Translating Developmental Science into Healthy Lives:

Realizing the Potential of Pediatrics

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My 3 Objectives For Today

• Provide a **generalist’s overview** of advances in developmental science

• Present an organizing, integrated, **ecobiodevelopmental** framework

• Discuss ways **pediatricians** might assist in **translating** science into healthier life-courses
Critical Concept #1

Childhood Adversity has Lifelong Consequences.

Significant adversity in childhood is strongly associated with unhealthy lifestyles and poor health decades later.
## ACE Categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Women (n=9,367)</th>
<th>Men (n=7,970)</th>
<th>Total (n=17,337)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Abuse</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Emotional</td>
<td>13.1%</td>
<td>7.6%</td>
<td>10.6%</td>
</tr>
<tr>
<td>- Physical</td>
<td>27.0%</td>
<td>29.9%</td>
<td>28.3%</td>
</tr>
<tr>
<td>- Sexual</td>
<td>24.7%</td>
<td>16.0%</td>
<td>20.7%</td>
</tr>
<tr>
<td><strong>Household Dysfunction</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Mother Treated Violently</td>
<td>13.7%</td>
<td>11.5%</td>
<td>12.7%</td>
</tr>
<tr>
<td>- Household Substance Abuse</td>
<td>29.5%</td>
<td>23.8%</td>
<td>26.9%</td>
</tr>
<tr>
<td>- Household Mental Illness</td>
<td>23.3%</td>
<td>14.8%</td>
<td>19.4%</td>
</tr>
<tr>
<td>- Parental Separation or Divorce</td>
<td>24.5%</td>
<td>21.8%</td>
<td>23.3%</td>
</tr>
<tr>
<td>- Incarcerated Household Member</td>
<td>5.2%</td>
<td>4.1%</td>
<td>4.7%</td>
</tr>
<tr>
<td><strong>Neglect</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Emotional</td>
<td>16.7%</td>
<td>12.4%</td>
<td>14.8%</td>
</tr>
<tr>
<td>- Physical</td>
<td>9.2%</td>
<td>10.7%</td>
<td>9.9%</td>
</tr>
</tbody>
</table>

* Wave 2 data only (n=8,667)  

Data from [www.cdc.gov/nccdphp/ace/demographics](http://www.cdc.gov/nccdphp/ace/demographics)
ACEs Impact Multiple Outcomes

Risk Factors for Common Diseases
- Smoking
- Alcoholism
- Promiscuity
- High Perceived Risk of HIV
- Obesity
- Illlicit Drugs
- IV Drugs
- Multiple Somatic Symptoms
- Poor Perceived Health

Prevalent Diseases
- Cancer
- Skeletal Fractures
- Liver Disease
- Chronic Lung Disease
- Ischemic Heart Disease
- Sexually Transmitted Diseases

General Health and Social Functioning
- Relationship Problems
- High perceived stress
- Married to an Alcoholic
- Difficulty in job performance

Mental Health
- Depression
- Anxiety
- Memory Disturbances
- Panic Reactions
- Poor Anger Control

Sexual Health
- Teen Paternity
- Teen Pregnancy
- Fetal Death
- Unintended Pregnancy
- Early Age of First Intercourse

ACEs
- Difficulty in job performance
- Married to an Alcoholic
- High perceived stress
- Poor Self-Rated Health
- Hallucinations
- Sleep Disturbances
- Memory Disturbances
- Panic Reactions
- Poor Anger Control
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General Health and Social Functioning
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Developing a Model of Human Health and Disease

Early childhood ecology strongly associates with lifelong developmental outcomes.

How do you begin to define or measure the ecology?

What are the mechanisms underlying these well-established associations?
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
Defining Adversity or 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)
Critical Concept #2

Epigenetics:

- Which genes are turned on/off, when, and where
- Ecology (environment/experience) influences how the genetic blueprint is read and utilized
- Ecological effects at the molecular level
- Stress-induced changes in epigenetic markers

"Genes may load the gun, but the environment pulls the trigger"
Through epigenetic mechanisms, the early childhood ecology becomes biologically embedded, influencing how the genome is utilized.
Critical Concept #3

Developmental Neuroscience:

- **Synapse** and circuit formation are experience and activity dependent.

- **Ecology** (environment/experience) influences how brain architecture is formed and remodeled.

- Early childhood adversity -> **vicious cycle of stress**

- **Diminishing cellular plasticity** limits remediation.

- **Potentially permanent** alterations in brain architecture and functioning.
Two Types of Plasticity

- **Synaptic Plasticity** –
  - Variation in the **STRENGTH** of individual connections
  - “from a whisper to a shout”
  - Lifelong (how old dogs learn new tricks)

- **Cellular Plasticity** –
  - Variations in the **NUMBER (or COUNT)** of connections
  - “from one person shouting to a stadium shouting”
  - Declines dramatically with age (**waning by age 5**)**
Maturation Progression

- Maturation generally proceeds from the back of the brain to the front.
- Explains in part...
  - Preference for physical activity (back of brain)
  - More risky, impulsive behaviors (limbic system)
  - More moody at times (limbic system)
  - Less than optimal planning and judgment (PFC)
  - Poor recognition of negative consequences (PFC)
Out of Balance

Prefrontal Cortex

Cold Cognition
Judgmental
Reflective
Calculating
Think about it

Biological maturity by 24

Amygdala

Hot Cognition
Emotional
Reactive
Impulsive
Just do it

Biological maturity by 18

Adapted from Ken Winters, Ph.D.
Impact of Early Stress

Chronic “fight or flight;” adrenaline / cortisol

Changes in Brain Architecture

Hyper-responsive stress response; ↓ calm/coping

CHILDHOOD STRESS
Declining plasticity in the developing brain results in potentially permanent alterations in brain functioning and development.
Eco-Bio-Developmental Model of Human Health and Disease

Ecology Becomes biology, and together they drive development across the lifespan.
The critical challenge now is to translate game-changing advances in developmental science into effective policies and practices for families with children to improve education, health, and lifelong productivity.
Advantages of an **EBD** Framework

- Though grounded in developmental science, the simplicity of the EBD framework may promote understanding as well as support for translation.

- Psychosocial stressors and other salient features of the ecology are every bit as biological as nutrition or lead (no distinction between mental and physical health, just healthy vs. unhealthy development).

- Emphasizes the dimension of time – to reflect the ongoing, cumulative nature of benefits and threats to health and wellness.
Advantages of an EBD Framework

- Underscores the need to improve the early childhood ecology in order to:
  - Mitigate the biological underpinnings for educational, health and economic disparities
  - Improve developmental/life-course trajectories

- Highlights the pivotal role of toxic stress
  - Not just “step on the gas” or enrichment
  - But “take off the break” by treating, mitigating or immunizing against toxic stress
Reinventing the Wheel - All over again?

<table>
<thead>
<tr>
<th>Models</th>
<th>Needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maslow’s Hierarchy of Needs</td>
<td>Self-Actualization</td>
</tr>
<tr>
<td>(Theoretical - 1943)</td>
<td>Need to know, explore and understand</td>
</tr>
</tbody>
</table>

Unmet needs are potential sources of **STRESS!!**
Linking **Childhood Experiences** and **Adult Outcomes**

**Toxic Stress**
- Epigenetic Modifications
- Disruptions in Brain Architecture
- Behavioral Allostasis
The **BIG** Questions are...

If **TOXIC STRESS** is the missing link between **ACE exposure** and the **unhealthy lifestyles** and **poor outcomes** seen as adults, it raises the following BIG questions:

1) Are there ways to **treat, mitigate, and/or immunize against** the effects of toxic stress?

2) What are the **long term costs** due to toxic stress versus the **up-front costs** to treat, mitigate or immunize?
Addressing **Toxic** Stress

- **Treatment** of the consequences
  - TF-CBT and PCIT are evidence-based
  - Reactive – some “damage” already done!
  - Very **COSTLY**
  - Efficacy linked to age and chronicity
    - Declining **brain plasticity**?
  - Insufficient **number of / access** to providers
    - Limited reimbursements; carve-outs
  - Mental Health **Parity**?
  - Persistent **STIGMA**
    - “Character Flaws” vs “Biological Mal-adaptations”
Addressing Toxic Stress

• Secondary / Targeted Preventions
  – Focused, targeted interventions for those deemed to be “at high risk”
  – Visiting Nurse Programs (Nurse Family Partner.)
  – Parenting Programs (Triple-P, Nurturing Parent.)
  – More likely to be effective; minimize “damage”
  – Requires screening
  – Still issues with stigma, numbers of/access to providers
Addressing **Toxic** Stress

- **Primary / Universal Prevention**
  - Proactive, universal interventions to make stress *positive*, instead of tolerable or toxic
  - Acknowledges that preventing all childhood adversity is *impossible* and even *undesirable*
  - **Actively building resiliency** ("immunizing" through positive parenting, 7C’s of resilience, promoting optimism, formalized social-emotional learning)
  - **SE Buffers** allow the physiologic stress response to return to baseline
    - **Parenting** skills for younger children
    - **SEL** skills for older children ([www.casel.org](http://www.casel.org))
Social-Emotional Skills Can Be Taught / Learned

Illinois Learning Standards

Social/Emotional Learning (SEL)

The standards describe the content and skills for students in grades K - 12 for social and emotional learning. Each standard includes five benchmark levels that describe what students should know and be able to do in early elementary (grades K - 3), late elementary (grades 4 - 6), middle/junior high (grades 6 - 8), early high school (grades 9 - 10), and late high school (grades 11 - 12). These standards build on the Illinois Social/Emotional Development Standards of the Illinois Early Learning Standards.

These standards have been developed in accordance with Section 15(a) of Public Act 93-0495. This Act calls upon the Illinois State Board of Education to “develop and implement a plan to incorporate social and emotional development standards as part of the Illinois Learning Standards.”

Introduction

Goals
- Goal 1 - Develop self-awareness and self-management skills to achieve school and life success
- Goal 2 - Use social-awareness and interpersonal skills to establish and maintain positive relationships
Critical Concept #5

SOCIAL-EMOTIONAL SKILLS...
(a.k.a – Affect Regulation, Non-Cognitive Skills)

...Are **learned** (they can be modeled, nurtured, taught, practiced, and reinforced)

...Effectively **buffer** against **toxic stress**
(by helping to turn **off** the physiologic stress response)

...Increase **test scores**
(an average of **11 points** by meta-analysis!)
Parenting as Primary Prevention

• Promoting **Parenting Skills** in the first 1000 days
  – Parenting is personal – makes pediatricians NERVOUS!
  – “Positive/Nurturing/Supportive” Parenting
  – A Poor investment?
    • Are parenting skills “teachable?” **YES!!**
    • Is there a “ceiling effect” on returns? **What is “OK?”**
  – Or the “**Gold Standard?**”
    • Shouldn’t this be **THE** reference point
    • (NOT routine, general, or control populations)

• Recent article from Luby et al., PNAS
  – **Maternal support** and **Depression severity** at ages 3-5
    • “Waiting Test” assessed the dyad (Bright Gift + Parental Surveys)
  – **Hippocampal volumes** at school age (7-13)
• Early maternal support exerts **a positive influence on hippocampal development**
• The positive effect of maternal support on hippocampal volumes was **greater in nondepressed children**

Luby et al., 2012. Available at: [www.pnas.org/cgi/doi/10.1073/pnas.1118003109](http://www.pnas.org/cgi/doi/10.1073/pnas.1118003109)
Critical Concept #6

For young children, parent/caregiver support is critical:

- Turns off physiologic stress response by addressing physiologic and safety needs (Maslow levels 1+2 – PROTECT)
- Turns off the physiologic stress response by promoting healthy relationships and attachment (Maslow level 3 - RELATE)
- Notes and encourages foundational coping skills as they emerge (Maslow levels 4+5 - NURTURE)

Pediatricians are ideally placed to:

- Promote this sort of “Purposeful” Parenting
- Advocate for a public health approach to address toxic stress
Social-Emotional Safety Nets

A Public Health Approach to “Toxic Stress”

Universal Primary Preventions
- Anticipatory guidance
- Consistent messaging
  - No identification
  - No stigma
  - Ceiling effects = Limited evidence base

Targeted Interventions
  (for those “at risk”)
  - Nursing home visits
  - Parenting programs
  - Early Intervention
  - Less ceiling = More evidence
  - Requires screening
  - Issues with stigma

Evidence-Based Treatments
  (for the symptomatic)
  - PCIT; TB-CBT
  - Treatment works!

Screening / stigma / access
WHAT are we DOING?!

Universal Primary Preventions
Bright Futures
Connected Kids
Circle of Security
Relationships as a “vital” sign

Basic EBCD Competencies

Targeted Interventions
Screening for risks
(assess the ecology)
Refer to/advocate for EBI
Collaborating/Developing EBI

Mid-level Competencies

Evidence-Based Treatments
Screening for diagnoses
Common factors approach
Refer for/advocate for EBT
Collaborating/Developing EBT

Advanced Competencies
Public Health Implications

• ACE data provide a working model for understanding and addressing the childhood antecedents of adult disease.

• Is there a gap between what we do and what we know?

• What we DO:
  – 95% of the trillions of dollars that we spend on health is on treatment and NOT prevention
Public Health Implications

• What we **KNOW**:
  – That **70% of early deaths are preventable**, with...
    – **40% due to behavioral patterns**
      (Is this behavioral allostasis?)
    – **15% due to social circumstances**, and
    – **10-15% due to shortfalls in medical care**

  McGinnis, Williams-Russo and Knickman, 2002
A **Public Health** Dilemma:

Do we continue to treat *disease*,

the **unhealthy lifestyles** that lead to *disease*,

or the **TOXIC STRESS** that leads to the adoption of unhealthy lifestyles??
CONCLUSION:

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

Frederick Douglass