The Impact of Adverse Childhood Experiences Across The Life Course

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ACE Study Concepts

www.RobertAndaMD.com
www.cdc.gov/ACE
www.ACEstudy.org
“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
The Walk to Paradise Garden

W. Eugene Smith
Stress (adrenaline, cortisol)

Unpredictable
Severe

Predictable
Moderate

Number of Episodes
Chronicity

Vulnerability

Resilience

Epigenetics
Intrauterine exposures
Gene mutations
Seeing the Pain

America's physicians confront family violence
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

Persistent Stress Changes Brain Architecture

Normal

Typical neuron—many connections

Toxic stress

Damaged neuron—fewer connections

Prefrontal Cortex and Hippocampus

Sources: Radley et al. (2004) Bock et al. (2005)
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) → Follow-up → Survey Wave II (N=8,667) → N = 17,421

Mortality
National Death Index
Morbidity
Hospital Discharge
Outpatient Visits
Emergency room visits
Pharmacy Utilization

Comprehensive medical Evaluations abstracted
Adverse Childhood Experiences
Ten Categories

**Household dysfunction:**
- Substance abuse
- Parental sep/divorce
- Mental illness
- Battered mother
- Criminal behavior

**Abuse:**
- Emotional
- Physical
- Sexual

**Neglect:**
- Emotional
- Physical
### 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>If you had:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<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:*

* A battered mother
<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
ACE Score and HIV Risks

ACE Score

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

Percent With Health Problem (%)
The ACE Score… Alcohol Use and Abuse

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

Percent with alcohol related problem

Alcoholic

Married an Alcoholic
ACEs are a Pathway to Leading Causes of Death...
The ACE Score and the Prevalence of Liver Disease (Hepatitis/Jaundice)
The ACE Score and the Prevalence of Coronary Heart Disease

![Bar chart showing the prevalence of coronary heart disease based on ACE Score. The x-axis represents ACE Score (0, 1, 2, 3, >=4), and the y-axis represents percent (%). The chart indicates a higher prevalence of coronary heart disease with higher ACE scores.]
A Focus on Mental Health...
The ACE Score and a Lifetime History of Depression

The bar chart shows the percentage of women and men who are depressed based on their ACE (Adverse Childhood Experiences) score. The x-axis represents the ACE score, and the y-axis shows the percentage of people depressed. The chart indicates a significant increase in depression rates for both genders as the ACE score increases, with a particularly high percentage for those with an ACE score of 3 and above.
The ACE Score and the Prevalence of Attempted Suicide

![Bar graph showing the prevalence of attempted suicide across different ACE scores.](image-url)
Cumulative ACEs Increase the Number of Lifetime DSM-IV Diagnoses*

National Comorbidity Survey – Replication Sample

*Putnam, Harris, Putnam unpublished data, 2011

*Putnam, Harris, Putnam unpublished data, 2011
Art of: Hieronymous Bosch
“The Creation of Adam”
Michelangelo 1508–1512
Relationship Between Number of Adverse Childhood Experiences and Adolescent Pregnancy

![Graph showing the relationship between ACE Score and percent who had a teen pregnancy](image-url)
Percent of Women Who Ever Had an Unintended Pregnancy by ACE Score

Percent

ACE Score

0 1 2 3 4 or more

Percent

0 10 20 30 40 50 60 70 80
Relationship Between Number of Adverse Childhood Experiences and Fetal Death—First or Second Pregnancy

Percent who had a fetal death after 1st or 2nd pregnancy

ACE Score

0
1-2
3-4
5+

18
16
14
12
10
8
6
4
2
0
The Costs of the Status Quo.. Reflect the Costs of 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

- Alcohol
- Drug

- 0: 50%, 54%
- 1: 63%, 68%
- 2: 71%, 77%
- 3: 74%, 80%
- 4: 72%, 74%
- ≥5: 81%, 84%
ACE Score and Repeated Suspension/Expulsion
Youth on Probation, Pierce County, WA

History of ≥ 7 expulsions or suspensions since the first grade

Prevalence (%) vs ACE Score

- 0: 16.9% (n=11)
- 1: 25.5% (n=158)
- 2: 35.3% (n=148)
- 3: 35.7% (n=148)
- 4: 38.6% (n=124)
- 5+ or more: 39.4% (n=148)

aOR (95% CI)
ACE Score and Poor Academic Performance
Youth on Probation, Pierce County, WA

Poor academic performance during most recent school term

<table>
<thead>
<tr>
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<th>Prevalence (%)</th>
<th>n</th>
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<tbody>
<tr>
<td>0</td>
<td>16.9%</td>
<td>11</td>
</tr>
<tr>
<td>1</td>
<td>25.0%</td>
<td>68</td>
</tr>
<tr>
<td>2</td>
<td>29.1%</td>
<td>132</td>
</tr>
<tr>
<td>3</td>
<td>28.1%</td>
<td>117</td>
</tr>
<tr>
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<td>105</td>
</tr>
<tr>
<td>5+</td>
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<td>135</td>
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</tbody>
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aOR (95% CI)
ACE Score and Felony Re-offense

Felony Re-offense Post Probation and ACE Score

- Within One Year
- Within Two Years

ACE Score:
- 0: 12% within one year, 16% within two years
- 1: 10% within one year, 18% within two years
- 2: 16% within one year, 25% within two years
- 3: 11% within one year, 20% within two years
- 4: 19% within one year, 25% within two years
- ≥ 5: 23% within one year, 31% within two years
One of Many Public Policy Responses

Values Drive Decisions

Annual Populations
As a Percent of the 1925 Population

WE'RE EXPANDING PRISONS ACROSS THE COUNTRY.

VERY GOOD, PRIME MINISTER! AND WHAT DO YOU PLAN TO DO ABOUT HOUSING FOR THE POOR AND MENTALLY ILL?

I JUST TOLD YOU.
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

13 States

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

18 States

Source: Behavioral Risk Factor Surveillance System, CDC.
States With ACE Studies
2009-2012

Source: Behavioral Risk Factor Surveillance System, CDC.
States With ACE Studies 2009-2013

21 States

Source: Behavioral Risk Factor Surveillance System, CDC.
I'm afraid you've had a paradigm shift.
The paradigm is shifting...

An the word is getting around
Adverse Childhood Experience (ACE) – Health Consequences
carried out in Kaiser-Permanente Health System in California

Adverse experiences, such as:
- Single parent
- Alcoholic family member
- Incarceration
- Depression in family
- Neglect
- Physical abuse
- Sexual abuse

Increased frequency of disorders later in life:
- Heart disease, smoking, obesity
- Drug abuse, high risk for AIDS
- Depression, anxiety, anger control
- Anti-social behavior
ACE Scores of 4 or More
Women in the Kaiser Health Plan
Vs Young Women Served by Crittendon

Percent with ACE Score of 4 or more (%)

<table>
<thead>
<tr>
<th></th>
<th>Kaiser</th>
<th>All</th>
<th>Young Mothers</th>
<th>Moms on Welfare</th>
<th>Moms in Juv Just</th>
</tr>
</thead>
</table>

Crittendon Foundation Survey
ACEs Effect An Array of Brain Functions

Affect Regulation
Panic reactions, depression, anxiety, hallucinations

Somatic Issues
Sleep disturbances, severe obesity, pain

Substance Use
Smoking, alcoholism, illicit drug use, IV drug use

Sexuality
Early intercourse, promiscuity, sexual dissatisfaction

Memory
Amnesia (childhood)

Arousal
High stress, problems with anger, perpetrating domestic violence
Neurobiology and Epidemiology Converge

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

![Graph showing the mean number of co-occurring outcomes against ACE Score. The y-axis represents the mean number of co-occurring outcomes ranging from 0 to 6, and the x-axis represents ACE Score from 0 to 7-8. Each bar represents an increasing number of outcomes as the ACE Score increases.]
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
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
..the prison pipeline extends into adulthood
ACE Scores
Kaiser Health Plan

Percent (%)

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

Percent (%)

ACE Score Messina and Greila
Am J Pub Health
October, 2006
Preventive Intervention is More Efficient and Produces Higher Returns than Later Remediation

Heckman, J. (2007)
“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

National Scientific Council
http://www.developingchild.net
Percent of Women Who Ever Had an Unintended Pregnancy by ACE Score
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.
Limits of Understanding

by Paul Klee
(1879-1940)
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