

Improving the Health of the People of California: A Life Course Perspective

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"If you want 1 year of prosperity, grow grain. If you want 10 years of prosperity, grow trees. If you want 100 years of prosperity, grow people."

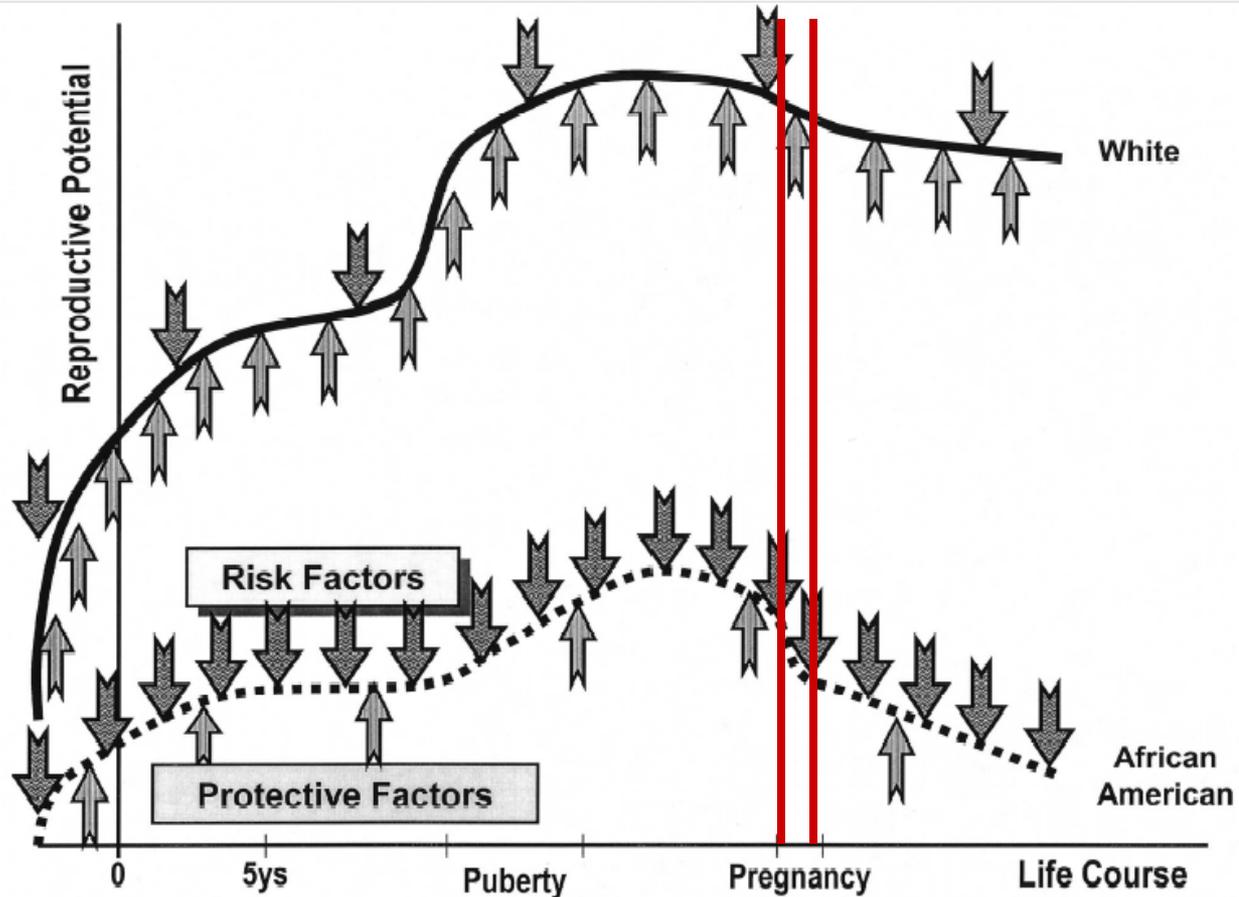
Chinese Proverb



Life-Course Perspective

- A way of looking at life not as disconnected stages, but as an integrated continuum
-

Life Course Perspective



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

Life Course Perspective

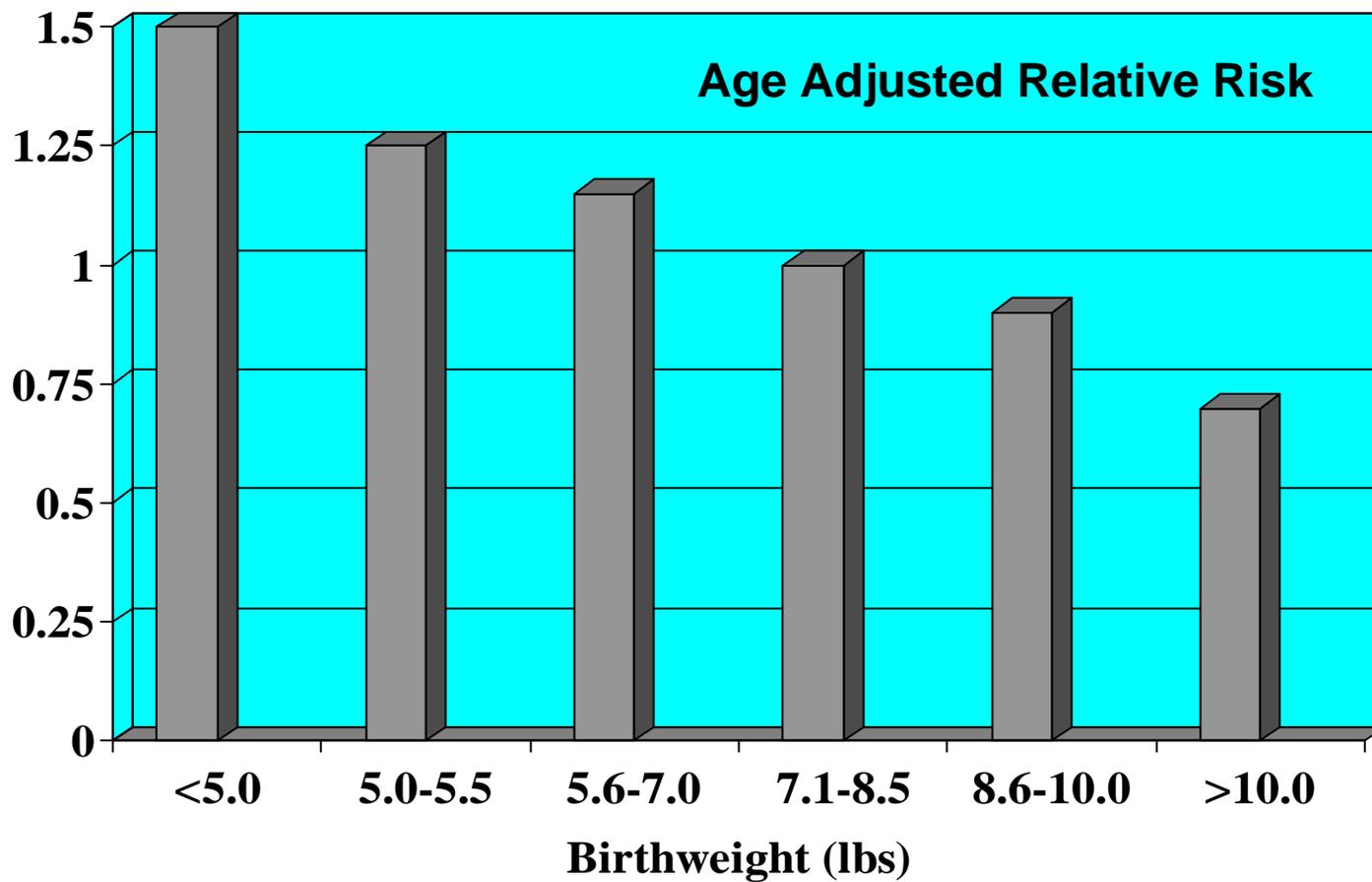
- ❑ Early programming
 - ❑ Cumulative pathways
 - ❑ Improving the health of the people of California
-

Early Programming



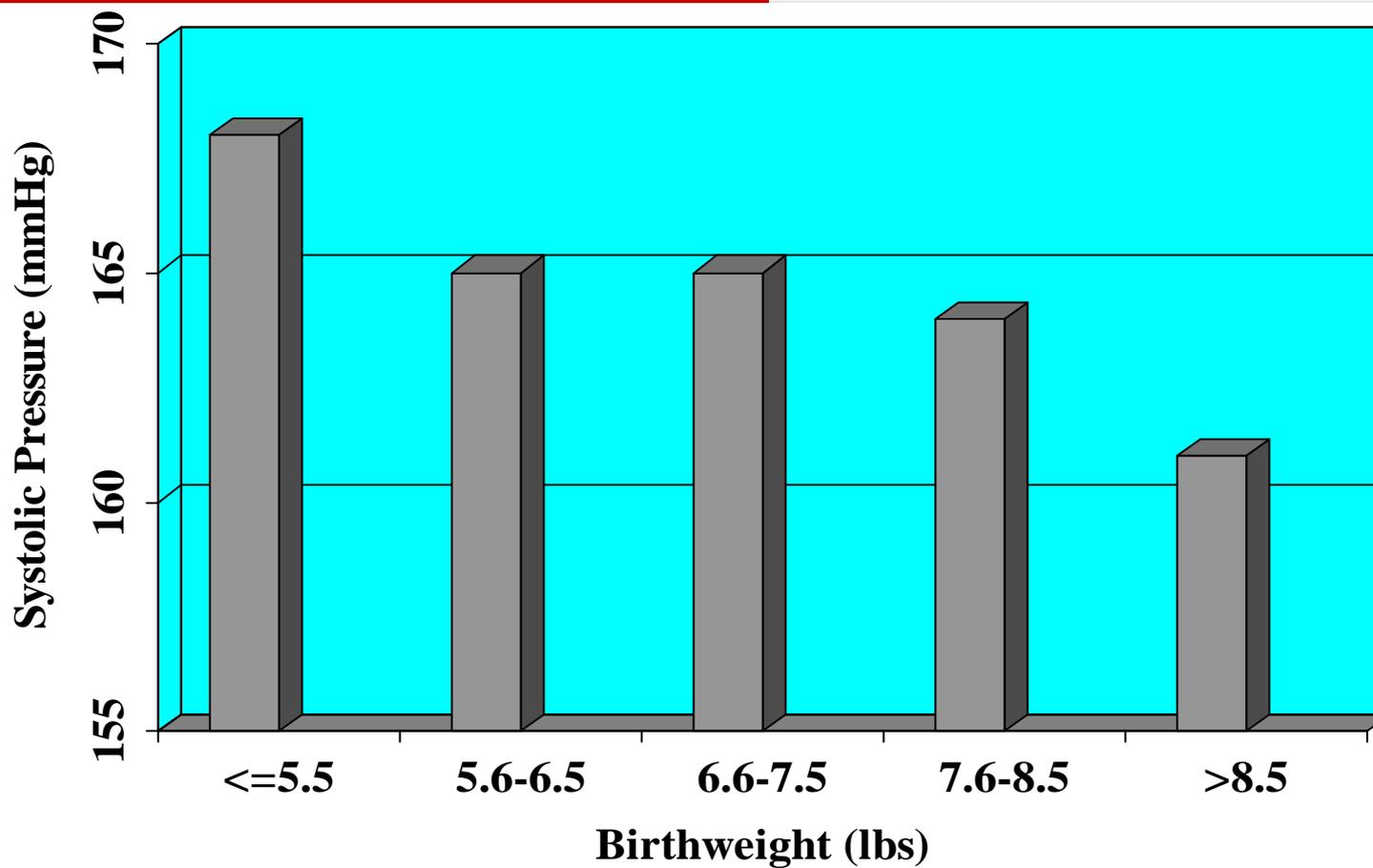
Barker Hypothesis

Birth Weight and Coronary Heart Disease



Barker Hypothesis

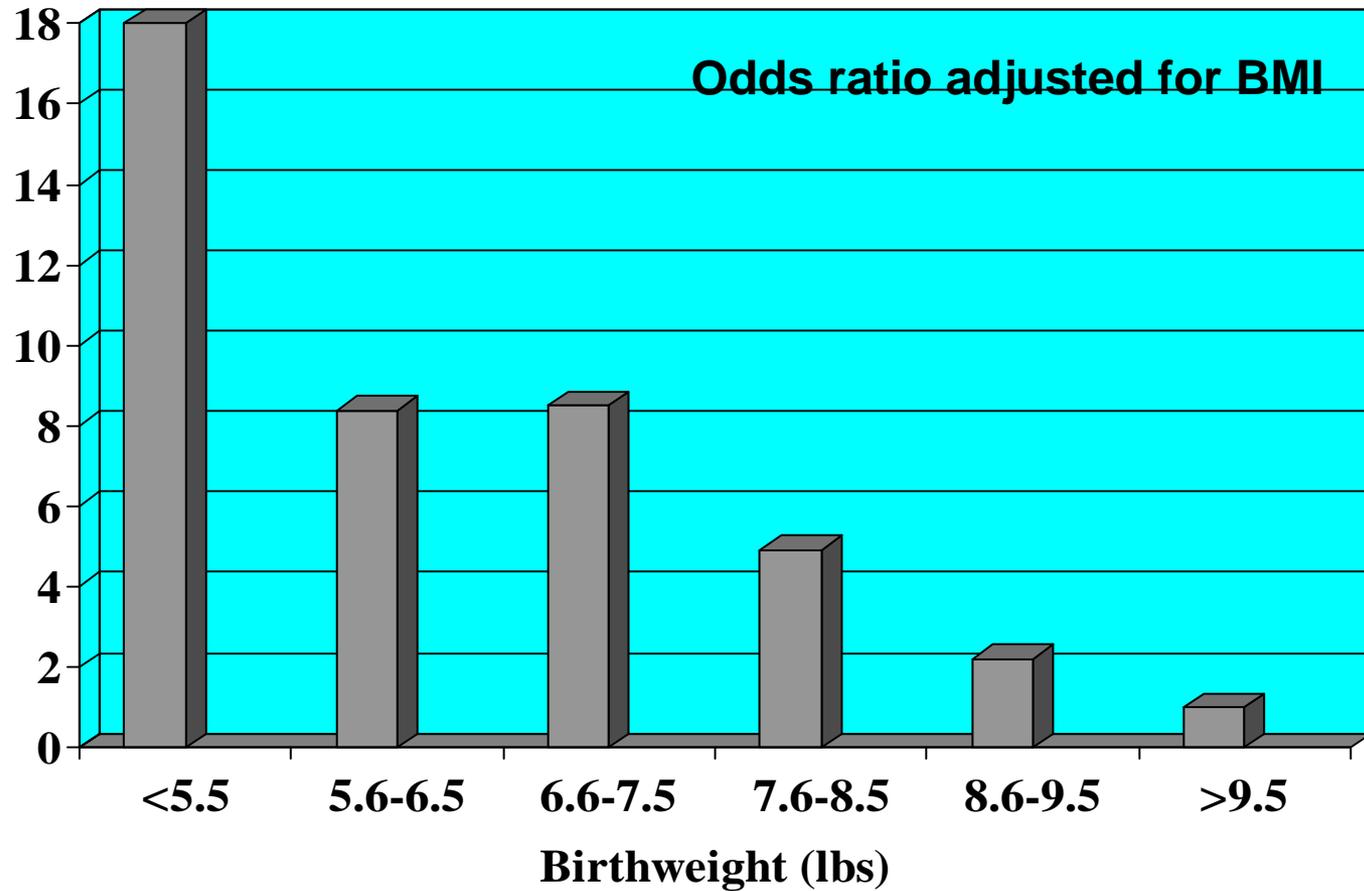
Birth Weight and Hypertension



Law CM, de Swiet M, Osmond C, Fayers PM, Barker DJP, Cruddas AM, et al. Initiation of hypertension in utero and its amplification throughout life. *Br Med J* 1993;306:24-27.

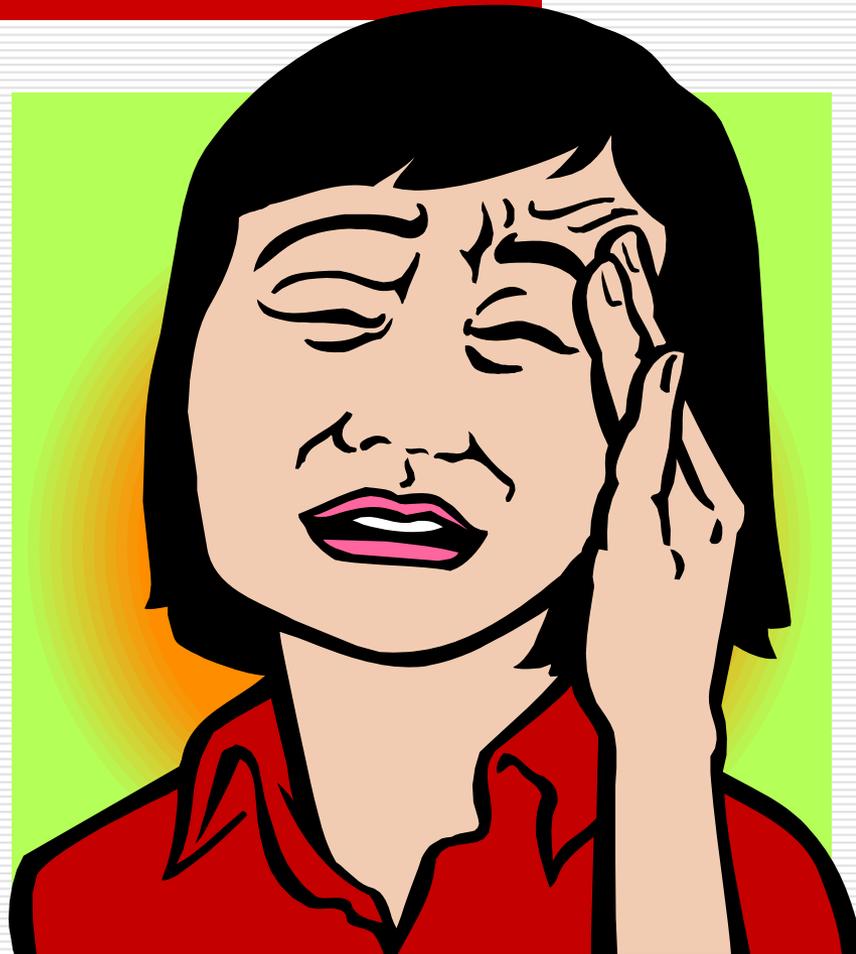
Barker Hypothesis

Birth Weight and Insulin Resistance Syndrome



Barker DJP, Hales CN, Fall CHD, Osmond C, Phipps K, Clark PMS. Type 2 (non-insulin-dependent) diabetes mellitus, hypertension and hyperlipidaemia (Syndrome X): Relation to reduced fetal growth. *Diabetologia* 1993;36:62-67.

Maternal Stress & Fetal Programming



Prenatal Stress & Programming of the Brain

- Prenatal stress (animal model)
 - Hippocampus
 - Site of learning & memory formation
 - Stress down-regulates glucocorticoid receptors
 - Loss of negative feedback; overactive HPA axis

 - Amygdala
 - Site of anxiety and fear
 - Stress up-regulates glucocorticoid receptors
 - Accentuated positive feedback; overactive HPA axis

Prenatal Programming of the Hypothalamic-Pituitary-Adrenal Axis

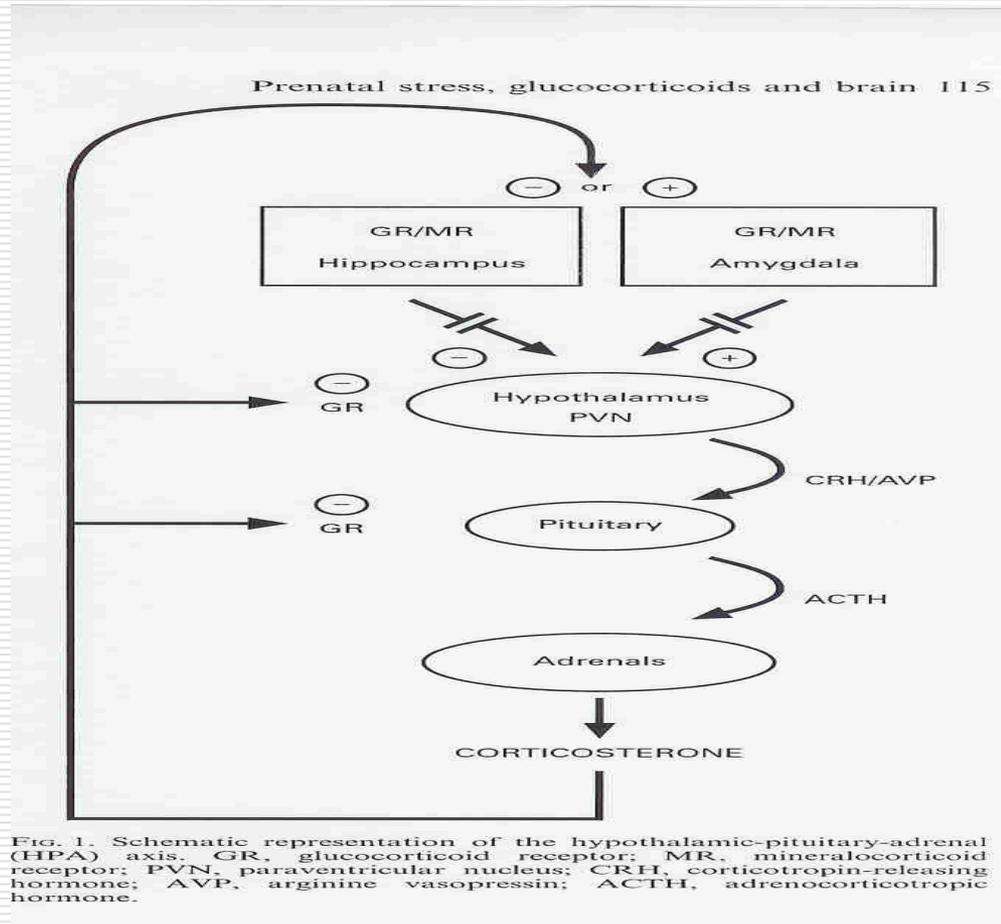


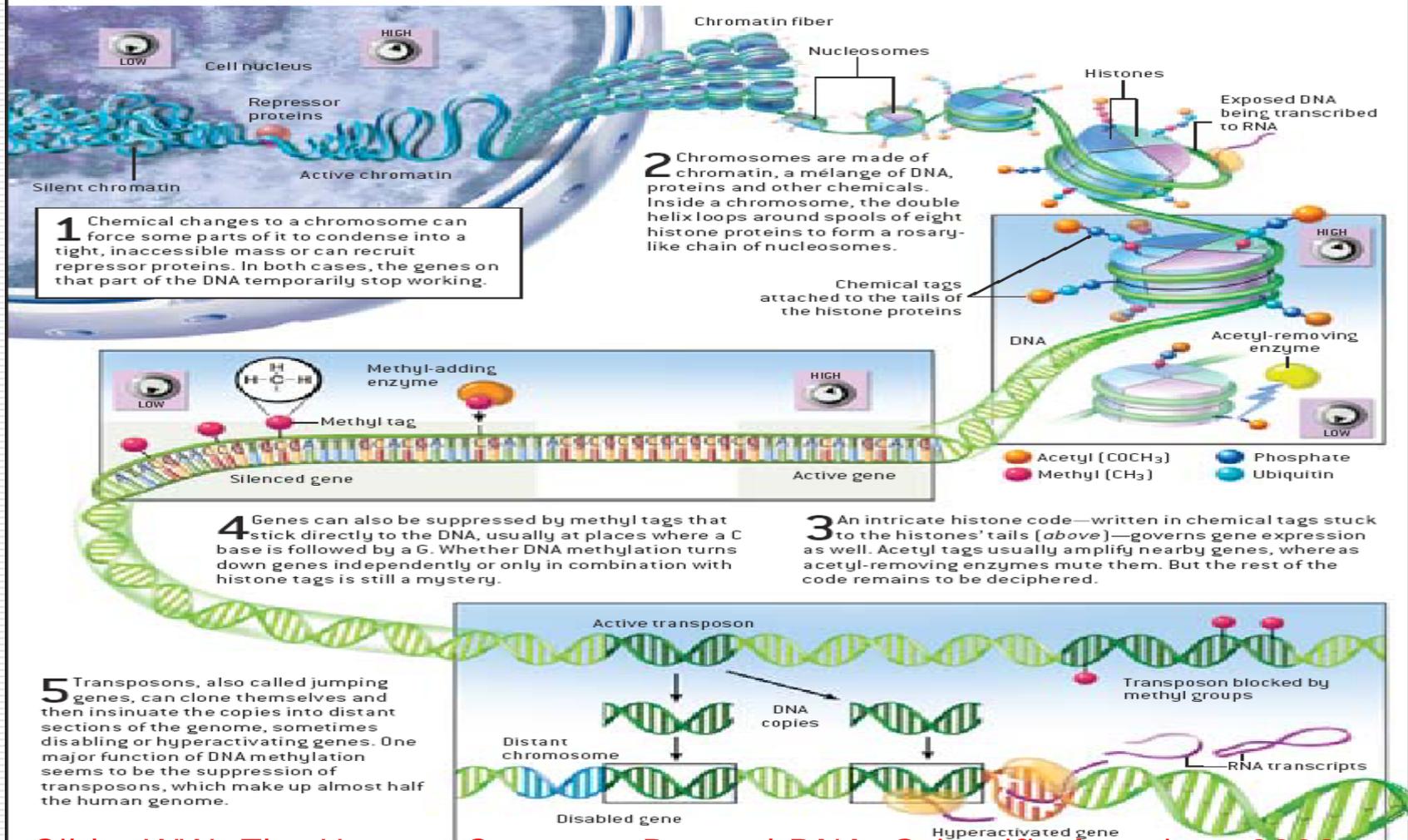
FIG. 1. Schematic representation of the hypothalamic-pituitary-adrenal (HPA) axis. GR, glucocorticoid receptor; MR, mineralocorticoid receptor; PVN, paraventricular nucleus; CRH, corticotropin-releasing hormone; AVP, arginine vasopressin; ACTH, adrenocorticotropic hormone.

Epigenetics

VOLUME CONTROLS FOR GENES

THE DNA SEQUENCE is not the only code stored in the chromosomes. So-called epigenetic phenomena of several kinds can act like volume knobs to amplify or mute the effect of genes. Epigenetic information is encoded as chemical attachments to

the DNA or to the histone proteins that control its shape within the chromosomes. Among their many functions, the epigenetic volume controls muffle parasitic genetic elements, called transposons, that riddle the genome.



Epigenetics

Same Genome, Different Epigenome



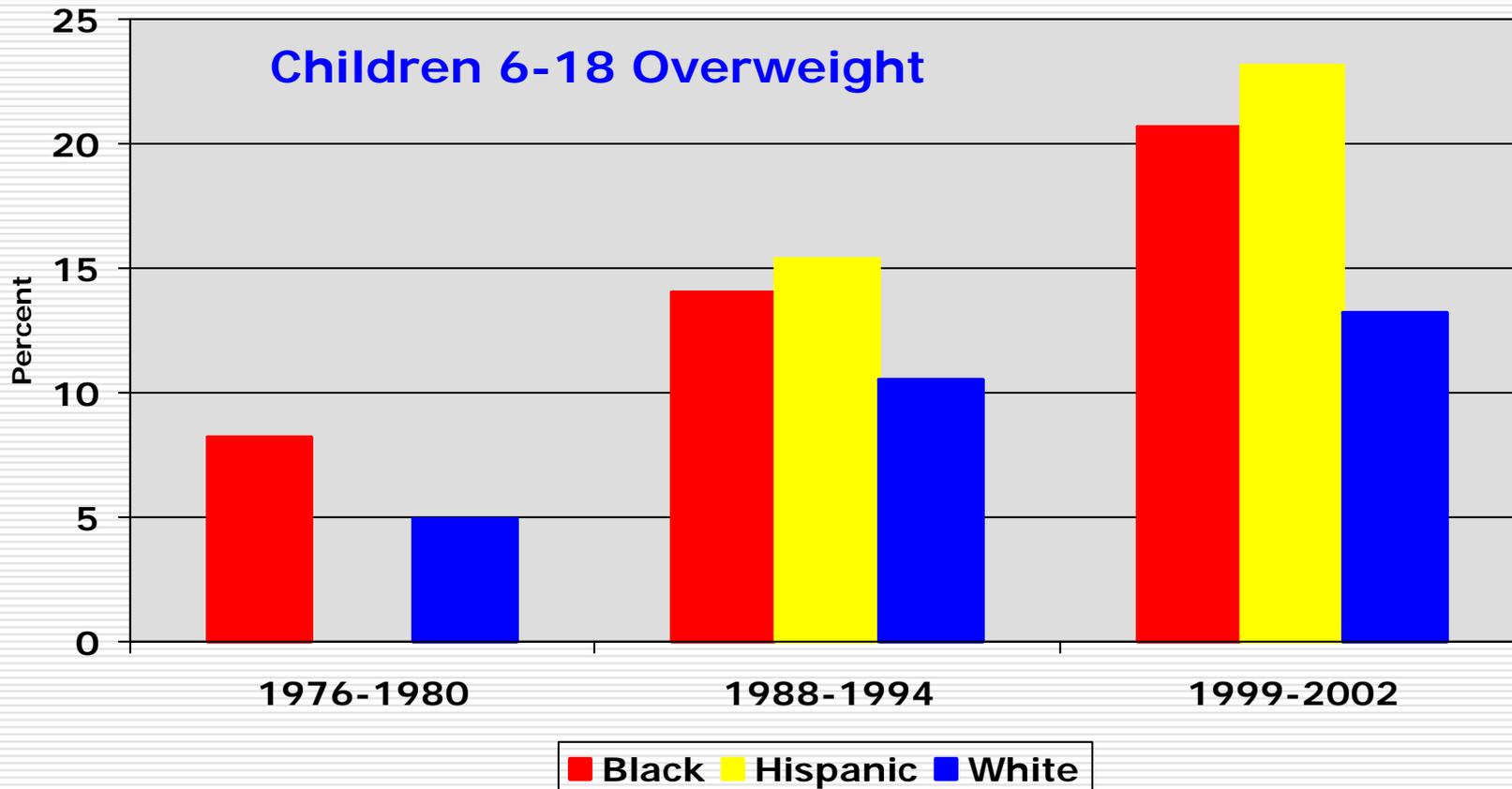
R.A. Waterland, R.A. Jirtle, "Transposable elements: targets for early nutritional effects on epigenetic gene regulation," *Mol Cell Biol*, 23:5293-300, 2003. Reprinted in [the New Scientist 2004](#)

Prenatal Programming of Childhood Obesity

OBESITY: A Weighty Issue
for Children



Epidemic of Childhood Overweight & Obesity



Source: National Center for Health Statistics, National Health and Nutrition Examination Survey

Note: Estimate not available for 1976-1980 for Hispanic; overweight defined as BMI at or above the 95th percentile of the CDC BMI-for-age growth charts

Prenatal Programming of Childhood Overweight & Obesity

Matern Child Health J
DOI 10.1007/s10995-006-0141-8

ORIGINAL PAPER

Prenatal Programming of Childhood Overweight and Obesity

Jennifer S. Huang · Tiffany A. Lee · Michael C. Lu

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Abstract *Objective:* To review the scientific evidence for prenatal programming of childhood overweight and obesity, and discuss its implications for MCH research, practice, and policy.

Methods: A systematic review of observational studies examining the relationship between prenatal exposures and childhood overweight and obesity was conducted using MOOSE guidelines. The review included literature posted on PubMed and MDCOnsult and published between January 1975 and December 2005. Prenatal exposures to maternal diabetes, malnutrition, and cigarette smoking were examined, and primary study outcome was childhood overweight or obesity as measured by body mass index (BMI) for children ages 5 to 21.

Results: Four of six included studies of prenatal exposure to maternal diabetes found higher prevalence of childhood overweight or obesity among offspring of diabetic mothers, with the highest quality study reporting an odds ratio of adolescent overweight of 1.4 (95% CI 1.0–1.9). The Dutch famine study found that exposure to maternal malnutrition in early, but not late, gestation was associated with increased

odds of childhood obesity (OR 1.9, 95% CI 1.5–2.4). All eight included studies of prenatal exposure to maternal smoking showed significantly increased odds of childhood overweight and obesity, with most odds ratios clustering around 1.5 to 2.0. The biological mechanisms mediating these relationships are unknown but may be partially related to programming of insulin, leptin, and glucocorticoid resistance *in utero*.

Conclusion: Our review supports prenatal programming of childhood overweight and obesity. MCH research, practice, and policy need to consider the prenatal period a window of opportunity for obesity prevention.

Keywords Prenatal programming · Childhood obesity · Overweight · Developmental programming · Fetal programming · Gestational diabetes · Maternal malnutrition · Cigarette smoking

Childhood overweight and obesity is a growing problem in the United States and worldwide. The prevalence of childhood overweight in the U.S. tripled between 1980 and 2000 [1]. Today approximately 1 in 6 (16%) U.S. children are overweight with significant racial-ethnic disparities. For example, nearly 1 in 4 (23%) non-Hispanic black girls ages 6 to 19 are overweight, a prevalence almost twice that of non-Hispanic white girls [1].

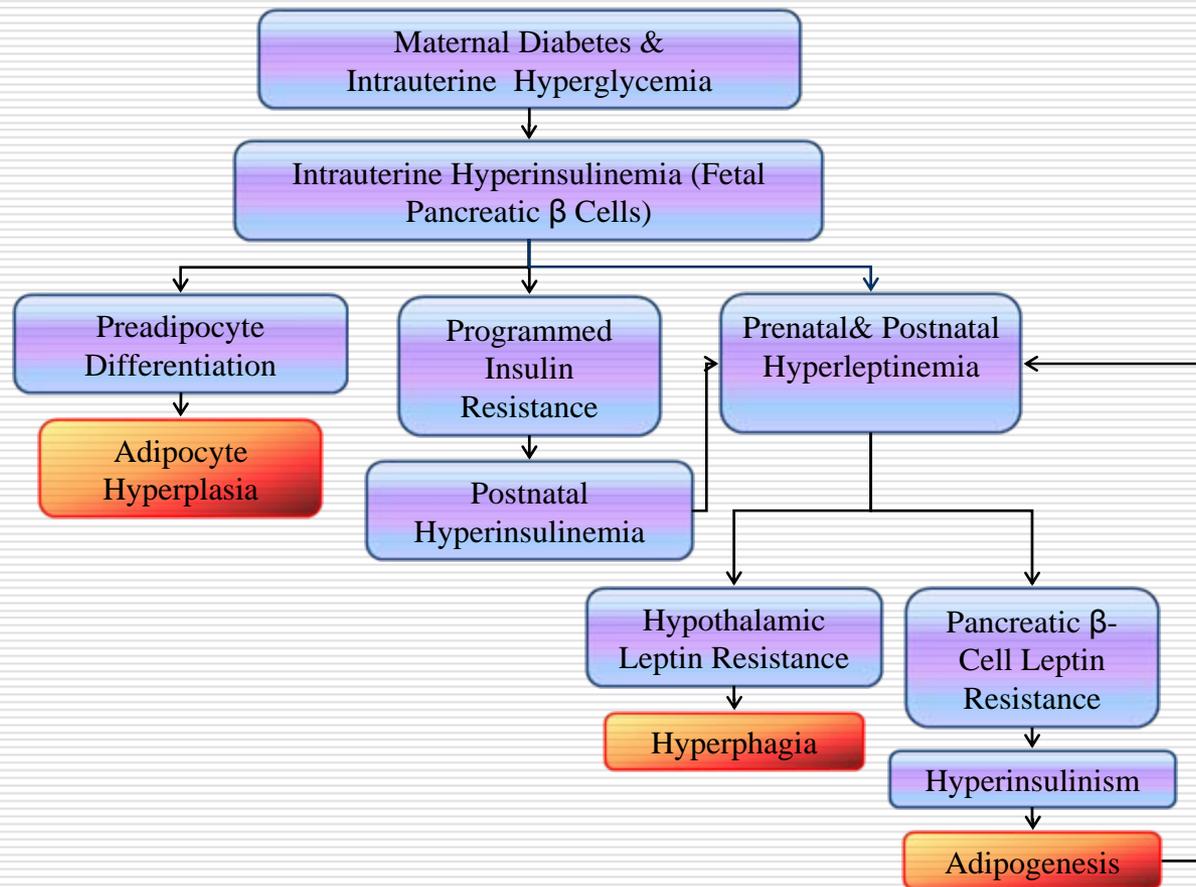
Overweight and obesity has significant lifelong consequences on the health and well-being of children [2, 3]. Childhood obesity is associated with early-onset Type II diabetes mellitus, hypertension, metabolic syndrome, and sleep apnea. It is also associated with cognitive or intellectual impairment and social exclusion and stigmatization as parts of a vicious cycle including school avoidance [3]. Childhood obesity tracks strongly into adulthood [4, 5]; obesity beyond

Disclaimer: The opinions expressed in this paper are the authors' and do not necessarily reflect the views or policies of the institutions with which the authors are affiliated.

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Prenatal Programming of Childhood Obesity



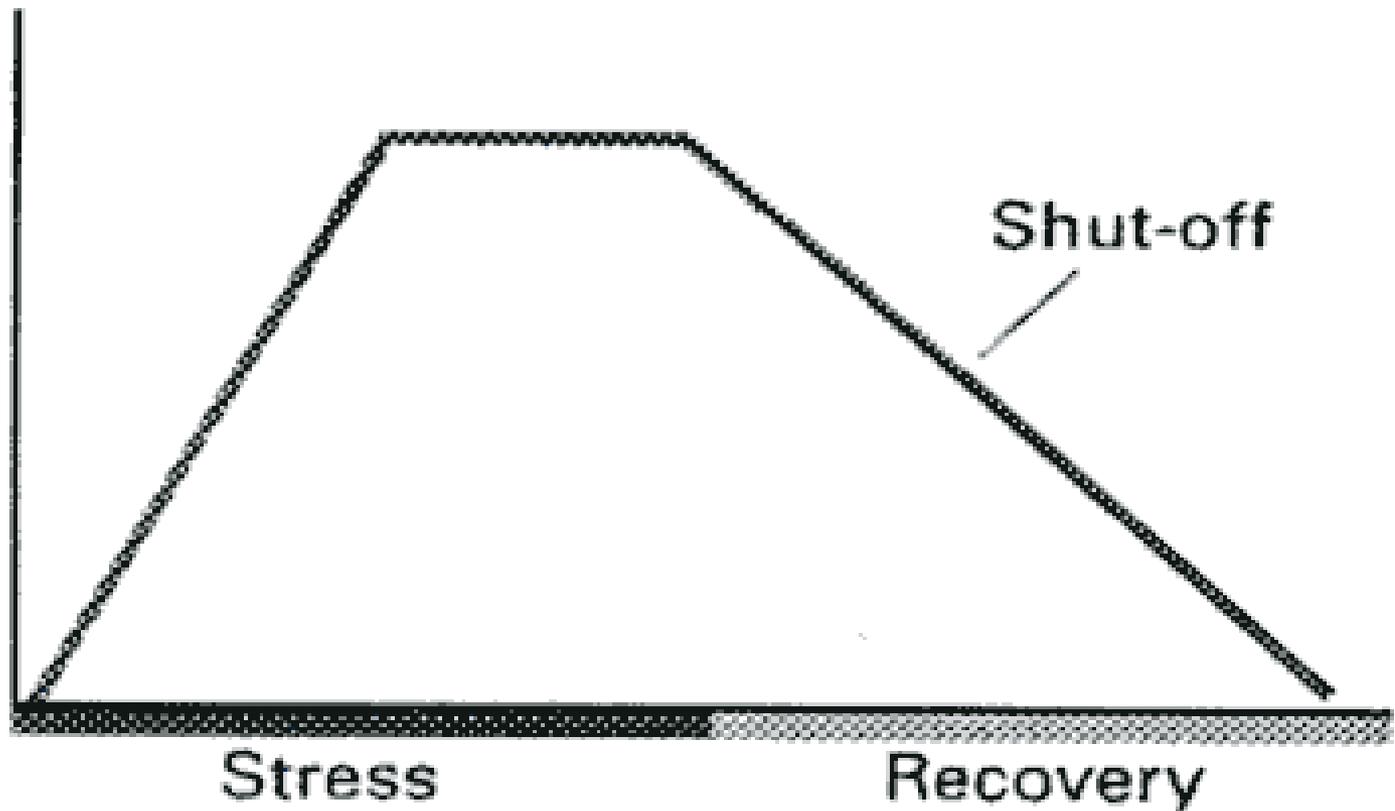
Cumulative Pathways



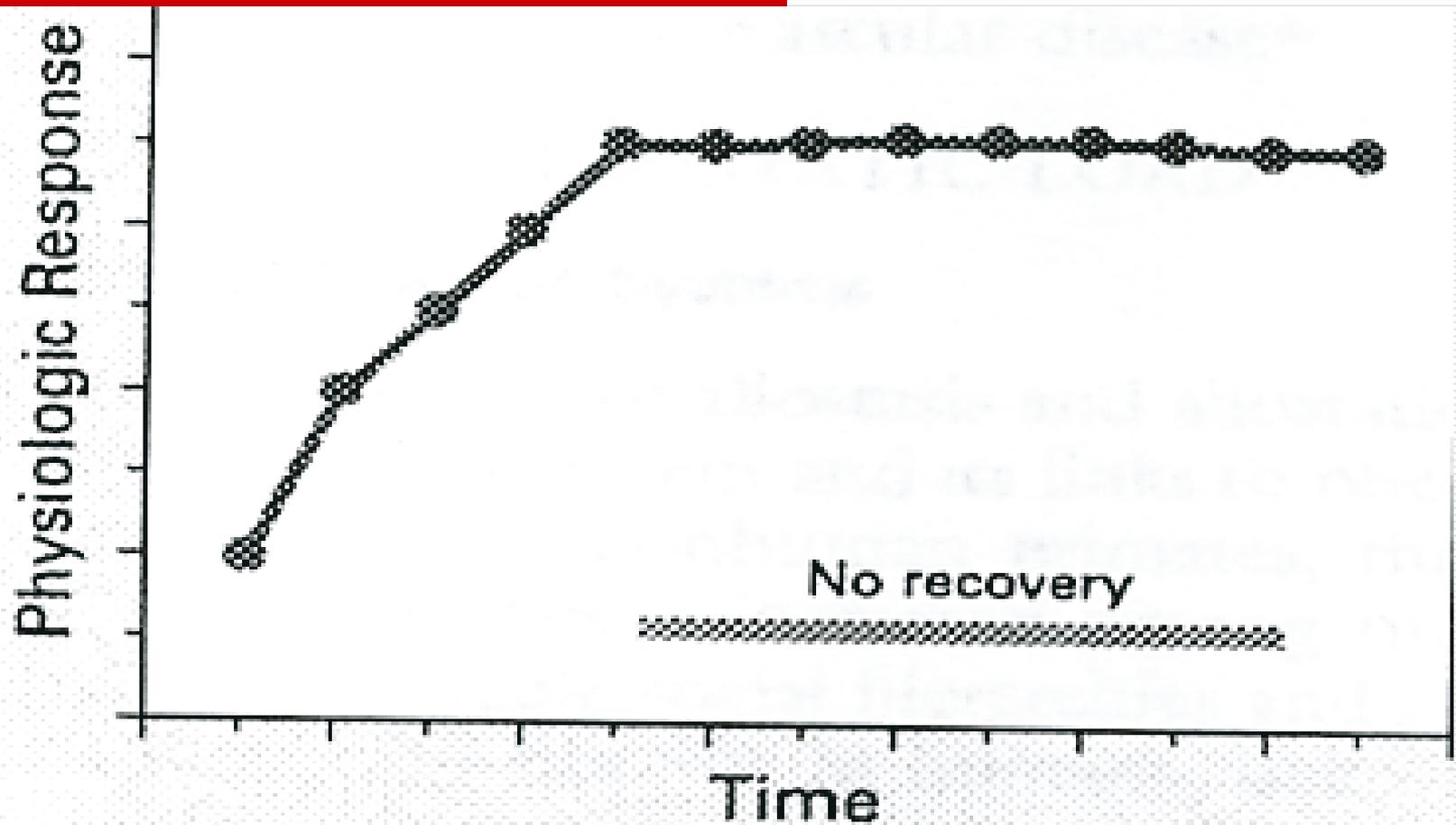
Allostasis:

Maintain Stability through Change

Allostasis



Allostatic Load: Wear and Tear from Chronic Stress



Stressed vs. Stressed Out

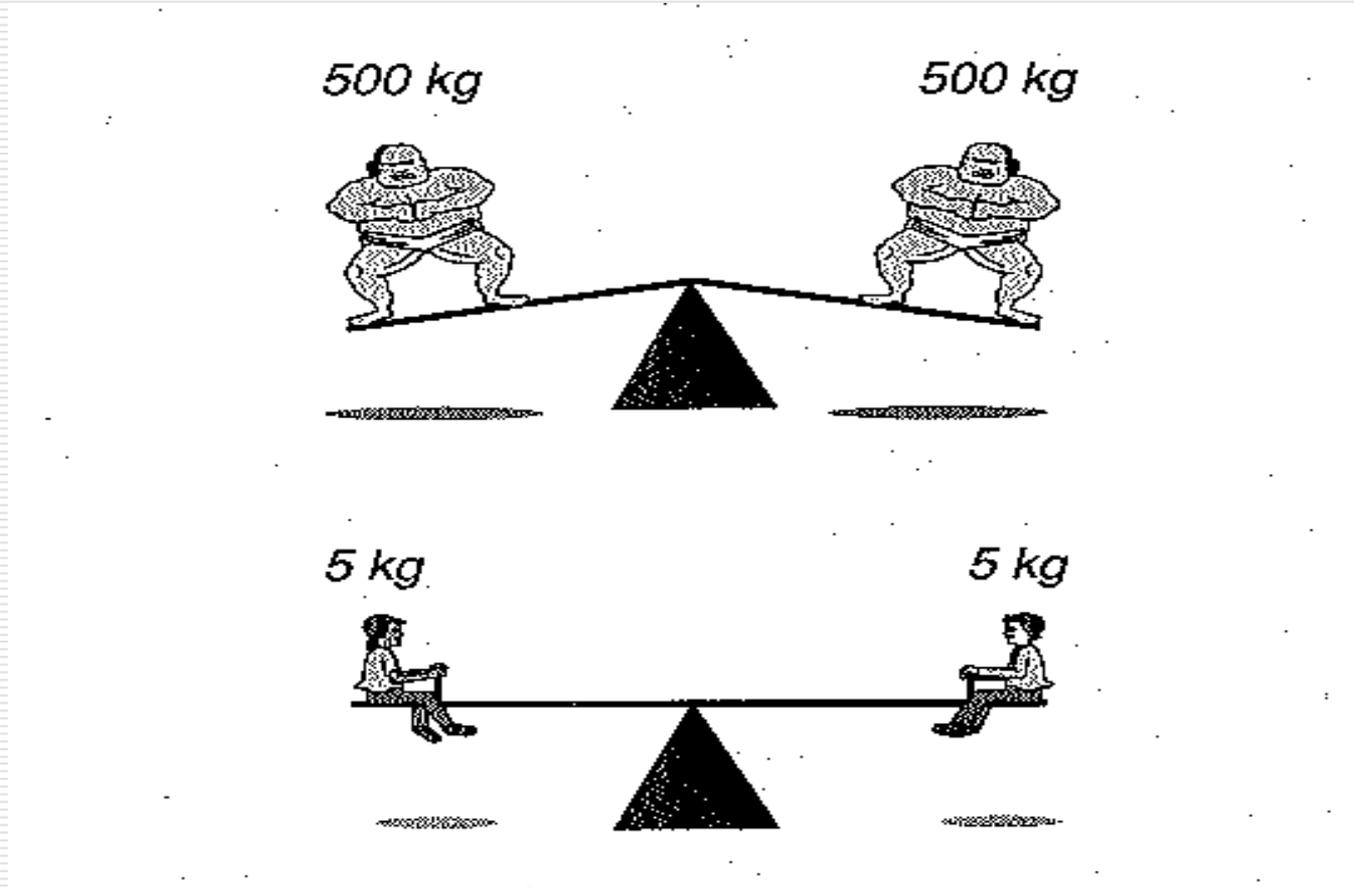
☐ Stressed

- Increased cardiac output
- Increased available glucose
- Enhanced immune functions
- Growth of neurons in hippocampus & prefrontal cortex

☐ Stressed Out

- Hypertension & cardiovascular diseases
- Glucose intolerance & insulin resistance
- Infection & inflammation
- Atrophy & death of neurons in hippocampus & prefrontal cortex

Allostasis & Allostatic Load



Rethinking Preterm Birth

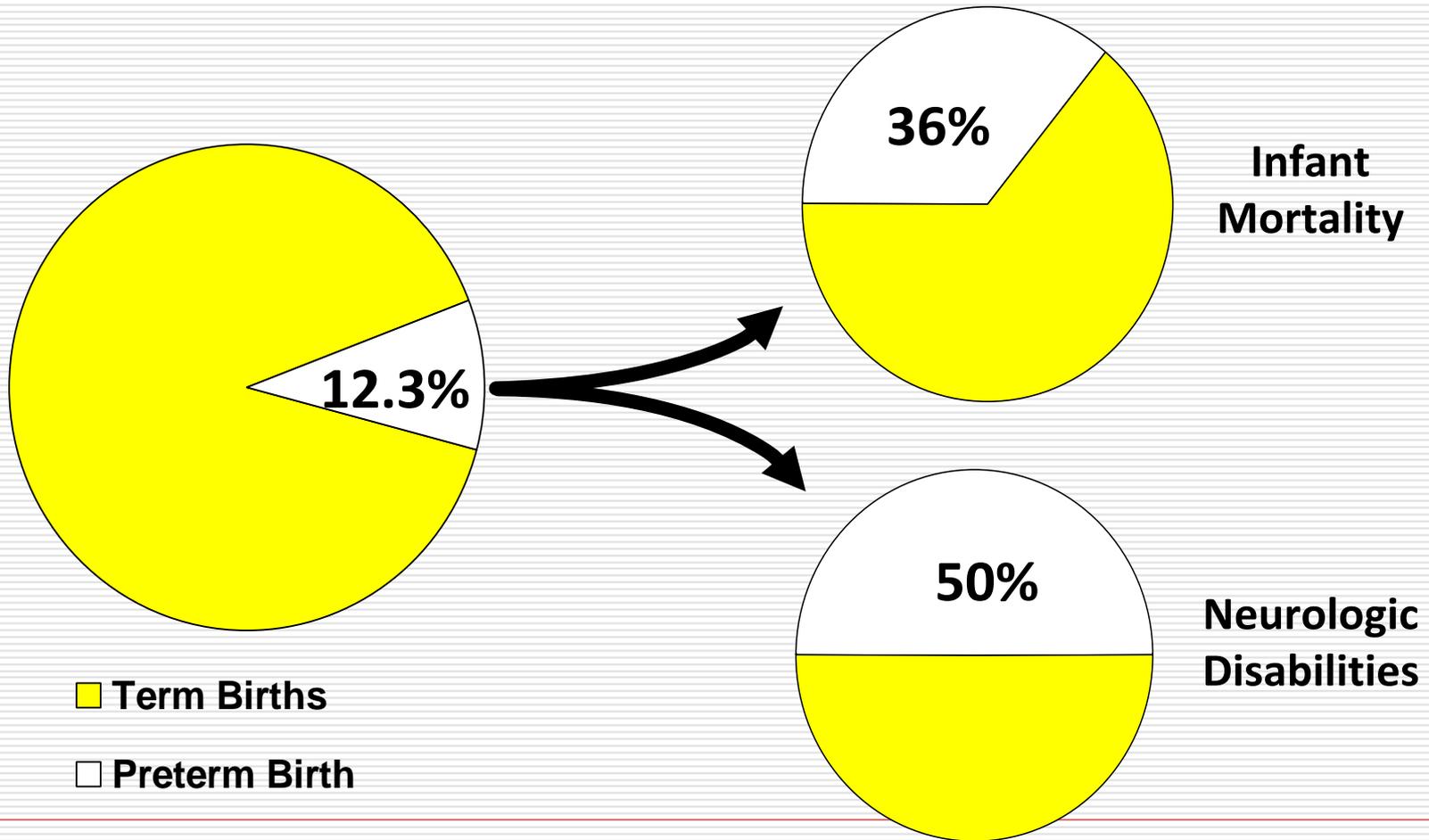


WARNING

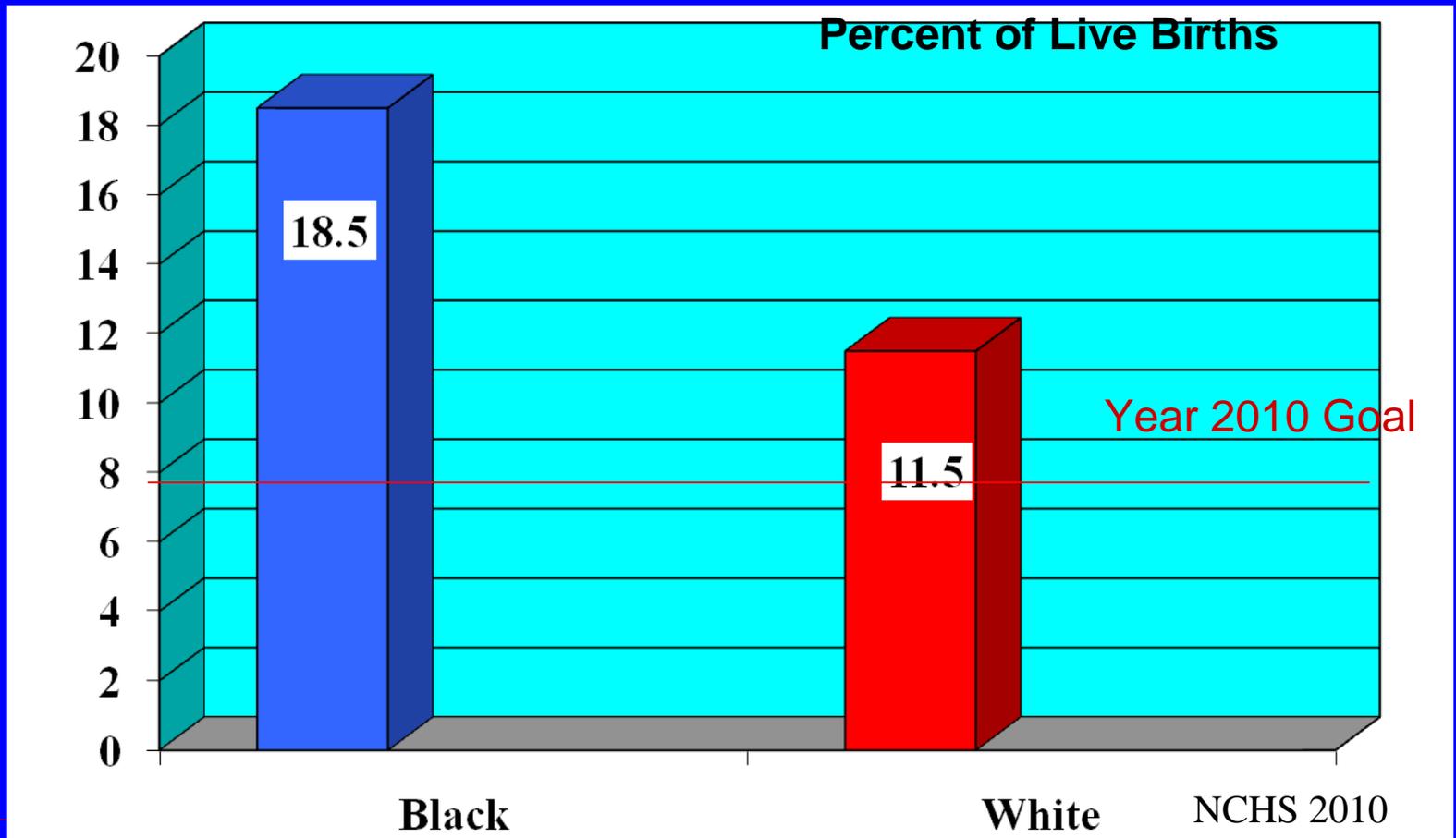
TO PREVENT INFANT FALL WHEN
• DO NOT LEAVE INFANT UNATTENDED
• DO NOT
TODAY'S PHOTO



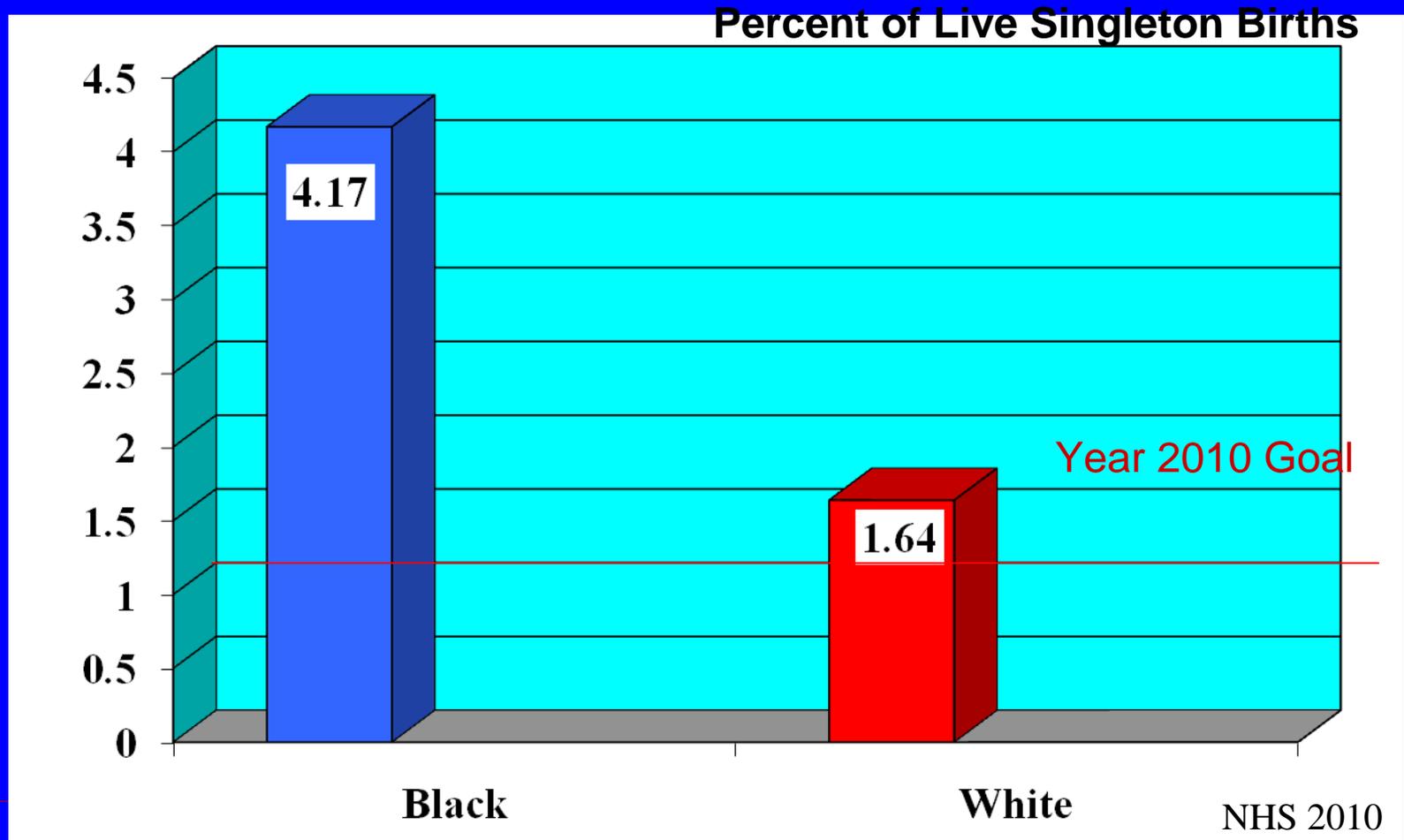
Preterm Birth



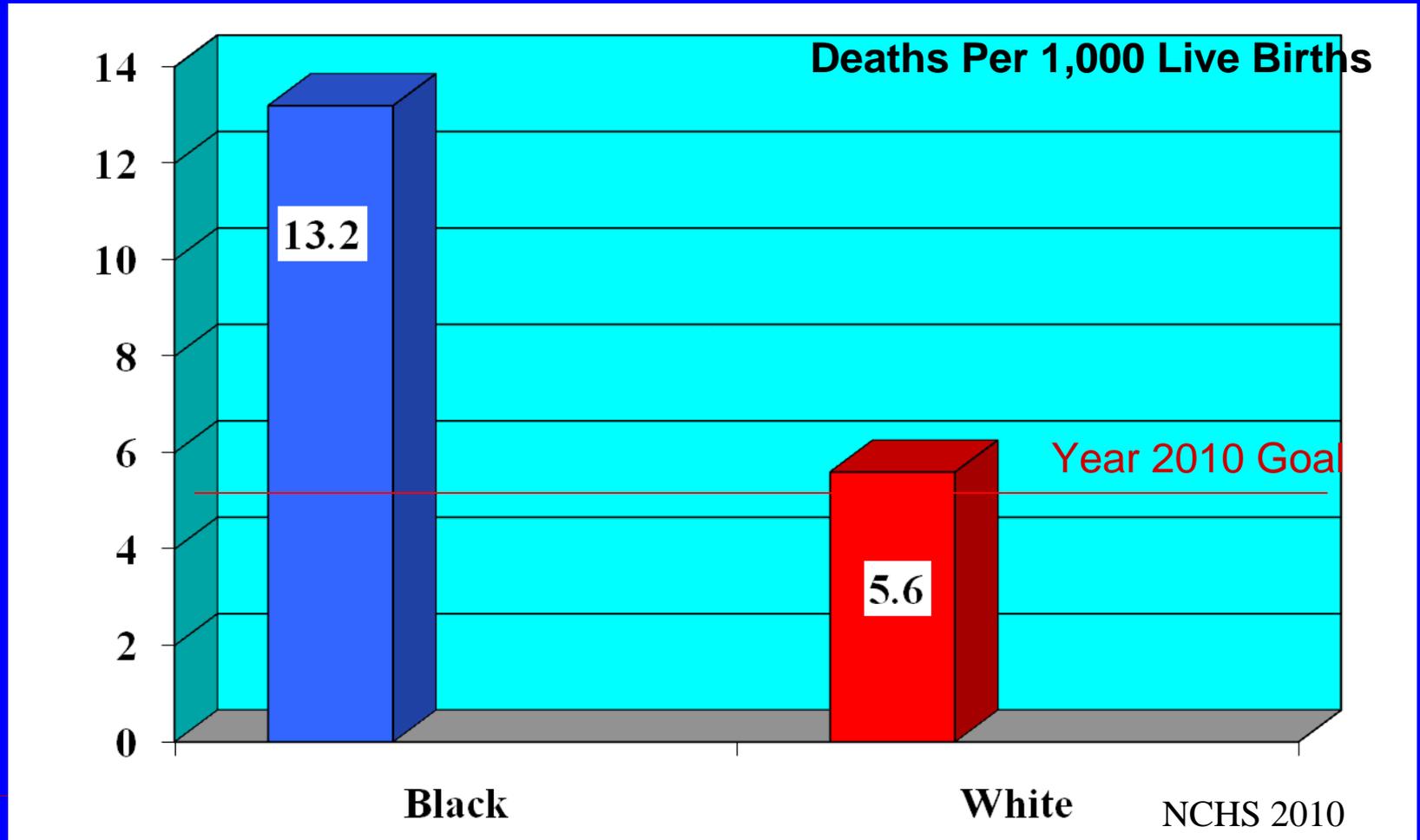
Racial & Ethnic Disparities Preterm Births < 37 weeks



Racial & Ethnic Disparities Very Preterm Births < 32 Weeks



Racial & Ethnic Disparities Infant Mortality

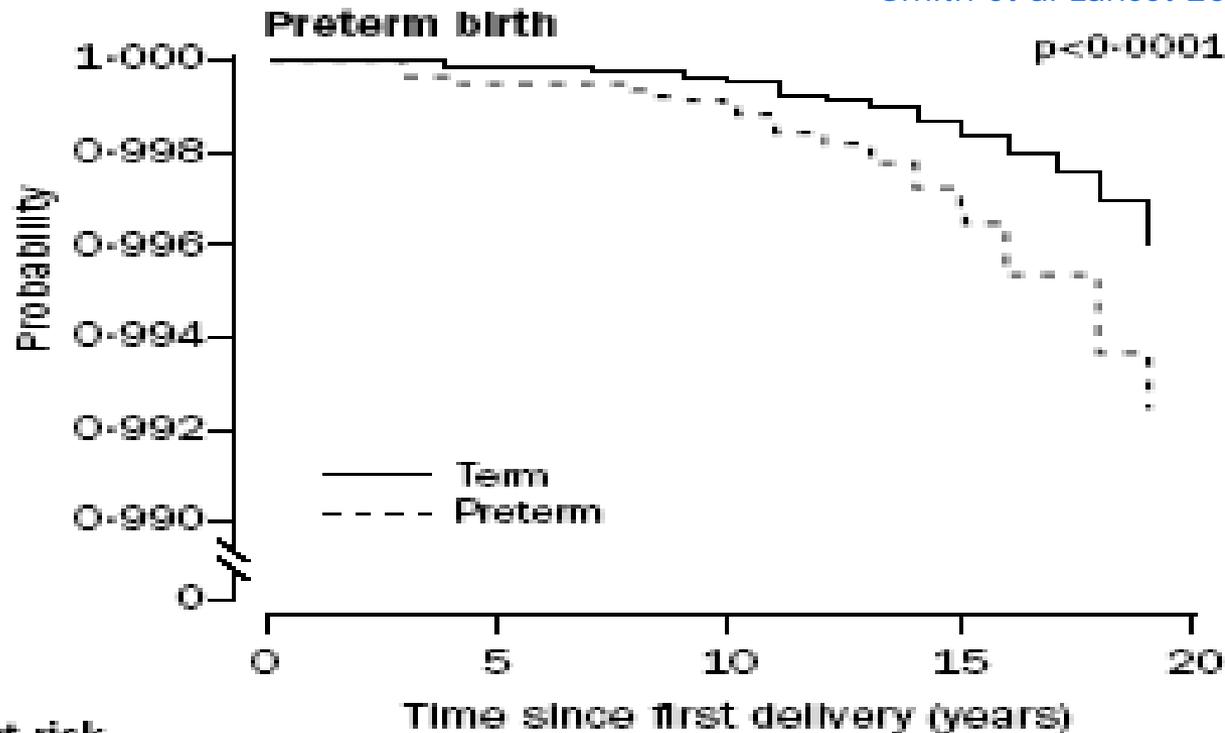


Rethinking Preterm Birth

Vulnerability to preterm delivery may be traced to not only exposure to stress & infection during pregnancy, but host response to stress & infection (e.g. stress reactivity & inflammatory dysregulation) patterned over the life course (early programming & cumulative allostatic load)

Preterm Birth & Maternal Ischemic Heart Disease

Smith et al *Lancet* 2001;357:2002-06



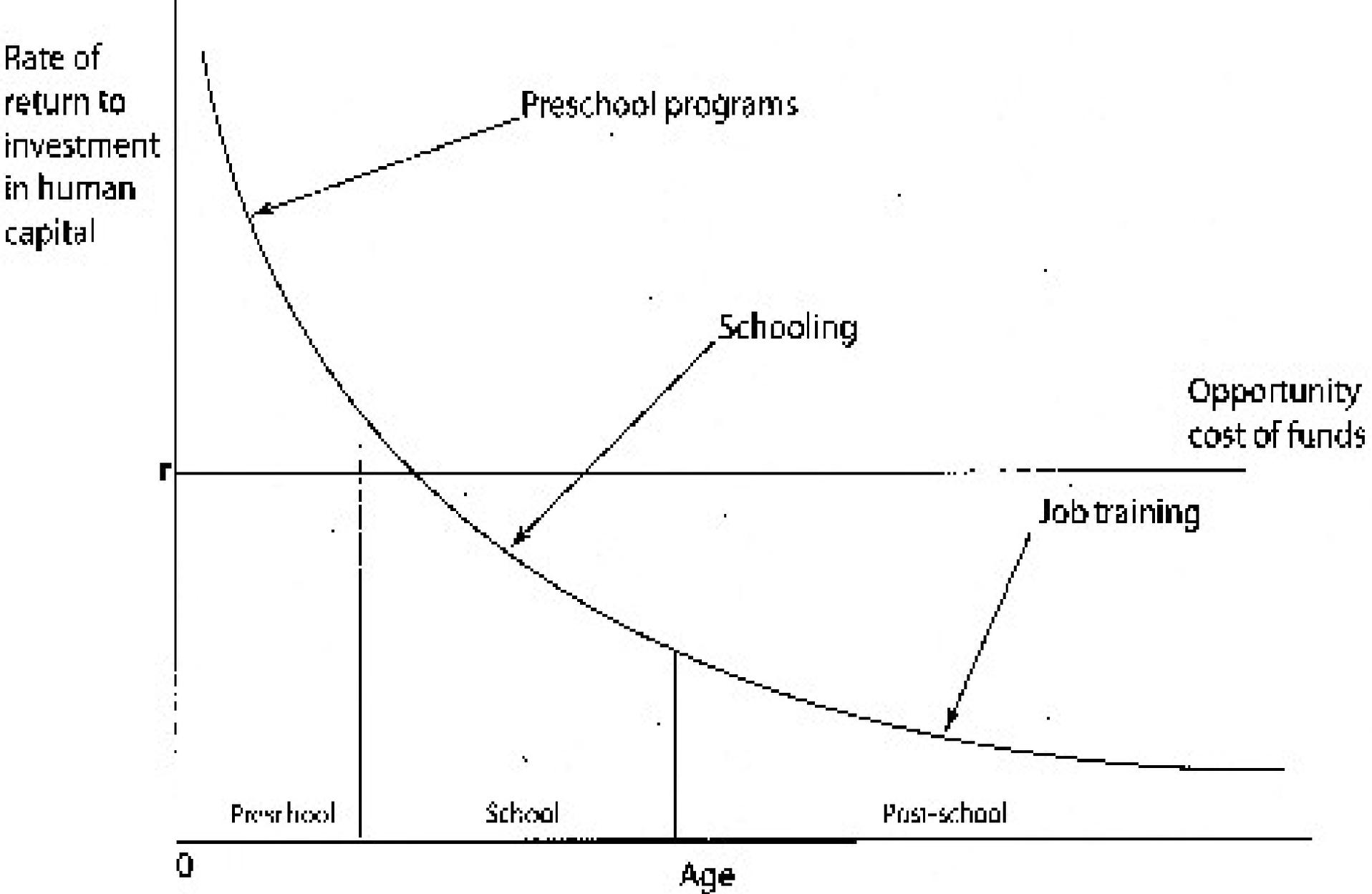
Number at risk

Term	121975	121813	121518	97169
Preterm	7315	7295	7262	5727

Kaplan-Meier plots of cumulative probability of survival **without** admission or death from ischemic heart disease after first pregnancy in relation to preterm birth

**Improving the Health of
the People of California:
*A Life-Course Perspective***

1. Invest Early

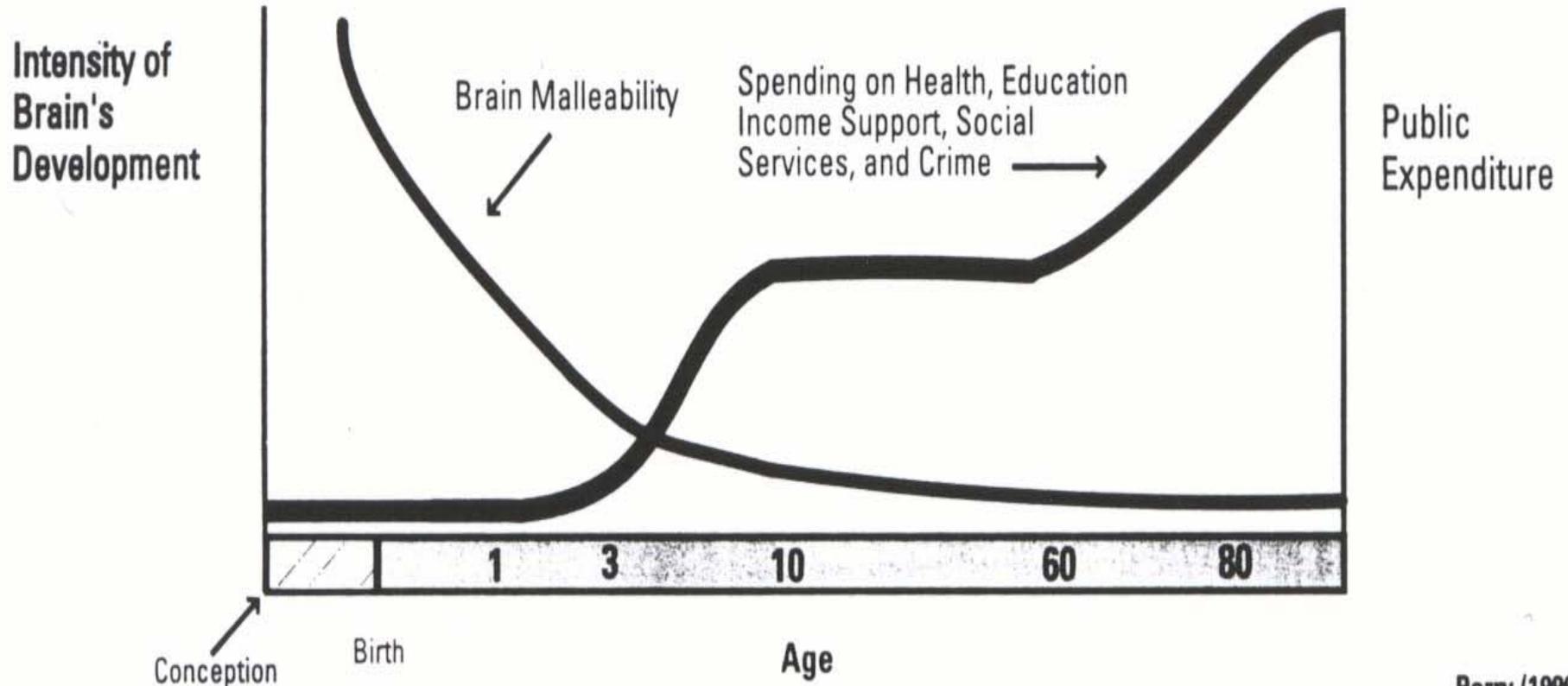


Rates of return to human capital investment initially setting investment to be equal across all ages

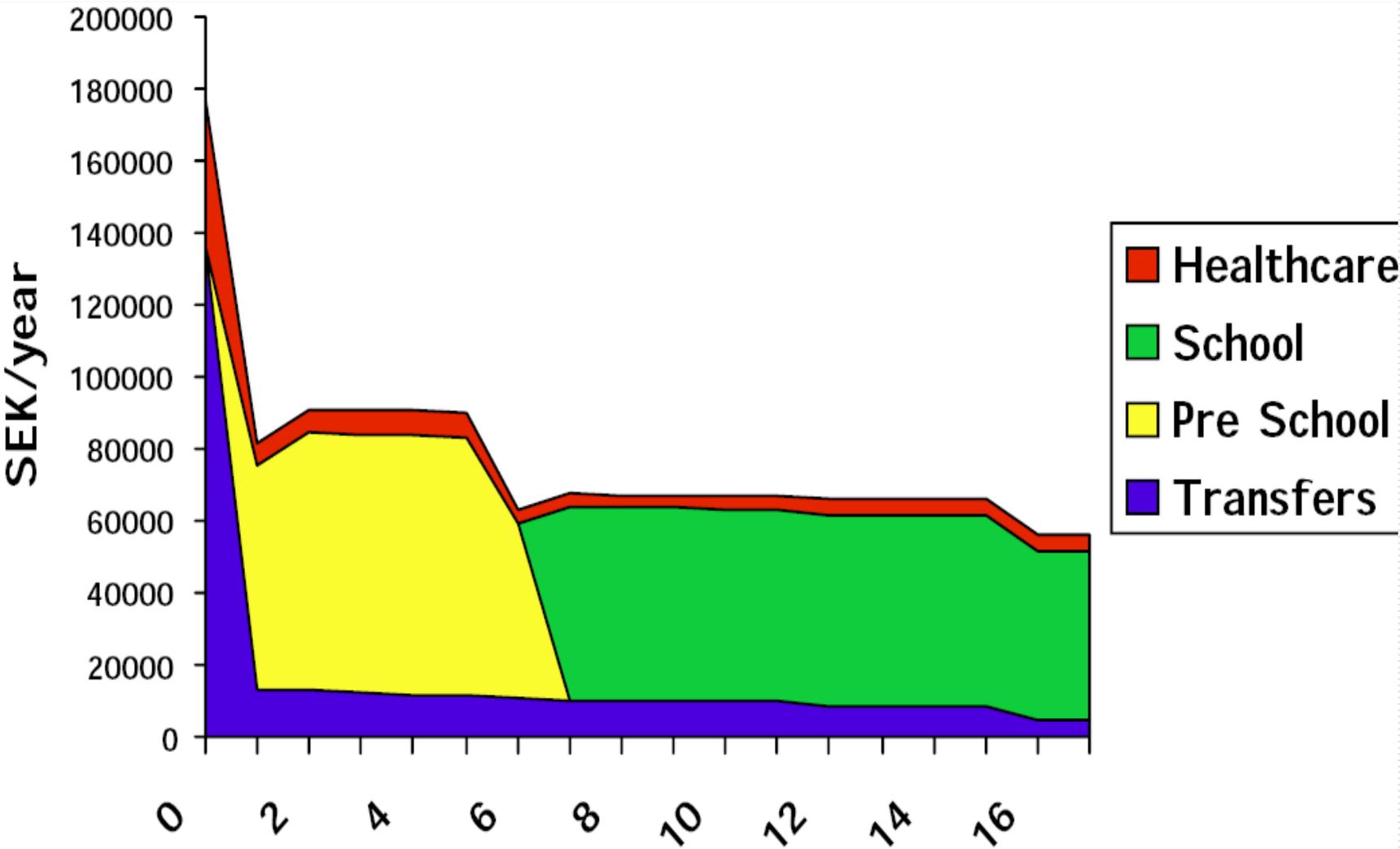
Too Much, Too Late?

FIGURE 4.2 BRAIN DEVELOPMENT - OPPORTUNITY AND INVESTMENT

Brain's Wiring and Development



Public Expenditures Children 0-17, Sweden, 1995



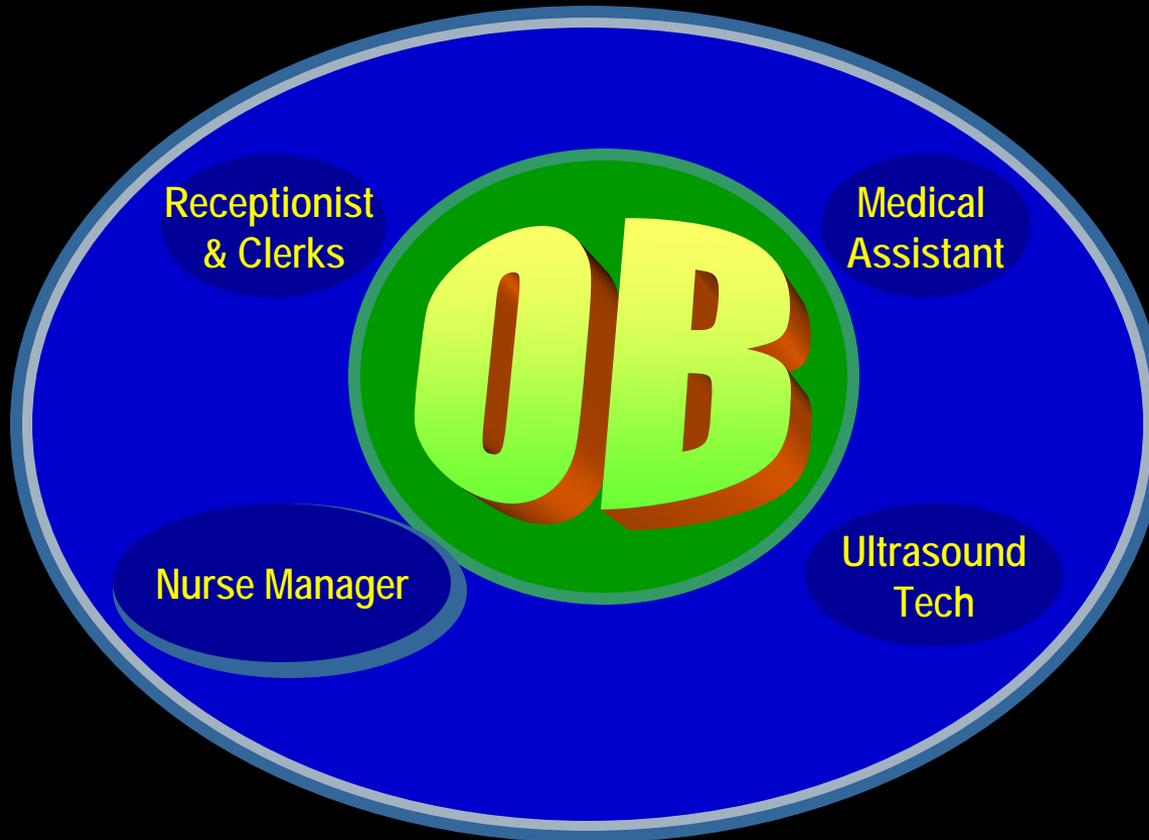
Put the W Back in MCH

**Not Only During Pregnancy,
But Before, Between, and Beyond
Pregnancy**

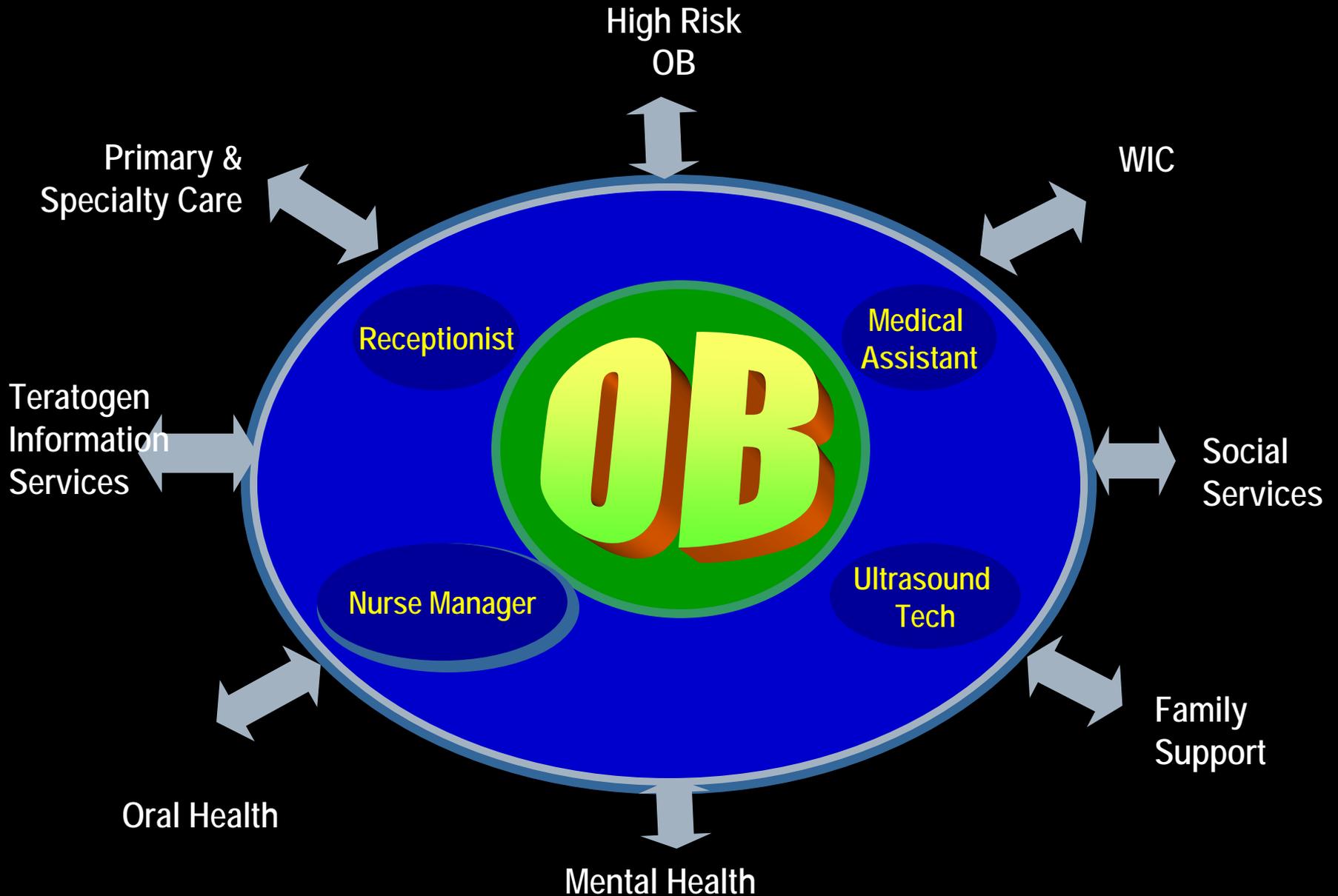
**PRECONCEPTION &
INTERCONCEPTION
CARE**

2. Improve Healthcare Quality

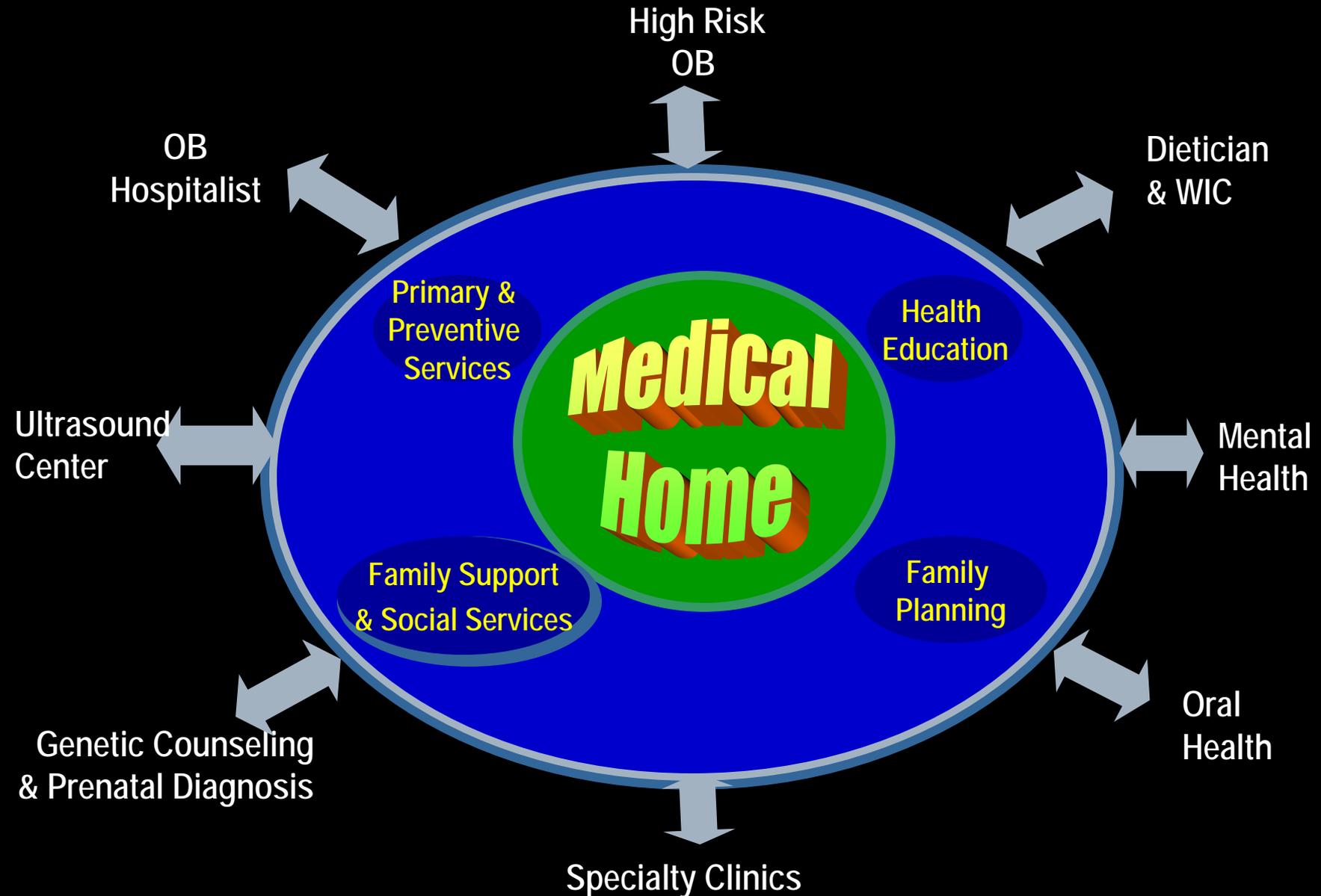
Prenatal Care 1.0



Prenatal Care 2.0



Prenatal Care 3.0

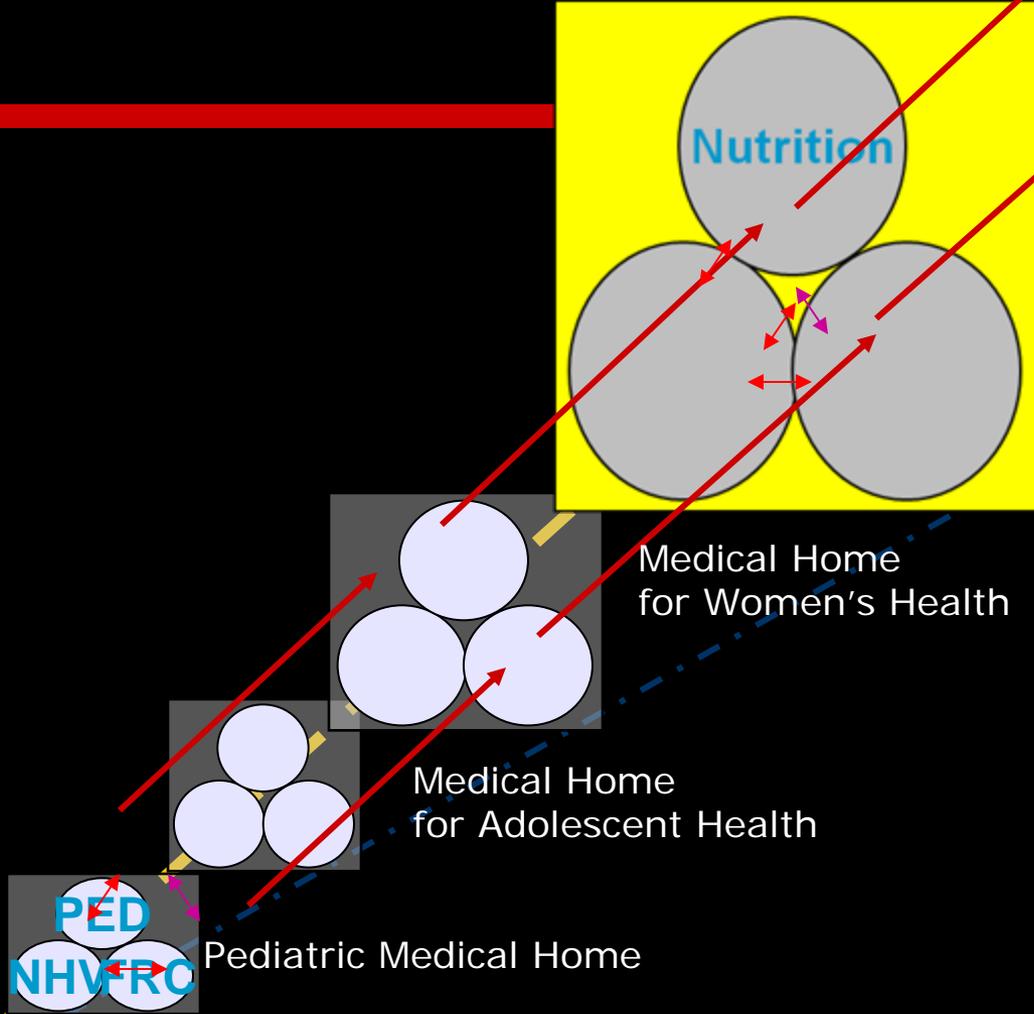


Prenatal Care 3.0

Optimal Health Development

Reproductive Potential

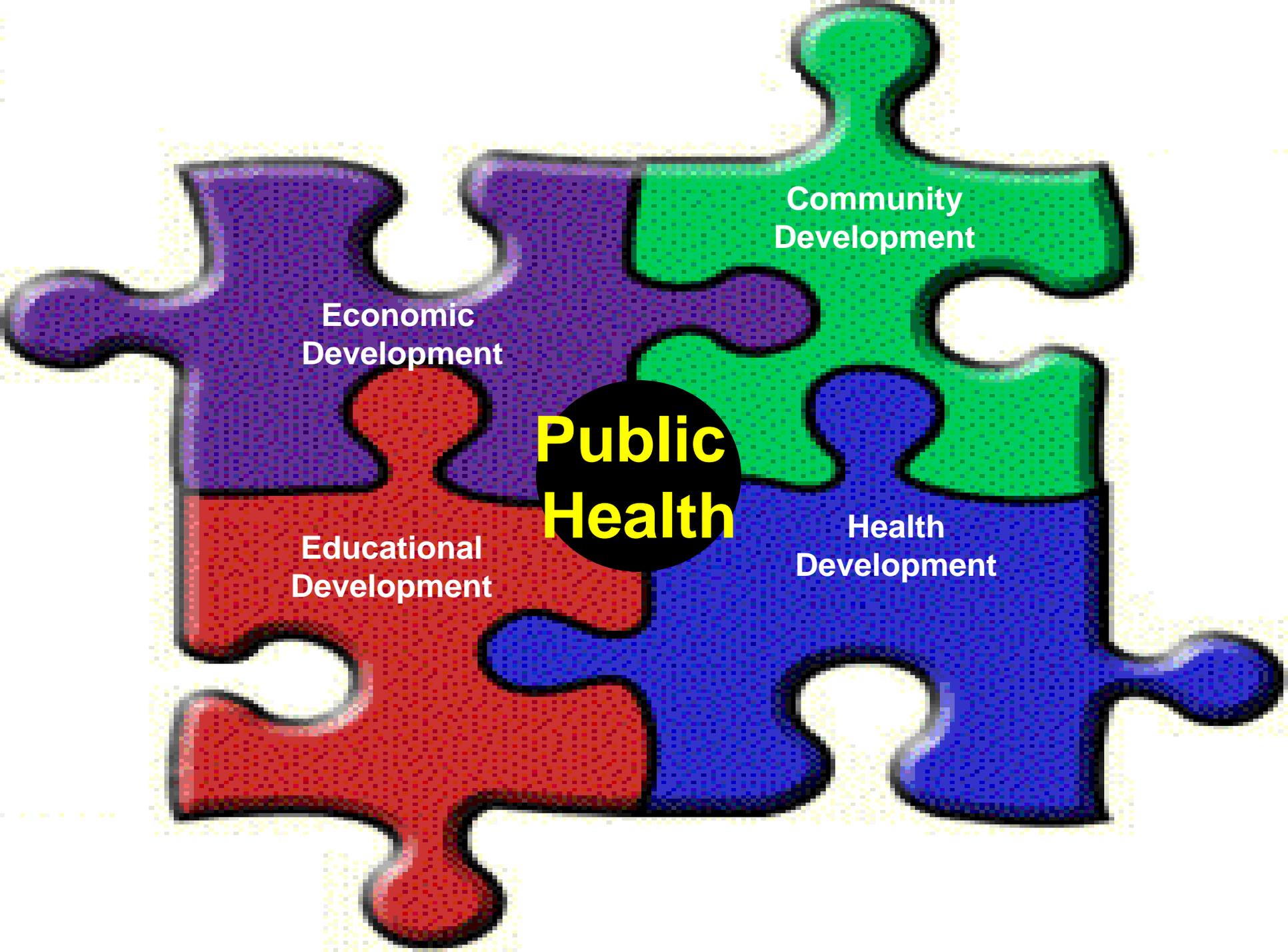
0 10 20 30 40 Years



Lower Health Development Trajectory

3. Reinvent Public Health

**Assure conditions in which
all Californian can be healthy**



Economic
Development

Community
Development

Educational
Development

Health
Development

**Public
Health**

**NMPP
MCH Life-
Course
Organization**

- Early Childhood
- Early Head Start
 - Head Start
 - UPK
 - Choir Academy

- Legislative Agenda
- Reauthorize Healthy Start
 - SCHIP
 - Minimum Wage Legislation
 - Women's Health Financing

- Economic Opportunities
- Harlem Works
 - Financial Literacy
 - LPN RN Training Program
 - Union Employment
 - Micro Lending Savings
 - Empowerment Zone

- Child Welfare
- Preventive Services
 - Foster Care Services
 - Parenting Workshops
 - Newborn Home Visiting
 - COPS Waiver

- Housing
- Home Ownership
 - Affordable Housing
 - Base Building- St. Nicks

- Health System
- Case Management - Title V Funds
 - Health Education - Regionalization
 - Outreach - Harlem Hospital
 - Perinatal Mood Disorders-Birthing Center
 - Interconceptional Care



Housing



Childcare



Medical Care



Jobs



Healthy Food



Alameda County Building Blocks Collaborative



Clean Air



Parks and Activities



Policy Makers



Education

Economic Justice



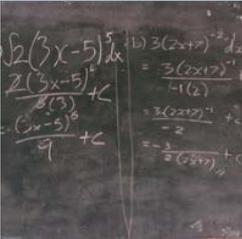
Preschool



Safe Neighborhoods



Residents

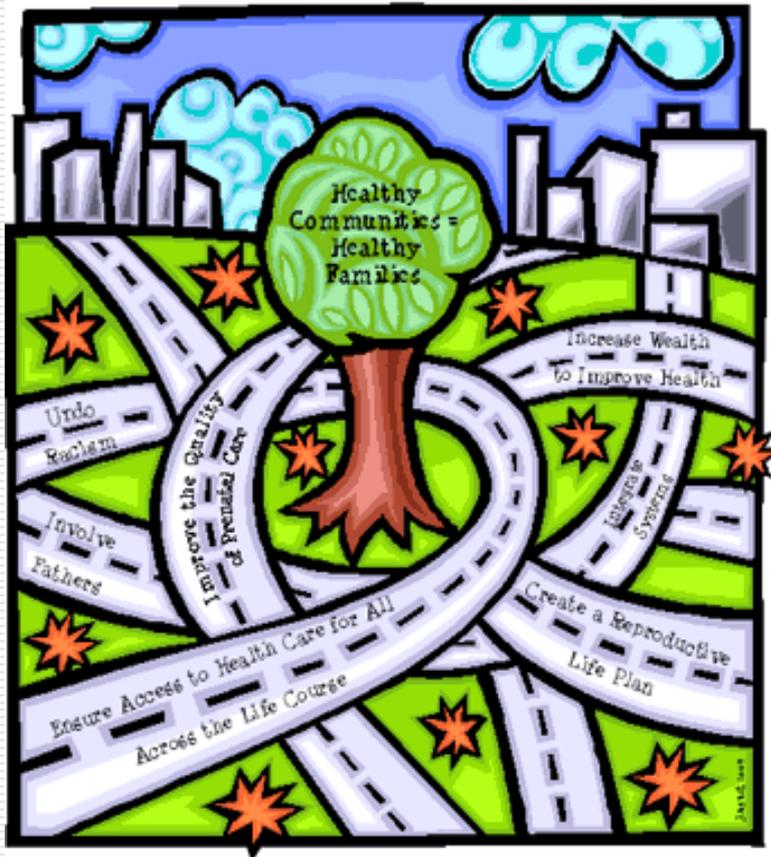


Transportation



Contra Costa County

Traveling Many Paths to Health Equity
in Contra Costa County



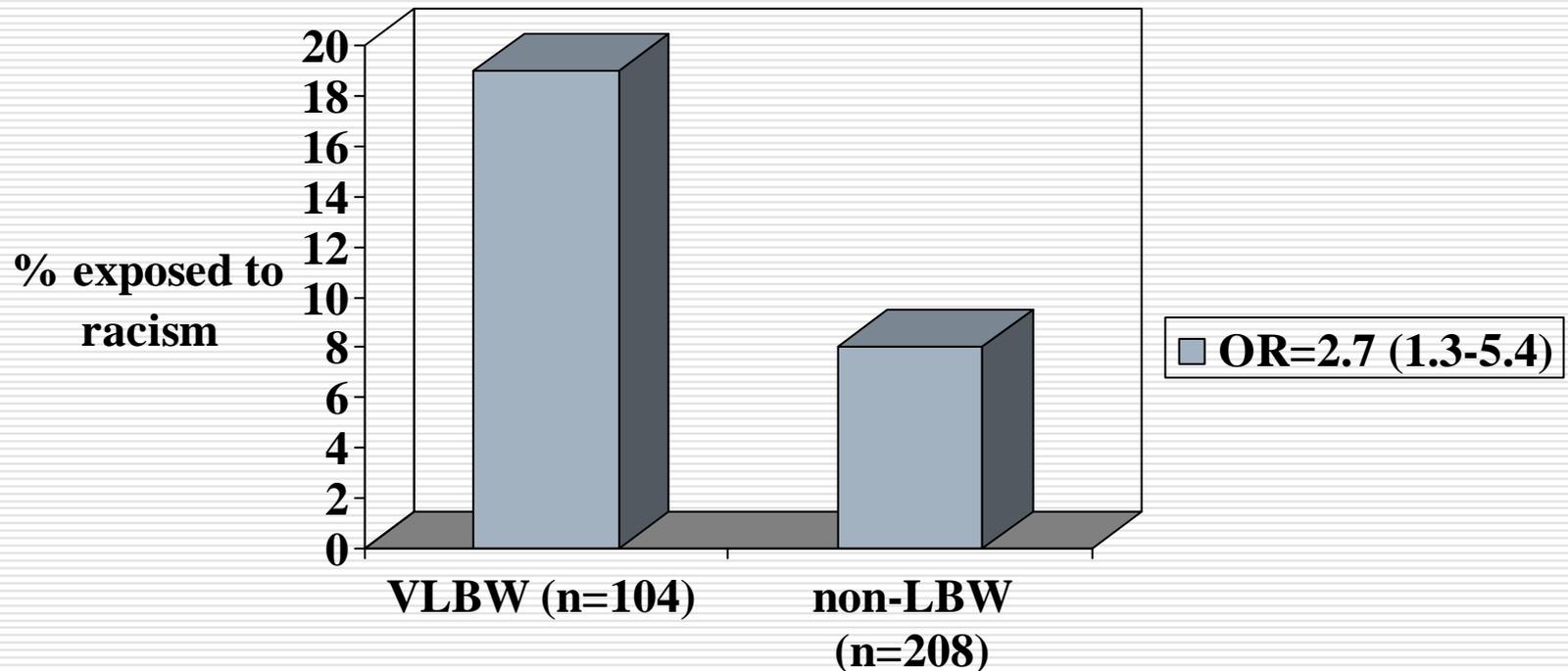
- Contra Costa County Life Course Initiative
- Building Economic Security Today (BEST)

Health
Development

Racism

MATERNAL LIFETIME EXPOSURE TO INTERPERSONAL RACISM IN 3 OR MORE DOMAINS AND INFANT BIRTH WEIGHT

(Collins et al, AJPB, 2004)



Going Public

Levels of Racism: A Theoretic Framework and a Gardener's Tale

Camara Phyllis Jones, MD, MPH, PhD

ABSTRACT

The author presents a theoretic framework for understanding racism on 3 levels: institutionalized, personally mediated, and internalized. This framework is useful for raising new hypotheses about the basis of race-associated differences in health outcomes, as well as for designing effective interventions to eliminate those differences.

She then presents an allegory about a gardener with 2 flower boxes, rich and poor soil, and red and pink flowers. This allegory illustrates the relationship between the 3 levels of racism and may guide our thinking about how to intervene to mitigate the impacts of racism on health. It may also serve as a tool for starting a national conversation on racism. (*Am J Public Health*. 2000;90:1212–1215)

Race-associated differences in health outcomes are routinely documented in this country, yet for the most part they remain poorly explained. Indeed, rather than vigorously exploring the basis of the differences, many scientists either adjust for race or restrict their studies to one racial group.¹ Ignoring the etiologic clues embedded in group differences impedes the advance of scientific knowledge, limits efforts at primary prevention, and perpetuates ideas of biologically determined differences between the races.

The variable race is only a rough proxy for socioeconomic status, culture, and genes, but it precisely captures the social classification of people in a race-conscious society such as the United States. The race noted on a health form is the same race noted by a sales clerk, a police officer, or a judge, and this racial classification has a profound impact on daily life experience in this country. That is, the variable "race" is not a biological construct that reflects innate differences,^{2,4} but a social construct that precisely captures the impacts of racism.

For this reason, some investigators now hypothesize that race-associated differences in health outcomes are in fact due to the effects of racism.^{5,6} In light of the Department of Health and Human Services' Initiative to Eliminate Racial and Ethnic Disparities in Health by the Year 2010,^{7,8} it is important to be able to examine the potential effects of racism in causing race-associated differences in health outcomes.

Levels of Racism

I have developed a framework for understanding racism on 3 levels: institutionalized, personally mediated, and internalized. This framework is useful for raising new hypotheses about the basis of race-associated differences in health outcomes, as well as for designing effective interventions to eliminate those differences. In this framework, *institutionalized racism* is defined as differential ac-

cess to the goods, services, and opportunities of society by race. Institutionalized racism is normative, sometimes legalized, and often manifests as inherited disadvantage. It is structural, having been codified in our institutions of custom, practice, and law, so there need not be an identifiable perpetrator. Indeed, institutionalized racism is often evident as inaction in the face of need.

Institutionalized racism manifests itself both in material conditions and in access to power. With regard to material conditions, examples include differential access to quality education, sound housing, gainful employment, appropriate medical facilities, and a clean environment. With regard to access to power, examples include differential access to information (including one's own history), resources (including wealth and organizational infrastructure), and voice (including voting rights, representation in government, and control of the media). It is important to note that the association between socioeconomic status and race in the United States has its origins in discrete historical events but persists because of contemporary structural factors that perpetuate those historical injustices. In other words, it is because of institutionalized racism that there is an association between socioeconomic status and race in this country.

Personally mediated racism is defined as prejudice and discrimination, where prejudice means differential assumptions about the abilities, motives, and intentions of others accord-

The author is currently with the Department of Health and Social Behavior, Department of Epidemiology, and the Division of Public Health Practice, Harvard School of Public Health, Boston, Mass. She will soon begin working with the Centers for Disease Control and Prevention, Atlanta, Ga.

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This article was accepted April 12, 2000.

Closing the Black-White Gap in Birth Outcomes: A 12-Point Plan

1. Provide interconception care to women with prior adverse pregnancy outcomes
2. Increase access to preconception care for African American women
3. Improve the quality of prenatal care
4. Expand healthcare access over the life course
5. Strengthen father involvement in African American families
6. Enhance service coordination and systems integration
7. Create reproductive social capital in African American communities
8. Invest in community building and urban renewal
9. Close the education gap
10. Reduce poverty among Black families
11. Support working mothers and families
12. Undo racism

All this will not be finished in the first 100 days. Nor will it be finished in the first 1,000 days, nor in the life of this Administration, nor even perhaps in our lifetime on this planet. But let us begin.

John F Kennedy (1961)



We hold these truths to be self-evident, that all men are created equal

Declaration of Independence 1776

I have a dream that my four little children will one day live in a nation where they will not be judged by the color of their skin, but by the content of their character

Martin Luther King, Jr (1963)

