

The Role of Life Experiences in Shaping Brain Development

Arkansas Community Advisory Council Forum
March 19, 2019

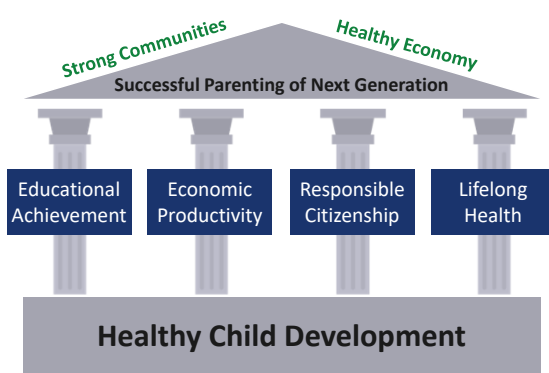
1

Building Strong Brains

Course Objectives

- Gain knowledge on the ACEs study and its impact on substance use
- Gain understanding on how changes to environmental factors and social norms associated with ACEs can prevent substance misuse

2



3

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.

4

Three Core Concepts in Early Development

1 Experiences Build Brain Architecture

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

<http://developingchild.harvard.edu/resources/experiences-build-brain-architecture/>

5

Brain Architecture Supports Lifelong Learning, Behavior and Health



- 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.

6

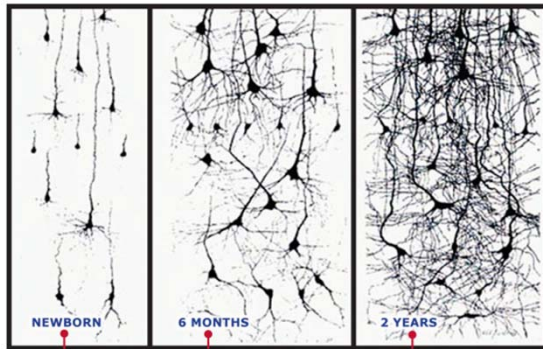
Brain Architecture



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.

7

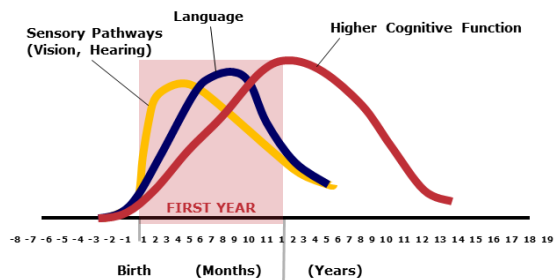
More Than **ONE MILLION** New Neural Connections Per Second



Source: Center on the Developing Child at Harvard University, 2009

8

Neural Circuits are Wired in a Bottom-Up Sequence



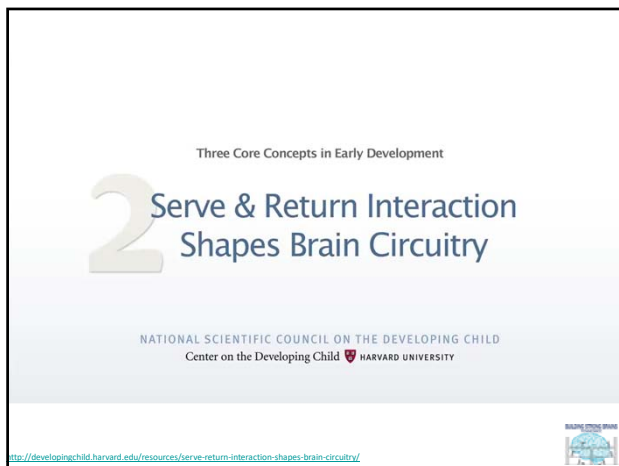
Source: Nelson, 2000

NATIONAL SCIENTIFIC COUNCIL ON THE DEVELOPING CHILD


9



10



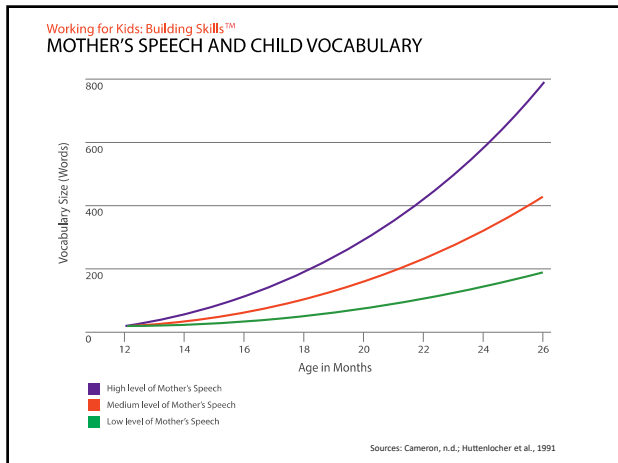
11



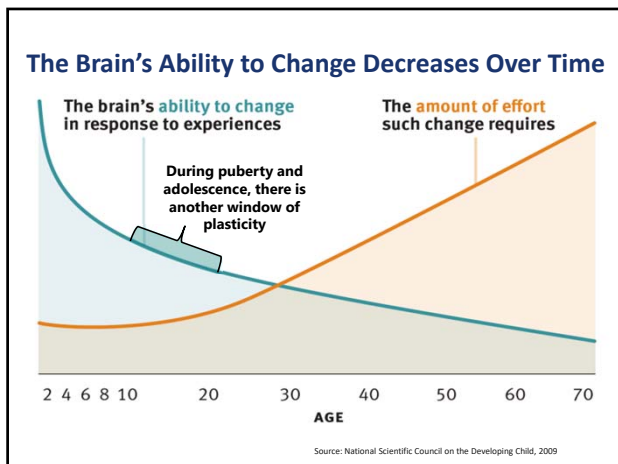
Serve & Return Interactions Build Brains and Skills

- 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.

12



13



14

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.

15

Three Core Concepts in Early Development

3 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/>

16

Positive Stress	Tolerable Stress	Toxic Stress
 <p>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.</p>	 <p>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.</p>	 <p>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.</p>

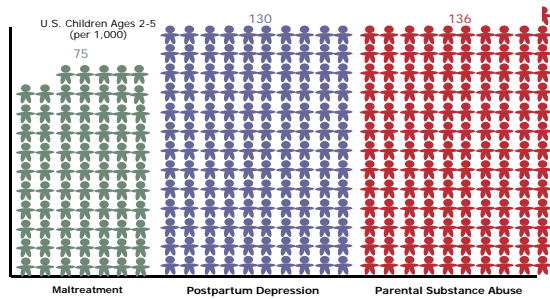
17

Body's Response to Different Types of Stress

POSITIVE	TOLERABLE	TOXIC
 <p>A normal and essential part of healthy development</p> <p>EXAMPLES getting a vaccine, first day of school</p>	 <p>Response to a more severe stressor, limited in duration</p> <p>EXAMPLES loss of a loved one, a broken bone</p>	 <p>Experiencing strong, frequent, and/or prolonged adversity</p> <p>EXAMPLES physical or emotional abuse, exposure to violence</p>

18

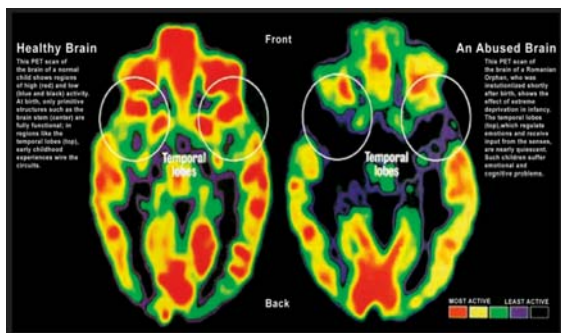
Common Sources of Toxic Stress



Source: Center on the Developing Child at Harvard University, 2007

19

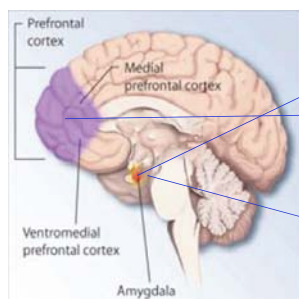
Experience Alters Brain Development Healthy vs. Neglected Brain



Sources: Felitti, 2011; Nelson et al., 2007

20

Toxic Stress Alters Brain Development



Amygdala:
Activates the stress response.
Toxic Stress: Enlargement

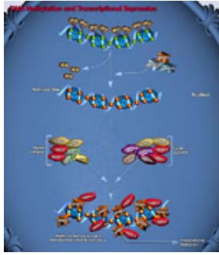
Prefrontal Cortex:
Usually a check to the amygdala.
Toxic Stress: Loss of neurons, less able to function.

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

21

Toxic Stress Changes Gene Expression

Epigenetics



Intergenerational
Transmission of Stress
Response in Male Mice

22

Summary: Toxic Stress Impacts

- 1 Brain Architecture
- 2 Biology and Physiology
- 3 Gene Expression and Epigenetics

23

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.

24

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

25

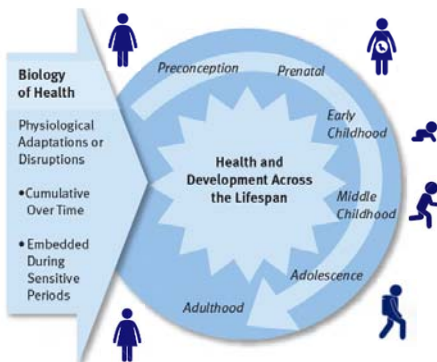
Building an "Air Traffic Control System" in the Developing Brain



	Working Memory	Inhibitory Control	Cognitive Flexibility
Adult	Remember multiple tasks, rules & strategies that may vary	Self-control, situationally appropriate responses	Revise actions & plans in changing circumstances
2-5 years	Remember 2 rules (shoes here, coats there)	Delay eating a treat, follow arbitrary rule	Shift actions as rules change
9-16 months	Execute simple 2-step plan (means-to-end tasks)	Begin to maintain focus despite distractions	Seek alternate methods when 1 st attempt fails

26

Early Life Stress Impacts Lifelong Health and Development



27

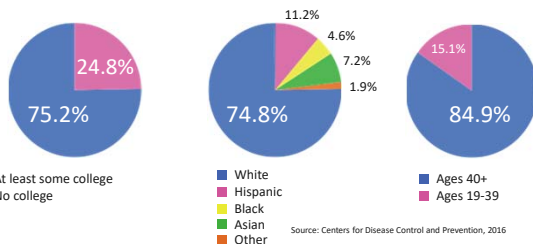
How Brains are Built

<https://www.youtube.com/watch?v=imVW0e1ky8s>

28

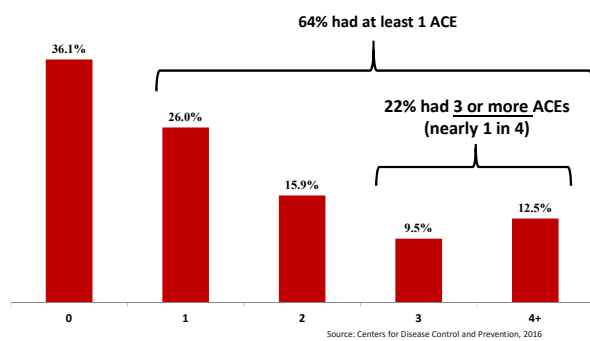
ACE Study

- Conducted by CDC and Kaiser Permanente
- 1995-1997
- 17,000+ HMO members
- Mostly white, middle-aged, insured
- Did not face life challenges such as poverty, racism

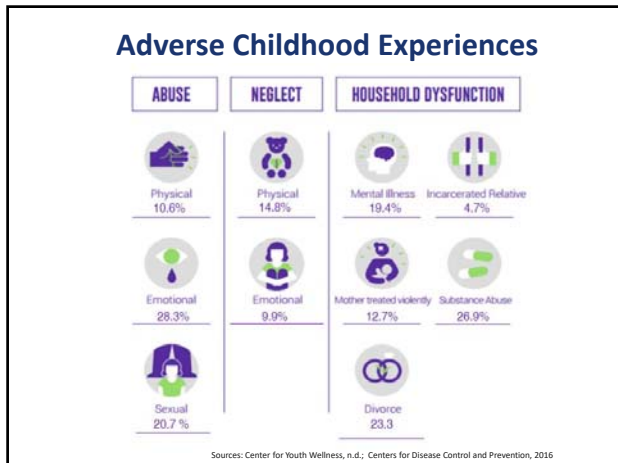


29

Number of ACEs Experienced Before Age 18 by Adults in CDC-Kaiser ACE Study 1997



30



31

What Are Adverse Childhood Experiences (ACEs)?

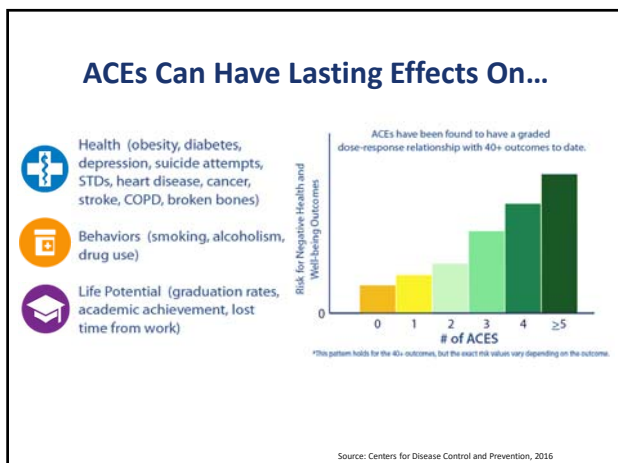
Are there "new" ACEs? YES!!

- Poverty
- Racism
- Peer Victimization, i.e., Bullying

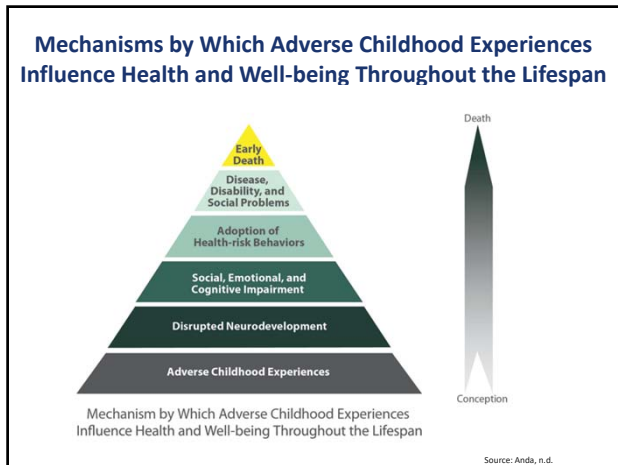
These are referred to as conditions of Trauma and Social Location

- Race/Social Conditions/Local Context
- Generational Embodiment/Historical Trauma

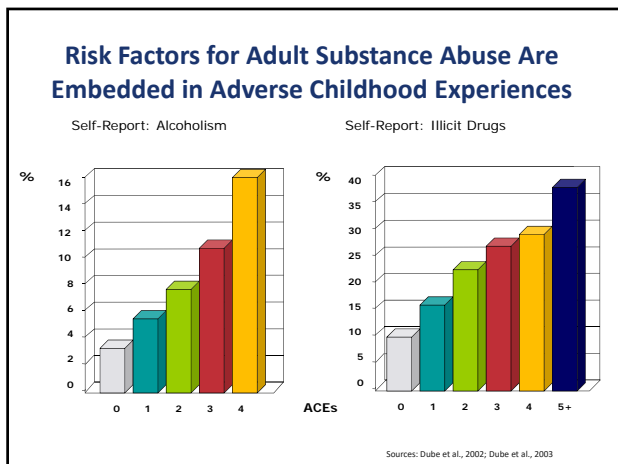
32



33



34



35



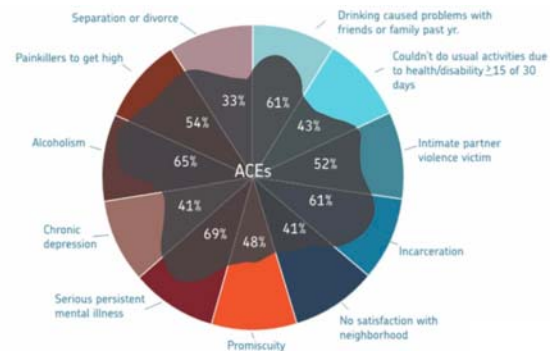
36

Adverse Childhood Experiences



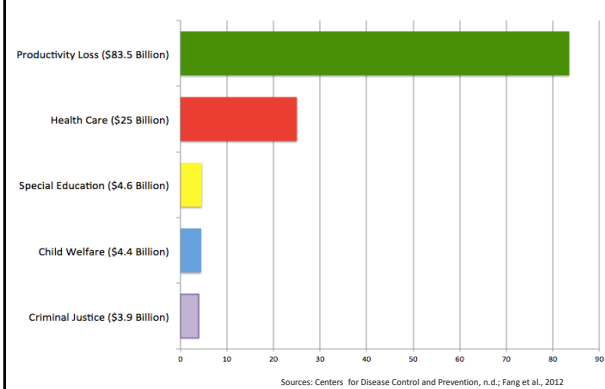
37

ACEs Compromise Community Prosperity



38

The Cost of ACEs

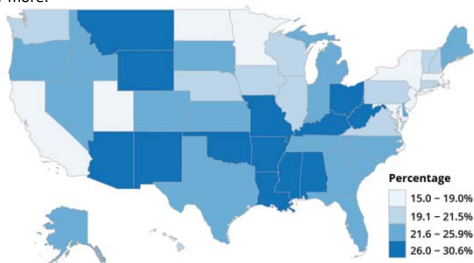


39

Percent of Children with Two or More ACEs in Arkansas

2017

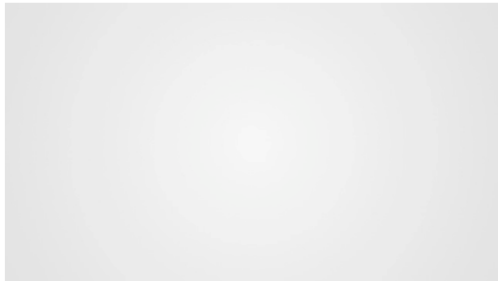
AR ranks 50th in the US for lowest percentage of children with ACEs scores of 2 or more.



Citation: Bethell, CD, Citation: Bethell, CD, Davis, MB, Gombojav, N, Stumbo, S, Powers, K. Issue Brief: A national and across state profile on adverse childhood experiences among children and possibilities to heal and thrive. Johns Hopkins Bloomberg School of Public Health, October 2017.

40

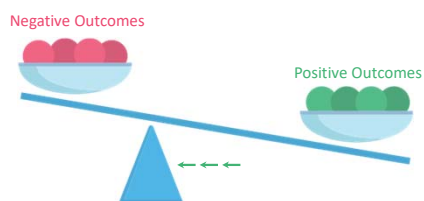
Fostering Resilience



<https://vimeo.com/106322359>

41

Fostering Resilience



Overtime, the cumulative impact of positive life experiences and coping skills can shift the fulcrum's position, making it easier to achieve positive outcomes.

42

Assure Every Child's Relationships and Environments Are:



- 📖 **Safe**—Free from physical & emotional harm.
- 📖 **Stable**—Familiar routines, people, & places.
- 📖 **Nurturing**—Sensitively care & encourage development

43

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



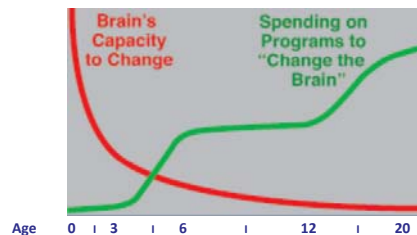
Executive Function and Self Regulation Skills can be built at any point across the lifespan.

Source: Cameron, n.d.

44

Moving the Needle

Focus has to shift from remediation to prevention and not just "prevention," but **primary prevention**

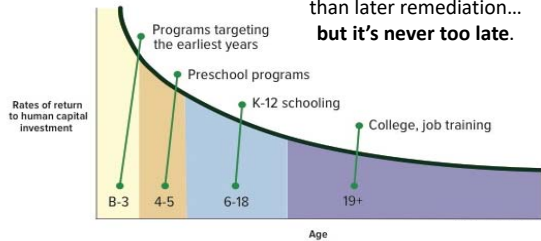


Source: Perry, 2004

45

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, 2007

46

Strategies to Build Executive Function in Adolescents



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

47



Charging Stations

48

What CAN Be Done About ACEs Across the Lifespan?



Home visiting to pregnant women and families with newborns



Parenting training programs



Parent support programs for teens and teen pregnancy prevention programs



Mental illness and substance abuse treatment

Source: Centers for Disease Control and Prevention, 2016

49

What CAN Be Done About ACEs Across the Lifespan?



Intimate partner violence prevention



Social support for parents



Preschool Enrichment



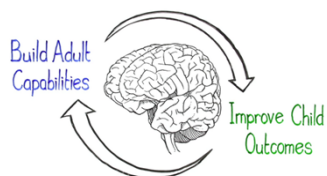
Sufficient income support for lower income families

Source: Centers for Disease Control and Prevention, 2016

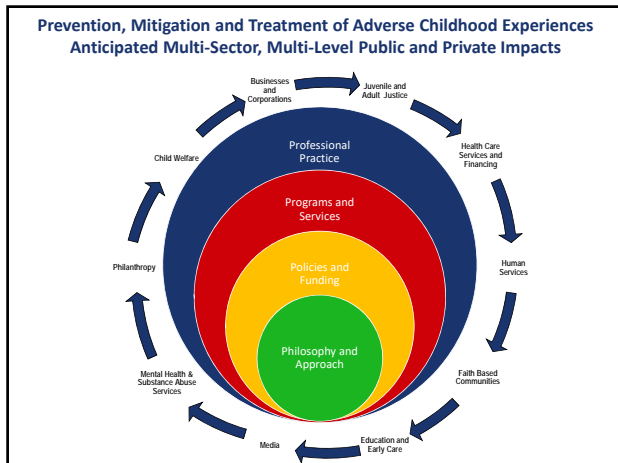
50

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)



51



52

The New Norm: Shifting the Conversation...

What is wrong with you?

TO

What has happened to you?

53



54
