

# EARLY CHILDHOOD DEVELOPMENT



# The Early Brain



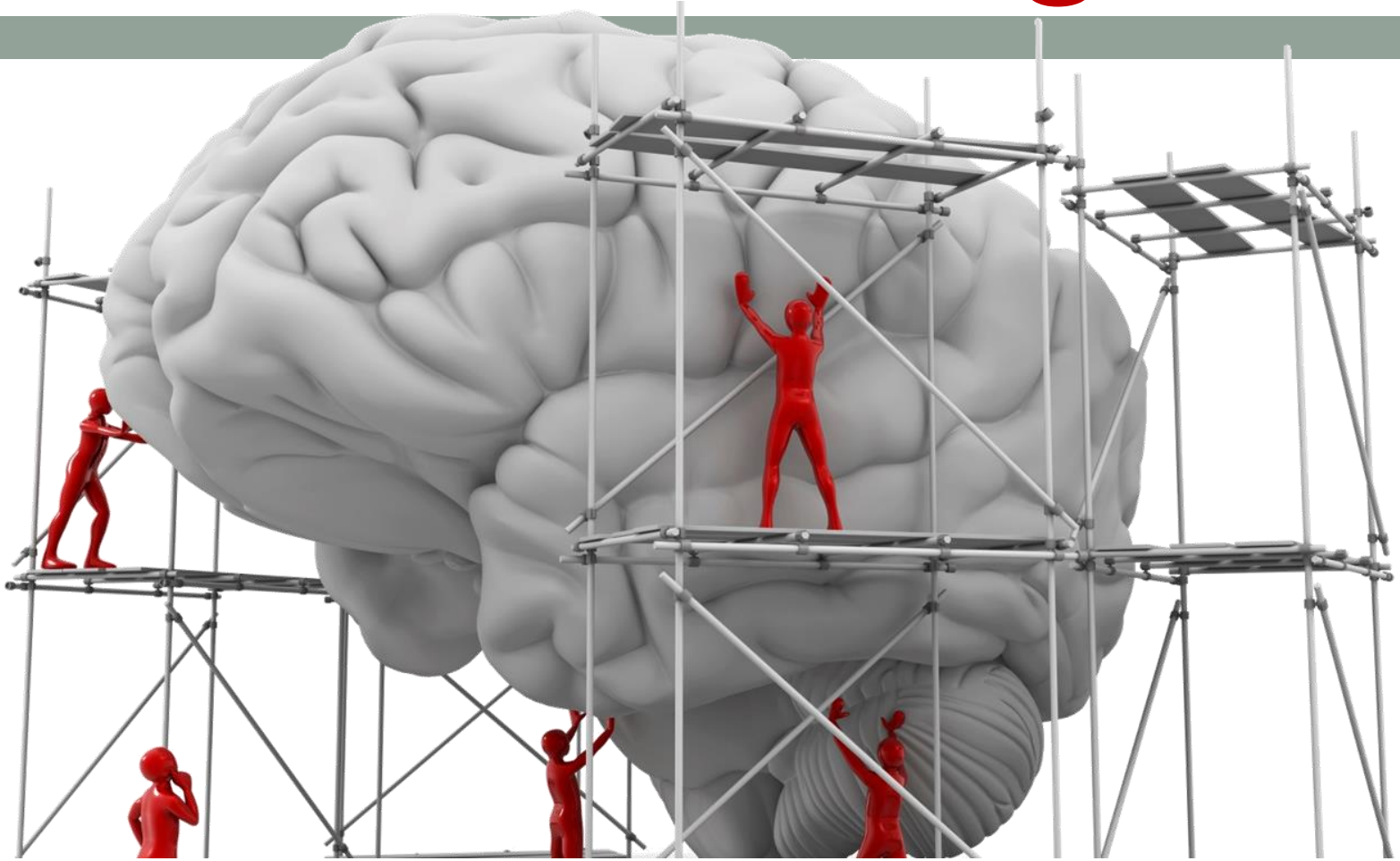
# Center on the Developing Child

Harvard University

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- Key Concepts
  - ▣ Brain Architecture
  - ▣ Serve and Return
  - ▣ Toxic Stress

# Where to Begin



# Brain Architecture

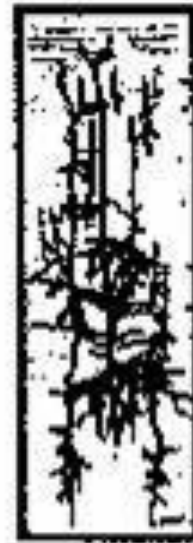
# Normal Brain Development



**Newborn**



**6-year-old**

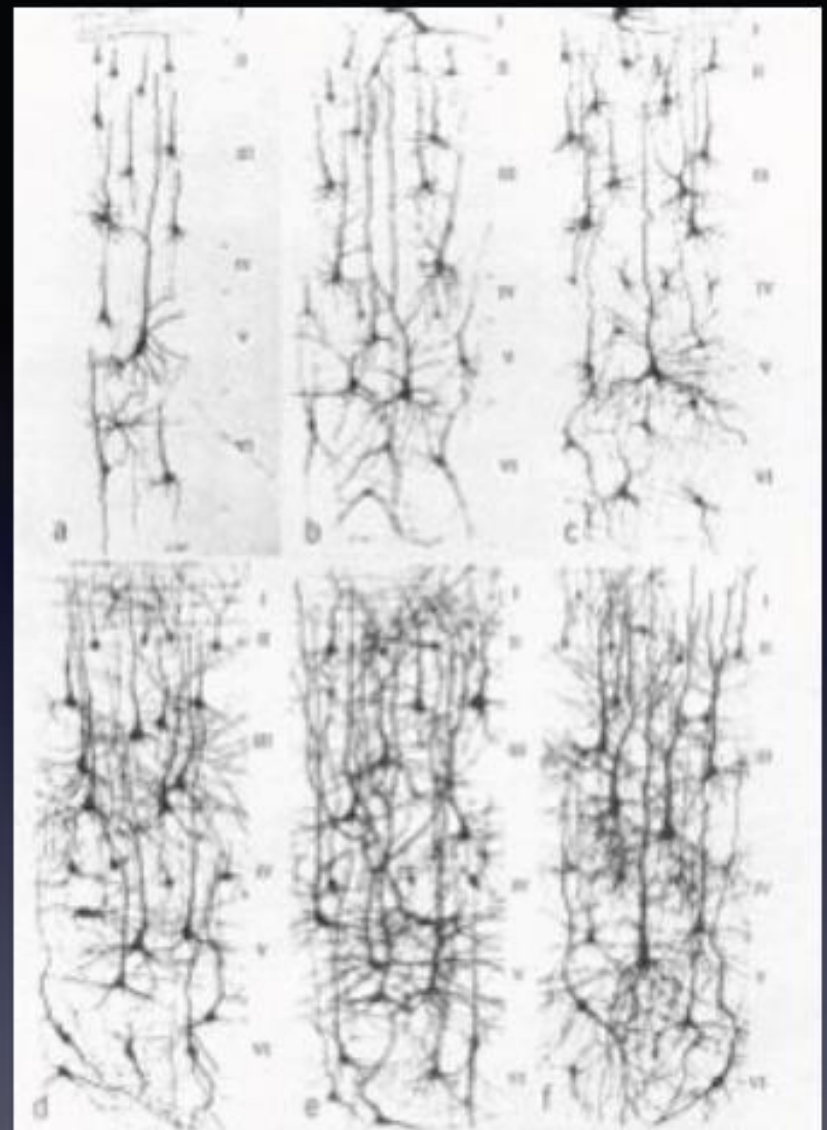


**Newborn**



**6-year-old**

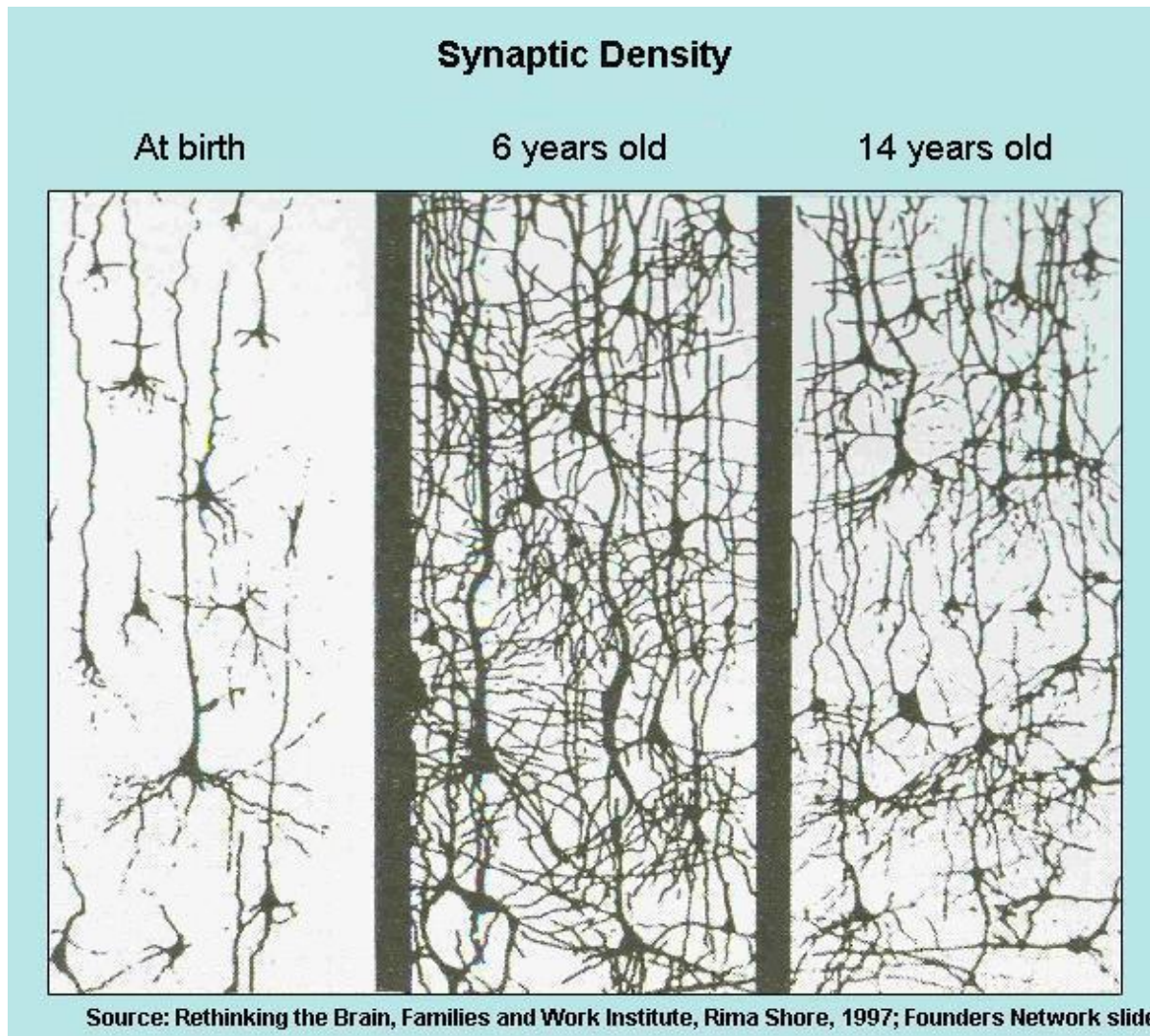
**700**  
New Neural  
Connections  
per Second



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.

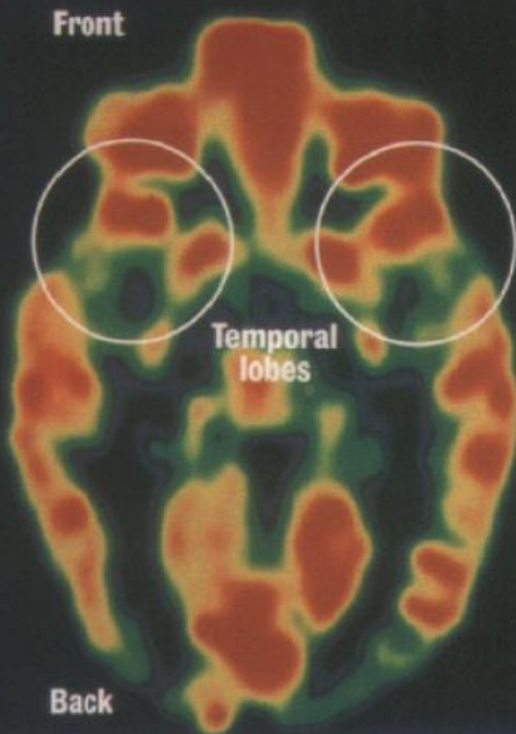
(from Corel, 1939-1959)

# Neuron Development/Pruning



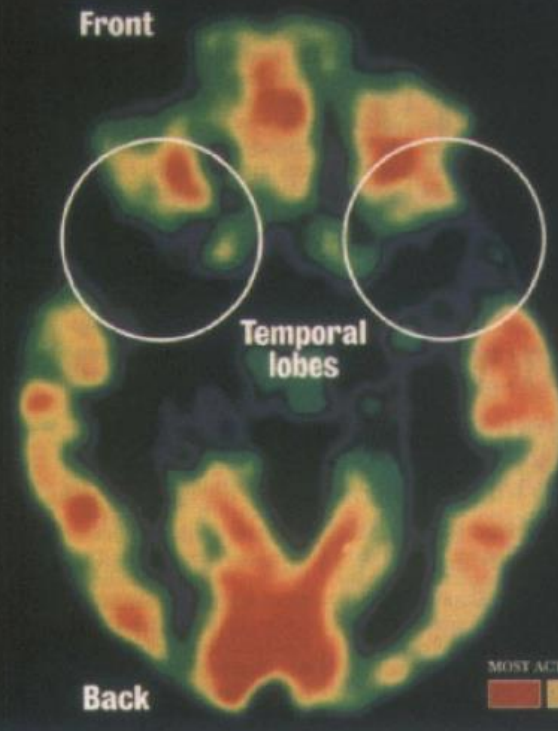
### Healthy Brain

This PET scan of the brain of a normal child shows regions of high (red) and low (blue and black) activity. At birth, only primitive structures such as the brain stem (center) are fully functional; in regions like the temporal lobes (top), early childhood experiences wire the circuits.



### An Abused Brain

This PET scan of the brain of a Romanian orphan, who was institutionalized shortly after birth, shows the effect of extreme deprivation in infancy. The temporal lobes (top), which regulate emotions and receive input from the senses, are nearly quiescent. Such children suffer emotional and cognitive problems.



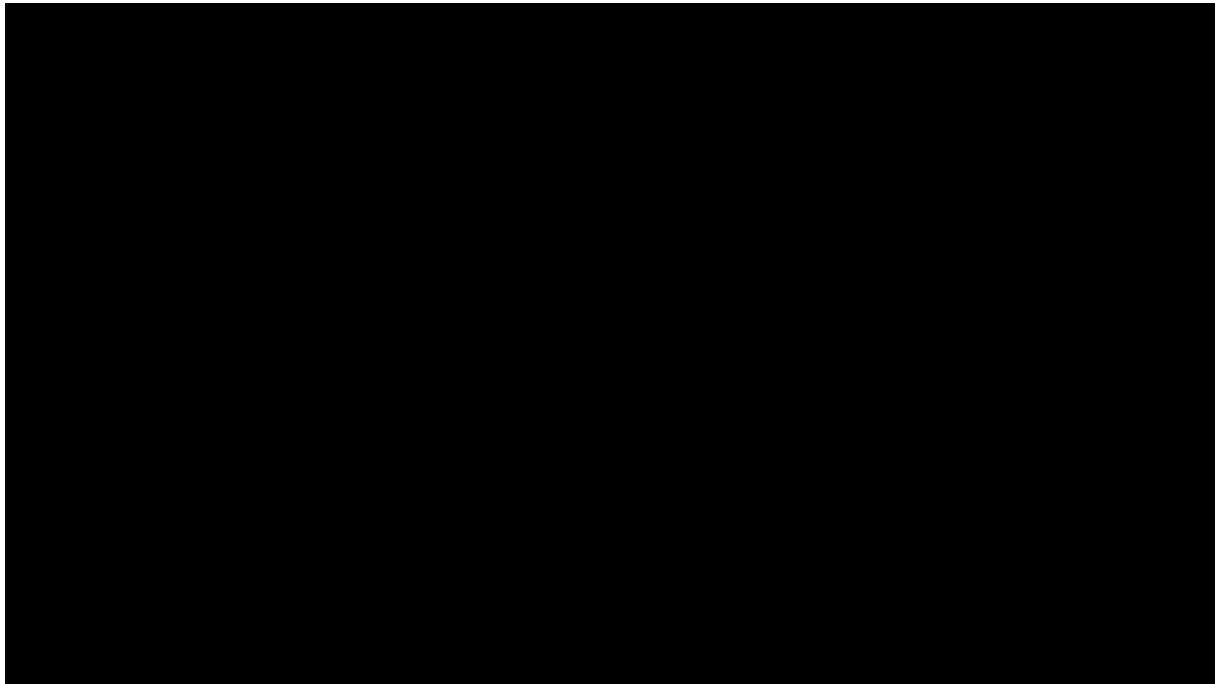




**HEBB'S AXIOM**

**Neurons That Fire Together  
Wire Together**

# Brain Architecture



# Serve and Return

- Shapes brain architecture
- Like a game of tennis or volleyball
- It is about responsive relationships and building adult capabilities.



# Serve and Return

What do you think about that?

You think its pretty. Me too. I like red. Do you?

It's pretty!

I like red and pink!



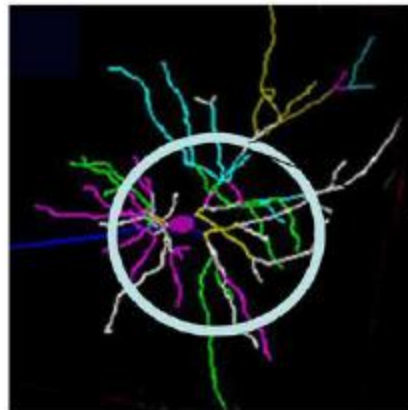
# Toxic Stress



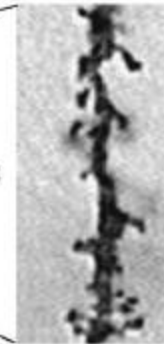


## Persistent Stress Changes Brain Architecture

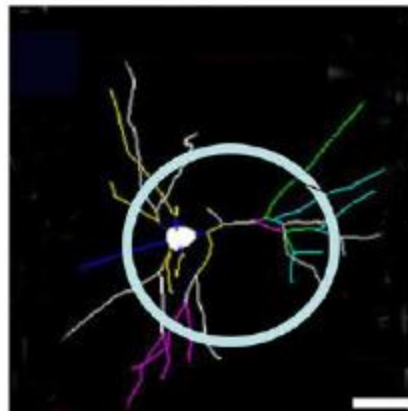
Normal



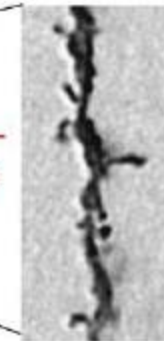
Typical neuron—  
many connections



Toxic  
stress



Damaged neuron—  
fewer connections



Prefrontal Cortex and  
Hippocampus

## Three Levels of Stress Response

### Positive

Brief increases in heart rate,  
mild elevations in stress hormone levels.

### Tolerable

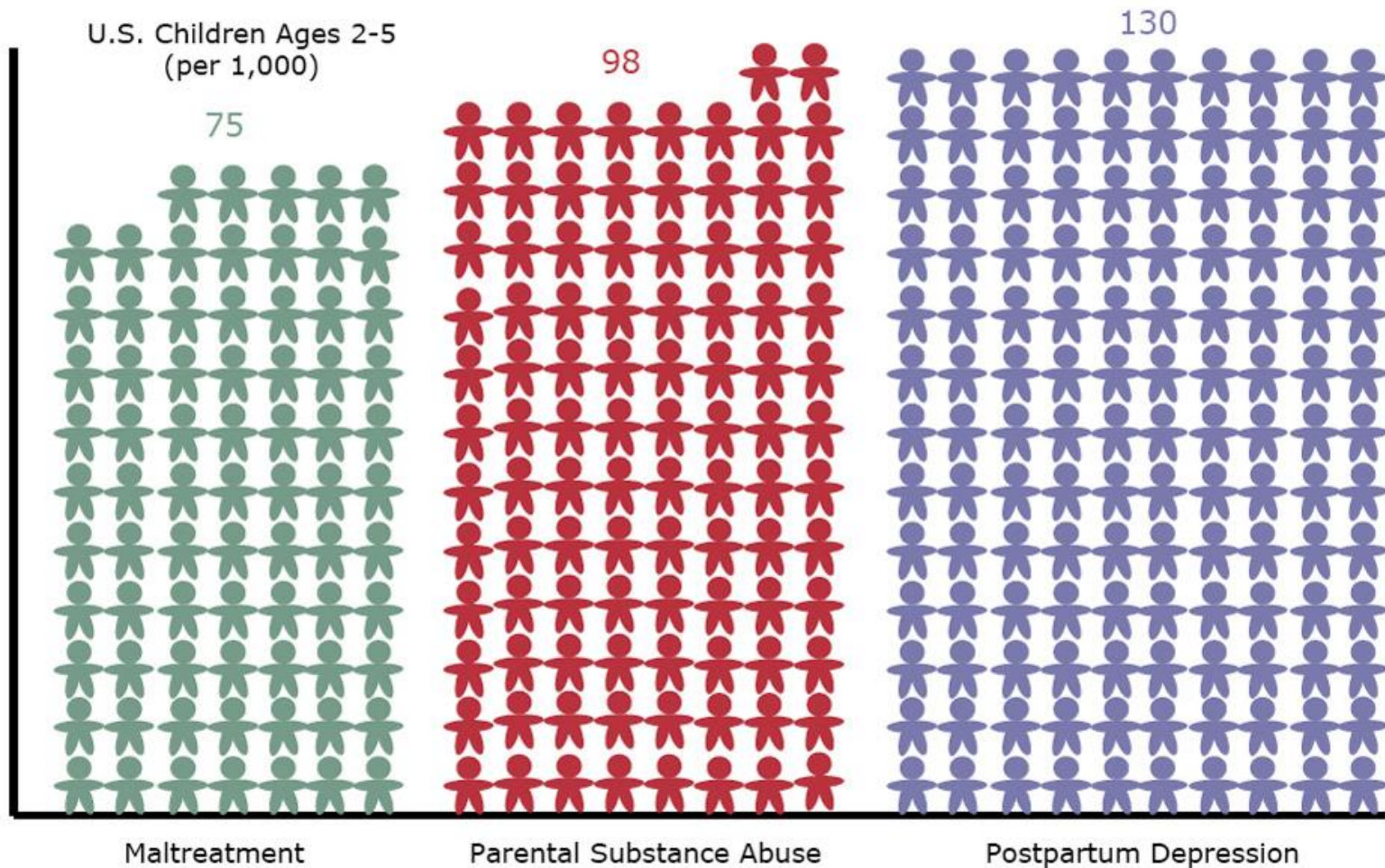
Serious, temporary stress responses,  
buffered by supportive relationships.

### Toxic

Prolonged activation of stress response systems  
in the absence of protective relationships.

Source: Center on the Developing Child at Harvard University

## Sources of Toxic Stress in Young Children



Source: Finkelhor et al. (2005)

Source: SAMHSA (2002)

Source: O-Hara & Swain (1996)



# Toxic Stress and Early Brain Development

- ***The Adverse Childhood Experiences (ACE) Study***
- **[www.ACESTUDY.org](http://www.ACESTUDY.org)**
- Involved ~17,000 patients at Kaiser Permanente Hospital
- Results “reveal staggering proof of the health, social, and economic risks that result from childhood trauma.”
  - [www.acestudy.org](http://www.acestudy.org)

# Adverse Childhood Experiences (ACE) Study:

surveyed >17,000 middle-class adults

**Adverse  
HEALTH  
Outcomes**

**Poor SOCIAL  
OUTCOMES**

**Adverse MENTAL  
HEALTH Outcomes**



Dr. Vincent Felitti –  
Kaiser Permanente

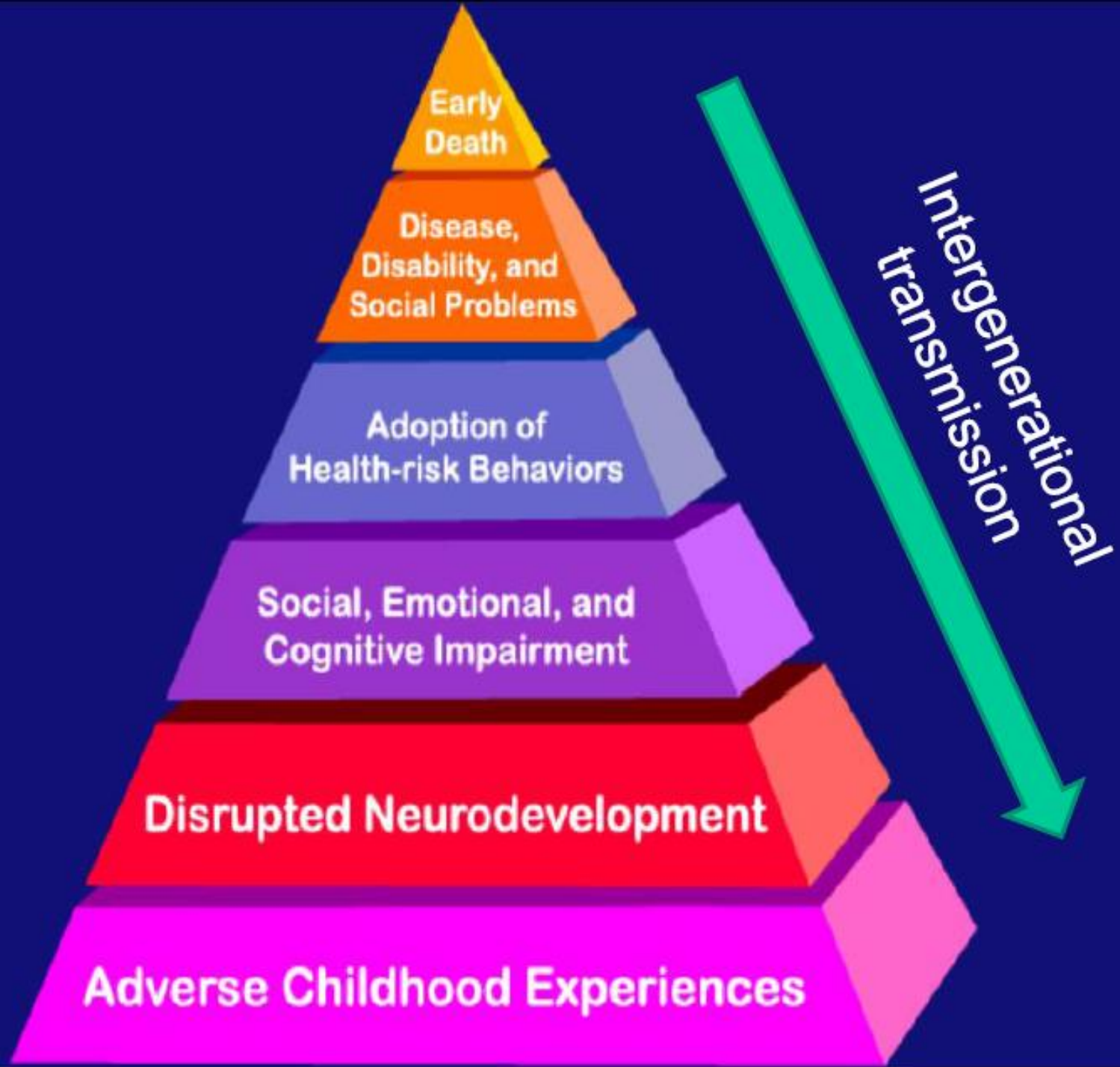


Dr. Robert Anda – Center for  
Disease Control and Prevention

Death



Conception



# ACE Questionnaire

- *Consists of 10 questions*
- *Is not all encompassing*
- *Categories*
  - ▣ *Abuse / Neglect*
    - Recurrent Emotional (by parents)
    - Recurrent Physical (by parents)
    - Emotional / Physical neglect
    - Sexual (by anyone)
  - ▣ *Household Dysfunction*
    - Substance Abuse
    - Mental Illness
    - Mother treated violently
    - Imprisoned household member
    - One or no parents (separation or divorce)

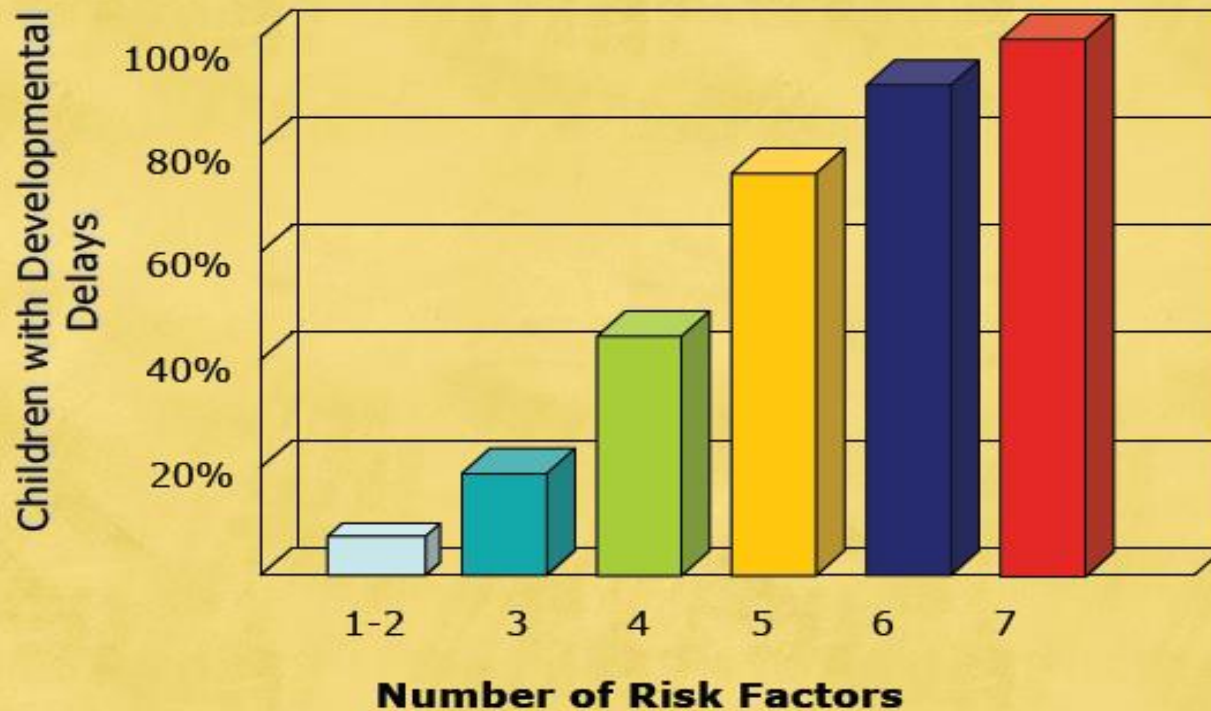
# ACE Score Implications

- As the ACE score increased, the chances of being a user of street drugs, tobacco or having problems with alcohol abuse increased in stepwise fashion.
- Compared to persons with ACE score of 0, those with a score of 4 or more were:
  - 2 times as likely to be smokers,
  - 12 times more likely to have attempted suicide,
  - 7 times more likely to be alcoholic,
  - 10 times more likely to have injected street drugs.

# ACE Score Implications (cont.)

- ACE score of 4 or higher:
  - 7 times more likely to be alcoholic
  - 6 times more likely to have sex by age 15
  - 2 times more likely to be diagnosed with cancer
  - 4 times more likely to have emphysema
- ACE score of 6 or higher:
  - 30 times more likely to attempt suicide
  - 20 year shortening of life span

## Significant Adversity Impairs Development in the First Three Years



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

# ACEs in Tennessee





# Tennessee-Specific Data

## ADVERSE CHILDHOOD EXPERIENCES IN TENNESSEE

FACT **NOT** FATE



Like a house's foundation, brain architecture is built over time and from the bottom up. Positive experiences in infancy and early childhood can build a strong and solid foundation. Negative experiences weaken the foundation which can lead to life-long problems.

Adverse Childhood Experiences, or "ACEs," are stressful or traumatic experiences that disrupt the safe, nurturing environments that children need to thrive. Exposure to ACEs can lead individuals toward the adoption of unhealthy habits and the onset of negative long-term health and economic issues.

Adverse childhood experiences that may negatively impact development include the following:

- Child maltreatment • Family dysfunction
- Witnessing community violence • Living in poverty
- Homelessness • Bullying by peers, siblings, and others
- Death of a parent

ACEs cause stress and challenges during childhood, adolescence, and into adulthood. Some adult outcomes associated with ACEs include the following:

- Heart disease • Diabetes • Obesity • Cancer
- Liver disease • Intimate partner violence • Depression
- Suicide attempts • Poor anger control • Smoking
- Substance abuse • Multiple sexual partners
- Unintended pregnancies • Fetal death

The more exposure to ACEs a person has, the more his or her risk increases for the issues above.

However, there is hope! Research shows that providing safe, stable, and nurturing relationships early in life can buffer the damaging effects of childhood adversity. Tennessee can do a number of things to both prevent and reduce ACEs across the state and to build protective factors in and around children so they can grow up to be healthy and happy.

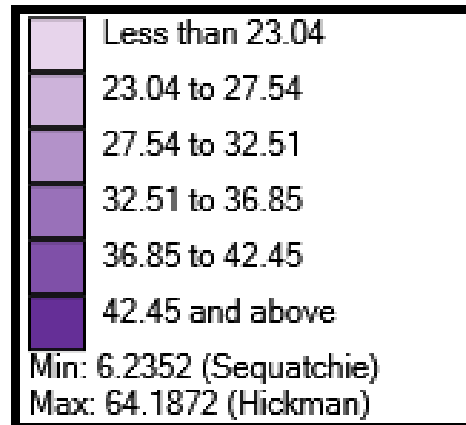
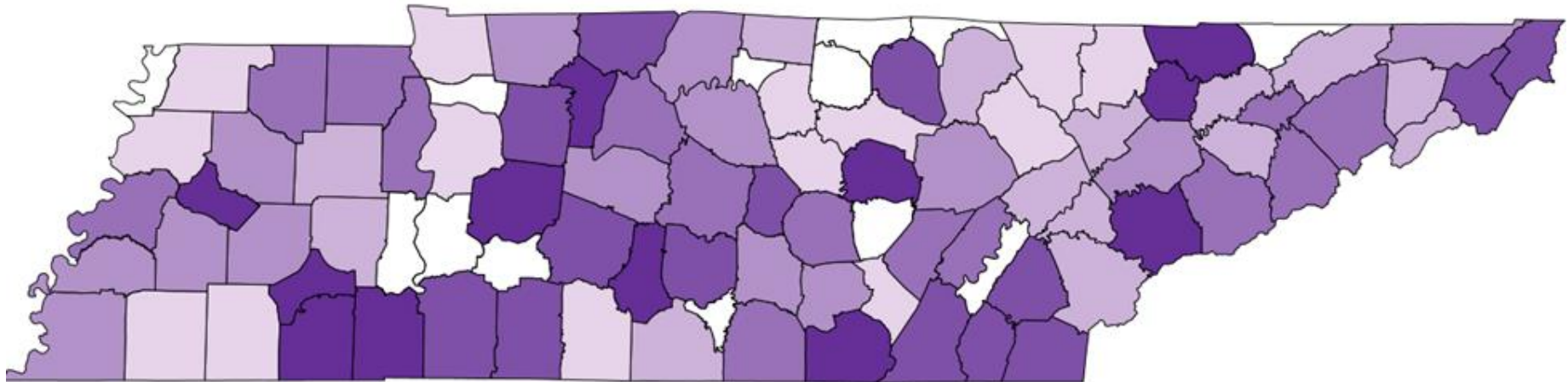
A person's ACE score is calculated by totaling the number of different types of adverse events experienced in childhood

| Child Maltreatment | Family Dysfunction |
|--------------------|--------------------|
| Physical           | Substance abuse    |
| Sexual             | Incarceration      |
| Psychological      | Mental illness     |
| Neglect            | Divorce/Separation |
|                    | Domestic Violence  |



# Geographic Distribution

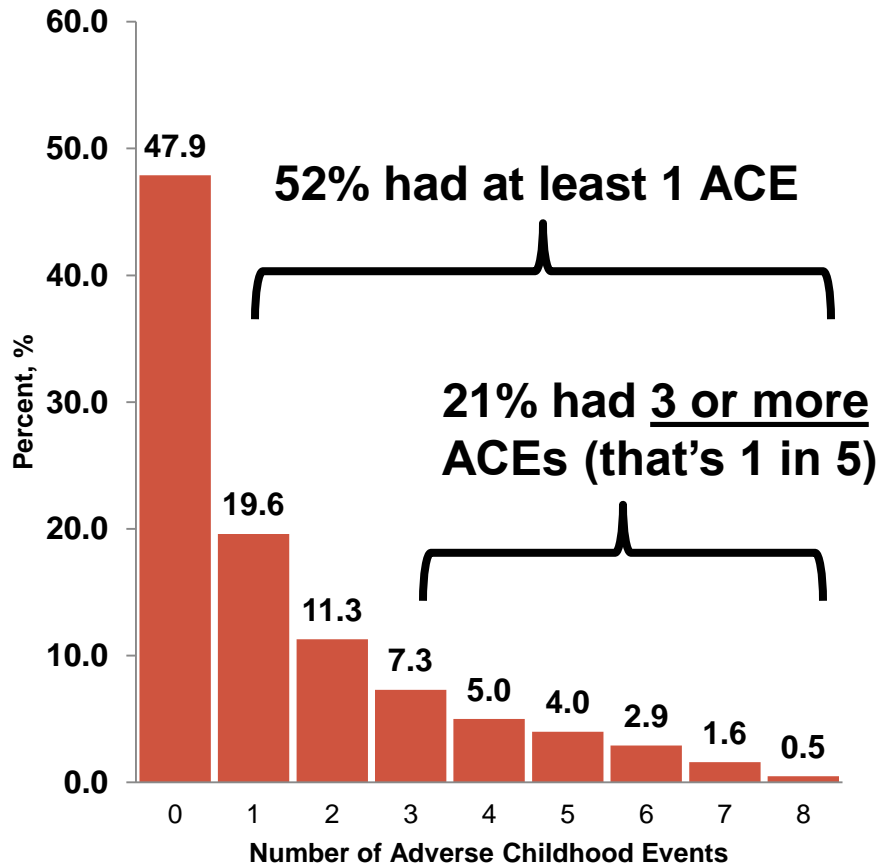
\*Percentage of population that has 2 or more ACEs



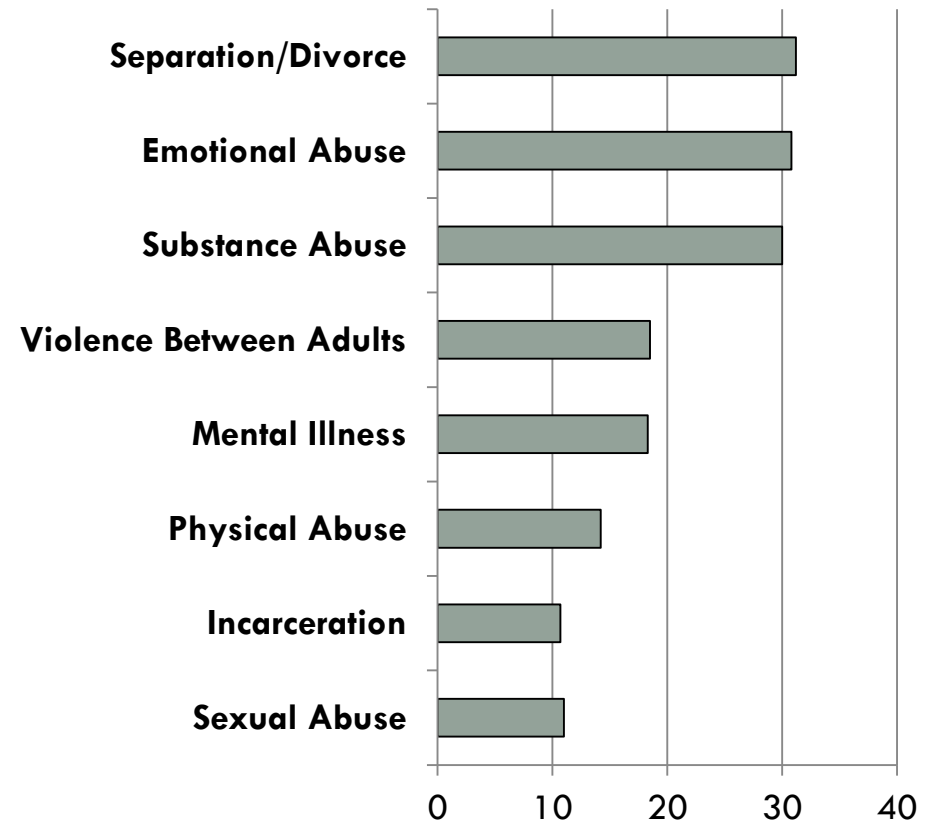
Source: Tennessee Behavioral Risk Factor Surveillance System (BRFSS), 2012.

# ACEs in TN (2012)

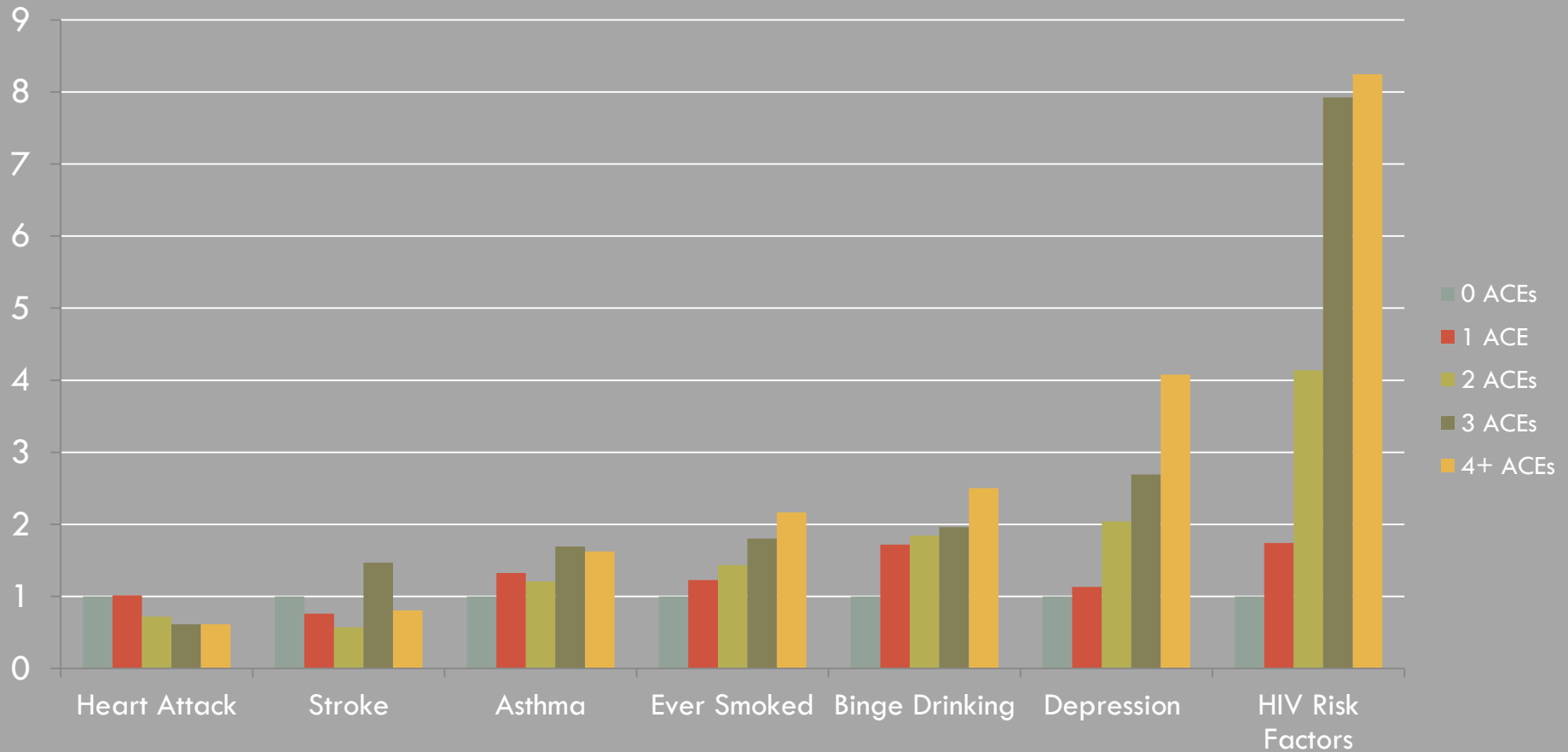
Prevalence of Adverse Childhood Experiences in Tennessee, 2012



Prevalence of Adverse Childhood Experiences in Tennessee by Category, 2012

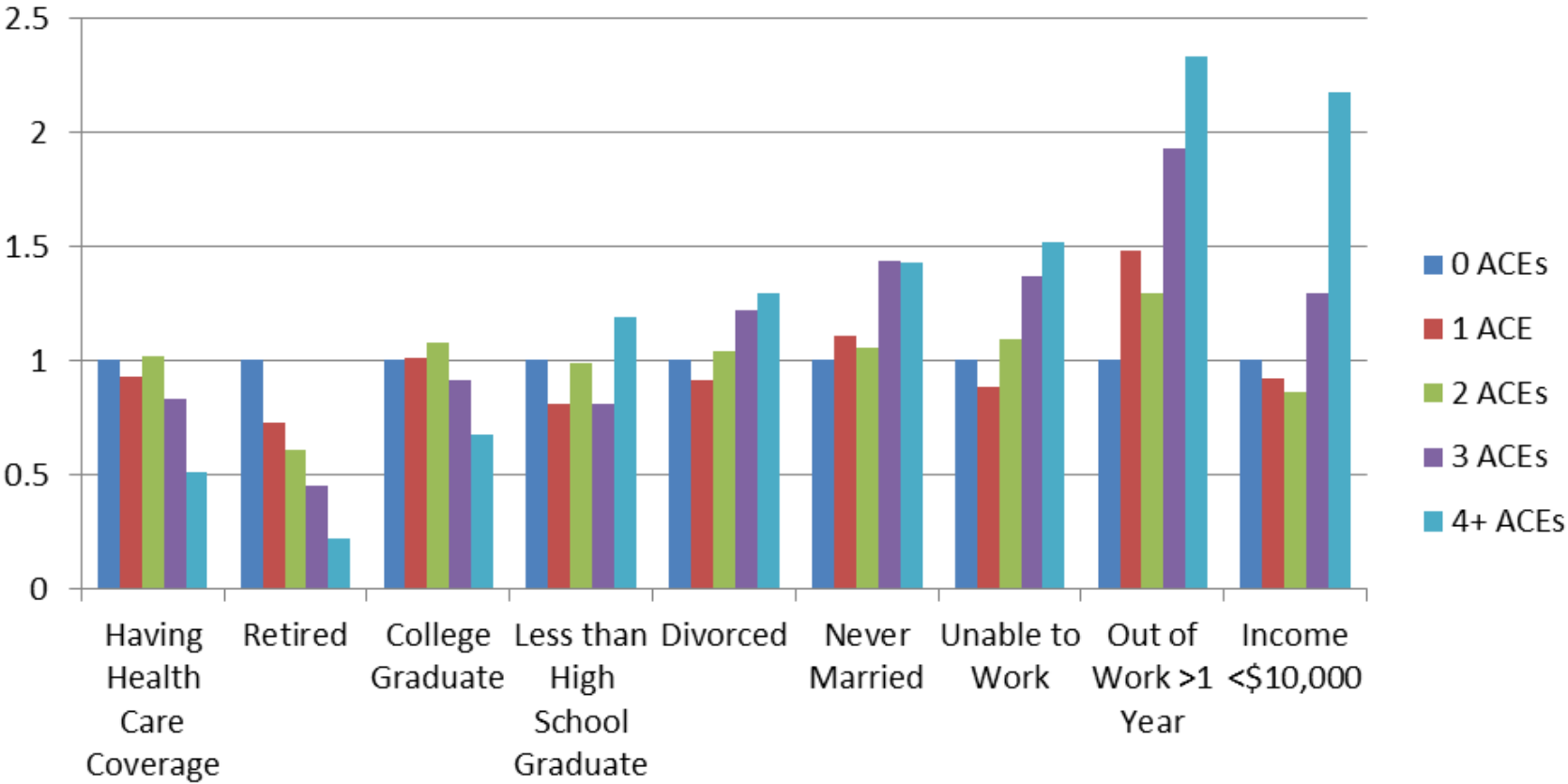


# Association of Health Outcomes and Behaviors by ACE Score\*



\* = All significant  $p \geq 0.05$

# Association of Economic Outcomes by ACE Score\*



\* = All significant  $p \geq 0.05$

# Childhood Traumatic Stress



# Child Traumatic Stress

- Occurs when children and adolescents are exposed to traumatic events or situations that overwhelm their ability to cope
- When a child is experiencing child traumatic stress, these reactions interfere with his or her daily life and ability to function and interact with others.
- May affect the way children view themselves, the world around them and their future.
- Repeated exposure to traumatic events (sometimes called “complex trauma”) can affect the child’s brain and nervous system and increase the risk of:
  - Low academic performance
  - Engagement in high-risk behaviors
  - Difficulties in peer and family relationships

# Other Possible Sources of Childhood Stress

- Poverty
- Discrimination
- Separation from caregivers and family members
- Frequent placements or moving around often
- Problems at school
- Immigration issues



# Remember...

□ ***Traumatized children may become traumatized adults.***



- When childhood trauma is not resolved, individuals may continue to live in a state of fear and helplessness.
- If a child does not receive successful intervention for trauma, they are more susceptible to long-term effects.

# The Good News



# What Can We Do About Early Brain Neurotoxicity?

- ❑ Home visiting
- ❑ Parent coaching
- ❑ Good childcare
- ❑ High quality early education programs
- ❑ Solid pediatric care
- ❑ Income-related programs
- ❑ Mental health services



# Continuing the Conversation...

