Basic Premises: “The circle”

• Poverty impacts biology
• Biology affects experiences, development, and health
• Health and experiences of parents exert influences on the life course of future generations
• Intergenerational patterns of health, as well as educational attainment, can be altered by applying fundamental principles of developmental science
Poverty: Conceptualization & Correlates

• Poverty = inadequate resources and insufficient experiences needed for survival, growth, and competence
• Federal Poverty Level (FPL) is based solely on income (2014: $23,850/yr for family of 4)
• In the U.S., race predicts income and poverty rates
• Children are disproportionately affected by poverty – foreshadowing entrenched health disparities that span generations
U.S. Black household income is 59% that of white/non-Hispanic households

Real median household income by race and ethnicity, 1989–2012 (2012 dollars)

Note: White refers to non-Hispanic whites, black refers to blacks alone or in combination, and Hispanic refers to Hispanics of any race. Shaded areas denote recessions.

Source: Current Population Survey Annual Social and Economic Supplement Historical Income Tables (Table H-5)
Increasing Poverty Rates among Children: Black:White Disparities >2X

Note: Races and ethnicities are presented in the following mutually exclusive categories: White refers to non-Hispanic whites, black refers to non-Hispanic blacks, and Hispanic refers to Hispanics of any race.

Source: Authors’ analysis of Current Population Survey Annual Social and Economic Supplement Historical Poverty Tables (Tables 3 and 4)
Health: Conceptualization & correlates

- Health = composite of physical, mental, and social-emotional indicators
- No consensus definition of health
- Health is more than absence of risk conditions, disease, and injuries
- The new vision for “precision medicine” (individualized, genomic-based) could revolutionize treatments and health outcomes
Being poor and/or Black predict(s) an excess of many health-related indicators

- Stress, anxiety, and depression
- Obesity and inadequate exercise
- Addictions
- Cardiometabolic diseases
- Injuries
- Respiratory illnesses
- Exposure to environmental toxins
- Prematurity, low birth weight, and infant mortality
- Disruptions in family structure, residence, work
- Premature death
Recent Scientific Evidence that “the circle can be broken”

1. Early educational and health interventions can disrupt expected intergenerational patterns of low educational attainment, poverty, and poor health (The Abecedarian Project)

2. Biological risks for non-optimal development can be overcome by systematic early supports (The Infant Health & Development Project)

3. Preconception and prenatal “stress and resilience” of parents can alter pregnancy outcomes and set the stage for lifelong health (The Community Child Health Network Study)
The Central Questions of The Abecedarian (ABC) Project

To what extent can increasing the early educational and health supports for children from extremely impoverished homes prevent intellectual and learning disabilities? promote cognitive and social outcomes? improve lifelong health and well-being?
The Abecedarian Project:
Two-Phase Randomized Controlled Trial (RCT)

Birth to 8

Preschool Intervention (N=57)
School-Age Intervention (N=25)
School-Age Control (N=22)

Preschool Control (N=54)
School-Age Intervention (N=24)
School-Age Control (N=21)

Timing of Intervention
Birth to 5
Ages 5 - 8
None

R = RANDOMIZATION
Abecedarian Project Intervention Services for **Treatment** and **Control** Groups

**Treatment Group**
Adequate nutrition
Supportive social services
Primary health care delivered

**Preschool treatment:**
Highly qualified staff
Implementation monitoring
High dosage: 5 days/week, 50 weeks/year, 5 years
“Learningames” Curriculum

- Cognitive / Fine Motor
- Social / Self
- Motor
- Language
- Individualized pace

**Control Group**
Adequate nutrition
Supportive social services
Primary health care delivered
Referrals for follow-up made when problems detected

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Ramey, Sparling, & Ramey
*Abecedarian: The Ideas, the Approach, and the Findings (2012)*
The Abecedarian Intervention Prevented Intellectual Disabilities: % with IQs >84

Martin, Ramey, & Ramey, 1990
American Journal of Public Health
Z Scores, Mean Standardized Scores, and Effect Sizes for Abecedarian Treatment and Control Children from 3 – 54 months

Ramey et al, 2000 Applied Developmental Science

![Graph showing mean Z scores for treatment and control groups over time](image-url)
## Estimated Cumulative Influences on IQ in the Abecedarian (ABC) Project sample

### Regression Coefficients

<table>
<thead>
<tr>
<th>Age in Months</th>
<th>ABC Intervention</th>
<th>Maternal IQ&lt;70</th>
<th>Positive Home Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>+ 7.9</td>
<td>1.0</td>
<td>+ 4.9</td>
</tr>
<tr>
<td>24</td>
<td>+ 12.7</td>
<td>- 4.3</td>
<td>+ 5.1</td>
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<tr>
<td>36</td>
<td>+ 18.6</td>
<td>- 8.2</td>
<td>+ 8.6</td>
</tr>
<tr>
<td>48</td>
<td>+ 13.2</td>
<td>- 11.7</td>
<td>+ 8.9</td>
</tr>
</tbody>
</table>

Abecedarian Project: Woodcock-Johnson Age-referenced Reading Standard Scores at age 8

Effect sizes are relative to the control condition and are calculated as $\frac{X^T - X^C}{SD^C}$.

Significant Health and Education Benefits of the Abecedarian (ABC) Intervention

15 Months to 35 Years Old

Intelligence (IQ)
Reading and math skills
Academic locus-of-control
Social Competence
Years in school
College attendance
Earned 4 yr college degree
Full-time employment
Cardiometabolic health

Grade Repetition
Special Education placement
Teen Pregnancies
Smoking & drug use
Teen depression
Welfare use
Overweight/BMI
Framingham Risk Score

Plus benefits to mothers of these children (education, employment)

Ramey, Sparling, & Ramey (2012); Science (2014)
The 8-site Infant Health and Development Program (IHDP)

• Designed to address the Abecedarian Project questions applied to a highly diverse, biologically at-risk population
• Enrolled 985 infants who were premature (<37 wks GA) and low birthweight children (< 2500 gm)
• Randomized Controlled Trial (RCT) in 8 cities/university partners
  - home visiting added (birth – 36 mos)
  - center-based education from 12 – 36 mos.

• PREMATURITY RATES: 17.1% Blacks, 10.8% Whites
• LBW RATES: 13.5% Blacks, 7.1% Whites
Stanford-Binet IQ Scores at 36 Months
Heavier LBW Group (2001-2500gm)

Infant Health and Development, *JAMA*, 1990
Ramey, AAAS, 1996
<table>
<thead>
<tr>
<th>Outcome</th>
<th>12 Months</th>
<th>24 Months</th>
<th>36 Months</th>
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</thead>
<tbody>
<tr>
<td>Cognitive Development</td>
<td>NS</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Adaptive and Prosocial Behavior</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Reduction in Behavior Problems</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Receptive Language</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Children’s Reasoning</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Positive Home Environment</td>
<td>NS</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Maternal-Child Interactive Behavior</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Maternal Problem Solving</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

*Ramey 1999, adapted from Gross, Spiker, & Haynes, 1997, Helping Low Birth Weight, Premature Babies*
The ABC intervention breaks the correlation between maternal education and child intelligence at age 3: From IHDP 8-site replication of ABC

Adapted from Ramey, Sparling, & Ramey 2012
The Community Child Health Network (CCHN): What we knew in 2002

1. Rigorous trials of high quality prenatal care failed to reduce prematurity and LBW, although it produced many other positive health behaviors in poor, Black women.

2. Retrospective studies showed support for fetal developmental programming of adult-onset illnesses (the Barker hypothesis), but many limitations in studies.

3. Experiences prior to conception likely to exert both biological and behavioral effects on parents and children.

4. Neighborhood and community effects documented as impacting pregnancy outcomes.

5. Maternal stress (as well as depression and anxiety) related to preparedness for pregnancy and parenting competency.
How the Community Child Health Network (CCHN) originated

• **2002**: CCHN sponsored by National Institute of Child Health and Human Development (NICHD) as a multi-phase, interdisciplinary, academic- and community-partnered network

• **Goal**: to develop innovative approaches to advance understanding of entrenched “maternal and child health disparities”

• **Phase 1**: Pilot research and community-academic partnerships; **Phase 2**: 5-site study of interconception care and pregnancy outcomes
Innovations in CCHN Study

• First to measure allostatic load (index of cumulative wear-and-tear due to stress) in women during childbearing years
• Included multiple measures of stress - perceived stress and environmental stressors - and resilience, as well as perceived racism and discrimination, depression, anxiety, trauma, neighborhood resources
• Strong focus on fathers and relationship quality with partners/mothers and their children
• First NICHD research network using Community-Based Participatory Research (CBPR)
Allostatic load

• A composite index of the wear-and-tear of exposure to episodic and chronic stress

• The consequences of allostasis – an ongoing set of processes to maintain homeostasis (regulate major body systems) while adapting to stress

• Predictive of disease (morbidity) and death in middle age to older age populations
10 Indices of Allostatic Load in CCHN

- **HPA Axis/Stress**: Systolic blood pressure, diastolic blood pressure, salivary cortisol (diurnal)
- **Immune/Inflammatory**: High-sensitivity C-reactive protein, tumor necrosis factor, interleukin-6
- **Metabolic**: Body Mass Index (BMI), waist-to-hip ratio, glycosylated hemoglobin, lipid panel
CCHN Phase 2 Study (2005-2012)

- Multisite, transdisciplinary, prospective, longitudinal study of the inter-pregnancy period in heterogeneous sample (with over-representation of low-income, black/African American, and Hispanic/Latino families and premature births)
- Enrolled 2510+ families at time of birth of one child, followed at least 24 mos or until next pregnancy and birth
The Preconception Origins of Family Health (CCHN Model)  - Ramey et al (2014)
Central Hypotheses tested from the CCHN Conceptual Framework

1. Parental stress and resilience will influence maternal allostatic load during the preconception period.

2. Parental stress and resilience will be associated with the quality of the mother-father relationship and social support as well as their mental health and parenting.

3. Maternal stress and allostatic load in the preconception period will influence prenatal development, including LBW and fetal programming of risk for stress-related health conditions. (new Phase 3 Study ongoing)

4. Community resources and challenges, including racism and discrimination, will impact parent stress, their health and health care utilization, and children’s neurocognitive development and cardiometabolic outcomes.
Collectively, we have converging scientific findings to supporting the conclusion that “the circle can be broken”

1. Early educational and health interventions *can* disrupt expected intergenerational patterns of low educational attainment, poverty, and poor health.

2. Consequences of biomarkers for non-optimal development (e.g., low birthweight, prematurity) *can* be overcome by systematic supports to promote health and development.

3. Preconception and prenatal “stress and resilience” of parents *can* alter pregnancy outcomes and set the stage for improved (vs impaired) lifelong health.
• We owe immense thanks to our many collaborators, community partners, and funding agencies (NIH, RWJ Foundation, MCHB, CDC, Pew Charitable trusts)
• All of these datasets are either in the public domain or scheduled for release to maximize scientific utility and build public trust
• For copies of this presentation and key supporting citations, please contact us:  
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