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E A R L Y E X P E R I E N C E S E L E V A T E E V E R Y T H I N G

TOXIC STRESS, RELATIONSHIPS, AND THE
DEVELOPMENT OF CHILDREN

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UNIVERSITY OF WISCONSIN-MADISON

EARLY BRAIN & CHILD DEVELOPMENT LEADERSHIP WORKGROUP
AMERICAN ACADEMY OF PEDIATRICS



www.facebook.com/DrLibrarian Twitter: [@navsaria](https://twitter.com/navsaria)
Live-tweeting encouraged!

Disclosure

I have no relevant financial relationships to disclose.

I will not discuss off-label use or investigational use in my presentation.

Although...

You can see what being around me can result in...



“Oh, that’s so nice...”
CRITICAL

The Science The Result The Solution? The Call

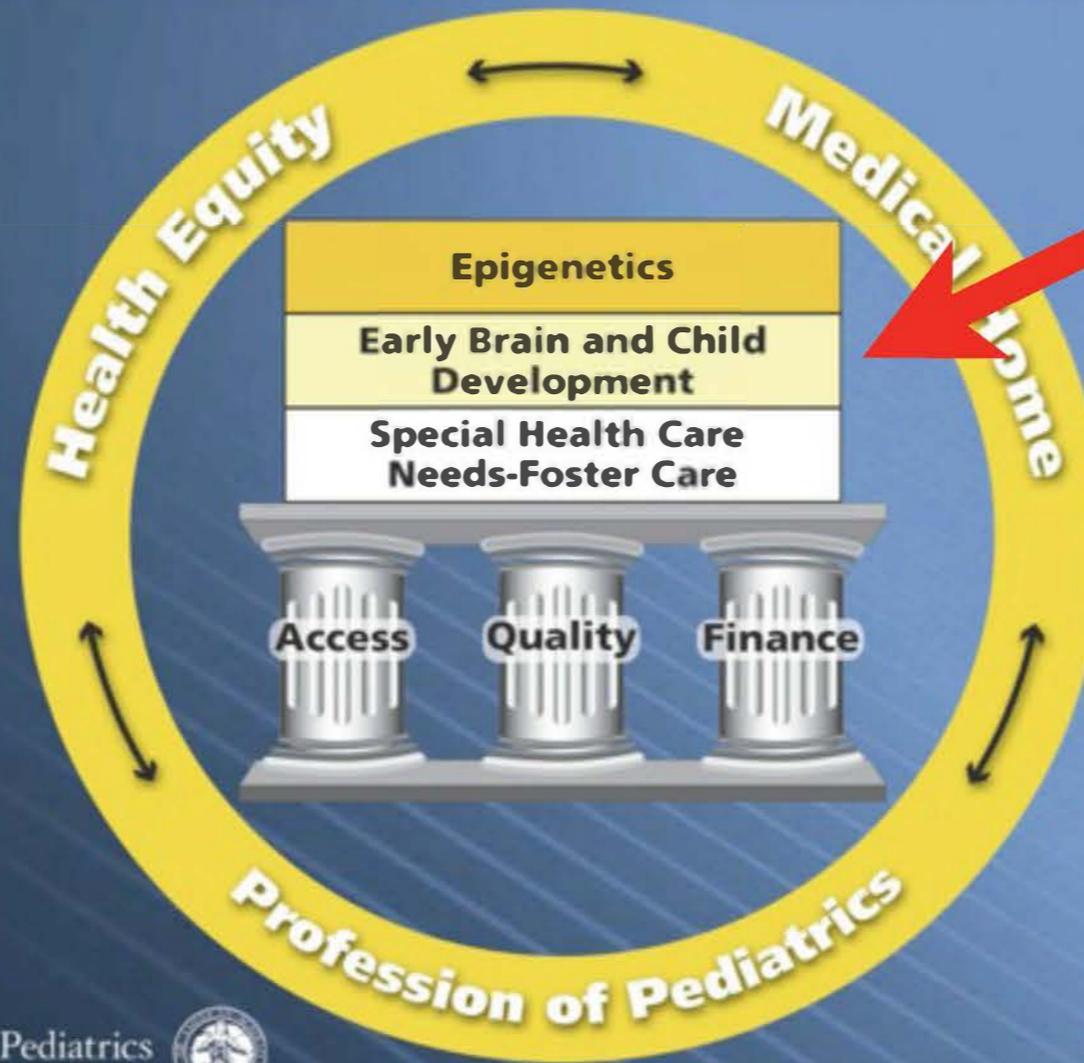


First, a story. . .

A Stroll Through the Early Brain

AAP Agenda for Children 2011-2012

DEDICATED TO THE HEALTH OF ALL CHILDREN™



American Academy of Pediatrics
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- Planning
- Implementing
- Integrating

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- Integrating
- Implementing
- Planning

The AAP's EBCD Initiative

“Building Brains, Forging Futures”
“It’s all about Nurturing Relationships”

Urgency

The Essential Role of “Us”



EARLY BRAIN AND CHILD DEVELOPMENT

from *The Science of Early Childhood Development*
National Scientific Council on the Developing Child, 2007

mind is its own place
of Hell; a
- John Milton: "Para

EARLY BRAIN AND CHILD DEVELOPMENT

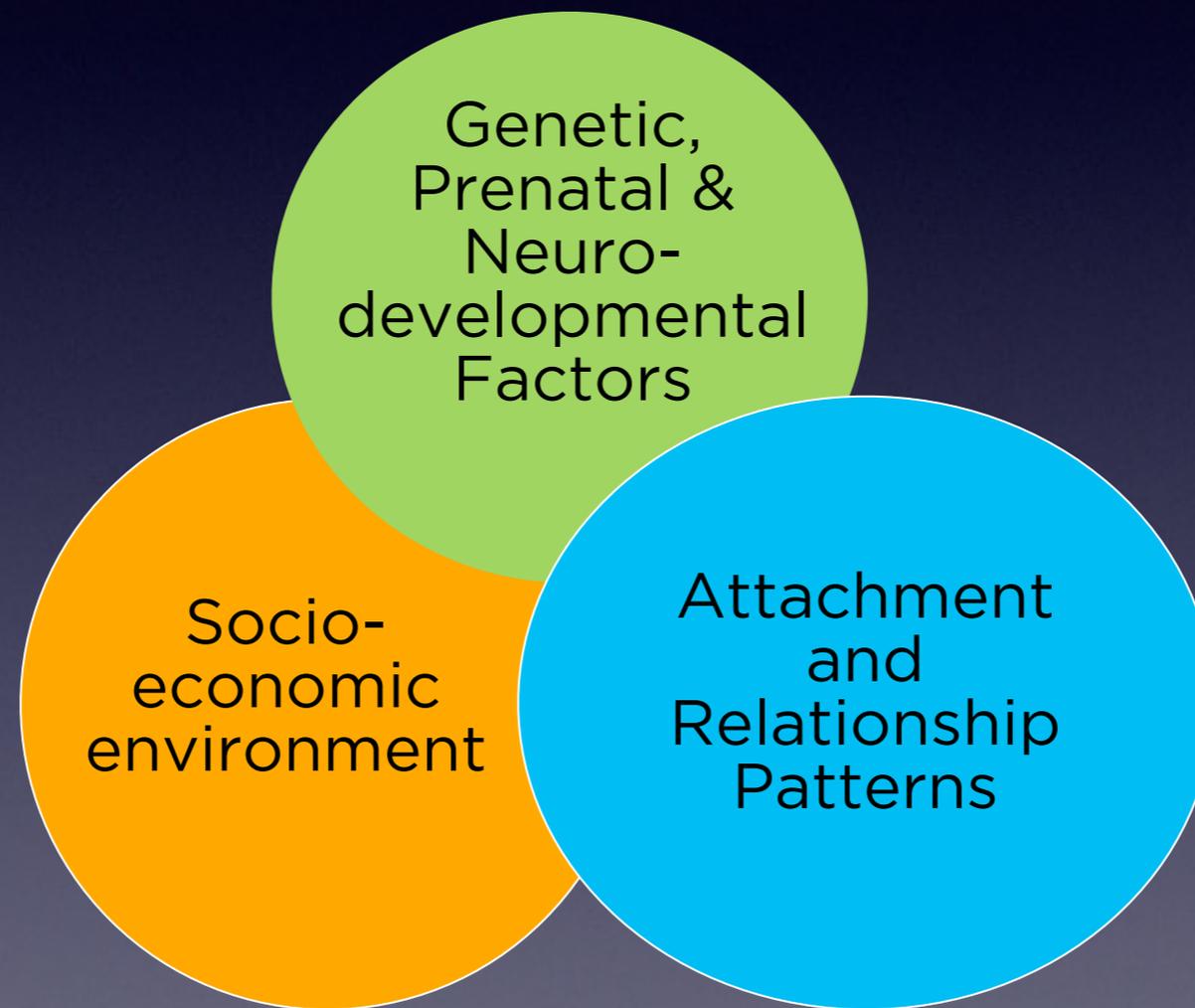
1

Child development is a foundation for **community** development and **economic** development, as capable children become the foundation of a prosperous and sustainable society.

2

Brains are built **over time**.

The **3-legged stool** for developmental and health trajectories



EARLY BRAIN AND CHILD DEVELOPMENT

3

The interactive influences of **genes** and **experience** literally shape the architecture of the developing brain and the active ingredient is the “**serve and return**” nature of children’s engagement in **relationships** with their parents and other caregivers in their family or community.



The Face to Face Paradigm Edward Z Tronick



EARLY BRAIN AND CHILD DEVELOPMENT

4

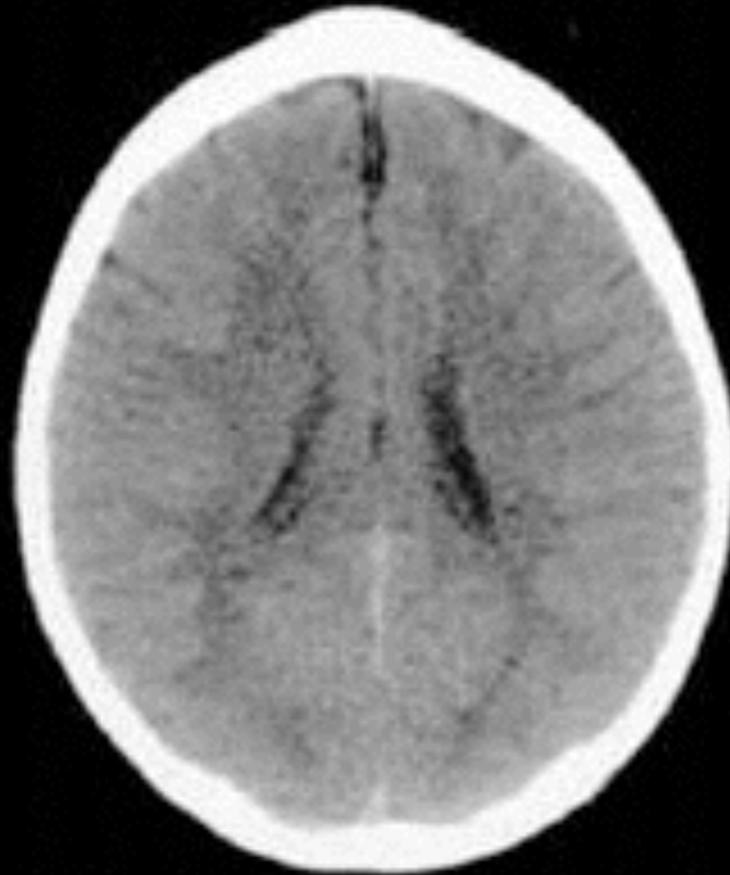
Both brain architecture and developing abilities are built “from the bottom up” with simple circuits and skills providing the **scaffolding** for more advanced circuits and skills over time.

EARLY BRAIN AND CHILD DEVELOPMENT

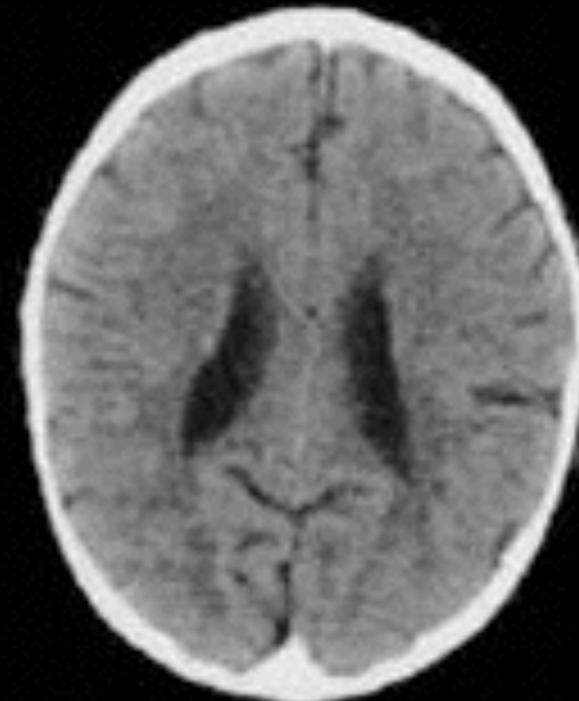
5

Toxic stress in early childhood is associated with **persistent** effects on the nervous system and stress hormone systems that can **damage developing brain architecture** and lead to lifelong problems in learning, behavior and both physical and mental health.

3 Year Old Children



Normal



Extreme Neglect

Normal

Extreme Neglect

THE STRESS RESPONSE:

increases in cortisol and epinephrine

Three Levels of Stress Response

Social-emotional buffering
is the **primary factor**
distinguishing level of stress.

Andy Garner, MD

Adversity & Toxic Stress

Toxic stress is the
key intergenerational transmitter
of social and health disparities

POSITIVE STRESS

Child sees someone approaching
with their immunization syringe

Parent leaving on the first day of preschool

TOLERABLE STRESS

Death of a family member

Serious illness

Natural disaster

What if it's worse?
What if there's no supportive relationships?

Child abuse
Parental substance abuse
Homelessness

TOXIC STRESS

CHILDHOOD STRESS

**Hyper-responsive
stress response**

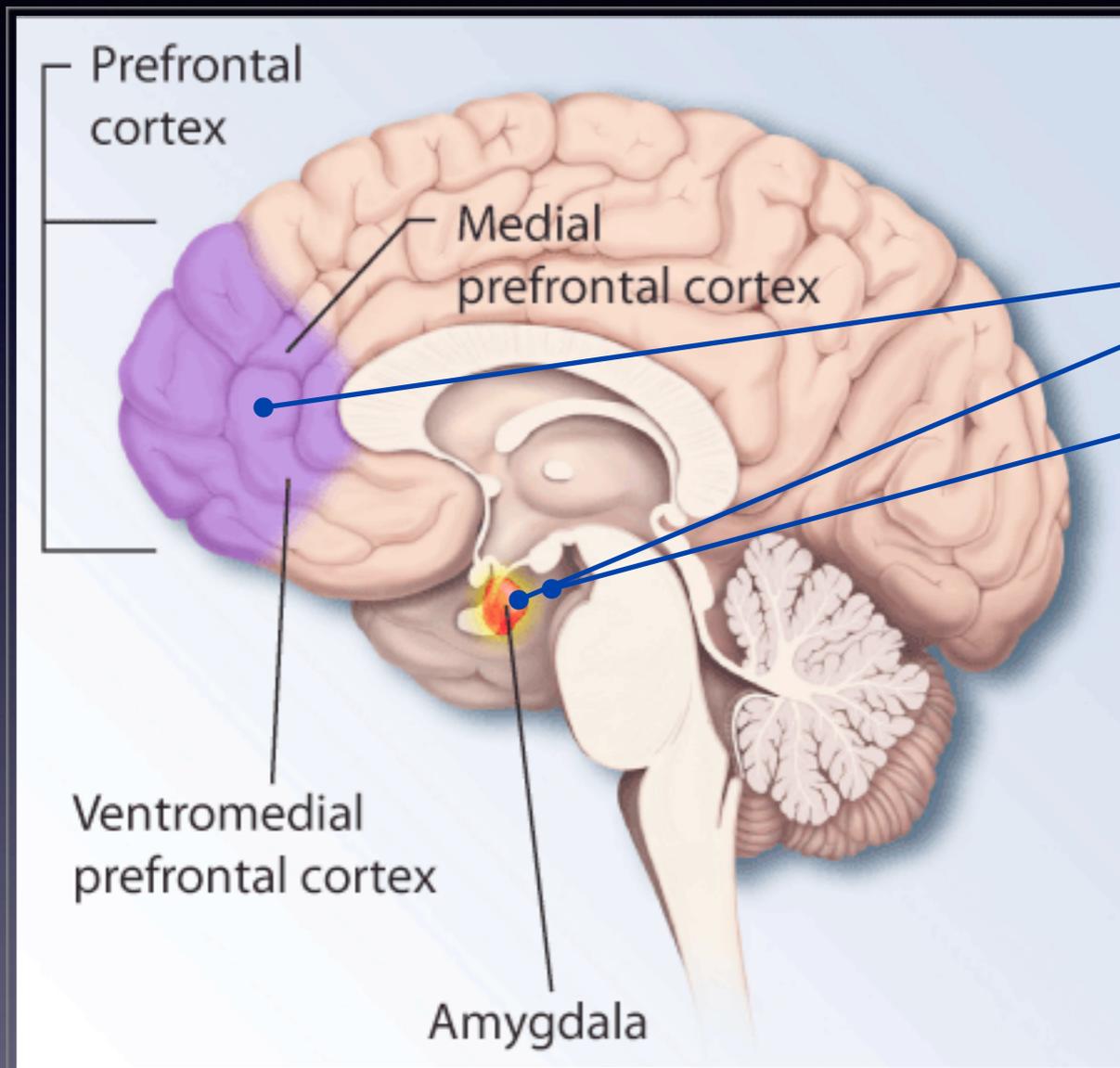
**decreased
calm/coping**

Chronic “fight or flight”

**increased
cortisol / norepinephrine**

**Changes in Brain
Architecture**

What happens?



Prefrontal cortex:

Hippocampus:

major role in memory and mood

Toxic stress/early adversity:

smaller hippocampal volumes,
poor memory, labile moods

lower neuronal density,
decreased function

ADHD **or** **Adversity?**



Impulsive

Can't plan ahead

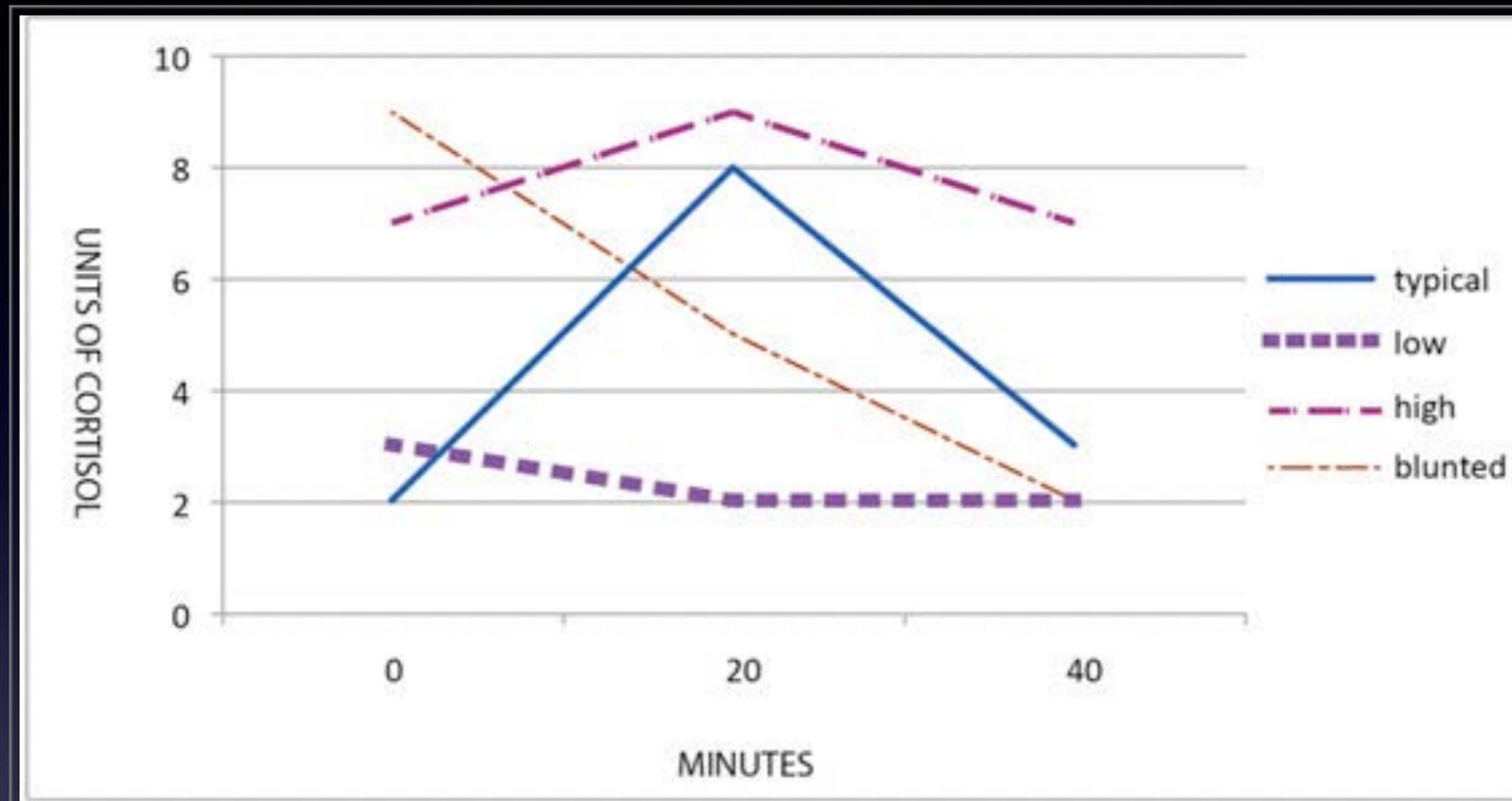
Anxious

Can't delay gratification

Labile mood

Poor memory

POVERTY IS NEUROTOXIC



Children with “typical” cortisol response had **higher** executive function, and were rated as having **more** self-control in the classroom.

Those with a flat (high or low) or blunted response had **low** levels of executive function and were rated as having **poor** self-regulation.

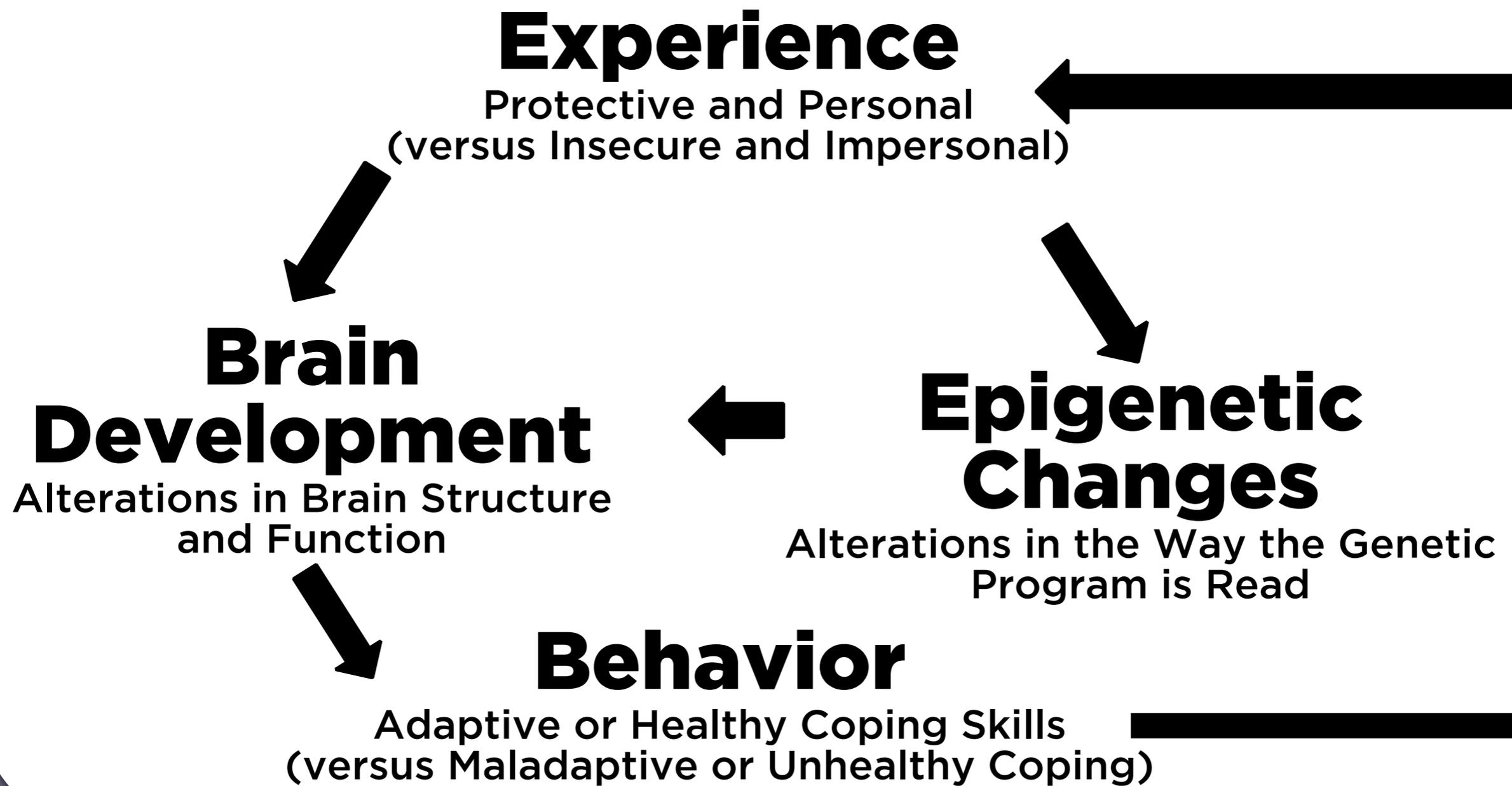
POVERTY IS NEUROTOXIC

Next, children in a large (1200) study whose mothers engaged in “scaffolding” during play found that the children had lower cortisol levels and were more attentive.

Those who were more authoritarian had higher cortisol levels and were found to be less attentive.

This was found at 7 months of age and again at 15 months.

They also found that the more **impoverished** the family, the **less likely** they were to engage in scaffolding.



EPIGENETICS

It's **really cool** stuff,
but I don't completely
understand it either.

EPIGENETICS



Maybe Lamarck was right.

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EPIGENETICS

“Which genes are turned on or off,
when and where.”

Structural Genome = ~23,000 inherited genes

Epigenome = built over time, determines what
genes are expressed

Structural Genome : Epigenome

Hardware : Operating System

Twins have same genome; different epigenomes

EPIGENETICS

Switches: nutritional status, toxin exposure, environmental interactions.

Lasting marks: Higher maternal stress in a child's **first year of life correlated with methylation levels on 139 DNA sites in those same children... in **adolescence**.**

Fetal exposures can lead to epigenetic changes that can be **passed on to future generations.**

EPIGENETICS

Repetitive, highly stressful experiences damage creation of **adversity response** systems.

Positive experiences, rich learning and supportive relationships **activate genetic potential** for countering adversity.

THE ADVERSE CHILDHOOD EXPERIENCES STUDY

The Most Important Study
You've (Probably) Never Heard Of.

In 1985, Dr Vincent Felitti noticed many patients in his obesity treatment programs had prior history of abuse or trauma

The CDC worked with Kaiser Permanente and looked retrospectively at over 17,000 patients.

This was the first study to simultaneously assess childhood exposure to multiple types of abuse, neglect, domestic violence and serious household dysfunction.

THE ADVERSE CHILDHOOD EXPERIENCES STUDY

Study participants were middle-class Americans from San Diego, 80% white, 74% attended college, average age of 57, split evenly between men and women.

Not exactly an impoverished, “at-risk” population.

THE ADVERSE CHILDHOOD EXPERIENCES STUDY

Emotional abuse	10%
Physical abuse	26%
Sexual abuse	21%
Emotional neglect	15%
Physical neglect	10%
Mother treated violently	13%
Household substance abuse	28%
Household mental illness	20%
Parental separation or divorce	24%
Incarcerated household member	6%

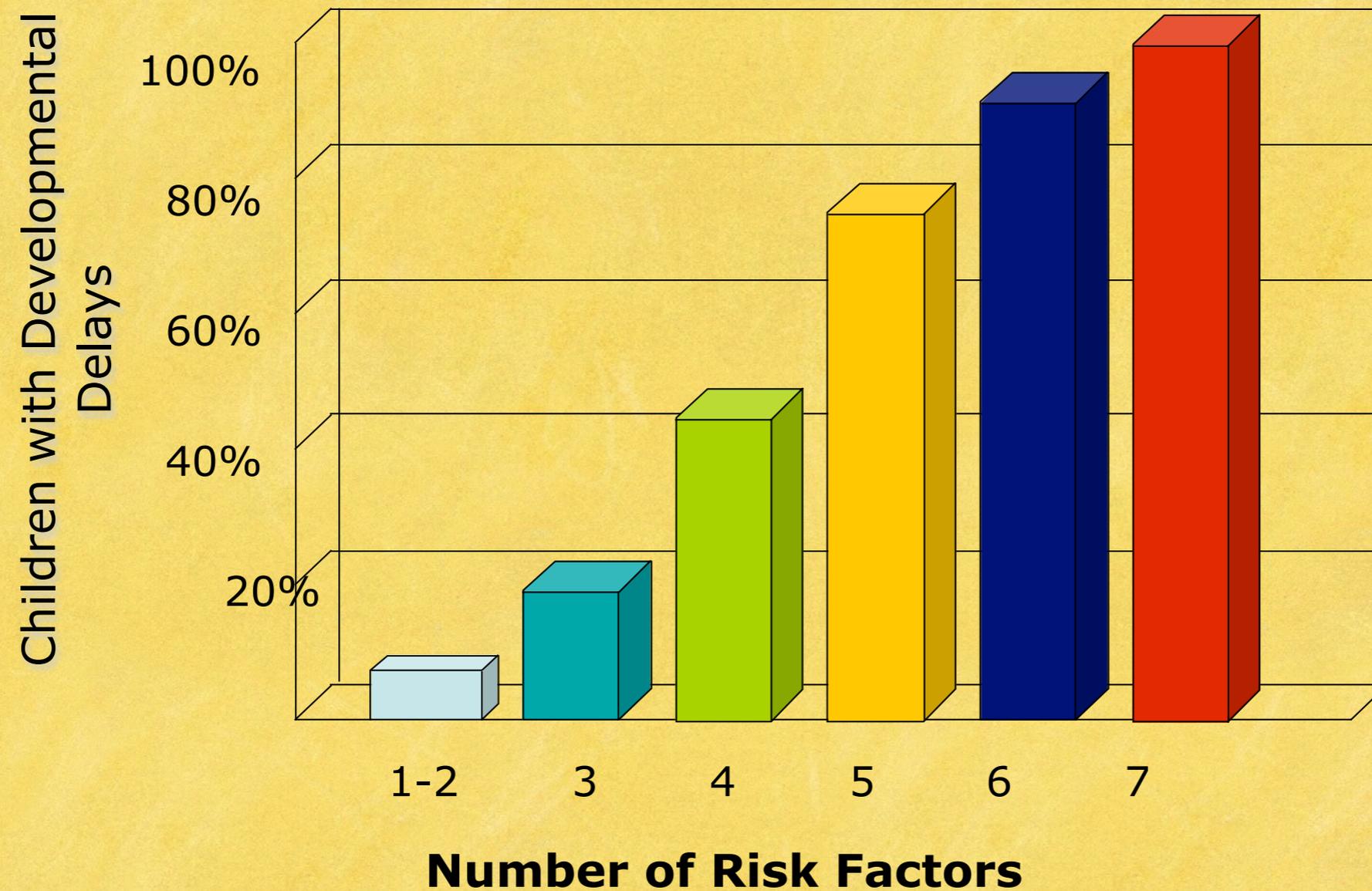


ACE Score (one point for each category listed)	Prevalence in study
0	33%
1	26%
2	16%
3	10%
4	6%
5	5%
6	6%



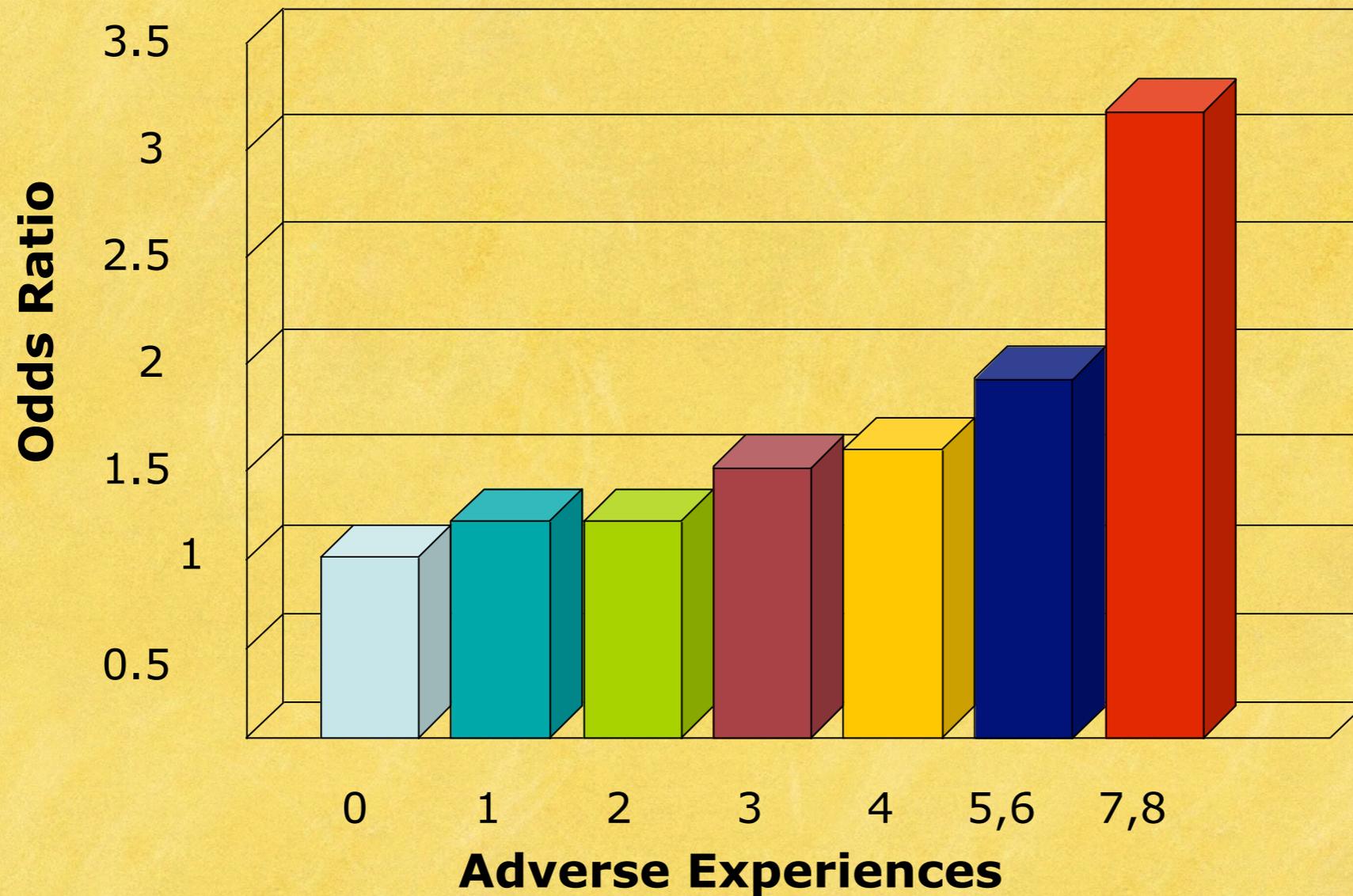
Not only are they unexpectedly common...
...their effects are **cumulative**.

Significant Adversity Impairs Development in the First Three Years



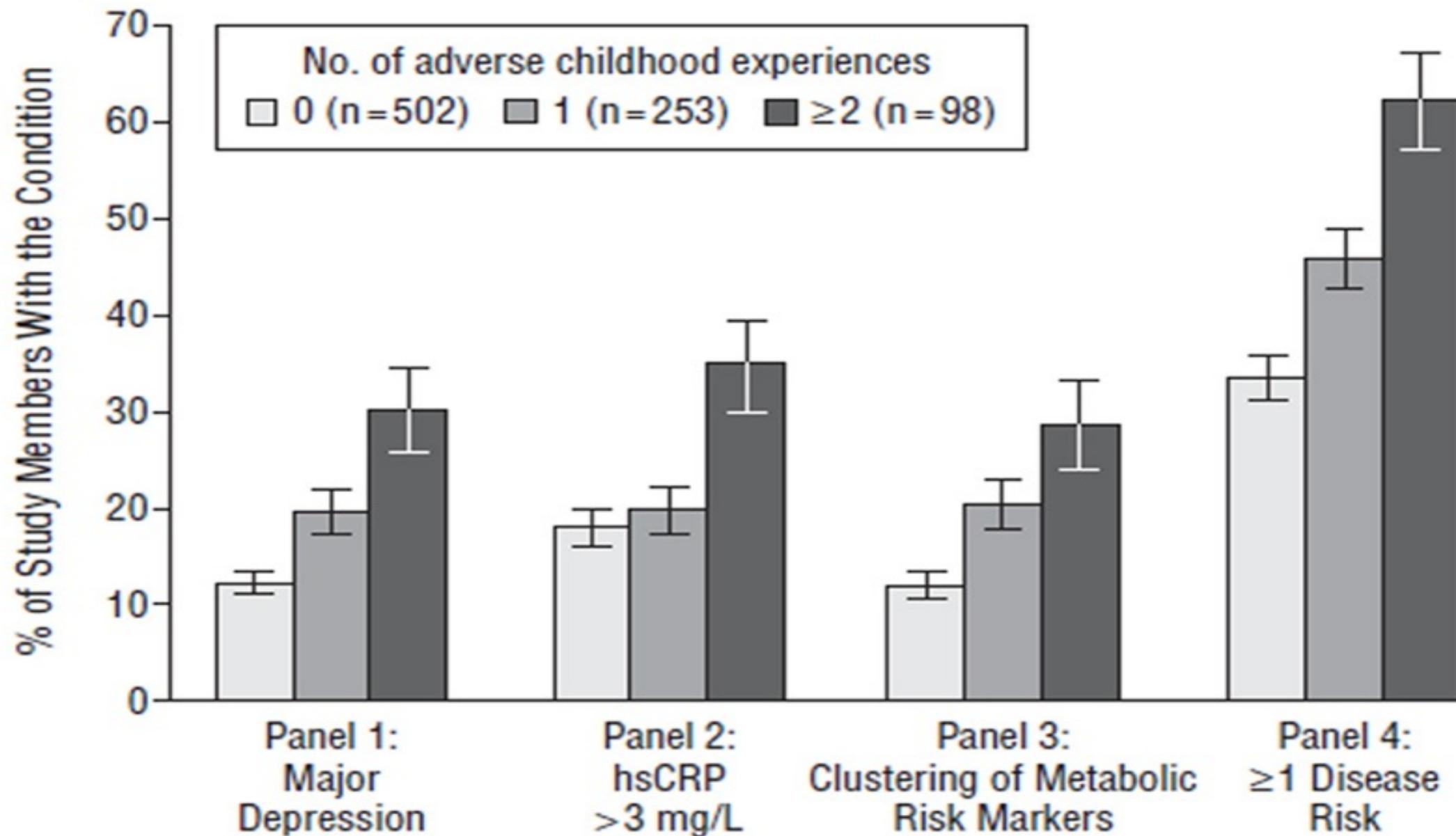
Source: Barth, et al. (2008) via Center on the Developing Child at Harvard University

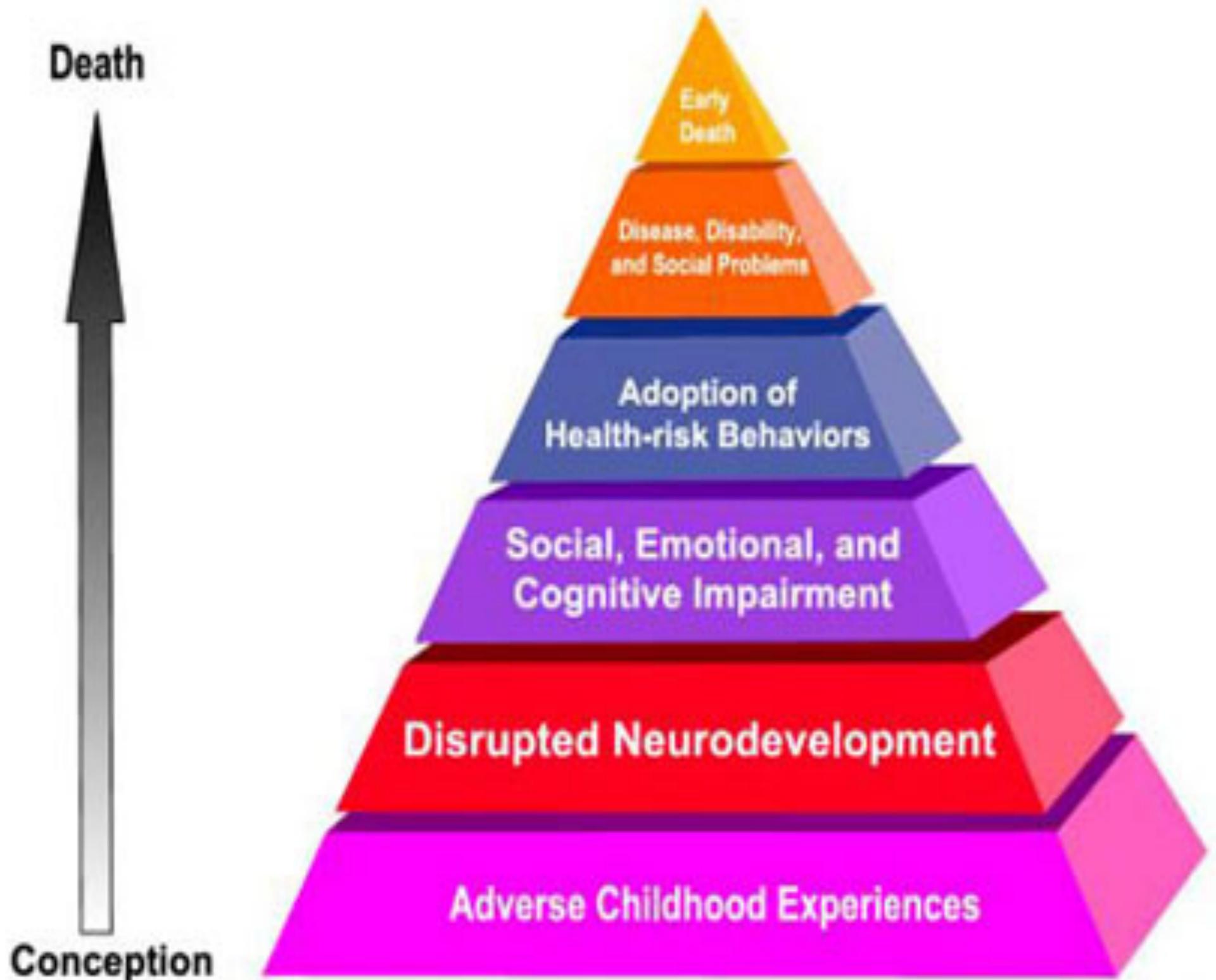
Risk Factors for Adult Heart Disease are Embedded in Adverse Childhood Experiences



Source: Dong, et al. (2004) via Center on the Developing Child at Harvard University

EVEN SMALL INCREASES IN ACEs...





Mechanisms by Which Adverse Childhood Experiences Influence Health and Well-being Throughout the Lifespan

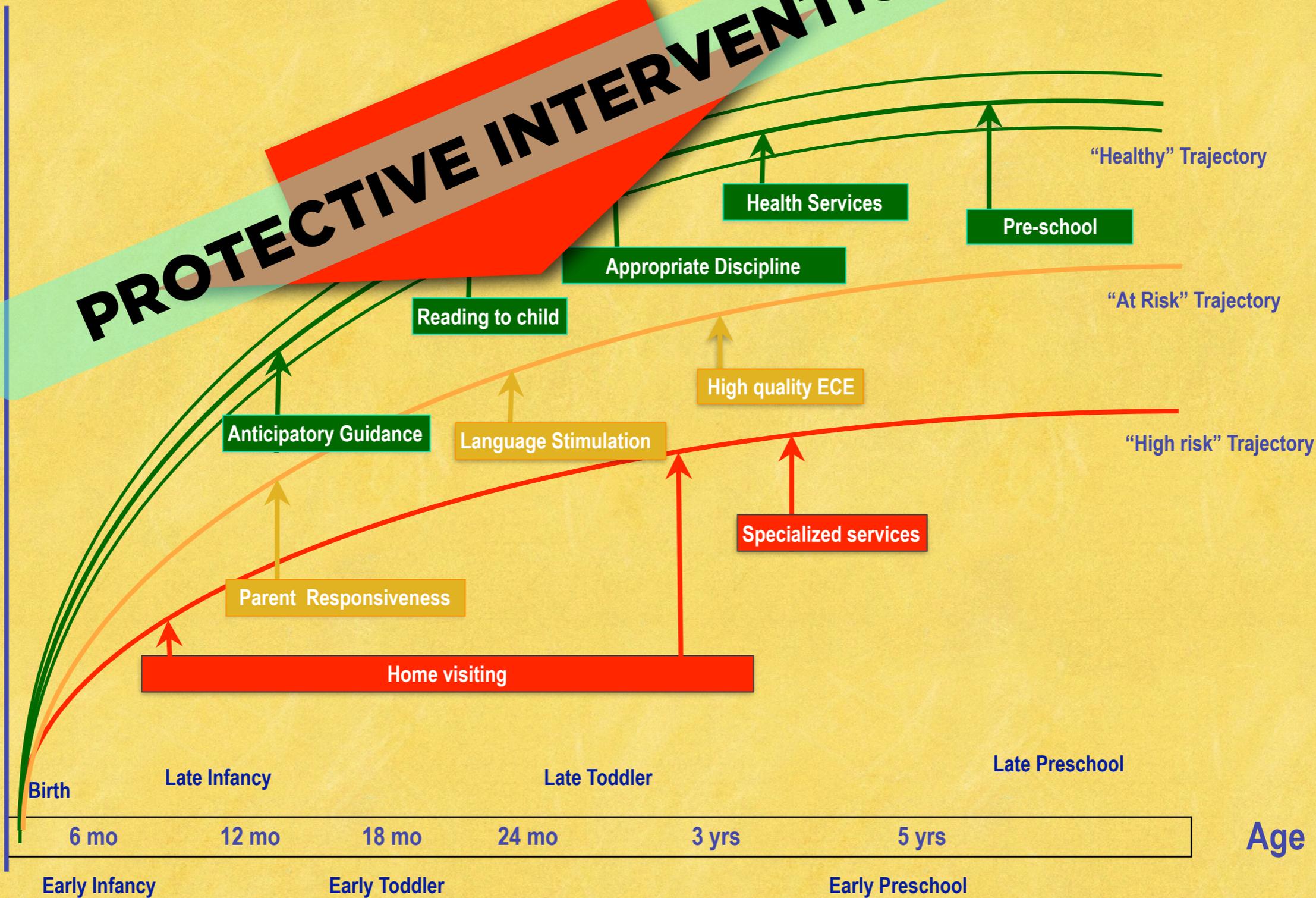
EARLY BRAIN AND CHILD DEVELOPMENT

6

Creating the right conditions for early childhood development is likely to be **more effective and less costly** than addressing problems at a later age.

PROTECTIVE INTERVENTIONS

Developmental Progress



Age

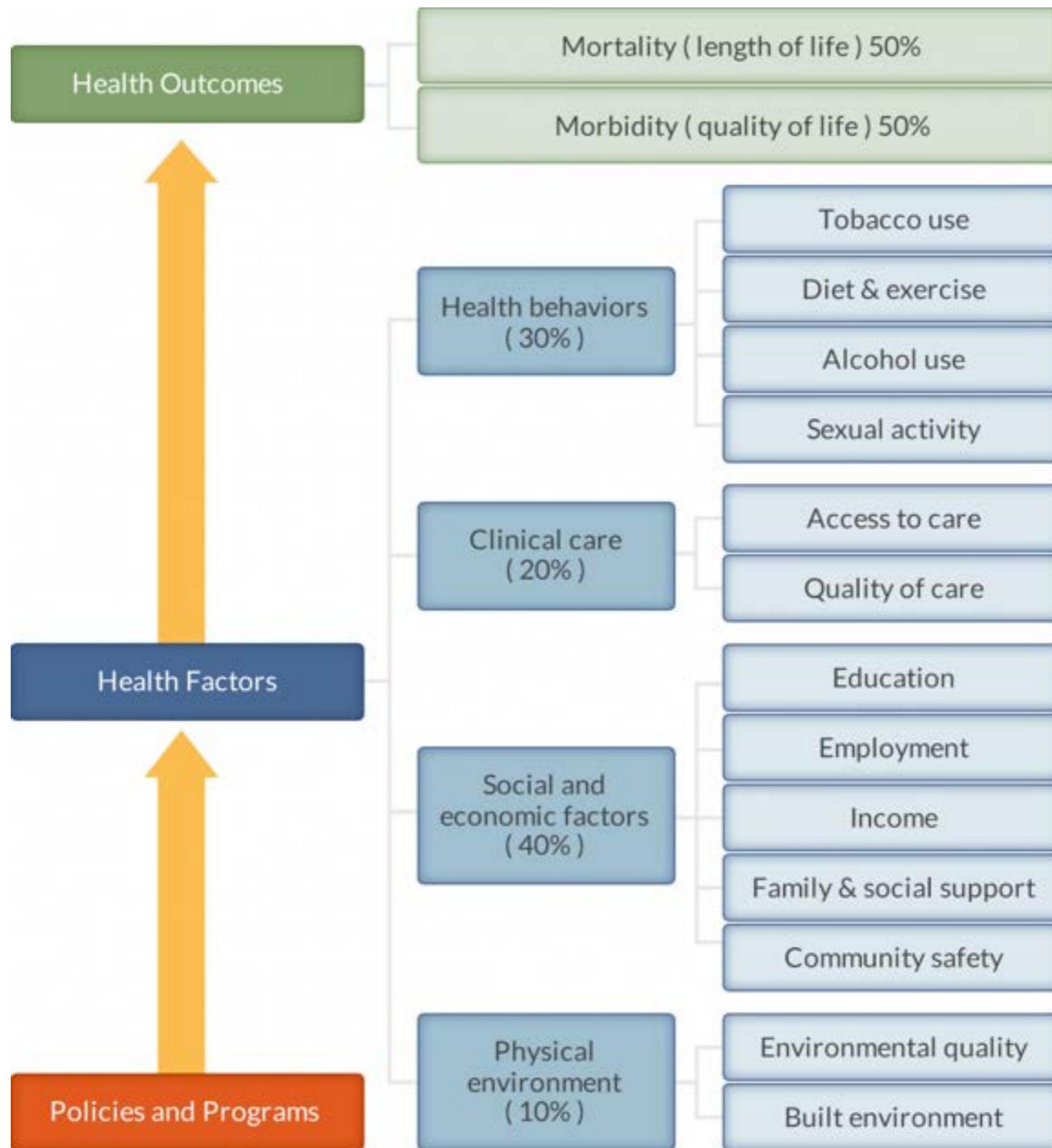
Three Promising Domains for EBCD Innovation

Jack Shonkoff, MD

Reduce emotional and behavioral barriers to learning.

Enhance the healthy development of children by transforming the lives of their parents.

Reconceptualize the health dimension of early childhood policy and practice.



Emotional self-regulation

Behavioural self-regulation

Empathy and perspective-taking

School Readiness Skills

Early Childhood Resource Center, RTI

**Communicating needs,
desires & interests in a
pro-social way**

**Understanding cause &
effect sequences**

Interest, motivation, persistence

The Brave New World of Pediatrics:

DEVELOPMENTAL ASSURANCE

Building a healthy mind, brain and body
for social purpose.

NONE OF THIS IS TO SAY...

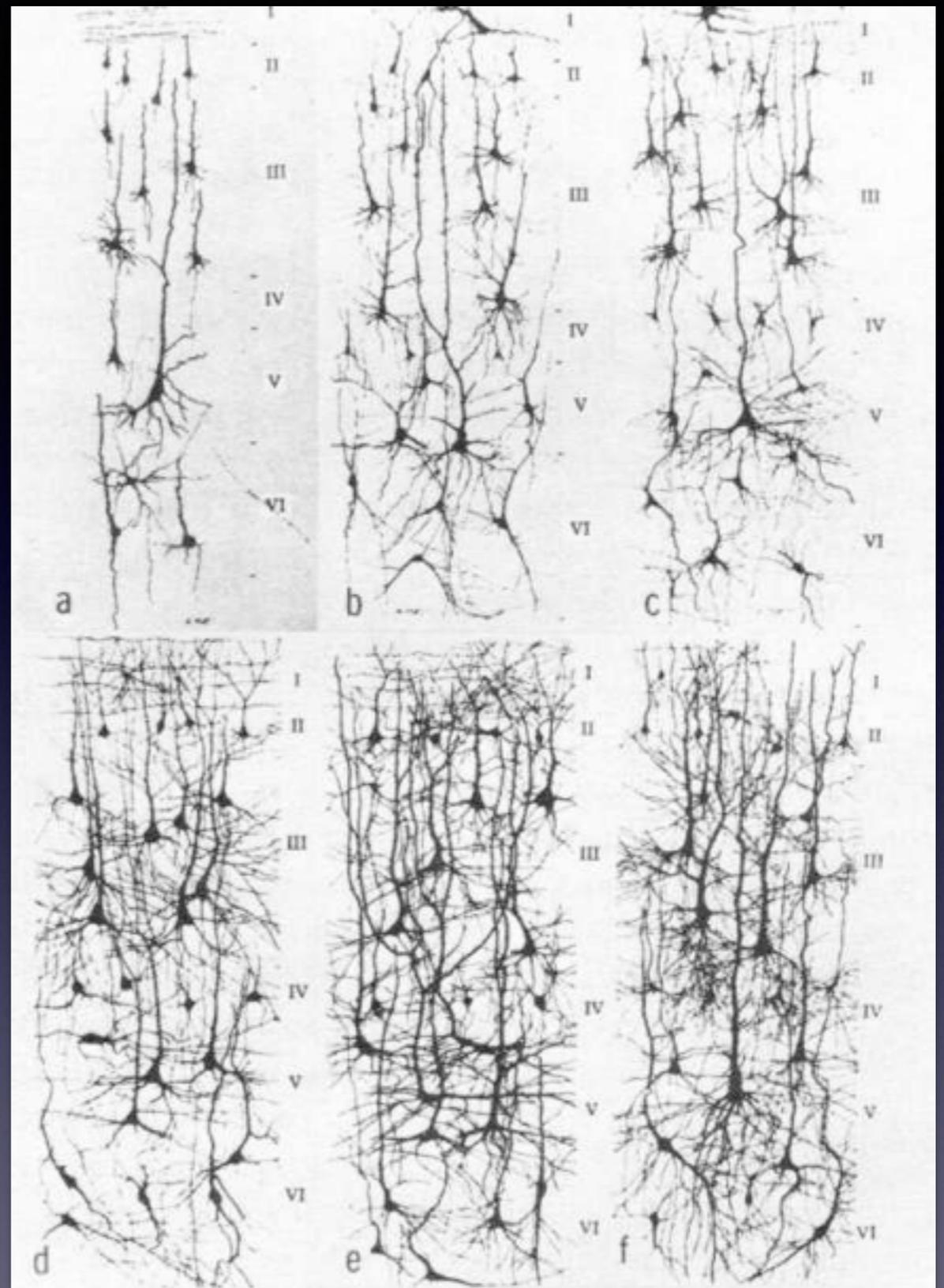
...that children should be engaged constantly

...that “bad things” are necessarily a long-term negative

...that children should not be appropriately disciplined

NUMBERS TO REMEMBER

700 New Neural Connections per Second



Postnatal development of human cerebral cortex around Broca's Area (FCBm); camera lucida drawings from Golgi-Cox preparations. a: newborn; b: 1 month; c: 3 months; d: 6 months; e: 15 months; f: 24 months.

(from Conel, 1939-1959)

PLASTICITY

Synaptic

Variation in
Strength of
connections

“A whisper
to a shout”

Lifelong

Cellular

Variation in
Number of
Connections

“One shout
to a stadium
shouting.”

Declining by
age 5!

Diminishing Cellular Plasticity
Limits Remediation

18 Months:

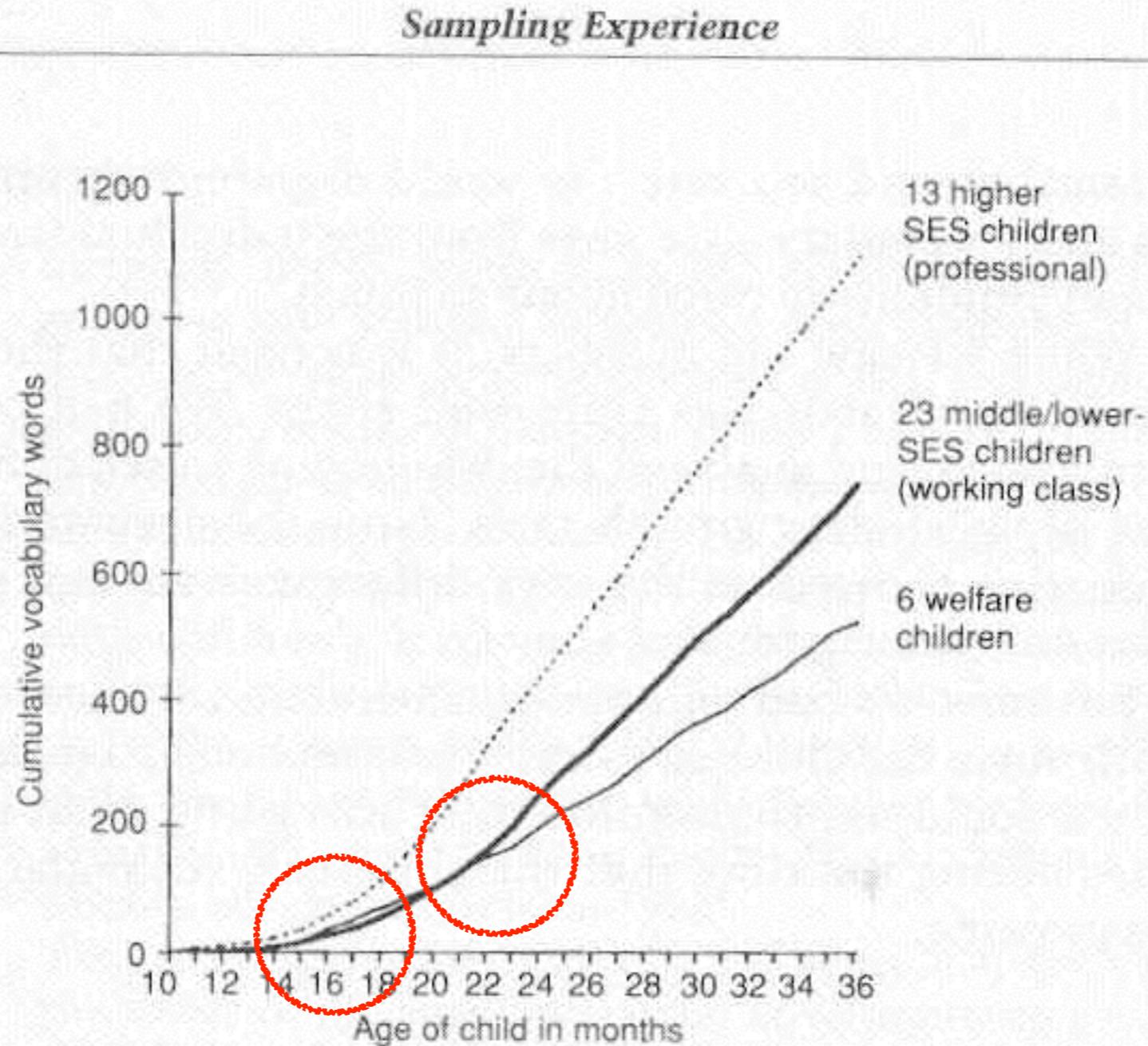


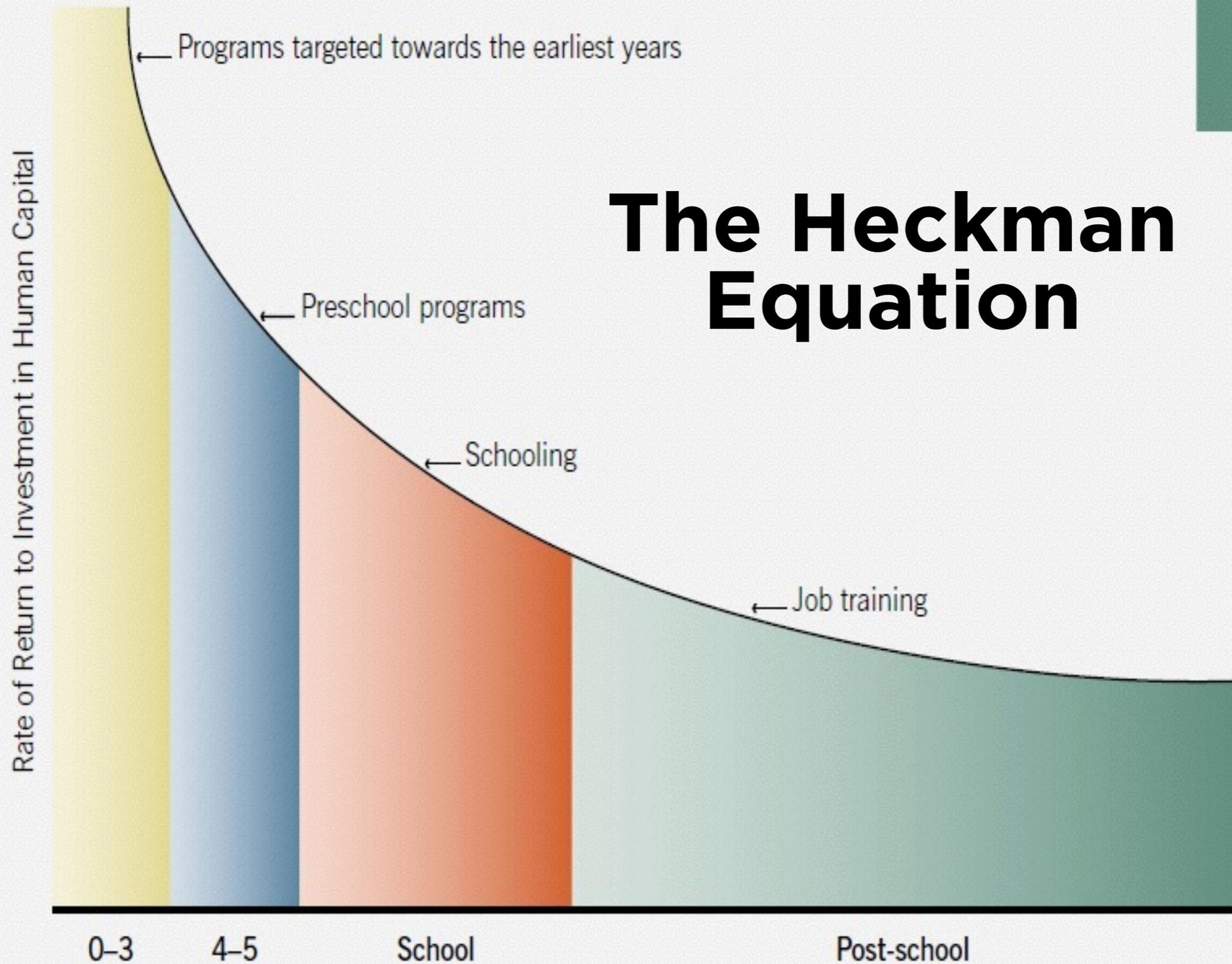
Figure 2. The widening gap we saw in the vocabulary growth of children from professional, working-class, and welfare families across their first 3 years of life. (See Appendix B for a detailed explanation of this figure.)



\$4-\$9

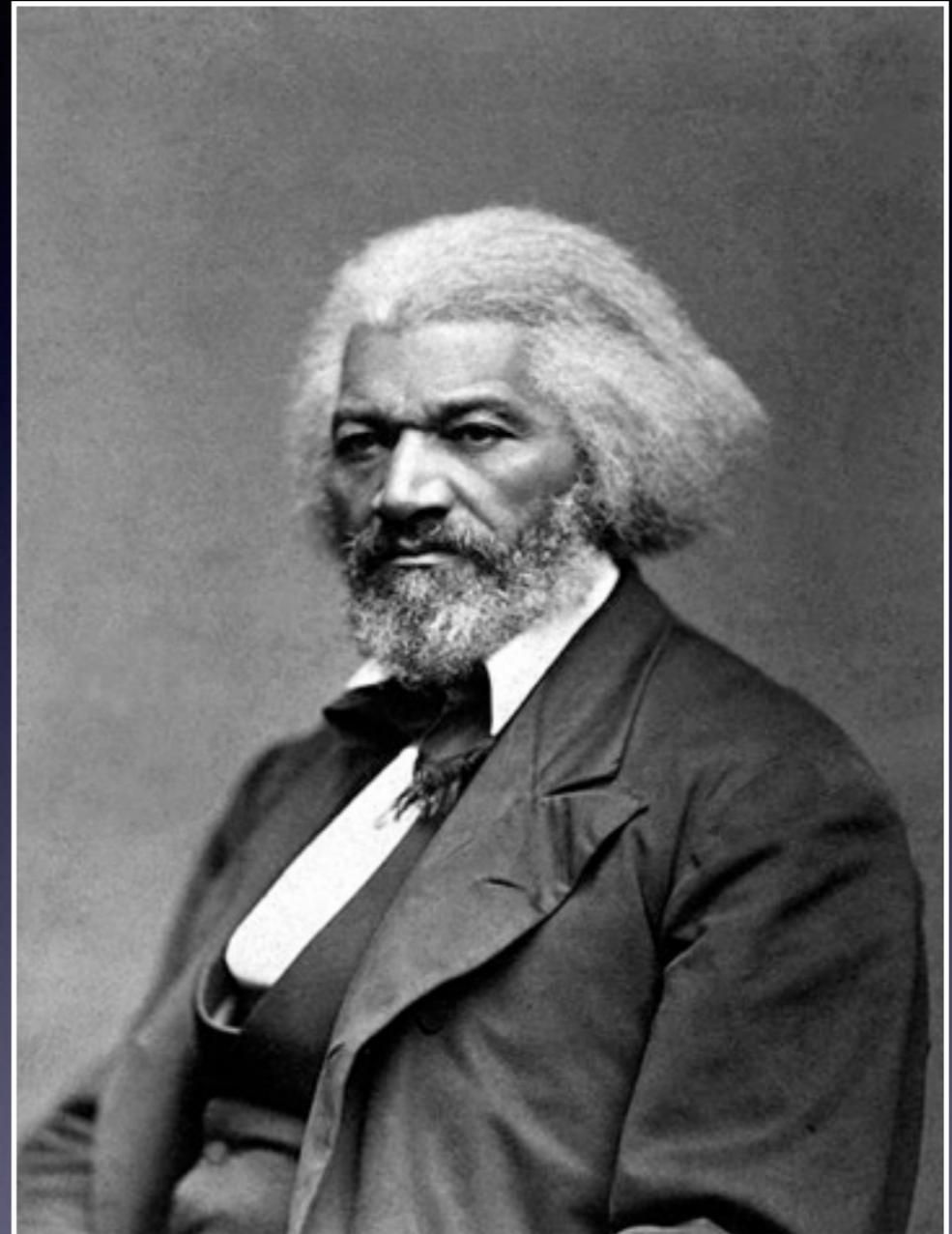
**in Returns for
Every Dollar Invested
in Early Childhood Programs**

Returns Per Annum to a Unit Dollar Invested



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

**— Frederick Douglass
(1817–1895)**



What can we do about it?

Principles of ~~The~~ Solutions

We **need** solutions which...

Build capabilities

Build capacities

Are based in homes
& communities

Address root causes

Have long-term effects

Address prevention

Leverage the
first 1000 days

Are evidence-guided

Are scalable

Clinical Practice

PEDIATRICIANS are Encouraged to →		<u>E</u> xplore the child's environment	<u>B</u> uild relationships / reciprocity		
General Principles →		What pediatricians might briefly assess during well child care	How pediatricians might strengthen the parent-child bond or attachment		
Brief Description →		<u>C</u> ultivate development		<u>D</u> evelop parenting confidence	
Well Child Care Visit ↓	Assess foundation: *Food and sleep *Safety *Social and emotional supports *Strengths and barriers to success	What pediatricians might teach parents about development		How pediatricians might support parents as they nurture their child's development	
Prenatal/Newborn/Week 1	Assess for food (planned breastfeed?), safety, parental supports	Baby's brain	quiet-alert state	parented. Explore what they plan TO do and NOT to do as parents.	
2-4 weeks	Assess overall parental well-being (maternal depression or substance use?)	Encourage responsive caregiving (responding promptly to cries of distress builds trust)	Prepare parent for the emerging social smile	Find opportunities to reassure and praise the parents, and encourage them to support each other	
2 months	Assess for family adjustment – parent self-care, return to work/childcare, time with partner, impact of new infant on siblings	Encourage smiling back at the baby's social smile (the beginning of the parent-child interaction, or "dyadic dance," that leads to cooing, feeding and speaking)	Anticipate cooing conversations	Enjoy interactions with an increasingly social baby	

Clinic? / Hospital? / Home Visiting

Resilience Training (7 Cs)

competence
connectedness
contribution
control

confidence
character
coping

Optimism

Emotional coaching

Positive Parenting

Parent-Child Home

Play and Learn

Poverty-aware approaches to care

Community

EBCD education

Investment in new strategies

Invest in community-based mentoring activities

after-school programs

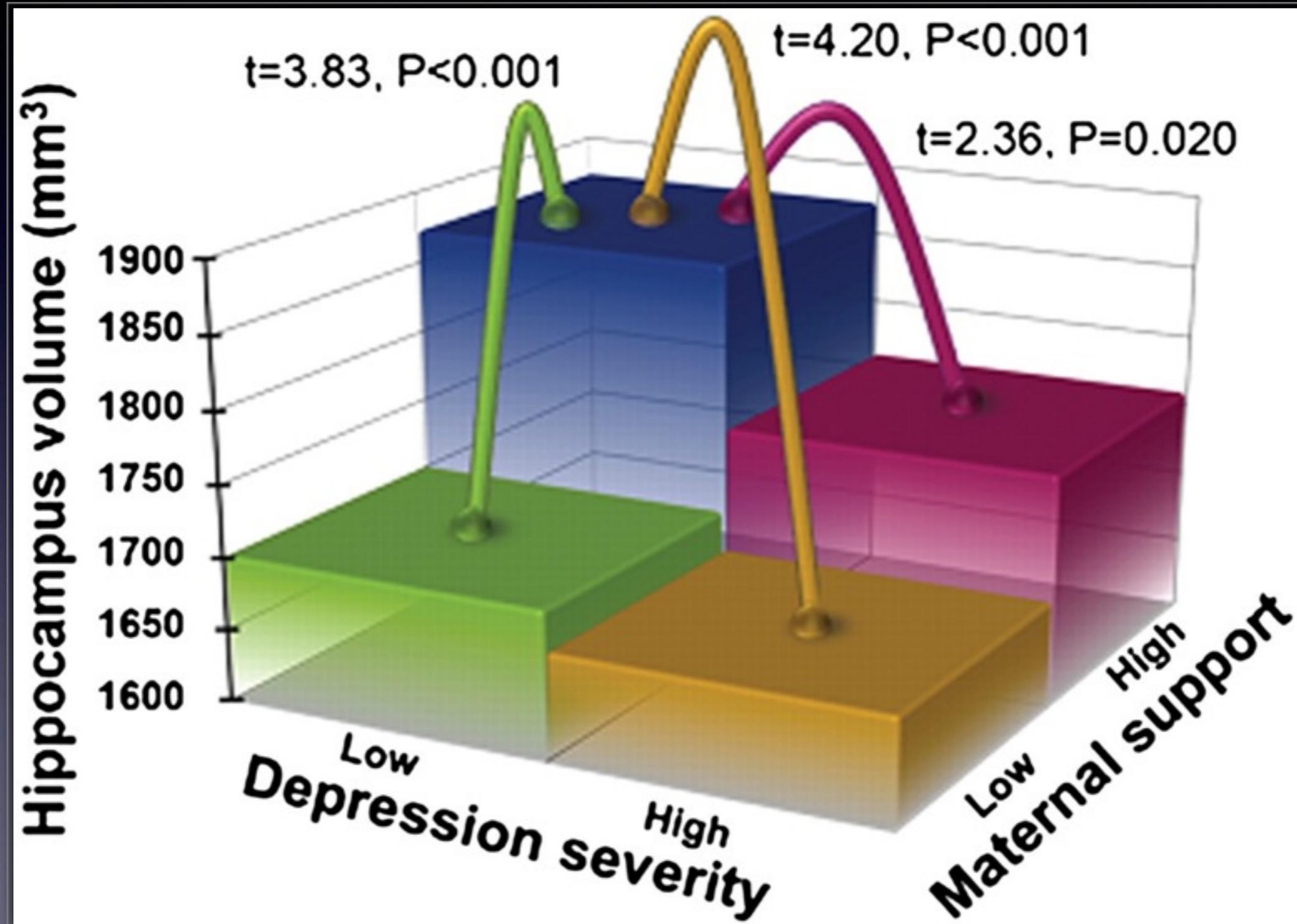
Big Brother/Big Sister

Little League

gymnastics

martial arts

Hippocampus Volume by Preschool Depression Severity and Maternal Support



Outside the Clinical Realm

Intentional Skill Building

Invest in EI programs

Education for those in judicial/foster care systems
Collaborate with social workers, mental health, etc.

Policy & Programmatic Changes
Advocacy

Treatment

Traumatic Stress networks

Appropriately trained professionals

Insurance coverage for services

BUILDING ADULT CAPACITIES



TWO OPEN WINDOWS

INFANT AND PARENT NEUROBIOLOGIC CHANGE

Parents (especially first time parents) self-report high levels of anxiety and concern over their infant's well-being in the first year of life

Even in “low risk” families, this anxiety and concern is often coupled with financial demands, sleep deprivation, and changes in the relationship between parents

Difficulty managing the stress of the transition to parenting is associated with:

- Risk for harsh parenting

- Risk for relationship difficulties

- Risk for serious postpartum mood disorders

T

New mothers and fathers during the first few months postpartum exhibit structural growth of the **reward circuit**

The amount of the growth is associated with positive feelings mothers reported about their baby (e.g. beautiful, perfect)

More functional brain activity in this region also occurs when looking at pictures of one's own vs. other infants

T

New mothers and fathers exhibit neural plasticity in the **social information circuit** including structural increases

New parents also exhibit heightened responses in this circuit to infant cries and images of their infant

These changes may support understanding of infant emotional and social cues during interactions, and in appropriately responding to the cues

T

Animal and human mothers exhibit reduced physical reactivity to acute social and cognitive stressors

During the postpartum period, in both mothers and fathers, there is structural growth in these **emotion regulation circuits**

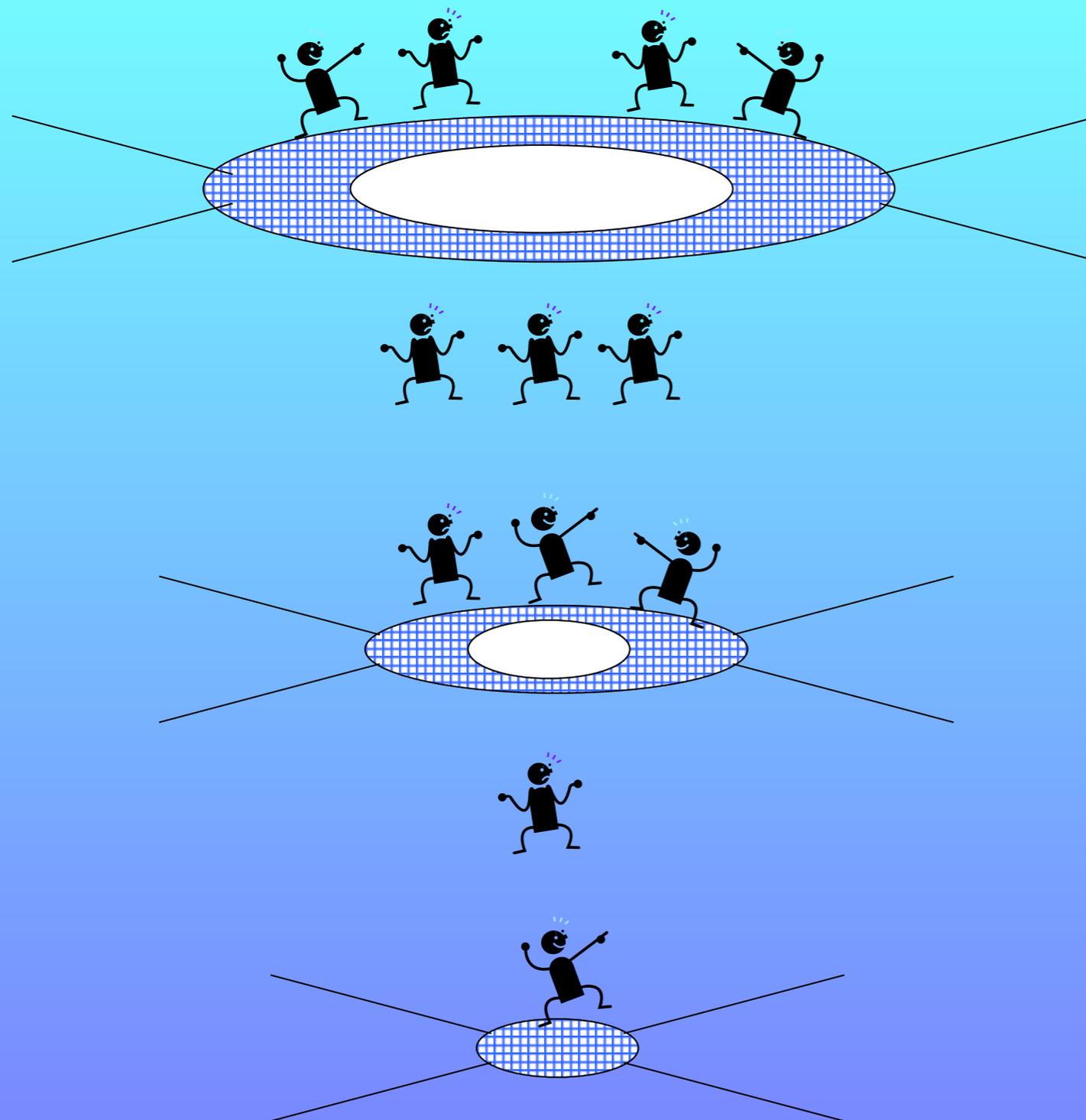
There is also increased activation while listening to infant cries in the prefrontal regions

Mothers with high levels of oxytocin also had reduced amygdala reactivity to negative emotional stimuli.

EARLY BRAIN AND CHILD DEVELOPMENT

The Call

Using A Public Health Approach to Building Healthy Brains



Universal Primary Preventions

Anticipatory Guidance
Bright Futures
Reach Out and Read
Social Supports
Relational Health
High Quality Child Care

Everyone

Screening/Targeted Interventions

Developmental/Risk Screening
Home Visiting
Head Start
Parenting Education/Support
Early Intervention

At-risk

Evidence-Based Treatments

CPP, COS, PCIT, TB-CBT
Intensive Home Visiting
Intensive Parenting Education
Care Coordination

Symptomatic

5 Rs of Early Childhood Education

ROUTINES

help children know what to expect of us & what is expected of them

READING

together daily

RHYMING

playing and cuddling

REWARDS

for everyday successes; praise is a powerful reward

RELATIONSHIPS

reciprocal and nurturing: the foundation of healthy child development



Peter H. Reynolds



CANDLEWICK PRESS
CAMBRIDGE, MASSACHUSETTS

ReadyNation



A business partnership for
early childhood and economic success

formerly the Partnership for America's Economic Success

State Network

Business leader organizations in many states have started supporting proven investments in early childhood. ReadyNation has sponsored business leader summits and provided other types of assistance to support business leader engagement in over half the states. There are also many other business groups in the states working in early childhood.

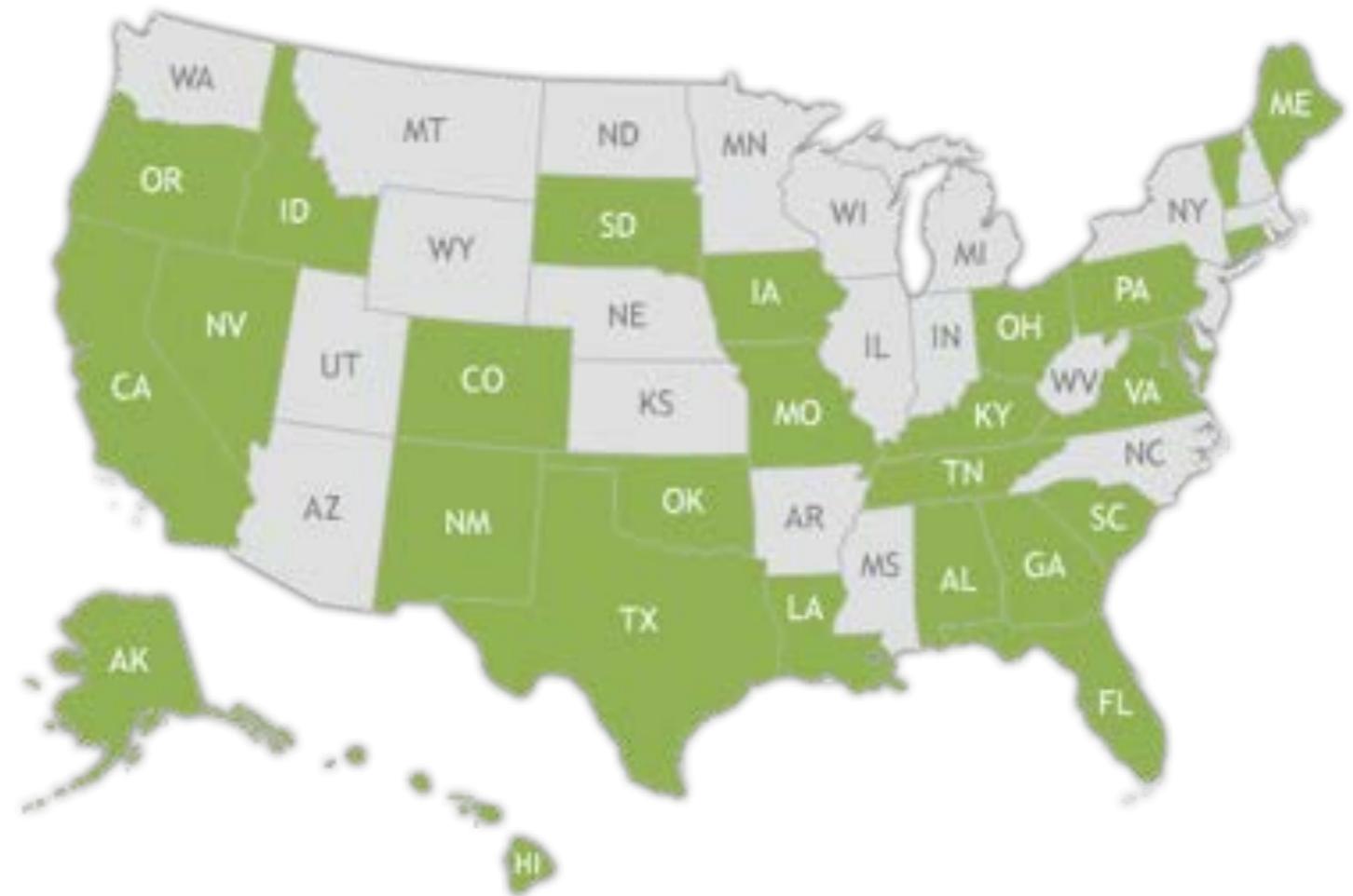
Click on the map to find out more about business organizations promoting early childhood policy in that state.

Learn more about our [National Network](#) of business organizations.

The States at a Glance

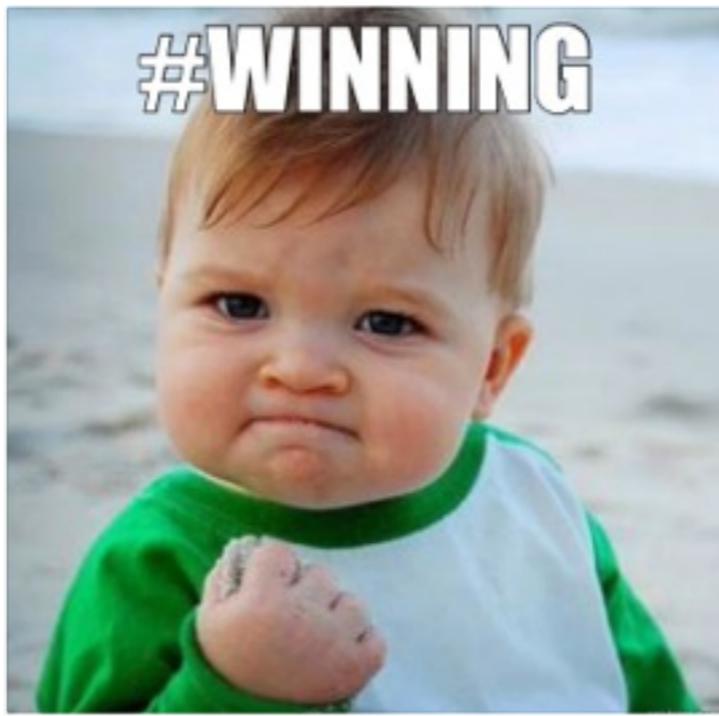
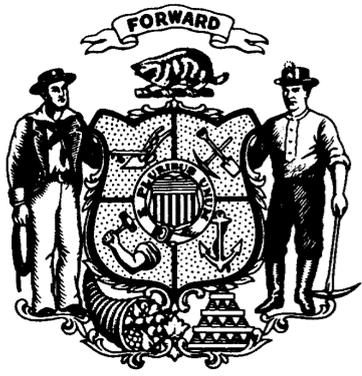
Looking for data on your state that illustrates both the status of children and the power of early investment? We recommend the following:

<http://www.readynation.org/state-network/>



Public Investment in Children by Age





Wisconsin
LEGISLATURE



LRB-3486/1
SRM:eev:ev

2013 SENATE RESOLUTION 59

Resolved by the senate, the assembly concurring, That policy decisions enacted by the Wisconsin state legislature will acknowledge and take into account the principles of early childhood brain development and will, whenever possible, consider the concepts of toxic stress, early adversity, and buffering relationships, and note the role of early intervention and investment in early childhood years as important strategies to achieve a lasting foundation for a more prosperous and sustainable state through investing in human capital.

(END)

Change the First Five Years and You Change Everything

Ounce of Prevention Fund

Accessible at <http://youtu.be/GbSp88PBe9E>

“While schools can do much to raise achievement among children who initially lag behind their peers, all too often pre-school gaps set in train a pattern of **ever increasing inequality** during school years and beyond. Any drive to improve social mobility must begin with an effective strategy to **nurture the fledgling talent in young children** so often lost before it has had a chance to flourish.”

The Sutton Trust

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twitter.com/navsaria
dnavsaria@pediatrics.wisc.edu



Public-facing Social Media
Please follow along!

**THE
END**