Adverse Childhood Experiences

Connecting a Developmental Lens to the Health of Society

Robert MD, MS,
ACE Study Concepts

ACEstudy.org

ACEsTooHigh.com
“In the brain, as in the economy, getting it right the first time is ultimately more effective and less costly than trying to fix it later. “

James Heckman
Nobel Laureate Economist

http://www.developingchild.net
Limits of Understanding

by Paul Klee
(1879-1940)
“The Creation of Adam”
Michelangelo  1508–1512
Early connections in the brain

The brain is undoubtedly one of nature's most remarkable creations: cells that can react to impulses, analyze and control behavior. As early as in the seventh week, nerve cells in the brain have begun to touch one another by means of projections, and some have even become connected in primitive nerve paths. The picture above shows nerve cells at this time, greatly enlarged. The rate of production is tremendous. 100,000 new nerve cells are created every minute, and by the time the baby is born, there will be some 100 billion. Left, the posterior lobes of the cerebrum shimmer through the skin of the forehead.
SYNAPTIC DENSITY: Synapses are created with astonishing speed in the first three years of life. For the rest of the first decade, children’s brains have twice as many synapses as adults’ brains.

Drawings supplied by H.T. Chugani.
Barriers to Educational Achievement Emerge at a Very Young Age

RAPID EARLY DEVELOPMENT: These PET scans suggest that the brain of a one year old more closely resembles an adult's brain than a newborn's.

Source: H.T. Chugani
Seeing the Pain

America's physicians confront family violence
Stress
(adrenaline, cortisol)

Unpredictable
Severe

Predictable
Moderate

Number of Episodes
Chronicity*

Vulnerability

(Poly)genetics
Epigenetics
Intrauterine
exposures*

Resilience
The Adverse Childhood Experiences (ACE) Study

Examines the health and social effects of ACEs throughout the lifespan among 17,421 members of the Kaiser Health Plan in San Diego County

A Primary Care Setting…
Educated…
Middle Class...
Predominantly White…
ACE Study Design

Survey Wave I (N = 9,508)

Survey Wave II (N = 8,667)

Follow-up

N = 17,421

Mortality
National Death Index

Morbidity
Hospital Discharge
Outpatient Visits

Emergency room visits

Pharmacy Utilization

Comprehensive medical Evaluations abstracted
Adverse Childhood Experiences Are Common

**Household dysfunction:**
- Substance abuse: 27%
- Parental sep/divorce: 23%
- Mental illness: 17%
- Battered mother: 13%
- Criminal behavior: 6%

**Abuse:**
- Psychological: 11%
- Physical: 28%
- Sexual: 21%

**Neglect:**
- Emotional: 15%
- Physical: 10%
Adverse Childhood Experiences Rarely Occur in Isolation…

They come in groups.
Prevalence of Childhood Abuse by Frequency of Witnessing Domestic Violence

Frequency of witnessing domestic violence:
- Never
- Once, Twice
- Sometimes
- Often
- Very often

Percent (%)

Childhood Abuse
- Emotional
- Physical
- Sexual
ACEs tend to come in groups…

<table>
<thead>
<tr>
<th>Additional ACEs (%)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>≥5</th>
</tr>
</thead>
<tbody>
<tr>
<td>A battered mother</td>
<td>95</td>
<td>82</td>
<td>64</td>
<td>48</td>
<td>52</td>
</tr>
</tbody>
</table>

*If you had:*
<table>
<thead>
<tr>
<th>ACE Score</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>33%</td>
</tr>
<tr>
<td>1</td>
<td>26%</td>
</tr>
<tr>
<td>2</td>
<td>16%</td>
</tr>
<tr>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td>4 or more</td>
<td>16%</td>
</tr>
</tbody>
</table>
ACEs, Smoking, and Lung Disease

ACE Score
- 0
- 1
- 2
- 3
- 4 or more

Percent With Health Problem (%)

Early smoking initiation
Current smoking
COPD

ACEs, Smoking, and Lung Disease
ACE Score and HIV Risks

ACE Score
- 0
- 1
- 2
- 3
- 4 or more

Percent With Health Problem (%)

Ever Injected Drugs
- Ever Had 50 or More Intercourse Partners
- Ever Had an STD

Legend:
- 0
- 1
- 2
- 3
- 4 or more
The ACE Score…
Alcohol Use and Abuse

Percent with alcohol related problem

ACE Score
- 0
- 1
- 2
- 3
- 4 or more

Alcoholic
- Married an Alcoholic
The ACE Score and the Prevalence of Liver Disease (Hepatitis/Jaundice)
The ACE Score and the Prevalence Ischemic Heart Disease

ACE Score

Percent (%)

ACE Score

0 1 2 3 >=4

0 1 2 3 4 5 6

Percent (%)

0 1 2 3 4 5 6
A Focus on Mental Health...
The ACE Score and a Lifetime History of Depression

- **0**
- **10**
- **20**
- **30**
- **40**
- **50**
- **60**
- **70**

- **Women**
- **Men**

<table>
<thead>
<tr>
<th>Percent depressed (%)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>&gt;=4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE Score</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>&gt;=4</td>
</tr>
</tbody>
</table>
The ACE Score and a History of Hallucinations

Percent who have ever hallucinated (%)

ACE Score

- 0
- 1
- 2
- 3
- >4
ACE Score and Rates of Antidepressant Prescriptions

![Bar chart showing prescription rates per 100 person-years for different ACE Score levels: 0, 1, 2, 3, 4, and >=5. The prescription rates increase with higher ACE Score.]
The ACE Score and the Prevalence of Attempted Suicide

ACE Score

Percent attempted (%)

ACE Score

Percent attempted (%)

The graph shows the relationship between ACE scores and the prevalence of attempted suicide. The y-axis represents the percentage of individuals who have attempted suicide, while the x-axis represents the ACE score.

- The ACE score of 0 has the lowest percentage of attempted suicide.
- The percentage increases as the ACE score increases, with a significant rise for scores of 3 and >=4.

This indicates a higher prevalence of attempted suicide with higher ACE scores.
Adverse Childhood Experiences
As a National Health Issue

ACEs have a strong influence on:
- adolescent health
- reproductive health
- smoking
- obesity
- alcohol abuse
- illicit drug abuse
- sexual behavior
- mental health
- risk of violence and revictimization
- stability of relationships
- performance in the workforce
Adverse Childhood Experiences
As a National Health Issue

ACEs increase the risk of:
- Early death
- Heart disease
- Chronic Lung disease
- Lung cancer
- Liver disease
- Autoimmune disease
- Suicide
- Injuries
- HIV and STDs
- other risks for leading causes of death
Neurobiology and Epidemiology Converge

Complex Trauma—Trauma Spectrum Disorders and the mean number of a variety of problems

![Bar chart showing the mean number of co-occurring outcomes for different ACE scores.](chart.png)

- Mean Number of Co-occurring Outcomes
- ACE Score
- 0 1 2 3 4 5 6 7-8

*Note: The chart illustrates the relationship between ACE scores and the mean number of co-occurring outcomes, highlighting the increasing trend with higher ACE scores.*
Cumulative ACEs Increase Clinical Complexity in Terms of the Number of Lifetime DSM-IV Diagnoses*

*Putnam, Harris, Putnam unpublished data, 2011

National Comorbidity Survey – Replication Sample

N=5692

Increasing ACEs
Art of Hieronymous Bosch
ACEs Changed the Landscape

• Provided a compelling tabulation of childhood adversity that directly related to easily understood costly outcomes

• Largely responsible for increased awareness of policy makers of the role of childhood trauma in costly medical, psychiatric and social problems

• Legitimized and stimulated interest in childhood adversities for researchers in a range of fields
ACEs Changed the Landscape

• **Pervasiveness of ACEs**
  – Huge number of major public health problems that were ACE-related (e.g., Depression, Substance Abuse, STDs, Cancer, Heart Disease, Chronic Lung Disease, Diabetes)
  – Significant number of middle-class Americans had ACEs

• **Perniciousness of ACEs**
  – Major contributors to the leading causes of death and disability
  – Life-shortening (~20 years for people with 6+ ACEs)

• **Persistence of ACEs**
  – Life-time effects
  – Likelihood of intergenerational transmission
Adverse Childhood Experiences

- Abuse and Neglect (e.g., psychological, physical, sexual)
- Household Dysfunction (e.g., domestic violence, substance abuse, mental illness)

Impact on Child Development

- Neurobiologic Effects (brain abnormalities, stress hormone dysregulation, physical development)
- Psychosocial Effects (e.g., poor attachment, poor socialization, poor self-efficacy, revictimization)
- Health Risk Behaviors (e.g., smoking, obesity, substance abuse, promiscuity)

Long-Term Consequences

Disease and Disability
- Major Depression, Suicide, PTSD
- Drug and Alcohol Abuse
- Heart Disease
- Cancer
- Chronic Lung Disease
- Sexually Transmitted Diseases
- **Intergenerational transmission of ACEs**

Social Problems
- Homelessness
- Prostitution
- Criminal Behavior
- Unemployment
- Parenting problems
- High utilization of health and social services
Beyond ACEs

- Link ACEs to existing and future programs seeking to prevent mental illness, medical diseases, substance abuse, health risk behaviors, and social dysfunction

- Prevent ACEs
  - Zero ACEs is protective
  - Prevent further ACEs in maltreatment victims

- Identify and treat ACEs early in life

- Identify mechanisms (behavioral and biological) through which ACEs negatively impact life trajectories
The Costs of the Status Quo..

Reflect the Costs of Ignoring and Impairing Early Childhood Development
Significant Adversity Impairs Development in the First Three Years

Source: Barth et al. (2008)
ACEs and High School Sophomores and Seniors

Washington School Classroom (30 Students)
Adverse Childhood Experiences (ACEs)

- 6 students with no ACE
- 5 students with 1 ACE
- 6 students with 2 ACEs
- 3 students with 3 ACEs
- 7 students with 4 or 5 ACEs
- 3 students with 6 or more ACEs

Population Average
Spokane Washington

Students with ACEs:

- Are 2 ½ times more likely to fail a grade
- Score lower on standardized tests
- Have language difficulties
- Are suspended or expelled more
- Are designated to special education more frequently
- Have poorer health

Courtesy of Chris Blodgett, PhD
Washington State University
Costs of the Status Quo

Criminal Justice

..the prison pipeline
ACEs Among Youth on Probation
Pierce County, Washington
ACE Exposure and Youth Outcomes

History of Alcohol & Drug Use and ACE Score

- 0: Alcohol 50%, Drug 54%
- 1: Alcohol 63%, Drug 68%
- 2: Alcohol 71%, Drug 77%
- 3: Alcohol 74%, Drug 80%
- 4: Alcohol 72%, Drug 74%
- ≥ 5: Alcohol 81%, Drug 84%

Legend:
- Purple: Alcohol
- Green: Drug
ACE Score and Felony Re-offense

Felony Re-offense Post Probation and ACE Score

- Within One Year
- Within Two Years

<table>
<thead>
<tr>
<th>ACE Score</th>
<th>Within One Year</th>
<th>Within Two Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>12%</td>
<td>16%</td>
</tr>
<tr>
<td>1</td>
<td>10%</td>
<td>18%</td>
</tr>
<tr>
<td>2</td>
<td>16%</td>
<td>25%</td>
</tr>
<tr>
<td>3</td>
<td>11%</td>
<td>20%</td>
</tr>
<tr>
<td>4</td>
<td>19%</td>
<td>25%</td>
</tr>
<tr>
<td>≥ 5</td>
<td>23%</td>
<td>31%</td>
</tr>
</tbody>
</table>

Within One Year and Within Two Years percentages are shown for different ACE Score categories.
..the prison pipeline extends into adulthood
ACE Scores
Kaiser Health Plan

Percent (%)

ACE Score

0 1 2 3 4 >=5

Messina and Greila
Am J Pub Health
October, 2006
ACE Scores
Kaiser vs Adult Women In Prison

Percent (%)

ACE Score

0 1 2 3 4 >=5

Messina and Greila
Am J Pub Health
October, 2006
..the pipeline to poverty and homelessness
ACE Score and Financial Instability and Risk of Unemployment

Prevalence of Impaired Performance (%)

ACE Score
- 0
- 2
- 3
- 4 or more

- Absenteeism (>2 days/month)
- Serious Financial Problems
- Serious Job Problems
Percent of Women Who Ever Had an Unintended Pregnancy by ACE Score

The graph shows the percentage of women who ever had an unintended pregnancy by their ACE score. The x-axis represents the ACE score, ranging from 0 to 4 or more, while the y-axis represents the percentage of women. The graph indicates that the percentage increases as the ACE score increases, with the highest percentage observed for those with an ACE score of 4 or more.
High Residential Mobility (>8 moves) During Childhood by ACE Score

Percent who moved 8 or more times (%) vs ACE Score

0 1 2 3 4 or 5 >=6
Preventive Intervention is More Efficient and Produces Higher Returns than Later Remediation

Heckman, J. (2007)
Beham, (Hans) Sebald (1500-1550): Hercules slaying the Hydra, 1545 from The Labours of Hercules (1542-1548).
A Public Health Framework For Change

Treatment

Education  Prevention

All must consider
Intergenerational transmission
States With ACE Studies in 2008

Source: Behavioral Risk Factor Surveillance System, CDC.
States With ACE Studies in 2009

Source: Behavioral Risk Factor Surveillance System, CDC.
States With ACE Studies in 2009-2010

Source: Behavioral Risk Factor Surveillance System, CDC.
States With ACE Studies in 2009-2011

Source: Behavioral Risk Factor Surveillance System, CDC.