MOVING TOWARD A MECHANISTIC UNDERSTANDING OF THE HEALTH CONSEQUENCES OF CHILDHOOD POVERTY

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A PARTIAL LIST OF HEALTH PROBLEMS ASSOCIATED WITH GROWING UP IN A LOWER-SES HOUSEHOLD

- **Perinatal:** More preterm birth, fetal growth restriction, infant mortality, neonatal mortality

- **Childhood:** Higher rates of obesity, NIDDM, more CVD risk factors, worse control of asthma and more activity limitations

- **Adulthood:** Higher risks of MetS, AMI, CHF, stroke, COPD, URI, multiple cancers, and premature mortality from any cause

- **Next Generation:** Offspring more likely to be PTB and SGA; have asthma and worse control of it; more CVD risk factors

- In general, these associations are independent of achieved SES, and upward economic mobility has fairly modest offsetting effects
RESEARCH GOALS

- Identify the biological mechanisms that link childhood SES with risk for health problems across the lifespan
- Identify protective and vulnerability factors for low-SES youth, and clarify how, when, and where they operate
- Use these results to inform better policy and practice
NON-RESOLVING INFLAMMATION AS COMMON PATHWAY

From Nathan and Ding. Cell 2010;140:871-882

PART 1: IDENTIFYING MECHANISMS
INFLAMMATION
SYSTEMIC REGULATION OF INFLAMMATION
Phenotypic Plasticity

- MO/Mφ
  More P/DAMP reactive
  Less GC sensitive
  More inflammation

- MO/M\(\phi\)
  Less P/DAMP reactive
  More GC sensitive
  Less inflammation

Disadvantaged

Advantaged

SIMPLIFIED FRAMEWORK
YOUNG ADULTS IL-6 RESPONSE BY EARLY SES

Miller et al. PNAS 2009; 106:14716-14721

Poly I:C via TLR3

Flagellin via TLR5
TRANSCRIPTIONAL PROFILING OF PBMC

Miller et al. PNAS 2009;106:14716-14721

Fold Difference in TFBM Prevalence
(Low EL SES / High EL SES)

- NF-κB
- GR
- NF-κB / GR

p = .01
p = .02
p = .001
MAPPING DEVELOPMENTAL TIMELINE

Images from Kim et al. AJOG 2015; 213:S53-69

INFLAMMATION AT THE MATERNAL-FETAL INTERFACE
MATERNAL INCOME AND PLACENTA INFLAMMATION

MORE IMMUNE ACTIVATION
LESS TISSUE MATURATION

Miller et al, Brain Behav Immun 2017; 64:276-84

TRANSCRIPTIONAL PROFILE OF CHORIONIC VILLI
WHO GETS SICK?
WHO STAYS HEALTHY?

PART 2: PROTECTIVE & VULNERABILITY FACTORS

Photos by Stephen Shames
PROTECTIVE FACTORS FOR LOW-SES YOUTH

- Nurturant caregiving - engaged, responsive, trustworthy adult
- Good self-control - keeping focused on distal, abstract goals
MATERNAL NURTURANCE AS BUFFER OF LOW CHILDHOOD SES?


METABOLIC SYNDROME AT MIDLIFE: MIDUS (N=1205)

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Predicted Number of MetS Components (Covariate Adjusted)
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Parental Educational Attainment
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- Less than HS Education
- HS Graduate or Equivalent
- Some College or AA Degree
- Bachelor’s Degree or More

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Lower Maternal Nurturance
Typical Maternal Nurturance
Higher Maternal Nurturance
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MATERNAL NURTURANCE AS BUFFER OF LOW CHILDHOOD SES?
CAN WE LEVERAGE PARENTING TO IMPROVE HEALTH?

- Family-oriented intervention (N=272)
- 11-year olds and caregivers
- African-Americans in rural South
- 8 weekly sessions led by community facilitators
- Parents: Engaged, vigilant, supportive parenting
- Youth: Goal setting, coping with peer stress, importance of rules
- Circulating inflammatory cytokines at age 19 (IL1, IL6, IL8, TNF, IL10, IFNg)
SAAF INTERVENTION REDUCES LOW-GRADE INFLAMMATION

Miller et al. PNAS 2014; 111:11287-92
INCREASES NURTURANT/INVOLVED PARENTING & DECREASES HARSH/INCONSISTENT PARENTING

PARTLY WORKS VIA PARENTING

Miller et al. PNAS 2014; 111:11287-92
CAN WE LEVERAGE SOCIAL RELATIONSHIPS TO IMPROVE PREGNANCY OUTCOMES?

- Small, preliminary, observational study
- Low-income community in SC; 95% Medicaid
- 20 women who received traditional prenatal care
- 20 women who participated in group-based prenatal care
- Groups of 8-10 women, met for 10 sessions across T2/T3
- Focus on transcripts associated with disadvantage in earlier study
CENTERING AND TRANSCRIPTION PROFILES RELATED TO SES

Miller et al, Brain Behav Immun 2017; 64:276-84
FOLLOW-UP RCT: HD092446

- 3000 pregnant women from same community in SC
- Randomized to GPNC vs. TPNC
- Primary endpoints:
  - Placental inflammatory lesions by histology
  - Placental gene expression profiles
- Other hypotheses:
  - Stress reduction vs. behavior change
  - GPNC to placenta to PTB/SGA
PROTECTIVE FACTORS FOR LOW-SES YOUTH

- Nurturant caregiving
- Good self-control - maintaining focus on distal, abstract goals
SHAPE - From Early to Late Adolescence (N=489)
Psychosocial Outcomes (19) by Family SES and Self Control (11-13)

Depressive Symptoms

Externalizing Symptoms

AFRICAN-AMERICAN YOUTH IN RURAL SOUTH

Brody et al. Psych Science 2013; 24:1285-93
**DO HEALTH BENEFITS FOLLOW?**

Allostatic Load (19) by Family SES & Self Control (11-13)

Brody et al. Psych Science 2013; 24:1285-93
Allostatic Load (19) by Family SES & Self Control (11-13)

DO HEALTH BENEFITS FOLLOW?

Brody et al. Psych Science 2013; 24:1285-93
AIM: From Late Adolescence to Early Adulthood (N=292)  
Psychosocial Outcomes (17-20) by Family SES & Self Control (17-19)  

NEW COHORT OF RURAL AFRICAN-AMERICANS  

Miller et al. PNAS 2015; 112:10325-30
AIM - From Late Adolescence to Early Adulthood: Cellular Aging (22) by Family SES & Self Control (17-19)

AGING OF IMMUNE CELLS, INDEXED BY DNA METHYLATION

Miller et al. PNAS 2015; 112:10325-30
Black - White Gap in Life Expectancy

From Braveman et al. AJPH 2010; 100:S186-96

HIDDEN COSTS OF MOBILITY FOR BLACK AMERICANS?
Figure 4:
Percent of African Americans, By Income Level, Saying They Have Personally Experienced Various Forms of Individual Discrimination Because of Their Race


HIGHER-SES BLACKS EXPERIENCE MORE DISCRIMINATION
Add Health (N = 13,009) Depressive Symptoms (24-32) by Childhood Disadvantage (13-18) and College Degree (Ever)

Depression by Race/Ethnicity

NH White

NH Black

Hispanic

Gaydosh, Schorpp, Chen, Miller, & Harris. PNAS 2018; 115:109-14

ARE THERE HEALTH COSTS OF MOBILITY? IF SO, FOR WHOM?
Add Health (N = 10,772)
Metabolic Syndrome (24-32) by Childhood Disadvantage (13-18) and College Degree (Ever)

Metabolic Syndrome by Race/Ethnicity

NH White

NH Black

Hispanic

Probability of metabolic syndrome

Adolescent disadvantage index, standardized

-1 0 1 2 3

No college degree

College or more

Gaydosh, Schorpp, Chen, Miller, & Harris. PNAS 2018; 115:109-14

ARE THERE HEALTH COSTS OF MOBILITY? IF SO, FOR WHOM?
EXPLANATIONS

**COSTS OF STRIVING**

- Constant hard driving efforts - “John Henryism"
- Limited time for restorative activities, health behaviors
- Competing demands and obligations in family life

**COSTS OF ARRIVING**

- Juggling multiple identities and social networks
- Never quite “arriving” because of wealth gap
- Alienation/discrimination in school/workplace
Can Upward Mobility Cost You Your Health?
By GREGORY E. MILLER, EDITH CHEN and GENE H. BRODY

January 4, 2014 2:30 pm

The Great Divide is a series about inequality.

Americans love a good rags-to-riches story. Even in an age of soaring inequality, we like to think that people can still make it big here if they work hard and stay out of trouble. The socioeconomic reality of most of the last four decades — stagnant wages, soaring income and wealth inequality, and reduced equality of opportunity — have dented, but not destroyed, the appeal of the American dream.

Those who do climb the ladder, against the odds, often pay a little-known price: Success at school and in the workplace can exact a toll on the body that may have long-term repercussions for health.

Among American children there are wide socioeconomic gaps on many dimensions of well-being: school achievement, mental health, drug use, teenage pregnancy and juvenile incarceration, to name just a few. Despite the risks that lower-income children face, we also know that a significant minority beat the odds. They perform admirably in school, avoid drugs and go on to college.

Psychologists refer to these children as resilient, because they achieve positive outcomes in adverse circumstances. They do so in part by cultivating a kind of determined persistence. Often with nurturing from a parent, relative or mentor, they set goals for the future, work diligently toward them, navigate setbacks, stay focused on the long term and resist temptations that might knock them off the ladder to success.
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