Adverse Childhood Experiences – Predictor’s of Future Health

“In my end is my beginning”

*T.S. Eliot*

*Four quartets*

Steve Wolfe, M.D.
Professor Emeritus
University of Iowa
Department of Family Medicine
Learning Objectives:

- Understand and articulate the relationship between adverse childhood experiences and adult health risks/behaviors
- Understand the relationship between adverse childhood experiences and social outcomes
- Understand the ecobiodevelopmental model of health and the impact of ACEs and toxic stress on childhood brain development
- Use the ACEs screening tool in your practice to access future health risks/behaviors
Disclosure:
Consultant, Iowa Medicaid Enterprise & Iowa Department of Public Health 1st Five

SPONSORED:
IOWA MEDICAID ENTERPRISE AND CENTER FOR DISEASE AND DISABILITY UNIVERSITY OF IOWA
The ACEs Study

Relationship of Childhood Abuse and Household Dysfunction to Many of the Leading Causes of Death in Adults: The Adverse Childhood Experiences (ACE) Study.

ACE Pyramid Concept for ACE Study
ACEs Study Design

1995-1997
ACEs questionnaire completed by 17,421 of 26,000 HMO members of Kaiser Permanente, San Diego Department of Preventive Medicine

www.acestudy.org
www.cdc.gov/ace/
Iowa BRFSS

- Annual survey conducted by CDC and Iowa
- 2012 BRFSS include questions to assess for ACES
- Surveyed 6,361 Iowans –
- Iowa ACES data consistent with original ACES study data

Adverse Childhood Experiences in Iowa: A New Way of Understanding Lifelong Health

Findings from the 2012 Behavioral Risk Factor Surveillance System

Commissioned by the Central Iowa ACEs Steering Committee
Adverse Childhood Experiences

ACE = Events/Incidents which harm social, cognitive, and emotional functioning causing a dramatic upset in the safe, nurturing environments children require to thrive.

ACEs are common stressful traumatic experiences which affect children’s neurodevelopment. The Ecobiodevelopmental Model of Health.

ACE score is a measure of the cumulative exposure to household dysfunction, abuse, and neglect.
THE TRUTH ABOUT ACES

WHAT ARE THEY?

ACEs are ADVERSE CHILDHOOD EXPERIENCES

The three types of ACEs include:

- **ABUSE**
  - Physical
  - Emotional
  - Sexual

- **NEGLECT**
  - Physical
  - Emotional

- **HOUSEHOLD DYSFUNCTION**
  - Mental illness
  - Incarcerated relative
  - Mother treated violently
  - Substance abuse
  - Divorce
What’s My ACE Score?

Prior to your 18th birthday:
1. Did a parent or other adult in the household often or very often…
   Swear at you, insult you, put you down, or humiliate you?
   
   or
   
   Act in a way that made you afraid that you might be physically hurt?
   Yes No If yes enter 1 ______

2. Did a parent or other adult in the household often or very often…
   Push, grab, slap, or throw something at you?
   
   or
   
   Ever hit you so hard that you had marks or were injured?
   Yes No If yes enter 1 ______

3. Did an adult or person at least 5 years older than you ever…
   Touch or fondle you or have you touch their body in a sexual way?
   
   or
   
   Attempt or actually have oral, anal, or vaginal intercourse with you?
   Yes No If yes enter 1 ______

4. Did you often or very often feel that…
   No one in your family loved you or thought you were important or special?
   
   or
   
   Your family didn’t look out for each other, feel close to each other, or support each other?
   Yes No If yes enter 1 ______

5. Did you often or very often feel that…
   You didn’t have enough to eat, had to wear dirty clothes, and had no one to protect you?
   
   or
   
   Your parents were too drunk or high to take care of you or take you to the doctor if you needed it?
   Yes No If yes enter 1 ______

6. Was a biological parent ever lost to you through divorced, abandonment, or other reason?
   Yes No If yes enter 1 ______

7. Was your mother or stepmother:
   Often or very often pushed, grabbed, slapped, or had something thrown at her?
   
   or
   
   Sometimes, often, or very often kicked, bitten, hit with a fist, or hit with something hard?
   
   or
   
   Ever repeatedly hit over at least a few minutes or threatened with a gun or knife?
   Yes No If yes enter 1 ______

8. Did you live with anyone who was a problem drinker or alcoholic or who used street drugs?
   Yes No If yes enter 1 ______

9. Was a household member depressed or mentally ill or did a household member attempt suicide?
   Yes No If yes enter 1 ______

10. Did a household member go to prison?
    Yes No If yes enter 1 ______

Now add up your “Yes” answers: ______ This is your ACE Score
What Did We Learn
ACEs Are **Common**

### Figure 3. – Prevalence of Adverse Childhood Experiences

#### Adverse Childhood Experiences Are Common

<table>
<thead>
<tr>
<th>Household dysfunction:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Substance abuse 27%</td>
<td></td>
</tr>
<tr>
<td>Parental sep/divorce 23%</td>
<td></td>
</tr>
<tr>
<td>Mental illness 17%</td>
<td></td>
</tr>
<tr>
<td>Battered mother 13%</td>
<td></td>
</tr>
<tr>
<td>Criminal behavior 6%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Abuse:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychological 11%</td>
<td></td>
</tr>
<tr>
<td>Physical 28%</td>
<td></td>
</tr>
<tr>
<td>Sexual 21%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Neglect:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotional 15%</td>
<td></td>
</tr>
<tr>
<td>Physical 10%</td>
<td></td>
</tr>
</tbody>
</table>
ACEs Are Interrelated

Table 4. Prevalence of the ACE Score by Gender

<table>
<thead>
<tr>
<th>ACE Score</th>
<th>Women</th>
<th>Men</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>31.3</td>
<td>34.2</td>
<td>32.7</td>
</tr>
<tr>
<td>1</td>
<td>24.2</td>
<td>27.3</td>
<td>25.6</td>
</tr>
<tr>
<td>2</td>
<td>14.8</td>
<td>16.4</td>
<td>15.5</td>
</tr>
<tr>
<td>3</td>
<td>10.4</td>
<td>9.3</td>
<td>9.9</td>
</tr>
<tr>
<td>4</td>
<td>6.8</td>
<td>4.8</td>
<td>5.9</td>
</tr>
<tr>
<td>≥5</td>
<td>12.5</td>
<td>8.0</td>
<td>10.5</td>
</tr>
</tbody>
</table>
ACEs Are Cumulative: Co-occurrence and Cumulative Effect of ACES
ACEs -- Strong Association With Alcohol Abuse
Relationship of ACE Score to Alcohol Use And Abuse

Figure 6.- Relationship of the ACE Score to Alcohol Use and Abuse

The ACE Score…
Alcohol Use and Abuse

Percent with alcohol related problem

ACE Score
0 1 2 3 4 or more

Early initiation of use (by age 14) Problem with alcohol use Alcoholic Married an Alcoholic
ACEs Are Common in Iowa

Prevalence of Individual ACEs in Iowa

- Emotional Abuse: 28% (19% affected with only this ACE)
- Physical Abuse: 16% (6%)
- Sexual Abuse: 10% (15%)
- Child Abuse: 28% (19%)
- Adult Substance Abuse: 26% (19%)
- Parent Separation/Divorce: 22% (3%)
- Mental Illness among Adults: 17% (15%)
- Violence Between Adults: 16% (6%)
- Incarcerated Household Member: 7% (22%)

Average score across seven comparison states:
(Arkansas, California, Louisiana, New Mexico, Tennessee, Washington & Wisconsin)
ACEs in Iowa Co-Occurrence

Iowa Population Estimates of ACEs Co-Occurrence

- 0 ACEs (930,835 Iowans)
- 1 ACE (440,458 Iowans)
- 2-3 ACEs (392,712 Iowans)
- 4-5 ACEs (194,550 Iowans)
- 6-8 ACEs (107,947 Iowans)
Iowans With ACEs Score 4 or Greater Experiencing Each ACE Category

Co-Occurrence of High ACE Scores among Those Who Experienced Specific ACEs

- Child Abuse
  - Emotional Abuse: 45%
  - Physical Abuse: 63%
  - Sexual Abuse: 56%

- Household Dysfunction
  - Adult Substance Abuse: 46%
  - Parent Separation/Divorce: 45%
  - Mental Illness among Adults: 54%
  - Violence Between Adults: 66%
  - Incarcerated Household Member: 79%

Iowa's General Population: 15%
ACEs Predict Future Health Risk Behaviors And Overall Quality of Life

ACEs and Poor Overall Health

More than *twice as many adults* rated their health poorly (23%) when they had four or more ACEs compared to those adults with zero ACEs who rated their health poorly (10%).
Health Risk Behavior And Illness Burden

- Worse Case: childhood trauma as measured by ACE score can reduce life expectancy by 20 years
Depression and Suicide

Figure 9. Relationship of the ACE Score to Depression and Suicide Attempts

The ACE Score and a Lifetime History of Depression or Suicide Attempts

Percent depressed or attempted suicide (%)

ACE Score
Iowa ACEs/Depression

ACEs and Depression

More than 33% of adults reporting four or more ACEs had received a diagnosis of clinical depression but were not currently taking any form of medication.
ACE Score and Teen Sexual Behaviors
ACEs and Population Attributable Risks

- Disability days: 52%
- Domestic violence: 52%
- Promiscuity: 48%
- IV drug abuse: 78%
- Life dissatisfaction: 67%
- Alcoholism: 65%
- Suicide attempt: 58%
- Drug abuse: 50%
- Hopelessness: 43%
- Current depression: 54%
## Iowa ACEs Study

### Probability of Outcomes

Given 100 American Adults

<table>
<thead>
<tr>
<th>No ACEs (33)</th>
<th>1-3 ACEs (51)</th>
<th>4-8 ACEs (16)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WITH 0 ACEs</td>
<td>WITH 3 ACEs</td>
<td>WITH 7+ ACEs</td>
</tr>
<tr>
<td>1 in 16 smokes</td>
<td>1 in 9 smokes</td>
<td>1 in 6 smokes</td>
</tr>
<tr>
<td>1 in 69 are alcoholic</td>
<td>1 in 9 are alcoholic</td>
<td>1 in 6 are alcoholic</td>
</tr>
<tr>
<td>1 in 480 uses IV drugs</td>
<td>1 in 43 uses IV drugs</td>
<td>1 in 30 use IV drugs</td>
</tr>
<tr>
<td>1 in 14 has heart disease</td>
<td>1 in 7 has heart disease</td>
<td>1 in 6 has heart disease</td>
</tr>
<tr>
<td>1 in 96 attempts suicide</td>
<td>1 in 10 attempts suicide</td>
<td>1 in 5 attempts suicide</td>
</tr>
</tbody>
</table>
### ACEs Adversely Affects Many Health Outcomes

<table>
<thead>
<tr>
<th>RISK FACTOR</th>
<th>% INCREASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td>242%</td>
</tr>
<tr>
<td>Obesity</td>
<td>22%</td>
</tr>
<tr>
<td>Depression</td>
<td>357%</td>
</tr>
<tr>
<td>Illicit drug use</td>
<td>443%</td>
</tr>
<tr>
<td>Injected drug use</td>
<td>1133%</td>
</tr>
<tr>
<td>STD</td>
<td>298%</td>
</tr>
<tr>
<td>Attempted suicide</td>
<td>1525%</td>
</tr>
<tr>
<td>Alcoholism</td>
<td>555%</td>
</tr>
</tbody>
</table>
WHAT IMPACT DO ACEs HAVE?

As the number of ACEs increases, so does the risk for negative health outcomes.

RISK

0 ACEs 1 ACE 2 ACEs 3 ACEs 4+ ACEs

Possible Risk Outcomes:

BEHAVIOR
- Lack of physical activity
- Smoking
- Alcoholism
- Drug use
- Missed work

PHYSICAL & MENTAL HEALTH
- Severe obesity
- Diabetes
- Depression
- Suicide attempts
- STDs
- Heart disease
- Cancer
- Stroke
- COPD
- Broken bones
ACE National Issue


Impact: heart disease, liver disease, injuries, obesity, diabetes, arthritis
ACE Scores Among Parents in Iowa

On average, 5 out of every 30 students in an Iowa school classroom will live with a parent who has a very high ACE score – a score of 4 or more.
Impact on Education And Future Work Place Problems
Significant Adversity Impairs Development in the First Three Years

![Bar chart showing the percentage of children with developmental delays based on the number of risk factors they experience in the first three years.](chart)

- **Children with Developmental Delays**
  - 1-2 risk factors: 20%
  - 3 risk factors: 40%
  - 4 risk factors: 60%
  - 5 risk factors: 80%
  - 6 risk factors: 100%
  - 7 risk factors: 100%

**Number of Risk Factors**

Source: Barth, et al. (2008)
Spokane Washington

Students with 3 or more ACEs:

- 2 ½ times more likely to fail a grade
- Score lower on standardized tests
- Have language difficulties
- Suspended or expelled more
- Designated to special education more frequently
- Poorer health

Courtesy of Chris Blodgett, PHD ~ Washington State University
Effect of ACEs on Educational Outcomes

New ACEs Pyramid Concept

ACE Impacts on Lifelong Health

- Adverse Childhood Experiences
- Disrupted Neurodevelopment
- Social, Emotional, and Cognitive Development
- Adoption of Health-Risk Behaviors
- Disease, Disability, and Social Problems
- Death
“IT IS EASIER TO BUILD STRONG CHILDREN THAN TO REPAIR BROKEN MEN.”

FREDERICK DOUGLAS
Nature Plus Nurture—
The Neurobiology of Development

Eco-Bio-Developmental
Model of Human Health and Disease

Ecology
Biology
Development

Biology
Physiologic Adaptations and Disruptions

The Basic Science of Pediatrics

Ecology
The social and physical environment

Development
Learning, Behavior, and Health

Ecology Becomes biology,
And together they drive development across the lifespan
Critical First 1000 Days

Brains Are Built from the Bottom Up: Skills Beget Skills

**SENSORY PATHWAYS**
(Vision, Hearing)

**LANGUAGE**

**HIGHER COGNITIVE FUNCTION**

**FIRST YEAR**

-8 -7 -6 -5 -4 -3 -2 -1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

**BIRTH** (MONTHS) (YEARS)

Neural connections in different areas of the brain associated with specific functions proliferate rapidly and then begin pruning in the earliest years of life.

Brains are built in a hierarchical fashion, starting with the simplest circuits and then moving up to more complex circuits. Sensory pathways like those for basic vision and hearing are the first to develop, followed by early language skills and higher cognitive functions. Connections proliferate and prune in a prescribed order: the timing is determined genetically but experiences affect whether the circuits are strong or weak. The brain is never a blank slate – every new competency is built upon competencies that came before. *Graph Source: C.A. Nelson (2000)*

www.developingchild.harvard.edu

Center on the Developing Child — Harvard University
Synapse Development
Brain Architecture

Three Core Concepts in Early Development

1Experiences Build Brain Architecture

NATIONAL SCIENTIFIC COUNCIL ON THE DEVELOPING CHILD
Center on the Developing Child  HARVARD UNIVERSITY
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.
Serve and Return

Three Core Concepts in Early Development

2
Serve & Return Interaction Shapes Brain Circuitry

NATIONAL SCIENTIFIC COUNCIL ON THE DEVELOPING CHILD
Center on the Developing Child • HARVARD UNIVERSITY
<table>
<thead>
<tr>
<th>Positive Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Normal and essential part of healthy development</td>
</tr>
<tr>
<td>- Brief increases in heart rate and blood pressure</td>
</tr>
<tr>
<td>- Mild elevations in hormonal levels</td>
</tr>
<tr>
<td>- Example: Tough test at school. Playoff game.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tolerable Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Body’s alert systems activated to a greater degree</td>
</tr>
<tr>
<td>- Activation is time-limited and buffered by caring adult relationships.</td>
</tr>
<tr>
<td>- Brain and organs recover</td>
</tr>
<tr>
<td>- Example: Death of a loved one, divorce, natural disaster</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Toxic Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Occurs with strong, frequent or prolonged adversity</td>
</tr>
<tr>
<td>- Disrupts brain architecture and other organ systems</td>
</tr>
<tr>
<td>- Increased risk of stress-related disease and cognitive impairment</td>
</tr>
<tr>
<td>- Example: abuse, neglect, caregiver substance dependence or mental illness</td>
</tr>
</tbody>
</table>

**Intense, prolonged, repeated, unaddressed**

**Social-Emotional buffering, Parental Resilience, Early Detection, Effective Intervention**
Brain Architecture

Persistent Stress Changes Brain Architecture

Normal

Chronic stress

Prefrontal Cortex and Hippocampus

Amygdala

Toxic Stress

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
Still Face Experiment
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.
Epigenetics

- Process determines which genes are turned on/off – synthesizer
- Environment/experience impacts how genotype is translated into phenotype
- “Genes load the gun, the environment pulls the trigger”
How Early Experiences Alter Gene Expression and Shape Development

National Scientific Council on the Developing Child
Working Paper 10: Early Experiences Can Alter the Gene Expression and Affect Long-Term Development
Eco-Bio-Development Model

Experience
  (Ecology)

Brain Development
  (Biology)

Epigenetic Changes

Behavior
  (Development)
Public Health Approach to ACEs

1) Identify protective factors:
   - Encourage nurturing and positive relationships
   - Provide knowledge of parenting and child development
   - Assist in developing parental resilience
   - Social connections
   - Concrete support in times of need
Public Health Approach to ACEs

2) Build Strong Communities:

- Inform and Educate
- Enhance Skills
- Provide Support
- Enhance Access And Reduce Barriers
- Community Activities
- Modify/Change Policy
“THE QUALITY OF LIFE FOR A CHILD BEGINS WITH THE BIRTH OF HIS OR HER PARENTS.”

---UNKNOWN
References

- The Adverse Childhood Experiences Study: [www.acestudy.org](http://www.acestudy.org)
- ACEs 360 Iowa: [www.iowaaces360.org](http://www.iowaaces360.org)
- Center of the Developing Child at Harvard University: [http://developingchild.harvard.edu](http://developingchild.harvard.edu)
- Nadine J. Burke et al. The impact of adverse childhood experiences on an urban pediatric population. *Child Abuse and Neglect* 35(2011)408-413
Thank You

QUESTIONS AND COMMENTS