Epigenetics and Health Disparities: Linking Biology and Social Science

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St. Regis Indian Mission: Where my great grandmother was baptized
New York and Michigan have the largest indigenous populations east of the Mississippi River. Niagara Falls has a higher percentage of Native American than any city east of the Mississippi. More than 2,000 American Indians live in Buffalo proper.
Jim Jarvis, MD, FAAP

Faculty Disclosure Information

In the past 12 months, I have had no financial relationships with the manufacturer(s) of any commercial product(s) and/or provider(s) of commercial service(s) discussed in this CME activity.

I do not intend to discuss an unapproved/investigative use of a commercial product/device in my presentation.
“As human beings we belong to an extremely resilient species. Since time immemorial we have rebounded from our relentless wars, countless disasters (both natural and man-made), and the violence and betrayal in our own lives. But traumatic experiences do leave traces, whether on a large scale (on our histories and cultures) or close to home, on our families, with dark secrets being imperceptibly passed down through generations. They also leave traces on our minds and emotions, on our capacity for joy and intimacy, and even on our biology and immune systems.”

*The Body Keeps the Score: Brain, Mind, and Body in the Healing of Trauma*, p. 1

Bessel van der Kolk, 2014
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…**
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)

<table>
<thead>
<tr>
<th></th>
<th>Non-Native</th>
<th>Native</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Abuse-M</td>
<td>30%</td>
<td>40%</td>
</tr>
<tr>
<td>Physical Abuse-F</td>
<td>27</td>
<td>42</td>
</tr>
<tr>
<td>Sexual Abuse-M</td>
<td>16</td>
<td>24</td>
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<tr>
<td>Sexual Abuse-F</td>
<td>25</td>
<td>31</td>
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<tr>
<td>Emotional Abuse</td>
<td>11</td>
<td>30</td>
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<tr>
<td>Household alcohol</td>
<td>27</td>
<td>65</td>
</tr>
<tr>
<td>Four or More ACEs</td>
<td>6</td>
<td>33</td>
</tr>
</tbody>
</table>

*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 all levels of ACEs for almost all outcomes, including heart disease


- 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
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)
### Domains of Impairment in Children Exposed to Complex Trauma

<table>
<thead>
<tr>
<th>I. Attachment</th>
<th>IV. Dissociation</th>
<th>VI. Cognition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problems with boundaries</td>
<td>Distinct alterations in states of consciousness</td>
<td>Difficulties in attention regulation and executive functioning</td>
</tr>
<tr>
<td>Distrust and suspiciousness</td>
<td>Amnesia</td>
<td>Lack of sustained curiosity</td>
</tr>
<tr>
<td>Social isolation</td>
<td>Depersonalization and derealization</td>
<td>Problems with processing novel information</td>
</tr>
<tr>
<td>Interpersonal difficulties</td>
<td>Two or more distinct states of consciousness</td>
<td>Problems focusing on and completing tasks</td>
</tr>
<tr>
<td>Difficulty attuning to other people's emotional states</td>
<td>Impaired memory for state-based events</td>
<td>Problems with object constancy</td>
</tr>
<tr>
<td>Difficulty with perspective taking</td>
<td></td>
<td>Difficulty planning and anticipating</td>
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</table>

<table>
<thead>
<tr>
<th>II. Biology</th>
<th>V. Behavioral control</th>
<th>VII. Self-concept</th>
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</thead>
<tbody>
<tr>
<td>Sensorimotor developmental problems</td>
<td>Poor modulation of impulses</td>
<td>Lack of a continuous, predictable sense of self</td>
</tr>
<tr>
<td>Analgesia</td>
<td>Self-destructive behavior</td>
<td>Poor sense of separateness</td>
</tr>
<tr>
<td>Problems with coordination, balance, body tone</td>
<td>Aggression toward others</td>
<td>Disturbances of body image</td>
</tr>
<tr>
<td>Somatization</td>
<td>Pathological self-soothing behaviors</td>
<td>Low self-esteem</td>
</tr>
<tr>
<td>Increased medical problems across a wide span (e.g., pelvic pain, asthma, skin problems, autoimmune disorders, pseudoseizures)</td>
<td>Sleep disturbances</td>
<td>Shame and guilt</td>
</tr>
<tr>
<td></td>
<td>Eating disorders</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Substance abuse</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Excessive compliance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oppositional behavior</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Difficulty understanding and complying with rules</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reenactment of trauma in behavior or play (e.g., sexual, aggressive)</td>
<td></td>
</tr>
</tbody>
</table>

Most Diseases That Show Health Inequities Are Complex Traits

Prevalence of SLE per 100,000 population

- General population
- Native American
Juvenile Idiopathic Arthritis: Northern Plains vs. Europe
Maurano et al (Science, 2012) showed that most disease-associated SNPs are in non-coding regions that are identified as DNase1 hypersensitivity sites (DHS). Such sites typically represent non-coding but functional parts of the genome.

Note importance of SNPs in regions active during fetal development.
Genetics of JIA

Limitations:
1. Chip-based genotyping, thus, limited resolution and can query only known SNPs.
2. Was not a genome-wide study: biased toward immune-related genes.
So, once again, what's *in* these regions?

### Table 1: Regions showing genome-wide significant association with oligoarticular and RF-negative polyarticular JIA

<table>
<thead>
<tr>
<th>Gene region</th>
<th>Chr.</th>
<th>Position</th>
<th>Most significant SNP</th>
<th>Minor allele</th>
<th>MAF&lt;sub&gt;CHR&lt;/sub&gt; (n = 13,056)</th>
<th>MAF&lt;sub&gt;CASE&lt;/sub&gt; (n = 2,810)</th>
<th>Best P value</th>
<th>Model</th>
<th>OR (95% CI)</th>
<th>SNP position</th>
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<td>HLA-DOQ1-HLA-DOAQ2</td>
<td>6</td>
<td>32657916</td>
<td>rs7775055</td>
<td>G</td>
<td>0.02</td>
<td>0.12</td>
<td>3.14 × 10&lt;sup&gt;-174&lt;/sup&gt;</td>
<td>Dominant</td>
<td>6.01 (5.30-6.81)</td>
<td>Intergenic</td>
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<td>PTN2</td>
<td>1</td>
<td>11430808</td>
<td>rs667067</td>
<td>A</td>
<td>0.10</td>
<td>0.14</td>
<td>3.19 × 10&lt;sup&gt;-25&lt;/sup&gt;</td>
<td>Additive</td>
<td>1.59 (1.45-1.73)</td>
<td>Intergenic</td>
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<tr>
<td>STAT4</td>
<td>2</td>
<td>191073034</td>
<td>rs10172438</td>
<td>G</td>
<td>0.23</td>
<td>0.28</td>
<td>1.28 × 10&lt;sup&gt;-13&lt;/sup&gt;</td>
<td>Additive</td>
<td>1.29 (1.20-1.37)</td>
<td>Intergenic</td>
</tr>
<tr>
<td>PTN2</td>
<td>18</td>
<td>12782448</td>
<td>rs2847293</td>
<td>G</td>
<td>0.17</td>
<td>0.20</td>
<td>1.44 × 10&lt;sup&gt;-17&lt;/sup&gt;</td>
<td>Additive</td>
<td>1.31 (1.22-1.41)</td>
<td>Intergenic</td>
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<td>ANKRD55</td>
<td>5</td>
<td>55440730</td>
<td>rs71624119</td>
<td>G</td>
<td>0.25</td>
<td>0.20</td>
<td>4.40 × 10&lt;sup&gt;-11&lt;/sup&gt;</td>
<td>Additive</td>
<td>0.76 (0.73-0.84)</td>
<td>Intergenic</td>
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<tr>
<td>I2-IL21</td>
<td>4</td>
<td>123387500</td>
<td>rs1479924</td>
<td>G</td>
<td>0.29</td>
<td>0.24</td>
<td>6.24 × 10&lt;sup&gt;-11&lt;/sup&gt;</td>
<td>Additive</td>
<td>0.73 (0.74-0.85)</td>
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<td>TYK2</td>
<td>19</td>
<td>10463118</td>
<td>rs34536443</td>
<td>G</td>
<td>0.05</td>
<td>0.03</td>
<td>1.0 × 10&lt;sup&gt;-10&lt;/sup&gt;</td>
<td>Additive</td>
<td>0.56 (0.47-0.67)</td>
<td>Coiling (NS)</td>
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<tr>
<td>IL2RA</td>
<td>10</td>
<td>6088841</td>
<td>rs7909619</td>
<td>C</td>
<td>0.11</td>
<td>0.08</td>
<td>8 × 10&lt;sup&gt;-10&lt;/sup&gt;</td>
<td>Additive</td>
<td>0.72 (0.64-0.80)</td>
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<td>SH2B3-ATXN2</td>
<td>12</td>
<td>11188450</td>
<td>rs3184604</td>
<td>A</td>
<td>0.49</td>
<td>0.54</td>
<td>2.60 × 10&lt;sup&gt;-9&lt;/sup&gt;</td>
<td>Additive</td>
<td>1.20 (1.13-1.27)</td>
<td>Coiling (NS)</td>
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<td>ERAF2-LNPEP</td>
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<td>11183782</td>
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<td>0.54</td>
<td>1.16 × 10&lt;sup&gt;-9&lt;/sup&gt;</td>
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<td>1.20 (1.13-1.28)</td>
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<td>UBEZL3</td>
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<td>21929209</td>
<td>rs2266889</td>
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<td>1.25 (1.15-1.35)</td>
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<td>C5orf55-IRF1</td>
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<td>13181321</td>
<td>rs4708692</td>
<td>T</td>
<td>0.44</td>
<td>0.39</td>
<td>1.02 × 10&lt;sup&gt;-8&lt;/sup&gt;</td>
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<td>0.84 (0.79-0.89)</td>
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<td>RUNX1</td>
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<td>rs9793859</td>
<td>G</td>
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<td>0.33</td>
<td>9.73 × 10&lt;sup&gt;-10&lt;/sup&gt;</td>
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<td>0.76 (0.70-0.83)</td>
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<td>37534034</td>
<td>rs2284033</td>
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<td>1.55 × 10&lt;sup&gt;-8&lt;/sup&gt;</td>
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<td>0.84 (0.79-0.89)</td>
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<td>rs7069750</td>
<td>C</td>
<td>0.44</td>
<td>0.48</td>
<td>2.93 × 10&lt;sup&gt;-8&lt;/sup&gt;</td>
<td>Additive</td>
<td>1.18 (1.11-1.25)</td>
<td>Intergenic</td>
</tr>
<tr>
<td>ZFP36L1</td>
<td>14</td>
<td>69253354</td>
<td>rs12434551</td>
<td>A</td>
<td>0.47</td>
<td>0.43</td>
<td>1.59 × 10&lt;sup&gt;-8&lt;/sup&gt;</td>
<td>Additive</td>
<td>0.77 (0.71-0.85)</td>
<td>Intergenic</td>
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Epigenetics: Genes and Environment
Epigenetics-Definition

Alterations to DNA or its associated proteins that do not change the actual coding sequence of the DNA but which may have effects on DNA function.
Epigenetic Alterations

The two main components of the epigenetic code

DNA methylation
Methyl marks added to certain DNA bases repress gene activity.

Histone modification
A combination of different molecules can attach to the ‘tails’ of proteins called histones. These alter the activity of the DNA wrapped around them.
Regulation of Transcription
Histone Geometry Suggests A Complex, Combinatorial “Histone Code”
Functional Elements Defined By Histone Marks
### Functional Elements in JIA GWAS Regions

**Disease-Associated Single-Nucleotide Polymorphisms From Noncoding Regions in Juvenile Idiopathic Arthritis Are Located Within or Adjacent to Functional Genomic Elements of Human Neutrophils and CD4+ T Cells**

Kaifu Jiang, Lisha Zhu, Michael J. Buck, Yannin Chen, Bradley Carrier, Tao Liu, and James N. Jarvis

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#### Table 1. Histone marks in the SNP linkage disequilibrium blocks in neutrophils

<table>
<thead>
<tr>
<th>Chr.</th>
<th>Linkage disequilibrium region</th>
<th>GWAS index SNP</th>
<th>No. of H3K4me1+/H3K27acenhancers</th>
<th>No. of H3K4me1-/H3K27ac+enhancers</th>
<th>No. of H3K4me1+/H3K27ac+enhancers</th>
<th>Enhancer signal</th>
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<td>1</td>
<td>114303808–114377568</td>
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<td>1</td>
<td>154291718–154379369</td>
<td>rs11265068, rs72698115†</td>
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<td>rs10174238</td>
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<td>rs1479904</td>
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<td>6</td>
<td>32592735–32594666</td>
<td>rs7775055†</td>
<td>0</td>
<td>0</td>
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*Chr. = chromosome; GWAS = genome-wide association study.
† The linkage disequilibrium blocks associated with these single-nucleotide polymorphisms (SNPs) were obtained from the 1000 Genomes Project pilot 1.
‡ The linkage disequilibrium block associated with this SNP was obtained from HapMap 3.

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More Complexity: Disease-Specific Enhancers

JIA-Treatment Influences Enhancer Marks
Methylation and Human Disease: SLE

Methylation patterns in CD4+ T cells

So What Does All This Mean?
Children of Poverty - A National Problem

Children Under Age 18 Living in Households with Incomes Below 100 Percent of the Poverty Threshold,* by Race/Ethnicity, 2010

*The U.S. Census Bureau uses a set of money income thresholds to determine who is in poverty; the poverty threshold for a family of four was $22,314 in 2010.


Children by family income, 2011

© National Center for Children in Poverty (www.nccp.org)
Basic Facts About Low-Income Children: Children Under 10 Years, 2011

Percentages may not add to 100 due to rounding.
Where Our Children Grow Up
Links Between Poverty and Health Measures

Is Obesity Caused by Poverty?

- Obesity Rate
  - Below Poverty Line
  - 1.00-1.99 x Poverty
  - 2.00-3.99 x Poverty
  - >= 4.00 x poverty

- Income Level
- Men
- Women
Adverse Childhood Events: Where Physical Health and Community Health Are Joined

1. Recurrent physical or emotional abuse.  2. Sexual abuse.
3. ETOH or other substance abuser in the home.
4. Incarcerated household member.
5. Someone who is chronically depressed, suicidal, or otherwise mentally ill.
6. Mother being treated violently.
7. One or no parents.
8. Emotional or physical neglect.
ACE Score and Smoking Status

![Graph showing the relationship between ACE score and percentage presently smoking. The x-axis represents ACE score (0 to 6 or more), and the y-axis represents percentage presently smoking. The graph shows an increasing trend as the ACE score increases.](image-url)
Childhood Development and Parental ACE

[Bar graph showing the percentage of children with developmental delays based on the number of risk factors.]
Early Stress

CHILDHOOD STRESS

Hyper-responsive stress response; ↓ calm/coping

Chronic “fight or flight;”
↑ cortisol / norepinephrine

Changes in Brain Architecture
Defining Adversity or Stress

- How do you define/measure adversity?

- Huge Individual variability
  - Perception of adversity or stress (subjective)
  - Reaction to adversity or stress (objective)

- National Scientific Council on the Developing Child (Dr. Jack Shonkoff and colleagues)
  - Positive Stress
  - Tolerable Stress
  - Toxic Stress

Based on the REACTION (objective physiologic responses)
Defining Adversity or Stress

Positive Stress

- Brief, infrequent, mild to moderate intensity
- Most normative childhood stress
  - Inability of the 15 month old to express their desires
  - The 2 year old who stumbles while running
  - Beginning school or daycare
  - The big project in middle school

Social-emotional buffers allow a return to baseline
(responding to non-verbal clues, consolation, reassurance, assistance in planning)

Builds motivation and resiliency

Positive Stress is NOT the absence of stress
Toxic Stress

- Long lasting, frequent, or strong intensity
- More extreme precipitants of childhood stress (ACEs)
  - Physical, sexual, emotional abuse
  - Physical, emotional neglect
  - Household dysfunction
- Insufficient social-emotional buffering
  (Deficient levels of emotion coaching, re-processing, reassurance and support)
- Potentially permanent changes and long-term effects
  - Epigenetics (there are life long / intergenerational changes in how the genetic program is turned ON or OFF)
  - Brain architecture (the mediators of stress impact upon the mechanisms of brain development / connectivity)
Stress: An Immune Modifier
Inflammation and Complex Traits in Children

- Preterm birth
- Obesity
- Bronchopulmonary dysplasia
- Asthma

(Asthma rates increase with ACE exposure - Wing et al Ann Allergy Asthma Immunol 2015; 114: 379)
Maybe Just Saying, “Eat Your Vegetables” Isn’t Enough
Epigenetics and Behavior

Dias BG and Ressler K, Nature Neurosci 2014; 17: 89
Epigenetics and Behavior: Brain Rewiring

Beta galactosidase staining of select olfactory regions: F1 offspring

Dias BG and Ressler K, Nature Neurosci 2014; 17: 89
Epigenetics and Behavior: Methylation of *Olfr51*
Stronger Parents Raise Stronger Children

- Infant mental health
- Court referral programs
  - Zero to Three’s Infant-Toddler Court Teams
    - Intervention includes referral of young parents to behavioral health for parenting assessment/training
- Prenatal/Early Life Home Visiting
  - Evidence-based interventions proven to improve the life trajectories of low income women and children
  - Positive effects now shown up to age 19 yrs

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

Nonparticipants
Nurse-Family Partnership Participants

Reading and Math Achievement Test Scores (percentiles)

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

Nonparticipants
Nurse-Family Partnership Participants

Total Language Score

Source: Reproduced with permission from Pediatrics, Vol. 120, e838, Copyright © 2007 by the AAP.
Source: Reproduced with permission from Pediatrics, Vol. 114, 1565, Copyright © 2004 by the AAP.
Days Hospitalized for Injuries
Birth to age 2—Memphis

Months Between Births
Between first and second child
(by first child’s fifth birthday)—Memphis

Source: JAMA, 1997, Vol. 278, 650, Copyright © 1997, American Medical Association. All rights reserved.

Source: JAMA, 2000, Vol. 283, 1987, Copyright © 2000, American Medical Association. All rights reserved.
Months Receiving Welfare Assistance (AFDC)
Birth through age 5—Memphis

Nonparticipants

Nurse-Family Partnership Participants

Months

10  20  30  40

Source: JAMA, 2000, Vol. 283, 1987, Copyright © 2000, American Medical Association. All rights reserved.

Months Receiving Food Stamps
Birth through age 5—Memphis

Nonparticipants

Nurse-Family Partnership Participants

Months

10  20  30  40  50

Source: JAMA, 2000, Vol. 283, 1987, Copyright © 2000, American Medical Association. All rights reserved.
Monetary Benefits

Net present value dollars per child 2003

- **Lower-risk families**: $7,271 (Cost) + $9,151 (Increased participant income) = $16,422
- **Higher-risk families**: $7,271 (Cost) + $41,419 (Increased participant income) = $48,690

- **Increased participant income** (net of welfare loss)
- **Reduction in tangible crime losses**
- **Savings to government**
- **Cost**

Source: 2005 RAND Corporation Study
Family Spirit Impact: Pregnancy to Age 3

Parenting
- Increased maternal knowledge \(^1,2,3,4\)
- Increased parent self-efficacy \(^3,4\)
- Reduced parent stress \(^2,4\)
- Improved home safety attitudes\(^3\)

Mothers’ Outcomes
- Decreased depression. \(^1,2,4\)
- Decreased substance use \(^4\)
- Fewer risky behaviors \(^3,4\)

Child Outcomes
- Fewer social, emotional and behavior problems through age 3. \(^2,3,4\)
- Lower clinical risk of behavior problems over life course \(^4\)

Decreased Externalizing, Internalizing and Dysregulation

ITSEA Problem Domains and Subscales within Domains

Externalizing
- Aggression/Defiance
- Peer Aggression
- Activity/Impulsivity

Internalizing
- General Anxiety
- Depression/Withdrawal
- Separation Distress
- Inhibition to Novelty
- Negative Emotionality

Dysregulation
- Eating
- Sleep
- Sensory Sensitivities
Parenting and Early Childhood Behavior Problems Associated with Obesity

- Negative parenting (inconsistent discipline; restrictive, coercive parenting) associated with increased obesity risk in children.
  - *Trends Endocrinol Metab.* 2013 Apr 19 E-pub

- Externalizing behaviors at 24 mos associated with higher BMI at 24 months and thru age 12
  - *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
$4-$9 in returns for every dollar invested in early childhood programs

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
  - 4 cohorts of disadvantaged children born 1972-77
    - Intervention provided from birth to age 5 years
  - Intervention:
    - Development of language, 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 including BP, A1C, obesity, HDL

*Science* 2014;343:1478-1485
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 percentile
- 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 for our patients and communities?

“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
CONCLUSION:

It is easier to build strong children than to repair broken men.

Frederick Douglass