




***THE HARD KNOCK LIFE: IMPACTS OF TOXIC  
STRESS ON CHILD DEVELOPMENT AND  
OPPORTUNITIES TO BUILD RESILIENCE***



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- I have no relevant financial disclosures.

# Childhood Matters

“Of a good beginning  
cometh a good end”

English proverb





# Why Pediatrics is the new Internal Medicine..

- Many adult diseases can be thought of as developmental disorders.
- The root of adult persistent health disparities lies in early childhood adversity.



# ACE Study

- Findings from the study suggest that adverse childhood experiences are behind the worst social and health problems in the country.
- Results of this study are causing the medical community to change the way we respond to disease.

# ACE Study

- Compared adult health status with 8 categories of adverse child experience.
  - Abuse
  - Household Dysfunction
- Found that adverse childhood experiences are common but often concealed.
- If someone had experienced one ACE, they had often experienced more.

Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, Koss MP, Marks JS.

[Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: The Adverse Childhood Experiences \(ACE\) Study. \*Am J Prev Med\* 1998;14:245–258.](#)

# Prevalence of ACEs

	Women	Men	Total
▪ Abuse	<u>(n=9,367)</u>	<u>(n=7,970)</u>	<u>(17,337)</u>
▪ Emotional	13.1%	7.6%	10.6%
▪ Physical	27.0%	29.9%	28.3%
▪ Sexual	24.7%	16.0%	20.7%
▪ Physical Neglect	9.2 %	10.2%	9.9%
▪ Emotional Neglect	16.7 %	12.4%	14.8%
▪ Household Dysfunction			
▪ Mother Treated Violently	13.7%	11.5%	12.7%
▪ Household Substance Abuse	29.5%	23.8%	26.9%
▪ Household Mental Illness	23.3%	14.8%	19.4%
▪ Parental Separation or Divorce	24.5%	21.8%	23.3%
▪ Incarcerated Household Member	5.2%	4.1%	4.7%

[www.cdc.gov/nccdphp/ace/demographics](http://www.cdc.gov/nccdphp/ace/demographics)


# ACE Scores

<u>ACE score</u>	<u>Prevalence</u>
0	36.1%
1	26%
2	15.9%
3	9.5%
4 or more	12.5%

- Pediatricians will likely see several children every week with ACE scores  $>4$ .
- Educators will see children every day with ACE scores  $>4$ .



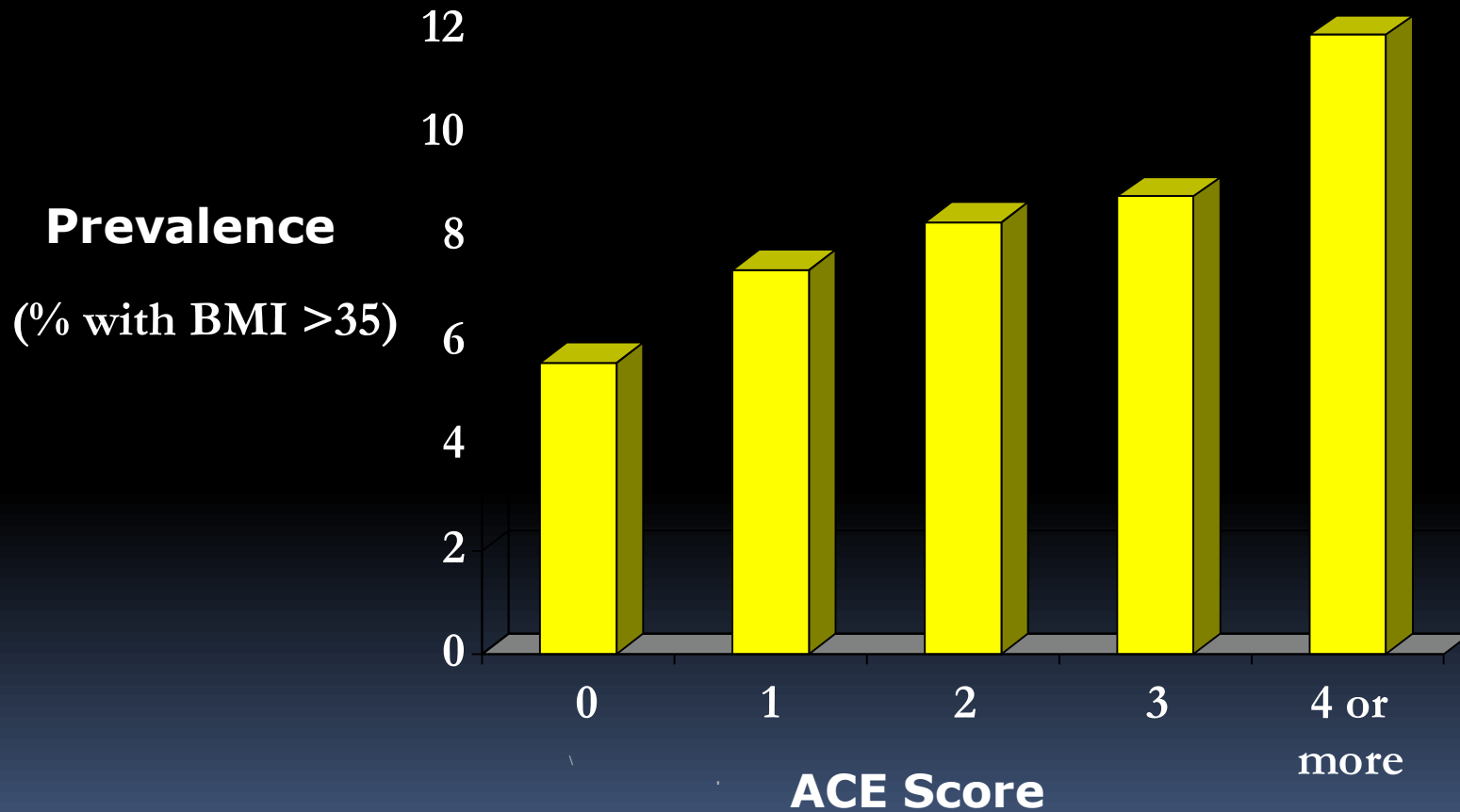
# ACEs and Health

- There was a strong, dose dependent relationship between childhood adverse experience and each of 10 adult health risk factors for leading causes of death in adults. ( $p < .001$ )
  - Significant dose response relationship between the number of childhood exposures and numerous adult diseases ( $p < .05$ )
  - People with 6 or more ACEs died nearly **20 years earlier** on average than those without ACEs.
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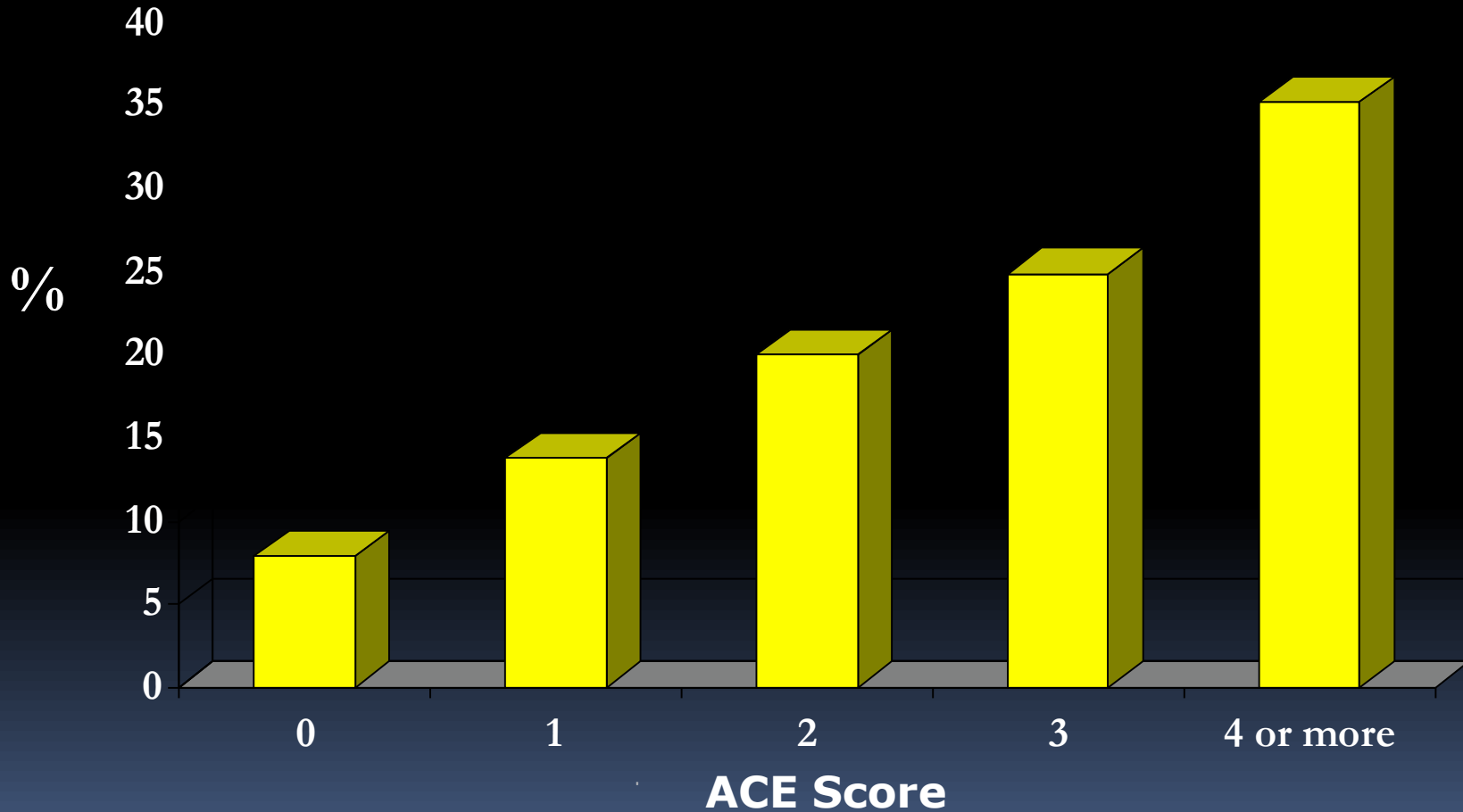
# Dose-response risk increases

- Alcoholism and alcohol abuse
- Chronic obstructive pulmonary disease
- Depression
- Fetal death
- Health-related quality of life
- Illicit drug use
- Ischemic heart disease
- Liver disease
- Poor work performance
- Financial stress
- Risk for intimate partner violence
- Multiple sexual partners
- Sexually transmitted diseases
- Smoking
- Suicide attempts
- Unintended pregnancies
- Early initiation of smoking
- Early initiation of sexual activity
- Adolescent pregnancy
- Risk for sexual violence
- Poor academic achievement

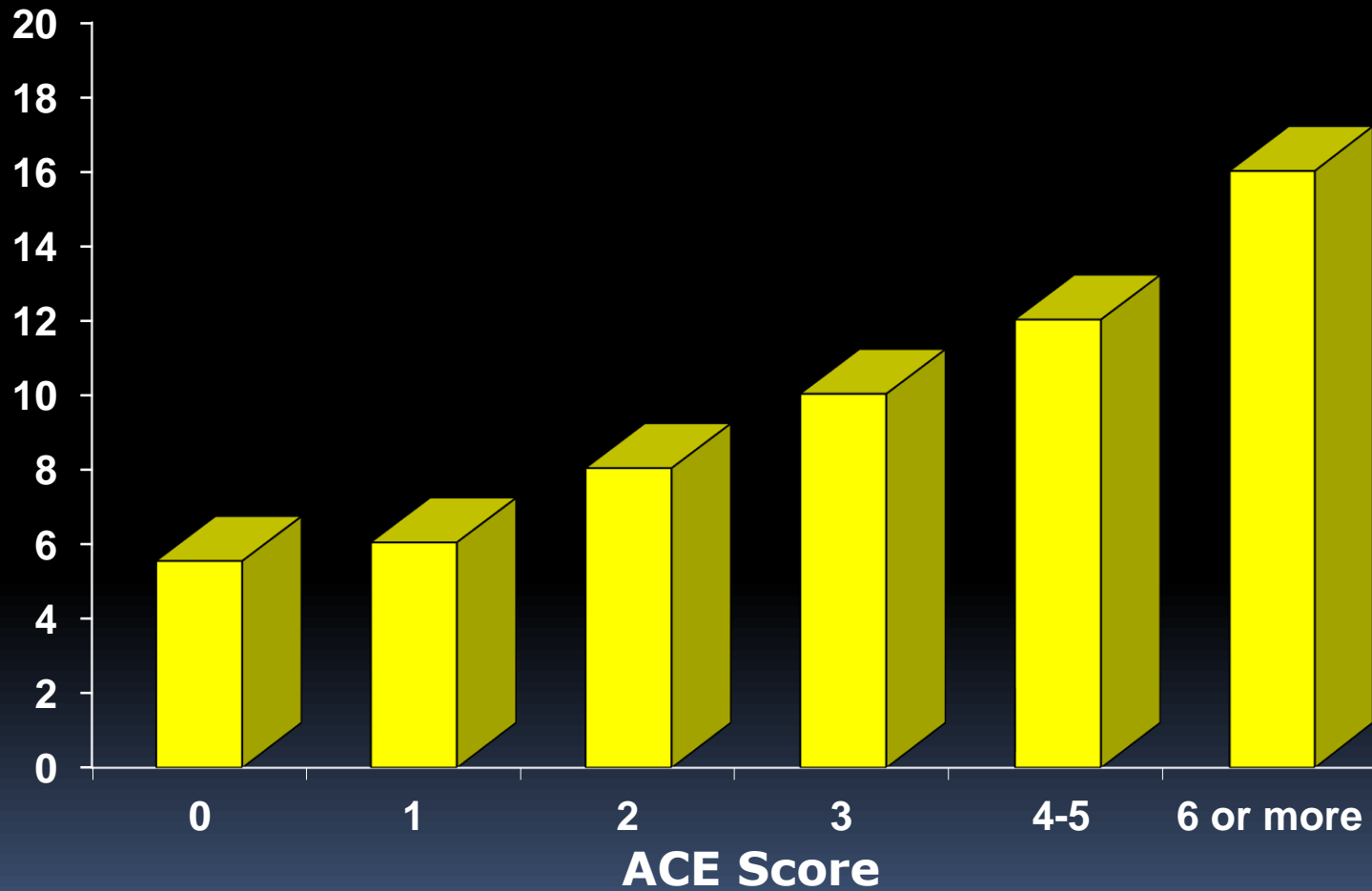
# ACEs and Severe Obesity



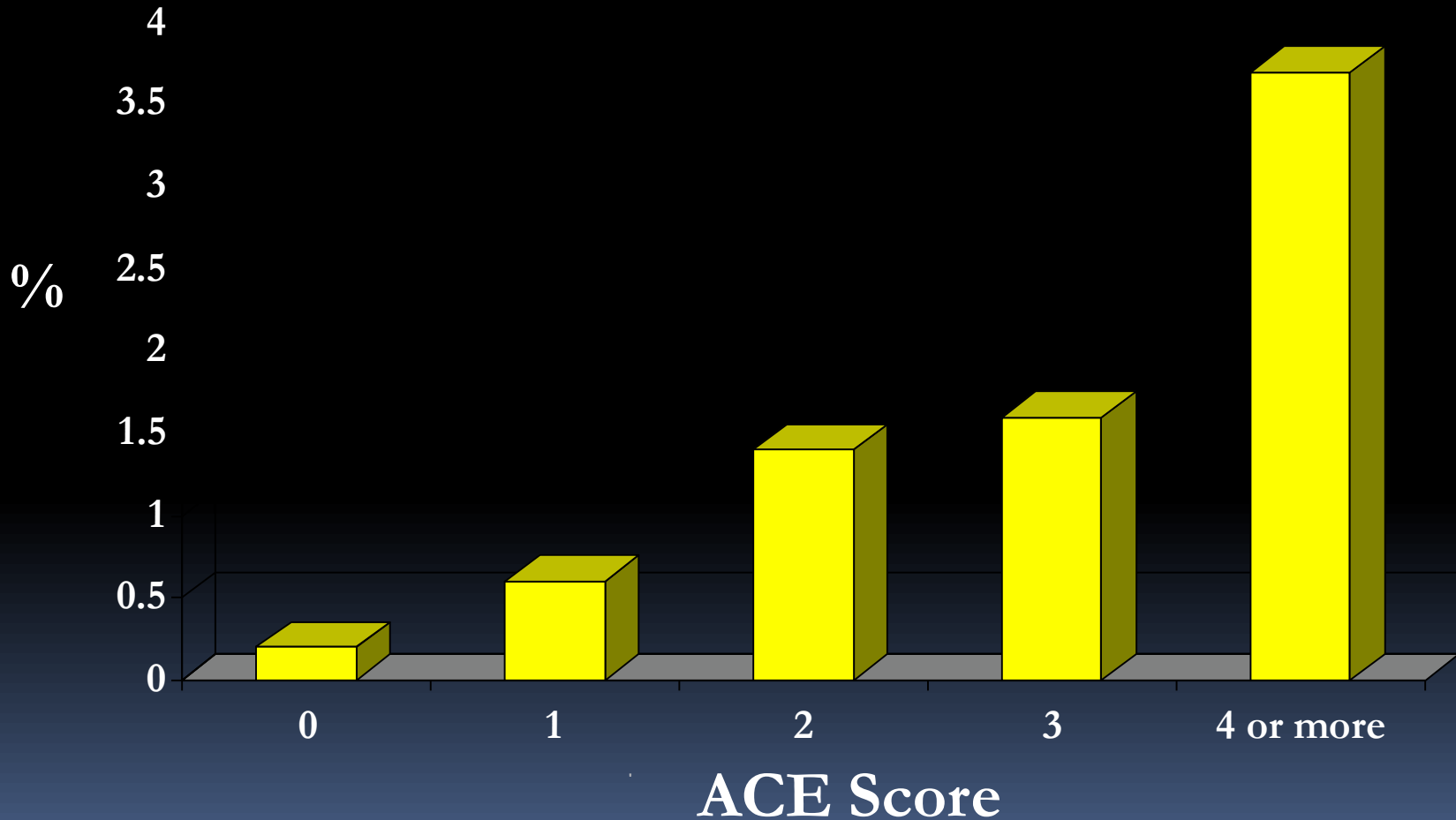
# ACEs and Illicit Drug Use



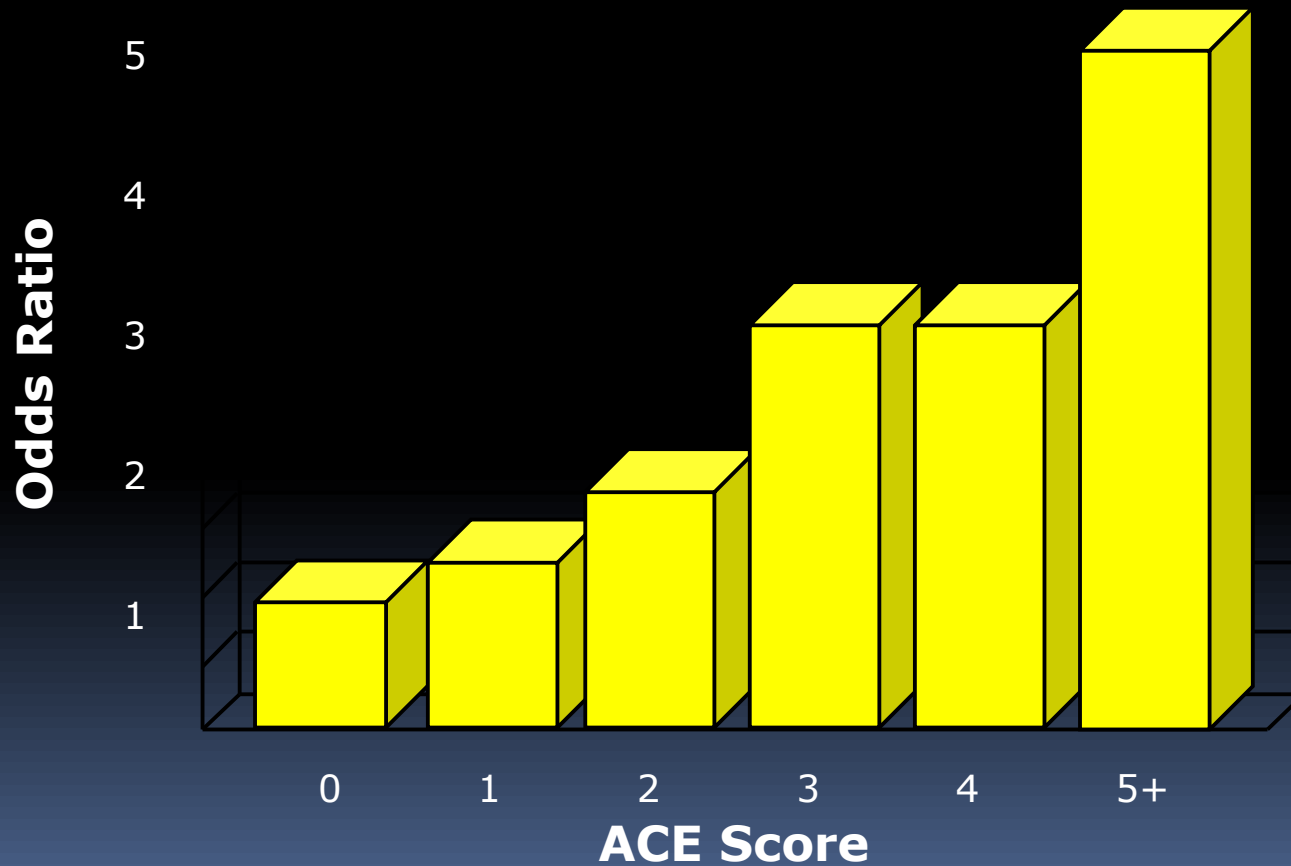
# ACEs and Smoking



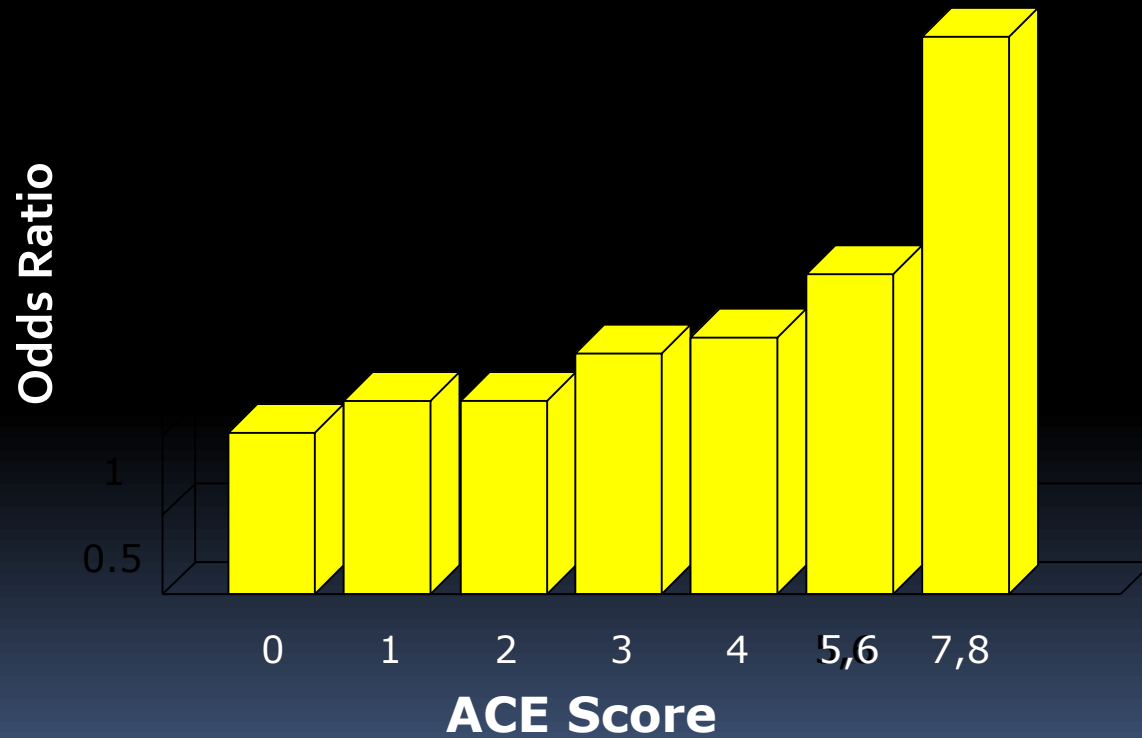
# ACEs and IV Drug Use



# Risk for Adult Depression



# Risk for Adult Heart Disease

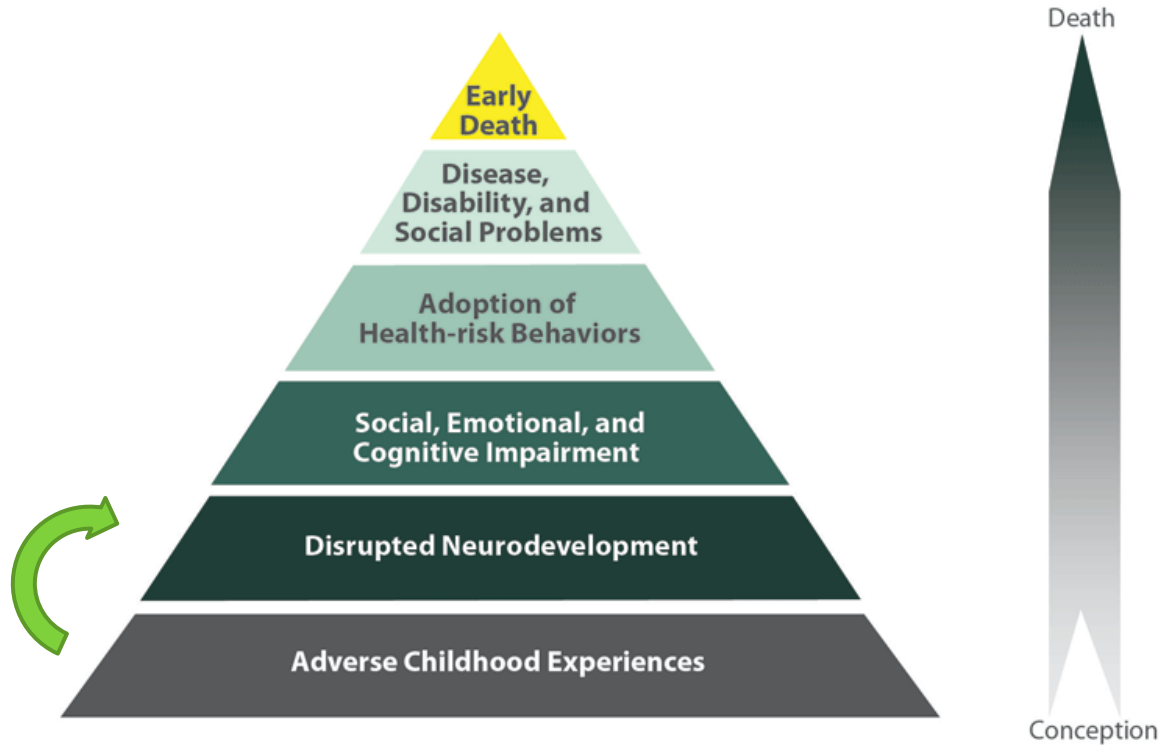


# Impact of ACEs in Pediatrics

- Children with 4 or more ACEs are 32 times more likely to have behavioral problems in school.
- Young children with ACE score of 4 or more are 2x as likely to have a BMI >85% Burke et al, 2011
- ACEs increase the risk of multiple high risk adolescent behaviors:
  - Younger age of first intercourse
  - Teen pregnancy
  - Suicide and self-harm.
  - Younger initiation of substance use.

# Impact of ACEs

Toxic Stress



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

# Types of Stress Response

*Based on physiologic response to stress*

## Positive Stress:

A necessary aspect of healthy development that occurs in the context of stable, supportive relationships.

Brief increases in heart rate and mild changes in stress hormone levels.



# Types of Stress Response

## Tolerable Stress:

Exposure to non-normative experiences that present a greater magnitude of threat.

Has the potential to cause damaging effect if occurs without the buffering of a supportive caregiver.



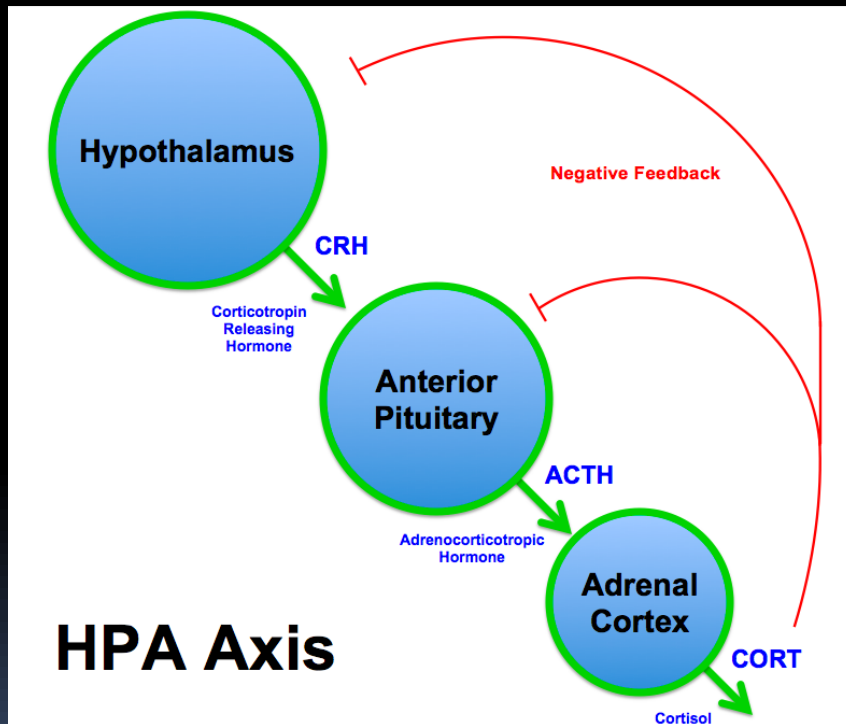
# Types of Stress Response

## Toxic Stress

Excessive or prolonged activation of the physiologic stress response systems in the absence of the buffering protection afforded by stable, responsive relationships

Can disrupt brain architecture and alter stress response.


# Neuroendocrine System (Stress Response)



- **Poverty, abuse and neglect = Stress in Children**
- **High Levels of hormones like Cortisol**
  - Elevated Heart Rate, Blood Pressure
  - Negative feedback regulates release of CRH and ACTH
- **Prolonged cortisol exposure causes decreased Glucocorticoid receptors.**
- **Immune resistance to anti-inflammatory effects of cortisol**



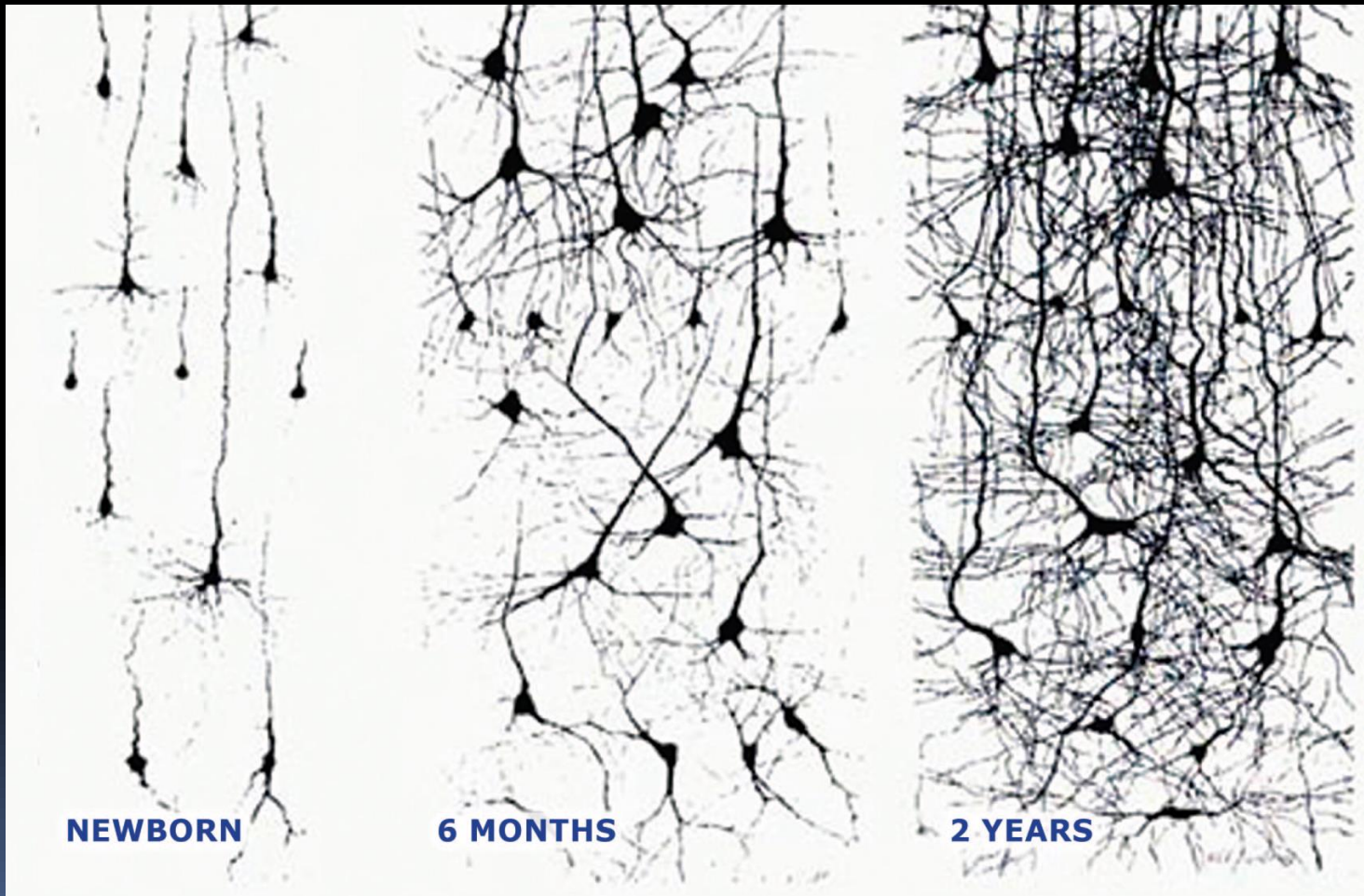
# Linking adversity to health problems

- Our current understanding focuses on these observations:
    - Brain architecture is affected by stress.
    - Adversity has effects on inflammation and immune function.
    - Adversity affects gene expression
    - Humans engage in behaviors to help regulate stress responses.
- 

# Toxic Stress and Brain Architecture

- Brain Development
  - Brain development is affected by repeated activation of circuits involved in stress regulation.
  - **Neurons shrink** in response to toxic stress in the hippocampus and prefrontal cortex.
    - Hippocampus – Involved in **memory**
    - Prefrontal Cortex - Responsible for executive functioning.
  - Hypertrophy and **over activity** of the amygdala and orbitofrontal cortex

# Toxic Stress and Brain Architecture



# Role of Prefrontal Cortex

## Executive Function starts in Childhood

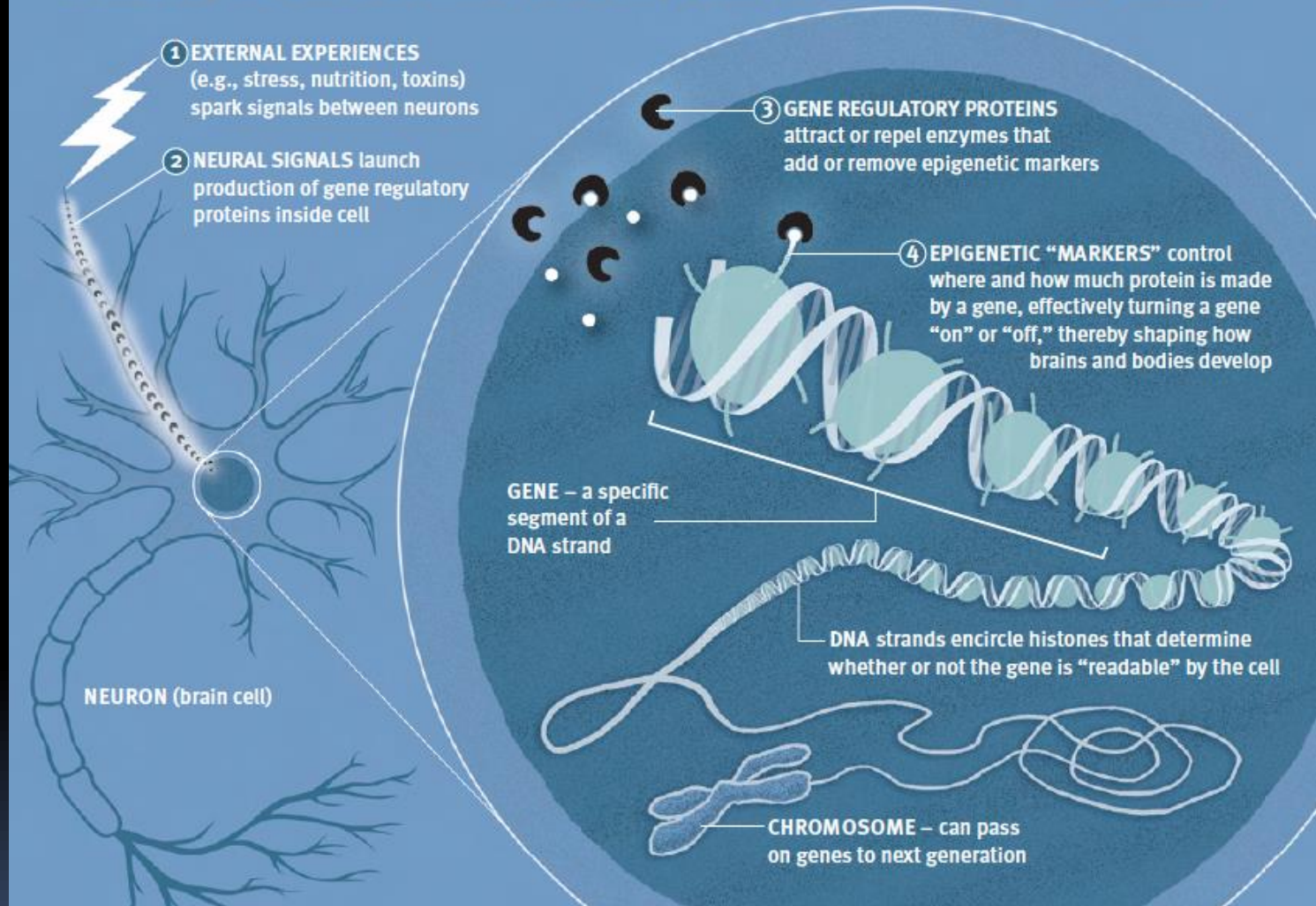
- Self-Control – ability to filter thoughts and impulses to resist temptations and distractions
- Working Memory – ability to hold and manipulate information in our heads over short periods of time
- Mental Flexibility – adjusting to changing demands, priorities, or perspectives



# Toxic Stress and Immune Development

- Animal and human studies have demonstrated that maternal stress is linked to altered cellular immune response at birth and more illnesses and health complaints in newborns.
- Greater inflammation in adults who experienced childhood adversity.
  - Higher CRP in adults with history of neglect, maltreatment. *Dunedin Multidisciplinary Health and Development Study Danese, 2006*

# How Early Experiences Alter Gene Expression and Shape Development



# Biological Memories

- Early social environments produce changes in gene expression.
- Genes that are “turned on” or “turned off” through DNA methylation lead to a cascade of effects in biology and behavior.
- Association between parental care and epigenetic regulation of genes involved in hypothalamic pituitary axis functioning.



*Meaney et al 2011*

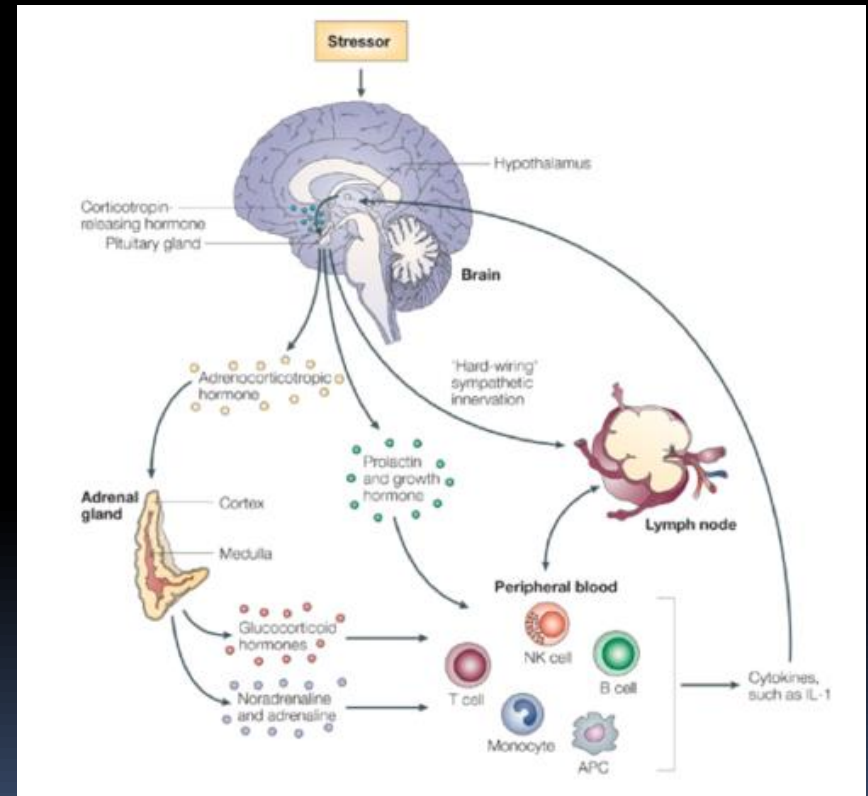
# Stressed vs. Stressed Out

- Allostasis: Maintaining stability through change.
  - Allostatic Load: Cumulative cost to the body of allostasis.
  - Allostatic Overload: can lead to pathophysiology in brain and body
- Under stress, people may use behavioral allostasis.

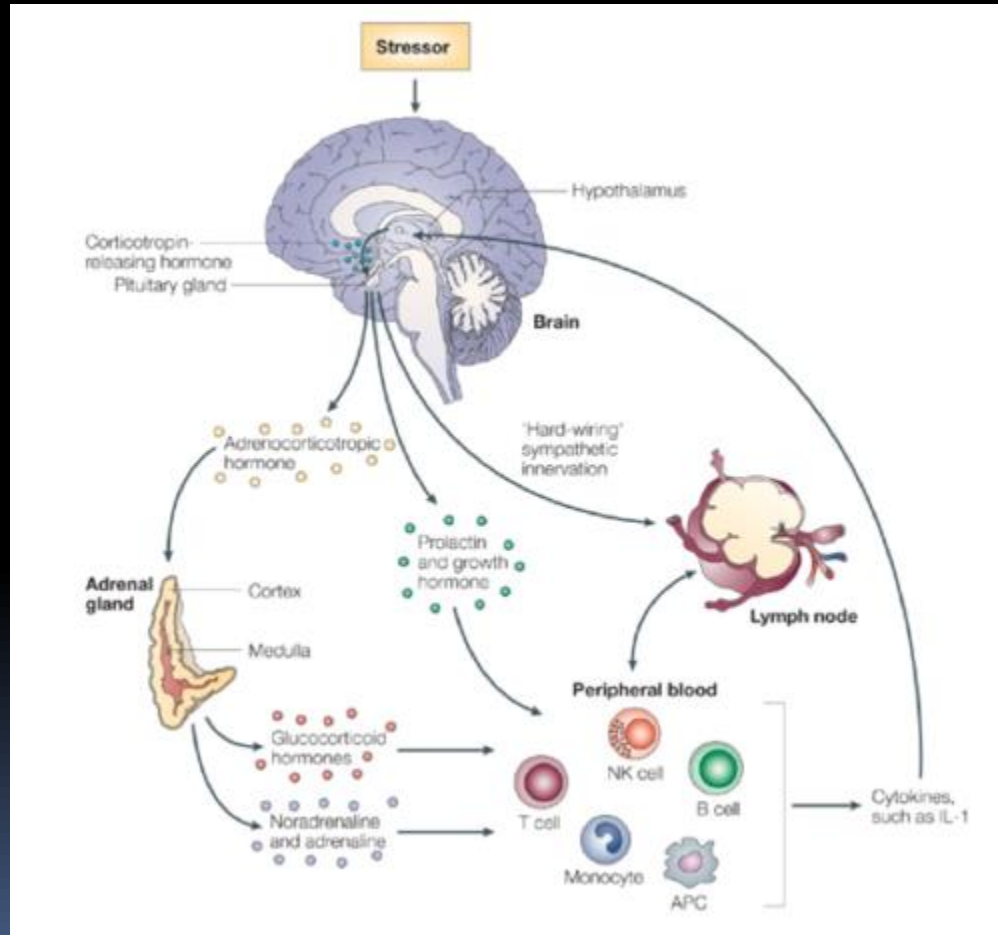


# Allostasis

- 3 Highly integrated systems: **Endocrine, Neurologic, and Immunologic.**
- Stress is perceived by areas of the brain including the amygdala.
- The sympathetic nervous system stimulates adrenal medulla (NE, Epi), activates the immune system,  $\uparrow$ HR,  $\uparrow$ BP
- CRH activates the neuroendocrine system through the HPA axis.



# Allostatic Load



# ACEs and Health



# Resilience Study – Werner and Smith

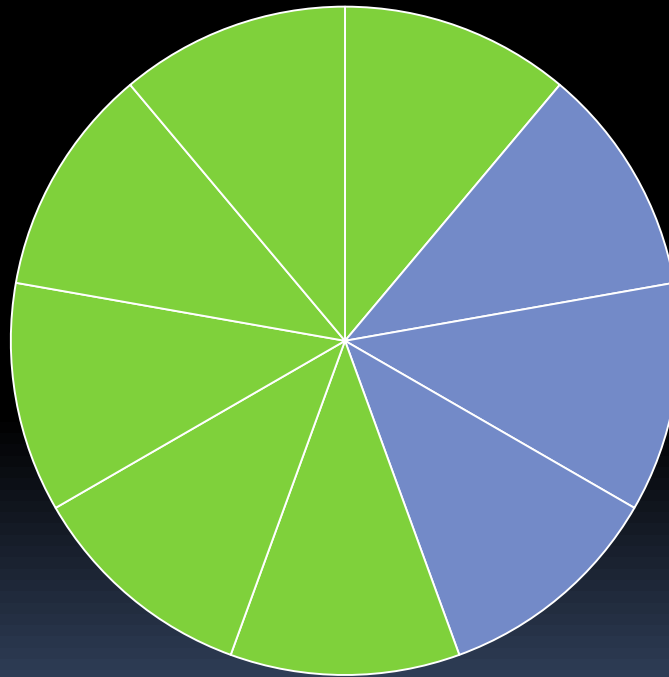
- Longitudinal Study in Kauai
- Followed 698 infants born in 1955 for 40 years.
- Checked in at ages 1, 2, 10, 18, 32, 40.



# Kauai Longitudinal Study

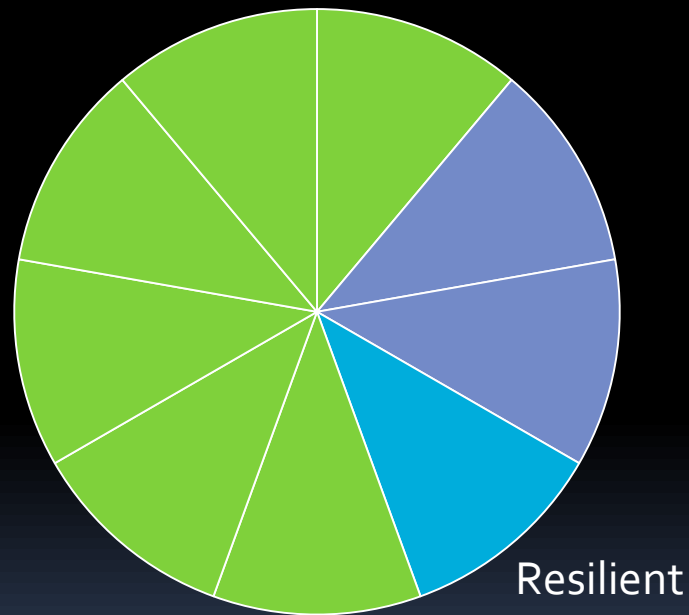
N=698

- Poverty
- Perinatal health problems
- Congenital handicaps
- Low parent education
- Familial alcoholism
- Violence
- Instability/discord
- Mental Illness



# Kauai Longitudinal Study – Age 18

N=698




# Kauai Longitudinal Study – age 32, 40

N=698





# Protective Factors

- Individual
    - Temperment
    - Social Competence
    - Problem Solving Skills
    - Autonomy
    - Sense of purpose
- 

# Protective Factors

- Individual
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# Protective Factors

- Family
  - Attachment
- Community
  - Elders and peers – sought out



# Protective Factors

- Recovery in Adulthood
  - Opportunities in 3<sup>rd</sup> and 4<sup>th</sup> decade of life.
  - Stable relationship
  - Religious conversion – participation in a community
  - Recovery from a life threatening illness/accident



# Kauai Longitudinal Study – age 32, 40

N=698

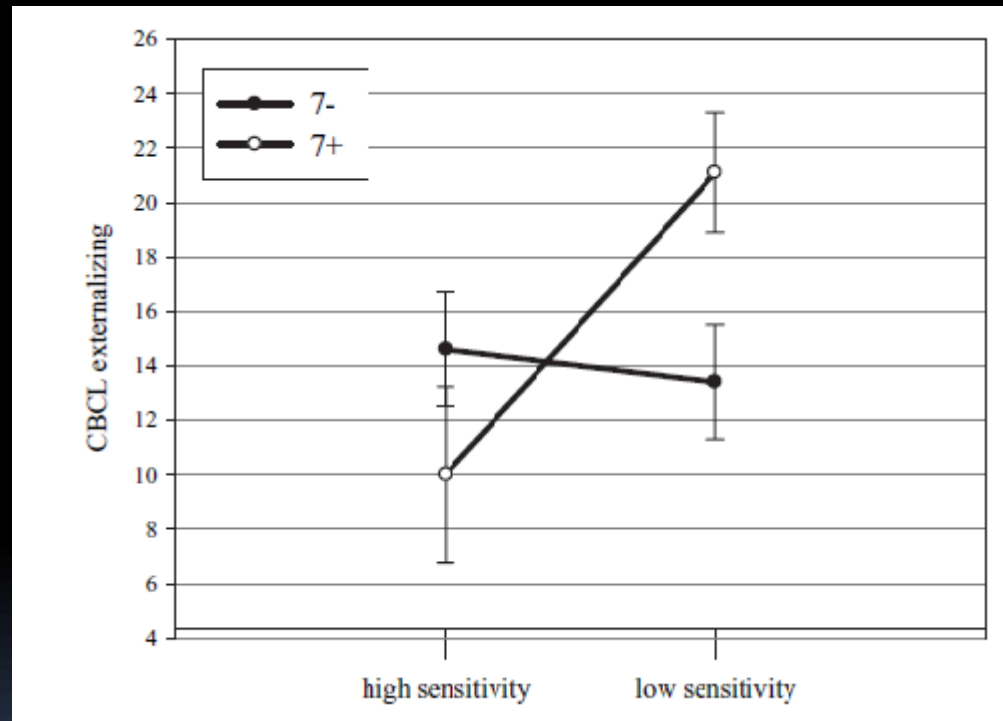


# Individual Responses to Adversity

- Large individual differences among “high-risk” individuals.
- Orchids vs. Dandelions?



# Differential Susceptibility

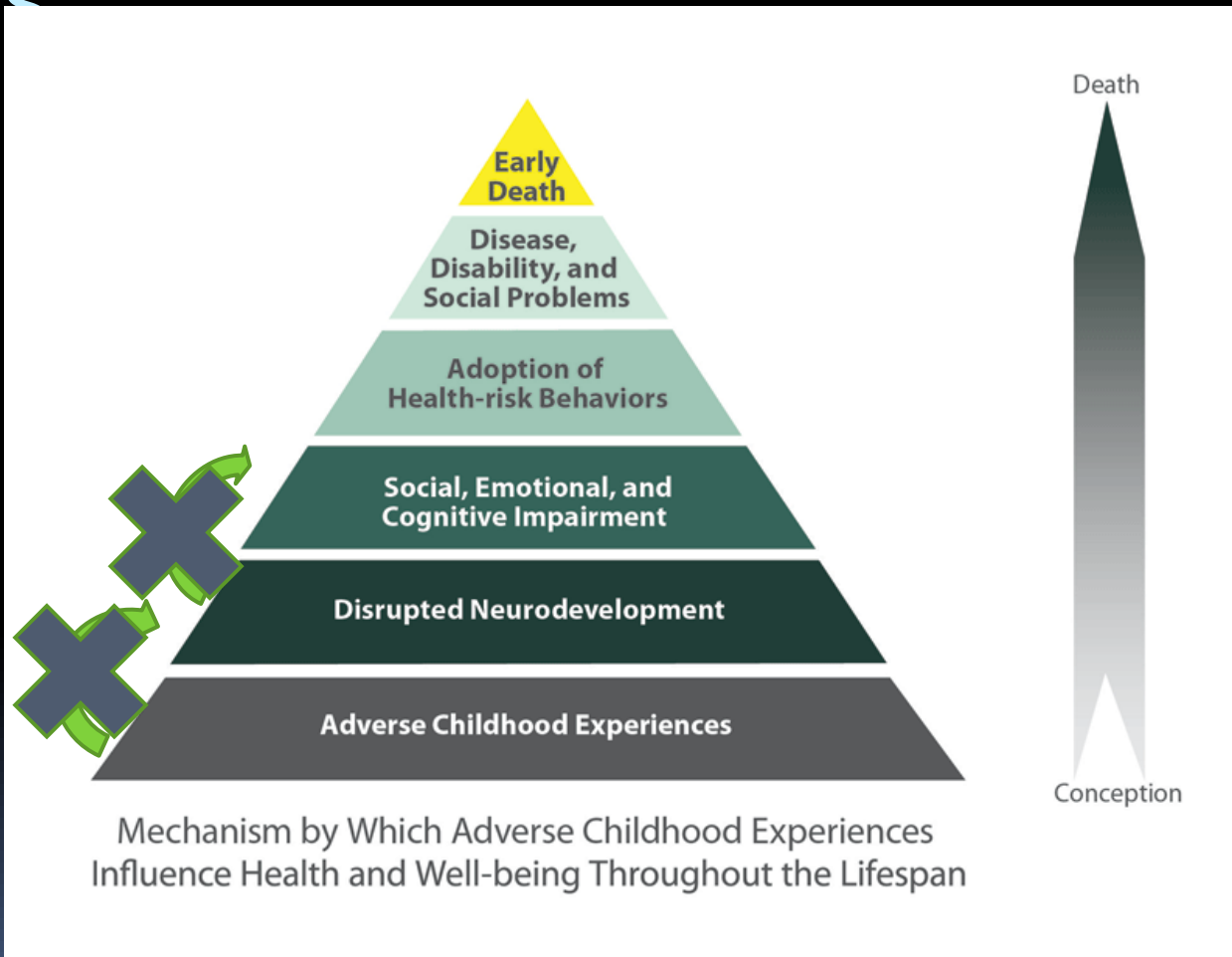


Bakermans Kranenburg and Ijzendoorn. Dev. Psychobio. 2006 Jul;48(5):406-9.

Bakermans Kranenburg et. al. Developmental Psychology. 2008, Vol. 44, No. 1,

193-300

# Ameliorating the Impact of ACEs



# Healing and Resilience for Children

## 1. Prevent ACES.

Universal Education  
Nurse Home Visitation  
Support families in  
poverty.

## 2. Prevent More ACES

### CYW Adverse Childhood Experiences Questionnaire (ACE-Q) Teen Self-Report

To be completed by Patient

Today's Date: \_\_\_\_\_  
Child's Name: \_\_\_\_\_ Date of Birth: \_\_\_\_\_  
Your Name: \_\_\_\_\_ Relationship to Child: \_\_\_\_\_

Many children experience stressful life events that can affect their health and development. The results from this questionnaire will assist your doctor in assessing your health and determining guidance. Please read the statements below. Count the number of statements that apply to you and write the total number on the line provided.

Please **DO NOT** mark or indicate which specific statements apply to you.

1) Of the statements in section 1, HOW MANY apply to you? Write the total number in the box.

#### Section 1. At any point since you were born...

- Your parents or guardians were separated or divorced
- You lived with a household member who served time in jail or prison
- You lived with a household member who was depressed, mentally ill or attempted suicide
- You saw or heard household members hurt or threaten to hurt each other
- A household member swore at, insulted, humiliated, or put you down in a way that scared you OR a household member acted in a way that made you afraid that you might be physically hurt
- Someone touched your private parts or asked you to touch their private parts in a sexual way that was unwanted, against your will, or made you feel uncomfortable
- More than once, you went without food, clothing, a place to live, or had no one to protect you
- Someone pushed, grabbed, slapped or threw something at you OR you were hit so hard that you were injured or had marks
- You lived with someone who had a problem with drinking or using drugs
- You often felt unsupported, unloved and/or unprotected

2) Of the statements in section 2, HOW MANY apply to you? Write the total number in the box.

#### Section 2. At any point since you were born...

- You have been in foster care
- You have experienced harassment or bullying at school
- You have lived with a parent or guardian who died
- You have been separated from your primary caregiver through deportation or immigration
- You have had a serious medical procedure or life threatening illness
- You have often seen or heard violence in the neighborhood or in your school neighborhood
- You have been detained, arrested or incarcerated
- You have often been treated badly because of race, sexual orientation, place of birth, disability or religion
- You have experienced verbal or physical abuse or threats from a romantic partner (i.e. boyfriend or girlfriend)

# AAP/Futures Without Violence/Institute for Safe Families

## Difficult Childhood

Many adults (a  
abuse or other

- ✓ Maybe some
- ✓ Maybe they
- ✓ Maybe some
- ✓ Maybe thing

These experienc  
ent. *No one des*

Difficult childhood experiences can put you and your children at higher risk for:

- ✓ Repeating
- ✓ Asthma, cl
- ✓ Smoking, c
- ✓ Anxiety, de
- ✓ Adult relat

But that's not  
your strength  
information g

## Health Effects

American Academy of Pediatrics  
DEDICATED TO THE HEALTH OF ALL CHILDREN™



**FUTURES  
WITHOUT VIOLENCE**®

[FuturesWithoutViolence.org](http://FuturesWithoutViolence.org)



[www.instituteforsafefamilies.org](http://www.instituteforsafefamilies.org)

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*Every parent needs support at some point. There are great confidential, helpful, and nonjudgmental numbers to call 24/7. In addition, there is an app that can help too. Scan the code to the right for more information.*



**Childhelp: 1 800-4A-CHILD (422-4453)**  
If you are feeling frustrated or angry with your child or just need to talk

**Treatment referral:  
1 800-662-HELP (4357)**  
Referral service for substance abuse and mental health issues

**National Fatherhood Institute:  
[www.fatherhood.org](http://www.fatherhood.org)**



# Healing and Resilience for Children

1. Prevent ACES.
  2. Prevent More ACES.
  3. Strengthen Protective Factors – Healthy Attachment
- 

# Influence of nurturing caregiver

- Warm parental care early in life produces resilience to adversity.
- Serve and return interactions with trusted adults is essential to development of brain circuits.
- **Address maternal mental health**
- Lower IL-6 in adults with history of responsive caregivers.



Harvard Center on the Developing Child  
Chen, 2010

# Promote the 5 R's

- **Reading** together as a daily family activity
- **Rhyming**, playing, talking, singing and cuddling together often
- **Routines** and regular times for meals, play and sleeping, which help child know what they can expect and what is expected of them
- **Rewards** for everyday successes, realizing that praise from those closest to a child is a very potent reward
- **Relationships** that are giving, supportive and constant are the foundation of healthy child development
  - AAP Early Brain and Child Development Initiative

# Healing and Resilience for Children

1. Prevent ACES.
2. Prevent More ACES.
3. Strengthen Protective Factors – Healthy Attachment
4. Parenting support and trauma intervention.

National Child Traumatic Stress Network;  
[www.nctsn.org](http://www.nctsn.org)

Trauma Response Program, Child Psychiatry

Trauma focused CBT

Parent – Child Interaction Therapy

# Beyond the first five years...



*The best time to plant a tree was 20 years ago...but the second best time is now.*

*Chinese proverb*

# Beyond the first five years...

- The brains of teens are still developing!
- Adolescent brains may be more sensitive to experiences that strengthen executive function.
- Relationships continue to buffer and lower allostatic loads.



Brody et al, 2014

# Beyond the first 5 years...

- Physical Activity
  - Increased hippocampal volume and PFC blood flow. Erickson et. al 2011
- Self-Care
  - Sleep, diet, exercise, routines
- Mindfulness can change the brain.
  - *Paying attention in a particular way, in the present moment, on purpose, non-judgementally. - Jon Kabat Zin*
  - *MBSR – Mindfulness Based Stress Reduction*

# Putting ACEs knowledge into action: The SPOT @ Jennings High School



- Supporting Positive Opportunities for Teens
- Comprehensive School Based Health Center located in Jennings High School. Services include:
  - Primary Care
  - Sexual and Reproductive health care
  - Behavioral Health

# Needs Assessment

## Students

1. Alcohol and drug abuse
2. Teen pregnancy
3. Stressful or poor family relationships
4. Fighting or physical aggression

## Parents

1. Stress and or frequent worrying
2. Stressful or poor family relationships
3. Alcohol and drug abuse
4. Teen pregnancy

## Teachers/Staff

1. Attention deficit & hyperactivity
2. Stressful or poor family relationships
3. Alcohol and drug abuse
4. Family substance abuse

# Addressing ACEs Jennings SBHC

1. Created a “Comfort Cove”
2. Implemented behavioral health screening for all students.
3. Teens who screen positive are linked to case manager and mental health professional.
4. Staff training in trauma
5. Partnership with school district toward becoming trauma informed.



# Sharing the Message with Others



# Sharing the Message with Others

Harvard Center on the Developing Child – Jack Shonkoff MD

# Community Conversations

- Walla Walla Washington:
  - Children's Resilience Initiative
- St Louis:
  - Alive and Well STL
- Iowa, Arizona, New J



*What does it mean to you to be*


## ALIVE AND WELL IN ST. LOUIS?

Research demonstrates that adverse events and stress - especially persistent, toxic stress or traumatic incidents - lead to disease. Join Alive and Well STL to help make St. Louis healthy.

[learn more](#)



# Summary

- Adverse Childhood Experiences are linked to poor adult health outcomes.
  - Toxic Stress is the link between ACEs and adult health outcomes.
  - Exposure to toxic stress causes changes in the brain, in gene expression, and in behavior.
  - Genetic variation affects risk and response to intervention.
  - Preventing and mitigating toxic stress has long term benefits.
  - Encouraging connection in stable relationships and promoting healthy behaviors, especially stress reduction, has benefits at every age and stage of development.
- 



*Out of suffering have emerged the strongest souls; the most massive characters are seared with scars.*

*Khalil Gibran*