Socioeconomic Status (SES) and Health: An Integrative Life-course Approach to Biosocial Linkages
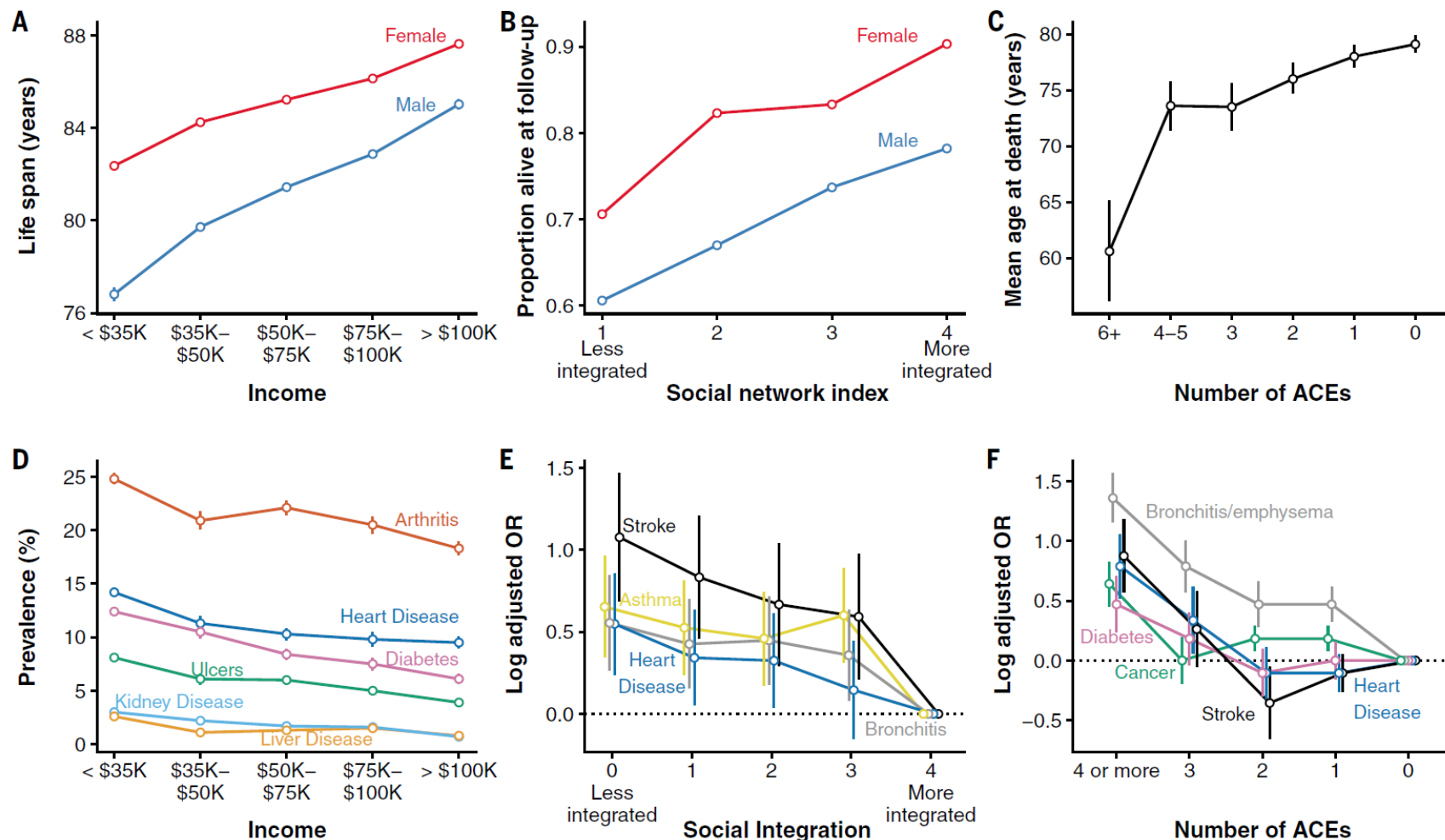
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# Figure 1. Social adversity predicts morbidity and mortality

Major Remaining Questions, Gaps & Challenges

- Why do SES factors have health impacts?
- When do the health impacts of SES emerge and how long do they last?
- Separate bodies of knowledge about the origins and mechanisms of SES differentials in health
- Previous research limited to correlational studies, cross-sectional data, and a single life stage.
- No knowledge of how the associations unfold or change over the full life course.
- Timing and duration of SES related exposures and their influences are not clear.

Figure 2. A General Integrative Model of SES and Health over the Life Course
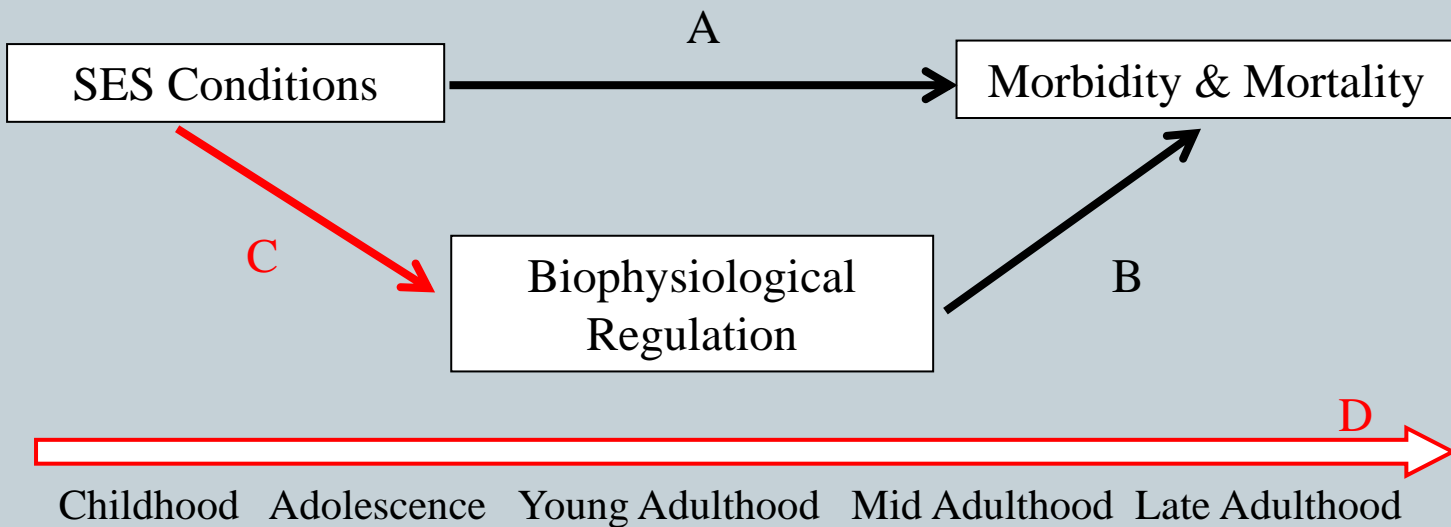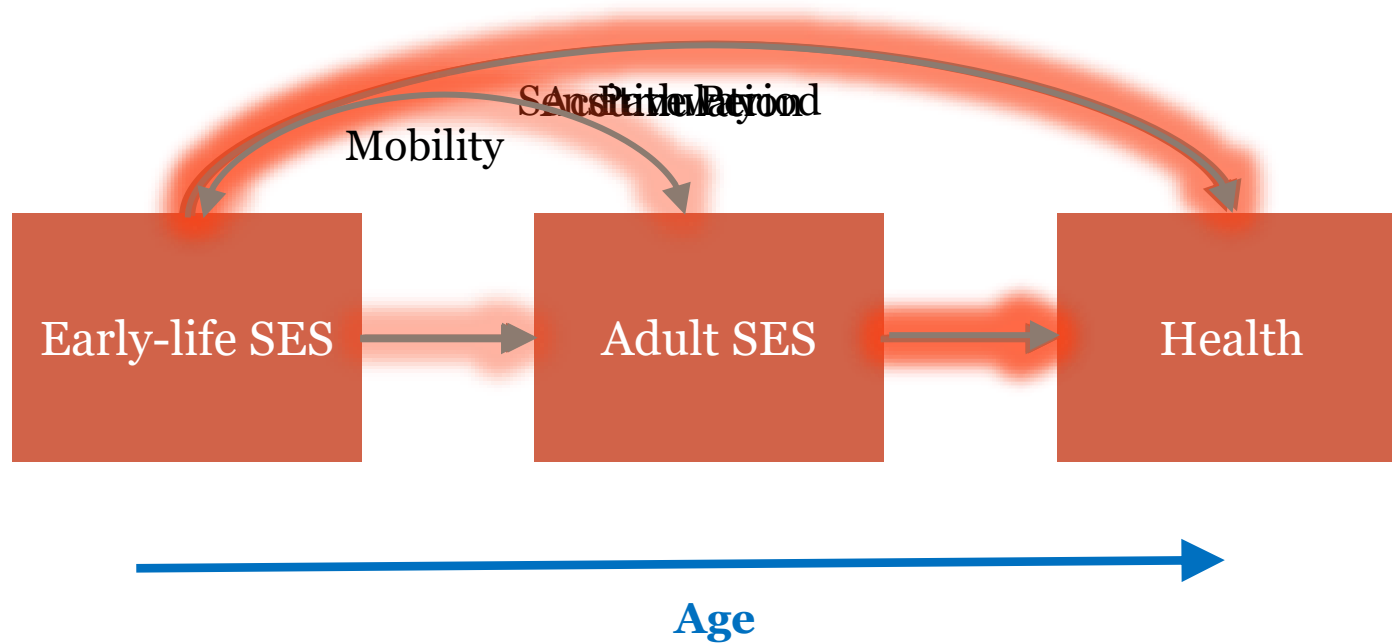
Research Goals

- **Conduct transdisciplinary research to understand how SES gets under the skin to affect health across the human life span**:

  - Path C: links between SES and biomarkers of physiological functioning (e.g., inflammation, cardiometabolic functions)

  - Trajectory D: the life course context and temporal dynamics
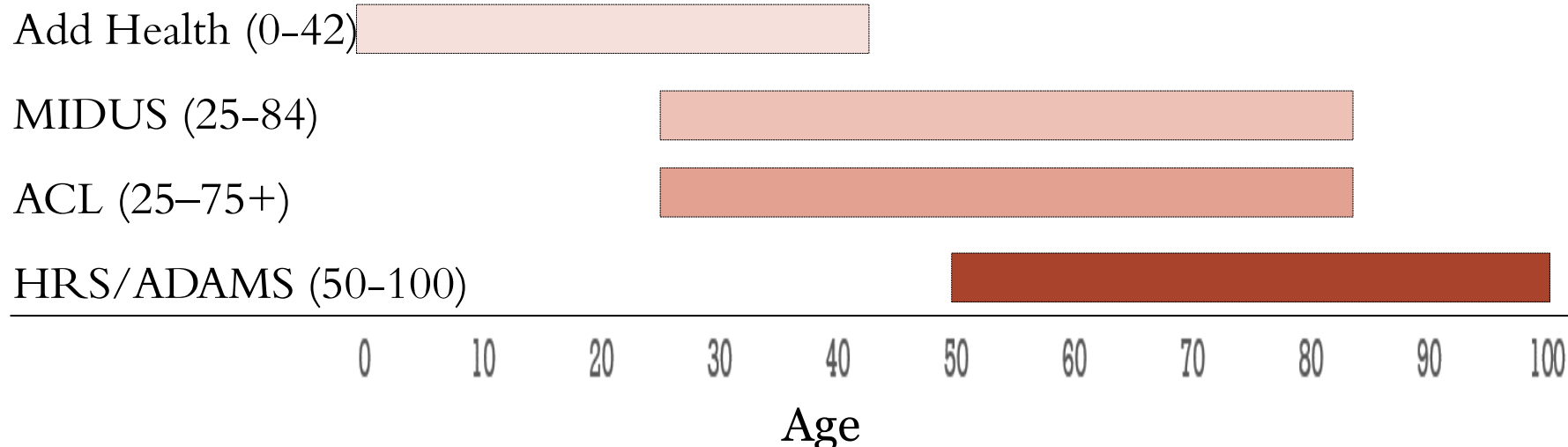
Figure 3. Life Course Hypotheses of SES and Health

Critical Period

Sensitive Period

Accumulation

Mobility

Early-life SES → Adult SES → Health

Age

Integrative Life Course Research Design

- Integrating multiple large-scale NIH population-based prospective cohort studies that collectively cover the life span from childhood to old age.

- A model for building a cumulative science of population health

Add Health (0–42)

MIDUS (25-84)

ACL (25–75+)

HRS/ADAMS (50-100)

0   10   20   30   40   50   60   70   80   90   100

Age

Analytic Methods: Integrative Data Analysis (IDA)

- Distinct strengths
  - Permitting examination of an extended developmental period beyond any one study
  - Levering increased sample heterogeneity to strengthen both internal and external validity
  - Accounting for study heterogeneity due to measurement, sampling design, and historical time
- Coordinated Analysis
  - Coordinated parallel modeling of the same associations across multiple datasets
- Pooled Analysis
  - Combining multiple datasets into one sample using a synthesized cohort sequential design

1. Early-life Socioeconomic Status (SES) and Adult Physiological Functioning across the Life Course

Table 1. Measures of SES across the Life Course Studies

	Add Health (Age 24-32)	MIDUS (Age 34-74)	HRS (Age 50-98)
Early life SES	**Parent education** (if two parent household, maximum of both)	**Parent education** (if two parent household, maximum of both)	**Parent education** (if two parent household, maximum of both)
	Household income (parent reported)	**Parent Socioeconomic Index** (SEI; based on education and occupation)	**Father unemployment**
	Welfare receipt (before age 18)	**Welfare receipt** (before age 16)	**Financial well-being** (before age 16)
Adult SES	**Respondent education**	**Respondent education**	**Respondent education**
	Respondent income	**Respondent income**	**Respondent income**
	Respondent assets	**Respondent assets**	**Respondent assets**

Figure 4. SES Associated with High-risk Biomarkers in Young Adulthood (Add Health, N=12,237): Accumulation of Risks
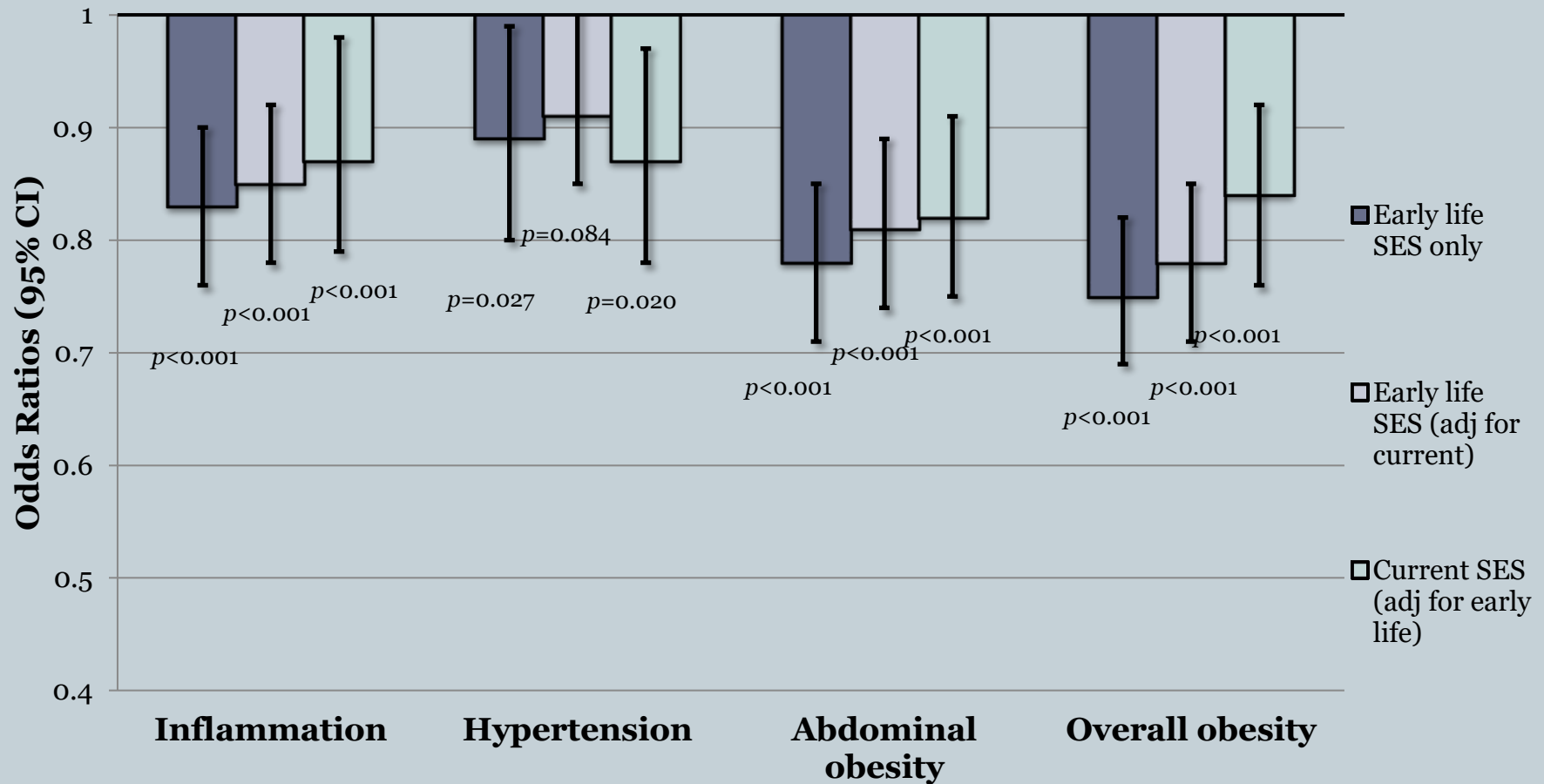
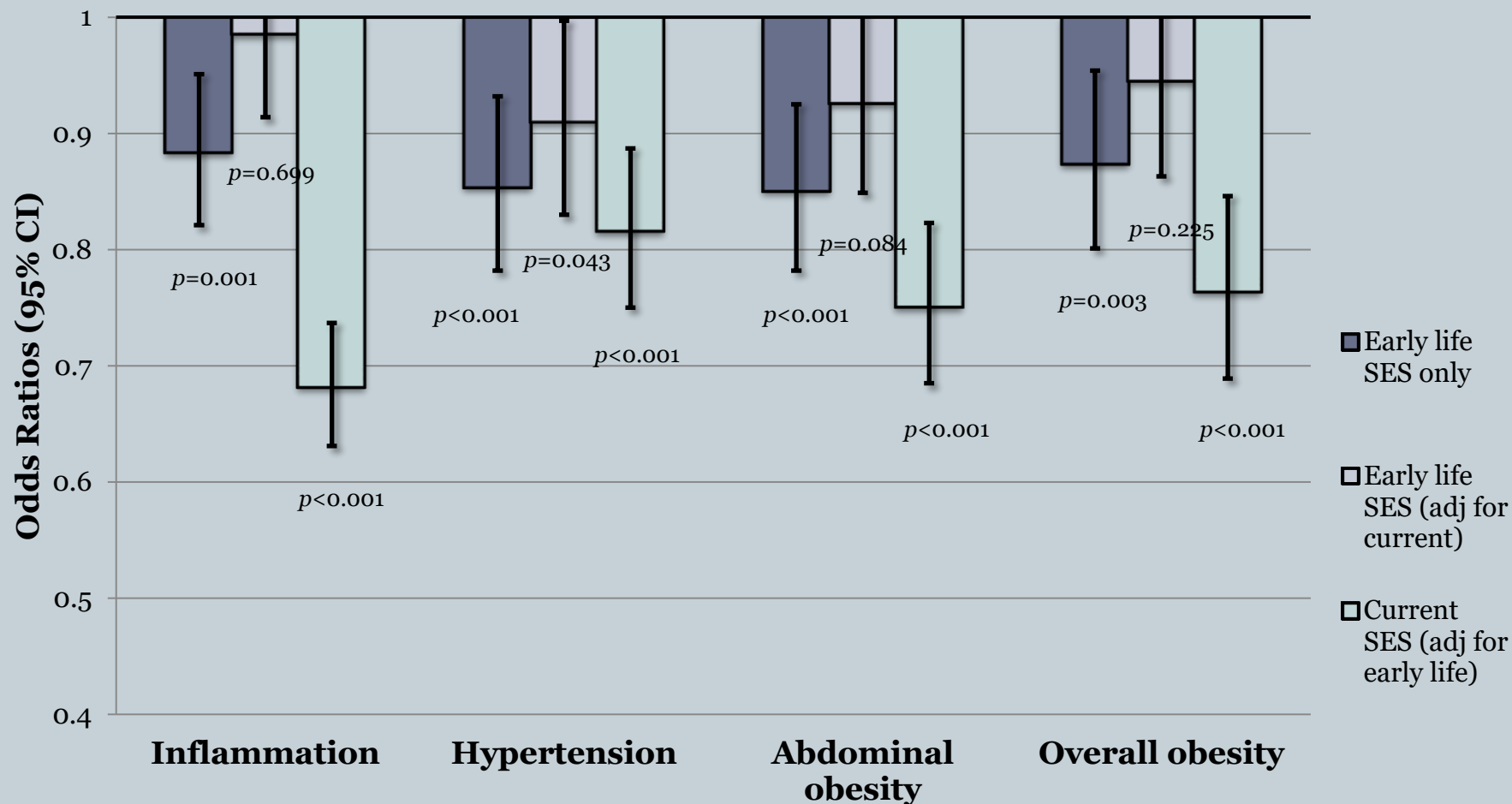Note: All models adjust for age, sex, race/ethnicity, marital status, and child health.

Source: Yang et al. (2017), *Biodemography and Social Biology*.

Figure 5. SES Associated with High-risk Biomarkers in Late Adulthood (HRS, N=7,889): Evidence of Pathway

Note: All models adjust for age, sex, race/ethnicity, marital status, and child health.

Source: Yang et al. (2017), *Biodemography and Social Biology*.

Figure 6. SES Mobility Associated with High-risk Biomarkers across the Life Span
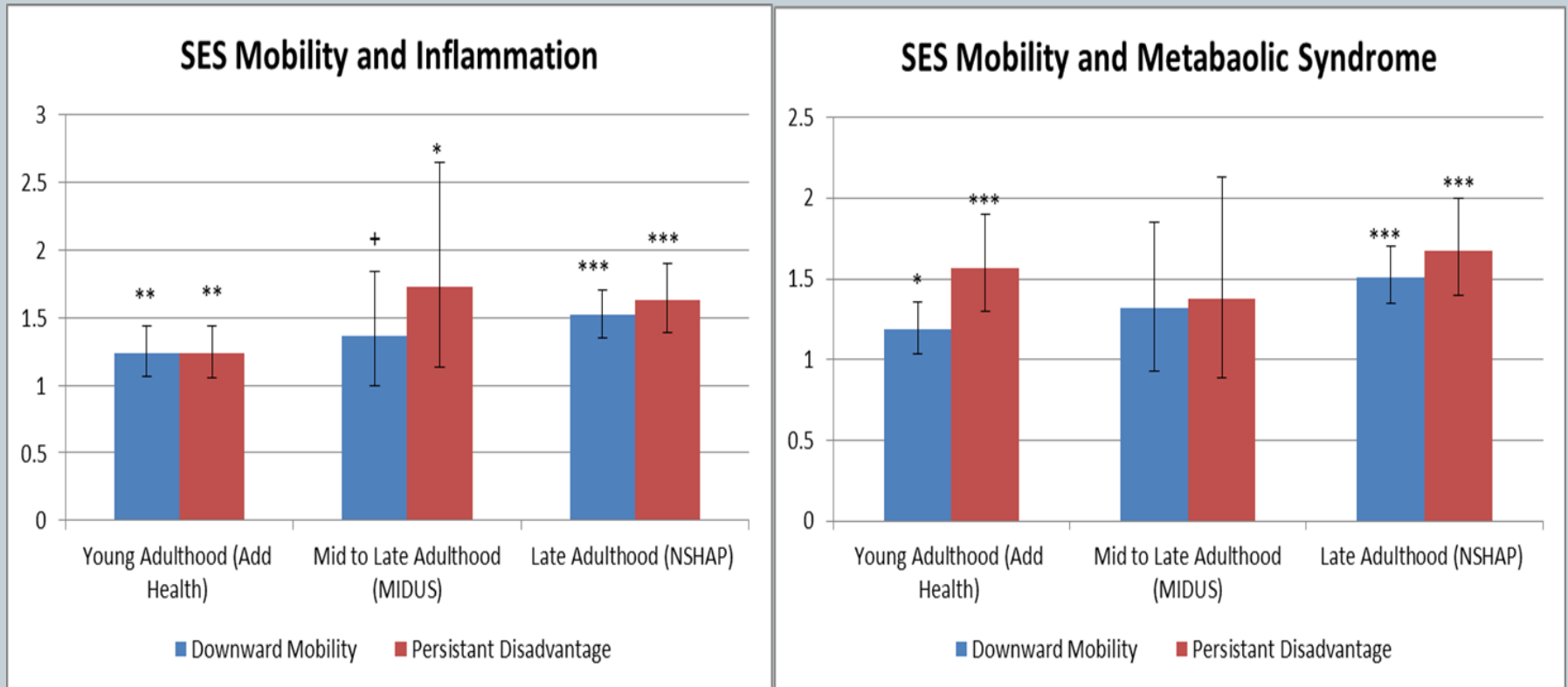
Note: +$p<.1$; *$p<.05$; **$p<.01$; ***$p<.001$ (two-tailed)

All models adjust for age, sex, race/ethnicity, marital status, and childhood health.

2. Multidimensional SES and Biological Risks for Illness across the Life Course

Table 2. Associations of Early Life and Adult SES with Inflammation across Life Course Studies

	Young Adulthood Add Health (N=10,586)		Mid Adulthood MIDUS (N=735)		Late Adulthood HRS (N=6,381)	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Early life SES	0.88**	(0.80 - 0.95)	0.99	(0.88 - 1.11)	0.95	(0.88 - 1.03)
Education (ref. HS)						
Less than HS	1.02	(0.80 - 1.31)	1.01	(0.63 - 1.61)	1.35***	(1.18 - 1.55)
Some college	0.96	(0.84 - 1.10)	0.96	(0.80 - 1.16)	1.50***	(1.18 - 1.91)
College +	0.77**	(0.66 - 0.90)	0.66***	(0.53 - 0.81)	0.84*	(0.73 - 0.97)
Income (ref. 2nd-3rd Q.)						
Bottom quartile	0.97	(0.85 - 1.12)	1.16+	(0.97 - 1.38)	1.06	(0.93 - 1.21)
Top quartile	0.92	(0.80 - 1.06)	0.92	(0.76 - 1.12)	0.95	(0.83 - 1.10)
Assets (ref. 2nd-3rd Q.)						
Bottom quartile	1.07	(0.96 - 1.19)	1.03	(0.86 - 1.24)	1.19*	(1.03 - 1.38)
Top quartile	0.98	(0.95- 1.01)	1.00	(0.82 - 1.21)	0.90+	(0.80 - 1.01)

*** $p<0.001$, ** $p<0.01$, * $p<0.05$, † $p<0.1$ (two-tailed test)
Note: All models adjust for age, race/ethnicity, sex, and self-rated childhood health

Table 3. Associations of Early Life and Adult SES with Metabolic Disorder across Life Course Studies

	Young Adulthood Add Health		Mid Adulthood MIDUS		Late Adulthood HRS	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Early life SES	0.93***	(0.89 - 0.97)	0.90*	(0.82 - 0.99)	0.97**	(0.95 - 0.99)
Education (ref. HS)						
Less than HS	0.93	(0.84 - 1.03)	0.82	(0.49 - 1.37)	1.02	(0.99 - 1.06)
Some college	0.95	(0.88 - 1.03)	1.02	(0.87 - 1.19)	0.96	(0.89 - 1.03)
College +	0.79***	(0.74 - 0.85)	0.83+	(0.69 - 1.00)	0.97	(0.94 - 1.01)
Income (ref. 2nd-3rd Q.)						
Bottom quartile	0.99	(0.95 - 1.07)	1.11	(0.96 - 1.29)	0.98	(0.95 - 1.02)
Top quartile	0.89**	(0.82 - 0.98)	0.93	(0.80 - 1.08)	0.97	(0.93 - 1.01)
Assets (ref. 2nd-3rd Q.)						
Bottom quartile	1.05*	(1.00 - 1.10)	0.93	(0.80 - 1.09)	1.01	(0.98 - 1.06)
Top quartile	0.97	(0.91 - 1.47)	0.85*	(0.72 - 0.99)	0.92***	(0.89 - 0.96)

*** $p<0.001$, ** $p<0.01$, * $p<0.05$, † $p<0.1$ (two-tailed test)
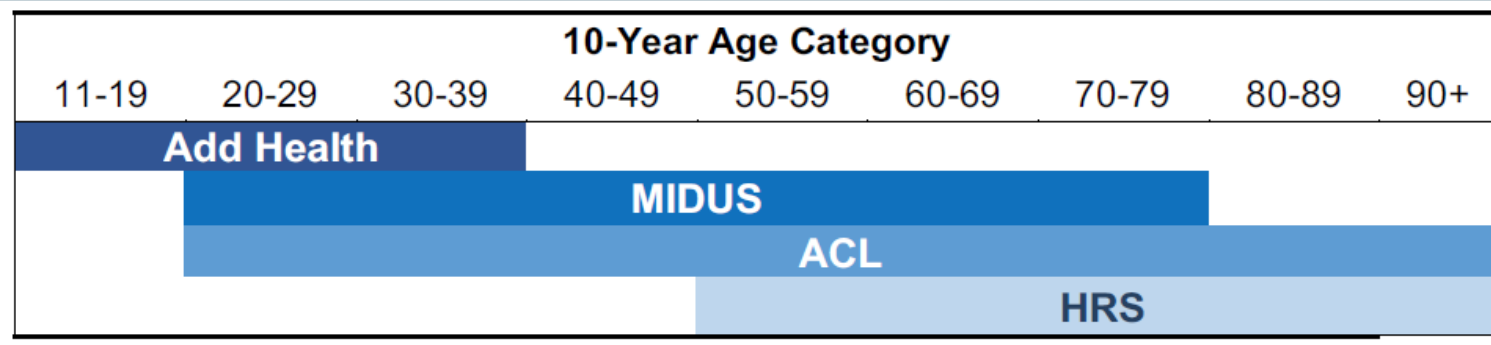Note: All models adjust for age, race/ethnicity, sex, and self-rated childhood health

Source: Yang et al. (2018), *Journals of Gerontology: Social Sciences.*

3. Life Course Trajectories of Body Mass Index (BMI) from Adolescence to Old Age: Educational Disparities

Integrative Life Course Design and Pooled IDA

A) Age Coverage and Overlaps by Study Membership

10-Year Age Category								
11-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90+

Add Health (11-39)

MIDUS (20-79)

ACL (20-90+)

HRS (50-90+)

B) Individual and Pooled Dataset Characteristics

Survey	N (Baseline)	Total Observations	Years	Length of Follow-Up	# Study Waves
Add Health	20,610	49,900	1994-2009	15 years	3
ACL	3,610	10,805	1986-2011	25 years	5
MIDUS	3,693	7,019	1995-2005	10 years	2
HRS	37,086	204,748	1992-2012	20 years	10
Combined	64,999	272,472	1986-2012	26 years	20

Figure 8. Predicted BMI Trajectories from Growth Curve Models for Women: 1994-2016 (N=126,285 person-years)
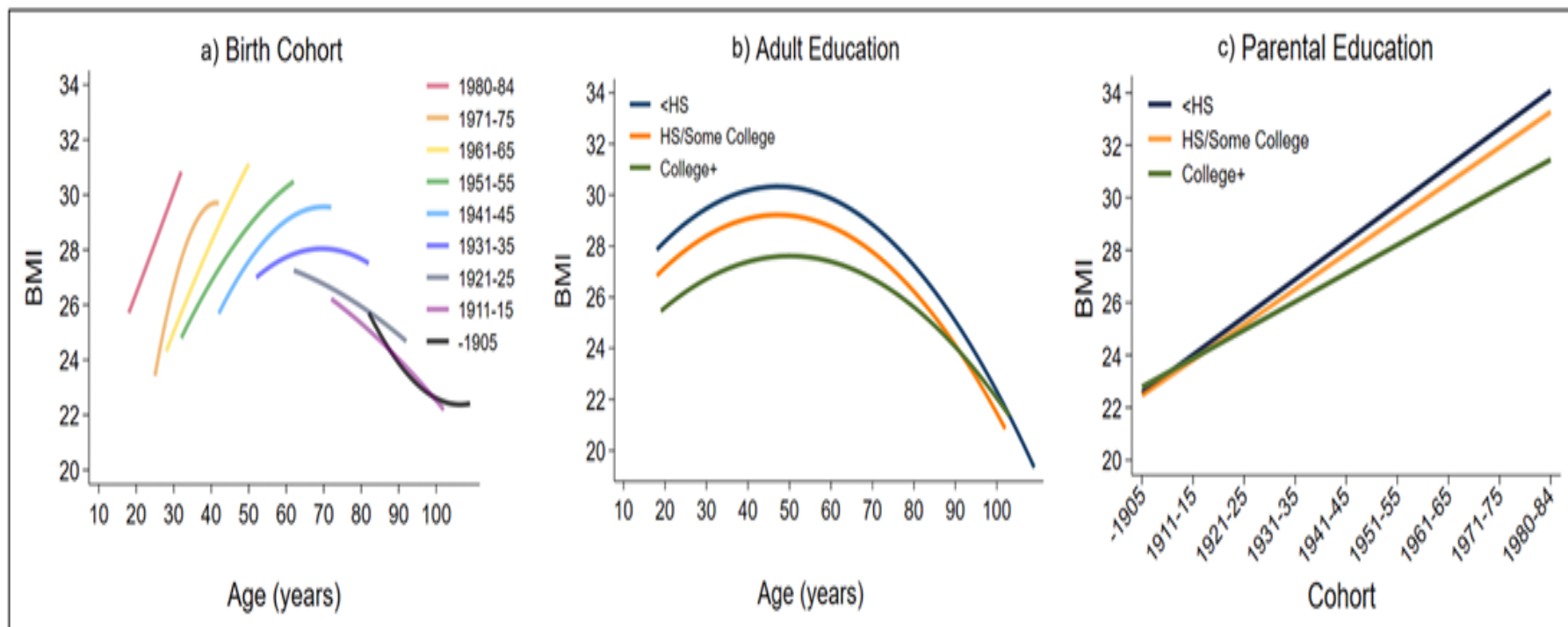
Note: All models adjust for age, birth cohort, race/ethnicity, parental education, adult education, immigration status, and study membership as well as interaction effects with study membership. The interaction effects shown in a) age x cohort , age^2 x cohort; b) age x education, , age^2 x education, and c) education x cohort are all statistically significant ($p<.001$; two-tailed test).

Summary of Findings

- The relationships between early and adult SES and health vary by life course stages and biomarkers of physiological functioning.
  - Young adulthood: *accumulation of risks model*
  - Mid to late adulthood:
    - Inflammation: *pathway model*
    - Metabolic disorder: *accumulation of risks* and *pathway models*
- Different components of adult SES link early SES to physiological functioning across life course stages.
  - Early-life SES to adult educational attainment is the most important pathway associated with physiological functioning throughout the life course.
  - The importance of wealth increases in shaping later-life health trajectories from mid to late adulthood.

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