THE NEW (OLD) PUBLIC HEALTH

How Neuroscience Is Changing Child and Maternal Health

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MILLER SCHOOL of MEDICINE

Disclosures

- Employment and Positions
  - University of Miami
  - Jackson Health Systems
  - State of Florida Title V program
  - SACHDNC (HRSA, MCHB)
- No disclosures re conflict of interest
  - No commercial interests
  - Medical-legal testimony (not related to topic today)

Child Health Today

- What are the 3 most significant issues for the health of children in the US today?

Child Health Today

- Poverty
- Access to health care
- Homelessness
- Hunger
- Substandard schools
- Child abuse
- AIDS
- Car crashes/trauma

- Obesity
- Maternal depression
- Substance abuse
- Violence
- Access to mental health
- Early childhood
- Low on political agenda
- Language/Culture

Child Health Today

- Which of these issues will be solved in a pharmaceutical or genomics laboratory?
- Which will be substantially impacted by 15 minute well child care visit with a health care provider?
- Which will be affected by a admission to a tertiary care hospital?

Learning Objectives

At the end of this session, you will be able to

1. Explain the strengths and weaknesses of the US system of care using <u>historical</u> examples
   2. Provide evidence of the relationship between <u>child development</u> and long-term health outcomes
   3. Describe at least one change in <u>systems of care</u> (clinical practice, public policy, or professional education) to address 21st c. child health issues
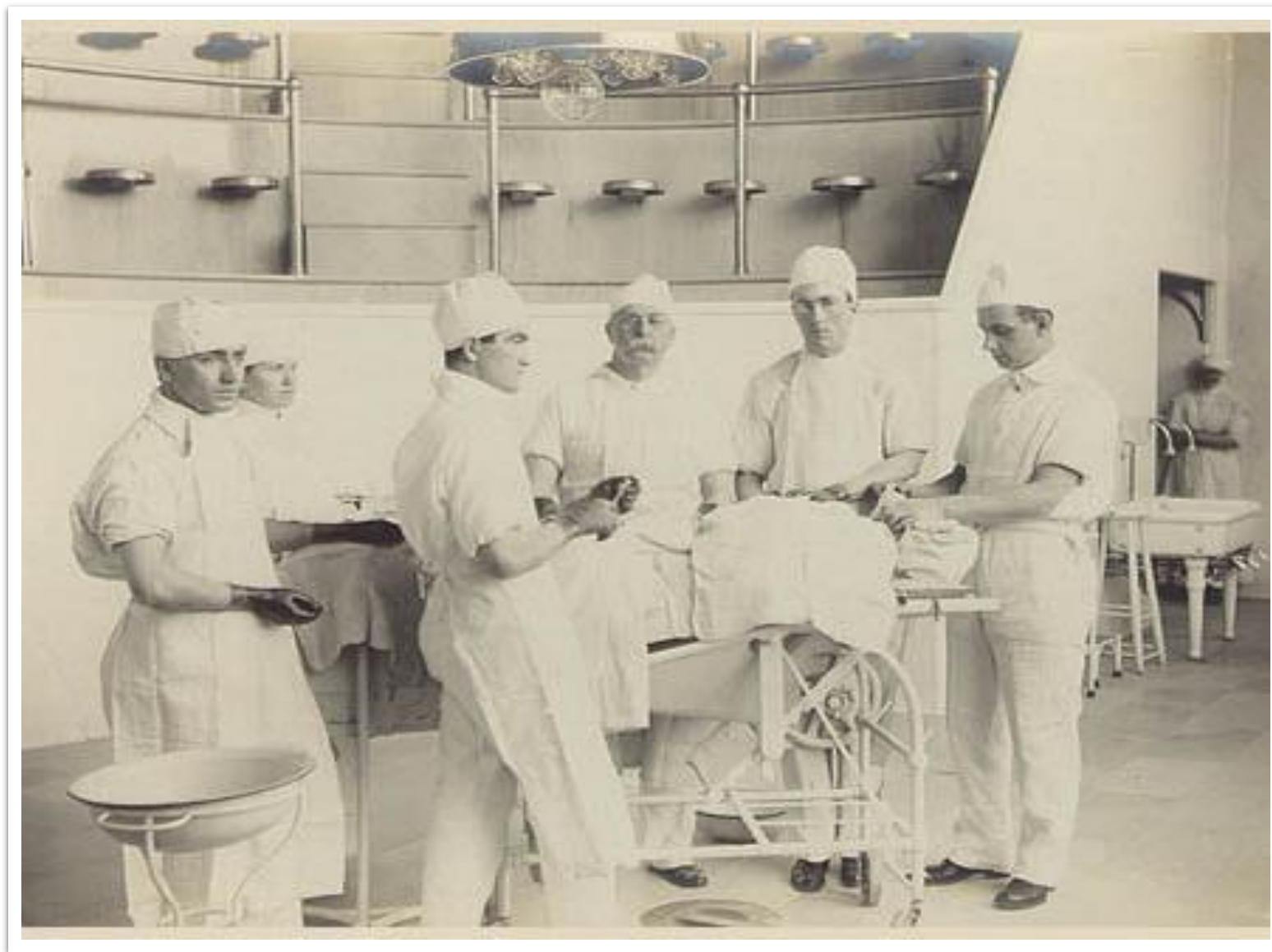
Doctor's
Office,
late 1800s

Hospital
Operating
Suite, c.
1910
Royal Victoria
Hospital

History of Medical Care

1870s

- General practice
- Varied training
- Rural/local/isolated
- Low income/prestige
- +/- State license
- Pre-germ theory
- Eclectic therapies

1930s

- Specialization
- Standardized training
- Urban/connected
- Reasonable income/prestige
- License required
- Germ theory
- **Health and Education Professionals**
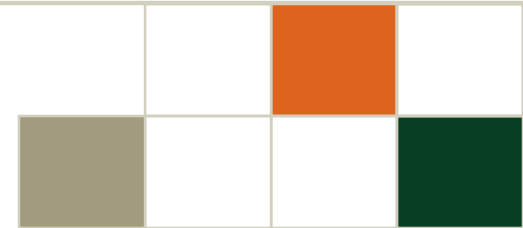
Faith in Science: Polio Vaccine

- NY Times, July 11, 1957
  - "MASS VACCINATION CUTS POLIO'S TOLL"

    "Mass vaccination with Salk vaccine has sharply reduced the number of paralytic polio cases in the city and state this year, health officials reported yesterday."

- Time Magazine, Aug. 12, 1957
  - "POLIO DECLINE"

    "Polio is declining sharply in most of the U.S. for the second year, with abundant evidence that much of the improvement is due to the Salk vaccine."
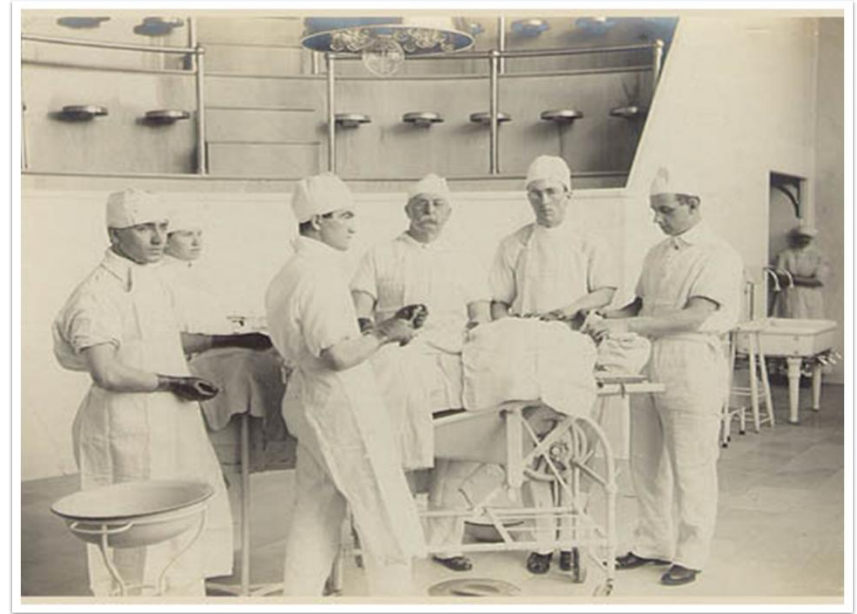
"Inward Vision; Outward Glance"

- The best way to improve health is to provide technologically sophisticated interventions to patients in the office, in the operating suite, or at the bedside of a modern hospital

- "Technological imperative in medicine"
  - Machines, vaccines, antibiotics, surgery, new drugs
  - The "Medical Model"

Charles Rosenberg

Inward Vision

Outline –History, Biology, and Policy

1. Why is the health care system the way it is?

2. What are the consequences of our current health care system?

3. What is the evidence that we should change (and focus on child development)?

4. Challenge to the current systems of care

5. [Your work here]

1. Infant Mortality (US Bureau of Statistics)

FIGURE 1. Infant mortality rate,* by year — United States, 1915–1997
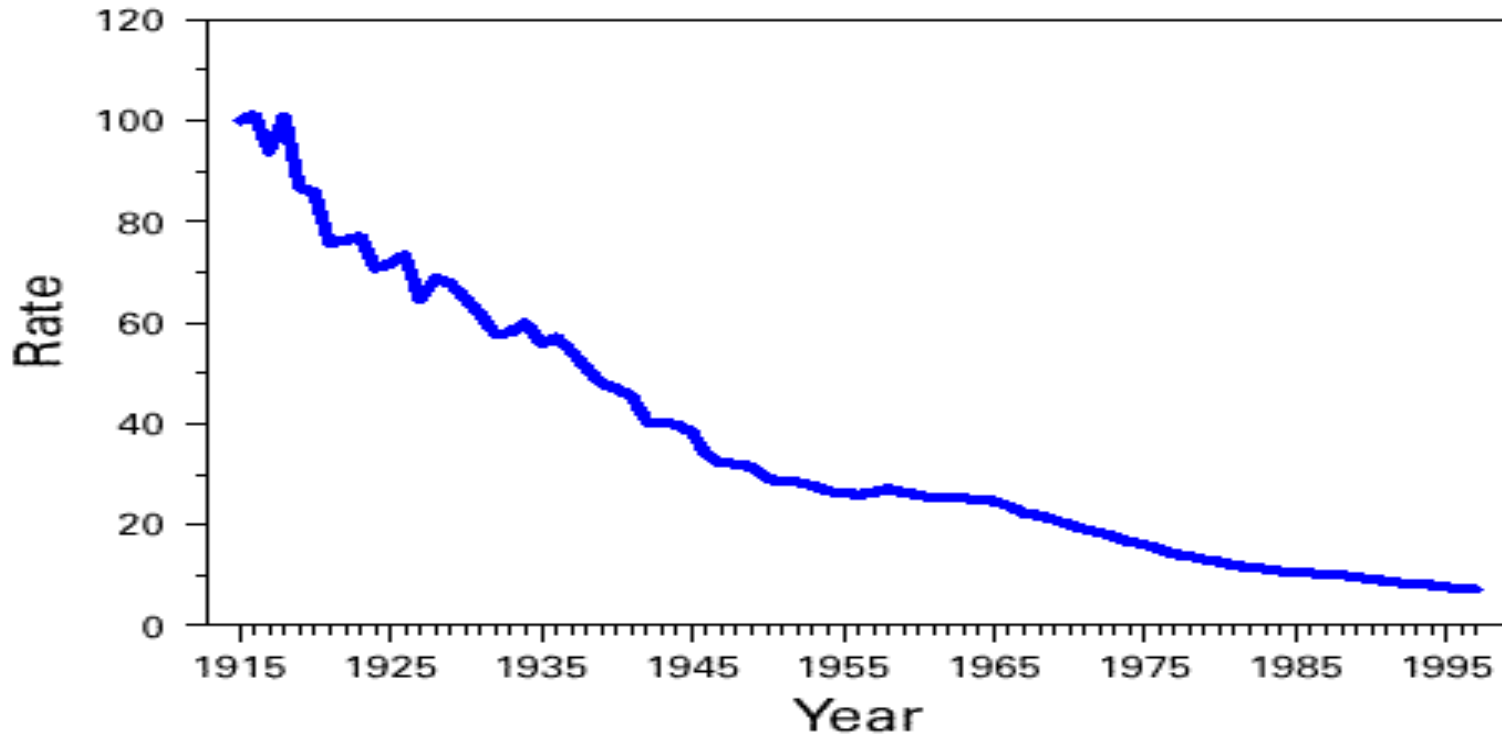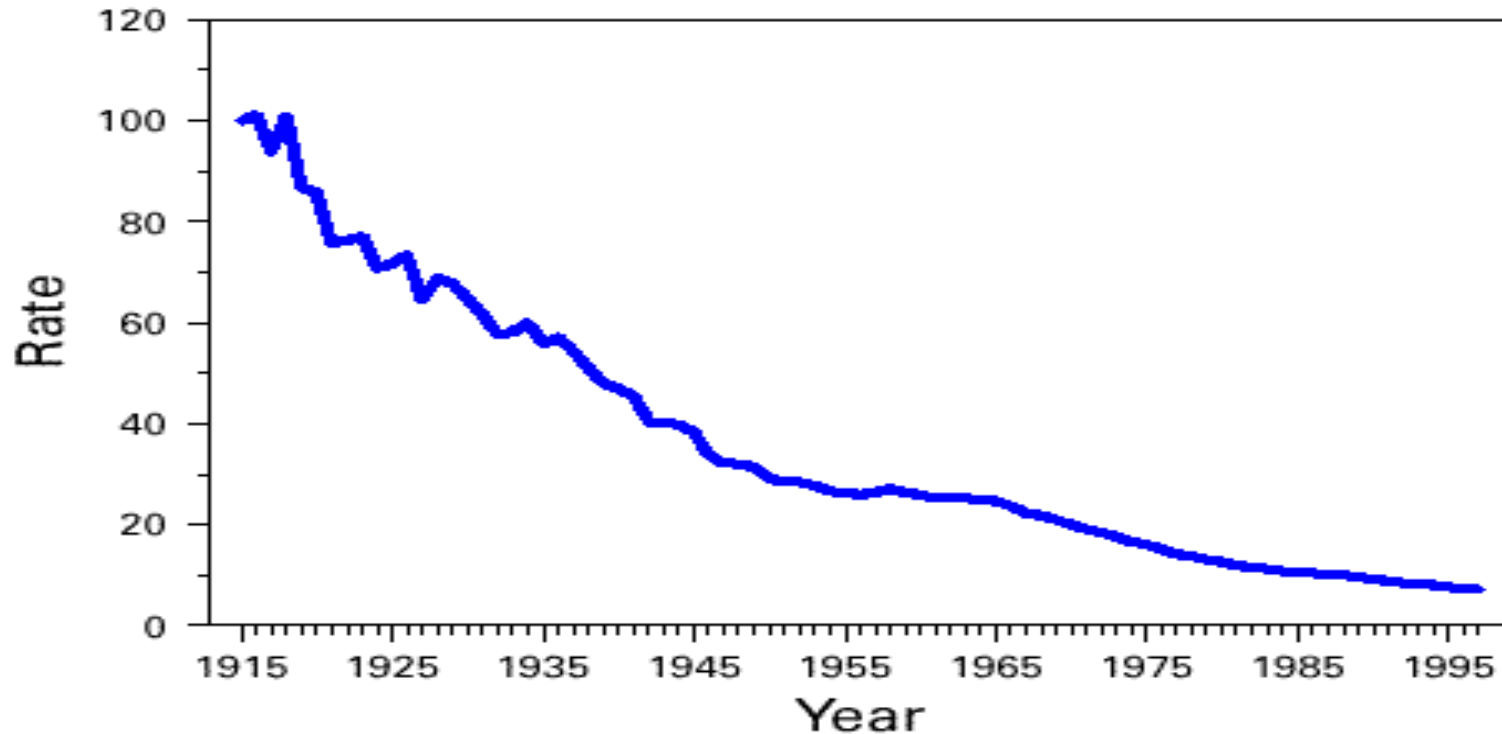

*Per 1000 live births.

US: Child are Healthy (Chronic conditions per 100)

|				
Learning disability	8.2		Obesity	16
ADHD	7.5		Allergies	9
Depression	3.3		Recurrent OM	8
Intellectual disability	1.5		Asthma	8
Autism	1.1		Diabetes	0.1
Hearing loss	0.4		Sickle cell	0.1
Visual loss	0.4		Child cancers	0.02
Cerebral Palsy	0.3		Liver transplant	0.0004
Down Syndrome	0.15			

2. Infant Mortality (US Bureau of Statistics)

FIGURE 1. Infant mortality rate,* by year — United States, 1915–1997
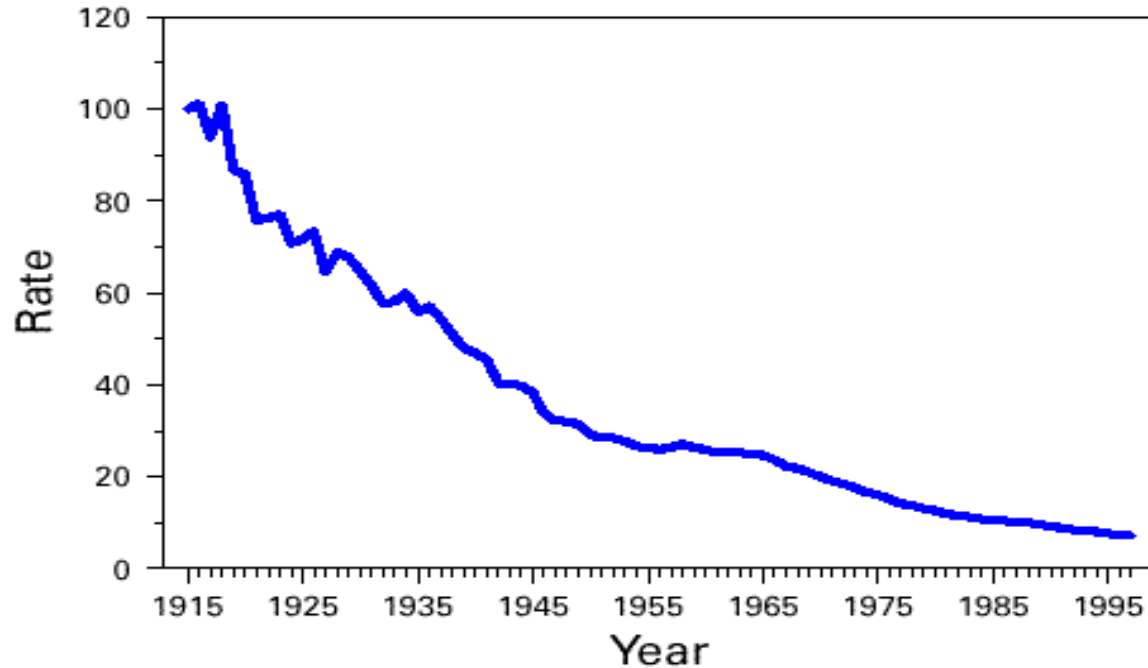
*Per 1000 live births.

Measles Mortality
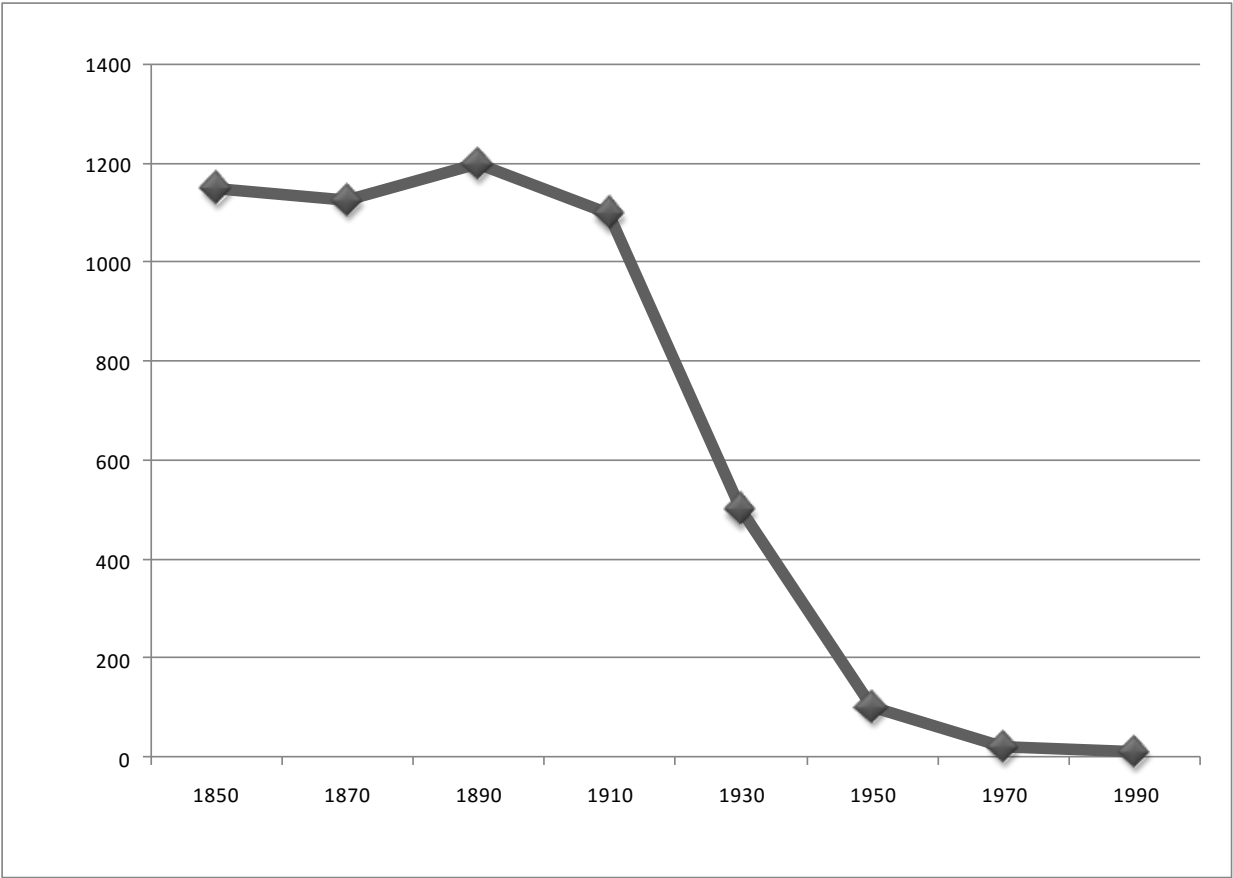
Decline in child mortality precedes
- Antibiotics (1940s and 50s); Vaccines (1950s and 60s)

FIGURE 1. Infant mortality rate,* by year — United States, 1915–1997
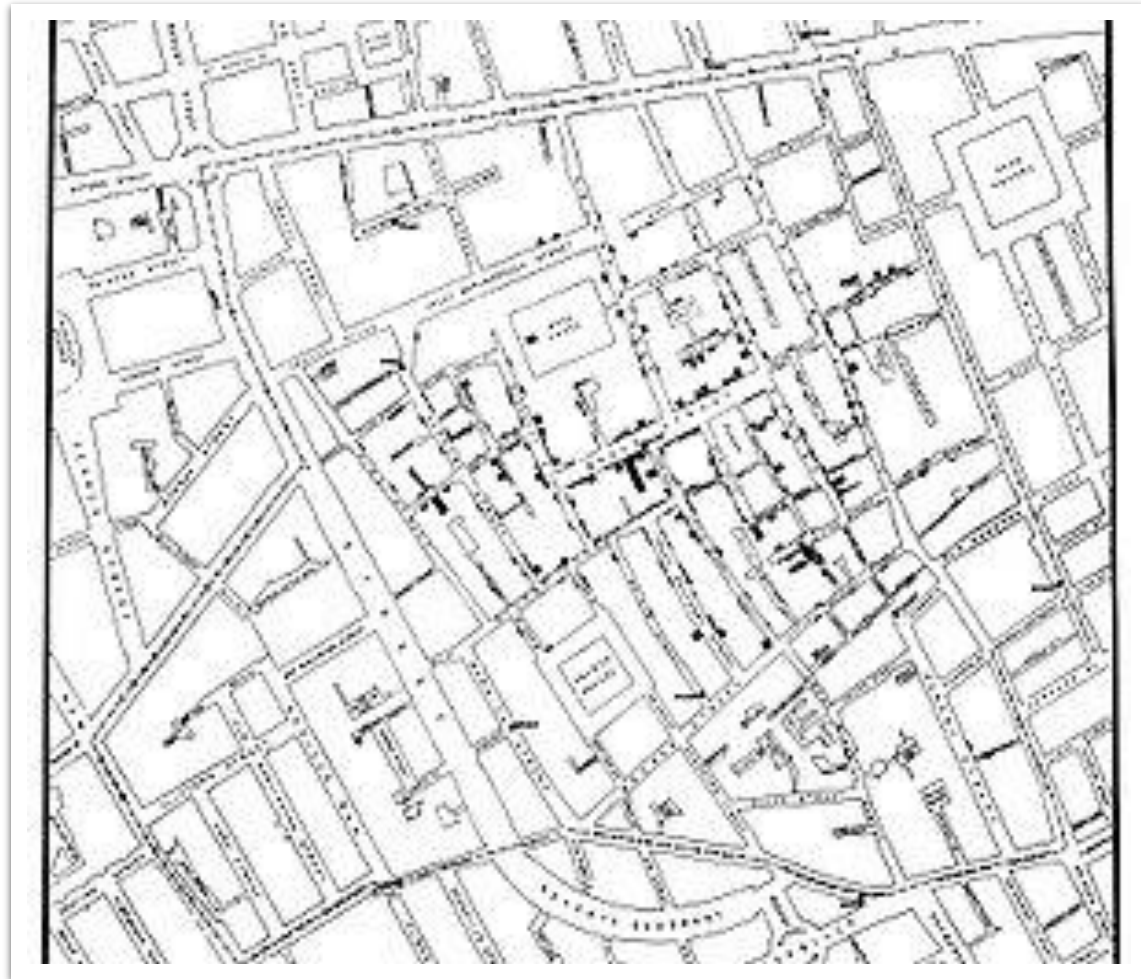
*Per 1000 live births.
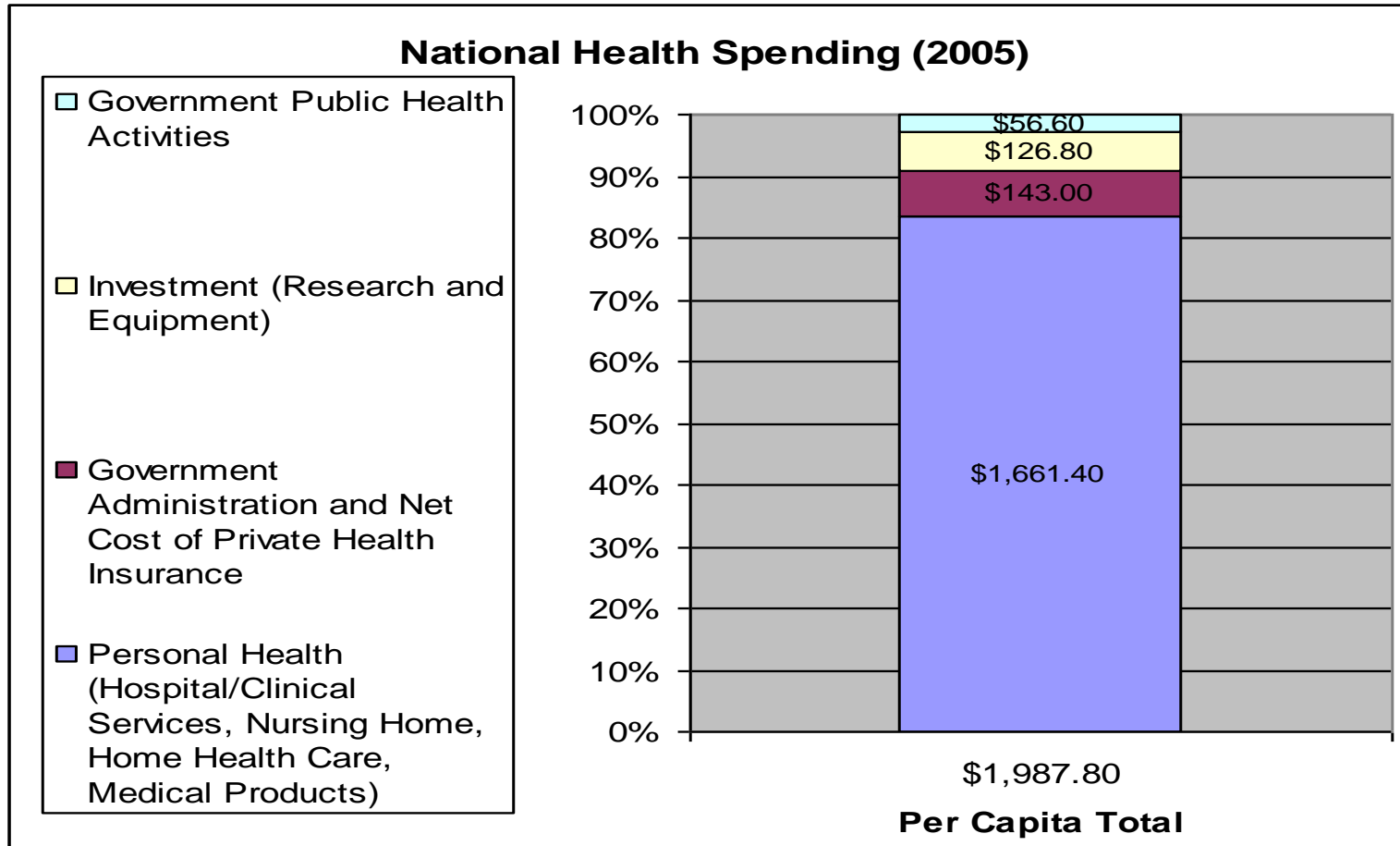
What is this?
Hint: 1854

John Snow's Cholera Map, 1854

Today: Biomedicine v. Public Health

- Clinical medicine
  - Individual patient
  - Office/hospital
  - Acute care, high tech
  - Focus on medicines, procedures
  - Internal systems
    - Hospital policy
    - Quality improvement
    - Regulations

- Public health/Population medicine
  - Populations
  - Community-based
  - Prevention
  - Provide some medicines, etc.
  - Focus on society
    - Access to care
   - Public health
    - Neighborhoods

US Spending on Health

National Health Spending (2005)

Legend:
- Government Public Health Activities
- Investment (Research and Equipment)
- Government Administration and Net Cost of Private Health Insurance
- Personal Health (Hospital/Clinical Services, Nursing Home, Home Health Care, Medical Products)

Chart values:
- $56.60
- $126.80
- $143.00
- $1,661.40

Per Capita Total: $1,987.80

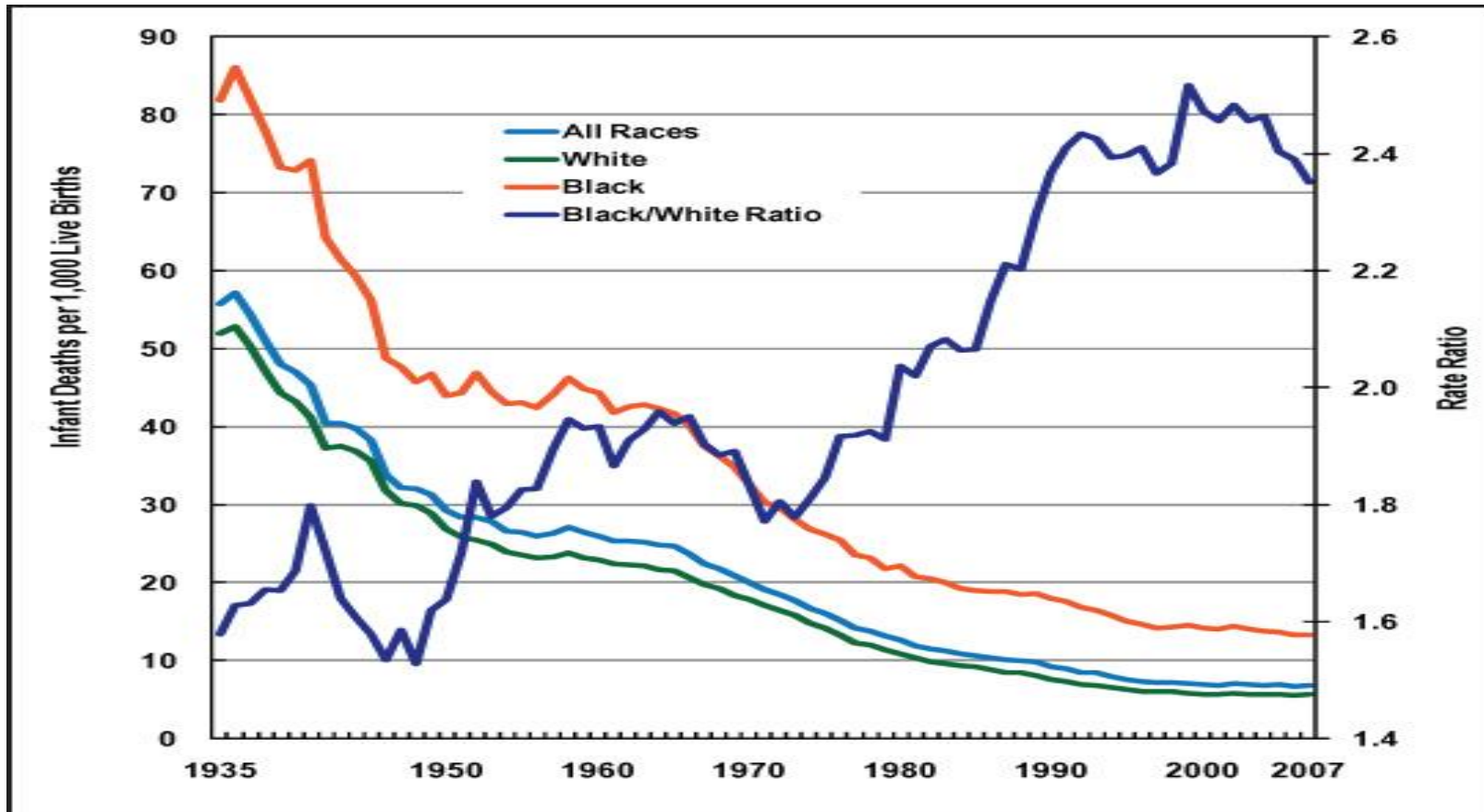# 3. Infant Mortality (US Bureau of Statistics)

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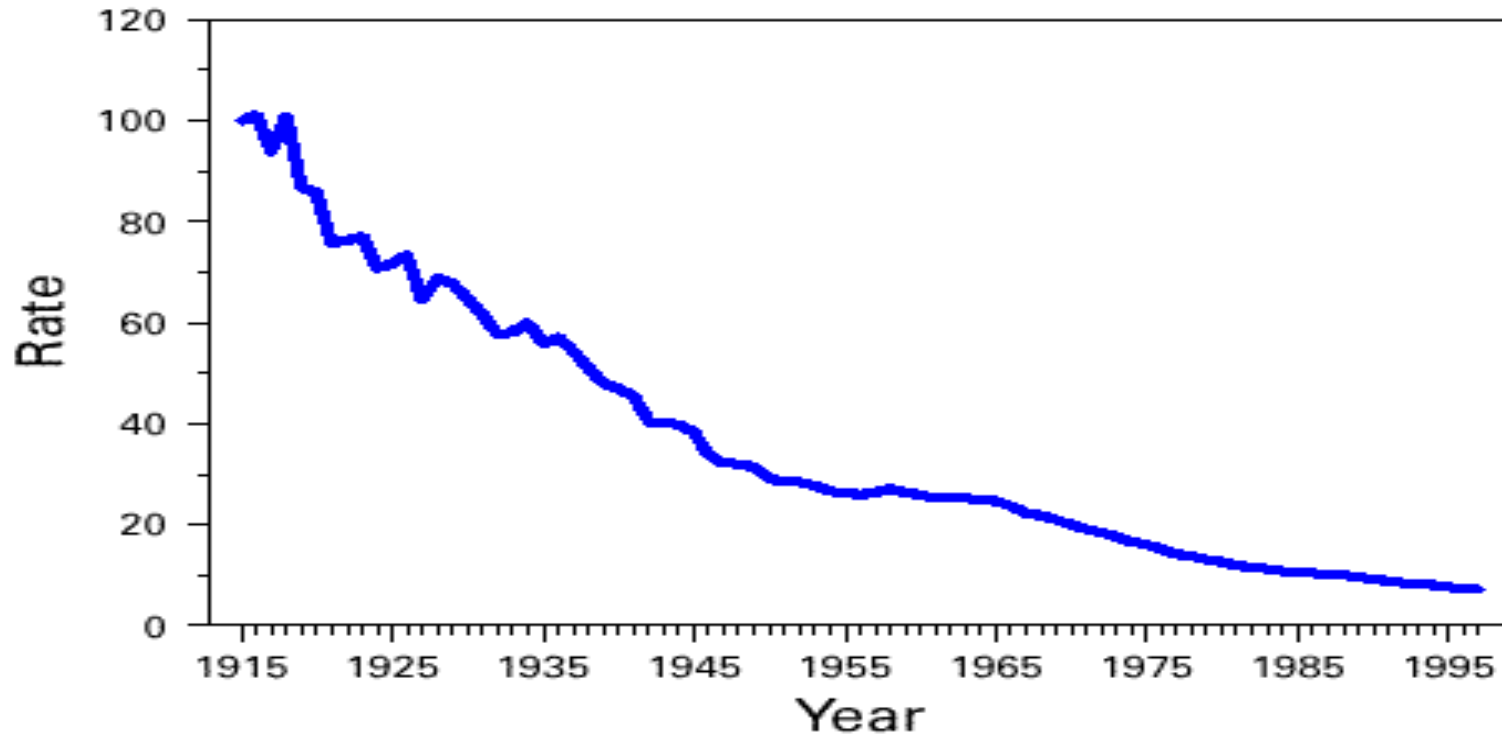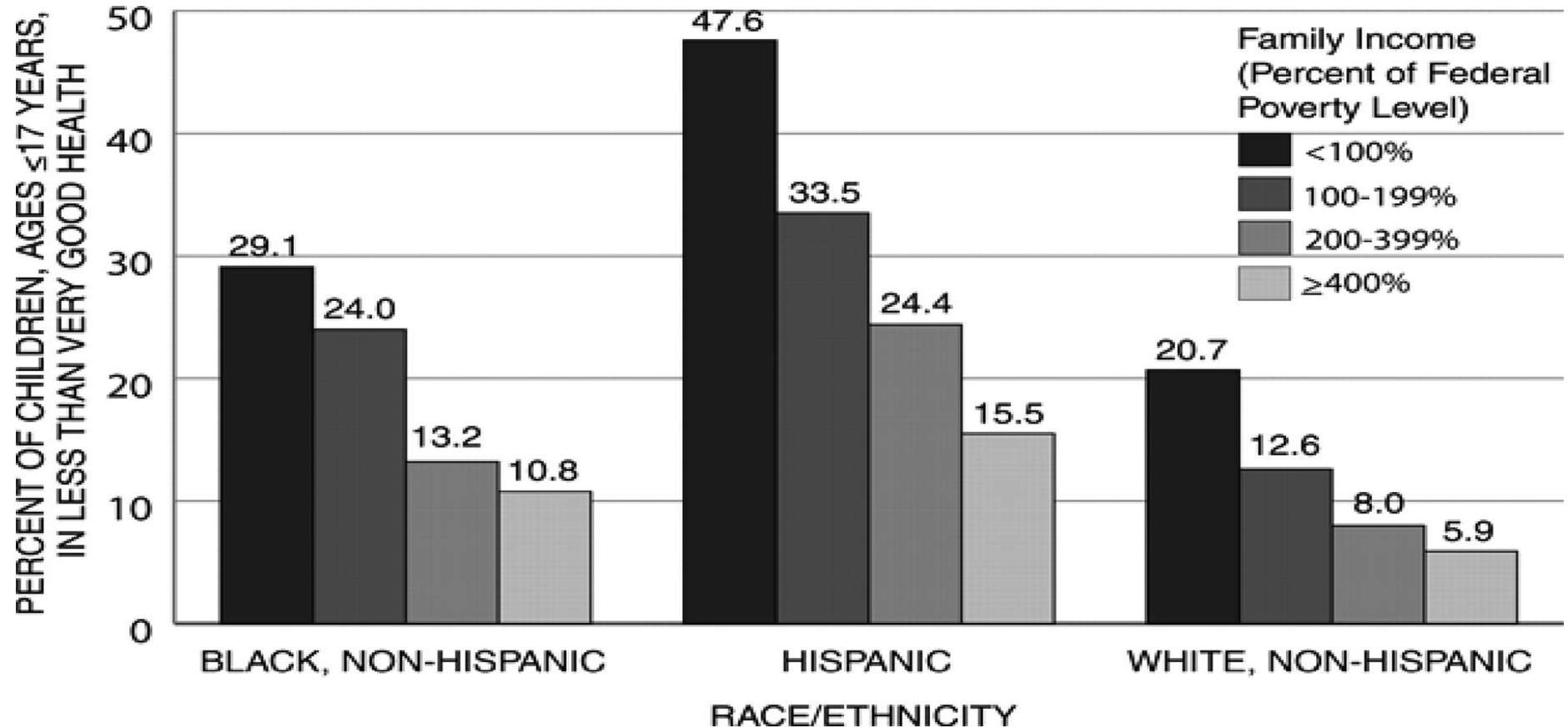


*Per 1000 live births.

IMR – Black/White Disparity

Title V 75 Anniversary Celebration. Infant Mortality in the United States, 1935-2007.
http://www.hrsa.gov/healthit/images/mchb_infantmortality_pub.pdf

Health Disparities in the US
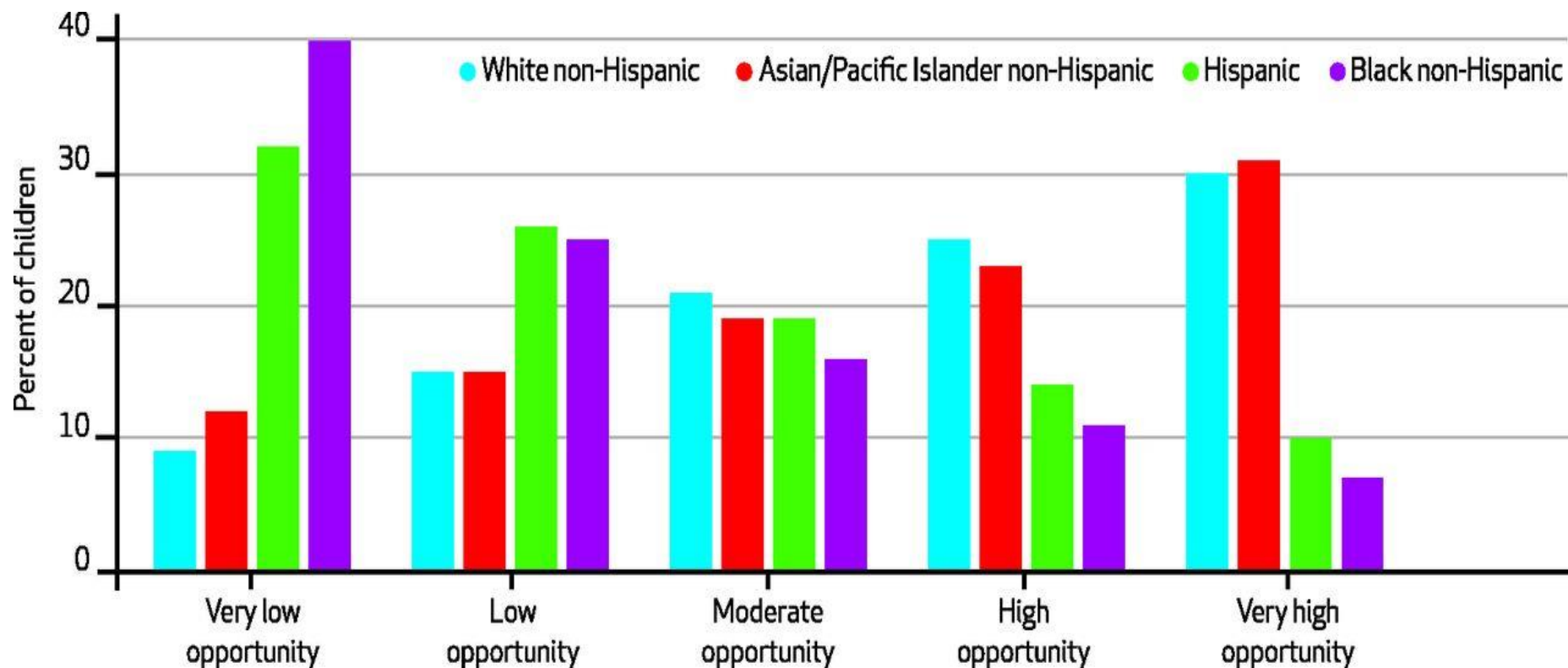

Braveman, P. et al. Pediatrics 2009;124:S163-S175

PEDIATRICS®

Reading and math scores at kindergarten entry by SES, ECLS-B study, 2001–2007

Reading (N = 6600)

Math (N = 6600)
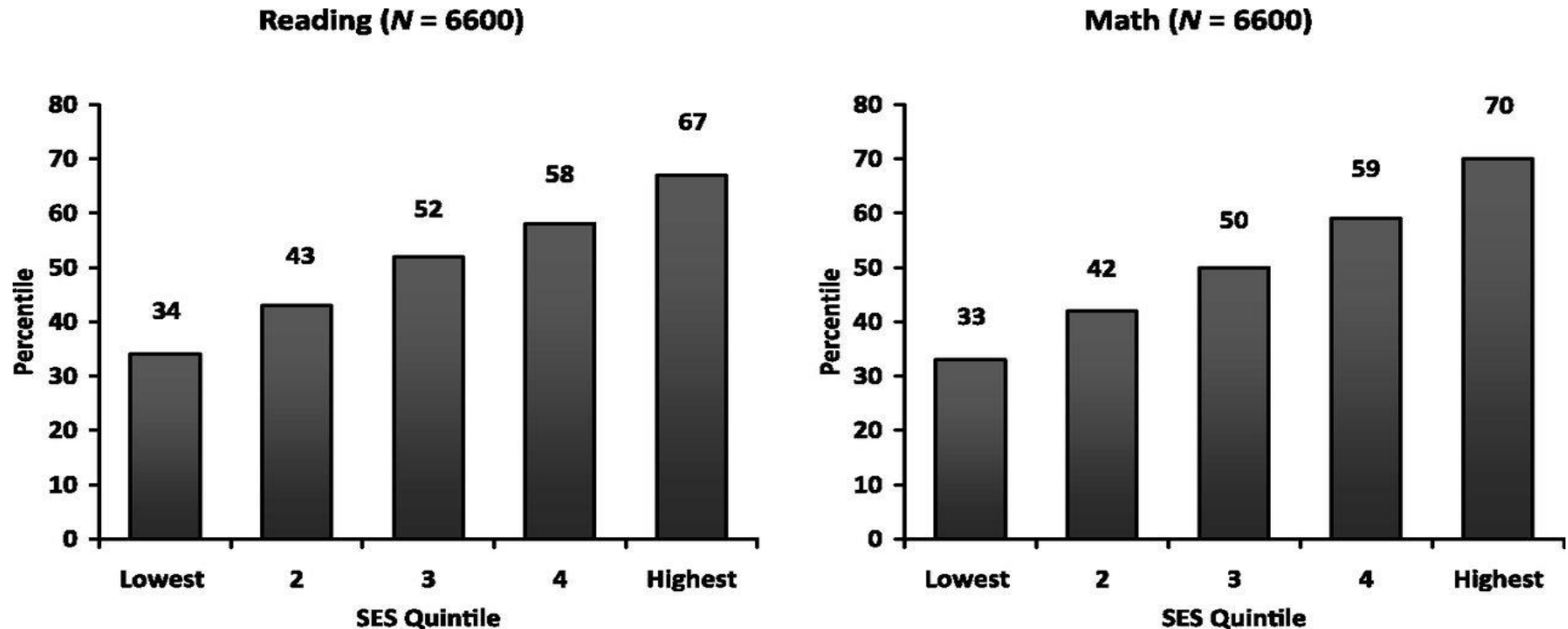
PEDIATRICS®

Percentages Of Children Living In Neighborhood Opportunity Category (100 Largest US Metropolitan Areas)

Acevedo-Garcia D et al. Health Aff 2014;33:1948-1957

HealthAffairs

Social Determinants

- The social determinants of health are those factors which are outside of the individual; they are beyond genetic endowment and beyond individual behaviors. They are the context in which individual behaviors arise and in which individual behaviors convey risk. The social determinants of health include individual resources, neighborhood (place-based) or community (group-based) resources, hazards and toxic exposures, and opportunity structures.   **Camara Jones, CDC, 2010**

Determinants of Health (per cent contribution)
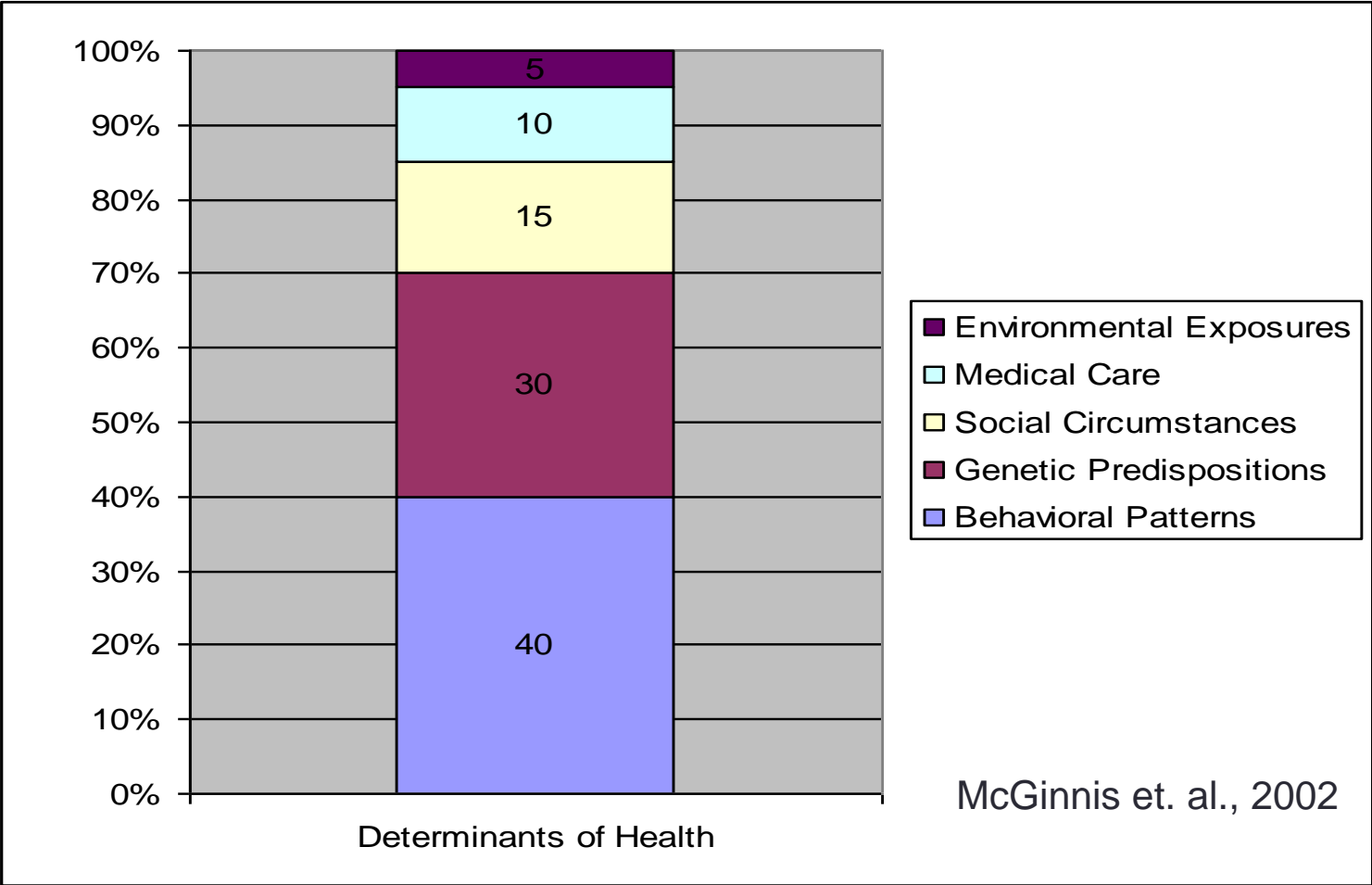
McGinnis et. al., 2002

Slide by I. Prilleltensky, 2014

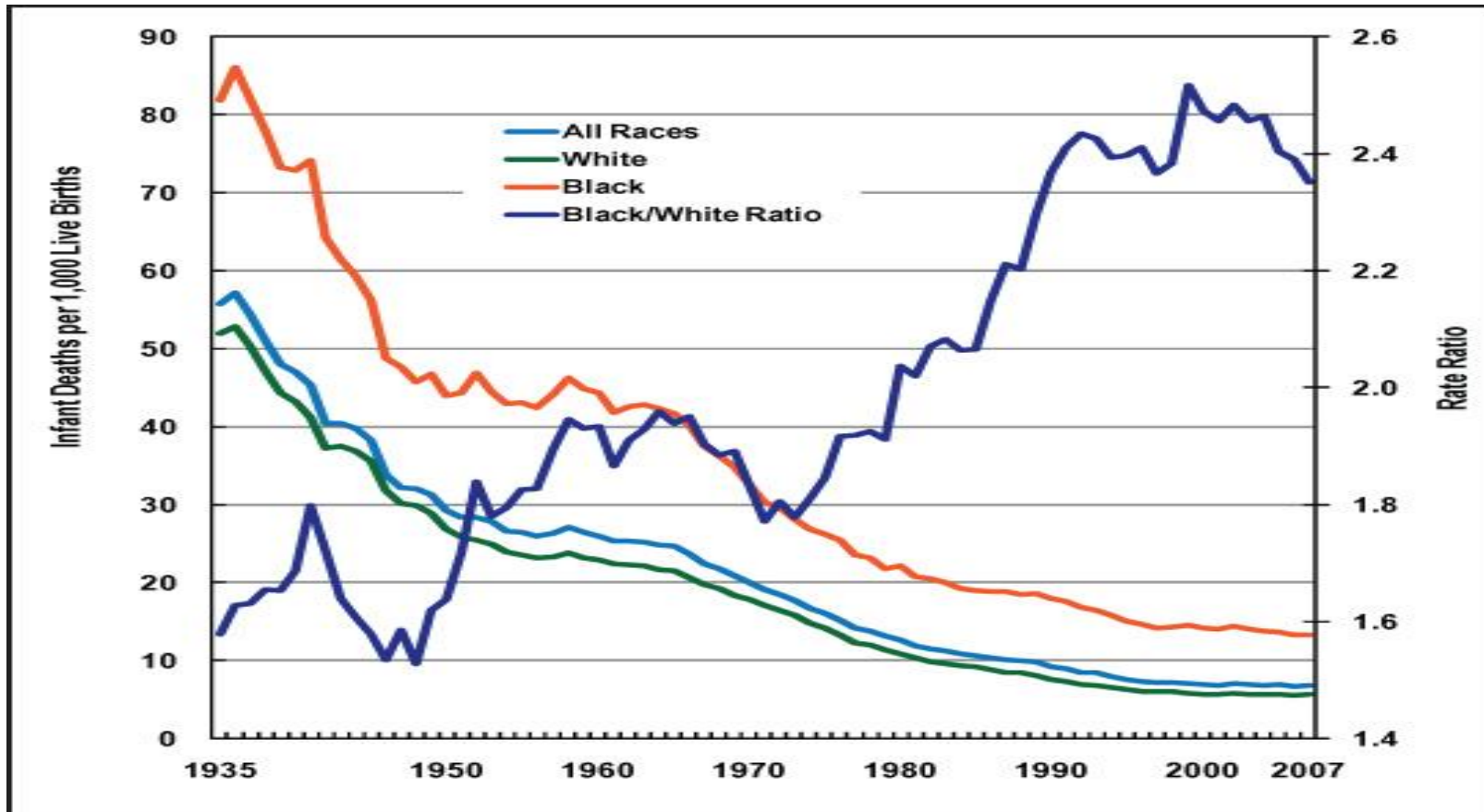# Outline –History, Biology, and Policy

1. Why is the health care system the way it is?

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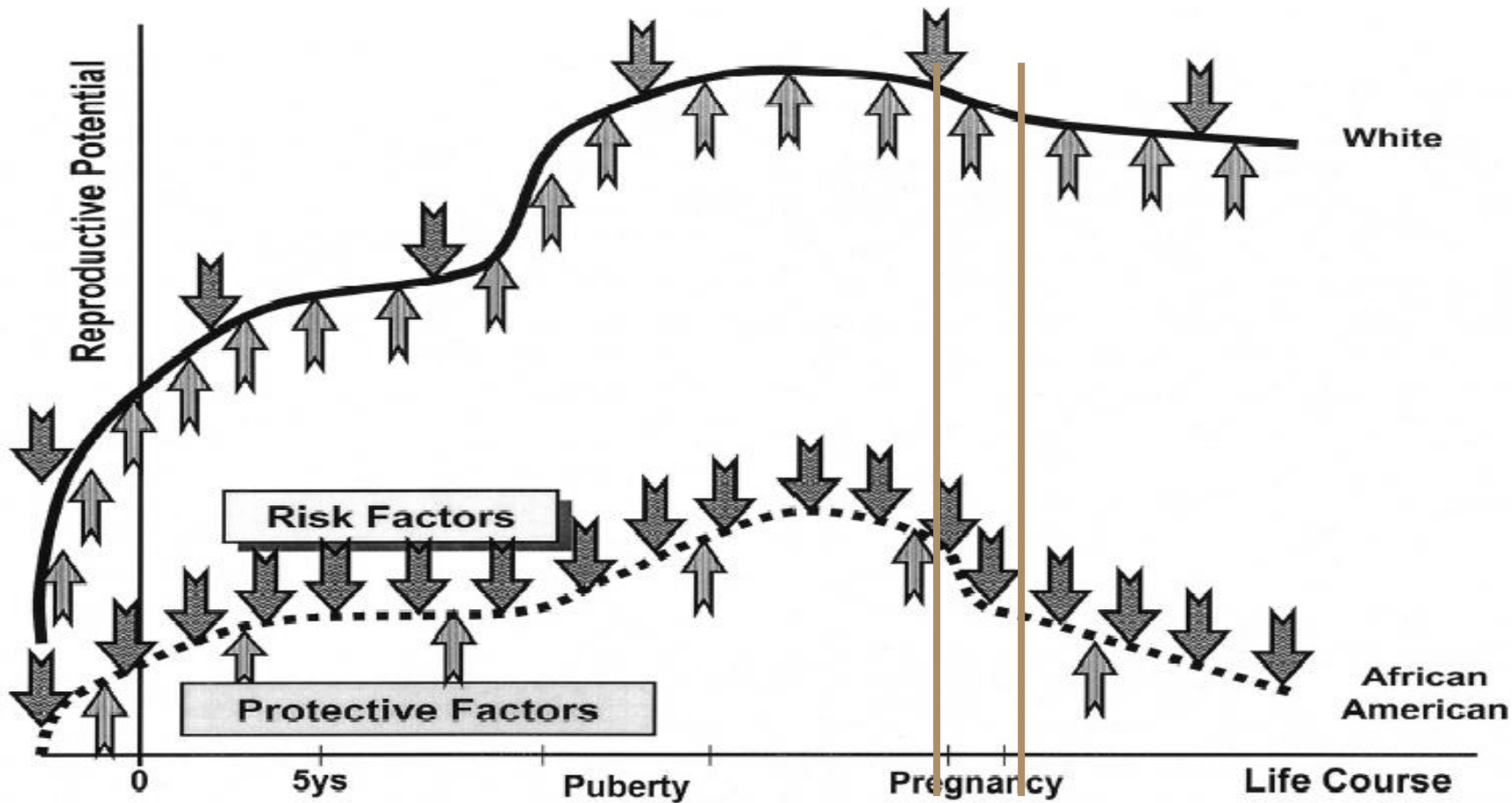# IMR – Black/White Disparity

Title V 75 Anniversary Celebration. Infant Mortality in the United States, 1935-2007.
http://www.hrsa.gov/healthit/images/mchb_infantmortality_pub.pdf

Life Course Perspective
(Birth Outcomes)

- "You can't cure a lifetime of ills in nine months of a pregnancy" (M. Kotelchuck)
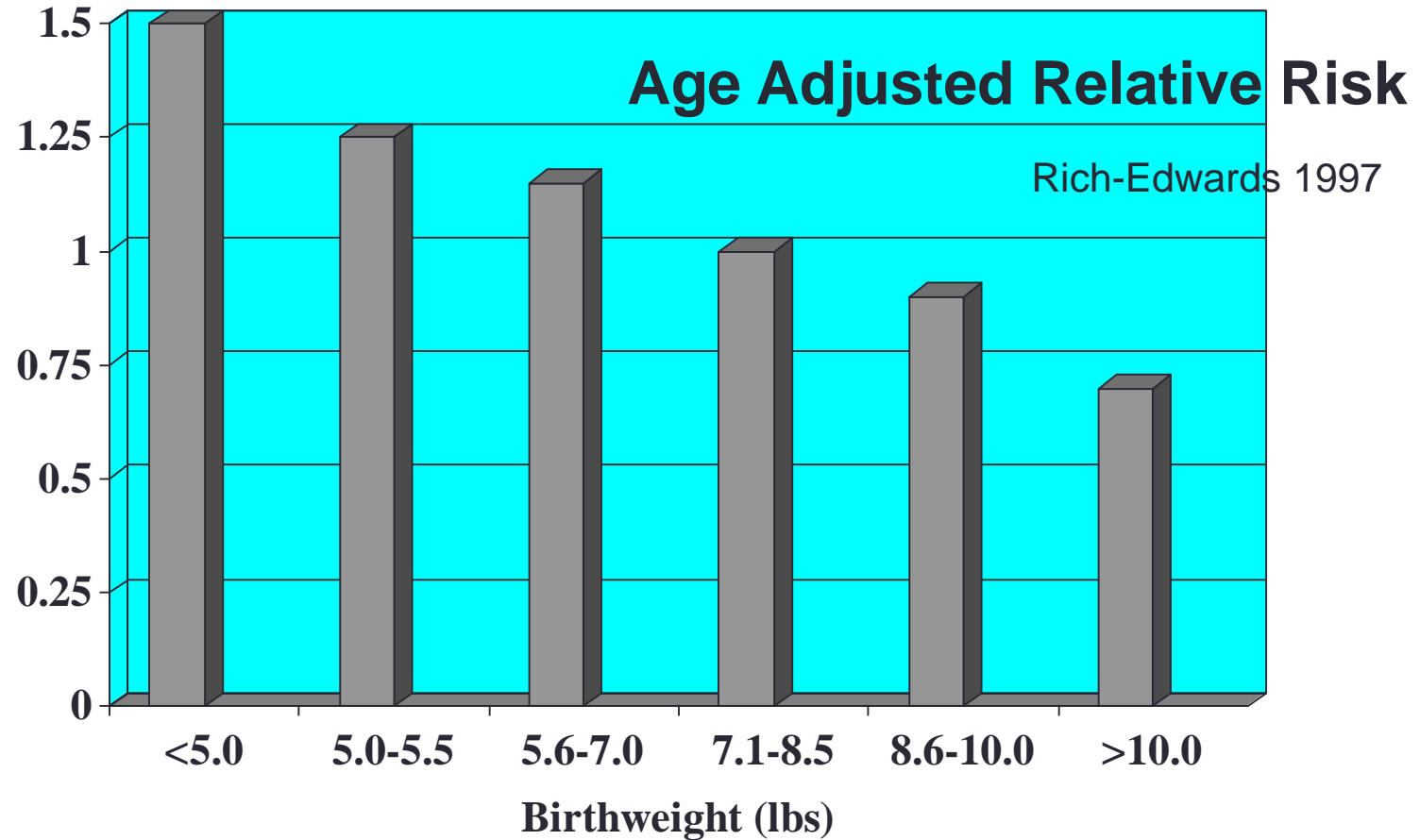 - "or in 3 months in a NICU . . ." (we might add)

Life Course Perspective

Lu MC, Halfon N. Racial and ethnic disparities in birth outcomes: life-course perspective. Maternal Child Health J. 2003;7:13-30.

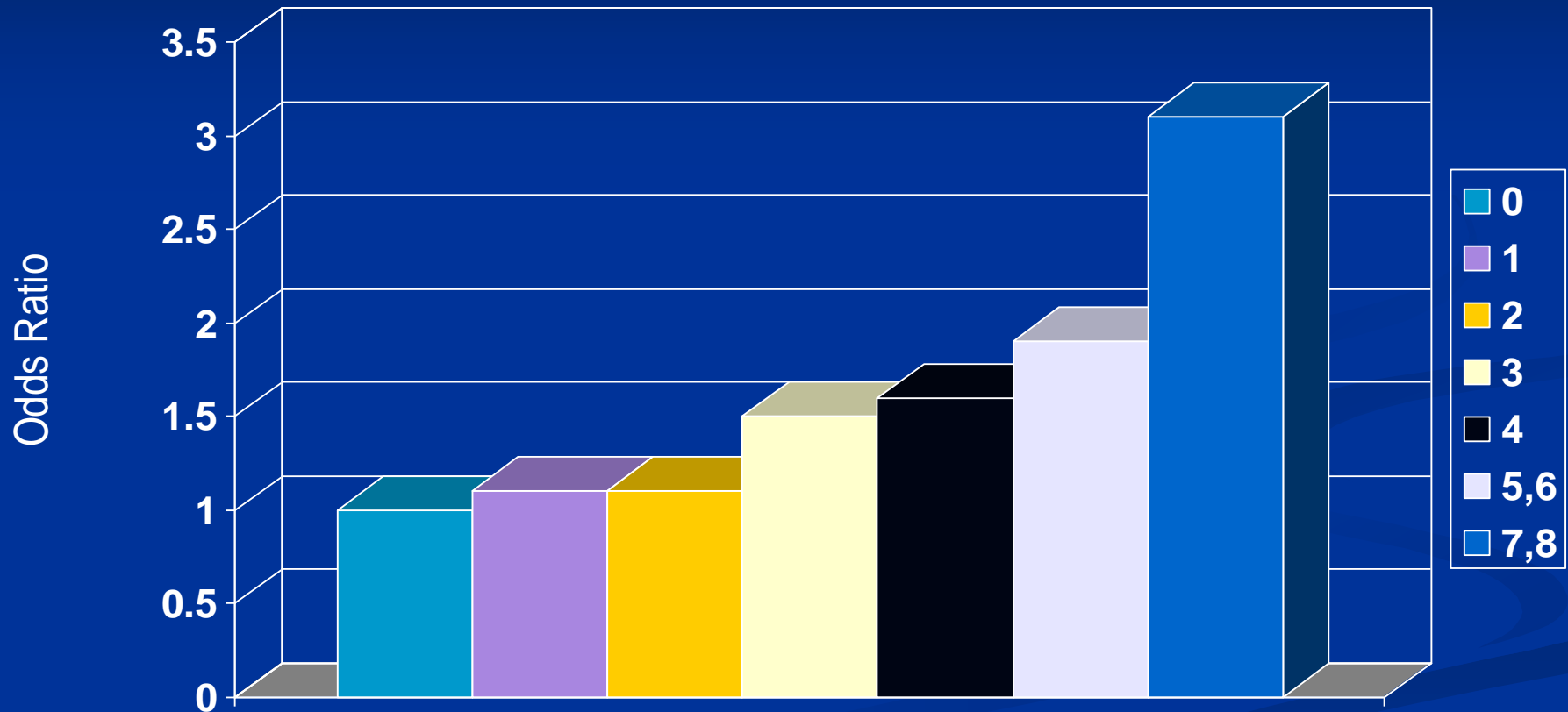# One Experimental Example of Lifecourse Maternal Stress Causes LBW

	Spontaneous Preterm Labor		Preterm Delivery Spontaneous Preterm Labor At 35–36 Weeks		At <35 Weeks	
	AOR	95% Confidence Interval	AOR	95% Confidence Interval	AOR	95% Confidence Interval
Epinephrine						
Waking						
Quartile 1 (referent)	1.0		1.0		1.0	
Quartile 2	0.8	0.4, 1.5	0.7	0.3, 1.5	1.3	0.3, 6.0
Quartile 3	1.0	0.5, 1.8	0.7	0.3, 1.4	2.6	0.7, 9.6
Quartile 4	1.8*	1.0, 3.2	1.3	0.7, 2.6	4.7*	1.4, 16.3
Bedtime						
Quartile 1 (referent)	1.0		1.0		1.0	
Quartile 2	0.9	0.4, 1.7	0.6	0.3, 1.4	2.2	0.6, 8.6
Quartile 3	1.0	0.5, 1.8	0.6	0.3, 1.3	3.3*	1.0, 11.4
Quartile 4	1.6	0.9, 2.9	1.4	0.7, 2.6	3.1	0.9, 11.1
Norepinephrine						
Waking						
Quartile 1 (referent)	1.0		1.0		1.0	
Quartile 2	2.8*	1.3, 6.0	2.9*	1.2, 7.4	2.6	0.7, 9.6
Quartile 3	2.6*	1.2, 5.6	2.8*	1.1, 6.9	2.2	0.6, 8.6
Quartile 4	3.7*	1.8, 7.9	3.6*	1.5, 9.0	3.9*	1.1, 13.7

Holzman C 2001

Barker Hypothesis
Birth Weight and Coronary Heart Disease

Age Adjusted Relative Risk

Rich-Edwards 1997

Adverse childhood events and adult ischemic heart disease

Odds Ratio

Adverse Events

Legend: 0, 1, 2, 3, 4, 5,6, 7,8

Center for Healthier Children, Families & Communities

al, 2004 UCLA

ACEs Predict the 10 Leading Causes of Adult Death/Disability

1. Heart disease
2. Cancer
3. Chronic lower respiratory diseases
4. Stroke
5. Unintentional injuries
6. Alzheimer's disease
7. Diabetes
8. Kidney disease
9. Influenza and pneumonia
10. Suicide

ACE Study, Felitti et al. 1998

One Biological Mechanism: Epigenetics

- Stress in early life causes long-lasting changes in physiology/behavior by inducing epigenetic changes
- Mice: arginine vasopressin (AVP)Murgatroyd et al (2009)
  - AVP - hormone affects mood and cognition
  - Mice exposed to high stress early in life showed differences in AVP and behavior later in life
  - Same mice showed significantly lower levels of DNA methylation in the regulatory region of the AVP gene

# Socioeconomic Disparities in Childhood Obesity Risk: Association With an Oxytocin Receptor Polymorphism
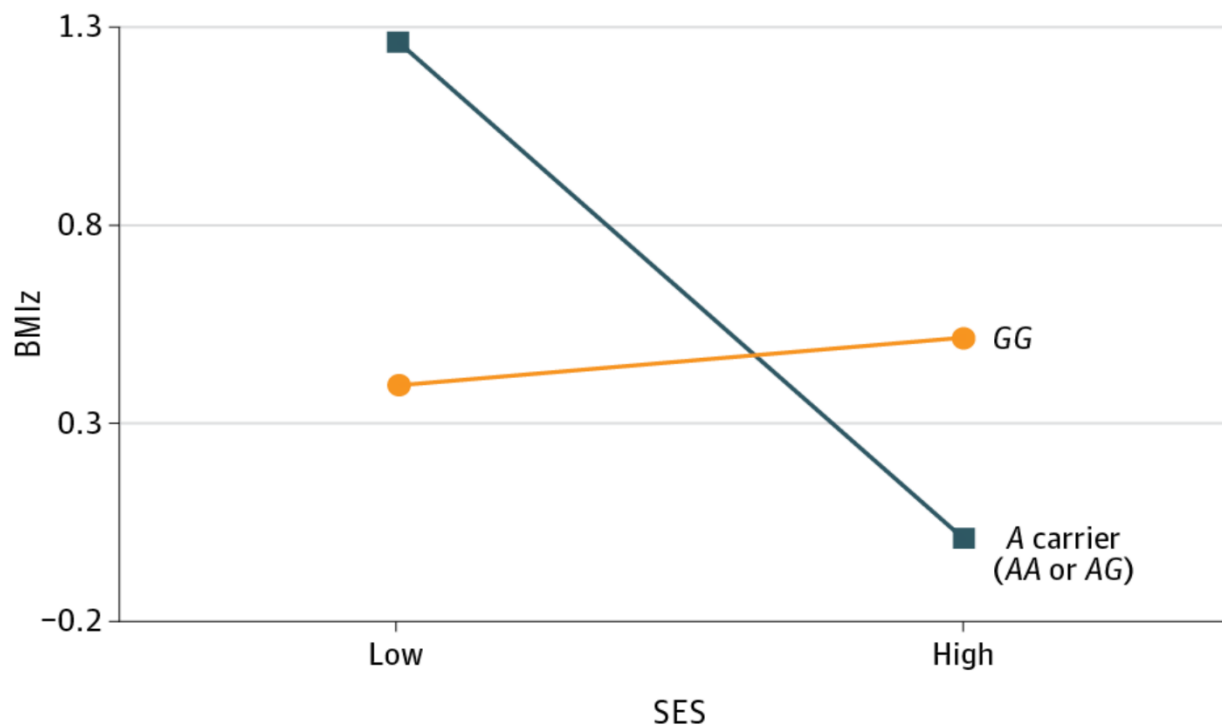
Socioeconomic Status (SES) and Oxytocin Polymorphism Interaction Predicting Standardized Body Mass Index z Score (BMIz)Children with an A allele in low SES families had the highest BMIz, while those in high SES families had the lowest BMIz. GG children were unaffected by their SES environment.

So what do we do? (4. Challenge)

- Acknowledge that our health care system was not designed to address social determinants/adverse child events
  - Payments schemes, training, institutions all built on an acute care model designed to focus on technological interventions for individual patients
- Do something.
  - Friedan's public health pyramid

Frieden TR. Am J Public Health 2010; 100(4):590-5
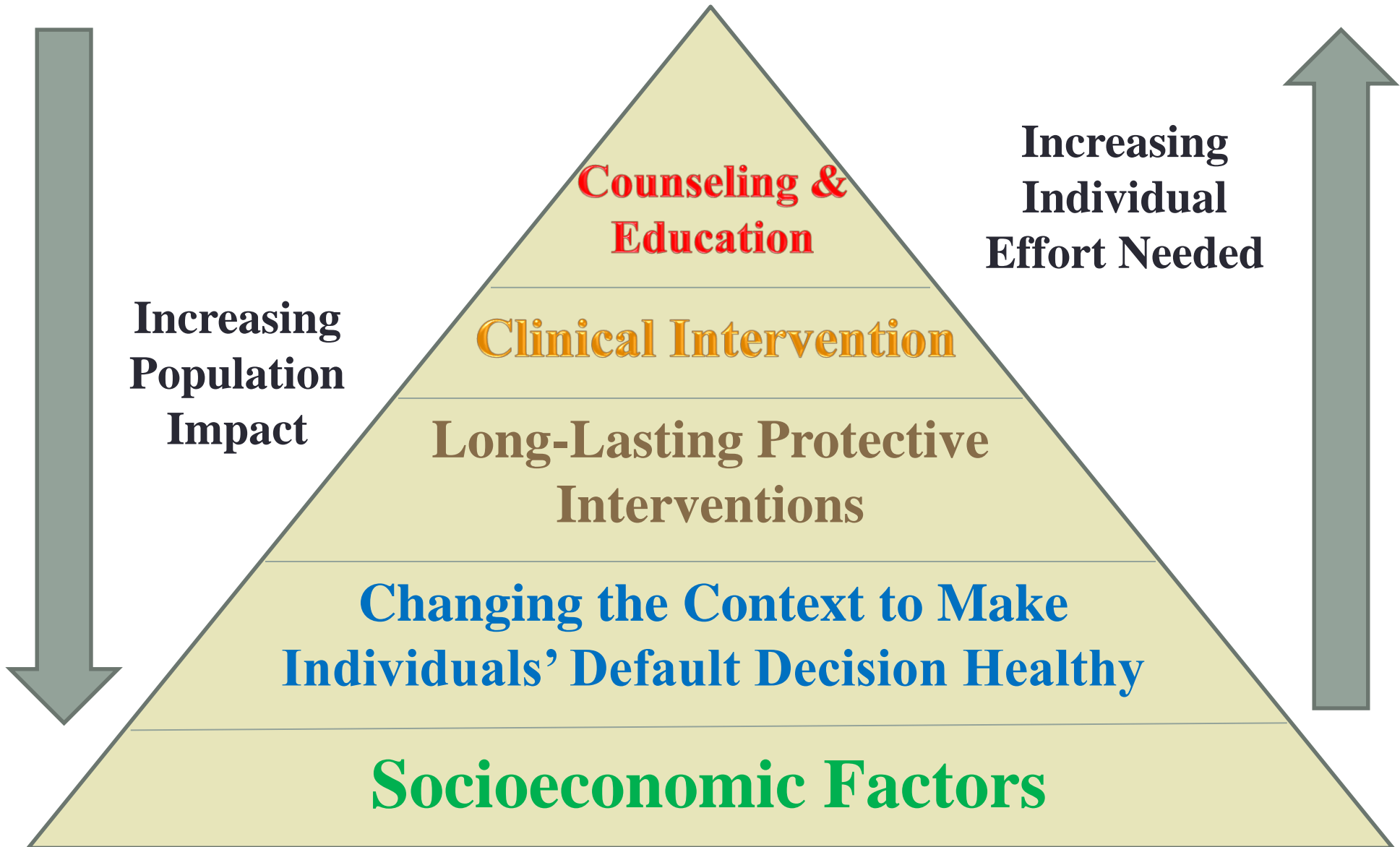
Income Inequality Increases Mortality
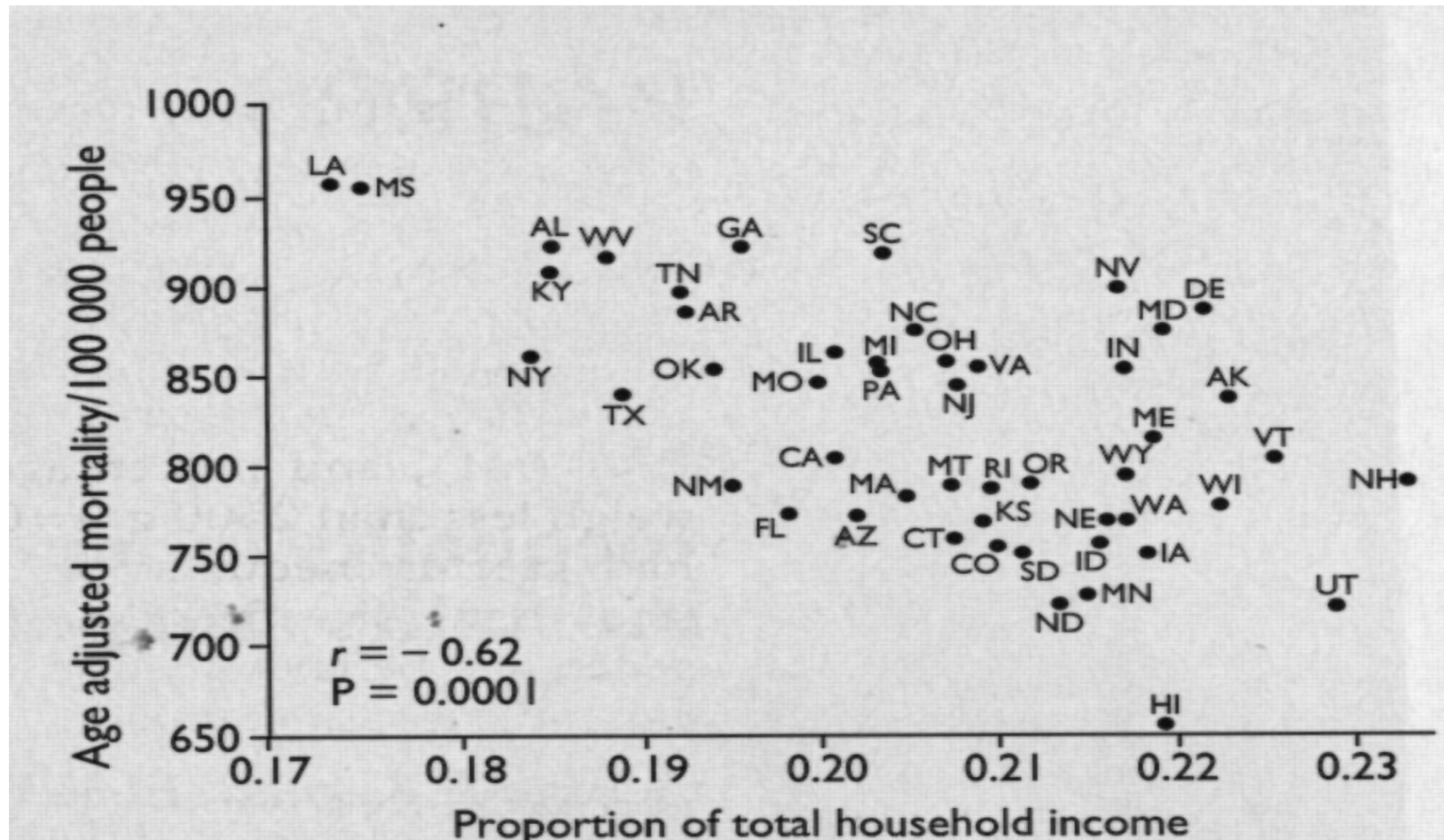
Poverty: What's the Problem?

- If social determinants are critical, what are we going to do about poverty, discrimination, structural inequities in our society?

- US has long history of deep ambivalence about directly addressing social and economic inequities
  - Does reducing poverty really make a difference?

Does Money Really Matter?
Families Below Poverty Line
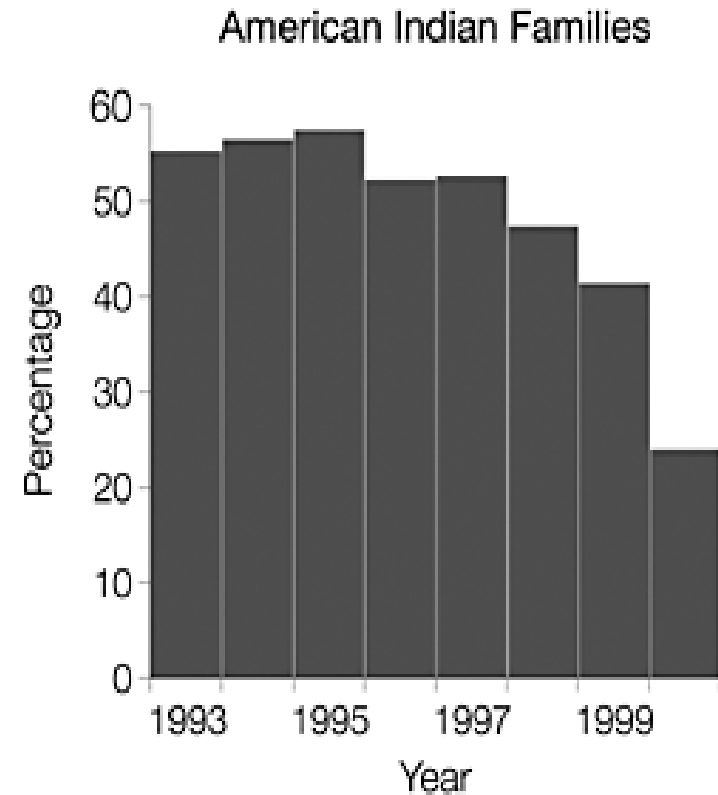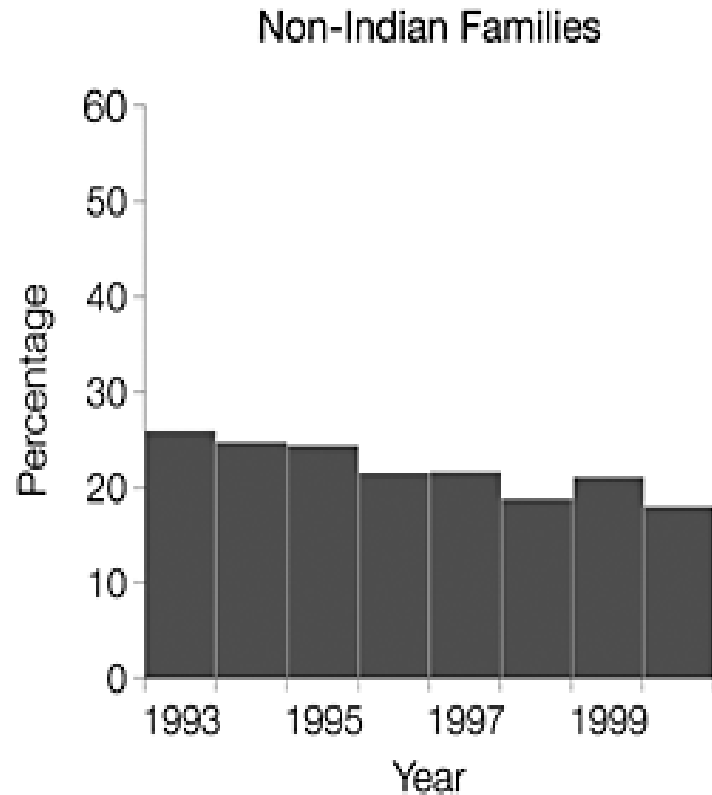
Costello, E. J. et al. JAMA 2003;290:2023-2029

# Behavioral Symptoms Before & After the Casino

Table 2. Mean Annual Frequency Scores of Behavioral Psychiatric Symptoms of American Indian Children Averaged Separately Over the 4-Year Period Before and After the Casino Opened

	Before Casino	After Casino	Contrast Before vs After Casino, OR (95% CI)*
Persistently poor, mean (SD)	2.41 (2.69)	2.91 (3.80)	0.80 (0.64-1.01), $P = .06$
Ex-poor, mean (SD)	2.25 (2.65)	1.34 (2.07)	1.66 (0.97-2.83), $P = .07$
Never poor, mean (SD)	1.30 (2.11)	1.37 (1.93)	0.95 (0.62-1.44), $P = .80$
Contrast persistently vs ex-poor*			
OR (95% CI)	1.07 (0.70-1.64)	2.21 (1.24-3.95)	
P value	.75	.007	
Contrast persistently vs never poor*			
OR (95% CI)	1.86 (1.25-2.78)	2.19 (1.47-3.28)	
P value	.002	<.001	
Contrast ex- vs never poor*			
OR (95% CI)	1.73 (1.03-2.91)	0.99 (0.53-1.86)	
P value	.04	.98	

Abbreviations: CI, confidence interval; OR, odds ratio.
*See Table 1 for explanation.
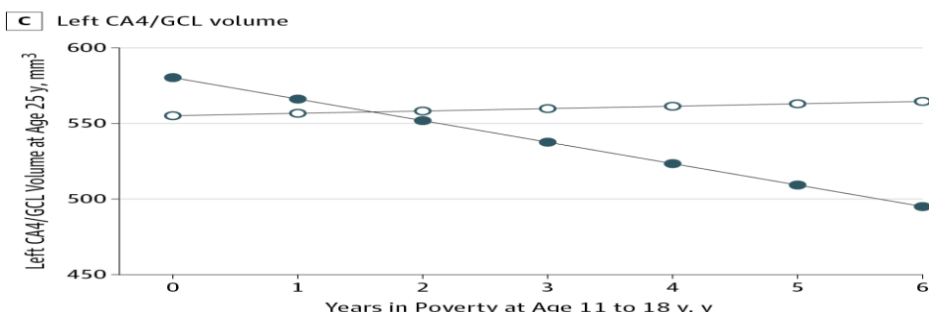
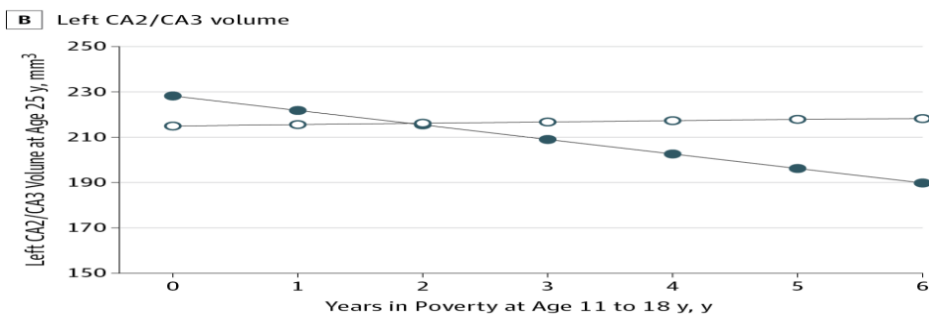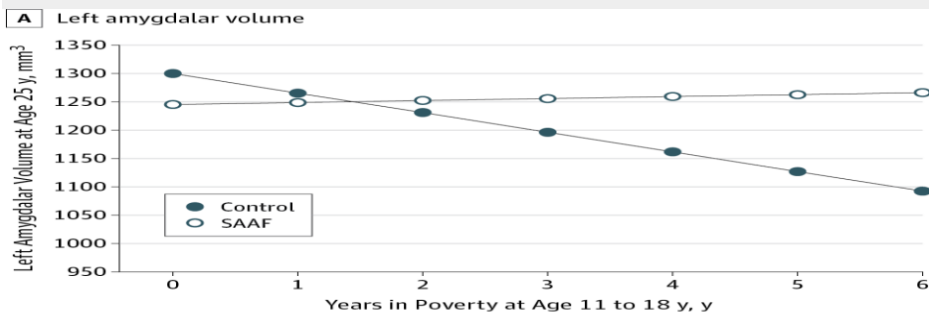**Costello, E. J. et al. JAMA 2003;290:2023-2029**

JAMA

Unconditional Prenatal Income Support (Manitoba, CA)
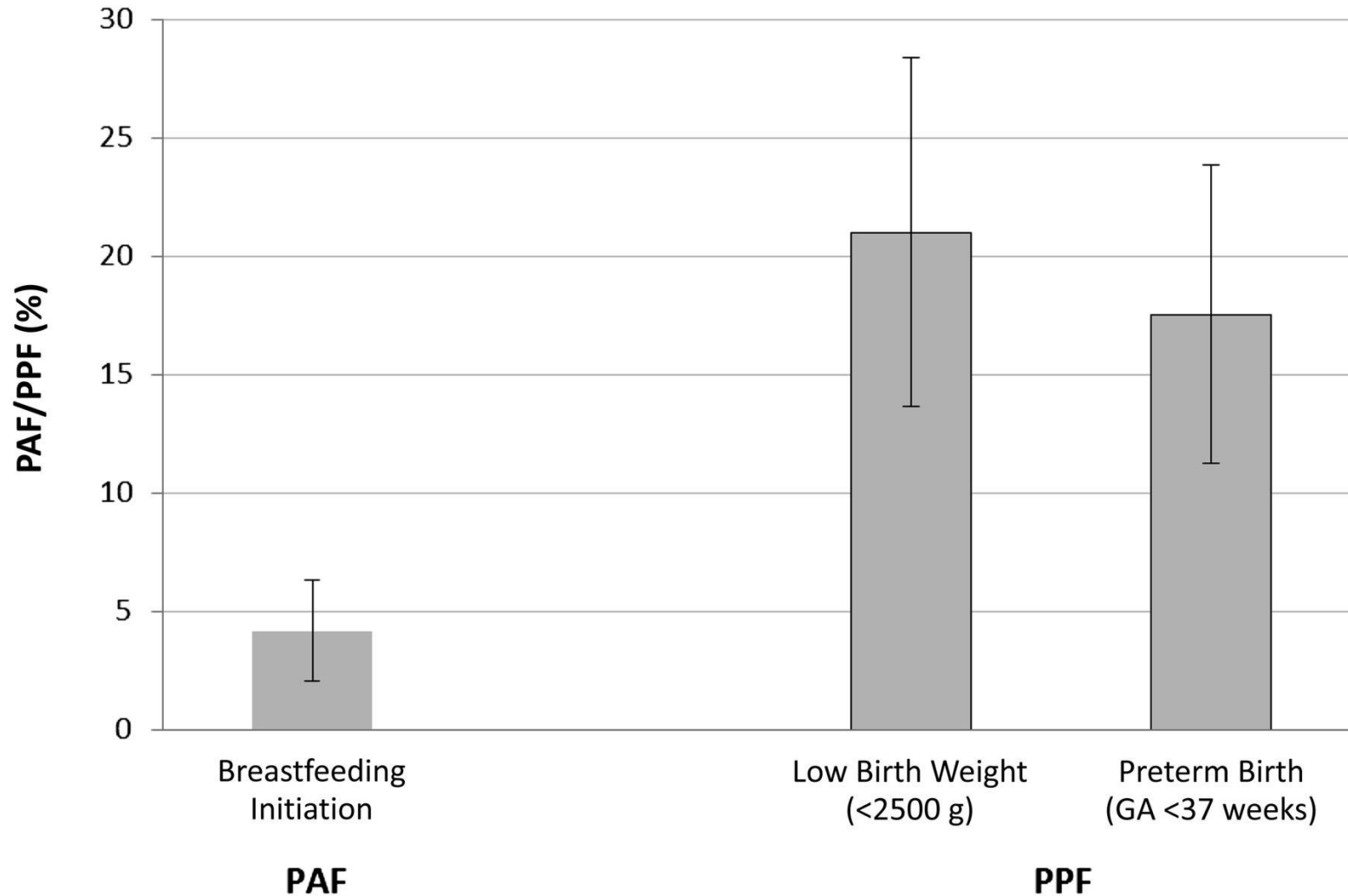
Marni D. Brownell et al. Pediatrics 2016;137:e20152992

PEDIATRICS®

Protective Prevention Effects on Association of Poverty With Brain Development

- "Strong African American Families" is an RCT study of 667 11 year-olds designed to help parents raise children with high levels of warmth, sensitivity, and emotional support
- Follow-up of 119 25 year-olds, effect of family poverty on youths was to decrease the volume of dentate gyrus, L hippocampus, and L amygdala volumes
- Participants did not show the same decrease as controls
- Inflammation, catecholamine levels, telomere lengths, epigenetic aging

Frieden TR. Am J Public Health 2010; 100(4):590-5
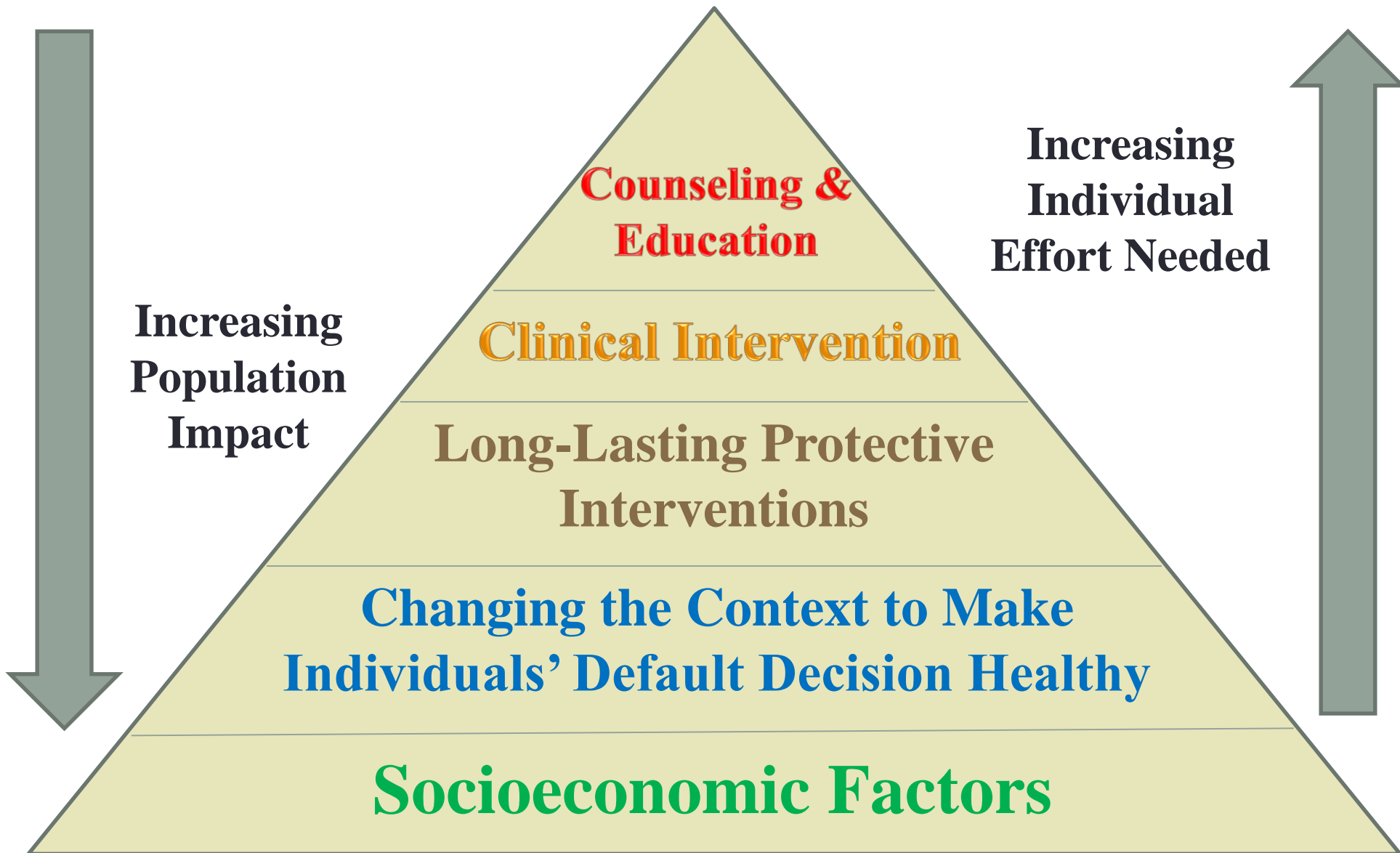
SEED for Oklahoma Kids

- 2008: 1358 randomly selected infants received $1000 into a 529 college savings plan; 1346 controls
- 4 year old - follow-up using ASQ – SE (caregiver)
- Improved social-emotional function in intervention group (predicts reading scores at age 7 years)
- Effects greater for disadvantaged subsamples
  - "I'm going to have to get him through school so he can use this and go to college"

Increasing Population Impact

Increasing Individual Effort Needed

Counseling & Education

Clinical Intervention

Long-Lasting Protective Interventions

Changing the Context to Make Individuals' Default Decision Healthy

Socioeconomic Factors

Frieden TR. Am J Public Health 2010; 100(4):590-5
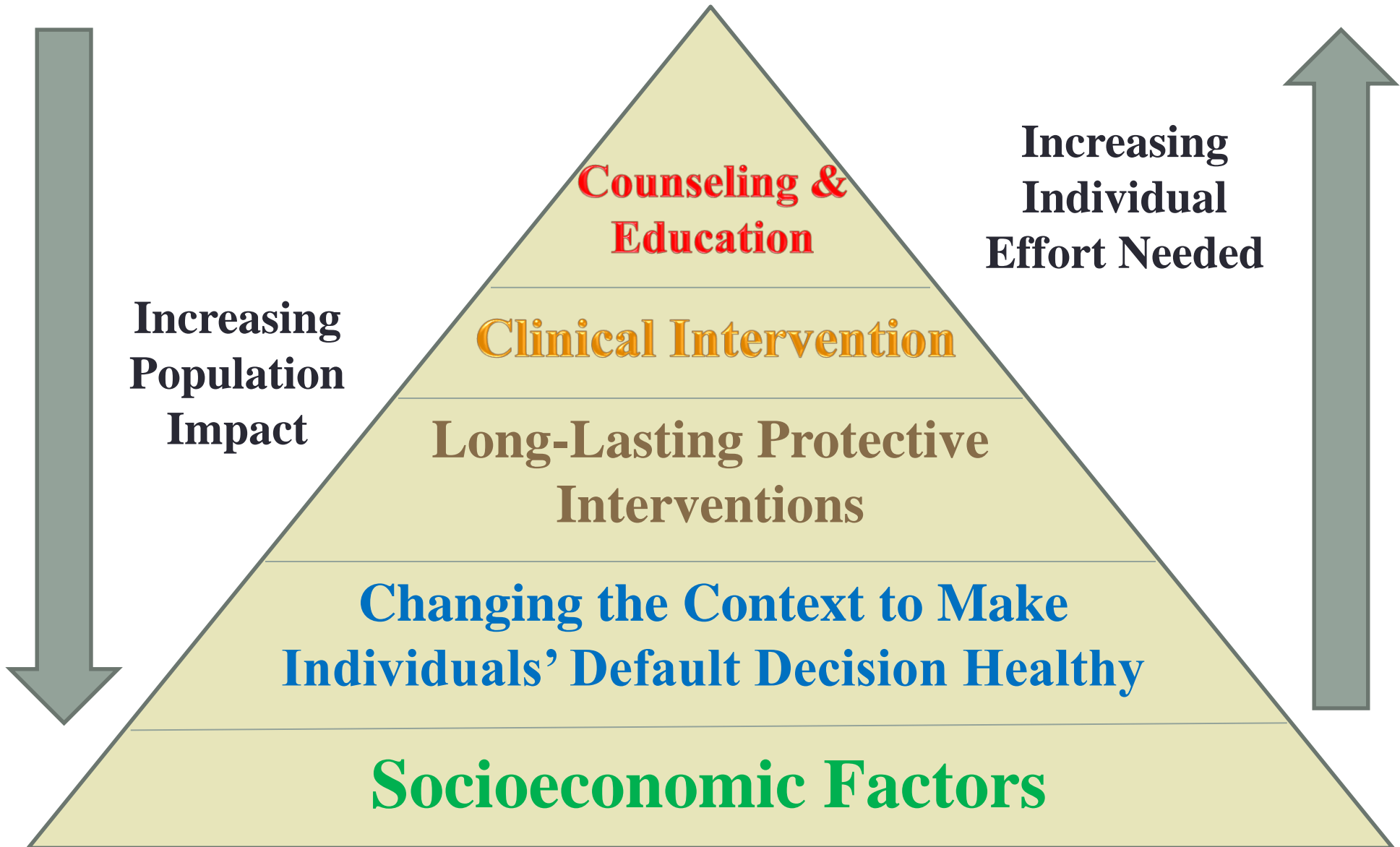
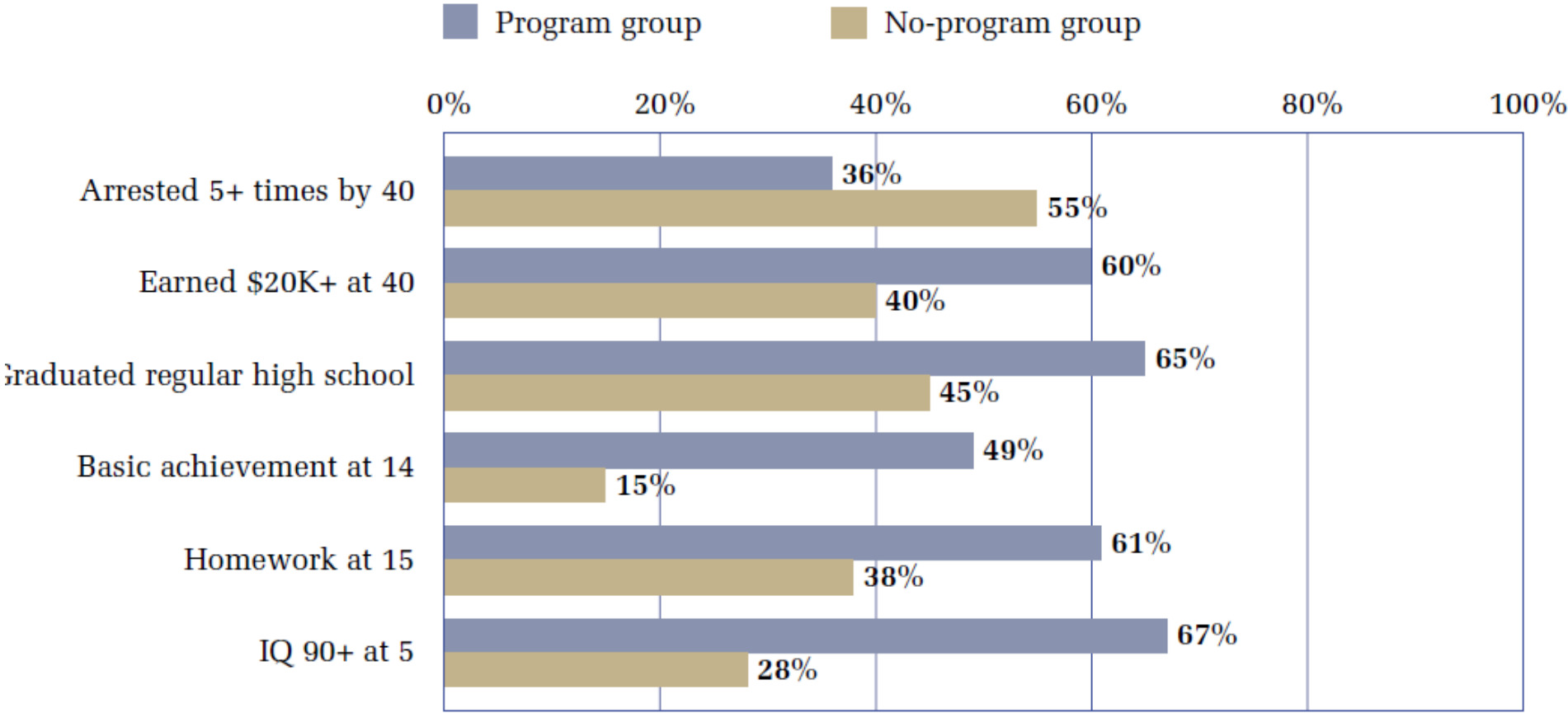# RWJF Commission to Build a Healthier America (AmJPrevMed 2011)

1. Ensure that all children have high-quality early childhood developmental support

2. Fund and design nutrition programs (e.g. WIC and SNAP) to meet the needs of hungry families for nutritious food.

3. Create public–private partnerships to open and sustain full-service grocery stores in all communities.

4. Feed children only healthy foods in schools.

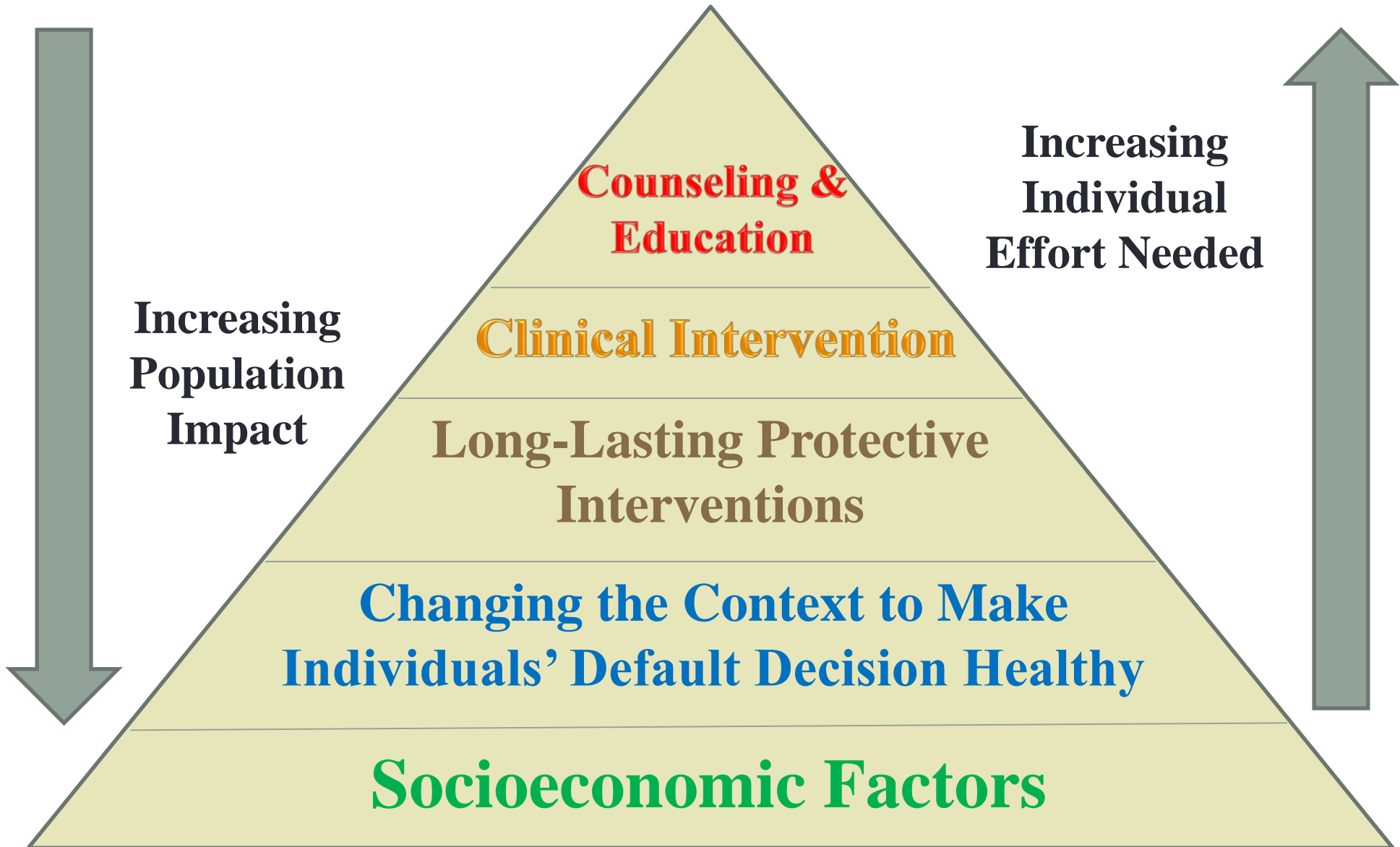5. Require all schools (K–12) to include time for all children to be physically active every day.

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Early Childhood Education

Figure 1
Major Findings: High/Scope Perry Preschool Study at 40

Legend: Program group / No-program group

Measure	Program group	No-program group
Arrested 5+ times by 40	36%	55%
Earned $20K+ at 40	60%	40%
Graduated regular high school	65%	45%
Basic achievement at 14	49%	15%
Homework at 15	61%	38%
IQ 90+ at 5	67%	28%

Frieden TR. Am J Public Health 2010; 100(4):590-5

Evidence-based Office Interventions

- Reach Out and Read
  - Book handouts and modeling reading with children
- Parent-Child Interaction Therapy, Triple P—Positive Parenting Program, Incredible Years
  - Behavior modification programs for parents
- Healthy Steps
  - Developmental specialist in office
- "WeCare" and "StreetCred"
  - Screening for social determinants; Tax credits

Positive Parenting Program: Skills for Families of Young Children in Pediatric Settings
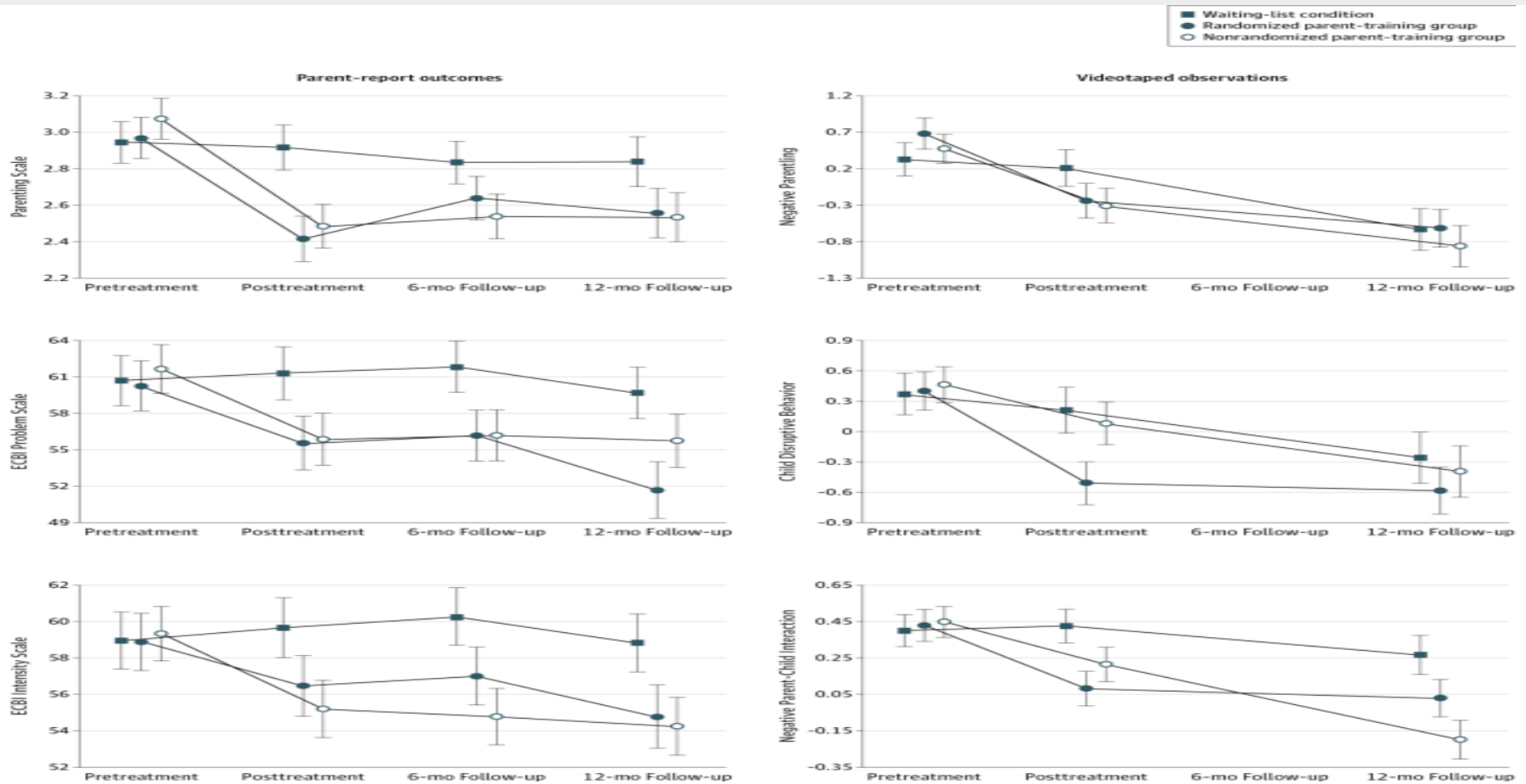
Enrollment in Resources at 12 Months of Age

	No. (%) in WE CARE Group	No. (%) in Control Group	Adjusted Odds Ratio (95% CI)
No. of Child Health Clinics	4	4	—
No. of mothers	135	136	—
Any community resource	53 (39)	33 (24)	2.1 (1.2–3.7)
Child care	20 (15)	9 (7)	6.3 (1.5–26.0)
Food assistance (WIC)	15 (11)	12 (9)	0.9 (0.4–2.1)
Food pantry	6 (4)	3 (2)	2.2 (0.7–6.7)
GED programs	2 (2)	1 (1)	1.9 (0.1–27.0)
Employment/job training	11 (8)	2 (2)	44.4 (9.8–201.4)
Fuel assistance	10 (7)	1 (1)	11.9 (1.7–82.9)
Homeless shelter	2 (2)	7 (5)	0.2 (0.1–0.9)
Need rental assistance	6 (4)	9 (7)	0.5 (0.1–2.0)

Garg A et al, "Addressing Social Determinants of Health at Well Child Care Visits: A Cluster RCT," *Pediatrics* 135 (2015) e296 -e304.

Outline –History, Biology, and Policy

1. Why is the health care system the way it is?

2. What are the consequences of our current health care system?

3. What is the evidence that we should change (and focus on child development)?

4. Challenge to the current systems of care

5. [Your work here]
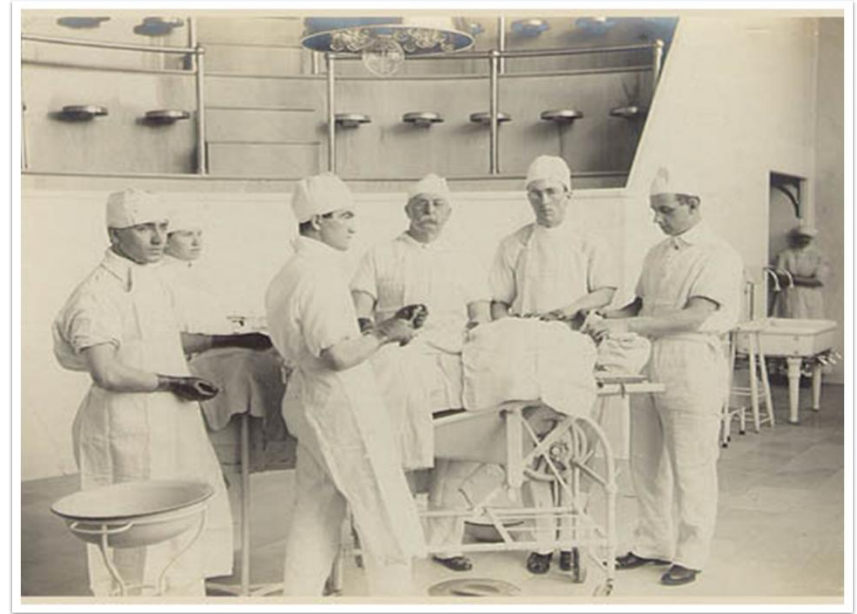
What Are We Going to Do?

- How should social determinants of health/lifecourse perspective affect **how we train child health, education, and public health professionals**?

- How should social determinants of health/lifecourse perspective affect how **we organize systems of care (medical, educational, child welfare, etc.)**?

- Do maternal-child health professionals have a **special obligation** to address the social determinants of health?
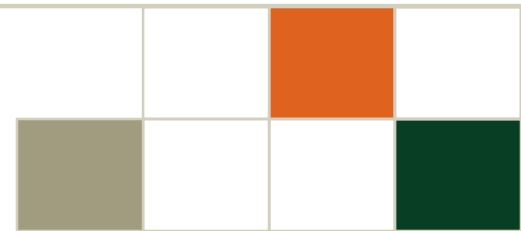
What Are We Going to Do?

- **Systems of care**
  - "Value-based care" – quality and cost both require addressing social determinants of health
  - Focus on base of pyramid: jobs/poverty/tax law
  - Hospitals/universities as "anchor" institutions
- **Personal obligation** (specialists?)
  - Do what they do well, but ensure access (eg SCID)
  - Value-based care: work with interprofessional team

Inward Vision

Well baby clinic
c. 1930

Hamilton, Public Health Nursing Branch

Outward Glance

Cholera clinic Mireleias, Haiti
c. 2012

Courtesy, Brett Van Leer-Greenberg