Getting to the Roots of Obesity: Early Life Experience

Ann Bullock, MD
Division of Diabetes Treatment and Prevention
Indian Health Service

"It is assumed that once the 'healthy choice' is pointed out, everyone will select it and no account is taken of the very differing circumstances and aspirations of different people's lives."

BMJ 2013;347:f6361 doi: 10.1136/bmj.f6361 (Published 25 October 2013)

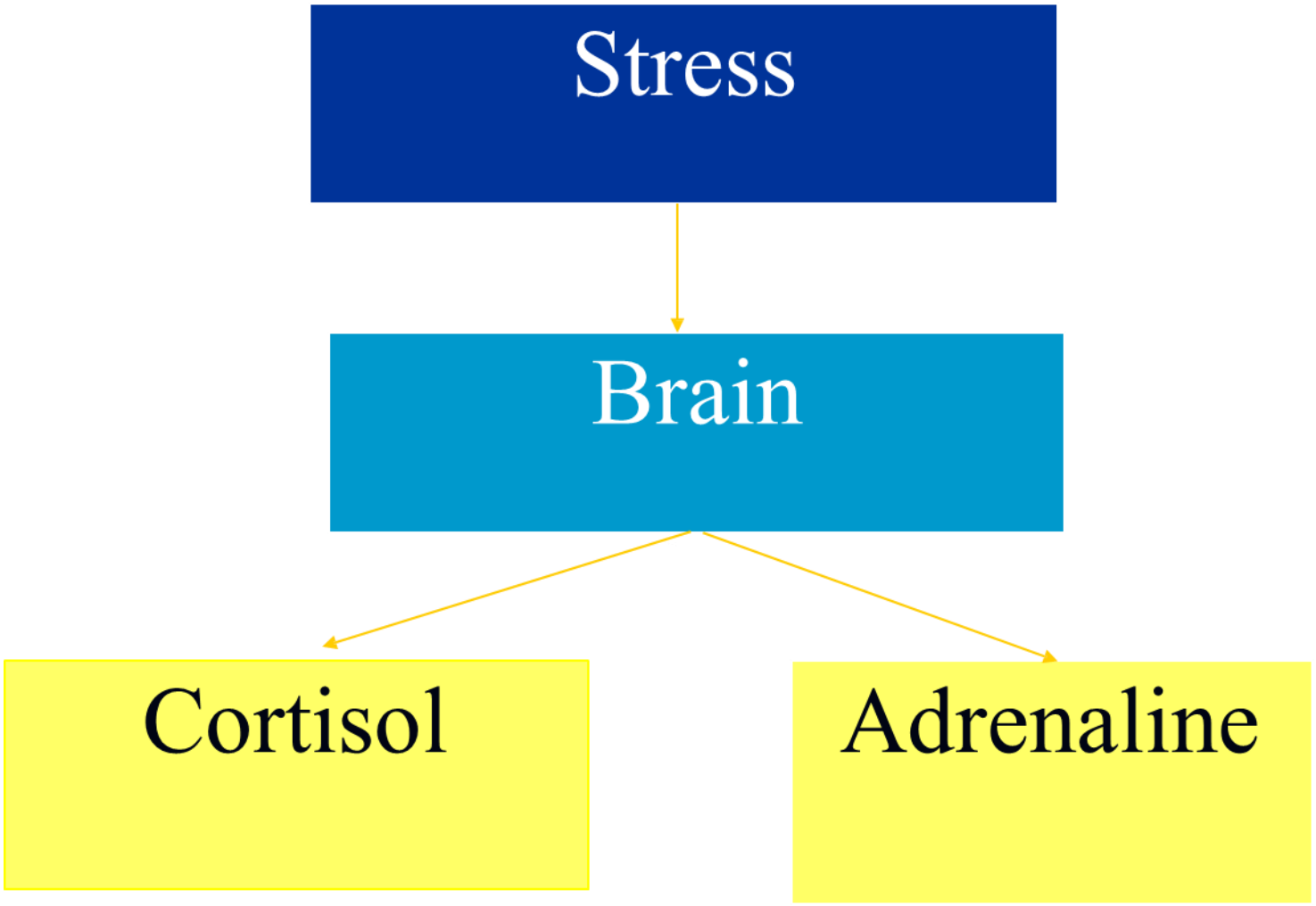
Our Current Path—
An all-too-common story: "Mary"

- Pre-conception
  - Mother's grandparents went to boarding school, parents have had trouble with alcohol; most of them developed diabetes
  - Family income below poverty line, buy food at reservation store
- Pregnancy and Birth
  - Single 15 year old, won't say who FOB is
  - Intermittent prenatal care
  - WIC foods have to be shared with family
  - Stopped using drugs when found out she was pregnant, cut down but continued smoking and got drunk "just a few times"
  - Mostly kept going to high school thru pregnancy
  - Mary born slightly SGA at 35 weeks gestation, spent 2 wks in hosp.

"Mary"

- Early Life
  - Grandmother already overwhelmed caring for other grandchildren, but agreed to watch Mary while mother tried to stay in school
    - Mary often sitting in front of TV most of day
  - Then put into tribal child care
    - High staff turnover, minimal teacher-student ratio
  - Family got by on commodities and WIC foods
  - Mary gained weight rapidly in 1st yr, then stayed >95th % ile
  - Mother's boyfriend moved in
    - Intermittently employed, binged on alcohol and drugs, sometimes hit mother in front of Mary
  - Mary held back to repeat 2nd grade as reading difficulties
  - Mary left school after 10th grade
- Now Mary becomes pregnant…

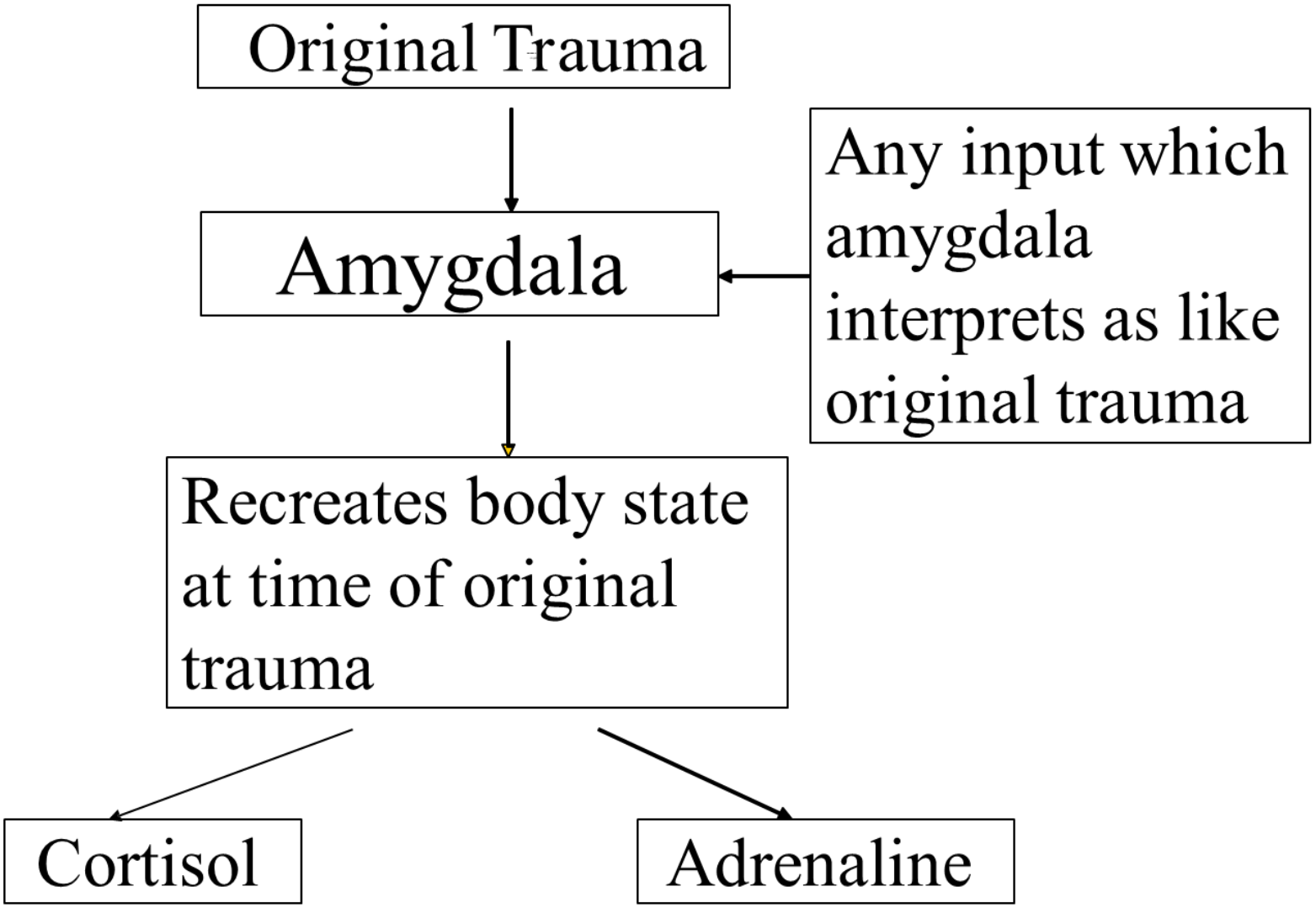
Basic Stress Pathway



Stress and Trauma

- **Stress**: anything that requires a response, can be "good" or "bad"

- **Trauma**: anything that ***overwhelms*** our ability to respond, especially if we perceive that our life or our connection to things that support us physically or emotionally is threatened



Original emotion re-experienced: fear, rage, sadness

Adapted from LeDoux, ***The Emotional Brain***, 1996

The brain itself is changed by stress

- "What fires together, wires together"
- Complex process of "sculpting" the brain, converting experience into neuronal changes
  - Cortisol, Brain-Derived Neurotrophic Factor (BDNF)
  - Chronic stress and depression:
    - shrink the hippocampus and prefrontal cortex
      - ↓ Memory, selective attention, executive function/decision making
    - potentiate growth of the amygdala
      - ↑ Fear/hypervigilience, anxiety, aggression

McEwen, *Physiol Rev* 2007;87:873-904

Adverse Childhood Experiences (ACE)

- **Physical, emotional, sexual abuse; mentally ill, substance abusing, incarcerated family member; seeing mother beaten; parents divorced/separated**

  --Overall Exposure: 86% (among 7 tribes)

	Non-Native	Native
Physical Abuse-M	30%	40%
Physical Abuse-F	27	42
Sexual Abuse-M	16	24
Sexual Abuse-F	25	31
Emotional Abuse	11	30
Household alcohol	27	65
Four or More ACEs	6	33

Am J Prev Med 2003;25:238-244

ACEs and Adult Health

- **ACE Score ≥4**
  - **4-12 x risk for alcoholism, drug abuse, depression and suicide attempt**
  - **2-4 x risk for smoking, teen pregnancy, STDs, multiple sexual partners**
  - **1.4-1.6 x risk for severe obesity**
  - **Strong graded relationship at <u>all</u> levels of ACEs for almost all outcomes, including heart disease**

Am J Prev Med 1998;14:245-258 and *Circulation* 2004;110:1761-6

- Across 10 countries, adults who experienced ≥3 childhood adversities
  - Hazard ratios 1.59 for diabetes, 2.19 for heart disease
  - Risk similar to the association between cholesterol and heart disease
    - Both in magnitude as well as population prevalence

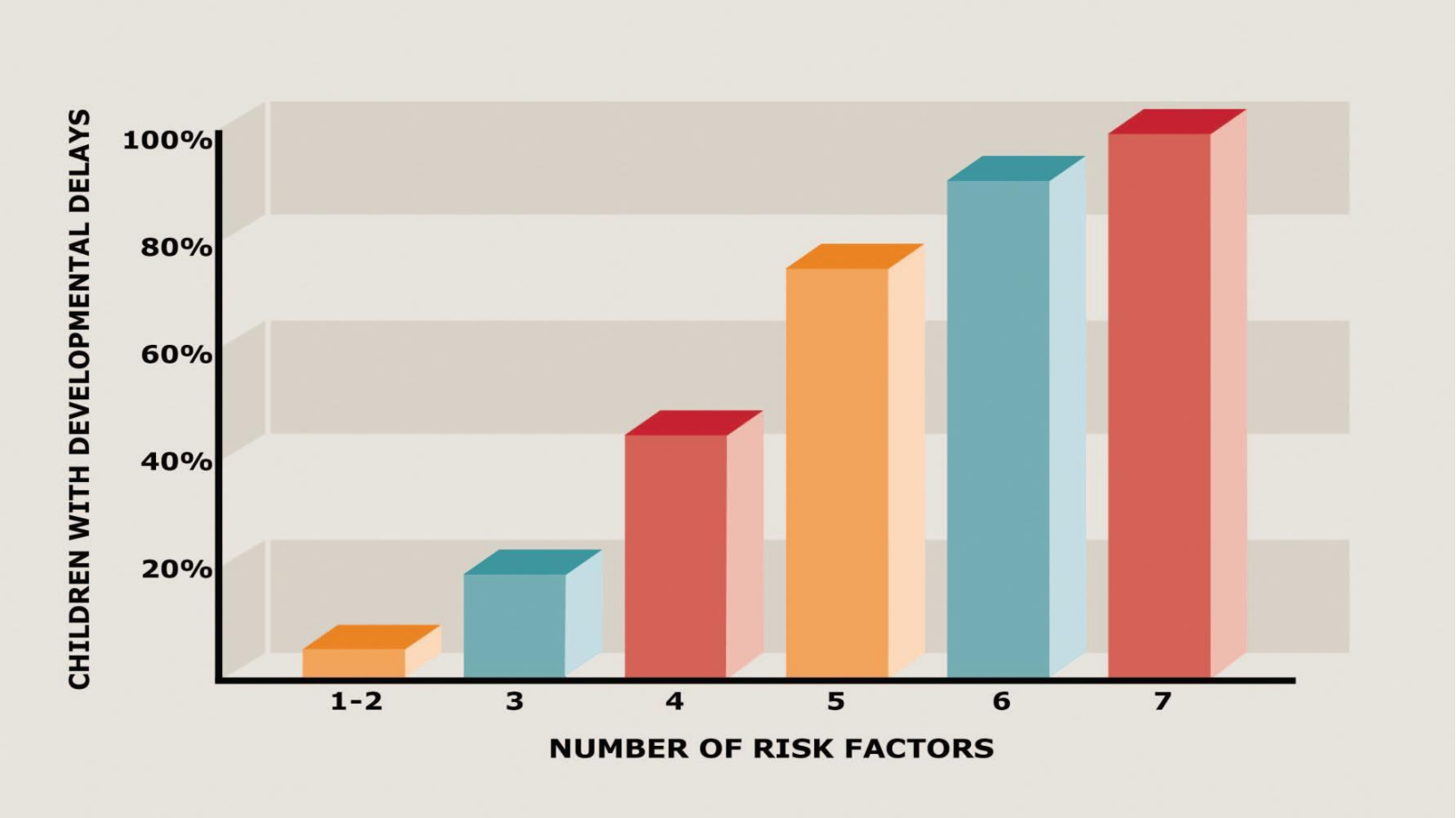
Arch Gen Psychiatry 2011;68:838-844

What is the average ACE score of:

- --the patients you work with?
- --the staff in your program?

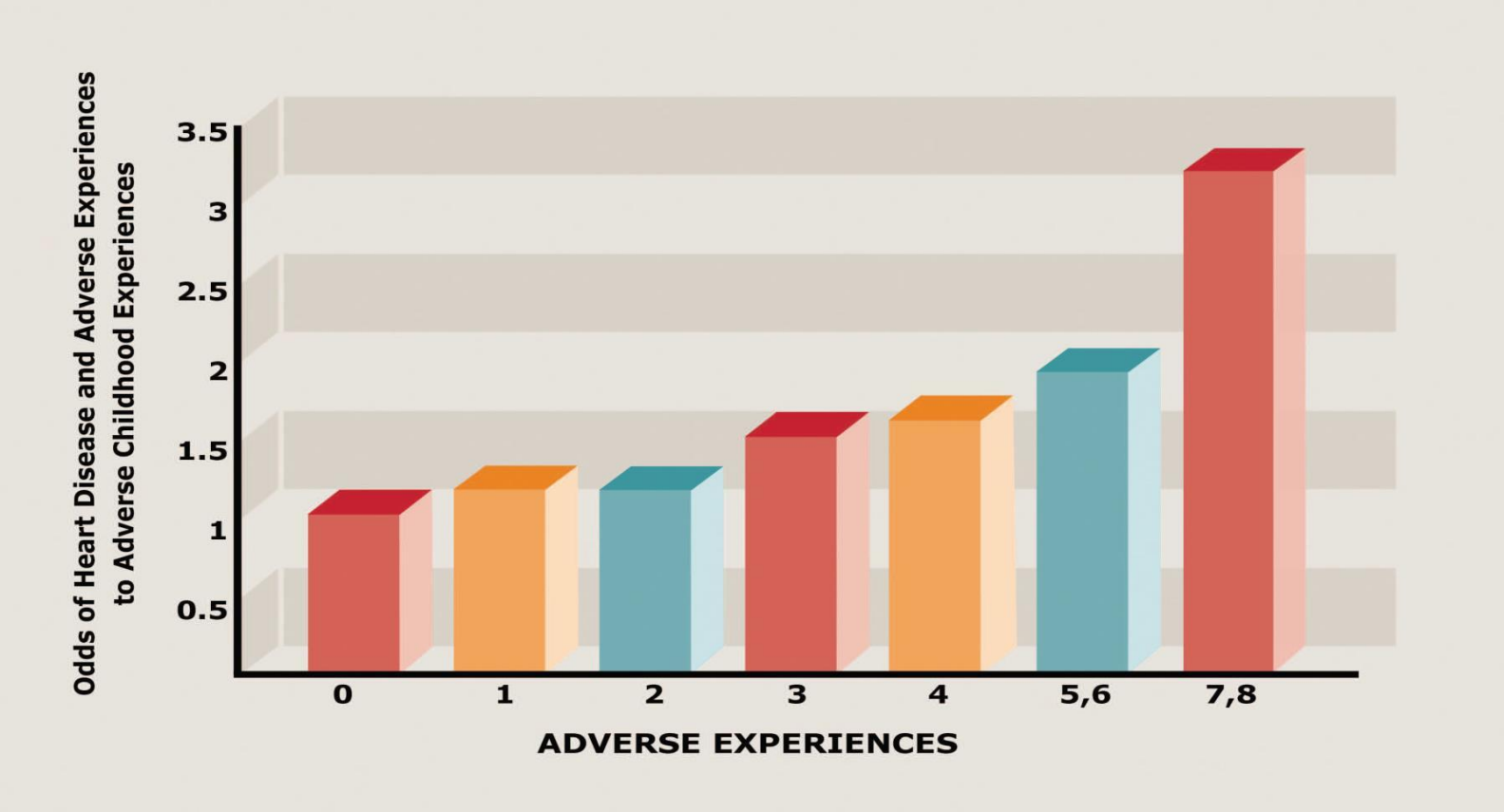
- What is *your* ACE score?

90-100% chance of developmental delays when children experience 6-7 risk factors



Center on the Developing Child at Harvard website
Source: Barth, et al. (2008)

3:1 odds of adult heart disease after 7- 8 adverse childhood experiences



Center on the Developing Child at Harvard website
Source: Dong et al. (2004)

Stress in Children: Long-term Consequences

- Chronic exposure to Intimate Partner Violence almost doubles (OR 1.8) risk of obesity at age 5 years

Arch Pediatr Adolesc Med 2010;164:540-546

- Young children who had objectively-measured poor quality maternal-child relationships had 2 ½ x ↑ prevalence of ***adolescent*** obesity c/w those who did not

Pediatrics 2012;129:132-40

- "…reducing toxic stress can target the common physiologic pathway implicated in an enormous array of health outcomes from asthma to cardiovascular disease."

Pediatrics 2013;131:319-327

Stress in Children

- Positive
  - Normal/necessary part of healthy development
    - First day with new caregiver; immunization
  - Brief increases in heart rate and stress hormones
- Tolerable
  - More severe, longer lasting stressor
    - Loss of a loved one, natural disaster, injury
  - If buffered by relationship with supportive adult(s), brain and body can recover
- Toxic
  - Strong, frequent, prolonged adversity
    - Abuse, neglect, caregiver mental illness, poverty
  - If no adult support, can disrupt brain and organ development long-term

Center on the Developing Child at Harvard Univ.

SIDEBAR 1.

Domains of Impairment in Children Exposed to Complex Trauma

I. Attachment

- Problems with boundaries
- Distrust and suspiciousness
- Social isolation
- Interpersonal difficulties
- Difficulty attuning to other people's emotional states
- Difficulty with perspective taking

II. Biology

- Sensorimotor developmental problems
- Analgesia
- Problems with coordination, balance, body tone
- Somatization
- Increased medical problems across a wide span (eg, pelvic pain, asthma, skin problems, autoimmune disorders, pseudoseizures)

III. Affect regulation

- Difficulty with emotional self-regulation
- Difficulty labeling and expressing feelings
- Problems knowing and describing internal states
- Difficulty communicating wishes and needs

IV. Dissociation

- Distinct alterations in states of consciousness
- Amnesia
- Depersonalization and derealization
- Two or more distinct states of consciousness
- Impaired memory for state-based events

V. Behavioral control

- Poor modulation of impulses
- Self-destructive behavior
- Aggression toward others
- Pathological self-soothing behaviors
- Sleep disturbances
- Eating disorders
- Substance abuse
- Excessive compliance
- Oppositional behavior
- Difficulty understanding and complying with rules
- Reenactment of trauma in behavior or play (eg, sexual, aggressive)

VI. Cognition

- Difficulties in attention regulation and executive functioning
- Lack of sustained curiosity
- Problems with processing novel information
- Problems focusing on and completing tasks
- Problems with object constancy
- Difficulty planning and anticipating
- Problems understanding responsibility
- Learning difficulties
- Problems with language development
- Problems with orientation in time and space

VII. Self-concept

- Lack of a continuous, predictable sense of self
- Poor sense of separateness
- Disturbances of body image
- Low self-esteem
- Shame and guilt

Cook, *et al.* 2005. *Psychiatric Annals* 35(5) p. 392

Overeating as a Stress Response

- **Food Insecurity:**
  - Prevalence of overweight in women ↑'s as food insecurity ↑

    Journal of Nutrition. 2001;131:1738-1745
  - Pregnancy: food insecurity assoc with pregravid obesity, ↑ gest wt gain, and gest diabetes

    J Am Diet Assoc 2010;110:692-701
    - 42% of households below poverty level are food insecure,
    - 21% of all households with children

    NEJM 2010;363:6-9
  - Independent risk factor for poor glycemic control

    Diabetes Care 2012;35:233-238
- Carbohydrates affect brain serotonin levels

  Obes Res 1995 Suppl 4:477S-480S
- "Comfort Foods" ↓ HPA axis stress response

  Proc Natl Acad Sci 2003;100:11696-11701

"We …know that sound maternal and fetal nutrition, combined with positive social-emotional support of children through their family and community environments, will reduce the likelihood of negative epigenetic modifications that increase the risk of later physical and mental health impairments."

Center on the Developing Child at Harvard University Working Paper 10, 2010

Prenatal/Early Life Home Visiting

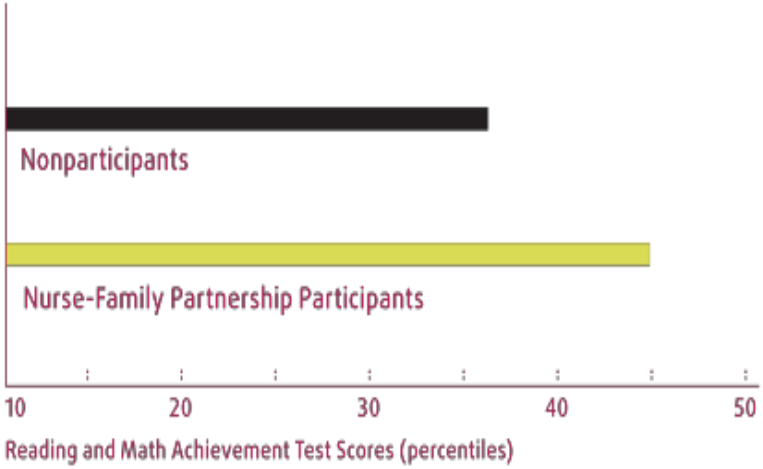
- One of the key evidence-based interventions proven to improve the life trajectories of low income women and children
  - Positive effects now shown up to ***age 19 yrs***

Arch Pediatr Adolesc Med 2010;164:9-15, 412-418, 419-424

- If home visiting were a medication, it would be malpractice not to provide it
- Examples of Home Visiting in AI/AN Communities
  - Tribal Maternal, Infant & Early Childhood Home Visiting Program (MIECHV)
    - 25 tribes/T.O.'s now funded to provide home visiting
  - IHS initiative with CHRs

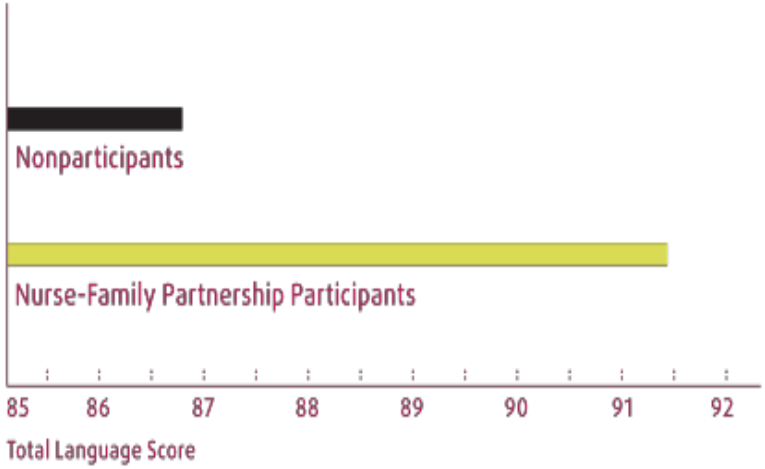
Academic Achievement

Grades 1–3, Age 9—Memphis
(Born to low-resource mothers)



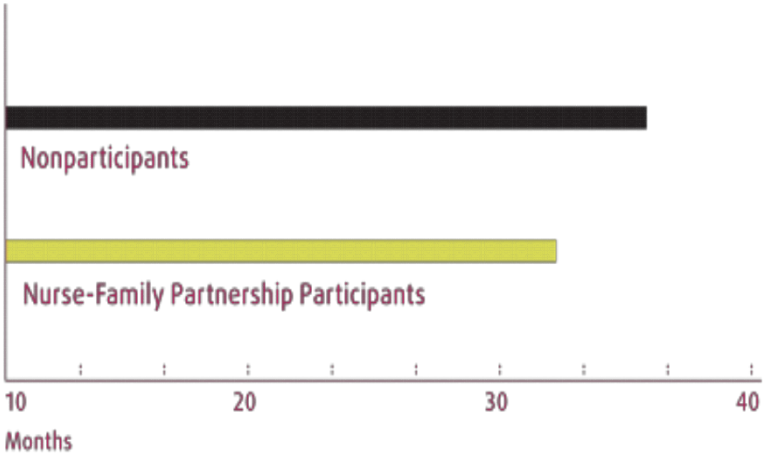
Preschool Language Scale

Age 4—Denver
(Born to low-resource mothers)



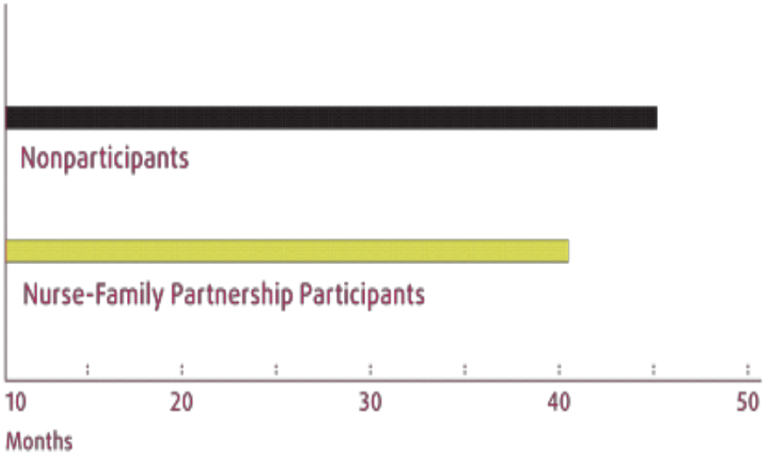
Months Receiving Welfare Assistance (AFDC)

Birth through age 5—Memphis

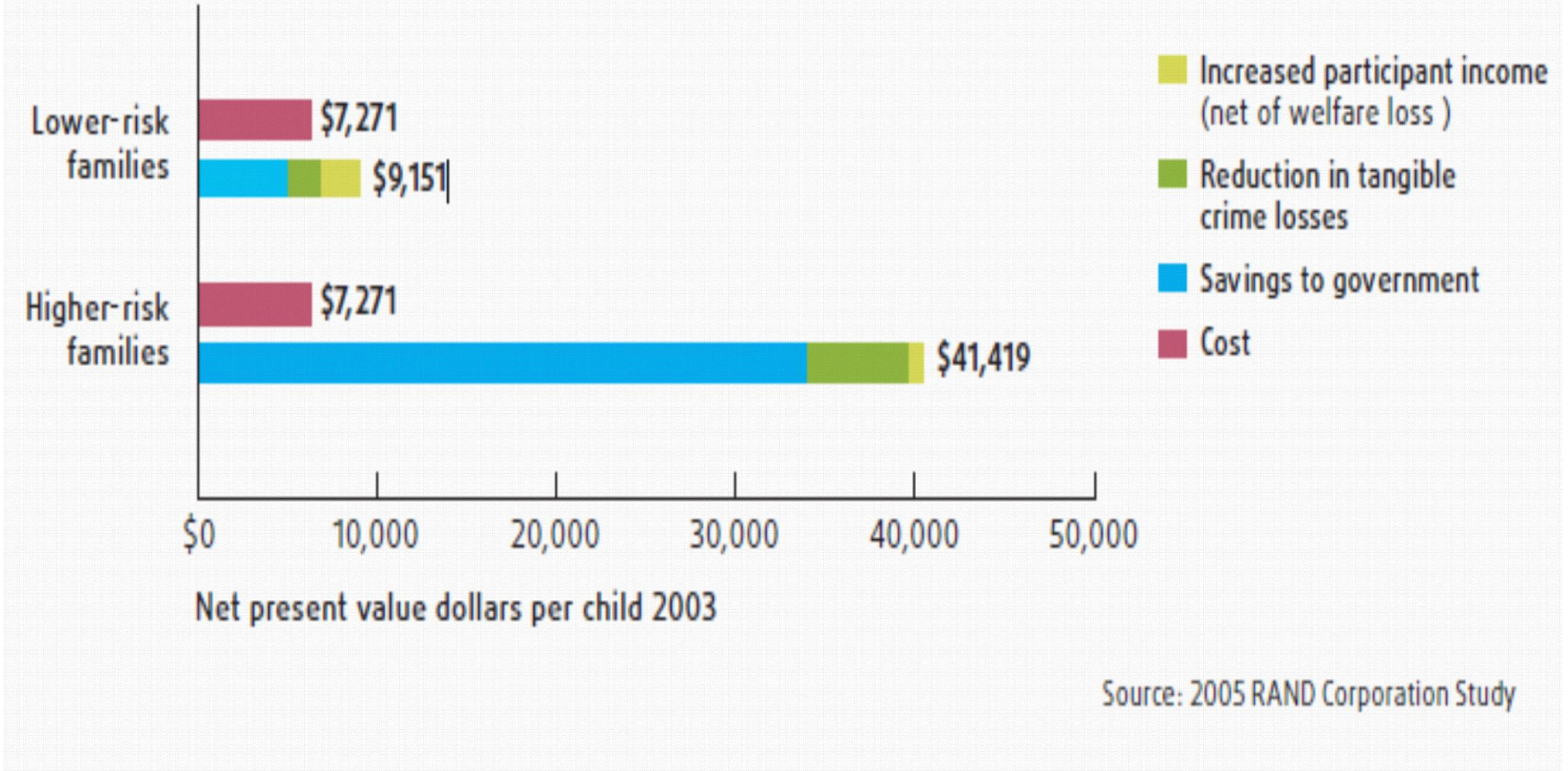


Months Receiving Food Stamps

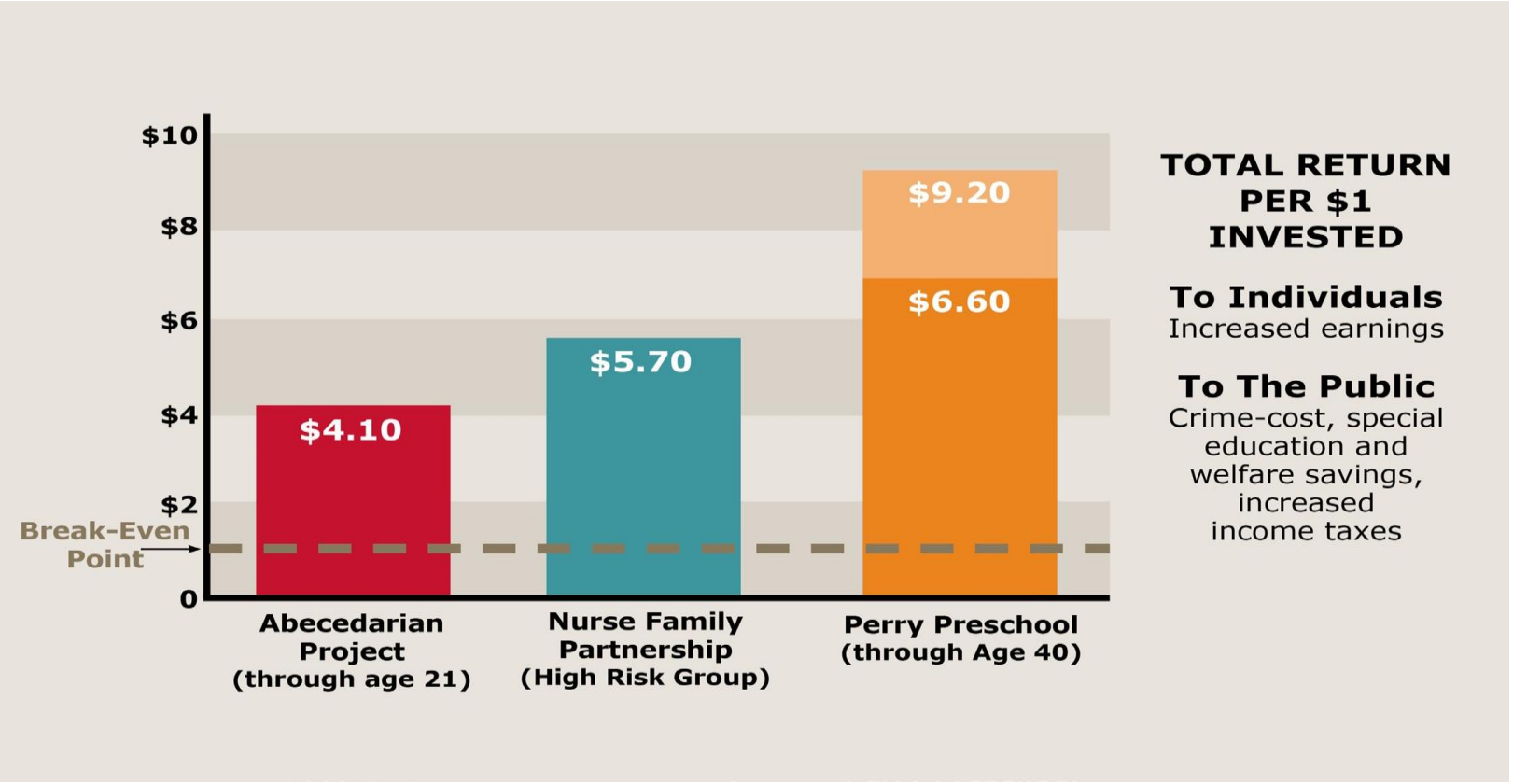
Birth through age 5—Memphis



Monetary Benefits



$4-$9 in returns for every dollar invested in early childhood programs



Center on the Developing Child at Harvard website

Sources: Masse, L. and Barnett, W.S., A Benefit Cost Analysis of the Abecedarian Early Childhood Intervention (2002); Karoly et al., Early Childhood Interventions: Proven Results, Future Promise (2005); Heckman et al., The Effect of the Perry Preschool Program on the Cognitive and Non-Cognitive Skills of its Participants (2009)

"Early Life Investments Substantially Boost Adult Health"

- Carolina Abecedarian Project
- Study: 4 cohorts of disadvantaged children born 1972-77
  - 2 stages: birth thru age 5yrs, ages 6-8yrs
  - Intervention children in stage 1
    - Language development, emotional regulation, cognitive skills
    - Caregiving/supervised play
    - Nutrition: 2 meals and a snack at childcare center
    - Primary pediatric care
- In their mid-30s: lower prevalence of CVD and metabolic disease risk factors incl BP, A1C, obesity, HDL

Science 2014;343:1478-1485

JOHNS HOPKINS BLOOMBERG SCHOOL of PUBLIC HEALTH

Johns Hopkins Center for American Indian Health

"In-Home Prevention of Substance Abuse *Risk* in Native Teen Families"
(NIDA Grant #: RO1 DA019042
with additional support from OBSSR)

Family Spirit Trial

Participants' Baseline Characteristics*

- Mean (SD) age = 18.1 (1.5) years
- Mean (SD) gestational age = 25 (3) weeks
- 77% first child
- 3% married
- 41% currently in school
- 51% lived in ≥ 2 homes in past year
- 32% elevated depression score (>16 on CES-D)

Lifetime drug use: 84% alcohol, 79% marijuana, 28% meth * Baseline is the assessment time when participants enrolled in the study, at ~24-28 weeks gestation.

Family Spirit Measured Impact 1999-2013

Parenting:

- Increased maternal knowledge.[1,2,3]
- Reduced parent stress.[2,4]
- Increased parent self-efficacy.[3,4]

Maternal Outcomes:

- Decreased maternal depression.[1,2,4]
- Fewer behavior problems (internal,externalizing,substance use) in mothers.[3,4]

Child Outcomes:

- Fewer **externalizing, internalizing, dysregulation problems** in children through age 0-3.[2,3,4]
- Higher impact among children of mothers who used substances at baseline.[3,4]

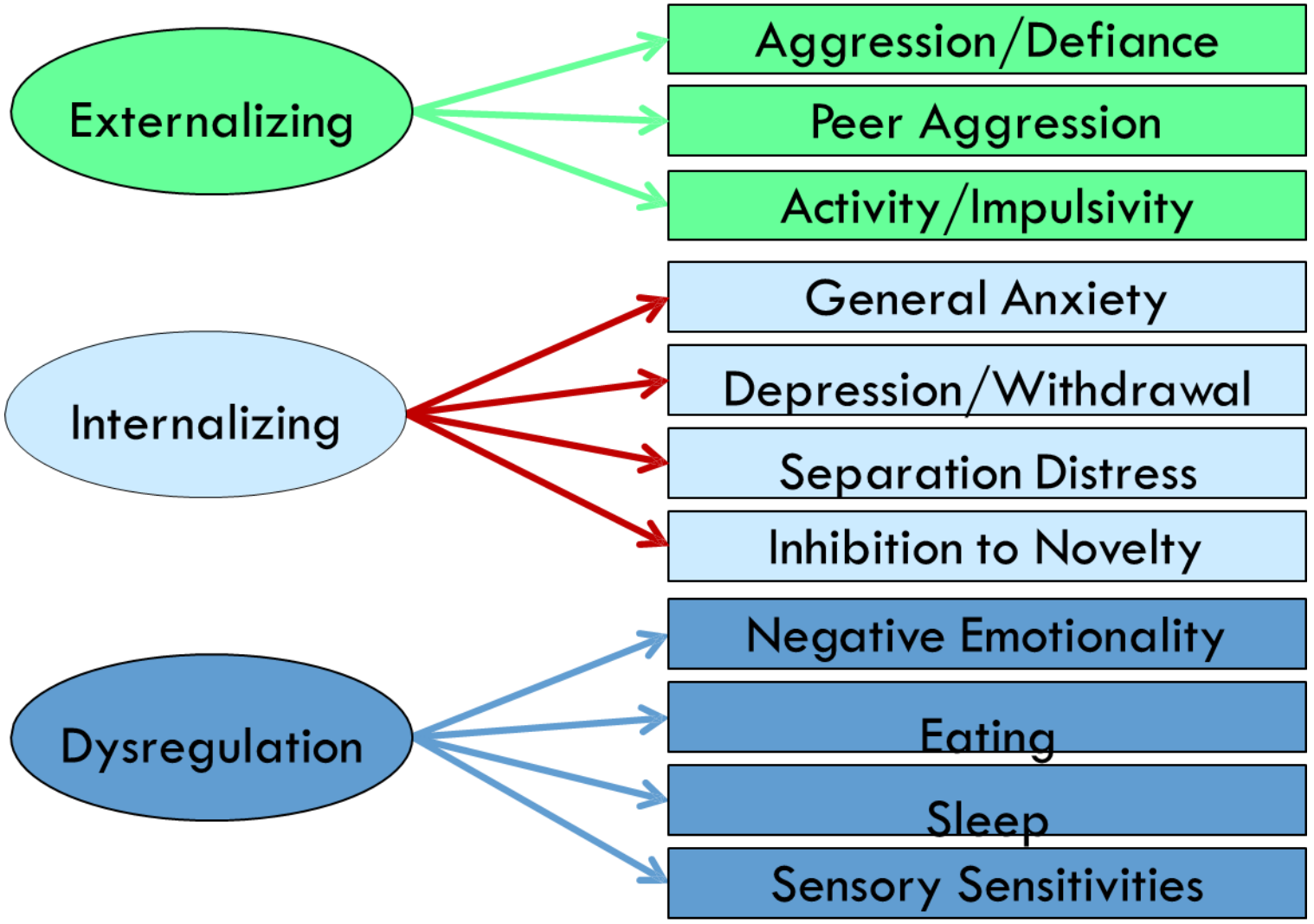
1 Barlow A, Varipatis-Baker E, Speakman K, et al *Arch Pediatr Adolesc Med.* 2006;160:1101-1107

2 Walkup J, Barlow A, Mullany B, et al. *Jour of the Amer Acad of Child and Adolescent Psychiatry.* June 2009.

3 Barlow, A, Mullany B, Neault N, et al. *Amer Jour of Psychiatry.* January 2013.

4 Three year postpartum data in preparation for manuscript

ITSEA Problem Domains and Subscales within Domains



Parenting and Early Childhood Behavior Problems Associated with Obesity

- Negative parenting (inconsistent discipline; restrictive, coercive parenting) associated with increased obesity risk in children.

  Int J Obes (Lond). 2006 Dec;30(12):1766-74.

  Trends Endocrinol Metab. 2013 Apr 19 E-pub

- Externalizing behaviors at 24 mos associated with higher BMI at 24 months and thru age 12 yrs

  BMC Pediatr. 2010 Jul 14;10:49

- Obese children have higher rates of externalizing and internalizing disorders.

  Acad Pediatr. 2013 Jan-Feb;13(1):6-13

“You did then what
you knew how to do, and when
you knew better, you did better.”
Maya Angelou

Poverty

- Prevalence of many health and social problems inversely related to poverty
- Nearly half of all U.S. children grow up in families that are poor or near-poor
- APA Task Force on Childhood Poverty (2013)
  - Strengthen Child Tax Credit, Earned Income Tax Credit, TANF
- Raising income (tribal casinos) assoc with ↓ child obesity, ↓ psychopathology risk

JAMA 2014;311:929-936 and 2003;290:2023-2029

- "Persistent interventions aimed at promoting better health, education, and social outcomes needs to start early and be consistently applied to counteract poverty's persistent and dampening pressures on children's well-being."

Neal Halfon, *JAMA* 2014;311:915-917

What can we do?

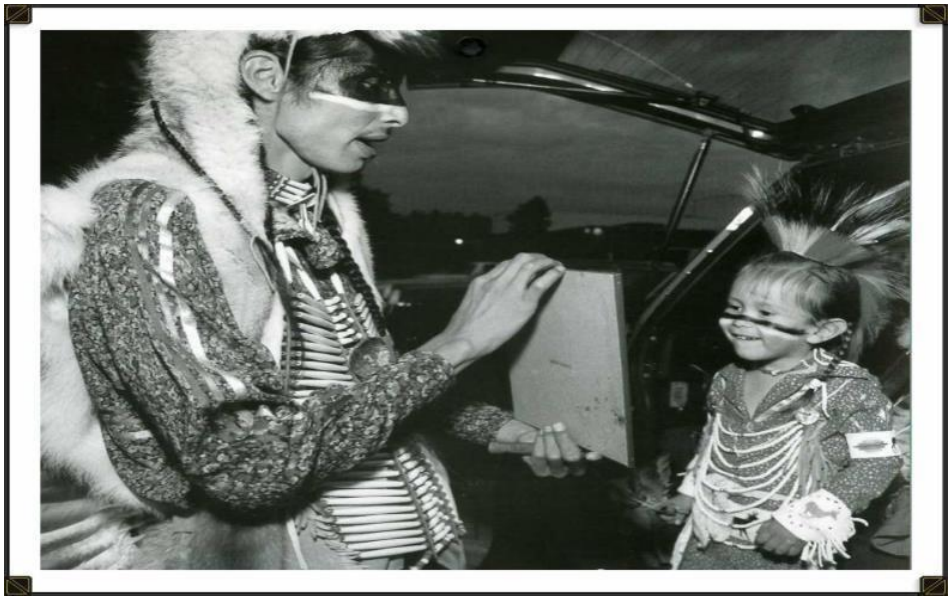
- Home Visiting and Case Management
- Provide *good* nutrition in sufficient quantities
  - WIC, food stamps, commodities don't go far enough
- Parenting
  - Bonding, breastfeeding starting at delivery (e.g. BFHI)
  - Parenting and coping skills training
  - Screen for/treat depression, substance abuse
  - Screen/intervene *early* in adverse childhood experiences
    - Court Referral Program (e.g. Zero to Three)
  - Strengthen, renew tribal pregnancy/childrearing practices
    - Traditional midwifery, doulas, support young parents by elders/family
- Learning
  - Excellent Head Start/Early Head Start, Child Care
  - Encourage parents to read to kids (Reach Out and Read)
- Poverty

The Path We *Could* Take Rewind: "Mary's" life

- As soon as mother's pregnancy diagnosed:
  - Matched with a home visitor/case manager
    - Weekly/biweekly visits focusing on developing a mentoring-type relationship, building on mother's strengths, helping her to set goals, teaching her new skills
    - All services needed were offered and tailored to her needs
    - WIC foods supplemented so mother had enough good food even though shared with family
    - Mother rewarded for participation in each component
  - Mother went to 90% of her prenatal appointments
    - All but first urine drug screen negative and most cotinine screens
  - Mary born at 39 wks gest, normal weight for gestation

Rewind: "Mary"

- Visits from home visitor continued until Mary was 2 yrs old
- Mother set/achieved goals: became a CNA through health occupations class and graduated from high school
  - Mary cared for during day by excellent tribal child care program: bonding, learning, good food, social skills, active play, tribal language all emphasized
- Mother attended parenting classes
  - Praised and hugged Mary, appropriately disciplined her
  - Ate dinner together and read to Mary most evenings
  - Left her boyfriend when he wouldn't stop drinking
- Mary's weight stayed around the 90th % ile
- Mary graduated from high school, went to tribal college, got a good job, married a guy she met at college
- Now Mary becomes pregnant…



Isn't this among the most important work we can do?

"The medicine is already within the pain and suffering. You just have to look deeply and quietly. Then you realize it has been there the whole time." Duran, 2006