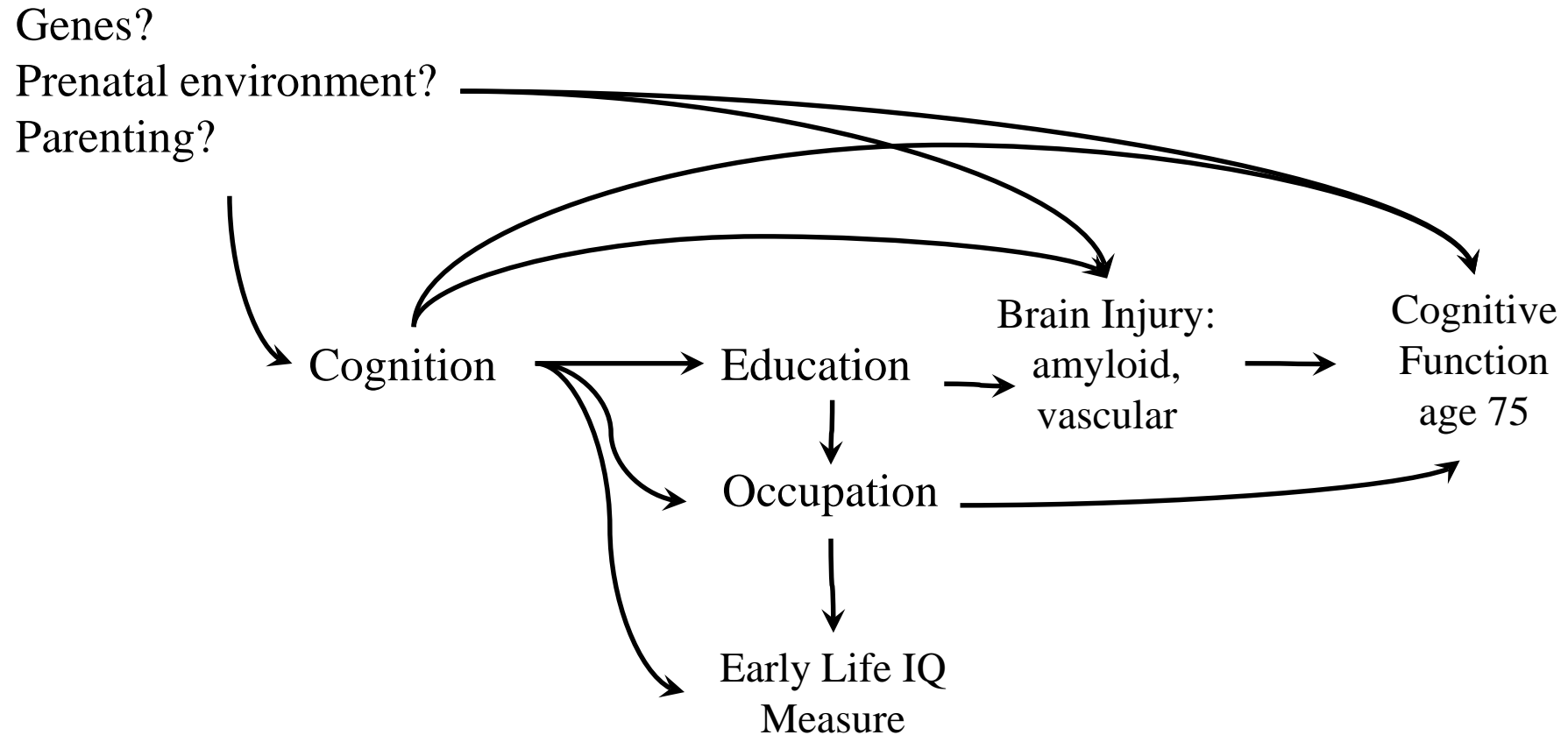
What, *precisely* is modifiable and causal?

- Selection bias
- Reverse causation
- Lifecourse
 - Timing (social or physiological developmental stages)
 - Critical periods
 - Gap between exposure and outcome and interaction between behavior and biology
 - Level (individual, family, community, system)
- Measurement
 - All highly correlated
 - Can't measure it all so we rarely have detailed measures across levels
 - Non-linear change
- Dose

Why is it so difficult to identify disparity causes?

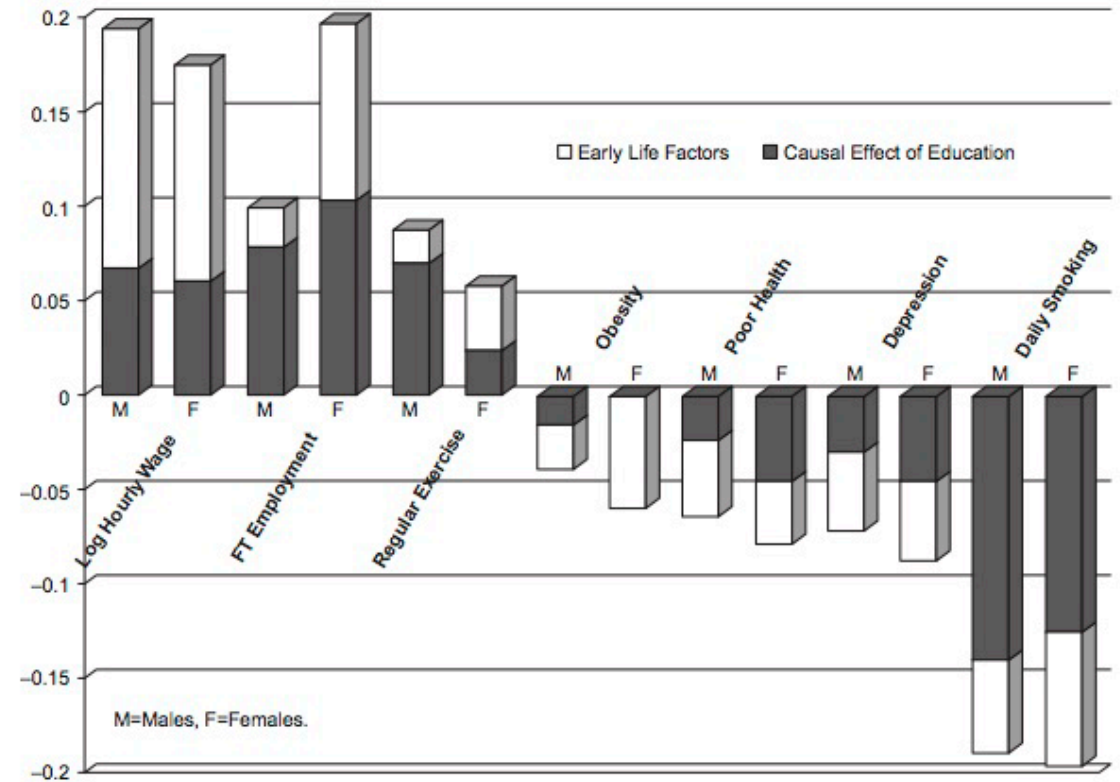
- Separately identify selection effects from causal (treatment) effects
 - Parents exacerbate initial endowment differences by engaging in reinforcing investments (Almond & Mazumder, 2013)
- Differentiate biological pathways from behavioral responses
 - Biological embedding of early life experiences
 - Behavior may buffer or magnify
 - Different early life conditions may act through different biological pathways, eliciting different outcomes
- Researchers lack comparable metric for exposures and outcomes
- Critical periods of development and nonlinear change in outcomes

Why is this difficult to answer?

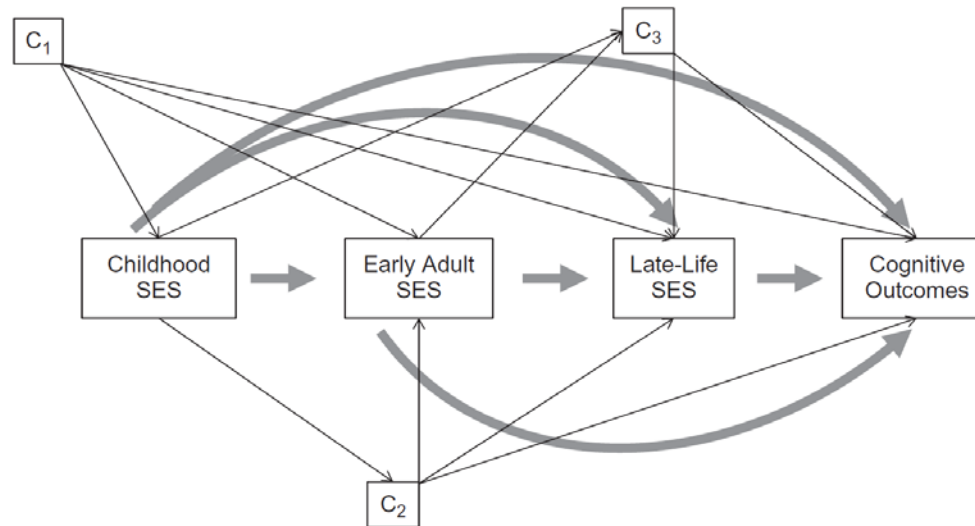


Decomposition of disparities – British Birth Cohort

- Education has a stronger causal effect on health behaviors than on health
- Early life factors (endowments and family environments) account for at least half of the adult disparities in poor health, depression, and obesity.
- The success of later interventions depends on the quality of earlier ones
 - Effect of education on health varies as function of early life endowments
 - Effect of education on smoking is stronger for males with higher cognition and lower self-regulation

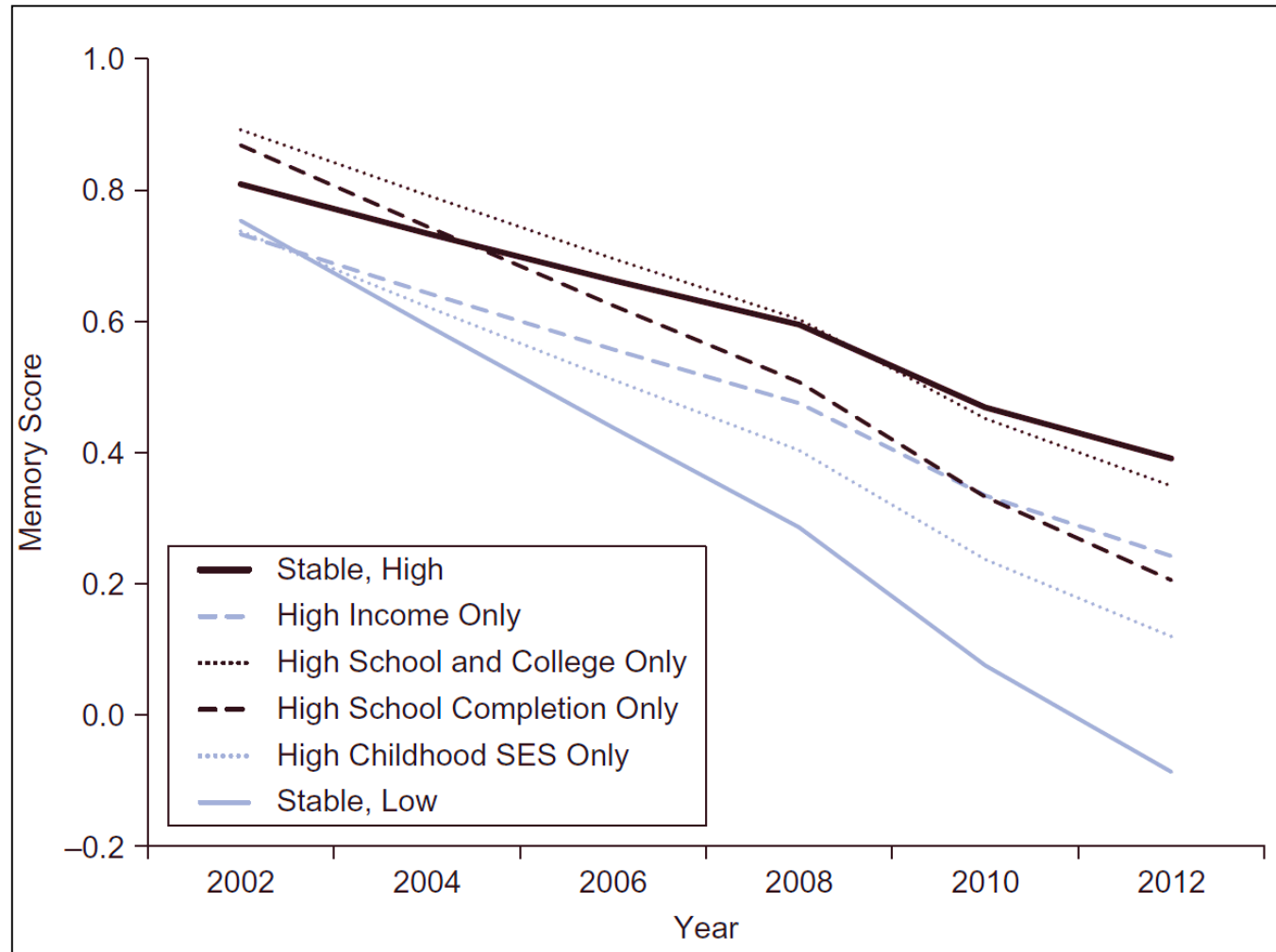


SES measures at each lifecourse period confound subsequent SES



- Tempting to ignore this complex confounding because all are correlated
- Must drill down and be specific to guide potential interventions
- Marden et al. considered childhood SES, own education, and mid-life income in HRS as predictors of memory and memory decline
- Used IPW to account for time-varying confounders

Education predicts baseline; inconsistent links with slope



- Stable low SES has lower starting point and faster decline than stable high SES
- Education most important for baseline
- Income most important for slope

Rationale for lifecourse model

- Health disparities
 - Adult illnesses are more prevalent and burdensome among individuals who have experienced adverse early life conditions (Galobardes, Lynch, & Davey-Smith, 2008)
- The exact mechanisms through which early life experiences translate into later life health are unknown
 - There is evidence for both biological and socioeconomic mechanisms (Hertzman & Boyce, 2010)
 - Identifying mechanisms is vital to design policies that are effective at reducing health inequalities
- Evidence for the social determinants of health (Marmot & Wilkinson, 2006) emphasizes the necessity for:
 - Prevention (upstream)
 - Consideration of dynamic nature of the formation of human capital
 - ***Role of economic and social policy as health policy***

What do we know about predictors of dementia?

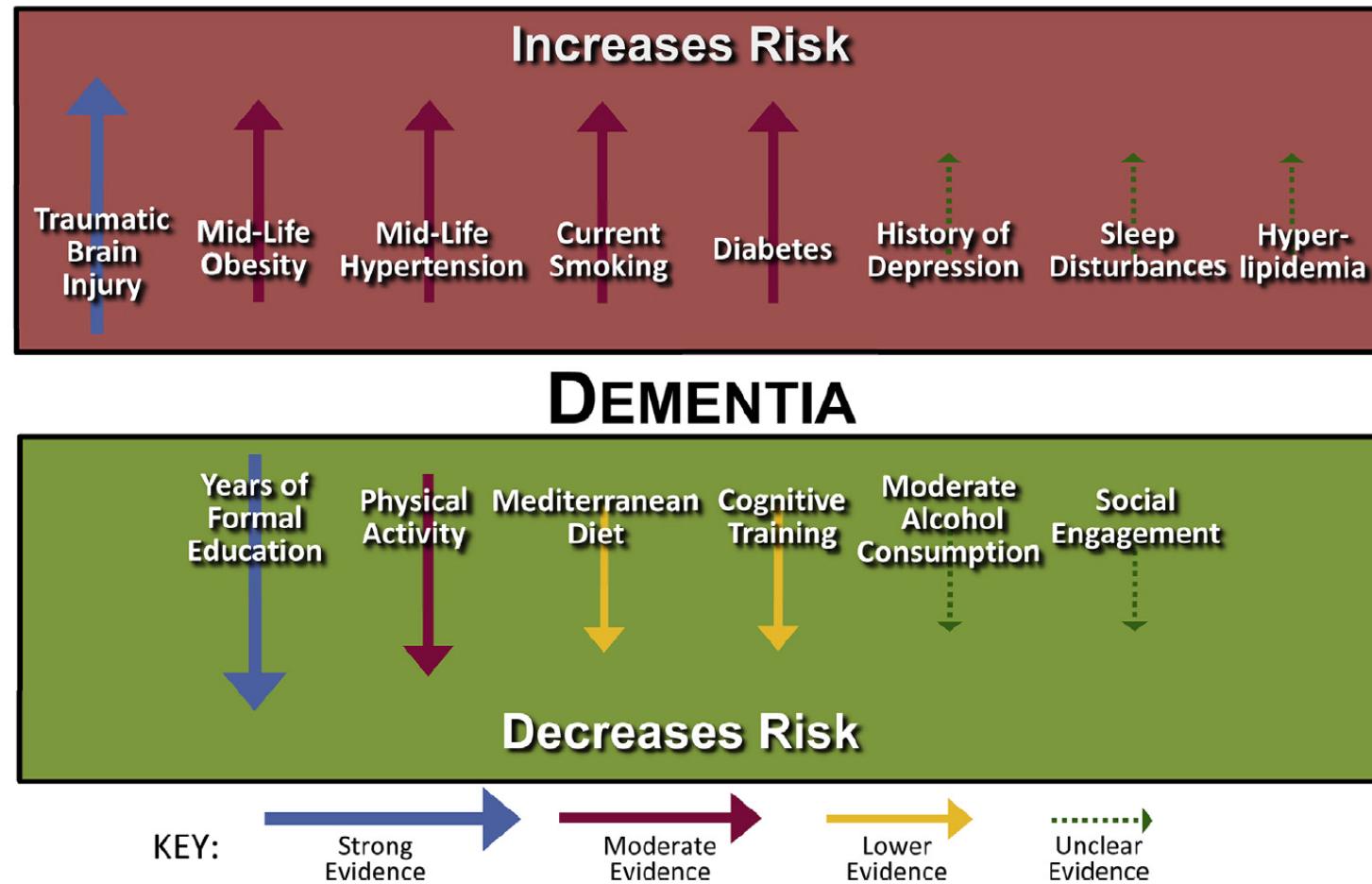


Fig. 2. Strength of evidence on risk factors for dementia.

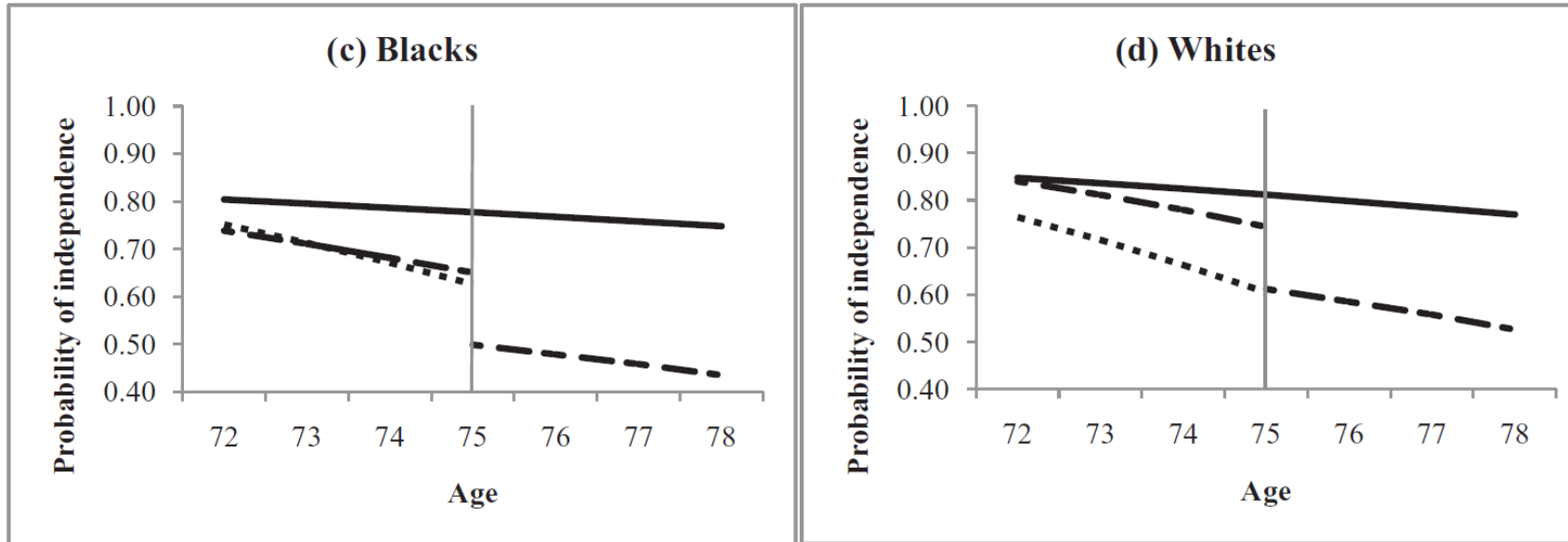
Lifecourse model of cognitive impairment and dementia

- Strongest, most consistent modifiable risk factors for dementia are associated with early life adversity
 - Most research purporting to evaluate the causes of dementia, MCI, or related impairment outcomes reproduces evidence on childhood cognitive development (Glymour interpretation)
- Implies that investing in healthy child development is a critical component of dementia prevention

Selection Bias

- An aspect of the selection process introduces a systematic discrepancy between the effect estimate in the analytic sample and the effect in the target population.
 - Definition of the population from which to sample
 - Enrollment into the study
 - Attrition due to drop-out
 - Attrition due to death
- Differences in recruitment across groups may lead to wrong answers
 - Minority participants may not be broadly representative of the community
- Minorities are less likely to present to clinics, are less likely to be formally diagnosed with neurocognitive disorder
 - e.g., minorities who present to memory disorder clinics are more likely to have neuropsychiatric symptoms than Whites

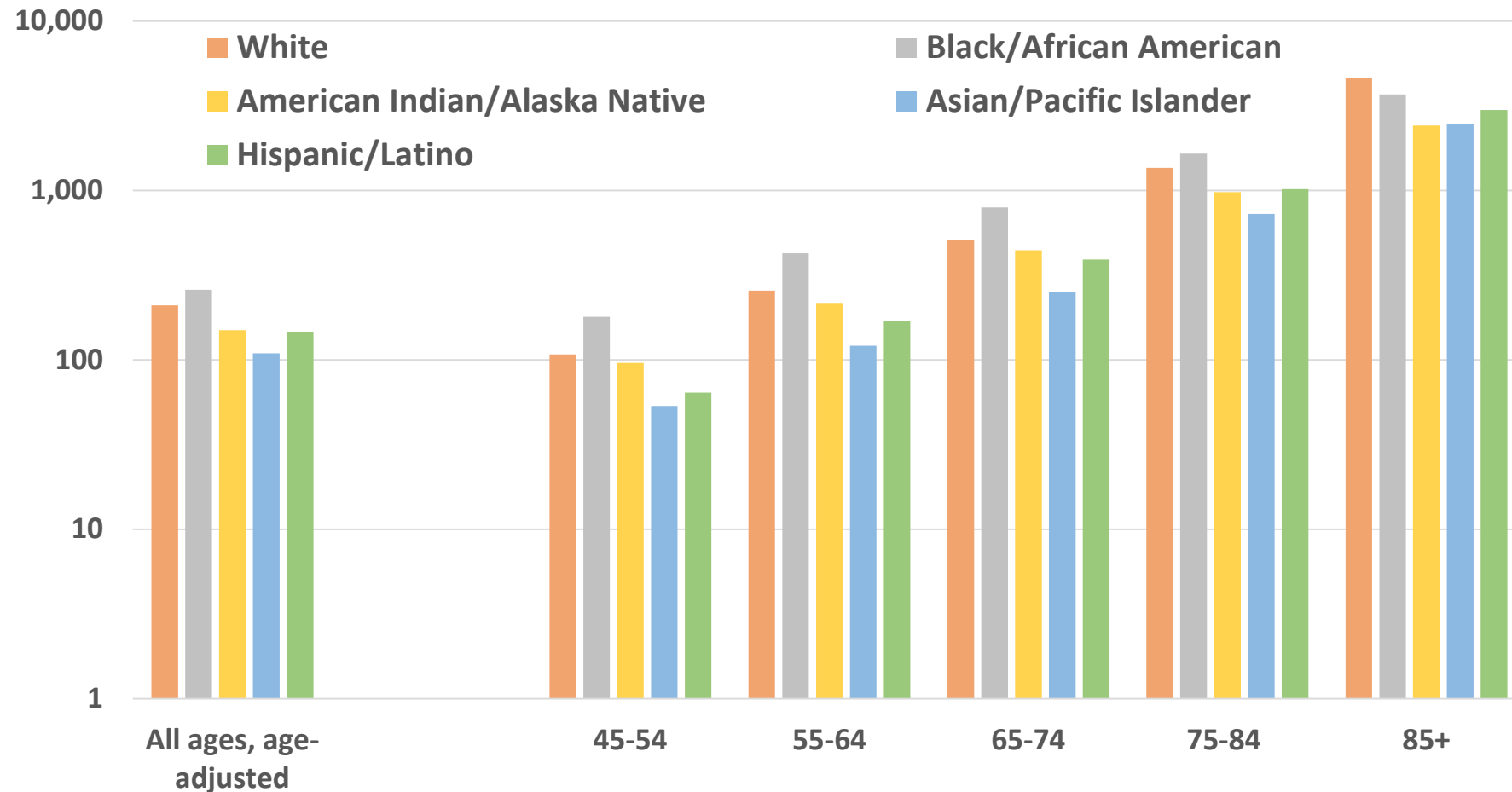
Is post-stroke disability worse among blacks due to worse stroke care or post-stroke therapy?



- Non-white stroke survivors averaged lower poststroke independence than white stroke survivors, this difference was not attributable to effects of stroke.
- The difference in probability of IADL independence between stroke-free and stroke survivors was 13 percentage points for non-whites and 6.7 percentage points for whites just prior to stroke
- Prestroke differences transmitted to the poststroke population

Disparities in many dimensions attenuate or reverse in late life

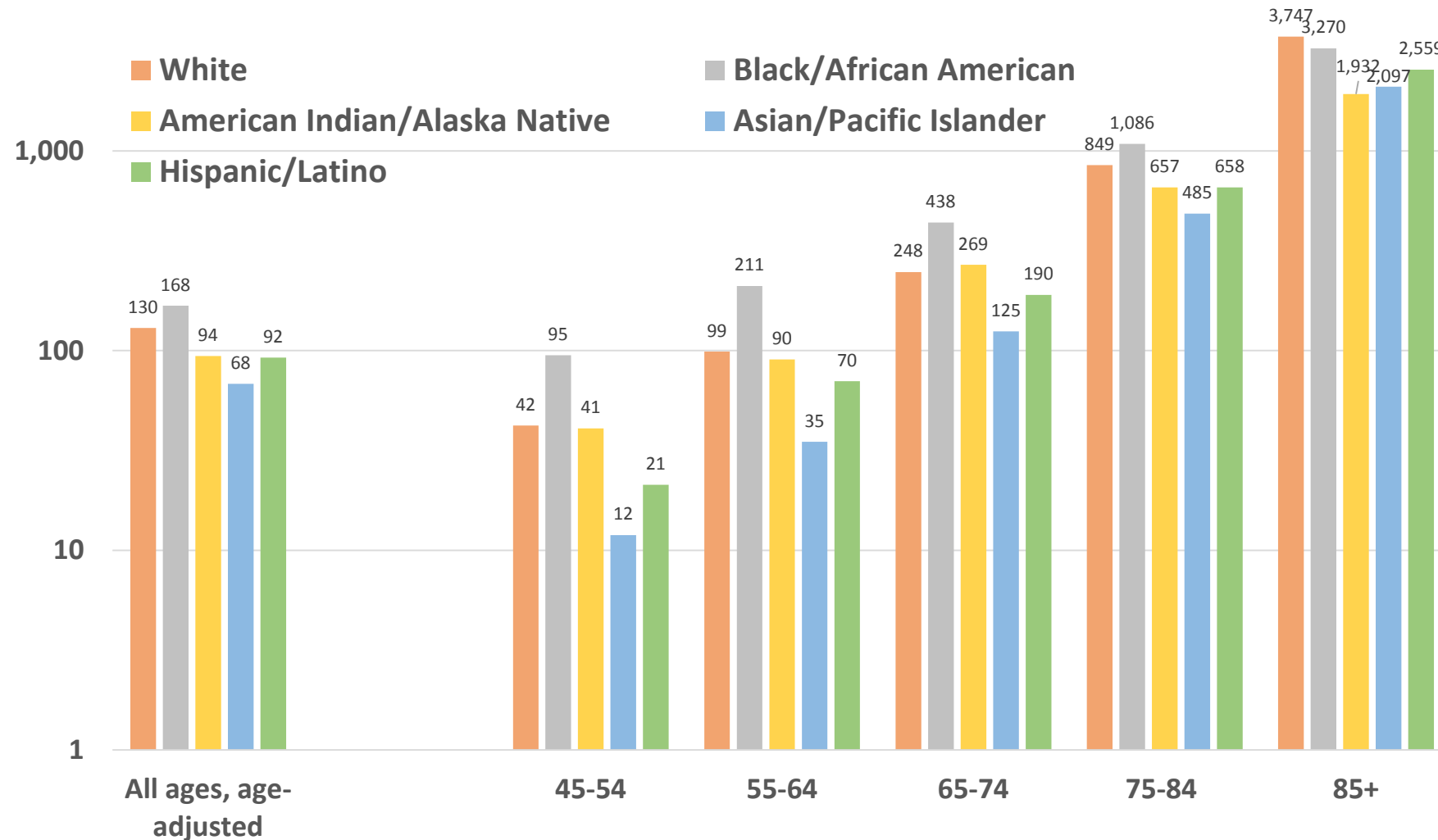
Male Death Rates from Heart Disease (per 100,000, log scale), 2014



Disparities in many dimensions attenuate or reverse in late life

10,000

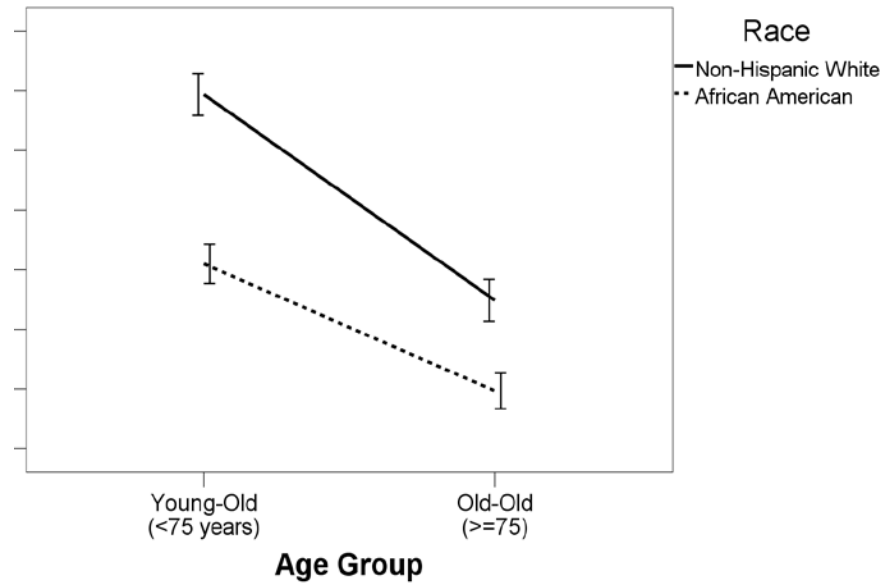
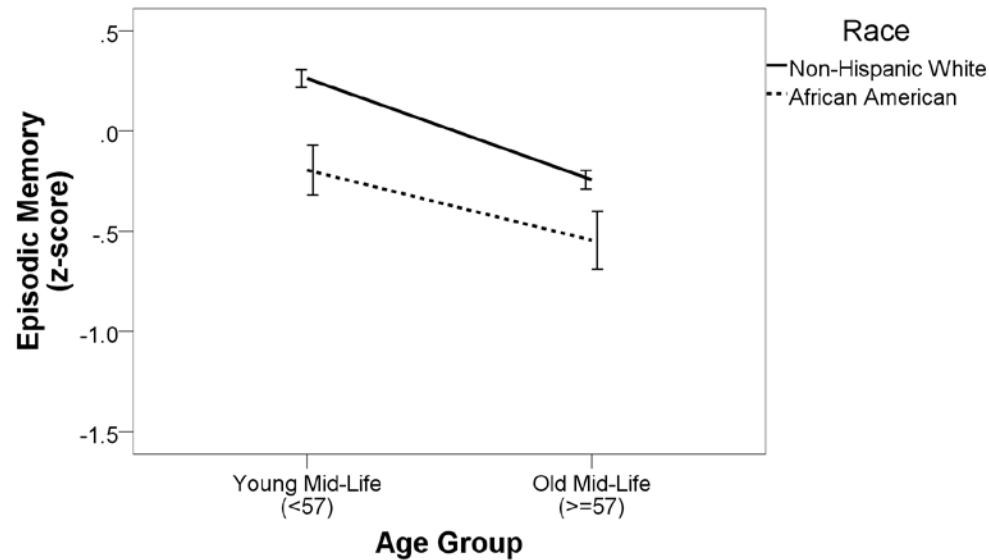
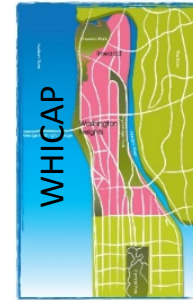
Female Death Rates from Heart Disease (per 100,000, log scale), 2014



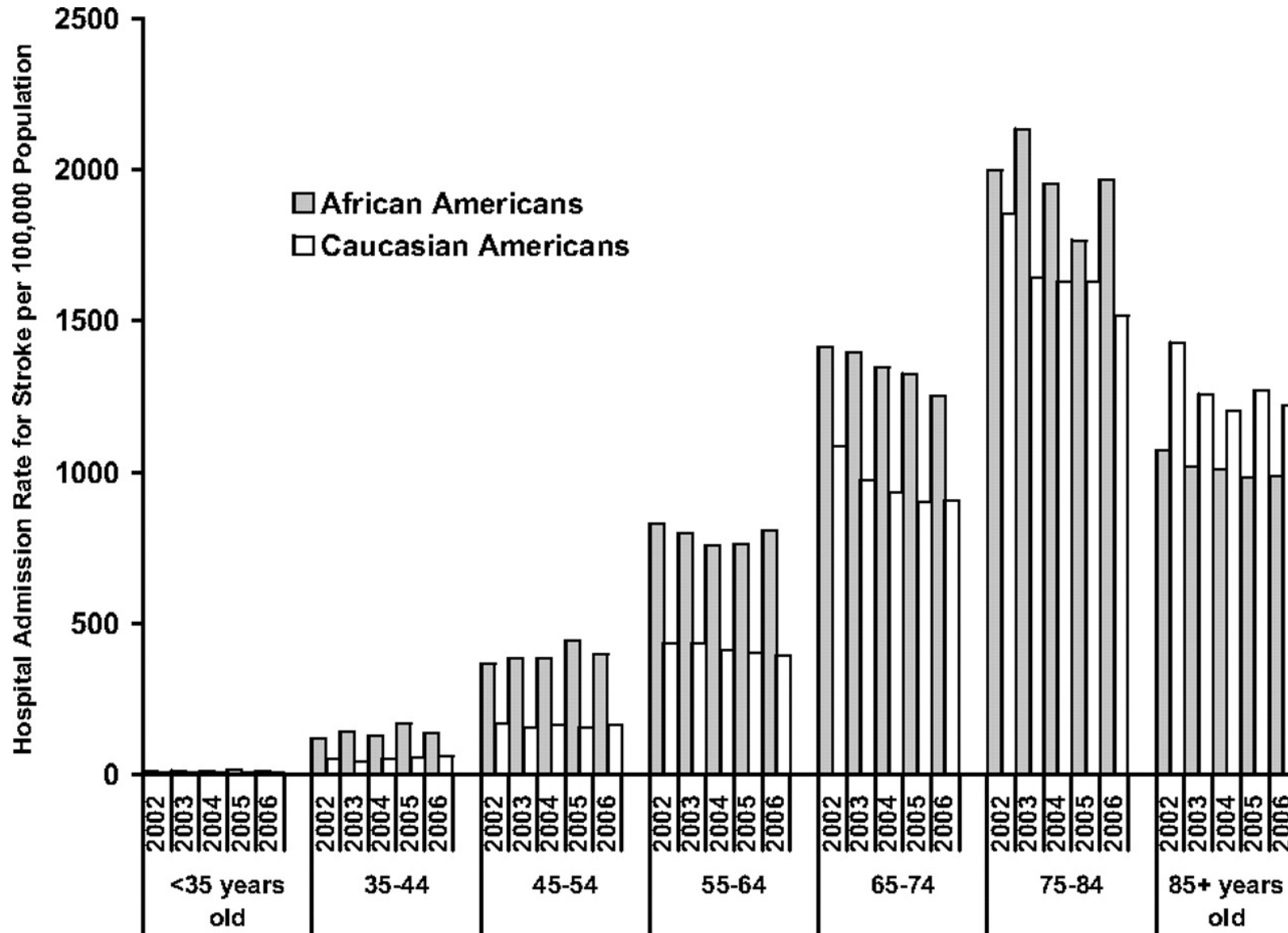
Evidence for age-as-leveler effects



Midlife in the United States
A National Study of Health & WellBeing

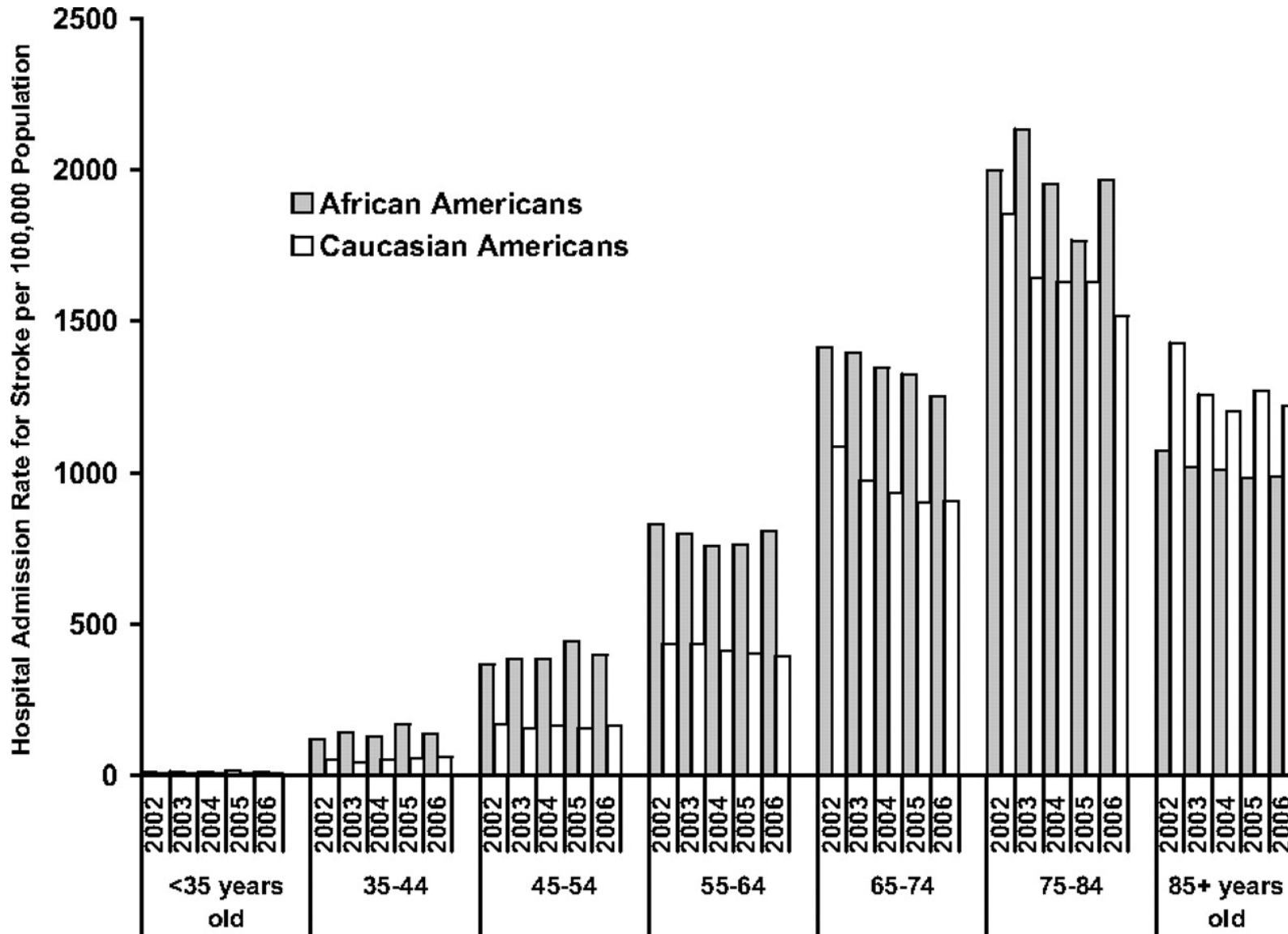


Age attenuation of stroke disparities



Stroke hospital admission rates per 100 000 population by age and race in South Carolina from 2002 to 2006. Wuwei Feng et al. Stroke. 2009;40:3096-3101

Age attenuation of stroke disparities



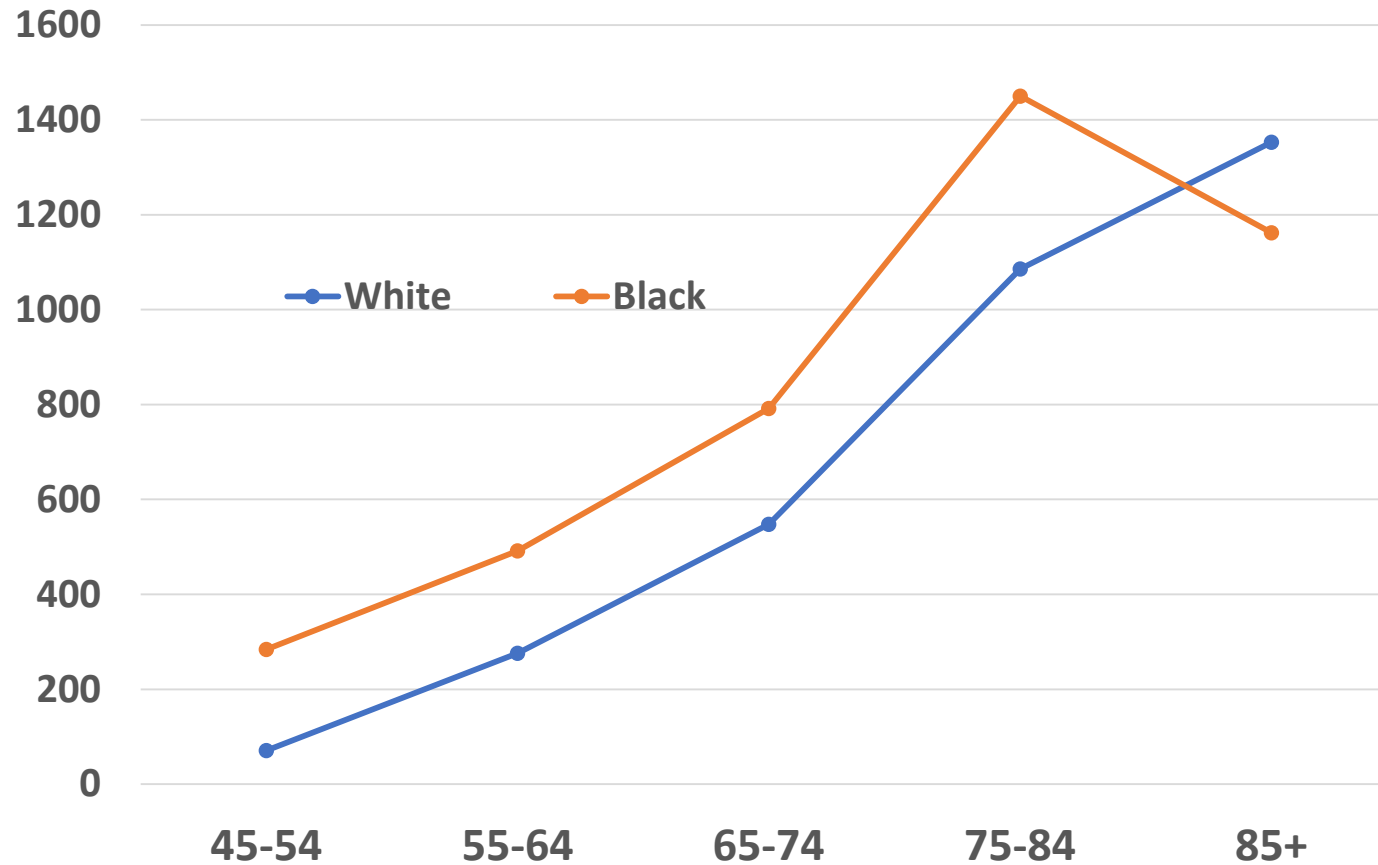
“...because both race groups are automatically covered by the federal Medicare program by age 65, more equal access to preventive services may also contribute to a gap reduction in stroke incidence between the 2 groups. Our findings suggest that the observed disparity in stroke admissions among younger patients may be amenable to expanded medical insurance coverage.”

Stroke hospital admission rates per 100 000 population by age and race in South

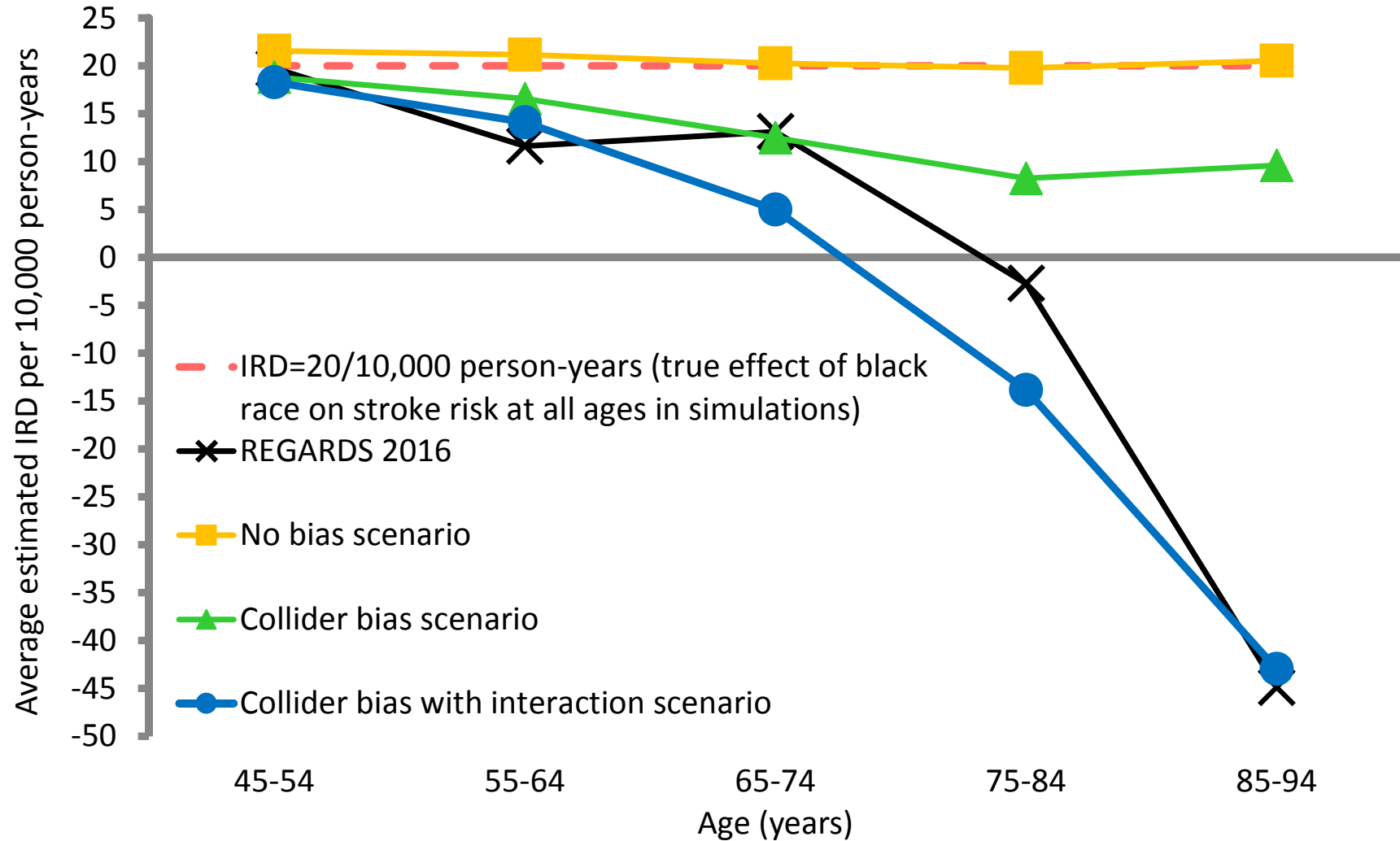
Carolina from 2002 to 2006. Wuwei Feng et al. Stroke. 2009;40:3096-3101

Age attenuation of stroke disparities: consistent across many studies

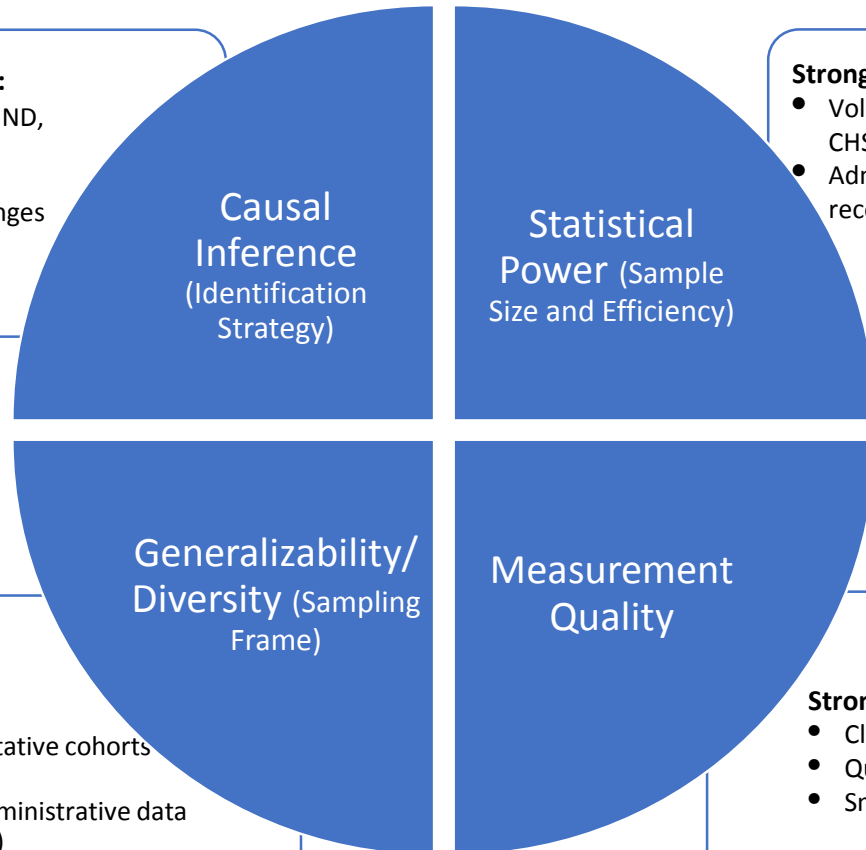
Stroke incidence rates among people who are still alive in each age group to experience a stroke from
Regards study (per 10,000 p/y)



Average observed black-white stroke IRD by age band across 2,000 simulated samples



Highly selected samples will likely increasingly dominate health research

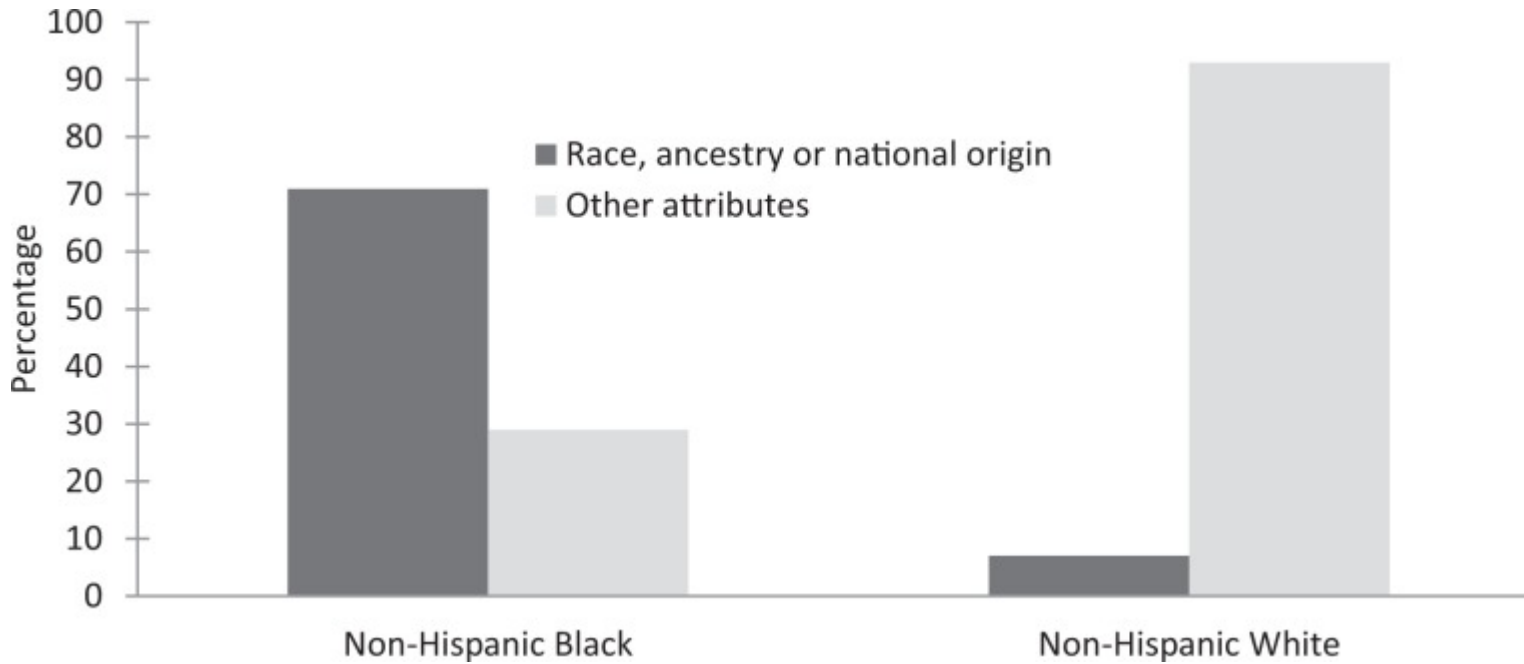


- Even with a goal for representativeness, selection is common.
- Clinic recruitment is common.
- Trade-off between measurement quality and sample representativeness.
- Precision medicine initiatives make little effort at representativeness.

Race and health

- Race is a social construction that is converted to biology via racism and inequality
 - “Systemic racism becomes embodied in the biology of racialized groups and individuals, and embodied inequalities reinforce a racialized understanding of human biology.” Gravlee, 2009
- Racism is persistent
 - “Racists consciously endorse egalitarian values and deny their negative feelings about Blacks, they will not discriminate directly and openly in ways that can be attributed to racism. However, because of their negative feelings, they will discriminate, often unintentionally, when their behavior can be justified on the basis of some factor other than race (e.g., questionable qualifications for a position). Aversive racists may therefore regularly engage in discrimination while they maintain a nonprejudiced self-image.” Dovidio et al., 2002

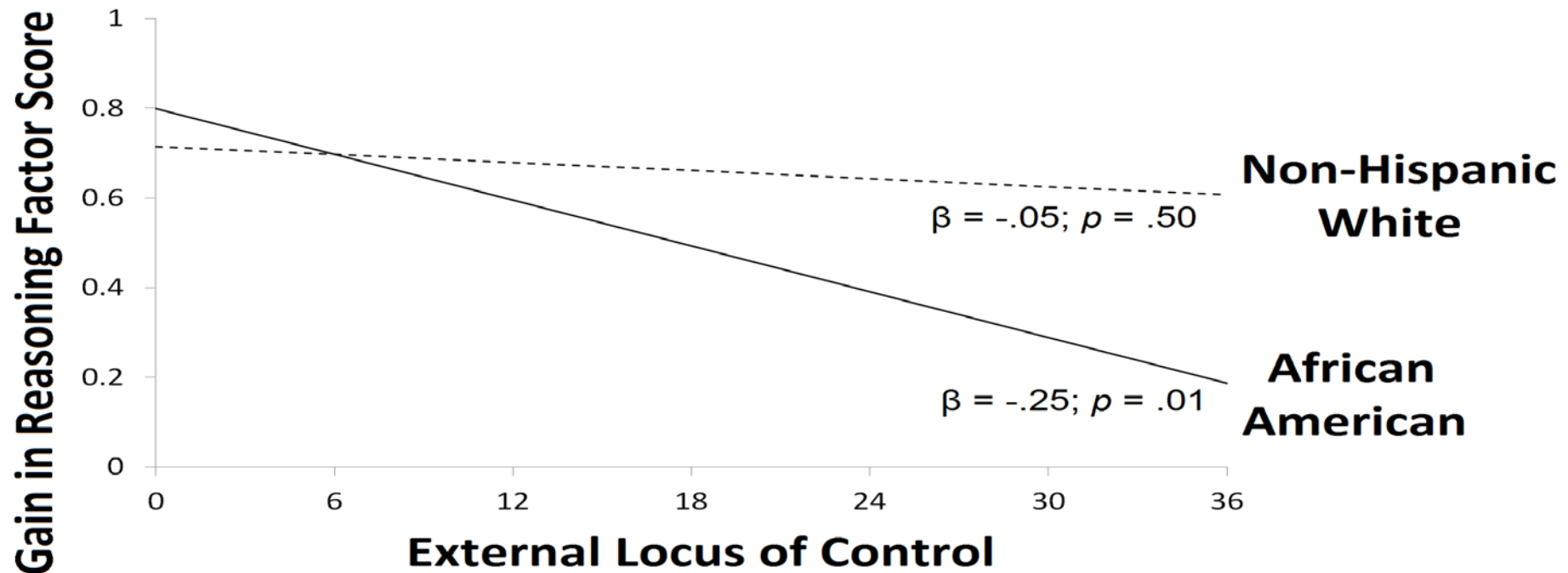
Everyday discrimination associated with shortened telomere length among older black adults (Liu & Kawachi, 2017)



Percentage attributing everyday experiences of discrimination to race, ancestry, or national origin, Health Retirement Study telomere sample, 2009

- Everyday discrimination was associated with shorter leukocyte telomere length among blacks ($\beta = -0.23$; 95% CI, -0.44 to -0.01)
- No association among whites ($\beta = 0.05$; 95% CI, -0.01 to 0.10)
- Mediators of the relationship among blacks included physical activity, smoking status, and obesity

Racial difference in benefit from cognitive intervention is mediated by psychosocial factors: ACTIVE trial



Barnes et al., 2012

Association of perceived discrimination to global cognitive function ($N = 407$)

Model term	Model 1	Model 2	Model 3
Age	-0.03 ^{**} (.004)	-0.02 ^{**} (.004)	-0.02 ^{**} (.004)
Male sex	-0.07 (.052)	-0.08 (.052)	-0.08 (.050)
Education	0.06 ^{**} (.007)	0.07 ^{**} (.007)	0.06 ^{**} (.006)
Discrimination	-0.02 [*] (.010)	-0.02 [*] (.010)	-0.02 (.010)
Vascular risk factors		0.03 (.027)	
Depressive symptoms			-.03 [*] (.013)

Note. Estimates (standard error in parentheses) from linear regression models.

^{*} $p < .05$.

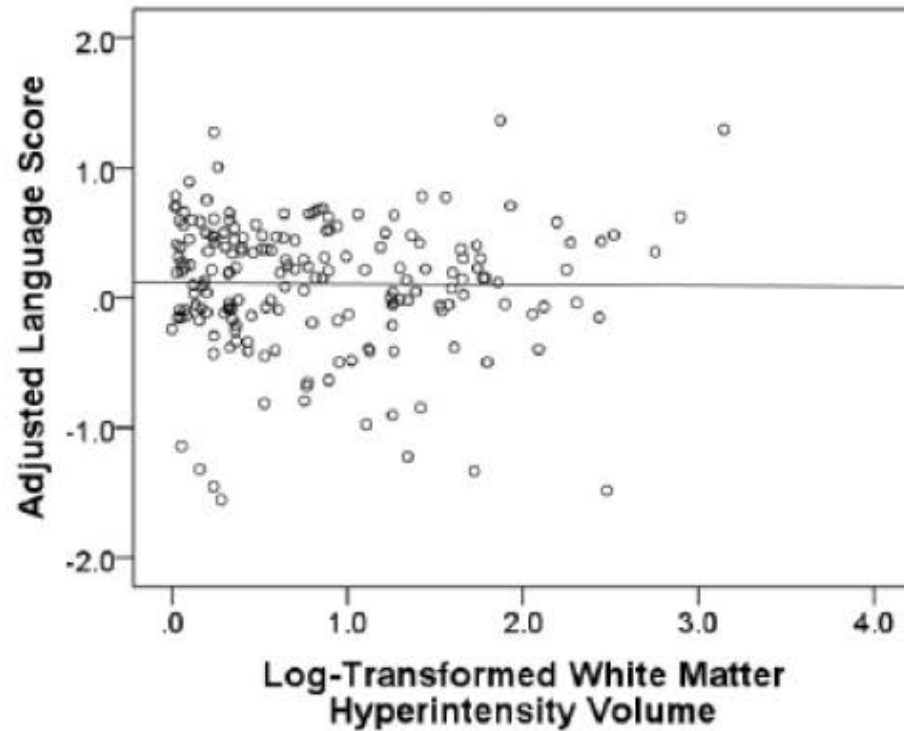
^{**} $p < .01$.

^{***} $p < .001$

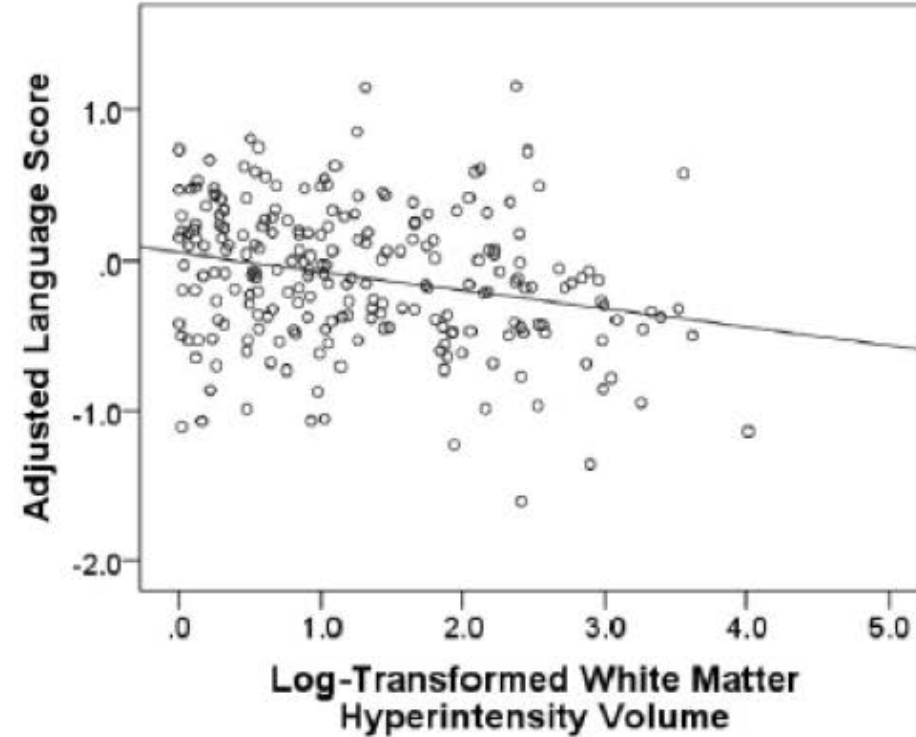
WMH & language

A. Language

Non-Hispanic White



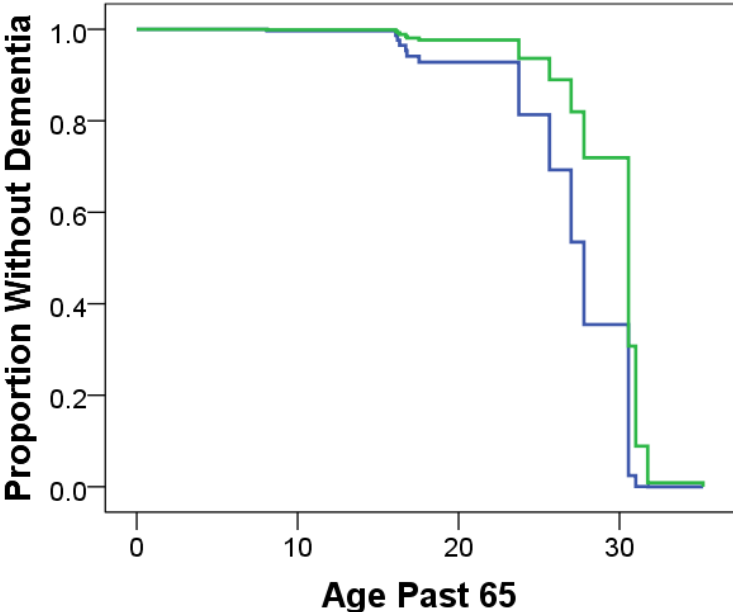
African American



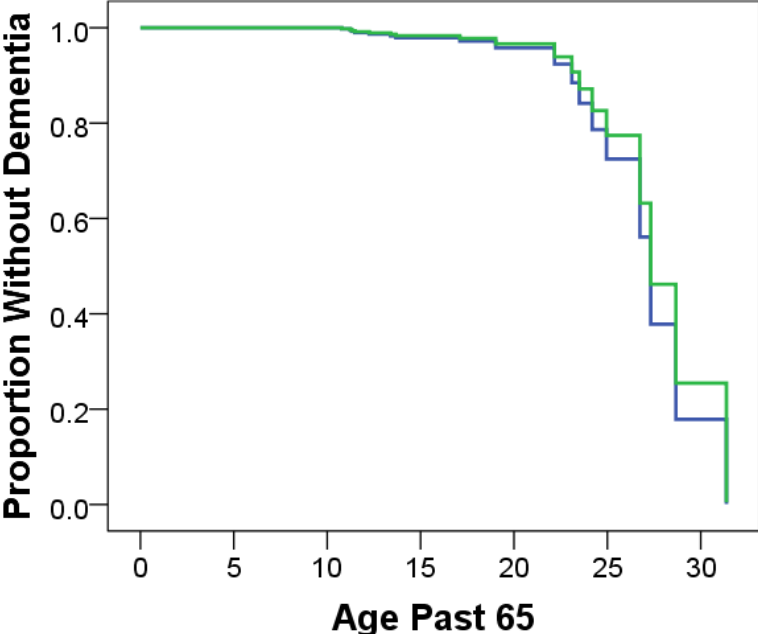
Hippocampal vol. & incident dementia

— Hippocampal volume below sample mean
— Hippocampal volume at or above sample mean

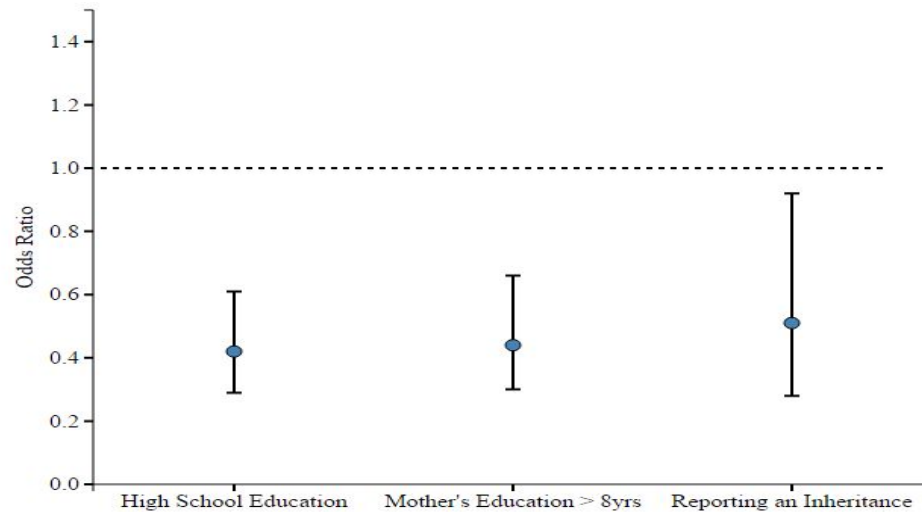
Non-Hispanic White



Non-Hispanic Black



Social factors correlate with African Ancestry and could confound relationship with AD



Marden, Walter, Kaufman, & Glymour, (2016)

- HRS non-Hispanic blacks

Comparing highest versus lowest quartile of African Ancestry

Higher African Ancestry is associated with

- Less education
- Fewer years of parental schooling
- No inheritance
- Lower income (about \$1400/year)
- Less wealth (about \$12,000)

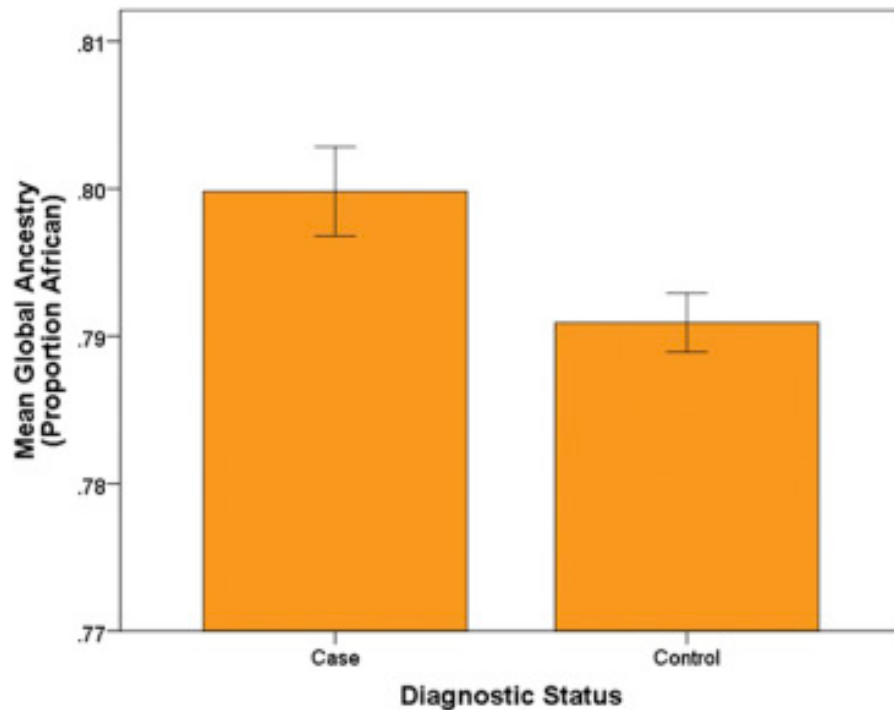
Ancestry doesn't biologically mediate or influence these factors

- African ancestry is a marker for social experiences of individual, parents and grandparents

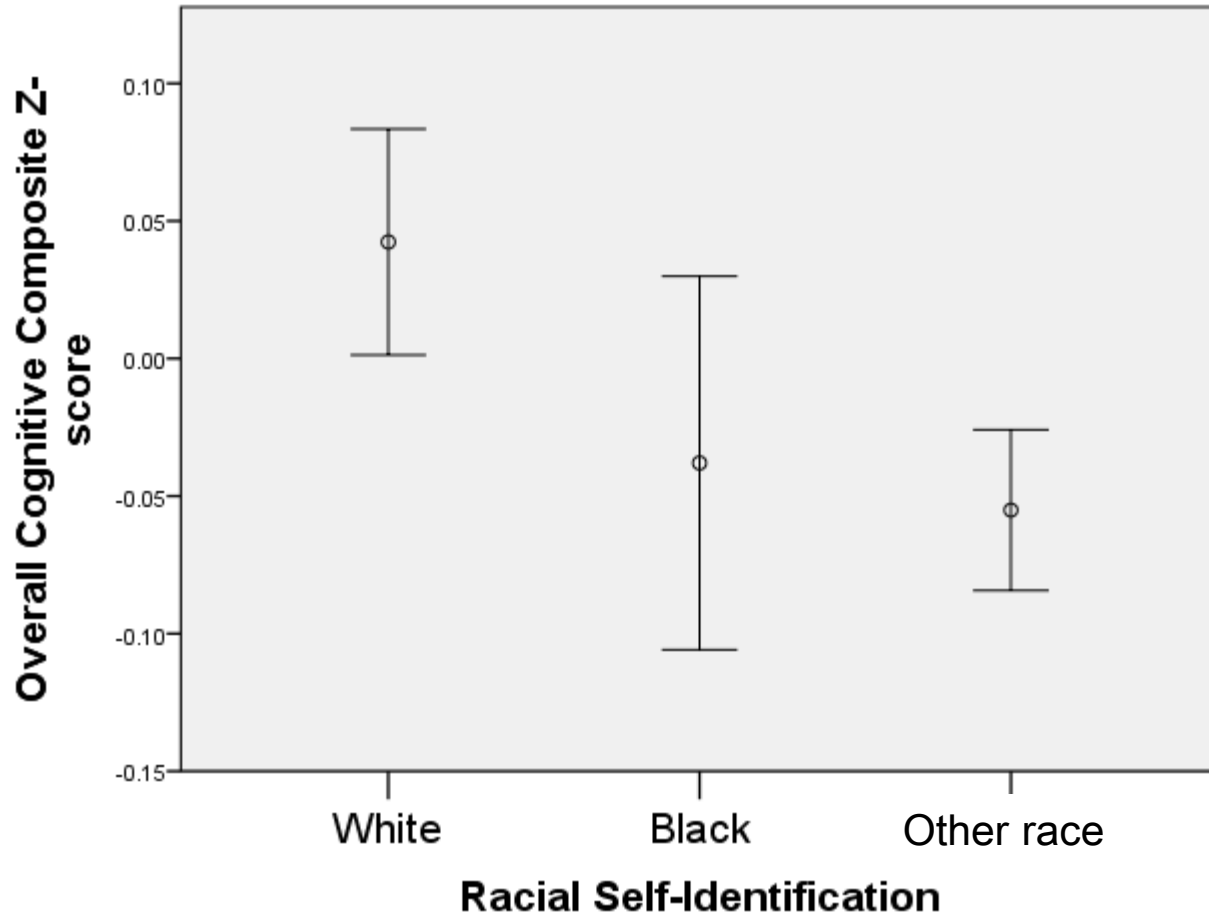
Accounting for socioeconomic status eliminated the association of European ancestry with lower risk of diabetes Colombia and attenuated the association in Mexicans (Flores et al., 2009)

Admixture mapping

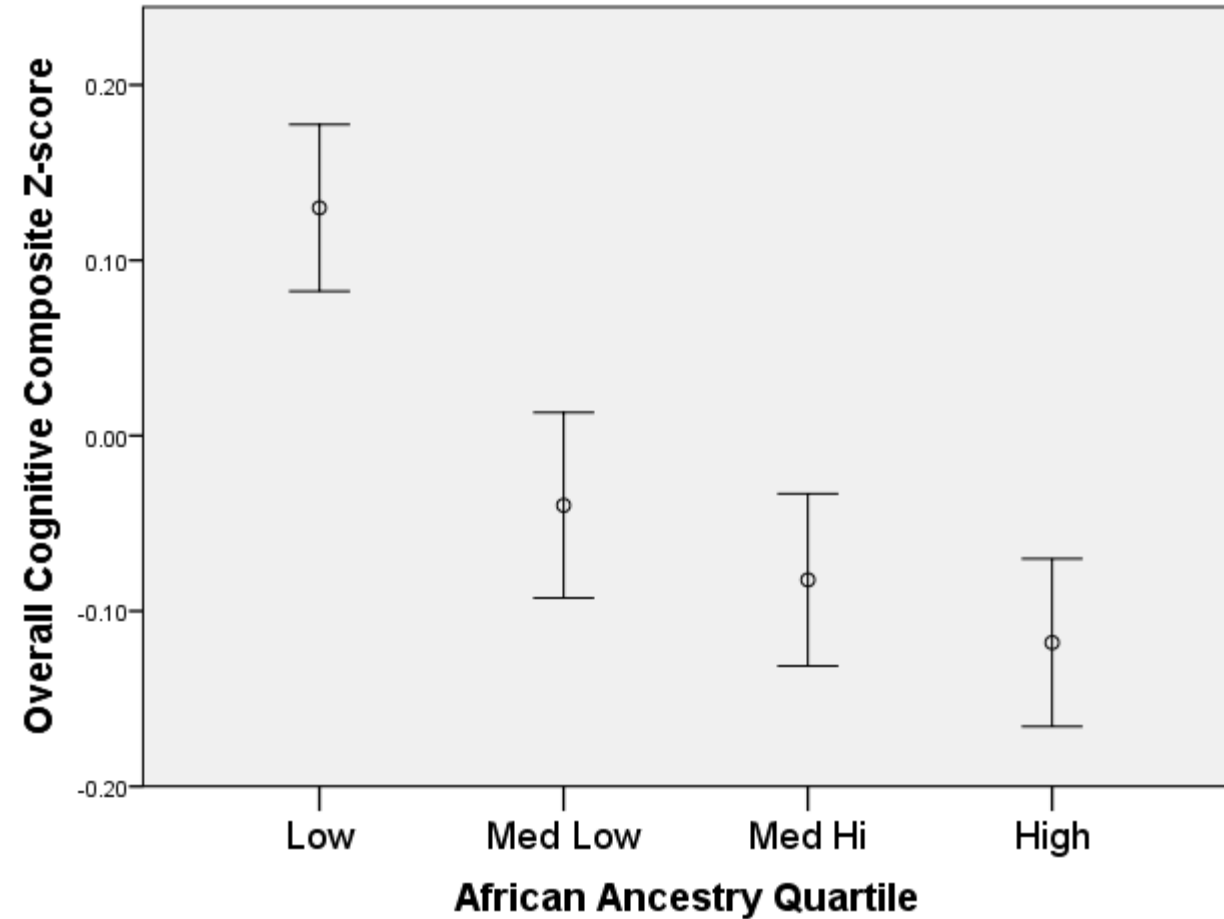
- Higher levels of African ancestry (whole genome level and at specific AD-related genetic loci like ABCA7) are associated with an increased risk for AD



Cognitive outcomes, racial self-identification, and African ancestry among Caribbean Latino older adults in WHICAP

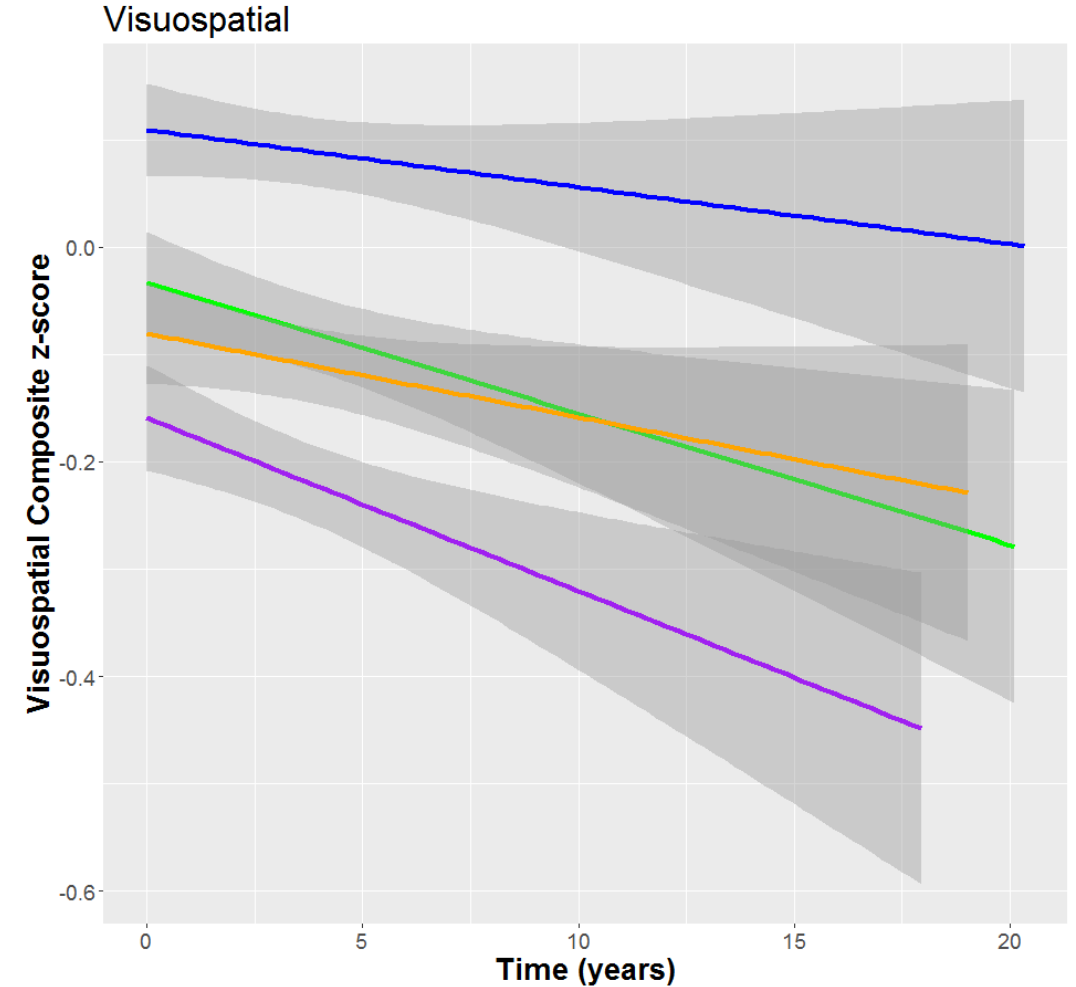
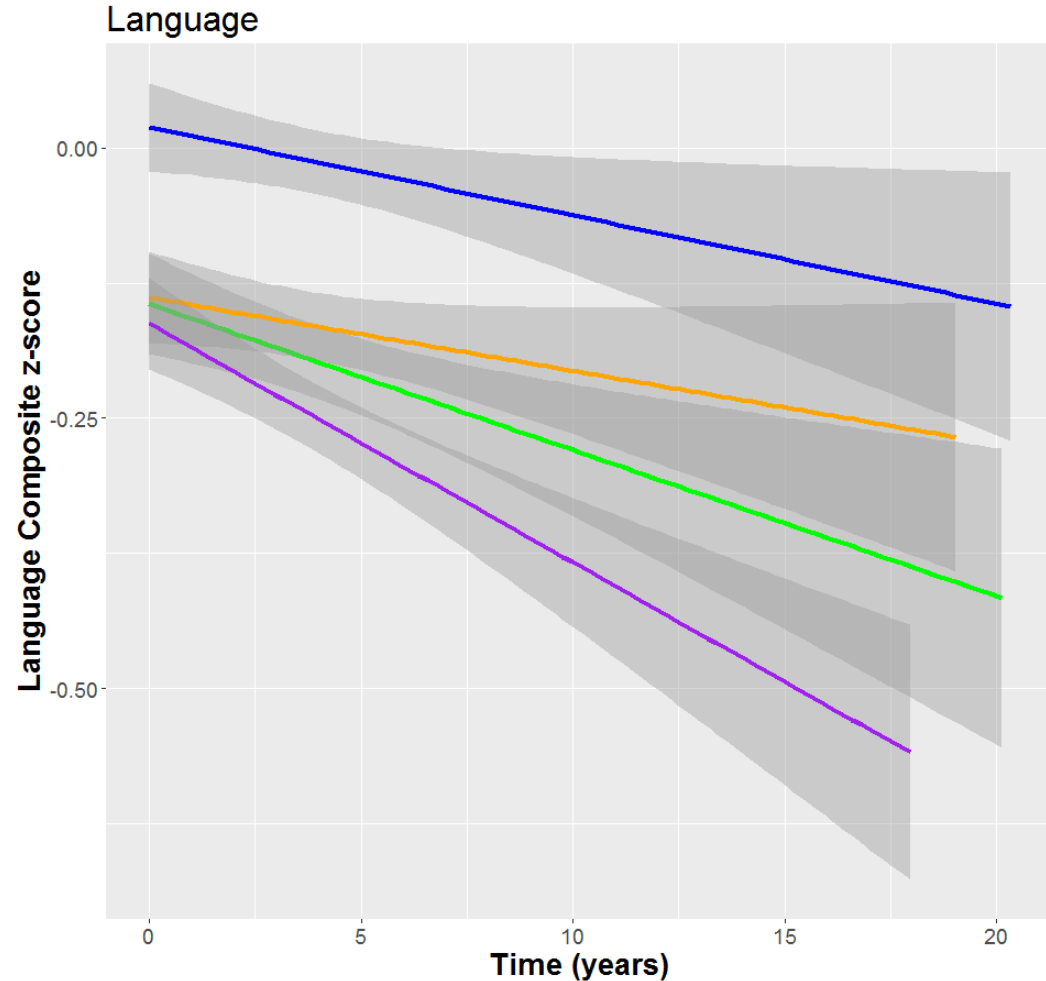


Error Bars: 95% CI



Error Bars: 95% CI

Cognitive trajectory and African ancestry among Caribbean Latino older adults in WHICAP



UK Policy Change Increased Education

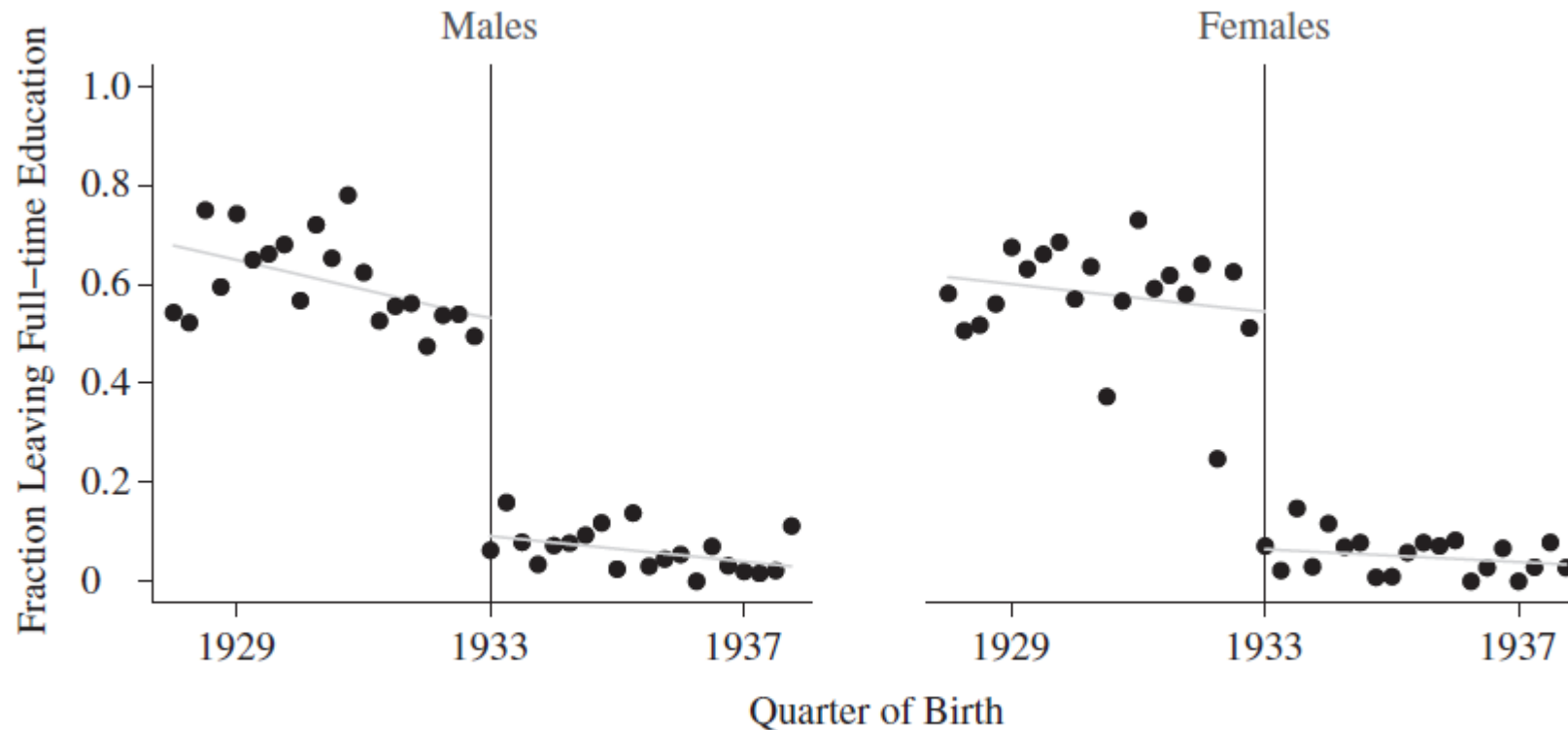


Fig. 1. *Effect of 1947 Reform on Fraction Leaving Full-time Education at or Before Age 14*

From Banks and Mazzone, 2012

From MM Glymour

UK Policy Change Increased Executive Functioning in Late Life

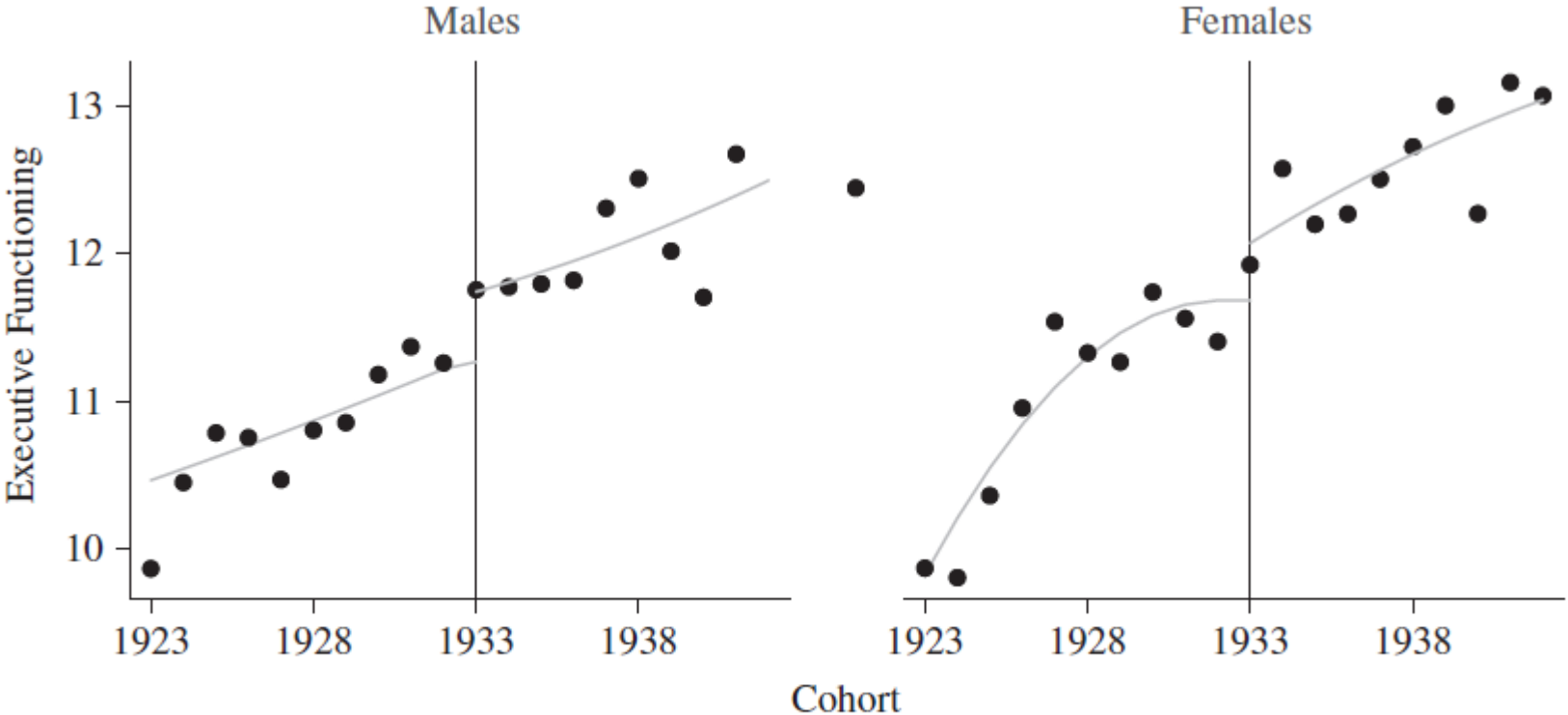
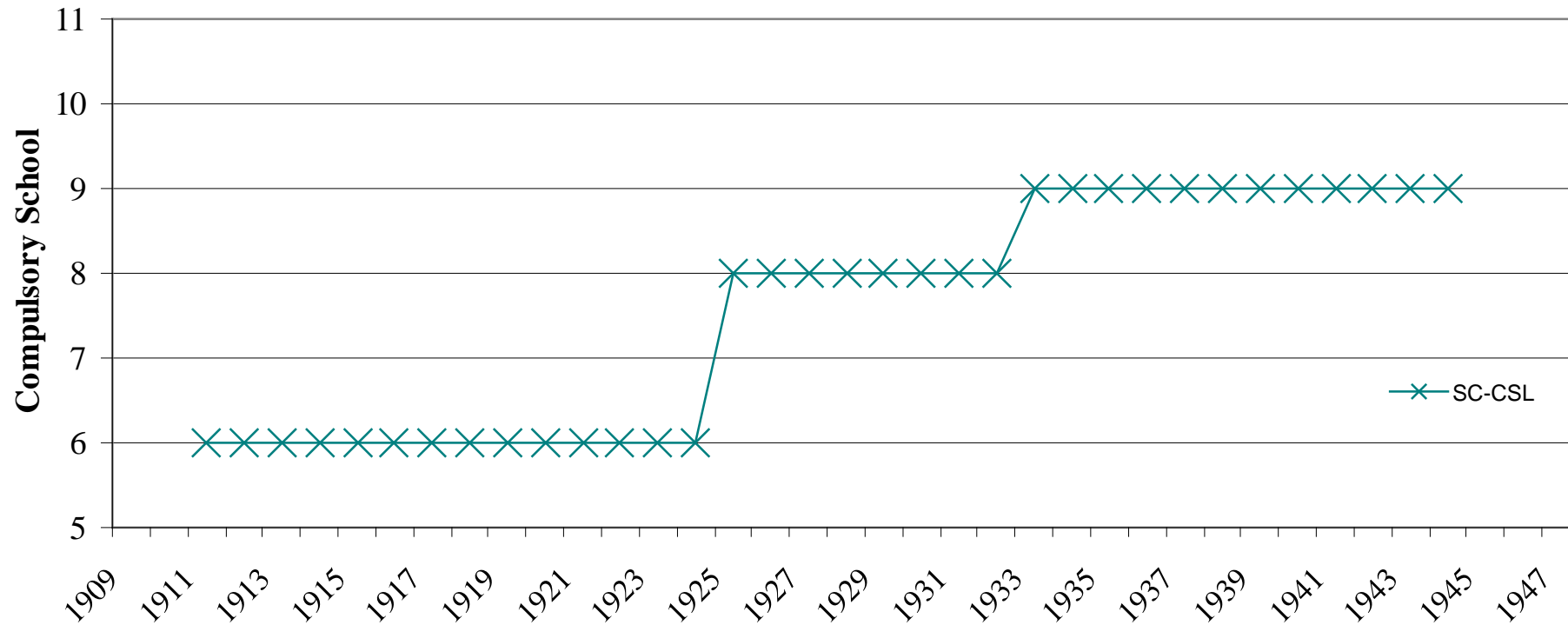


Fig. 9. *Effect of 1947 Reform on Executive Functioning (Conditional on Leaving Before 16)*

From Banks and Mazzona, 2012

Early 20th Century Compulsory Schooling Law Changes in South Carolina



Birth Cohort affected, based on laws in force at ages 6 and 14

Natural Experiments: IV Estimates for Education

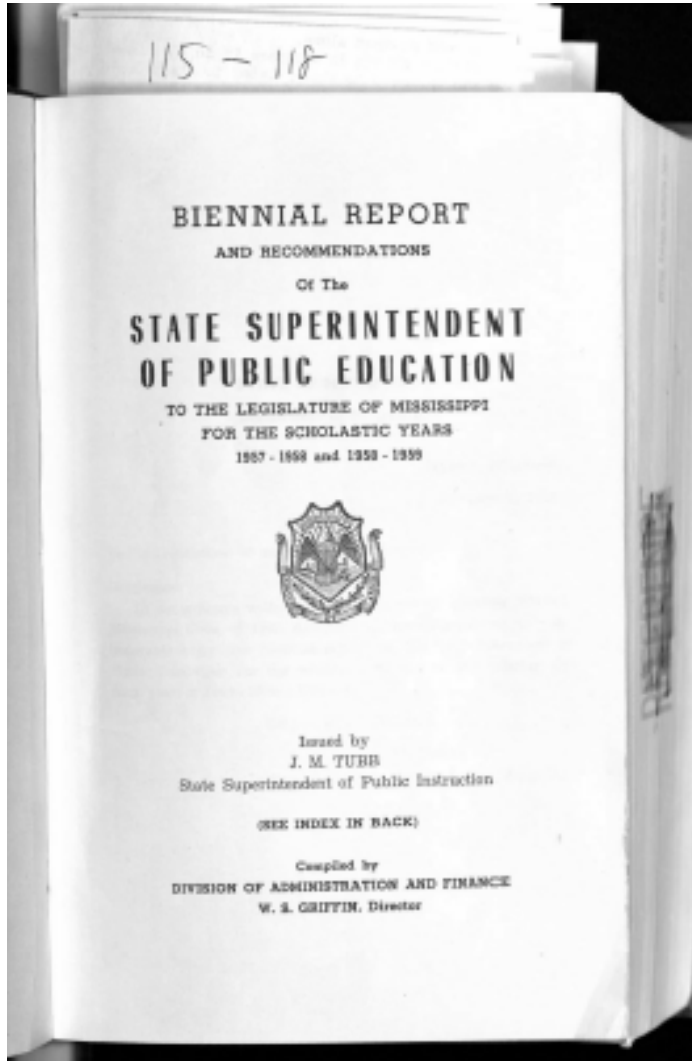
HRS through 2002, n=10,964

Estimated effect of 1 year ed'n on cognitive test scores

Model covariates	Memory		Cognition	
	β_{IV}	95% CI [^]	β_{IV}	95% CI [^]
1. Unadjusted	0.33	(0.27, 0.39)	0.19	(0.12, 0.26)
2. Birthyear, and sex	0.30	(0.14, 0.46)	0.34	(0.05, 0.63)
3. Model 2 + birth state	0.18	(0.02, 0.33)	0.03	(-0.22, 0.27)
4. Model 3 + state condns	0.34	(0.11, 0.57)	-0.06	(-0.37, 0.26)
5. OLS estimates	0.09	(0.08, 0.10)	0.15	(0.14, 0.16)

State reports

- State biennial reports



SCHOOL CENSUS AND ENROLLMENT

County and Separate School Districts	School Census — 1957			School Enrollme 1957 - 58	
	White	Negro	Total	White	Negro
Gulfport	5440	1638	7078	5690	1695
Long Beach	996	49	1045	906	389
Pass Christian	421	326	747	578	542
Hinds AHS				65	542
HINDS	5238	7515	12753	5482	6652
Jackson	17666	29848	57514	15141	10385
Jackson College Demon.					98
HOLMES	1955	7962	9917	1824	6501
Holmes AHS				118	
HUMPHREYS	2639	6761	9400	1722	4218
ISSAQUENA	432	884	1316		
ITAWAMBA	3902	290	4192	2903	272
Itawamba AHS				488	
JACKSON	1783	285	2048	1735	122
Moss Point	2712	1733	4445	3129	1144
Ocean Springs	973	255	1228	967	262
Pascagoula	3706	949	4655	3802	829
JASPER	2040	3148	5188	1912	2986
JEFFERSON	656	3009	3665	585	2143
JEFFERSON DAVIS	1866	3332	5198	1704	2628
JONES	7579	1835	9414	6802	1665
Laurel	4539	3305	7844	3508	2493
KEMPER	1268	3011	4279	1027	2714
LAFAYETTE	1879	2564	4443	940	1708
Oxford	771	263	1034	758	641
University High S.				540	
LAMAR	3381	698	4079	3359	575
LAUDERDALE	3005	2329	5334	2613	2061
Meridian	9635	7124	16759	6671	3504
LAWRENCE	1591	1503	3094	1771	1434
LEAKE	3053	3218	6271	2601	2824
LEE	4460	1892	6352	3787	2165
Tupelo	3763	1500	5263	2910	953
Baldwyn	377	290	667		
LEFLORE	1554	7519	9073	1157	6475
Greenwood	2508	2833	5341	2818	2316
LINCOLN	3165	1513	4678	2399	1406
Brookhaven	1877	1699	3576	1798	1319
LOWNDES	1639	2588	4227	1471	2056
Columbus	3502	3028	6530	3709	2771
MADISON	1260	6990	8250	698	3837

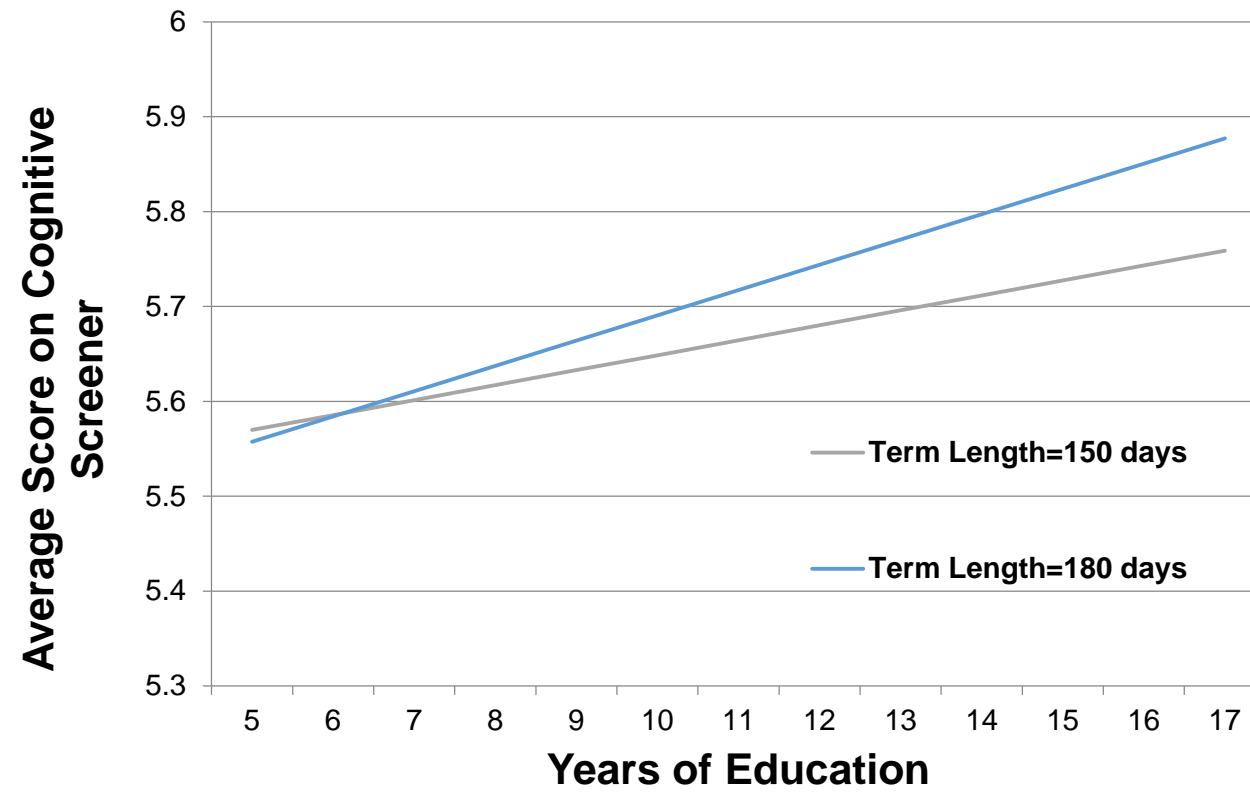
State reports

- Mississippi 1936-1937, report on education for black children

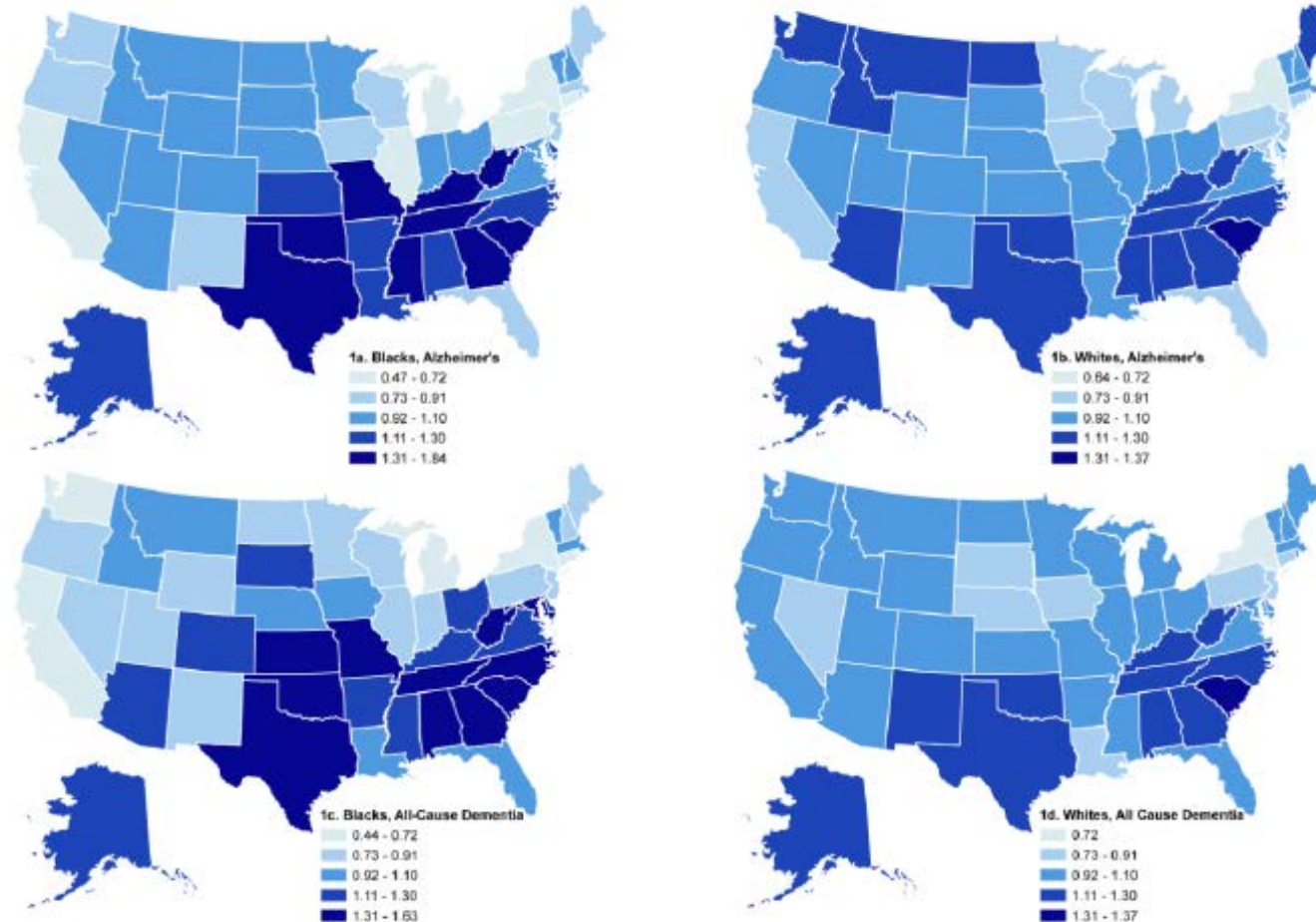
school. Of those enrolled in school only 72% or 217,313, are in average daily attendance. Less than half of those who are supposed to be in school are in regular attendance. The teaching force, numbering 5,863 teachers, has an average of 50 enrolled pupils each. This average situation is rarely ever found, for teachers in the lower grades frequently have in their charge from seventy-five to one hundred and fifty pupils. In a great many cases these teachers are forced to teach double sessions each day—one group in the forenoon and a totally different group in the afternoon. Small enrollments are found in the upper grammar grades and in the high school grades. By the time the sixth or seventh grades are reached, pupils begin to leave school in large numbers.

Historical investments in quality of schooling and cognition in later life

Education gradient is steeper in states with longer term length



Alzheimer's Disease and All-cause Dementia Mortality by Race and Place of Birth

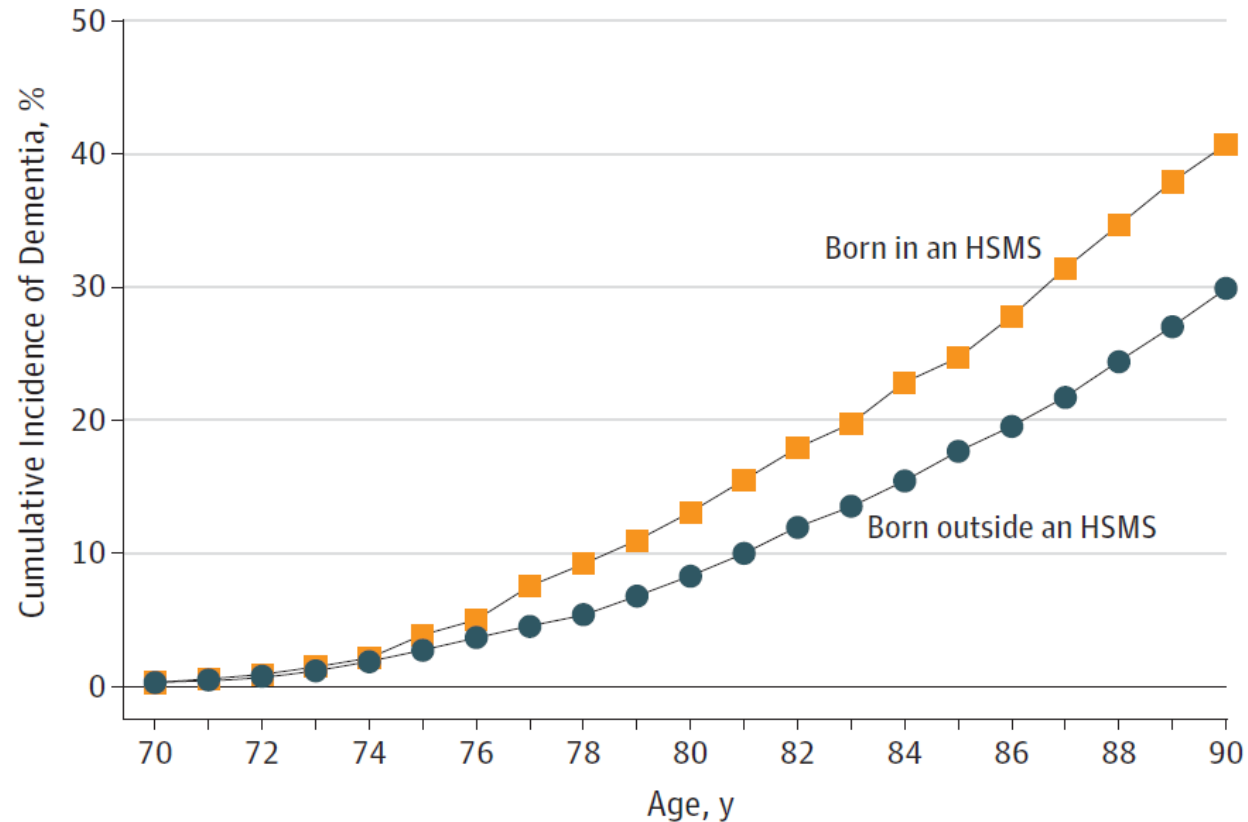


Odds ratios for Alzheimer's or all-cause dementia-related mortality in 2000, by race and state of birth, compared to the national average, based on empirical Bayes (shrinkage) random effect estimates from logistic models, US born blacks and whites ages 65–89.

Glymour et al., *Alzheimer Dis Assoc Disord* 2011

Gilsanz: Place of birth and dementia risk among Kaiser Northern CA participants

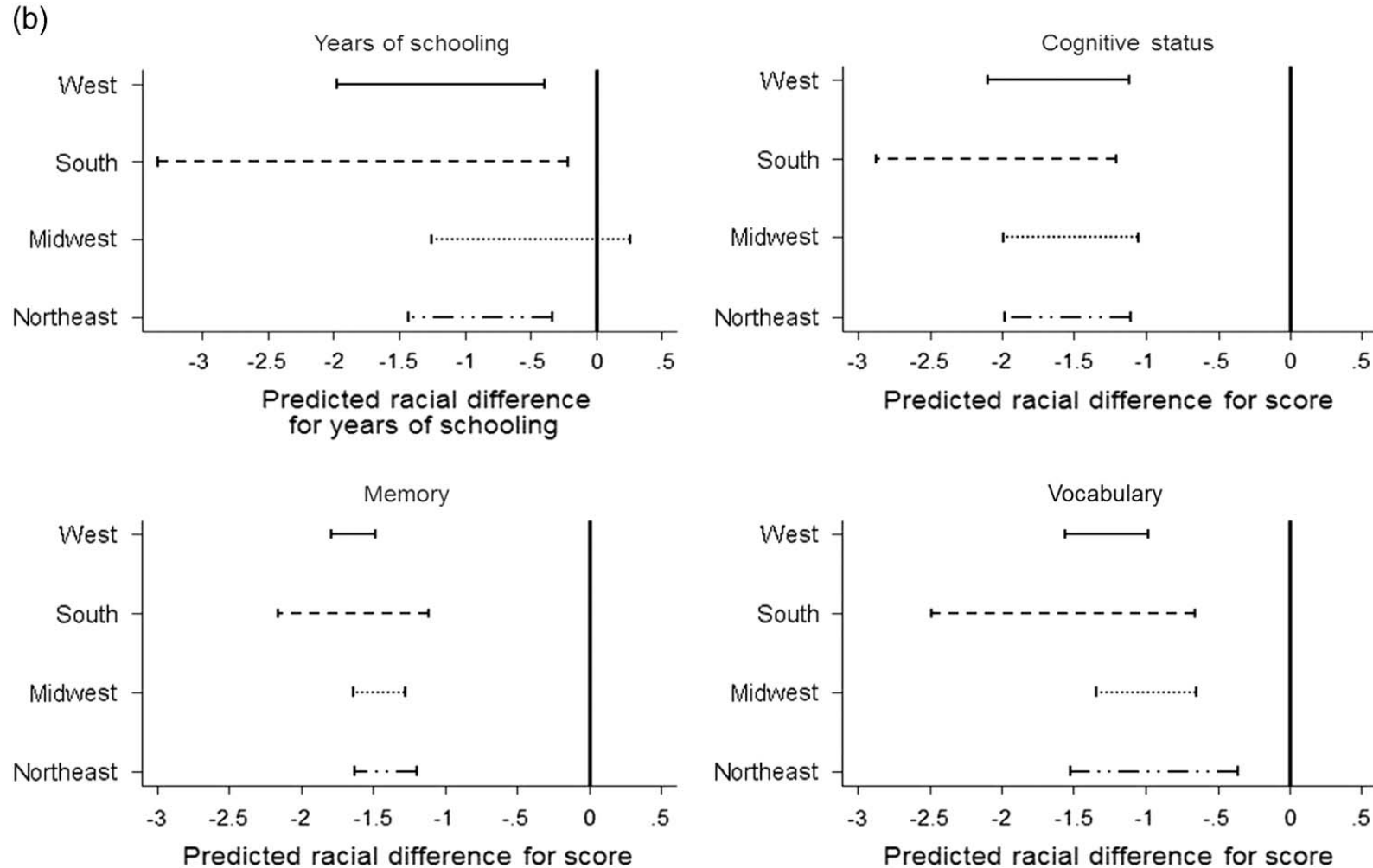
Figure. Cumulative Incidence Dementia Adjusted for Death Rates by Birth Place



High stroke mortality states: top quintiles of stroke mortality rates (i.e., states with >83 stroke deaths per 100 000 people older than 35 years) Alabama, Alaska, Arkansas, Louisiana, Mississippi, Oklahoma, Tennessee, South Carolina, and West Virginia.

All participants had been in Northern California for 23+ years (since 1973)

Racial disparities by US region of primary school education in HRS

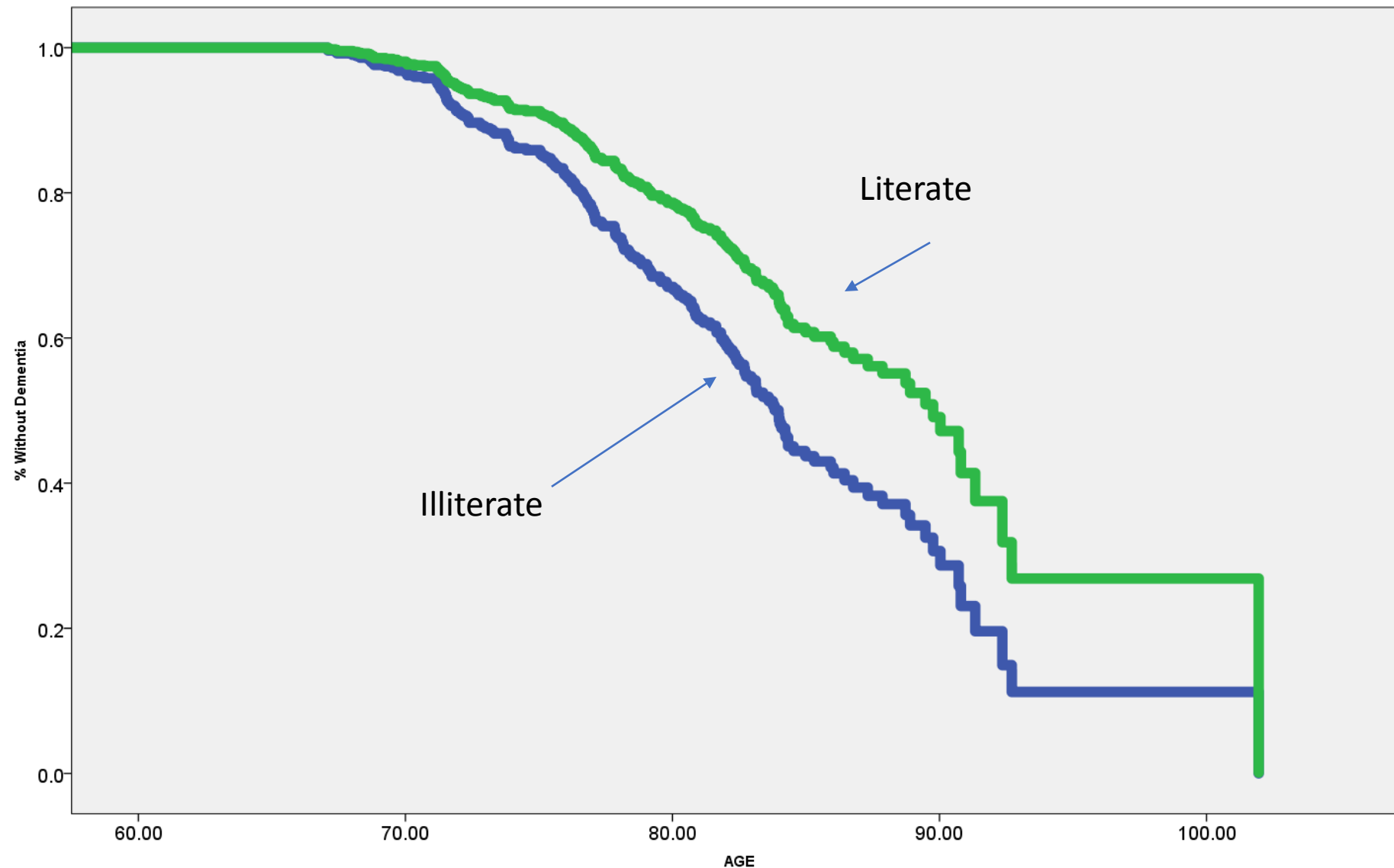


Resilience - individual variations in response to risk

- Resilience originates from the Latin word *resiliens*, which refers to the pliant or elastic quality of a substance
- Good outcomes in spite of serious threats to adaptation of development (Rutter, 1987)
- ability to bounce back from adversity, frustration, and misfortune (Janas, 2002)
- Capacity to face stressors without significant negative disruption in functioning (Perry, 2002)

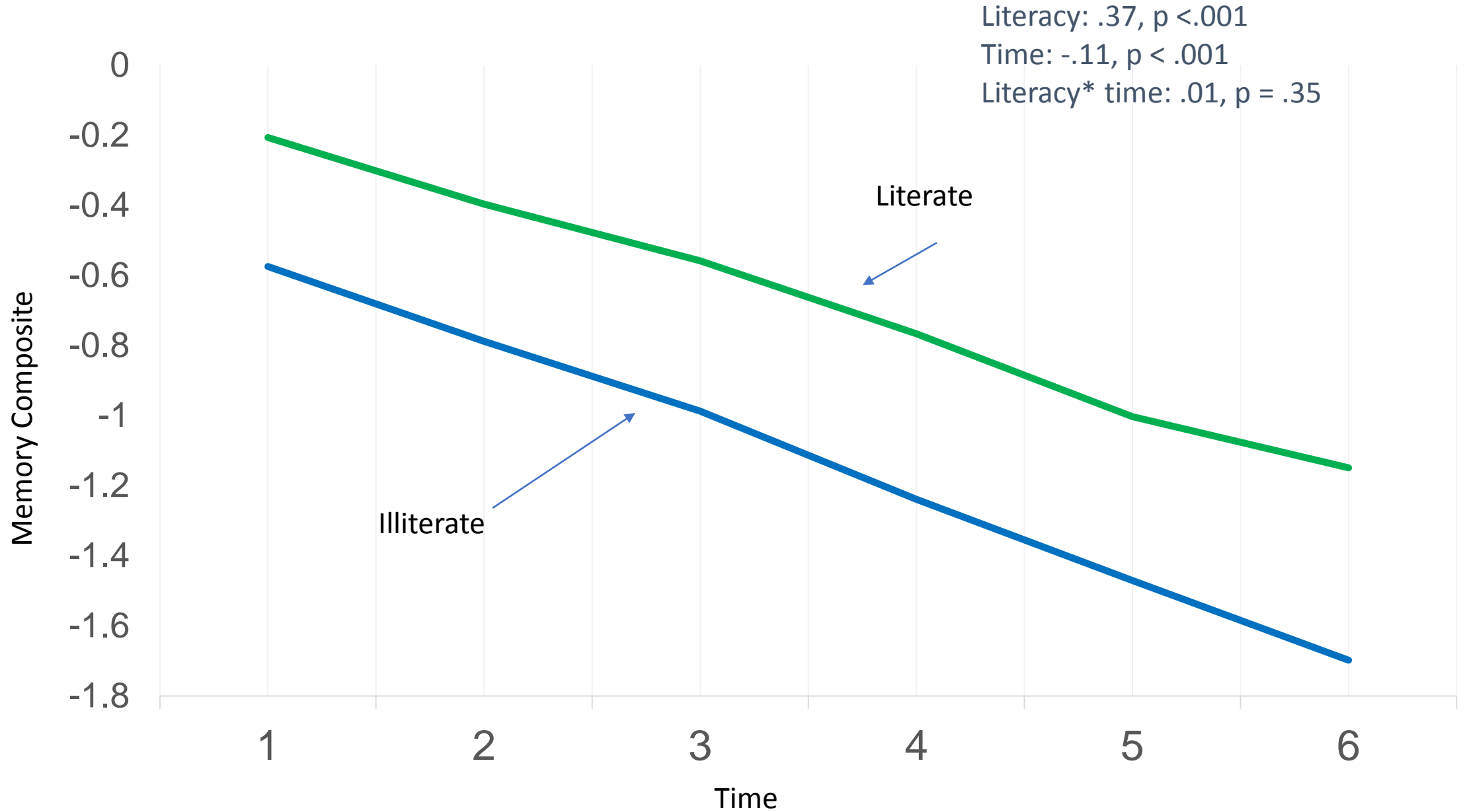
Project Talent Medicare-linked dataset

Among those with 0 – 4 years of schooling: Cumulative AD incidence in literates and illiterates at mean of covariates



Hazard Ratio = 1.66
95% CI = 1.15 - 2.39
p = .006

Mixed Effects Model



Race and incident dementia by recruitment cohort

	White	Black	Hispanic	Total
1992 total	245	393	491	1129
1992 incident AD	20	76	126	222
1992 %	8.2	19.3	25.7	19.7
Person years	1080.02	1695.45	2203.22	
1999 total	528	569	631	1728
1999 incident AD	30	57	107	194
1999 %	5.7	10	17	11.2
Person years	3126.82	2899.16	3190.37	

Secular Trends in AD incidence by race

	Model 1	Model 2	Model 3
	HR (95%CI)	HR (95%CI)	HR (95%CI)
All Participants			
1999	0.59 (0.49-0.72)	0.62 (0.50-0.77)	0.69 (0.55-0.86)
1992	1.0 (ref)	1.0 (ref)	1.0 (ref)
Non-Hispanic White			
1999	0.60 (0.34-1.05)	0.72 (0.35-1.47)	0.80 (0.37-1.71)
1992	1.0 (ref)	1.0 (ref)	1.0 (ref)
African-American			
1999	0.52 (0.36-0.73)	0.65 (0.44-0.97)	0.87 (0.57-1.34)
1992	1.0 (ref)	1.0 (ref)	1.0 (ref)
Hispanic			
1999	0.64 (0.49-0.83)	0.60 (0.45-0.79)	0.62 (0.47-0.83)
1992	1.0 (ref)	1.00 (ref)	1.00 (ref)

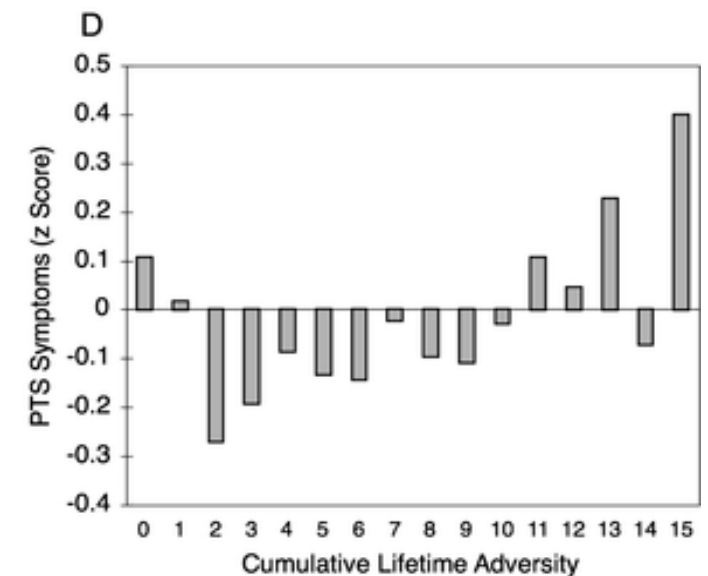
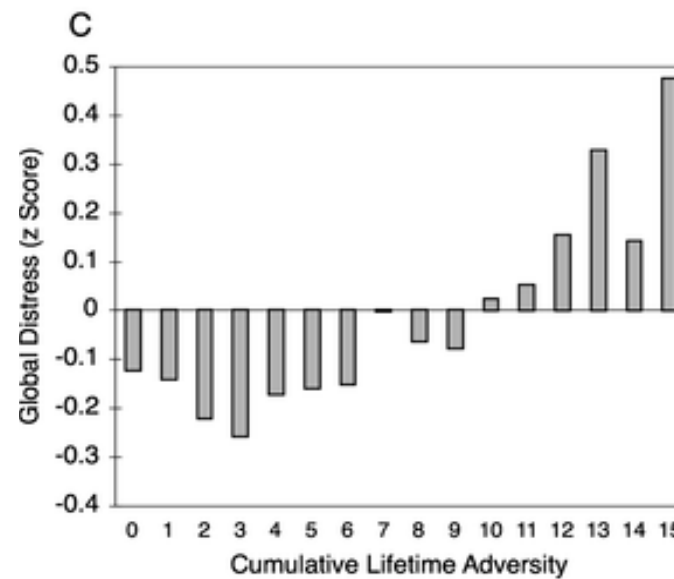
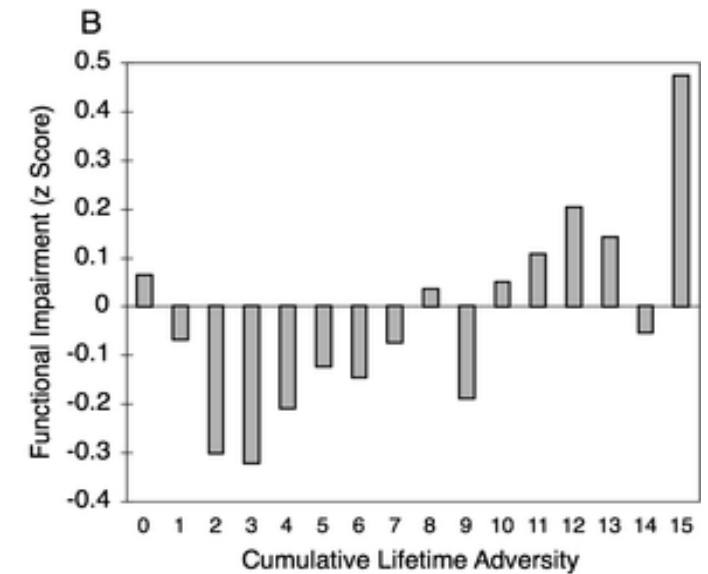
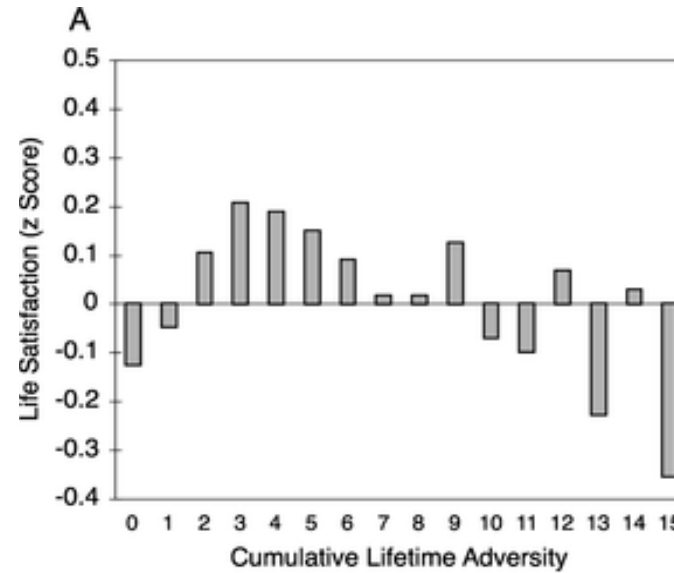
Model 1 Including cohort as predictor, adjusted for age, sex, race/ethnicity, baseline memory complaints

Model 2: Model 1 plus diabetes, heart disease, stroke, hypertension, current smoking, and BMI

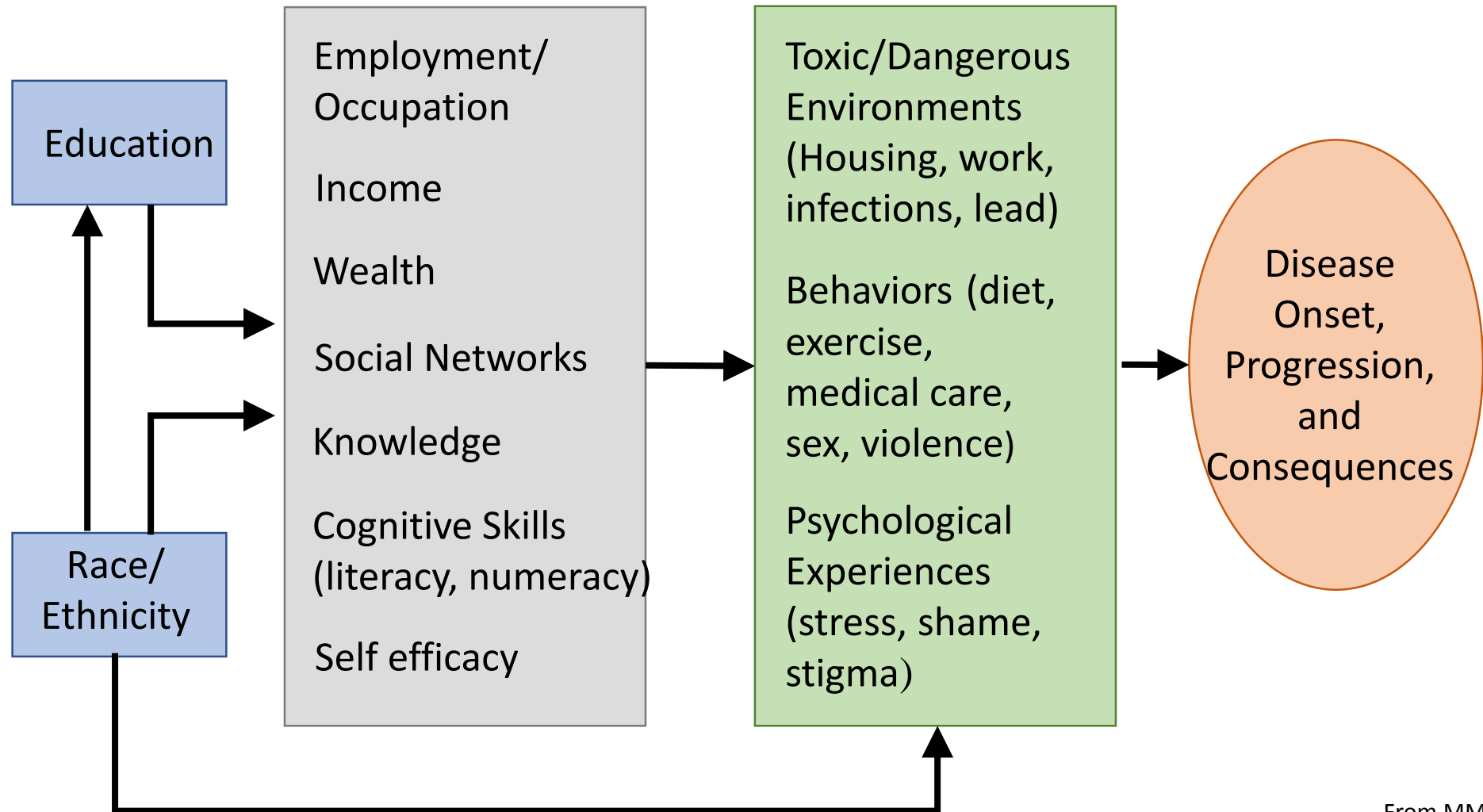
Model 3: Model 2 plus education

Resilience: U-shaped curve?

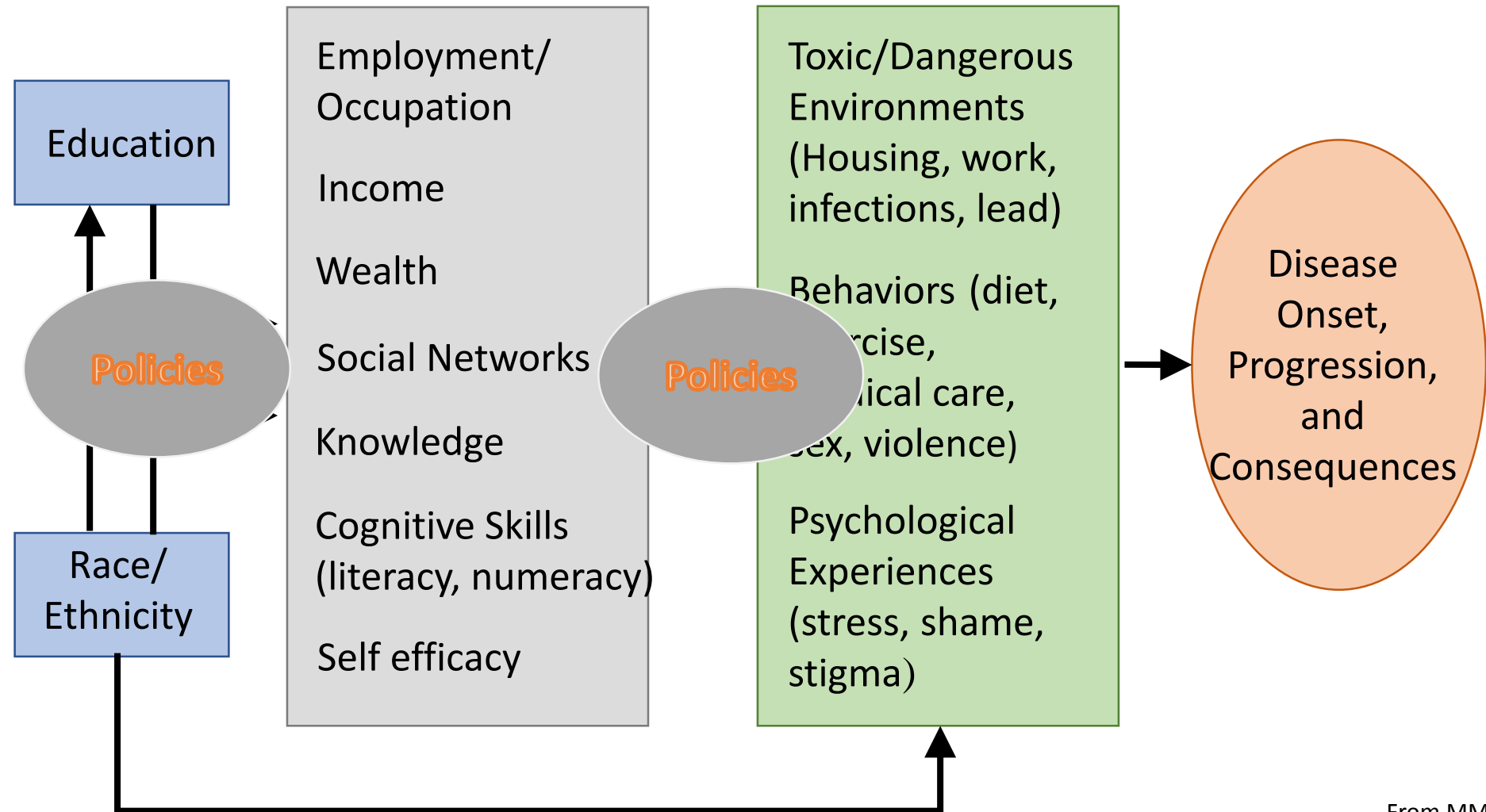
- Mental health and well-being outcomes by cumulative lifetime adversity count.
- Life satisfaction is positively valenced
- PTS = posttraumatic stress



Multiple mechanisms operating across the lifecourse create social inequalities in health and promote resilience



Policy interventions



How do we intervene when the cause is racism?



Hicken, Kravitz-Wirtz, Durkee, & Jackson

2018, Soc Sci Med

- Advocate for a shift from “a biomedical/risk factor model that documents the health behaviors, experiences, and outcomes of marginalized racial groups”
- To a view of systemic “social, economic, and political” inequalities that “maintain the dominance of a single racial group.”

What would it look like to intervene on racialized institutions?

Woodrow Vereen, Jr. and sons



Robert F. Smith



Driving while Black



Racism intervention

1. Representations of African Americans in film
2. Racial disparities in public school suspension rates;
3. Disproportionate density of fast food in African American neighborhoods
4. Targeted marketing of cigarettes to African Americans
5. Black-White housing-based wealth disparities
6. Racial disparities in NYPD Stop & Frisk policies.

Naa Oyo A. Kwate, "Racism Still Exists": A Public Health Intervention Using Racism "Countermarketing" Outdoor Advertising in a Black Neighborhood, *J. Urban Health*, 2014

Bedford-Stuyvesant v. Harlem ads

- After 6 months, no neighborhood difference in:
 - attitudes related to race and racism
 - most health outcomes
- Greater decline in psychological distress in “treatment” neighborhood



Naa Oyo A. Kwate, “Racism Still Exists”: A Public Health Intervention Using Racism “Countermarketing” Outdoor Advertising in a Black Neighborhood, *J. Urban Health*, 2014

Research agenda for aging health disparities

- Conduct studies designed to elucidate causal mechanisms
 - Instrumental variables
 - Policy changes
- Embed health measures within planned interventions
 - Increased income
 - Improving neighborhood and household (e.g., MTO)
 - Values affirmation reduces stereotype threat/perceived racism
- Within person longitudinal studies
 - Baseline prior to development of disease (midlife or prior)
 - Leverage existing studies of infants & mothers, school-age children, adults
 - Repeat assessment
 - Importance of incidence and trajectory data, avoiding patient recruitment
- Measure disease burden using population feasible biomarkers

Research agenda for aging health disparities

- Lifecourse perspective
 - Follow up into mid-life and later life needed for school, twin, and birth cohorts
 - Investigate potential critical periods (primary vs. secondary school; later life learning)
- Intervene on fundamental causes – National Plan, Summit, Accountability
 - Racism & discrimination
 - Education
 - Neighborhood