Before, Between and Beyond Pregnancy: From Concept to Practice

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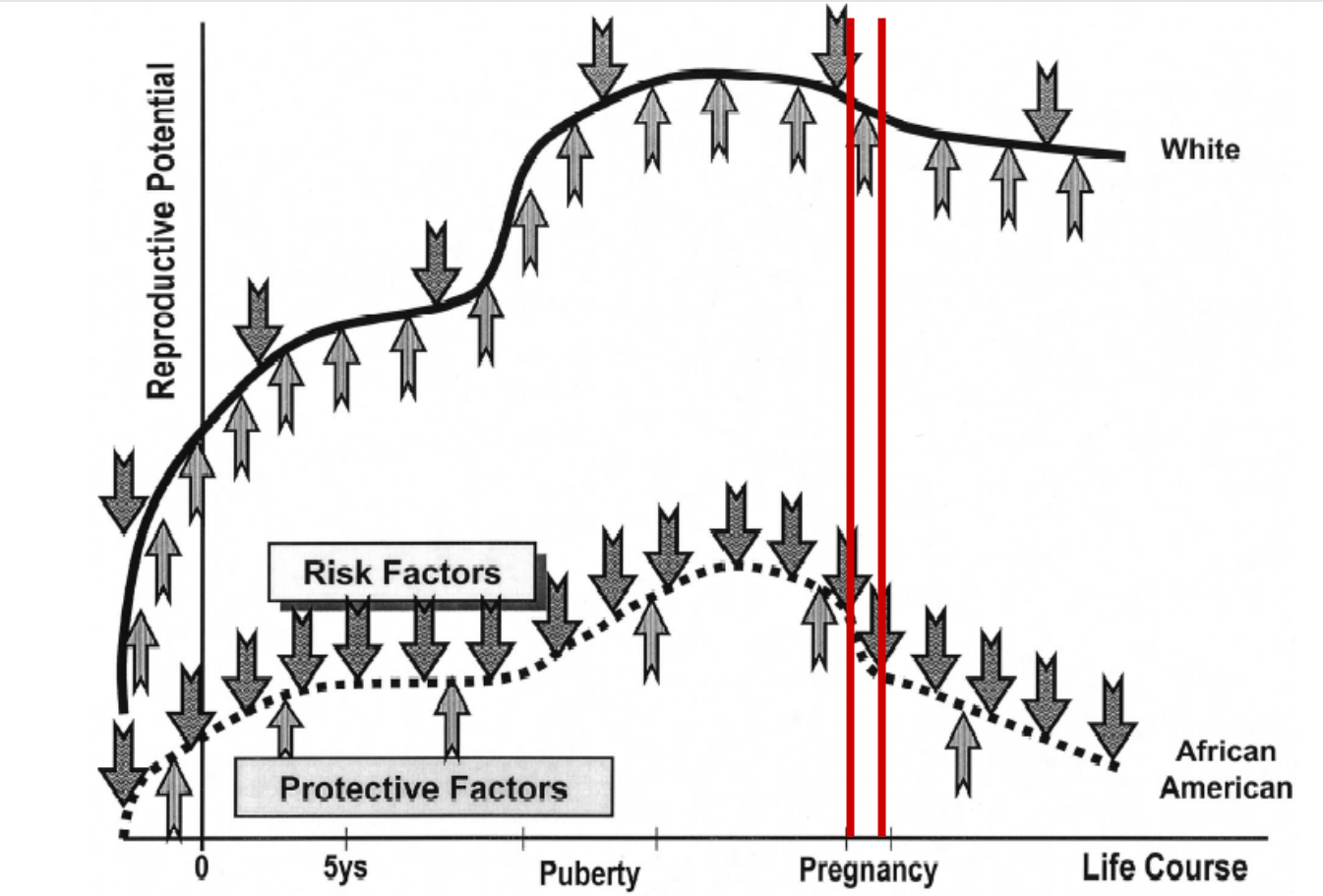
Life-Course Perspective

- 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.

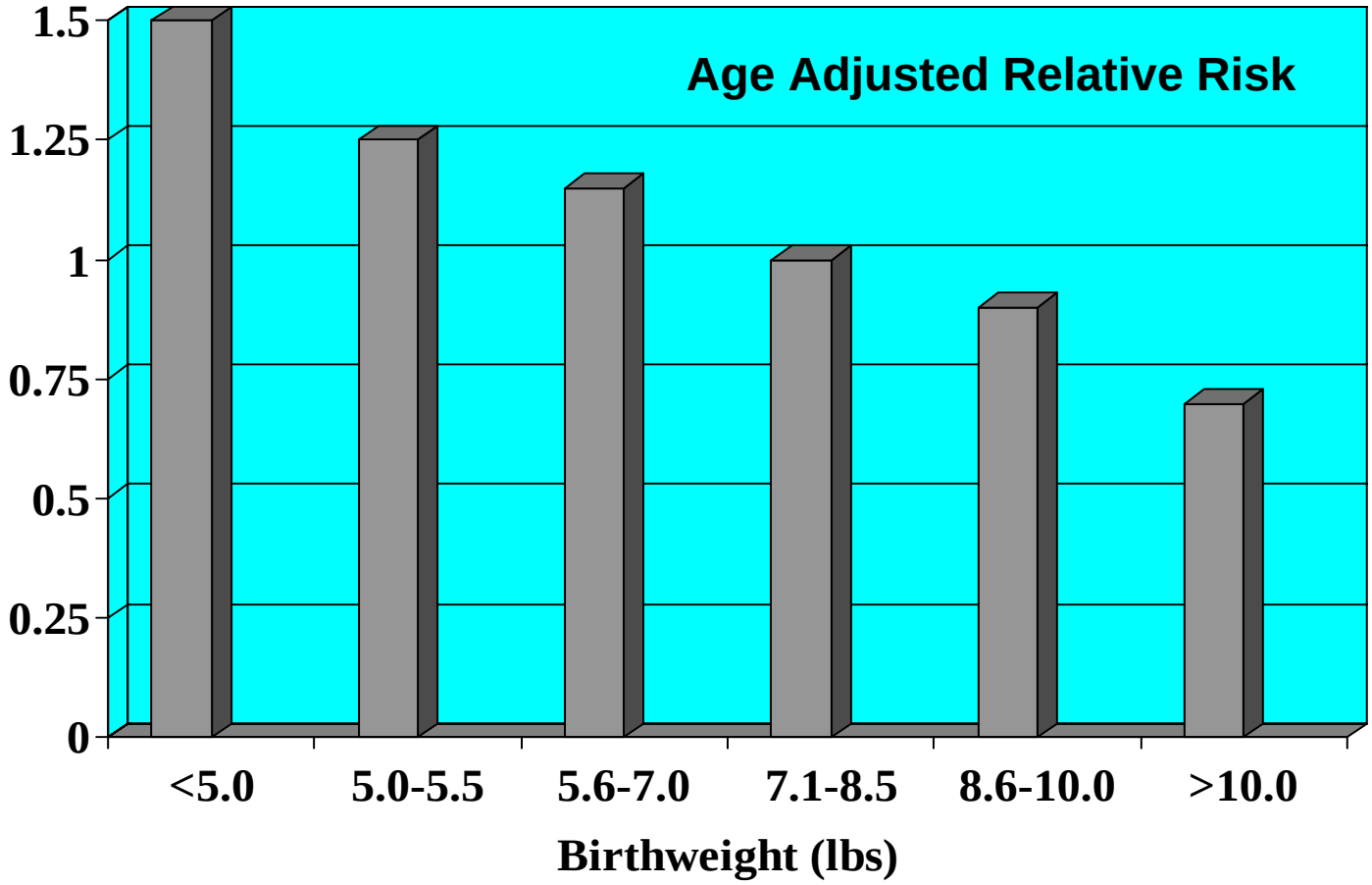
Life Course Perspective

- Early programming
- Cumulative pathways
- Improving MCH: A life-course perspective

Early Programming

Barker Hypothesis

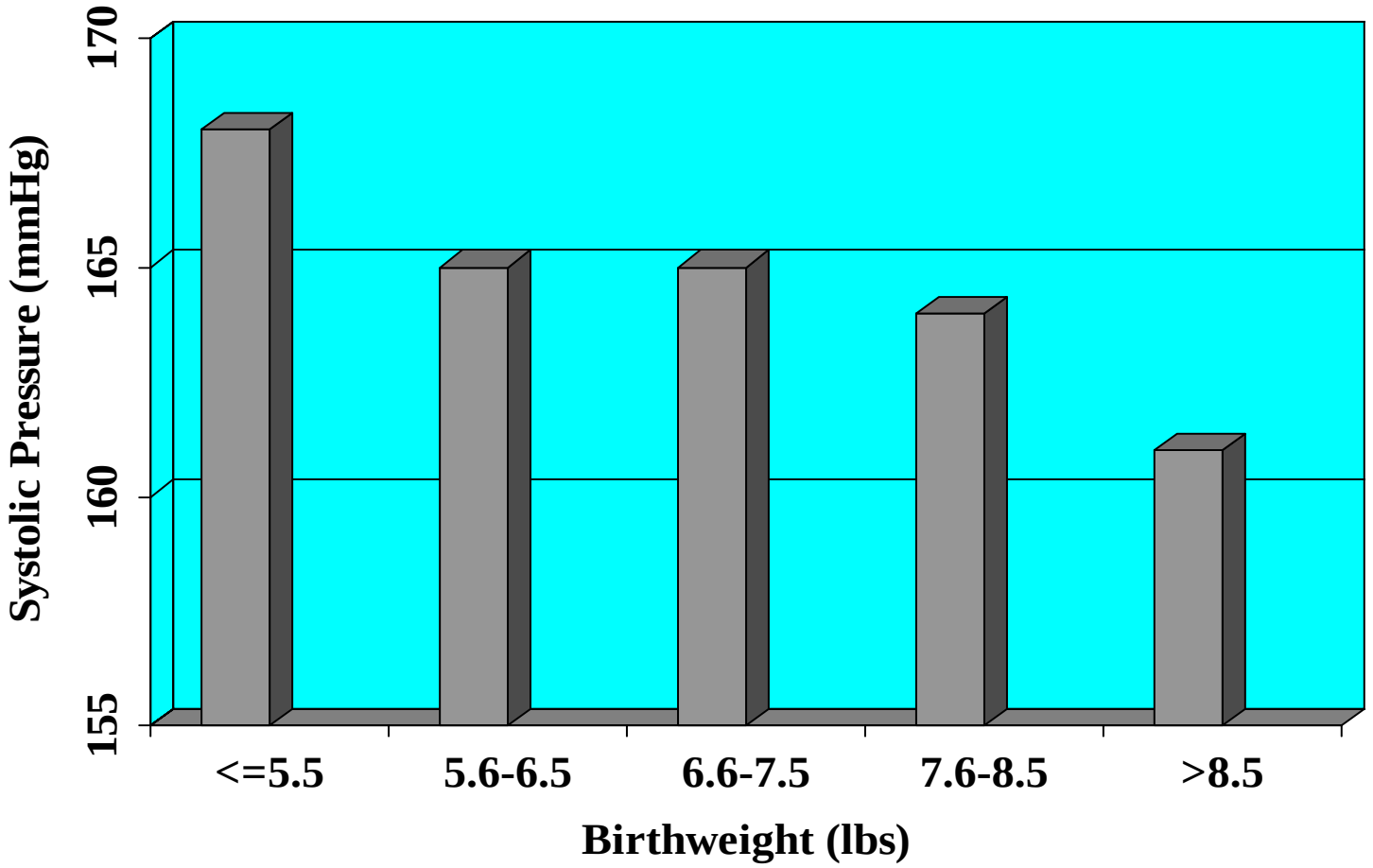
Birth Weight and Coronary Heart Disease



Rich-Edwards JW, Stampfer MJ, Manson JE, Rosner B, Hankinson SE, Colditz GA et al. Birth weight and risk of cardiovascular disease in a cohort of women followed up since 1976. Br Med Jr 1997;315:396-400.

Barker Hypothesis

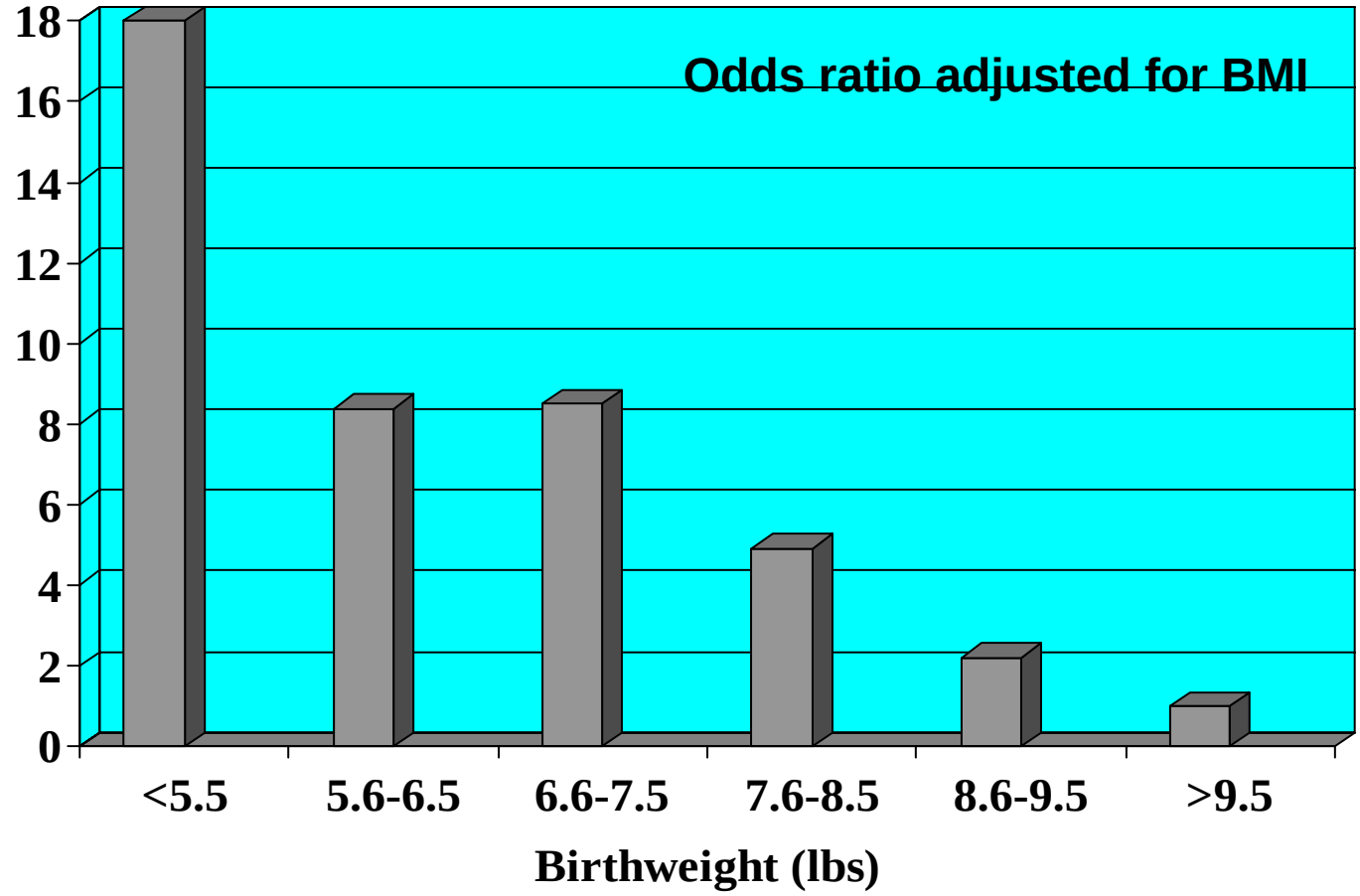
Birth Weight and Hypertension



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.

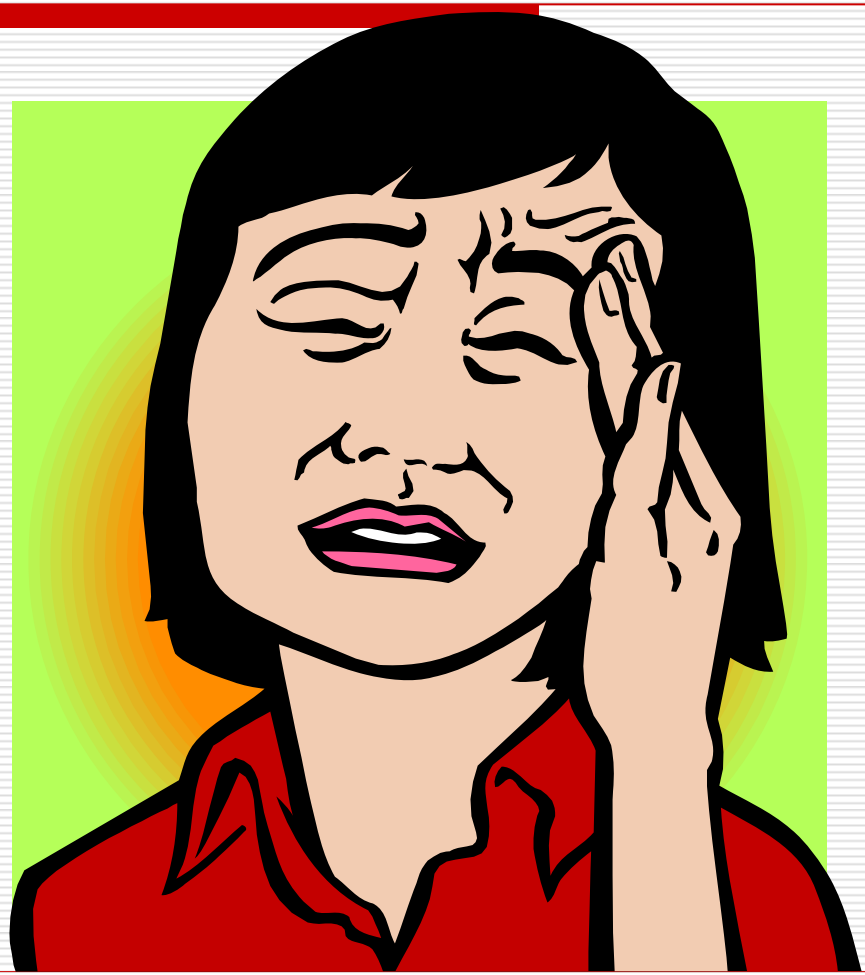
Barker Hypothesis

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

Welberg LAM, Seckl JR. Prenatal stress, glucocorticoids and the programming of the brain. J Neuroendocrinol 2001;13:113-28.

Prenatal Programming of the Hypothalamic-Pituitary-Adrenal Axis

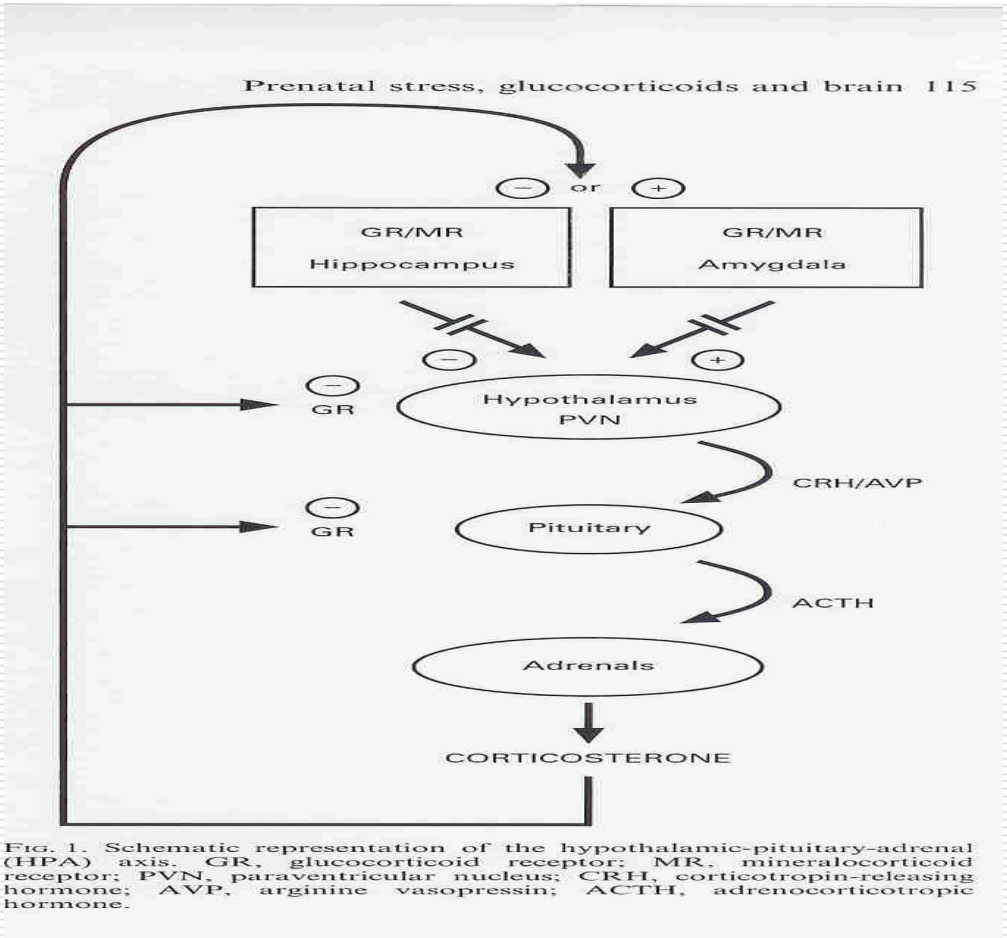
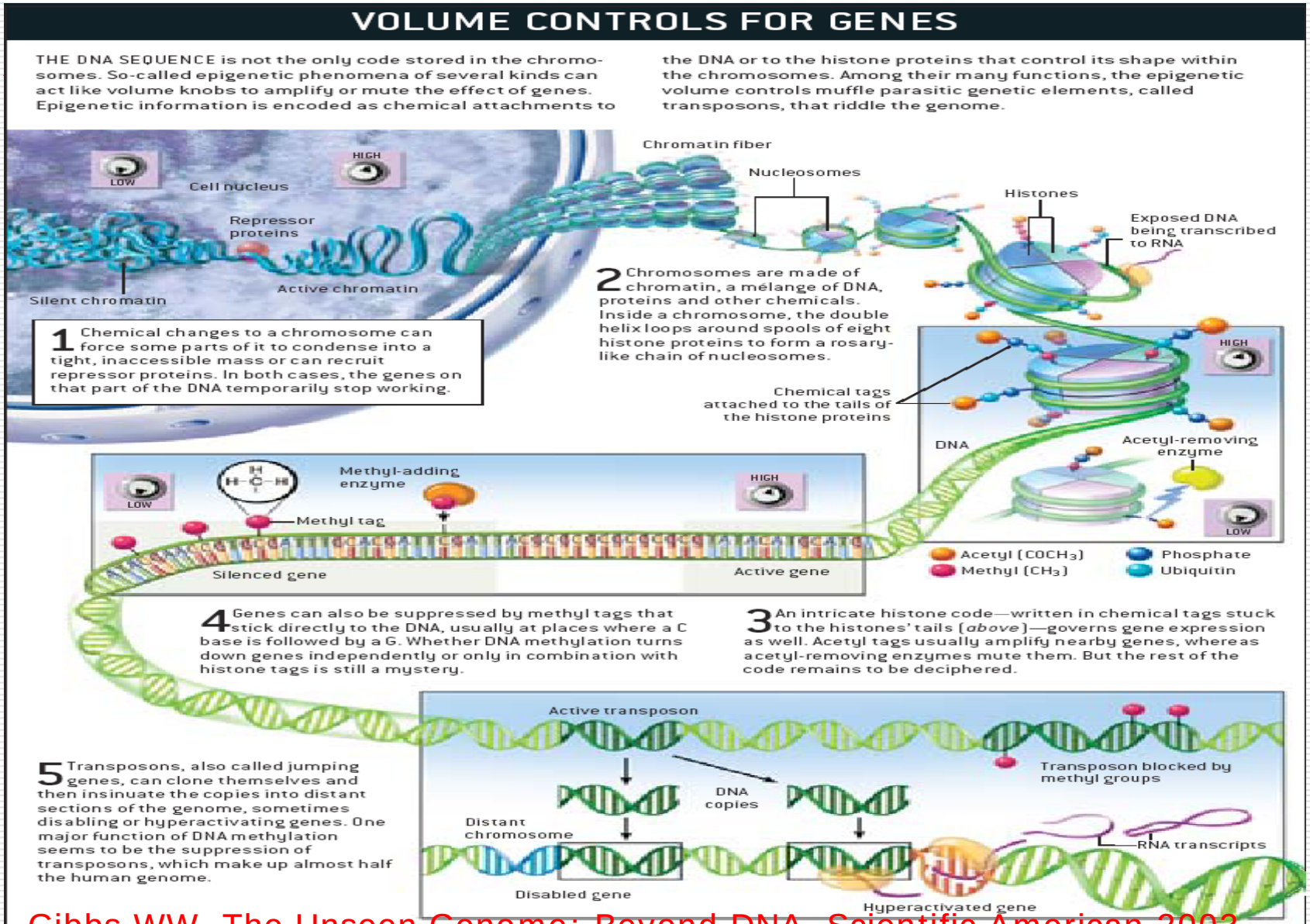


FIG. 1. Schematic representation of the hypothalamic-pituitary-adrenal (HPA) axis. GR, glucocorticoid receptor; MR, mineralocorticoid receptor; PVN, paraventricular nucleus; CRH, corticotropin-releasing hormone; AVP, arginine vasopressin; ACTH, adrenocorticotropic hormone.

Welberg LAM, Seckl JR. Prenatal stress, glucocorticoids and the programming of the brain. J Neuroendocrinol 2001;13:113-28.

Epigenetics



Gibbs WW. The Unseen Genome: Beyond DNA. Scientific American 2003

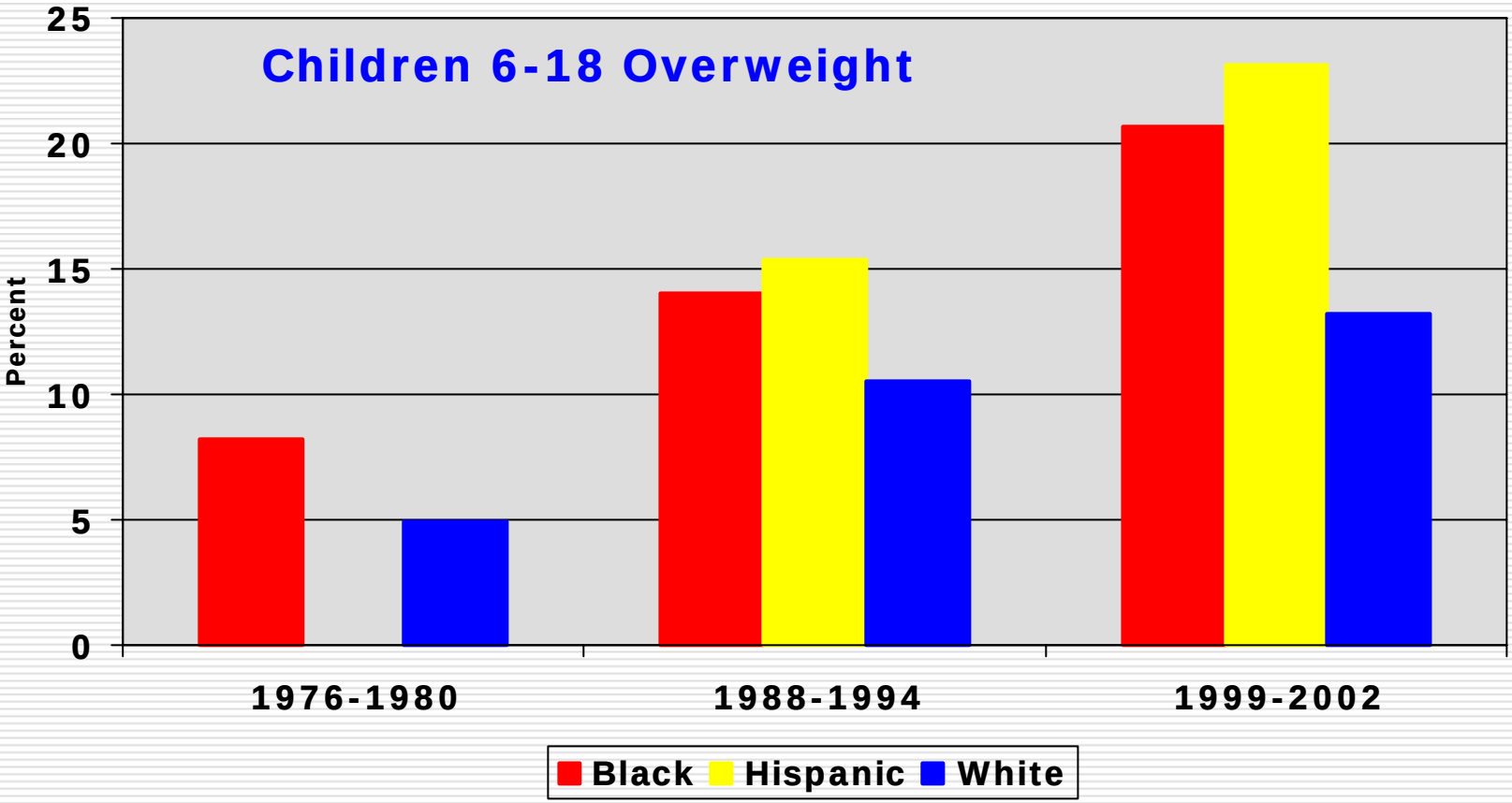
Epigenetics

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

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 ofr 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

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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

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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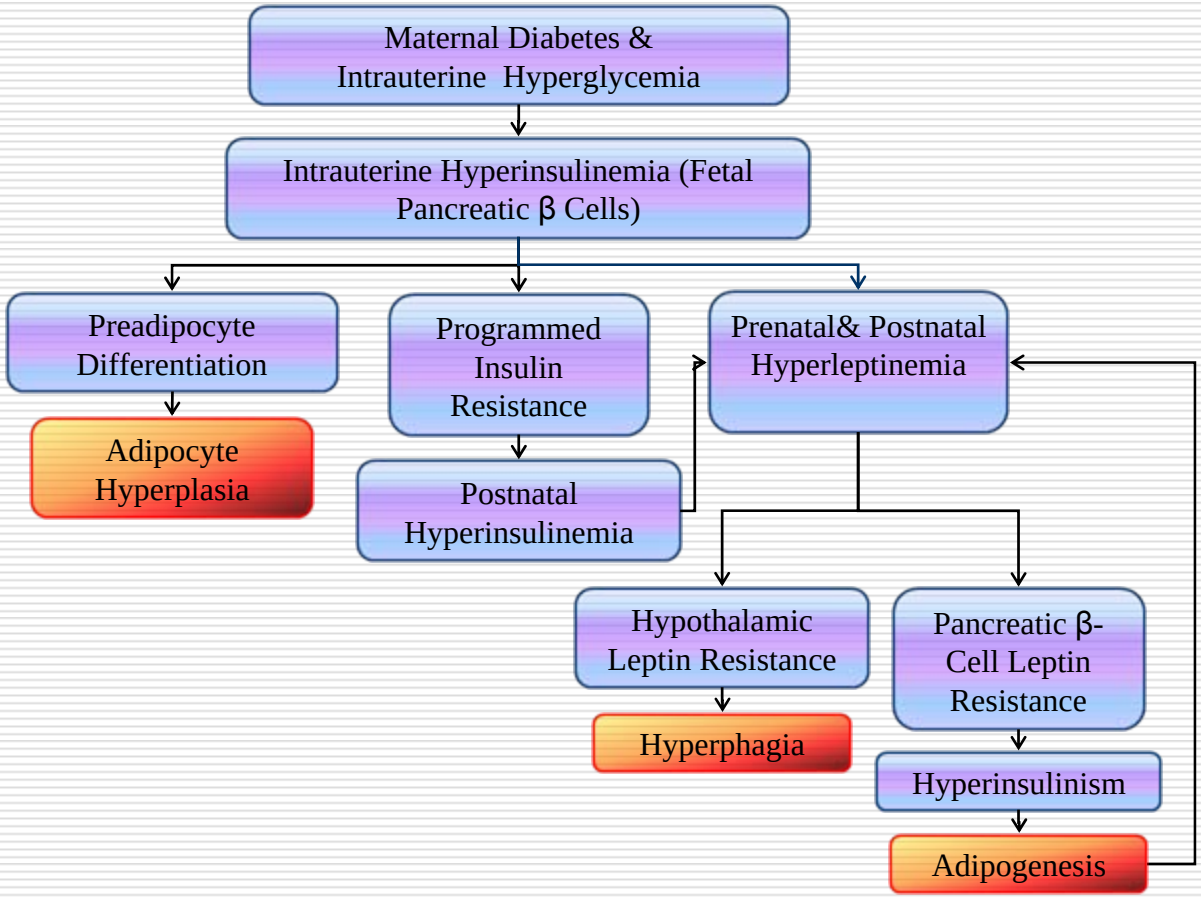
Childhood overweight and obesity is a growing problem in the United States and worldwide. The prevalence of childhood overweight in the U.S. tripled between 1980 and 2000 [1]. Today approximately 1 in 6 (16%) U.S. children are overweight with significant racial-ethnic disparities. For example, nearly 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

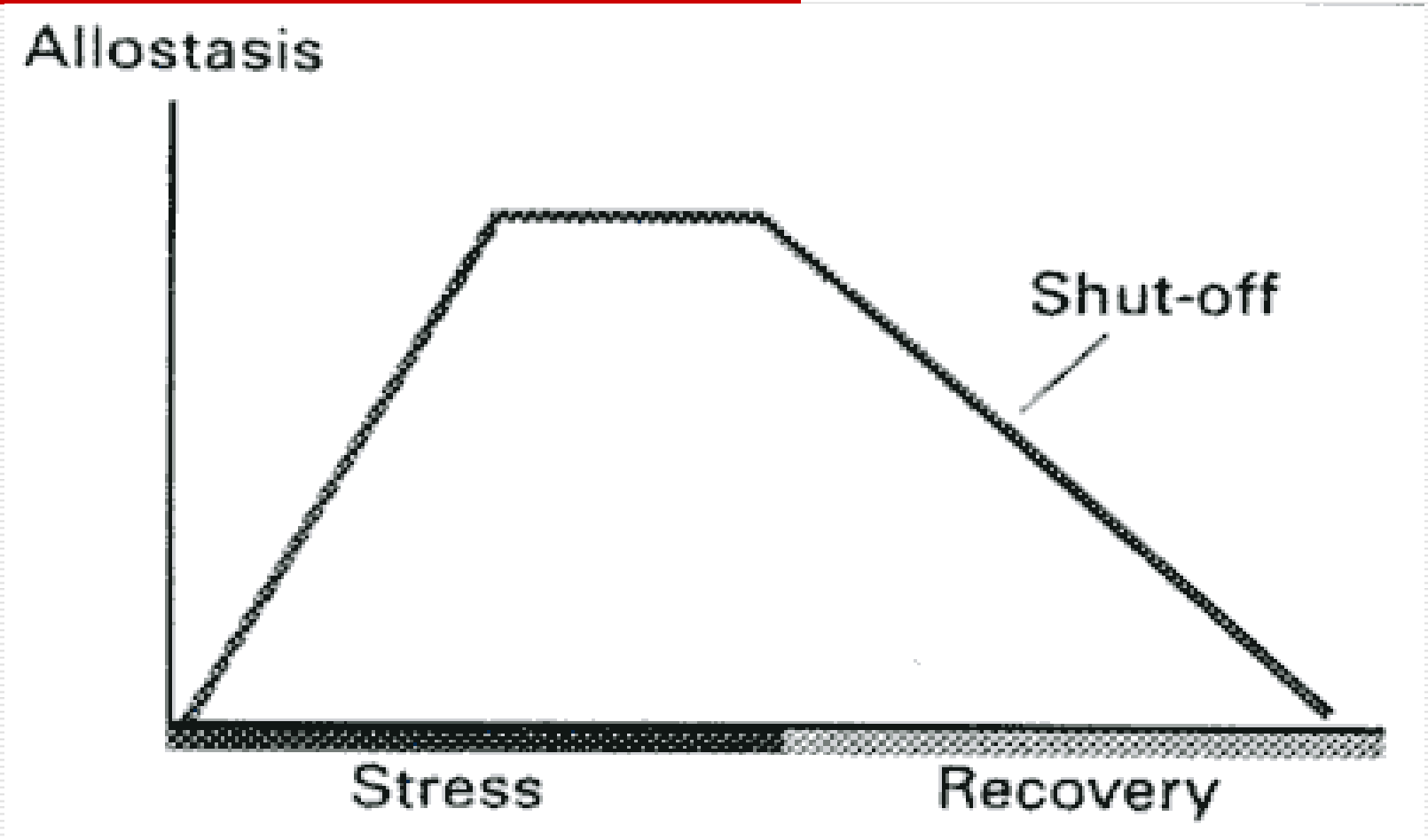
Prenatal Programming of Childhood Obesity



Cumulative Pathways

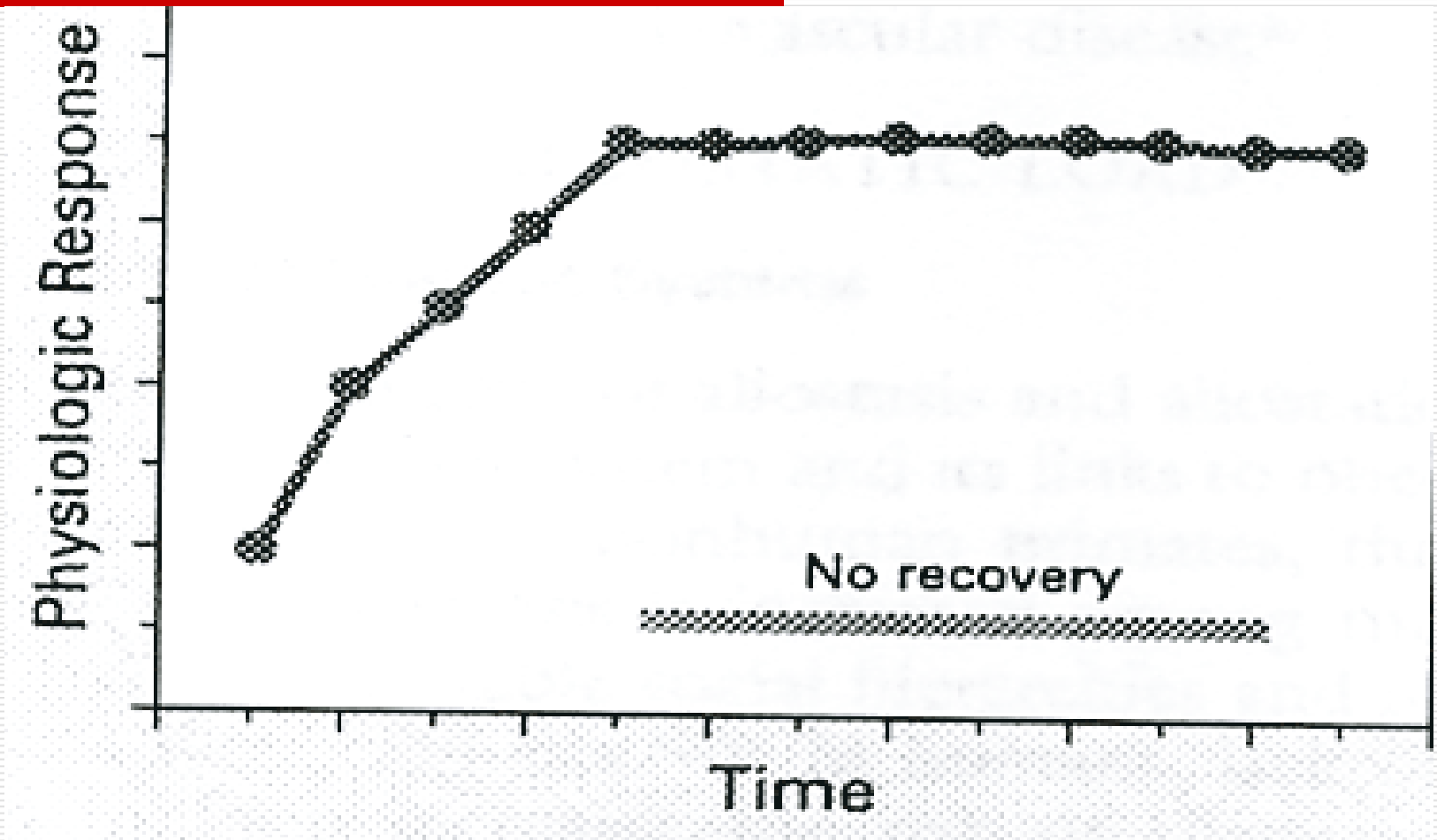
Photo: http://www.lam.mus.ca.us/cats/encyclo/smilodon/

Allostasis:
Maintain Stability through Change



McEwen BS. Protective and damaging effects of stress mediators. N Eng J Med. 1998;338:171-9.

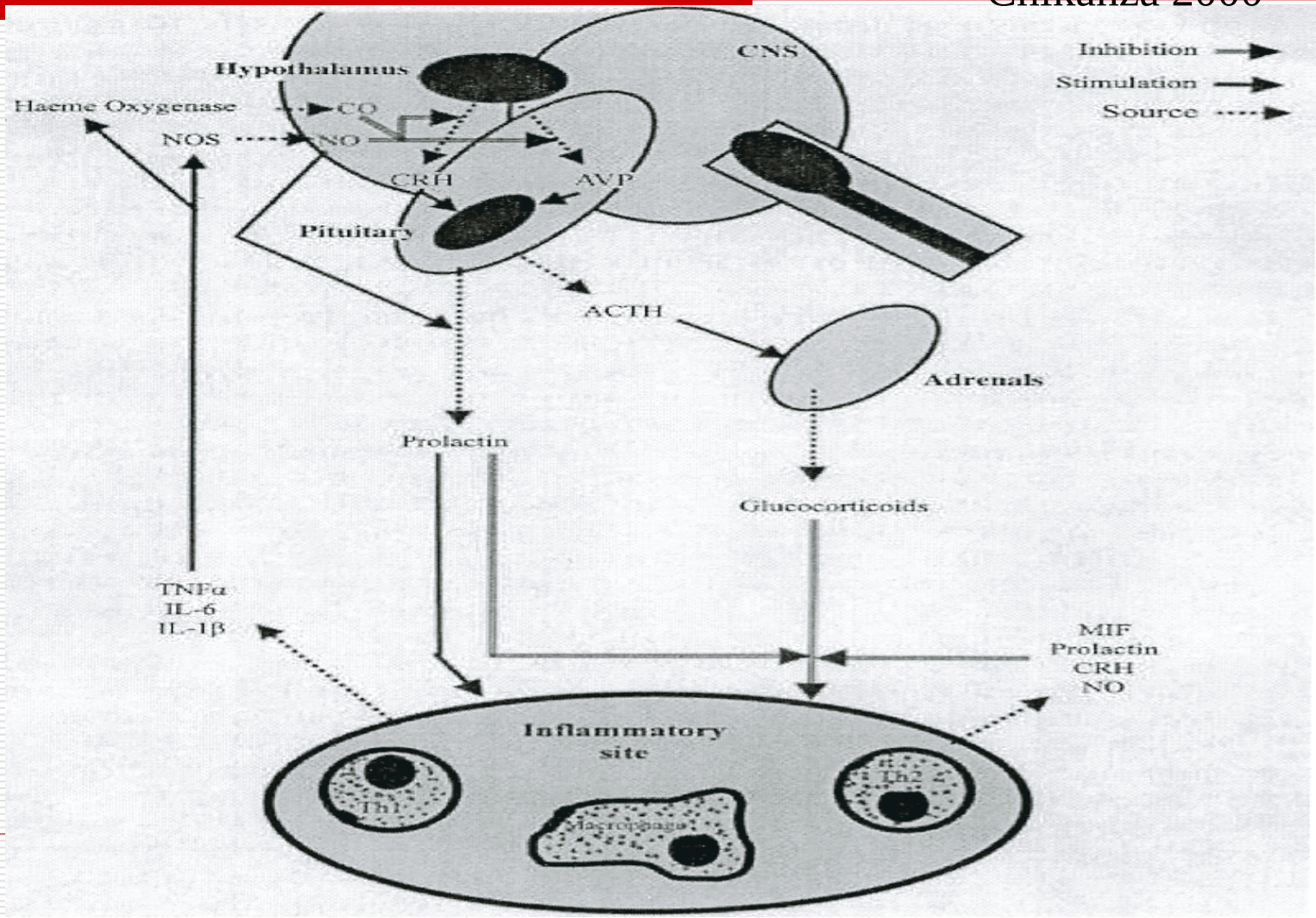
Allostastic Load:
Wear and Tear from Chronic Stress



McEwen BS. Protective and damaging effects of stress mediators. N Eng J Med. 1998;338:171-9.

HPA Axis & Immune System

Chikanza 2000



Stressed vs. Stressed Out

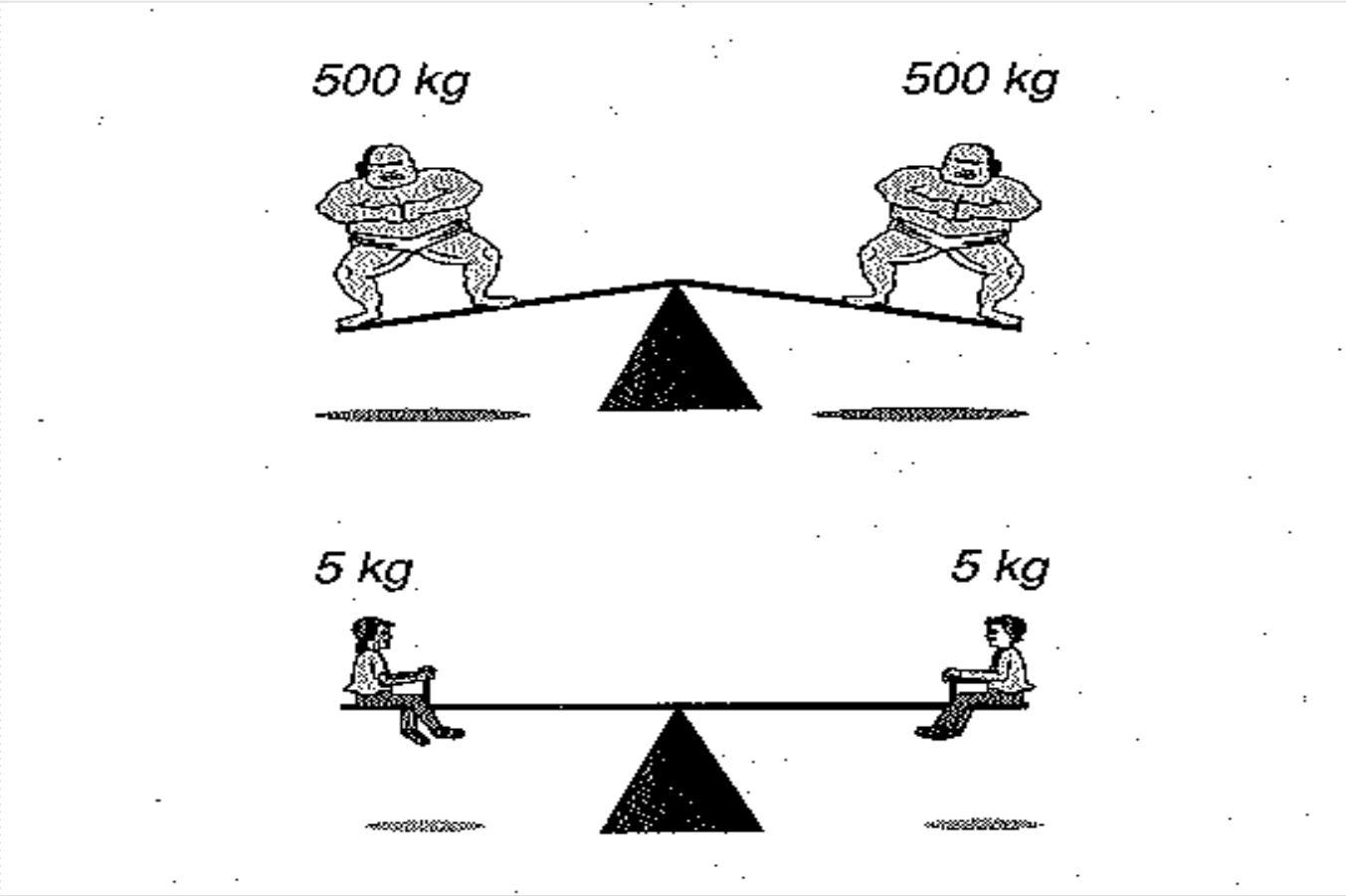
Stressed

- 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

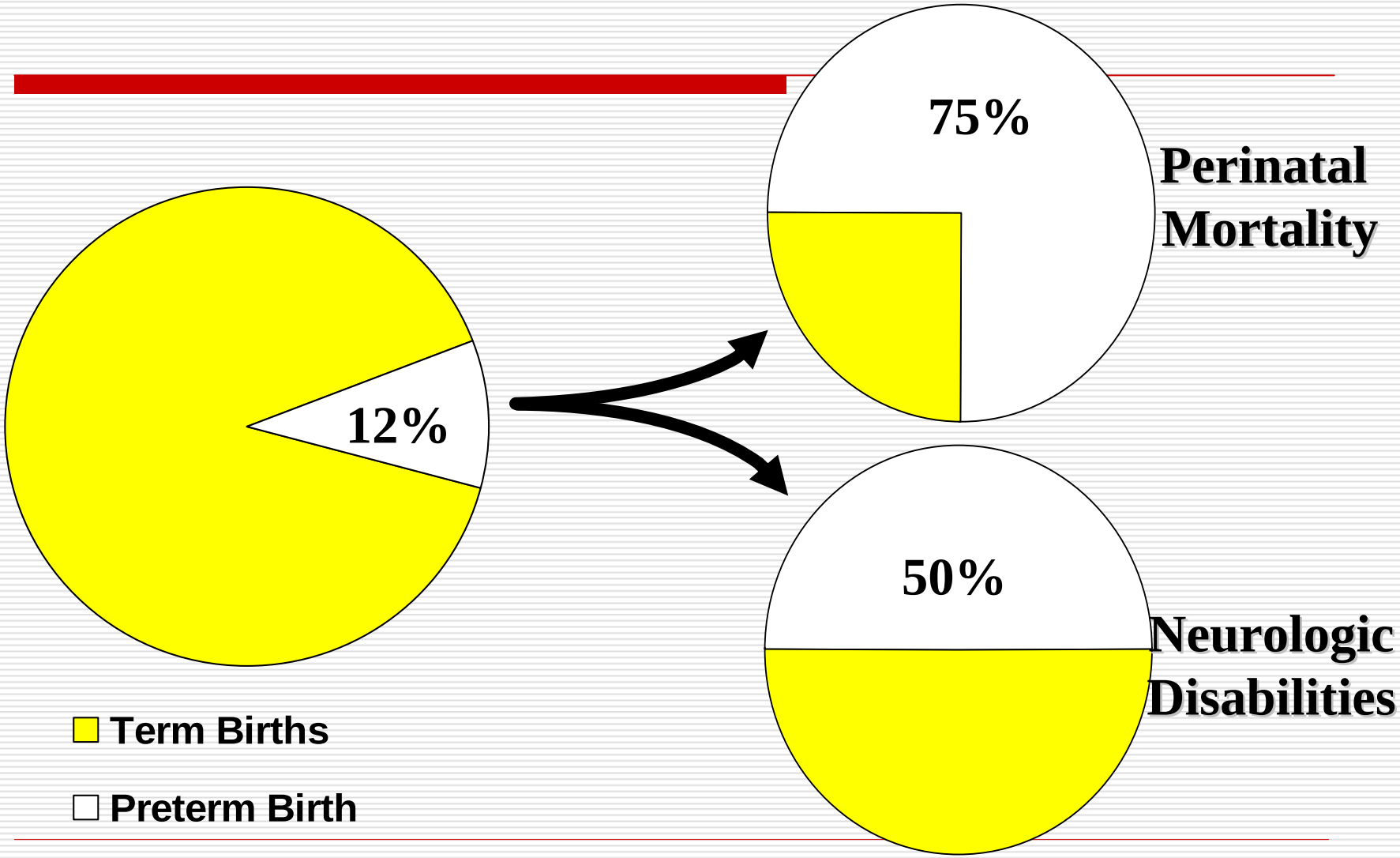


McEwen BS, Lasley EN. The end of stress: As we know it. Washington DC: John Henry Press. 2002

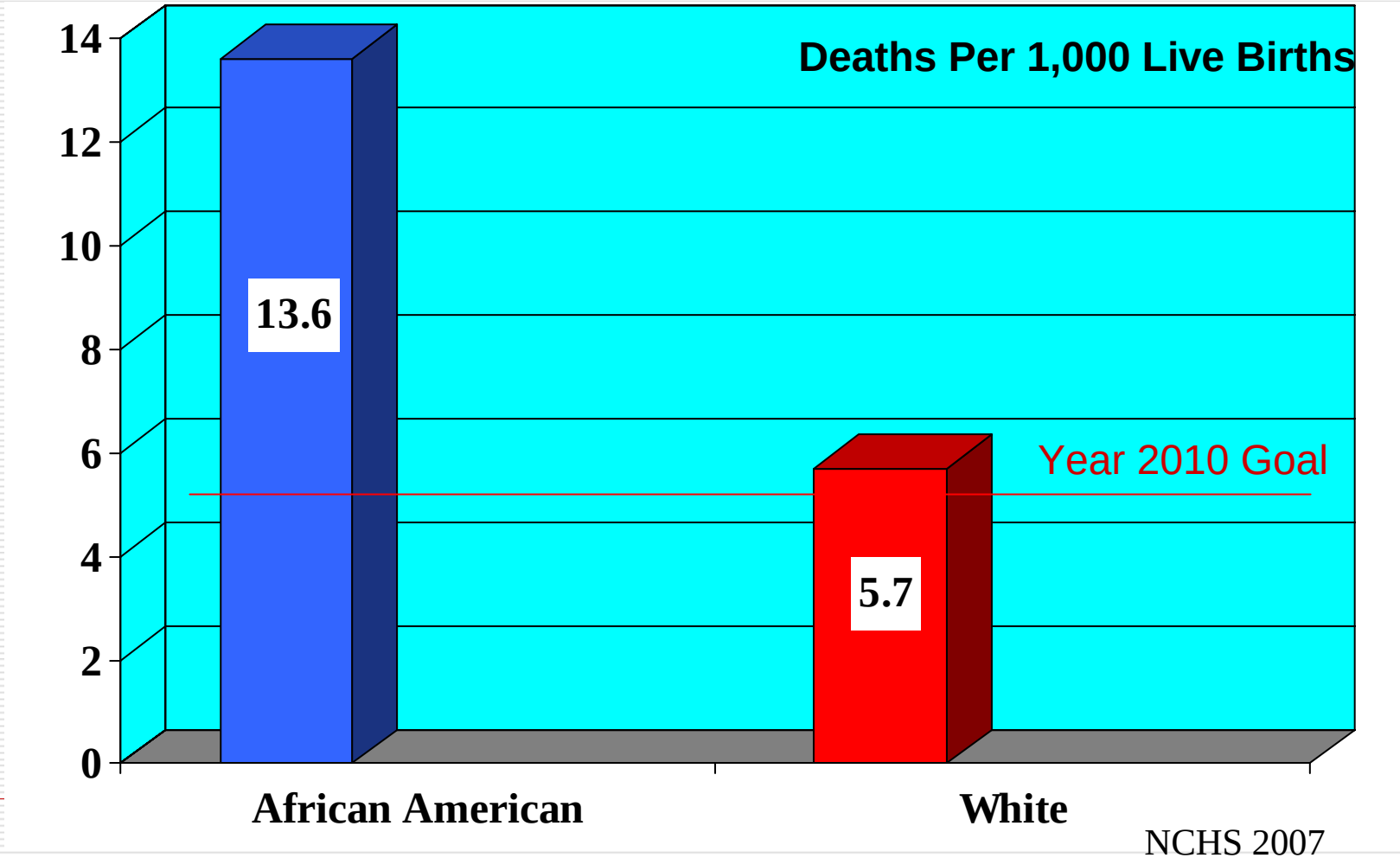
Rethinking Preterm Birth

March of Dimes

Sequelae of Preterm Birth

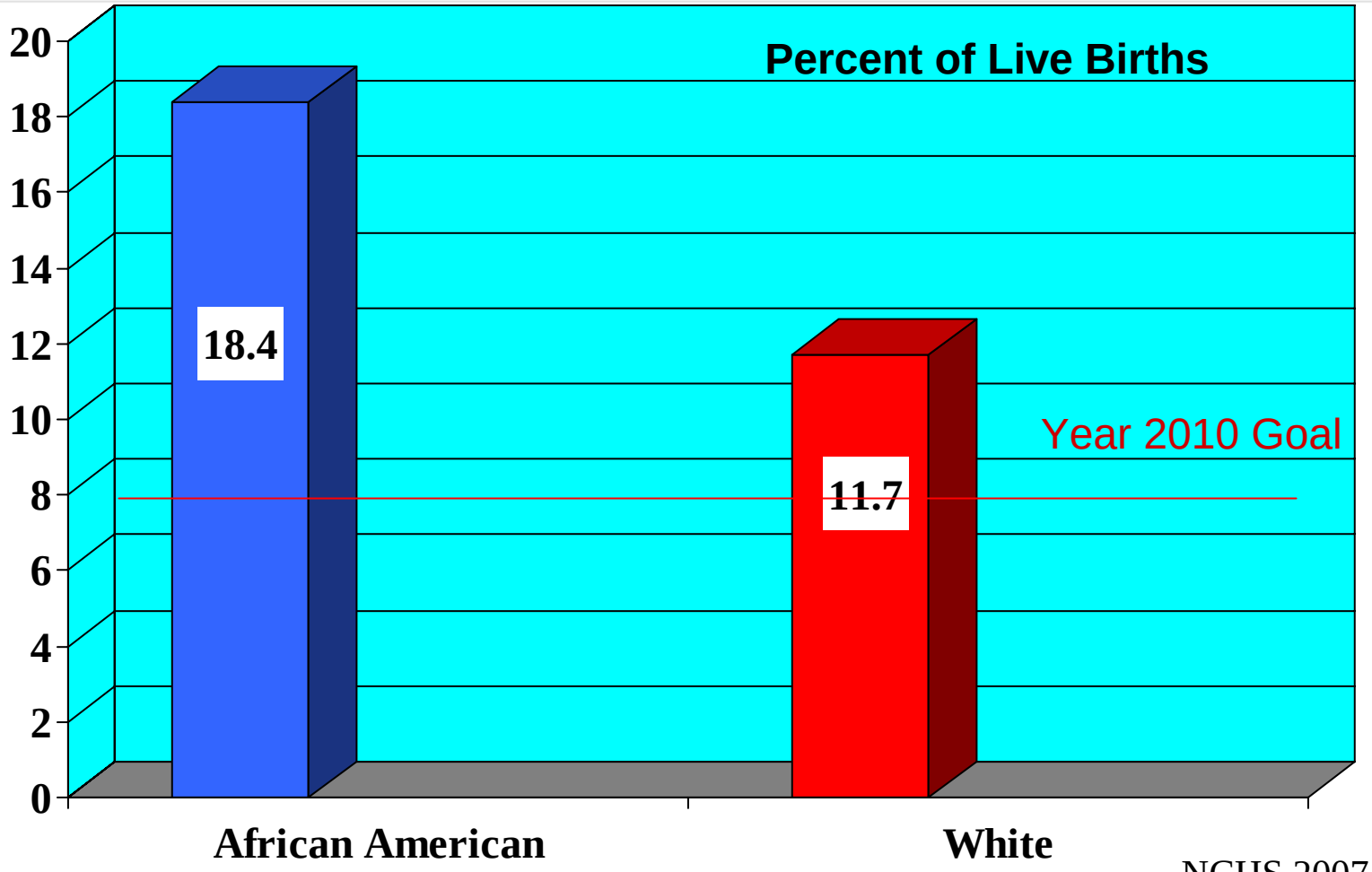


Racial & Ethnic Disparities
Infant Mortality



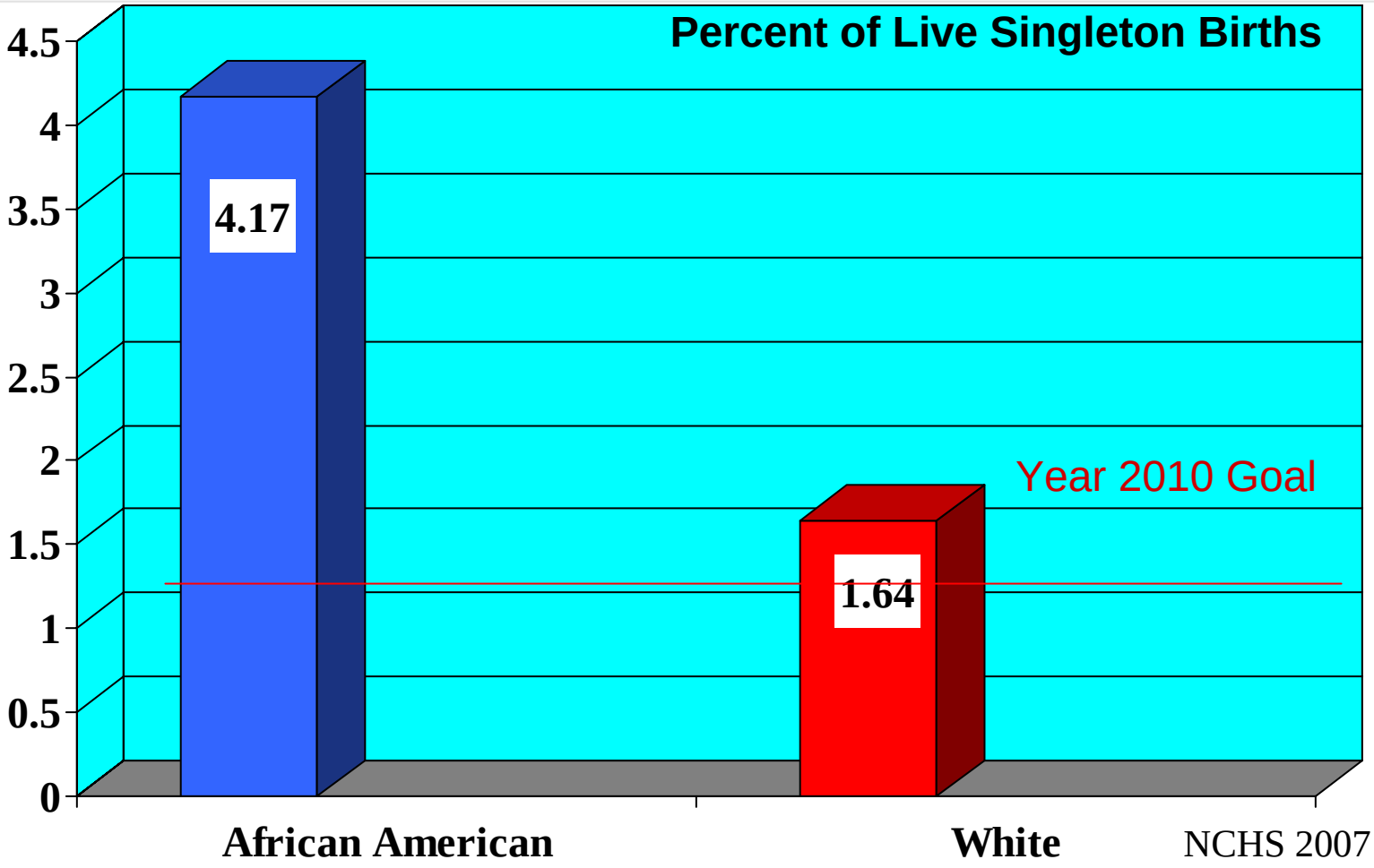
NCHS 2007

Racial & Ethnic Disparities
Preterm Births < 37 Weeks



NCHS 2007

Racial & Ethnic Disparities
Very Preterm Births < 32 Weeks

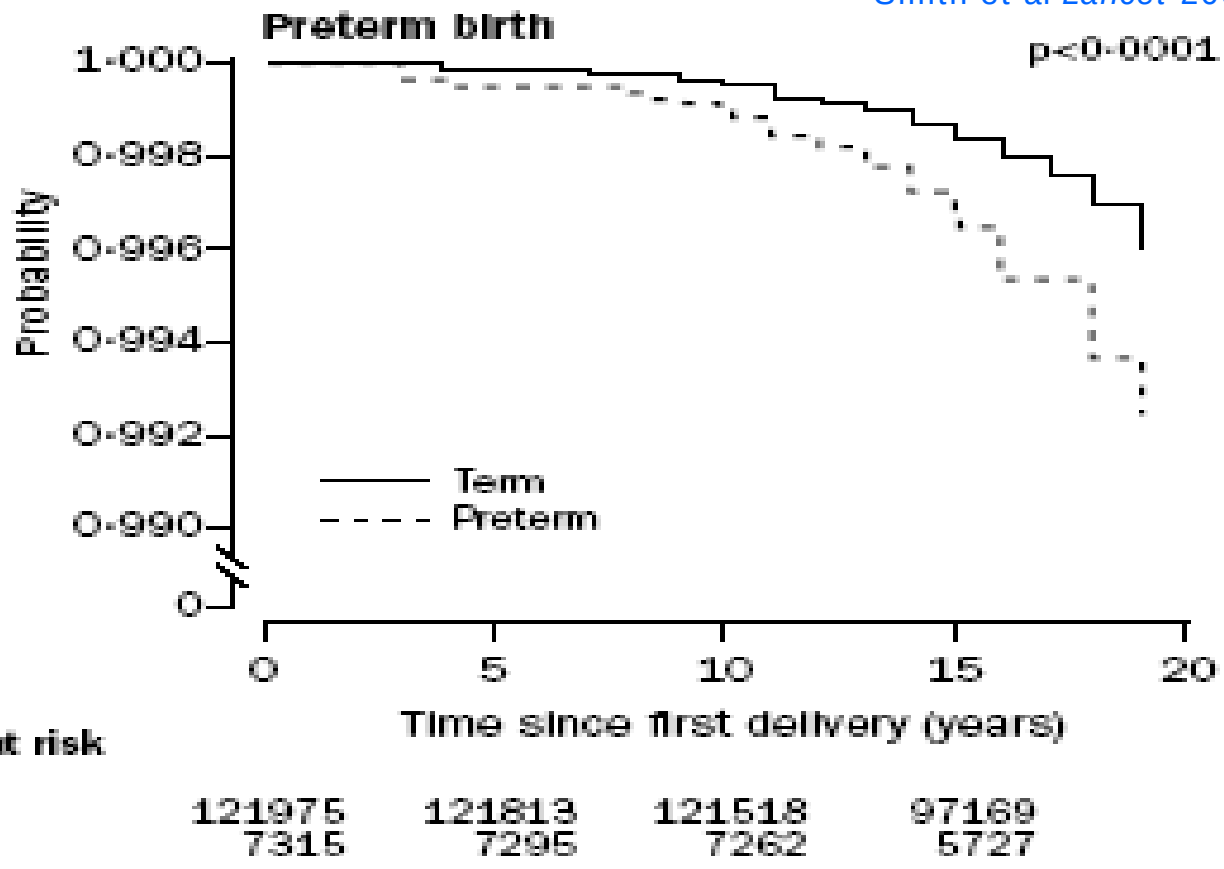


Rethinking Preterm Birth

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



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 MCH:
A Life-Course Perspective

Women's Health:
A Life-Course Perspective

Improving MCH:
A Life-Course Perspective

The life-course perspective suggests a need for an expanded approach to improve perinatal health, one that emphasizes not only risk reduction during pregnancy, but also health promotion and optimization before and between pregnancies and, indeed, across the life course. The approach needs to be both clinical and population-based, addressing individual factors as well as social determinants of perinatal health.

Access

Improve Healthcare Access
Before, Between, Beyond Pregnancy

- **Preconception & interconception care**
  - Mandated coverage & provision to override exclusions based on preexisting conditions
  - Covered service under FEHBP
  - Medicaid waiver (e.g. Illinois Healthy Women Initiative)

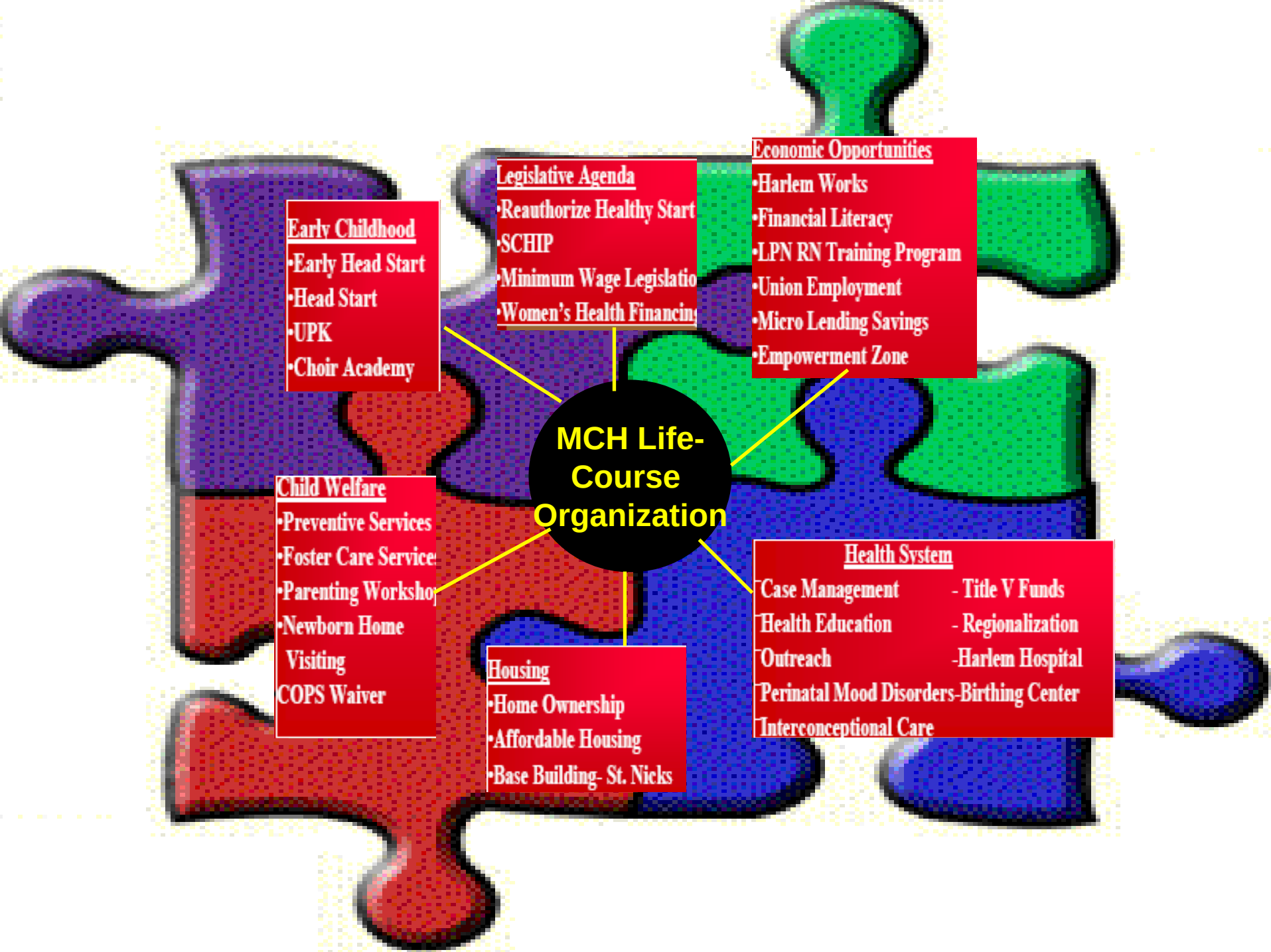
- **Comprehensive women's healthcare over the life course.**

Interconception Care

Quality

Enhance service integration
Before, Between, Beyond Pregnancy

- **Medical home for pregnancy**
  - **California's Comprehensive Perinatal Services Program (CPSP)**
- **Wellness homes across the life course**
  - **Hope Street Family Center in Los Angeles**
  - **DC Developing Families Center**


MCH Life-Course Organization
Early Childhood
•Early Head Start
•Head Start
•UPK
•Choir Academy
Legislative Agenda
•Reauthorize Healthy Start
•SCHIP
•Minimum Wage Legislatio
•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 Service
•Parenting Worksho
•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

Wellness

Invest in Wellness
Before, Between, Beyond Pregnancy

- **Wellness Trust**
  - Fund prevention (VAT, sin tax, etc)
  - Set national priorities on prevention (USPSTF)
  - effective delivery systems
  - develop an information technology backbone
  - Incentivize prevention

- **Children's Trust**

Family & Community

Strengthen Families & Communties
Before, Between, Beyond Pregnancy

- Fatherhood initiatives
- Best start zones

Reproductive Social Capital

- Features of social organization (e.g. networks, norms, and social trust) that facilitate coordination and cooperation to promote reproductive health within a community.

Reproductive Social Capital

- 100 Intentional Acts of Kindness toward a Pregnant Woman

Education

Educational Development

1. Preconception and prenatal care
2. Parenting education
3. Child care
4. Universal Preschool
5. Early Head Start and Head Start
6. K-12 – small class size, teacher quality, standards
7. After school and summer programs
8. Youth development
9. Health education/physical education
10. Comprehensive school health clinics

Educational Development

Early Childhood programs
After-school programs
Summer Programs
\+ Comprehensive school health clinics

$ 156 billion

Environment

“Now that *you’re* here,
the word of the Lorax seems perfectly clear.
UNLESS someone like you
Cares a whole awful lot,
Nothing is going to get better.
It’s not.
“SO…
Catch!” calls the Once-ler.
He lets something fall.
“It’s a Truffula Seed.
It’s the last one of all!
You’re in charge of the last of the Truffula Seeds.
And Truffula Trees are what everyone needs.
Plant a new Truffula. Treat it with care.
Give it clean water. And feed it fresh air.
Grow a forest. Protect it from axes that hack.
Then the Lorax
And all of his friends
May come back.”

- Dr. Seuss, *the Lorax*

Policy

Maternity Leave

Country	Weeks before delivery	Weeks after delivery	Salary
USA	4	6	No
UK	10 + 5 days	25 + 5 days	Yes
France	6 + 3 days	8 + 5 days	Yes
Germany	7 + 3 days	8	Yes
Italy	8 + 5 days	12 + 6 days	Yes
Spain	16	6	Yes
Finland	4	37	Yes
Czech Republic	6	22	Yes

Adjusted from ILO Report of 1998

Expand Parental Leave

- Only 45% of parents working in private sector have guaranteed unpaid parental leave through FMLA
- Only 5% have paid parental leave

- **Expand paid leave**
  - Unemployment insurance
  - Temporary disability insurance
  - New social insurance
  - New cash benefits program

We Can
Do Better

- The definition of insanity is doing the same thing over and over and expecting different results

Benjamin Franklin

- "We must become the change we want to see."

- MOHANDAS GANDHI

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"Never, ever, think outside the box."