The Role of Life Experiences in Shaping Brain Development

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Sullivan County Anti-Drug Coalition
Building Strong Brains Tennessee

Mission

We work to change the culture of Tennessee so that the state’s overarching philosophy, policies, programs and practices for children, youth and young adults utilize the latest brain science to prevent and mitigate the impact of adverse childhood experiences.
Public Private Partnership

Public and Private Sector Steering Groups

Supported by:

Foundations and In-kind Resources
Tennessee State Government
Healthy Child Development

Successful Parenting of Next Generation

- Educational Achievement
- Economic Productivity
- Responsible Citizenship
- Lifelong Health

Strong Communities
Healthy Economy
Four Core Concepts of Development

1. **Brain Architecture** is established early in life and supports lifelong learning, behavior and health.

2. Stable, caring relationships and “Serve and Return” interactions shape brain architecture.

3. **Toxic Stress** in the early years of life can derail healthy development.

4. **Resilience** can be built through “Serve and Return” relationships, improving self-regulation skills and executive function. Though there are sensitive periods of brain development in early childhood and adolescence, resilience can be strengthened at any age.
Three Core Concepts in Early Development

Experiences Build Brain Architecture

NATIONAL SCIENTIFIC COUNCIL ON THE DEVELOPING CHILD
Center on the Developing Child

http://developingchild.harvard.edu/resources/experiences-build-brain-architecture/
Brains are built over time, starting in the earliest years of life. Simple skills come first; more complex skills build on top of them.

Cognitive, emotional and social capabilities are inextricably intertwined throughout the life course.

A strong foundation in the early years improves the odds for positive outcomes and a weak foundation increases the odds of later difficulties.
Brain Architecture

The early years of life matter because early experiences affect the architecture of the maturing brain. As it emerges, the quality of that architecture establishes either a sturdy or a fragile foundation for all of the development and behavior that follows. Getting things right the first time is easier than trying to fix them later.
More Than **ONE MILLION**
New Neural Connections Per Second

Source: Center on the Developing Child at Harvard University, 2009
Neural Circuits are Wired in a Bottom-Up Sequence

- Sensory Pathways (Vision, Hearing)
- Language
- Higher Cognitive Functions
- Self-Regulation

FIRST TWO YEARS

Birth (Months) (Years)

Slide courtesy of Ross A. Thompson
Serve & Return Relationships
Support Skill Learning
Three Core Concepts in Early Development

Serve & Return Interaction Shapes Brain Circuitry

NATIONAL SCIENTIFIC COUNCIL ON THE DEVELOPING CHILD
Center on the Developing Child

http://developingchild.harvard.edu/resources/serve-return-interaction-shapes-brain-circuitry/
Secure Attachment Cycle

1. Baby has a need
2. Baby Cries
3. TRUST DEVELOPS
4. Need met by caregiver
Insecure Attachment/Trauma Cycle

- Baby has a need
- Baby Cries
- Need not met by caregiver
- Mistrust develops
Still Face Experiment

https://www.youtube.com/watch?v=apzXGEbZht0
Intergenerational Transmission of Early Adversity

Early Adversity

Parental Neglect/Abuse

Turn Away from Infant

Turn to Habitual Behaviors to Reduce Stress

Parenting Related Stress

Dysregulated Stress Response

Risk for Addiction & Mental Health Problems

Impaired Response to Infant Cues (High Stress/Low Reward)
Serve & Return Interactions Build Brains and Skills

• Young children naturally seek interaction through babbling, facial expressions and gestures, and adults respond in kind.
• These “serve and return” interactions are essential for the development of healthy brain circuits.
• Therefore, systems that support the quality of relationships in early care settings, communities and homes also support the development of sturdy brain architecture.
• Quality relationships continue to be vital in adolescence in order to reinforce brain architecture and build resilience.
MOTHER’S SPEECH AND CHILD VOCABULARY

Sources: Cameron, n.d.; Huttenlocher et al., 1991
The Brain’s Ability to Change Decreases Over Time

During puberty and adolescence, there is another window of plasticity
Adolescent Brain Development: A Period of Vulnerabilities and Opportunities

The brain starts to undergo a “remodeling” project in adolescence, making it an opportune time to build resilience.

- **Air Traffic Control**: Before and during puberty, a second period of rapid neural growth occurs in the prefrontal cortex.

- **“Use it or lose it”**: The adolescent brain strengthens the neural connections that are used most often and prunes away those that aren’t used as frequently.

- **Integration**: The *corpus callosum*, which relays information between different parts of the brain, also undergoes waves of growth during adolescence, improving self-regulation.

Sources: Siegel, 2015; Spinks, n.d.
Three Core Concepts in Early Development

Toxic Stress Derails Healthy Development

NATIONAL SCIENTIFIC COUNCIL ON THE DEVELOPING CHILD
Center on the Developing Child HARVARD UNIVERSITY

http://developingchild.harvard.edu/resources/toxic-stress-derails-healthy-development/
Positive Stress

Short, stressful events like meeting new people or starting the first day of school are healthy for brain development. They prepare the brain and body for stressful situations later in life.

Tolerable Stress

Tragic, unavoidable events like a natural disaster or losing a loved one aren't good for us. But if supportive caregivers are around to buffer the stress response, these events won't do lasting damage to the brain and body.

Toxic Stress

Ongoing, repeated exposure to abuse or neglect is bad for brain development. If no supportive adults are present to help buffer the stress response, stress hormones will damage developing structures in the child's brain. The result is an increased vulnerability to lifelong physical and mental health problems, including addiction.
Body’s Response to Different Types of Stress

**POSITIVE**
A normal and essential part of healthy development

**EXAMPLES**
- getting a vaccine,
- first day of school

**TOLERABLE**
Response to a more severe stressor, limited in duration

**EXAMPLES**
- loss of a loved one,
- a broken bone

**TOXIC**
Experiencing strong, frequent, and/or prolonged adversity

**EXAMPLES**
- physical or emotional abuse,
- exposure to violence
Common Sources of Toxic Stress

- Maltreatment: 75 (per 1,000)
- Postpartum Depression: 130
- Parental Substance Abuse: 136

Source: Center on the Developing Child at Harvard University, 2007
Experience Alters Brain Development
Healthy vs. Neglected Brain

Sources: Felitti, 2011; Nelson et al., 2007
Toxic Stress Alters Brain Development

Amygdala:
Activates the stress response.
Toxic Stress: Enlargement

Prefrontal Cortex:
Usually a check to the amygdala.
Toxic Stress: Loss of neurons, less able to function.

Hippocampus:
Major role in memory and mood.
Toxic Stress: Impairment in understanding and emotion.
Toxic Stress Changes Gene Expression

Epigenetics

Intergenerational Transmission of Stress Response in Male Mice
An “Air Traffic Control System” in the Brain

- Executive functioning is a group of skills that help us to focus on multiple streams of information at the same time, set goals and make plans, make decisions in light of available information, revise plans and resist hasty actions.

- Executive functioning is a key biological foundation of school readiness, as well as outcomes in health and employability.

- Although there are sensitive periods of development, executive functioning can be built along any point in the lifespan.
What are Executive Function Skills?

**Inhibitory Control** — filter thoughts and impulses to resist temptations and distractions

**Working Memory** — hold and manipulate information in our heads over short periods of time

**Cognitive Flexibility** — adjust to changed demands, priorities or perspectives
### Building an “Air Traffic Control System” in the Developing Brain

<table>
<thead>
<tr>
<th>Age</th>
<th>Working Memory</th>
<th>Inhibitory Control</th>
<th>Cognitive Flexibility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adult</strong></td>
<td>Remember multiple tasks, rules &amp; strategies that may vary</td>
<td>Self-control, situationally appropriate responses</td>
<td>Revise actions &amp; plans in changing circumstances</td>
</tr>
<tr>
<td><strong>2-5 years</strong></td>
<td>Remember 2 rules (shoes here, coats there)</td>
<td>Delay eating a treat, follow arbitrary rule</td>
<td>Shift actions as rules change</td>
</tr>
<tr>
<td><strong>9-16 months</strong></td>
<td>Execute simple 2-step plan (means-to-end tasks)</td>
<td>Begin to maintain focus despite distractions</td>
<td>Seek alternate methods when 1st attempt fails</td>
</tr>
</tbody>
</table>
Early Life Stress Impacts Lifelong Health and Development

- Preconception
- Prenatal
- Early Childhood
- Middle Childhood
- Adolescence
- Adulthood

Biology of Health
- Physiological Adaptations or Disruptions
  - Cumulative Over Time
  - Embedded During Sensitive Periods
How Brains are Built

https://www.youtube.com/watch?v=LmVWOe1ky8s
ACE Study Demographics

Participants were mostly white, middle-aged, college educated and insured. They didn’t face many of life’s challenges such as poverty or racism.

- At least some college: 75.2%
- No college: 24.8%

- Ages 40+:
  - White: 84.9%
  - Hispanic: 15.1%

- Ages 19-39:
  - White: 74.8%
  - Hispanic: 11.2%
  - Black: 4.6%
  - Asian: 7.2%
  - Other: 1.9%

Source: Centers for Disease Control and Prevention, 2016
Number of ACEs Experienced Before Age 18 by Adults in CDC-Kaiser ACE Study 1997

64% had at least 1 ACE

22% had 3 or more ACEs (nearly 1 in 4)

Source: Centers for Disease Control and Prevention, 2016
Adverse Childhood Experiences

<table>
<thead>
<tr>
<th>ABUSE</th>
<th>NEGLECT</th>
<th>HOUSEHOLD DYSFUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical</td>
<td>Mental Illness</td>
<td>Incarcerated Relative</td>
</tr>
<tr>
<td>10.6%</td>
<td>19.4%</td>
<td>4.7%</td>
</tr>
<tr>
<td>Emotional</td>
<td>Emotionally</td>
<td>Mother treated violently</td>
</tr>
<tr>
<td>28.3%</td>
<td>9.9%</td>
<td>12.7%</td>
</tr>
<tr>
<td>Sexual</td>
<td>Substance Abuse</td>
<td>Divorce</td>
</tr>
<tr>
<td>20.7%</td>
<td></td>
<td>23.3%</td>
</tr>
</tbody>
</table>

Sources: Center for Youth Wellness, n.d.; Centers for Disease Control and Prevention, 2016
ACEs Can Have Lasting Effects On...

Health (obesity, diabetes, depression, suicide attempts, STDs, heart disease, cancer, stroke, COPD, broken bones)

Behaviors (smoking, alcoholism, drug use)

Life Potential (graduation rates, academic achievement, lost time from work)

Source: Centers for Disease Control and Prevention, 2016
Adverse Childhood Experiences

https://www.youtube.com/watch?v=ccKFkcfXx-c
Mechanisms by Which Adverse Childhood Experiences Influence Health and Well-being Throughout the Lifespan

Source: Anda, n.d.
**New Additions to the ACEs Questionnaire**

*The Philadelphia ACE Study Questions*

<table>
<thead>
<tr>
<th>Conventional ACEs</th>
<th>Expanded ACEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Abuse</td>
<td>Witnessing Violence</td>
</tr>
<tr>
<td>Emotional Abuse</td>
<td>Living in Unsafe Neighborhoods</td>
</tr>
<tr>
<td>Sexual Abuse</td>
<td></td>
</tr>
<tr>
<td>Emotional Neglect</td>
<td>Experiencing Racism</td>
</tr>
<tr>
<td>Physical Neglect</td>
<td></td>
</tr>
<tr>
<td>Domestic Violence</td>
<td>Living in Foster Care</td>
</tr>
<tr>
<td>Household Substance Abuse</td>
<td></td>
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<tr>
<td>Incarcerated Care Provider</td>
<td>Experiencing Bullying</td>
</tr>
<tr>
<td>Mental Illness in the Home</td>
<td></td>
</tr>
</tbody>
</table>
Understanding Implicit Bias

https://www.youtube.com/watch?v=ucEAcIMkS0c
Trauma and Social Location

Adverse Childhood Experiences

- Early Death
- Disease, Disability, and Social Problems
- Adoption of Health-risk Behaviors
- Social, Emotional and Cognitive Impairment
- Adverse Childhood Experiences

Historical Trauma/Embodiment

- Early Death
- Burden of disease, distress, criminalization, stigmatization
- Coping
- Allostatic Load, Disrupted Neurological Development
- Complex Trauma/ACE
- Social Conditions/Local Context
- General Embodiment/Historical Trauma

Conception

Death

Microaggressions, implicit bias, epigenetics
Significant Adversity Impairs Developmental Milestones in the First Three Years

Source: Barth et al., 2008
ACEs Compromise Community Prosperity

Source: ACE Response, n.d.
ACEs Compromise Community Prosperity

Source: Perkins, 2016
The Cost of ACEs

- Productivity Loss ($83.5 Billion)
- Health Care ($25 Billion)
- Special Education ($4.6 Billion)
- Child Welfare ($4.4 Billion)
- Criminal Justice ($3.9 Billion)

Sources: Centers for Disease Control and Prevention, n.d.; Fang et al., 2012
Number of ACEs Experienced Before Age 18 by Adult Tennesseans

2016

61% had at least 1 ACE

27% had 3 or more ACEs (that’s 1 in 4)

Source: Tennessee Department of Health, 2016
Tennesseans with Higher ACE Scores Have a Greater Risk of Engaging in Health Risk Behaviors

2016

Source: Tennessee Department of Health, 2016
Tennesseans with Higher ACE Scores Have a Greater Risk of Disease

2016

Source: Tennessee Department of Health, 2016
Tennesseans with Higher ACE Scores Have a Greater Risk of Poor Mental Health

2016

Source: Tennessee Department of Health, 2016
Tennesseans with Higher ACE Scores Have Poorer Economic Outcomes

2016

Odds Ratio

- Divorced
- Never Married
- Out of work >1 yr
- Income < $10,000

Source: Tennessee Department of Health, 2016
Tennesseans with Higher ACE Scores Attain Less Education

2016

Odds Ratio

Not a High School Graduate

College Graduate

Source: Tennessee Department of Health, 2016
ACEs Data on Individuals Who Are Incarcerated and/or in Substance Abuse Treatment

The Family Center

75% Have 4 or more ACEs
- Results in 5 - 10 years earlier death
- Compare to 13% from original ACE study

54% Have 6 or more ACEs
Number of ACEs Experienced by Newly Enrolled Evidence Based Home Visiting Participants

*July 1, 2015 – June 30, 2016*

- **26%** Have 4 or more ACEs
  - Results in 5 - 10 years earlier death
  - Compare to 13% from original ACE study

- **12%** Have 6 or more ACEs
A Caution: ACEs Are Not Destiny

Some children are more susceptible than others to toxic stress.

Adults other than parents and caregivers can play a buffering, caring role.

There is opportunity to repair damage across development, from early childhood through adulthood.

Interventions at any point in childhood, adolescence, and adulthood make a difference.
Keys to Healthy Development

• Early support for emotional, social, cognitive and language development

• Supportive relationships with adults and caregivers and opportunities to learn from infancy to young adulthood

• Highly specialized early interventions for children and families experiencing significant adversity

• Opportunities to build executive functioning skills across childhood and adolescence
Fostering Resilience

https://vimeo.com/106322359
Fostering Resilience

When positive experiences outweigh negative experiences, a child’s “scale” tips toward positive outcomes.
Fostering Resilience

The initial placement of the fulcrum affects how easily the scale tips toward positive or negative outcomes.
Overtime, the cumulative impact of positive life experiences and coping skills can shift the fulcrum’s position, making it easier to achieve positive outcomes.
Children of Color are More Likely to Experience Systemic Barriers to Building Resilience
Assure Every Child’s Relationships and Environments Are:

- Safe — Free from physical & emotional harm.
- Stable — Familiar routines, people, & places.
- Nurturing — Sensitively care & encourage development
Improving Air Traffic Control Helps with Stress Management Across the Lifespan

Focusing Attention
Problem Solving
Planning Ahead
Behavior Regulation
Controlling Impulses
Adjusting to New Circumstances

Executive Function and Self Regulation Skills can be built at any point across the lifespan.

Source: Cameron, n.d.
Collective Ingenuity
ACEs Require Public Health Approaches

Primary Prevention
Creating safe, stable, nurturing relationships and environments as well as community infrastructures that promote social cohesion

Secondary Prevention
Services for those “at risk”

Tertiary Prevention
Treatment Services

Raise Awareness
Policy Change
Norms Change
Use a Trauma-Informed Approach in Your Organization and Community

• According to SAMHSA’s concept of a trauma-informed approach, “A program, organization, or system that is trauma-informed:

  1. *Realizes* the widespread impact of trauma and understands potential paths for recovery;

  2. *Recognizes* the signs and symptoms of trauma in clients, families, staff, and others involved with the system;

  3. *Responds* by fully integrating knowledge about trauma into policies, procedures, and practices; and

  4. Seeks to actively resist *re-traumatization.*"

• A trauma-informed approach can be implemented in any type of service setting or organization and is distinct from trauma-specific interventions or treatments that are designed specifically to address the consequences of trauma and to facilitate healing.

Source: SAMHSA, 2018
Use a Trauma-Informed Approach in Your Organization and Community

SAMHSA’S 6 PRINCIPLES of a TRAUMA-INFORMED APPROACH

SAFETY
Prevents violence across the lifespan and creates safe physical environments.

TRUSTWORTHINESS
Fosters positive relationships among residents, City Hall, police, schools and others.

EMPOWERMENT
Ensures opportunities for growth are available for all.

COLLABORATION
Promotes involvement of residents and partnership among agencies.

PEER SUPPORT
Engages residents to work together on issues of common concern.

HISTORY, GENDER, CULTURE
Values and supports history, culture and diversity.

Source: SAMHSA, 2018
Move the Needle by Investing Early

Focus has to shift from remediation to prevention and not just “prevention,” but primary prevention

Source: Perry, 2004
The Biggest Returns Come From Early Investments

Early intervention is more effective in producing favorable outcomes than later remediation... but it’s never too late.

Source: Heckman, 2018
Returns for Every Dollar Invested in Early Childhood Programs

Source: Center on the Developing Child at Harvard University, 2009
Create Charging Stations
Support Mental Levelness in Young Children

https://vimeo.com/120444414
Build Executive Functioning in Childhood and Adolescence

- Sports and Physical Activity
- Goal Setting, Planning and Monitoring
- Yoga, Meditation and Mindfulness Activities
- Journaling and Self-Talk
- Logic Puzzles and Computer Games
- Theater, Music and Dance

Source: Center on the Developing Child at Harvard University, 2014
Use a Two- and Three-Generation Approach

- Early Childhood intervention also promotes healthy parenting by those children as adults
- Early “Child” Intervention needs to include focus on adult development as caregivers and on those skills inherent to caring for others
- Ensuring healthier, more mindful, socially connected caregivers positively impacts child health (and also the next generation)
What CAN Be Done About ACEs Across the Lifespan?

- Adopt Trauma-Informed School Policies and Practices
- Access to High-Quality, Affordable Childcare and Pre-K
- Home Visiting to Pregnant Women and Families with Newborns
- Business and Organization Policies that support working parents
- Access to Integrated Healthcare
- Parent Support Programs for Teens and Teen Pregnancy Prevention Programs
What CAN Be Done About ACEs Across the Lifespan?

- Access to Mental Health and Substance Abuse Treatment
- Sufficient Income Support for Low-Income Families
- Intimate Partner Violence Prevention
- Bringing Community Development and Childhood Development together
- Health System Investment in Communities
- Social Supports for Parents

...and so much more
Prevention, Mitigation and Treatment of Adverse Childhood Experiences
Anticipated Multi-Sector, Multi-Level Public and Private Impacts

- Business and Corporations
- Juvenile and Adult Justice
- Health Care Services and Financing
- Human Services
- Faith Based Communities
- Philanthropy
- Mental Health & Substance Abuse Services
- Education and Early Care
- Media
- Philosophy and Approach
- Policies and Funding
- Programs and Services
- Professional Practice
- Child Welfare

BUILDING STRONG BRAINS
TENNESSEE
The New Norm: Shifting the Conversation...

What is wrong with you?

TO

What has happened to you?
Further Information

Tennessee Commission on Children and Youth Website
https://www.tn.gov/tccy/topic/tccy-aces
Adverse Childhood Experiences
Community Survey

http://bit.ly/2dZOeWg