

How to Make a Smart & Healthy Baby: *What You Need to Know BEFORE You Get Pregnant*

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Acknowledgements

- Hawaii State Department of Health
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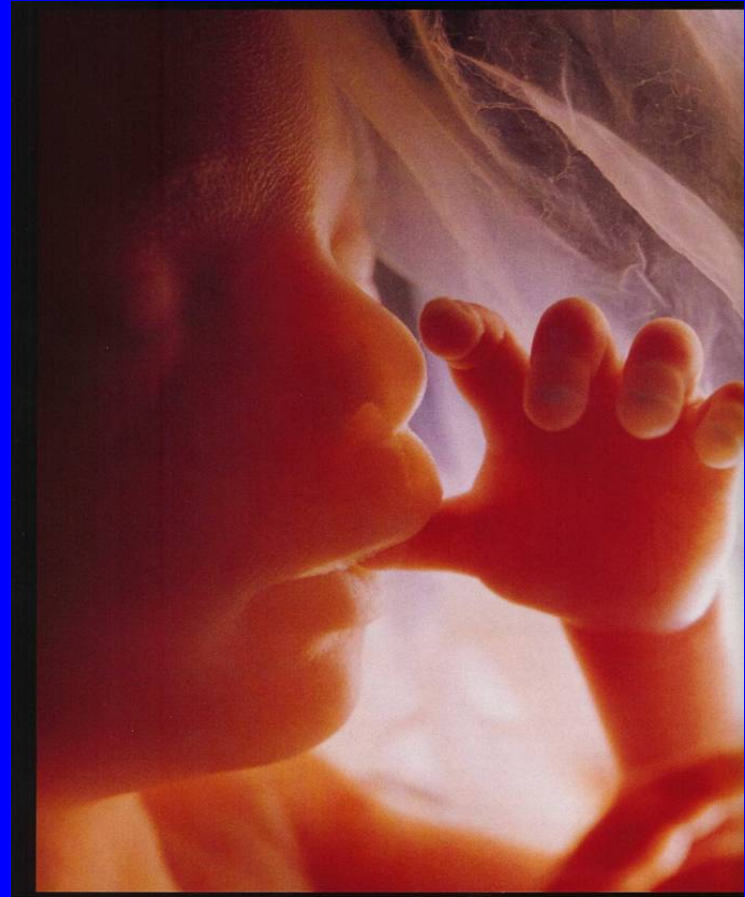
Outline

- Developmental programming
 - Allostasis and allostatic load
 - How to make a smart and healthy baby
-

Developmental Programming

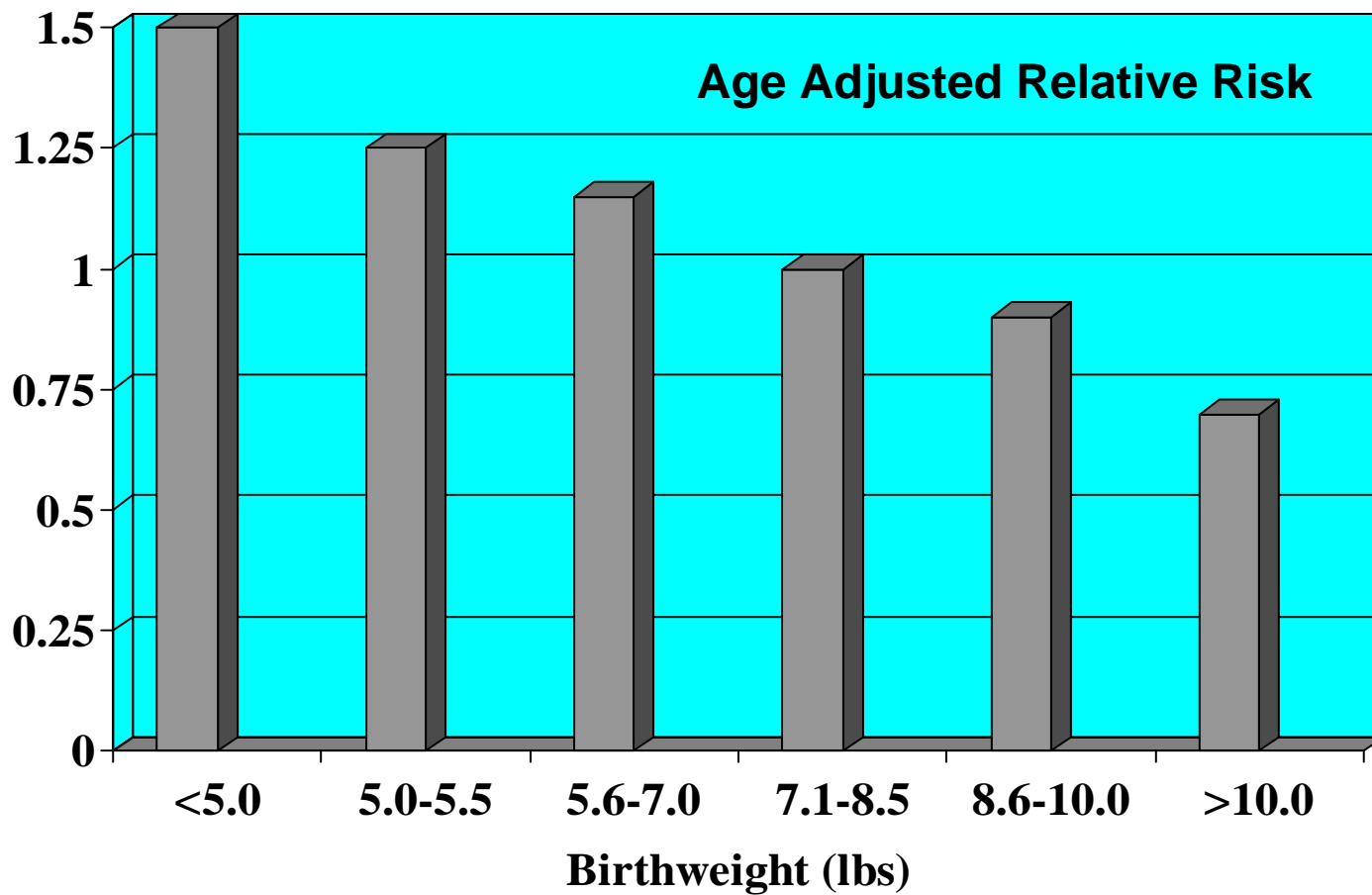
Developmental Programming

The process whereby a stimulus or insult, at a sensitive or 'critical' period, has lasting or lifelong impact on health or function.



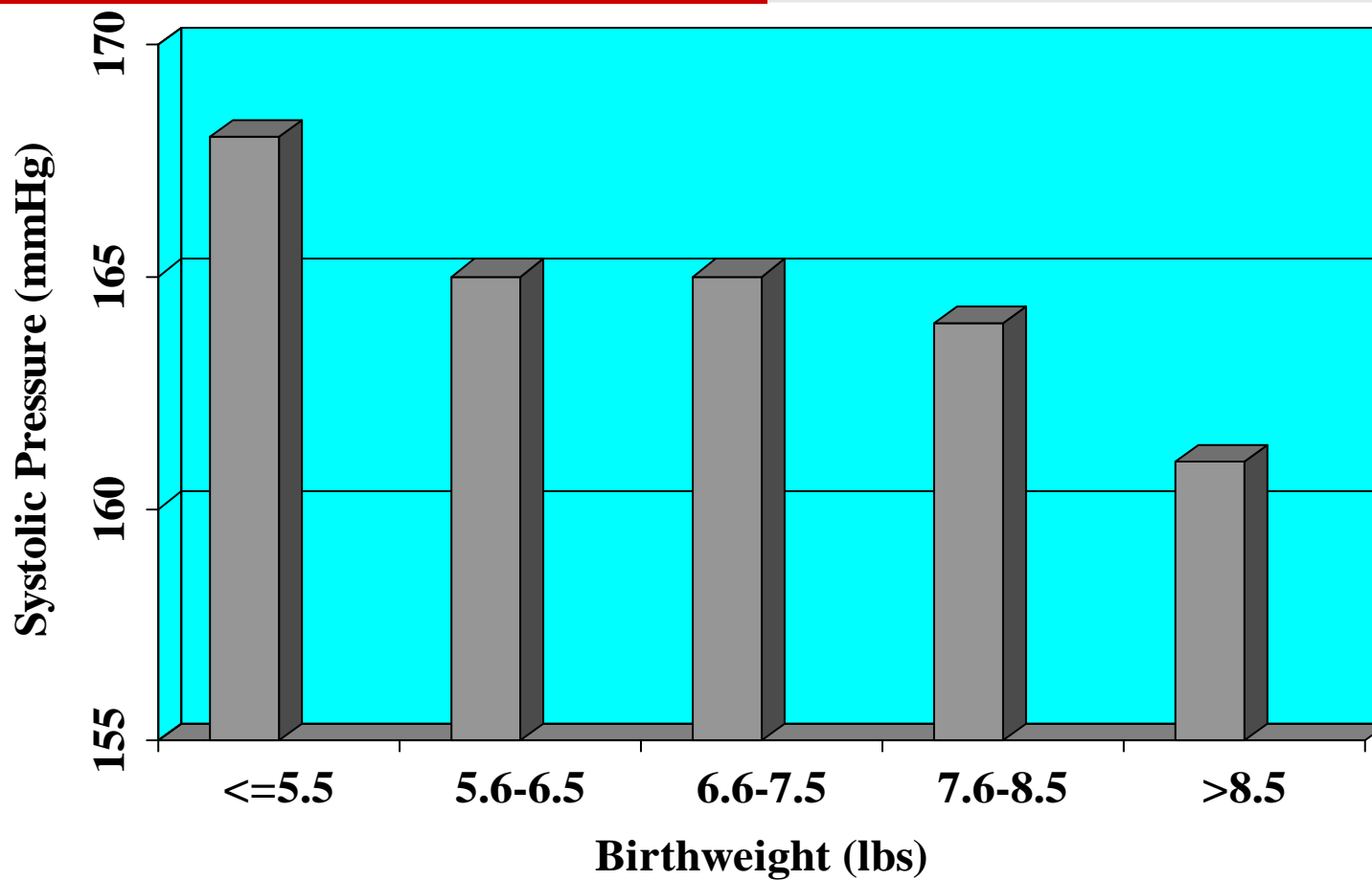
Barker Hypothesis

Birth Weight and Coronary Heart Disease



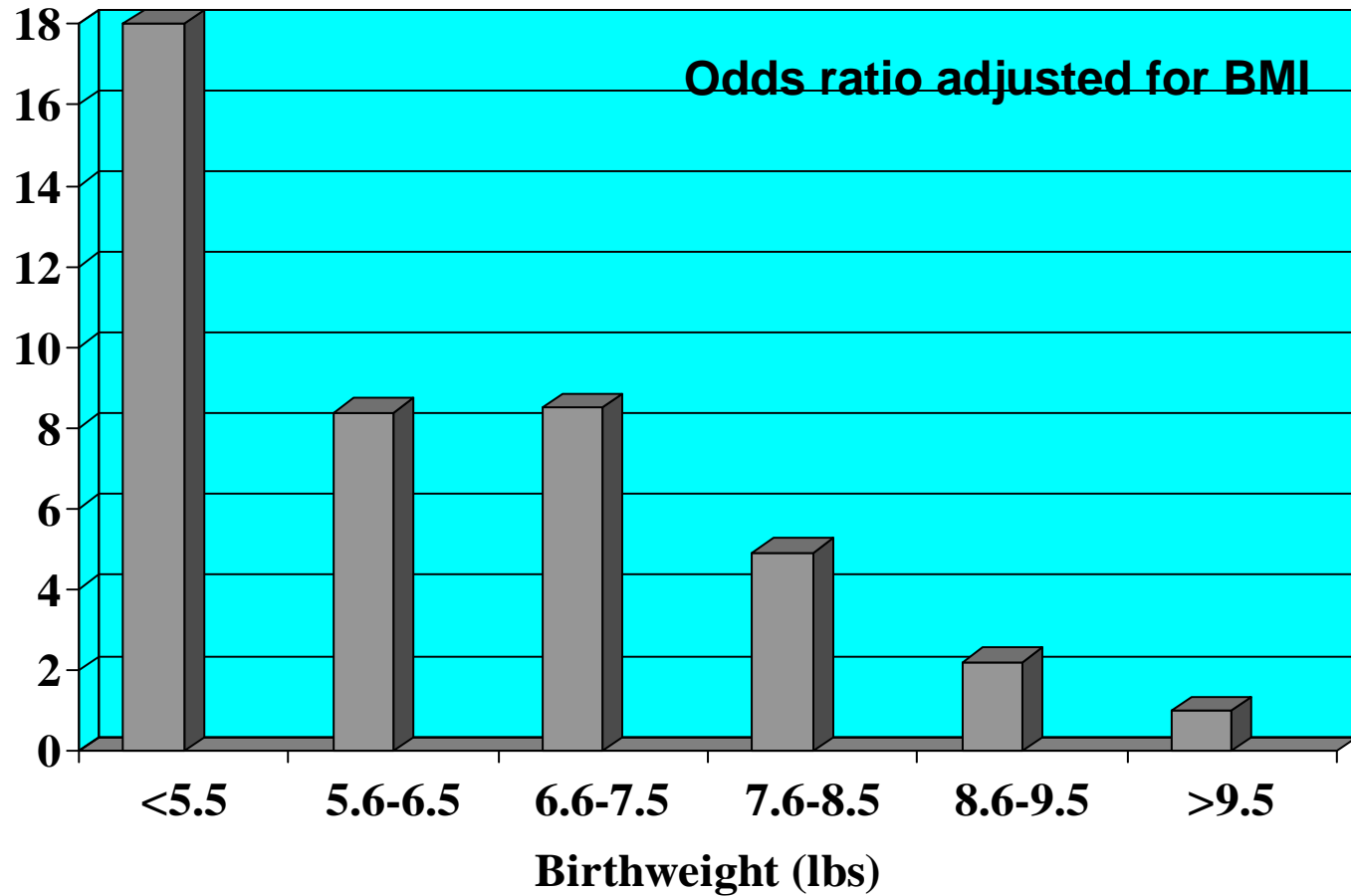
Barker Hypothesis

Birth Weight and Hypertension



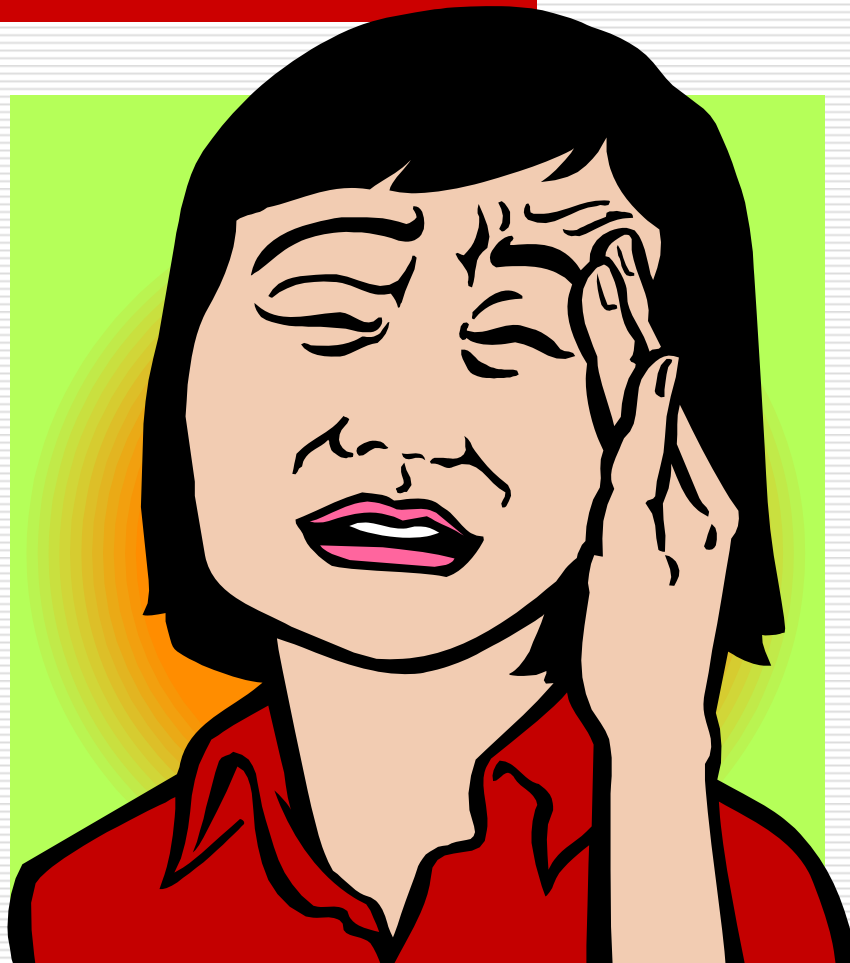
Barker Hypothesis

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

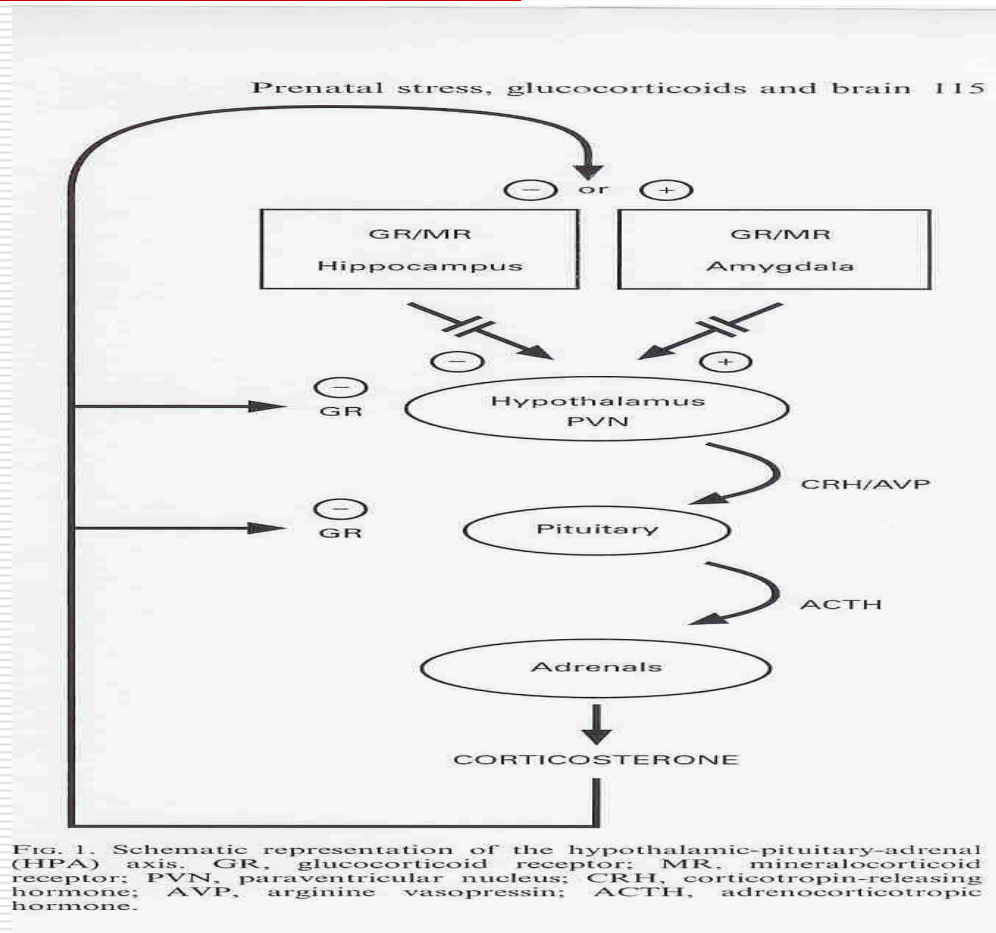


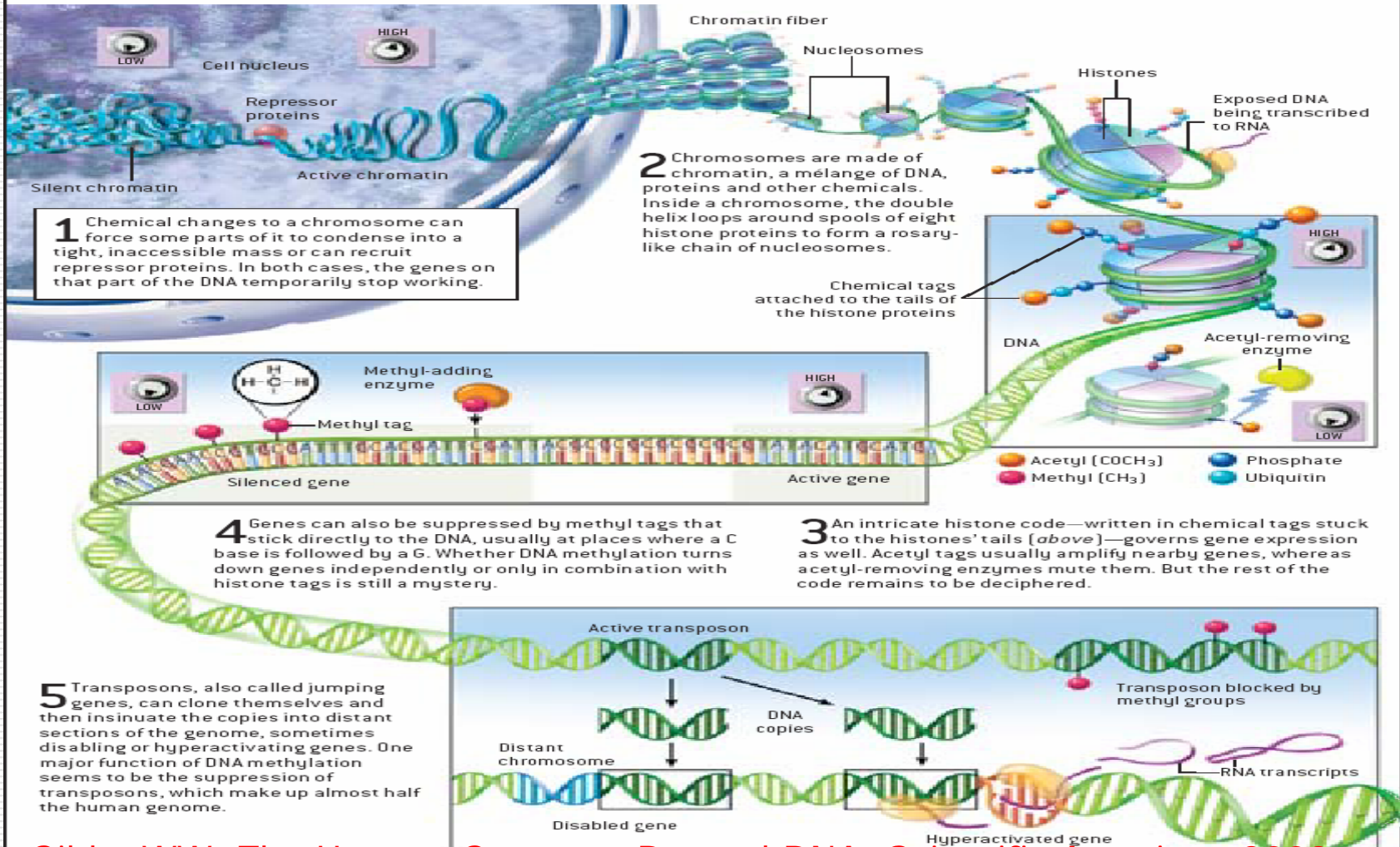
FIG. 1. Schematic representation of the hypothalamic-pituitary-adrenal (HPA) axis. GR, glucocorticoid receptor; MR, mineralocorticoid receptor; PVN, paraventricular nucleus; CRH, corticotropin-releasing hormone; AVP, arginine vasopressin; ACTH, adrenocorticotropic hormone.

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



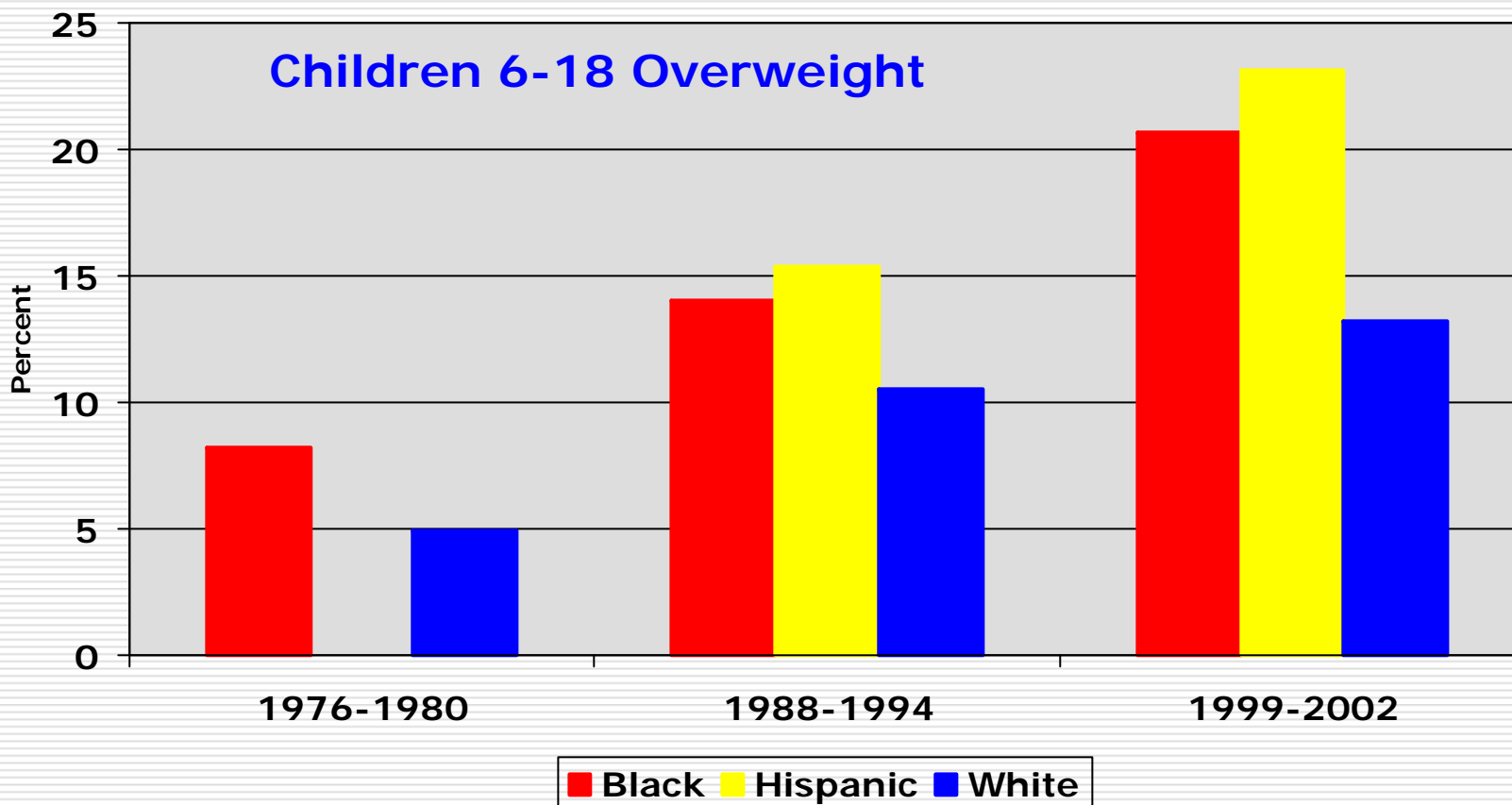
R.A. Waterland, R.A. Jirtle, "Transposable elements: targets for early nutritional effects on epigenetic gene regulation," *Mol Cell Biol*, 23:5293-300, 2003. Reprinted in [the New Scientist 2004](#)

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

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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 MDCconsult 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].

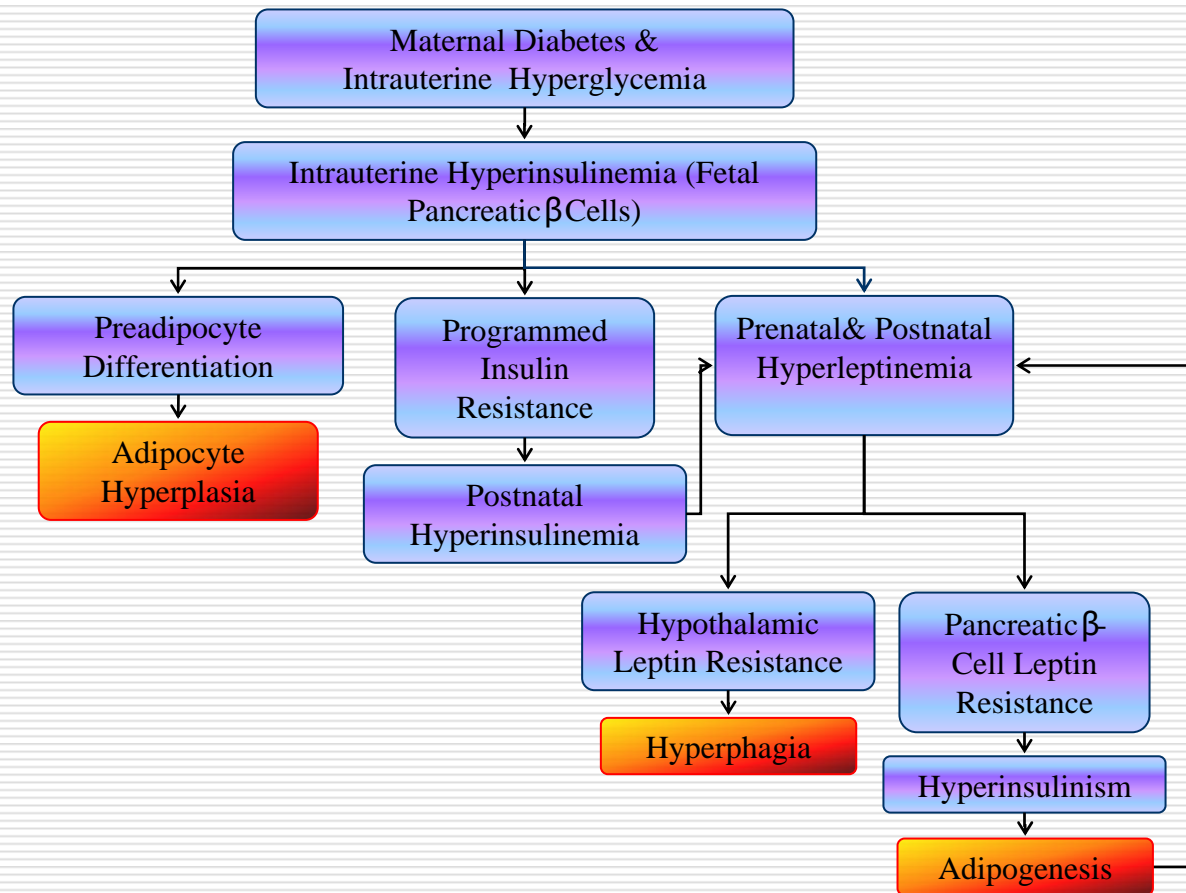
Overweight and obesity has significant lifelong consequences on the health and well-being of children [2, 3]. Childhood obesity is associated with early-onset Type II diabetes mellitus, hypertension, metabolic syndrome, and sleep apnea. It is also associated with cognitive or intellectual impairment 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



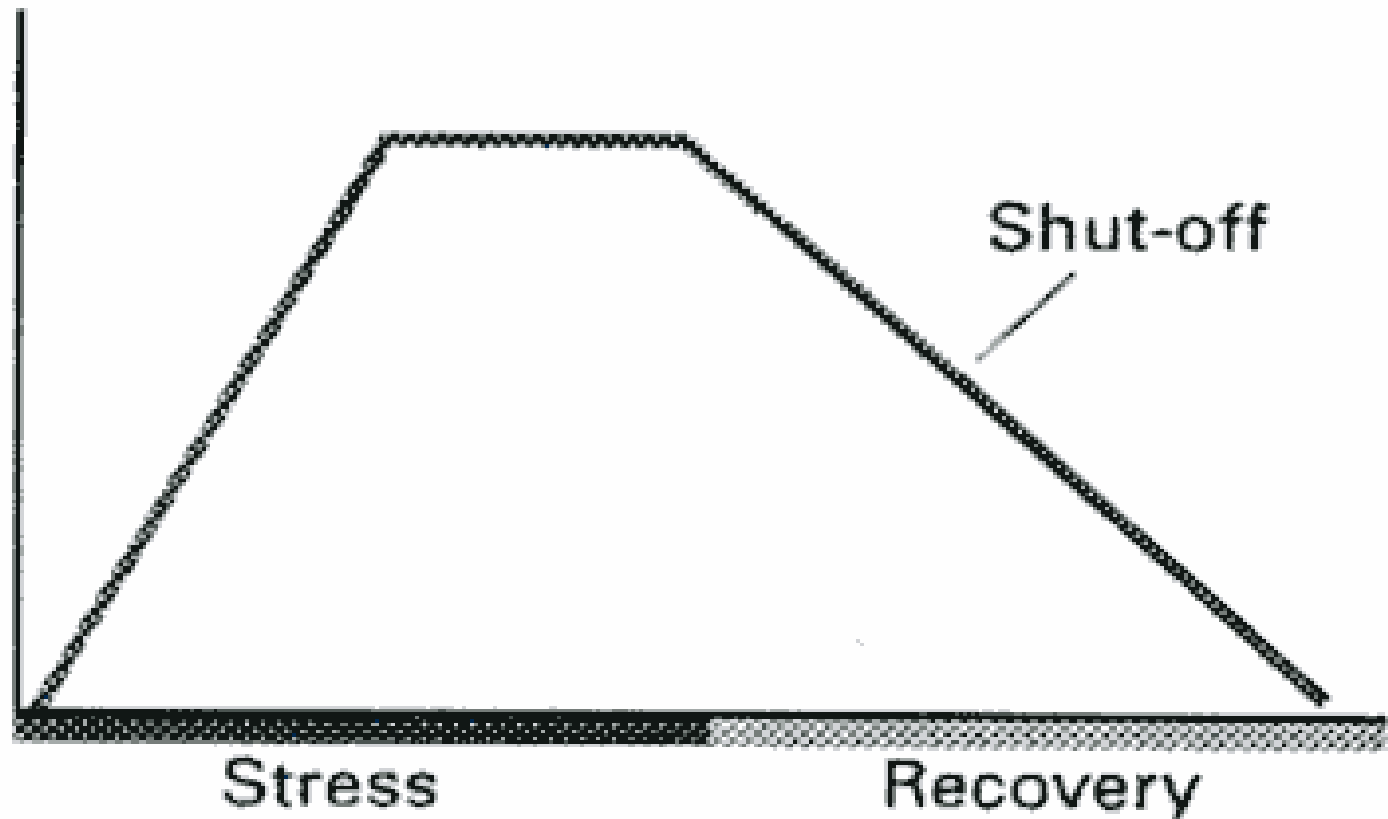
Allostasis



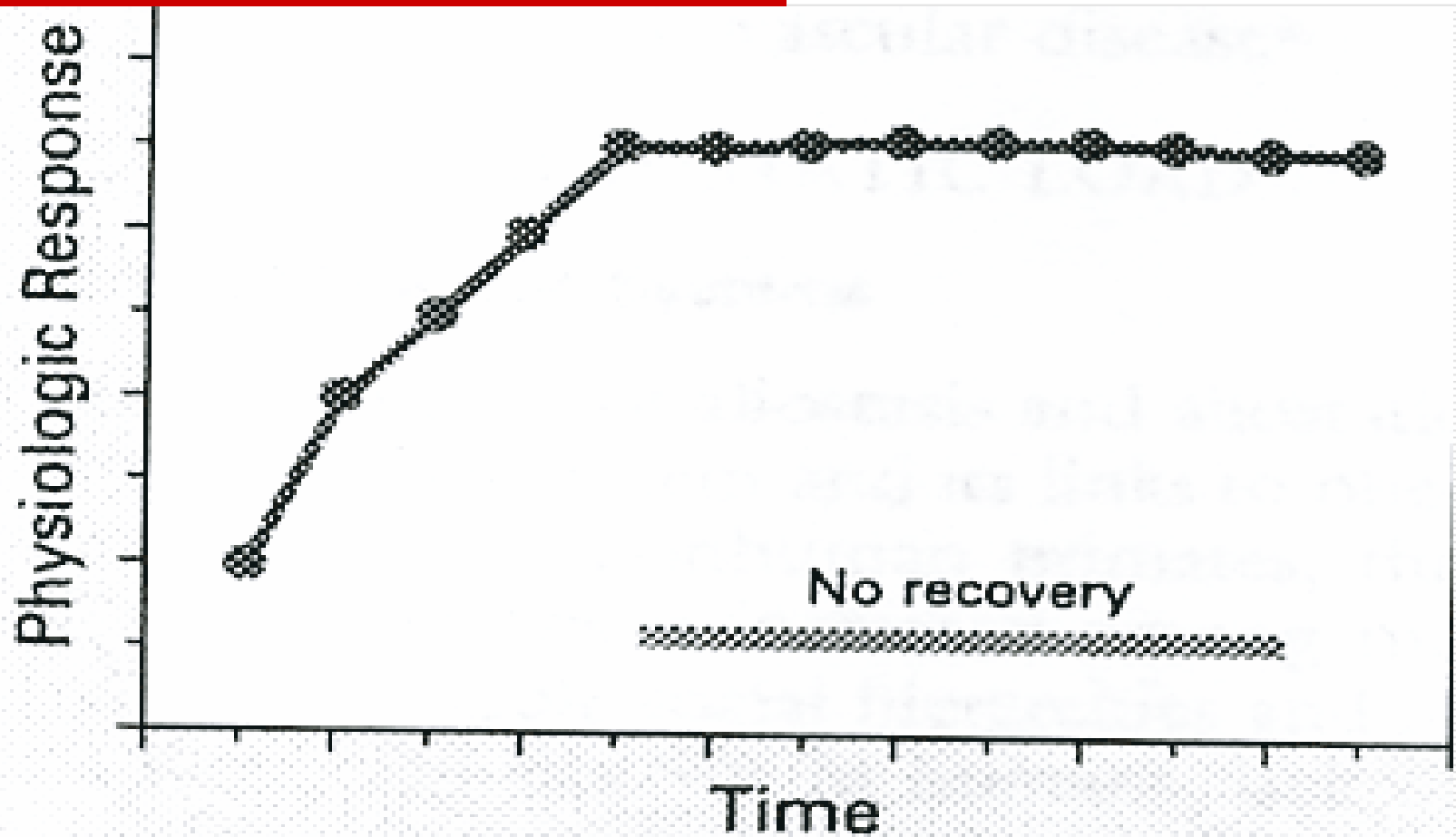
Photo: <http://www.lam.mus.ca.us/cats/encyclo/smilodon/>

Allostasis: Maintain Stability through Change

Allostasis



Allostatic Load: Wear and Tear from Chronic Stress



Stressed vs. Stressed Out

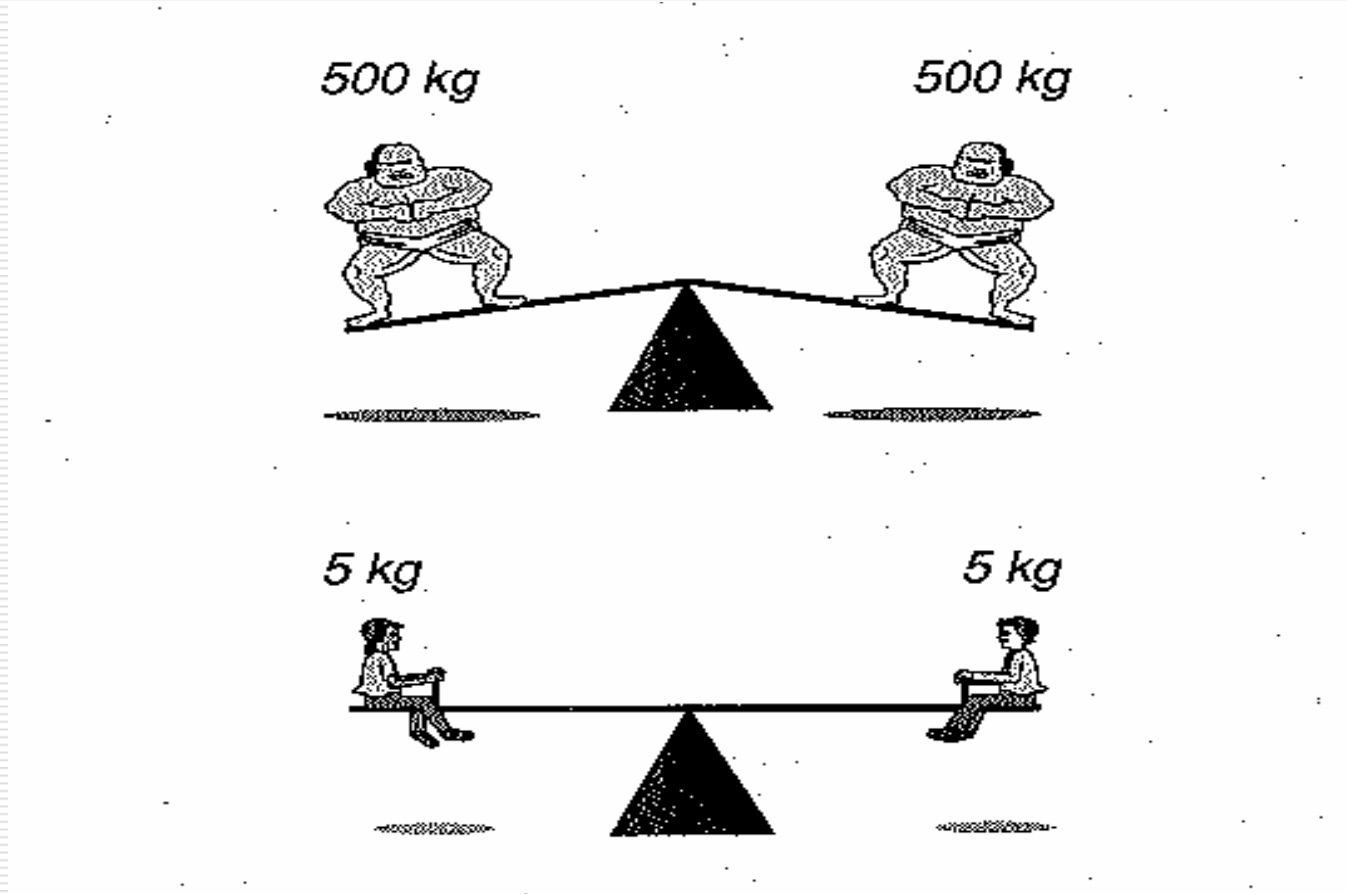
□ Stressed

- 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



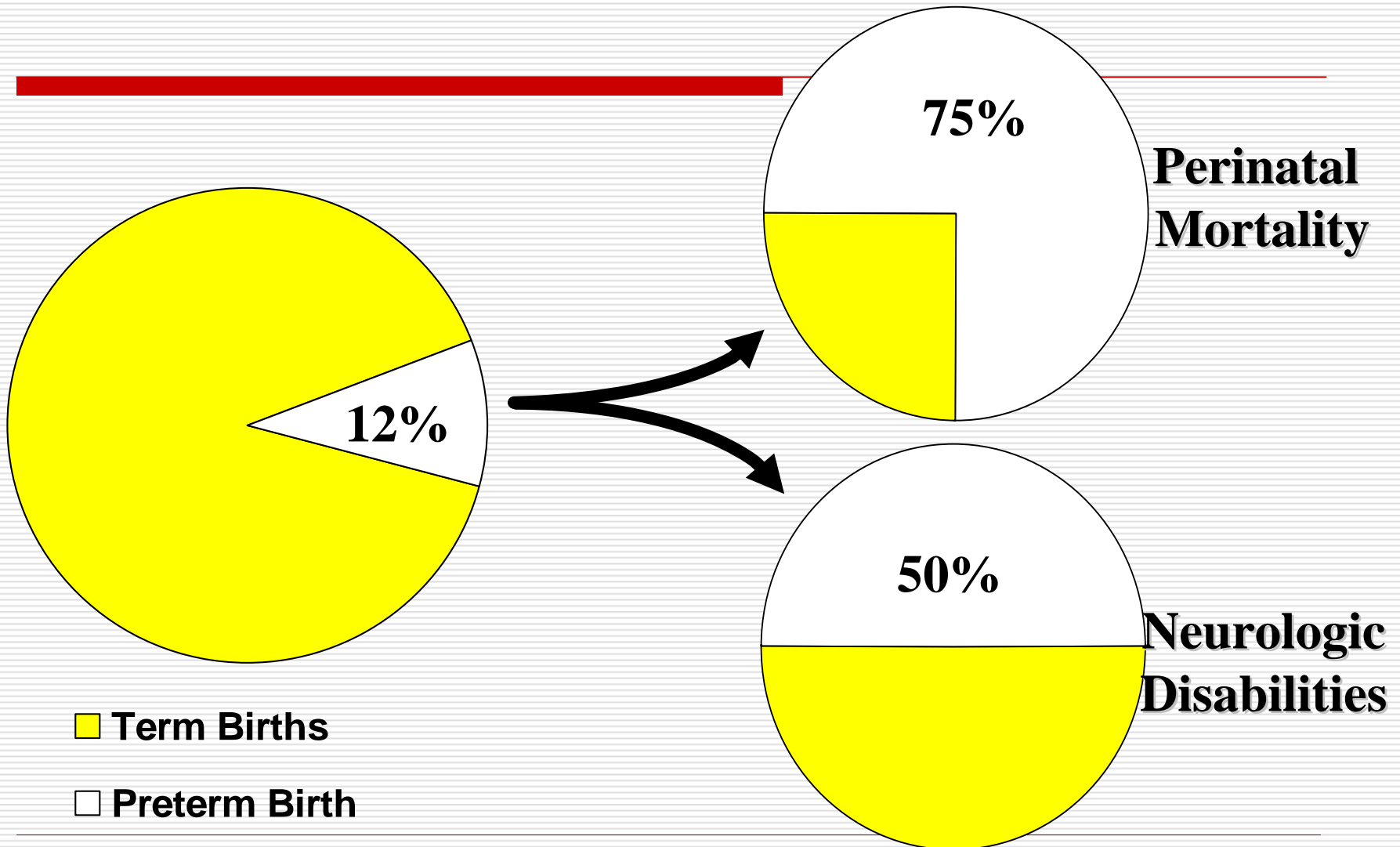
Rethinking Preterm Birth



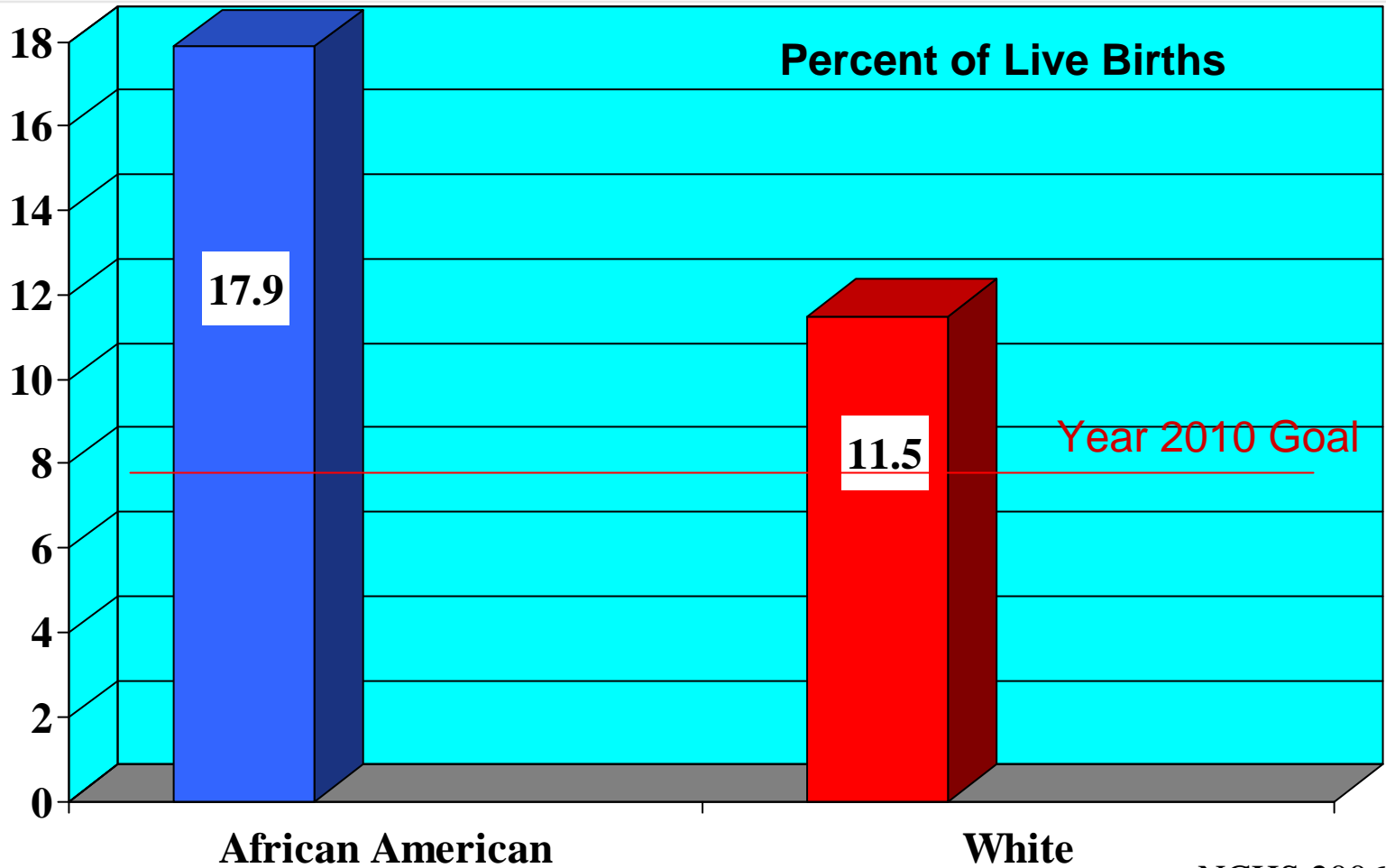
WARNING

TO PREVENT INFANT FALL WHEN
• DO NOT LEAVE INFANT UNATTENDED
• DO NOT
YOUNG CHILD

Sequelae of Preterm Birth

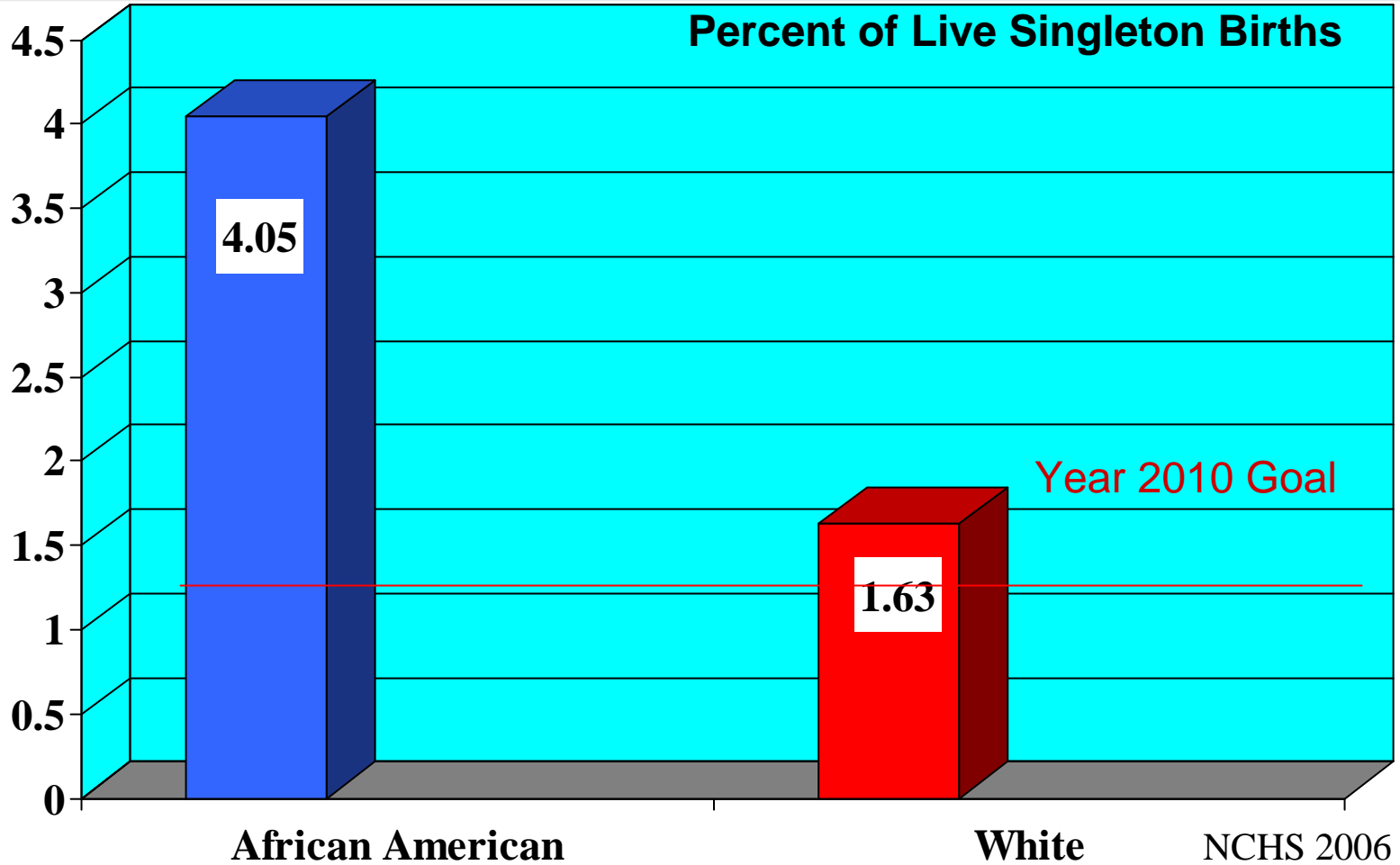


Racial & Ethnic Disparities Preterm Births < 37 Weeks

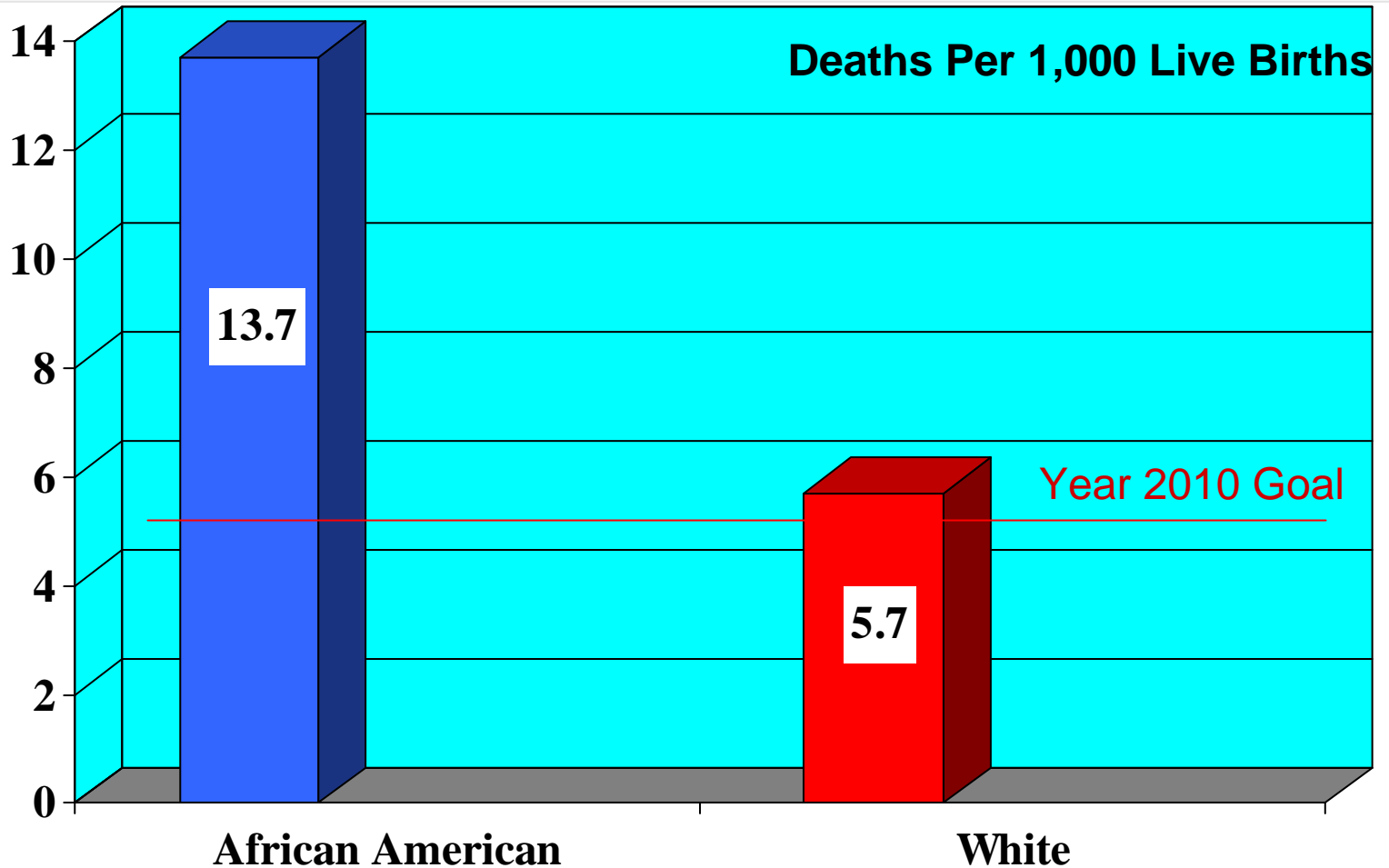


Racial & Ethnic Disparities

Very Preterm Births < 32 Weeks



Racial & Ethnic Disparities Infant Mortality



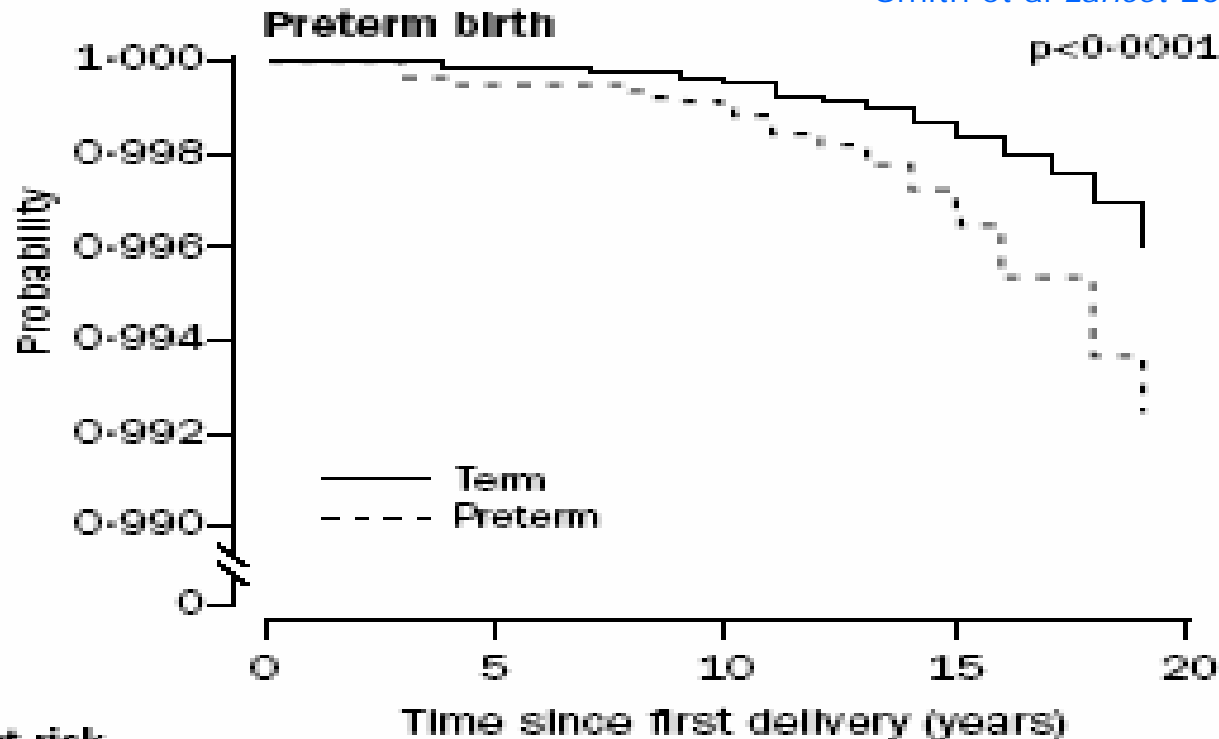
NCHS 2006

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

How To Make A Smart & Healthy Baby

What You Need to Know
BEFORE
You Get Pregnant

1.

**Nutritional
Preparedness**

Achieve A Healthy Pre-Pregnancy Weight

- Underweight: BMI < 18.5
- Normal: BMI = 18.5-24.9
- Overweight: BMI = 25-29.9
- Obese BMI \geq 30

Achieve A Healthy Pre-Pregnancy Weight

- For weight loss,
 - Decrease calories in
 - Increase calories out (exercise)
 - Keep track of weight & nutrition

- Maintain a healthy weight for 3-6 months before pregnancy

Eat A Balanced Diet Everyday

- ❑ Whole grain foods: 5-7 servings
- ❑ Plant oils: 6 teaspoons
- ❑ Vegetable and fruits: 5 servings
- ❑ Nuts, beans and lentils: ½ to 1 cup
- ❑ Fish, poultry or egg
- ❑ Dairy: 3 servings
- ❑ Multivitamin: 1 a day

Make Every Calorie Count

- Determine how many calories you need
- Count your calories
- Avoid empty calories
 - Keep to <265 Kcal/day
- Make food substitutions
 - Baked sweet potato: 101 Kcal
 - Medium fries w/ ketchup: 478 calories with 238 empty calories
- Don't supersize
- Bring snacks to work
- Avoid fast foods
- Avoid stress eating

My Pyramid

www.mypyramid.gov

Carbs:

Low-Carb Diet for Pregnancy?

- ❑ Carbs are vital for fetal development
- ❑ Carbs are a primary source of energy
- ❑ Carbs are an important source of folic acid
- ❑ Carbs are an important source of fiber
- ❑ Carbs are an important source of calcium
- ❑ High protein diet (>25%) associated with increased very preterm births & neonatal deaths

Carbs: Go Low on Glycemic Index

- Keep glycemic index <70

Carbs:

Go Low on Glycemic Index

- ❑ 100% whole grains
- ❑ High fiber (>3g per serving)
- ❑ Choose whole foods over processed foods
- ❑ Choose fresh fruits over fruit juice, punch, or roll
- ❑ Add protein to your snacks

Fats:

Load Up On Smart Fats

- How much smart fats do I need?
 - Preconception: 220 mg DHA
 - Pregnancy: 300 mg DHA (650 mg DHA+EPA)

- Sources of smart fats
 - Wild coldwater fish
 - 4-oz Alaskan wild salmon-830 mg DHA + 130mg EPA
 - Fish oil
 - Microalgae DHA supplement
 - DHA-fortified eggs

What You Need to Know about Mercury in Fish & Shellfish

- 2004 EPA/FDA Joint Advisory for
 - Women who might become pregnant
 - Women who are pregnant
 - Nursing mothers
 - Young children

- Do not eat Shark, Swordfish, King Mackerel, or Tilefish
- Eat up to 12 ounces (2 average meals) a week
 - Shrimp, canned light tuna, salmon, pollock, catfish are low in mercury
 - Albacore ("white") tuna has more mercury than canned light tuna

- Check local advisories about locally caught fish
 - www.epa.gov/ost/fish

Fats:

Dump the Dumb Fats

- Reduce fat intake
 - Total fat: <30% of total calories
 - Saturated fat: <5% of total calories
- Go non-fat on dairy
- Minimize red meat & unskinned poultry
- Avoid deep-fried foods in restaurants
- Use olive oil as your principal dietary oil
 - Canola oil for cooking
- Avoid *trans* fats and partially-hydrogenated oils

Proteins:

Eat High Quality Proteins

- 20-25% of total calories

- Animal proteins
 - Load up on smart fats (DHA eggs, coldwater fish)
 - Dump the dumb fats (saturated fats, trans fats, partially hydrogenated oils)

- Plant proteins
 - Eat a variety of plant proteins
 - nuts, beans, lentils, wheat, rice
 - If you are a vegan:
 - Pay attention to iron, B12, zinc & other micronutrients
 - See a registered dietician

Micronutrients:

Eat A Rainbow of Fruits & Vegetables

□ 5 a day

□ Think ROYGBIV

- **Red: strawberries, raspberries, red grapes, pink grapefruit, beets and red bell peppers**
- Orange: orange, apricots and orange bell peppers; carrots, oranges, papayas, peaches, sweet potatoes and yams.
- Yellow: yellow bell pepper, squash, banana, lemon, pineapple, plantain, and star fruit
- **Green: spinach, kale, collards, brussels sprouts, broccoli, cauliflower**
- Blue, Indigo, Violet: Prunes, raisins, blueberries, and plums

Buy Organic on the “Dirty Dozen”

- “Dirty Dozen”
 1. Peaches
 2. Apples
 3. Sweet bell peppers
 4. Celery
 5. Nectarines
 6. Strawberries
 7. Cherries
 8. Lettuce
 9. Grapes – imported
 10. Pears
 11. Spinach
 12. Potatoes

Micronutrients: Choosing Your Multivitamin

- Folic acid
 - 400 mcg a day
 - 4000 mcg a day with prior NTD

- Avoid excess (more isn't always better)
 - A > 10,000 IU
 - D > 4,000 IU

- Look for USP label

- Nutrition first!



Top 10 Brain Foods

- Beans
- Eggs
- Nuts & seeds
- Olive oil
- Alaskan wild salmon
- Yogurt & kefir
- Whole grains
- Spinach, collards, kale & broccoli
- Prunes, raisin, blueberries
- Oranges, red bell pepper, tomato

Top 10 Toxic Foods

- ❑ Swordfish, shark, king mackerel and tile fish
- ❑ Soft cheese and unpasteurized milk
- ❑ Hot dogs, luncheon meats, deli meats, raw or smoked seafood
- ❑ Raw or undercooked meat
- ❑ Unwashed vegetables, raw vegetable sprouts, and unpasteurized juices
- ❑ Liver
- ❑ Saturated fats, *trans* fats, and partially hydrogenated oils
- ❑ Added sugars
- ❑ Refined flour
- ❑ Herbal preparations

2.

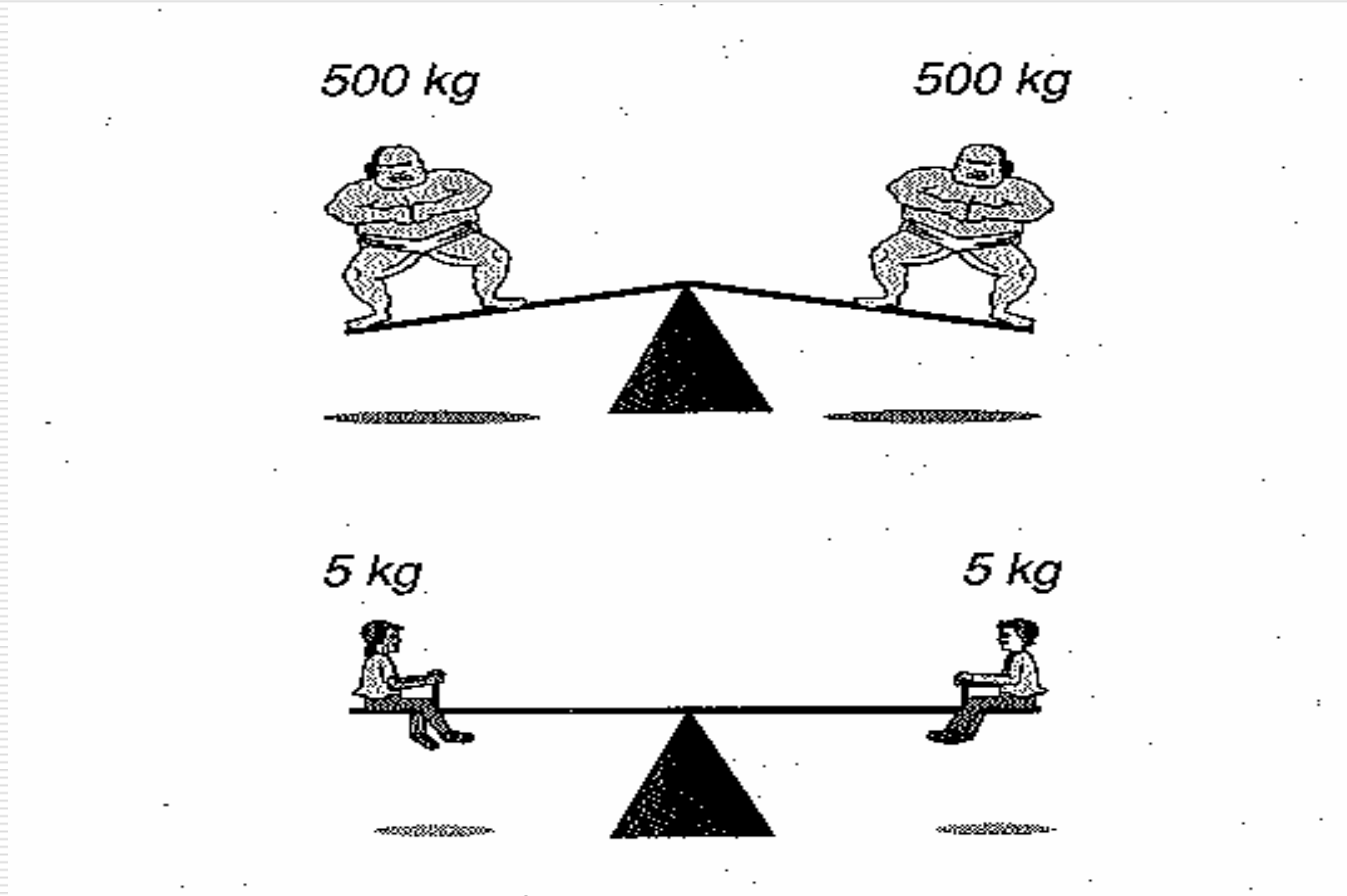
Stress

Resilience

Resilience

the capability of a strained body to recover its size and shape after deformation caused especially by compressive stress.

Allostasis & Allostatic Load



Stress Resilience

- Exercise
 - Eat right
 - Get a good night's sleep
-

Stress Resilience

- **Relaxation techniques**
 - Breathing exercises
 - Progressive relaxation
 - Meditation
 - Mindfulness
-

Stress Resilience

- Learn to prevent stress
 - Planning ahead
 - Avoiding stress
 - Setting limits

Stress Resilience

Problem Solving

- Recognize the problem
- Define the problem and identify the cause(s)
- Propose solutions
- Decide on a solution and plan out action steps
- Evaluate the effectiveness of problem-solving

Conflict Resolution

- Emotional intelligence (EQ)
 - Communication skills
 - Negotiation skills
-

Stress Resilience

- ❑ Positive Mental Health
 - ❑ A sense of meaning
 - ❑ Self-acceptance
 - ❑ Autonomy
 - ❑ Positive relations with others
 - ❑ Satisfaction with life
 - ❑ Optimism
-

Stress Resilience

- ❑ Develop Positive Mental Health
 - ❑ Find your purpose (“follow your bliss”)
 - ❑ Use your strengths
 - ❑ Count your blessings
 - ❑ Live in gratitude
 - ❑ Learn to forgive
 - ❑ Savor life’s joy
 - ❑ Spend time with friends and families
 - ❑ Practice daily acts of kindness
 - ❑ Learn to be optimistic
-

Stress Resilience

Relational Resilience

Get connected

- Spouse/partner
 - Mentor at work
 - Neighborhood/community (social capital)
 - Spirituality
-

Stress Resilience

**Relationality is primary,
All else is derivative.**

- Ronald David

Black babies are dying because their mothers are dying in dead relationships.

- Sister Byllye Avery

Get Help

Intimate Partner Violence

- Have you been hit, kicked, punched, or otherwise hurt by someone in the past year? If so, by whom?
 - Do you feel safe in your current relationship? Are you afraid of your partner?
 - Is there a partner from a previous relationship who is making you feel unsafe now?
 - Has anyone, including your partner, ever forced you to have sex?
 - Does your partner physically scream or curse at you? If so, how often?
 - Does your partner insult or talk down to you? If so, how often?
 - Does your partner threaten you with harm? If so, how often?
-

Get Help: Depression

- **Depressed mood (feeling sad, depressed, hopeless, blue) most of the day,**
 - **Loss of interest or pleasure in almost all activities,**
 - **Recurrent thoughts of death or suicide, or making a suicide attempt**
 - Significant weight loss or weight gain (as a result of change in appetite)
 - Insomnia or sleepiness nearly every day
 - Slowed thinking, speech or body movement or restless and agitation
 - Fatigue or loss of energy nearly every day
 - Feelings of worthlessness or excessive guilt
 - Problems with clear thinking, concentration, and decision-making
 - Recurrent thoughts of death or suicide, or making a suicide attempt
-

Get Help: Alcohol or Substance Abuse

- Cut-down:** Have you ever felt you should cut down on your drinking?
 - Annoyed:** Have people annoyed you by criticizing your drinking?
 - Guilty:** Have you ever felt bad or guilty about your drinking?
 - Eye-opener:** Have you ever had a drink first thing in the morning (as an "eye opener") to steady your nerves or get rid of a hangover?
-

3.

Immune Tune-Up

How to Give Your Immune System A Tune-Up?

- ❑ Get rid of ongoing infections & inflammation
- ❑ Make lifestyle changes to improve immune fitness

Immune Tune-Up

- Brush
- Floss
- Go see your dentist

Immune Tune-Up

- Get checkup for
 - UTI
 - RTI
 - STI

Immune Tune-Up

- ❑ Don't get burnt by the TORCH
 - ❑ **T**oxoplasmosis
 - ❑ **O**thers (e.g. Syphilis, Chickenpox, Hepatitis B)
 - ❑ **R**ubella
 - ❑ **C**ytomegalovirus (CMV)
 - ❑ **H**erpes simplex virus (HSV)

How to Avoid Toxoplasmosis

- ❑ Wear gloves when you garden
- ❑ Cook all meat thoroughly
- ❑ Wash raw vegetables thoroughly
- ❑ Exercise precautions around cats
 - ❑ Have someone else change the litter box
 - ❑ Wear gloves when you change the litter box
 - ❑ Change the litter box daily
 - ❑ Cover outdoor sandboxes
 - ❑ *Never* feed your cat raw meat
 - ❑ Keep indoor cats indoors

How to Avoid Cytomegalovirus

- ❑ Wash hands with soap and water after contact with diapers or saliva
- ❑ Do not share food, drinks, or utensils (spoons or forks) with young children
- ❑ Check your CMV titer if you work in day care

Immune Tune-Up

- Update your immunizations
 - Tdap
 - Hepatitis B
 - Influenza
 - MMR
 - Chickenpox
 - HPV

Immune Tune-Up

- Eat right
- Exercise
- Reduce stress

4.

Healthy Environment

Detoxify Your Home

Bathroom

■ Get rid of antibacterial soap

- triclocarban and triclosan

■ Get rid of air fresheners

- phthalates, formaldehyde, glycol ethers, and petroleum

■ Get rid of personal care products containing

- Phthalates, formaldehyde, glycol ethers, petroleum

■ Get rid of bathroom cleaners containing

- ammonia, alkylphenol ethoxylate, chlorine bleach, glycol ether, sodium hydroxide, sodium lauryl sulfate

■ Get rid of molds & mildew

Detoxify Your Home

- Kitchen & dining room
 - Get rid of non-stick pans
 - perfluorinated chemicals
 - Don't microwave plastic
 - Unless it says "microwave safe"
 - Get rid of glass & window cleaners containing
 - Glycol ethers or ammonia
 - Get rid of stovetop, countertop & oven cleaners
 - Lye, sodium hydroxide, chlorine bleach, silica
 - Get rid of drain cleaners containing
 - Sodium hydroxide, sodium hypochlorite
- Avoid using pesticides

Tap vs. Bottled Water

Tap water

- Test your tap water for lead
- Use a water filter
 - www.nsf.org

Bottled water

- Check the recycle number on bottle
 - Plastics to Avoid
 - #3 (polyvinyl chloride, which may contain phthalates)
 - #6 (polystyrene)
 - #7 (polycarbonate, which may contain BPA)
 - Keep bottled water away from heat
 - Don't reuse water bottles
-

Detoxify Your Home

- Living Room and Bedrooms
 - **Get rid of vinyl wallpapers & blinds**
 - Phthalates
 - **Replace furniture containing**
 - urea-formaldehyde (ask for “exterior grade” products)
 - **Replace mattress & sofas containing**
 - polybrominated diphenyl ethers (PBDEs)
 - **Replace old carpets**
 - Volatile organic compounds, dusts & dustmites
 - **Air out dry-cleaning**
 - Perchloroethylene
-

Avoid Occupational Exposures

- **OSHA** (Occupation Safety and Health Act)
 - **MSDS** (Material Safety Data Sheet)
 - **OTIS** (Organization of Teratology Information Services)
 - <http://www.otispregnancy.org>
 - 1-800-532-3749
-

"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."

5.

Fatherhood Readiness

Protect Your DNA

- tobacco
- alcohol
- drugs (e.g. anabolic steroids)
- caffeine
- poor diet
- radiation and chemotherapy
- testicular hyperthermia
- diabetes mellitus
- varicoceles
- epididymitis
- 1,2-dibromo-3-chloropropane
- nonylphenol
- polycyclic aromatic hydrocarbons (PAHs)
- polychlorinated biphenyls (PCBs)
- dioxins
- phthalates

Preconception Care for Men?

- Reproductive life plan
 - Past reproductive history
 - Current medical conditions
 - Medications
 - Family history & genetic risks
 - Work & hobbies
 - Risk behaviors
 - Mental health
 - Weight
 - Blood pressure
 - Physical examinations
 - Laboratory testing
 - Immunizations
 - Go see your dentist
-

6.

Preconception Care

Key Components of Preconception Care

1. Reproductive life plan
 2. Past reproductive history
 - **Interconception care**
 3. Medical assessment
 4. Medication use
 5. Infections & immunizations
 6. Genetic risks
 7. Healthy weight & nutrition
 8. Psychosocial & behavioral risks
 9. Healthy environment
 10. Physical assessment
-

Interconception Care

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

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

- **MOHANDAS GANDHI**

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<http://www.cartoonbank.com>



"Never, ever, think outside the box."