


# Root of the Root:

## *Translating the Science of Toxic Stress to Transform Health Outcomes in California*

Nadine Burke Harris, MD, MPH, FAAP  
State Surgeon General, California  
April 6, 2019





# Adverse Childhood Experiences

## ABUSE



Physical



Emotional



Sexual

## NEGLECT



Physical



Emotional

## HOUSEHOLD DYSFUNCTION



Mental Illness



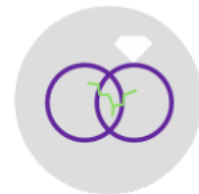
Incarcerated Relative



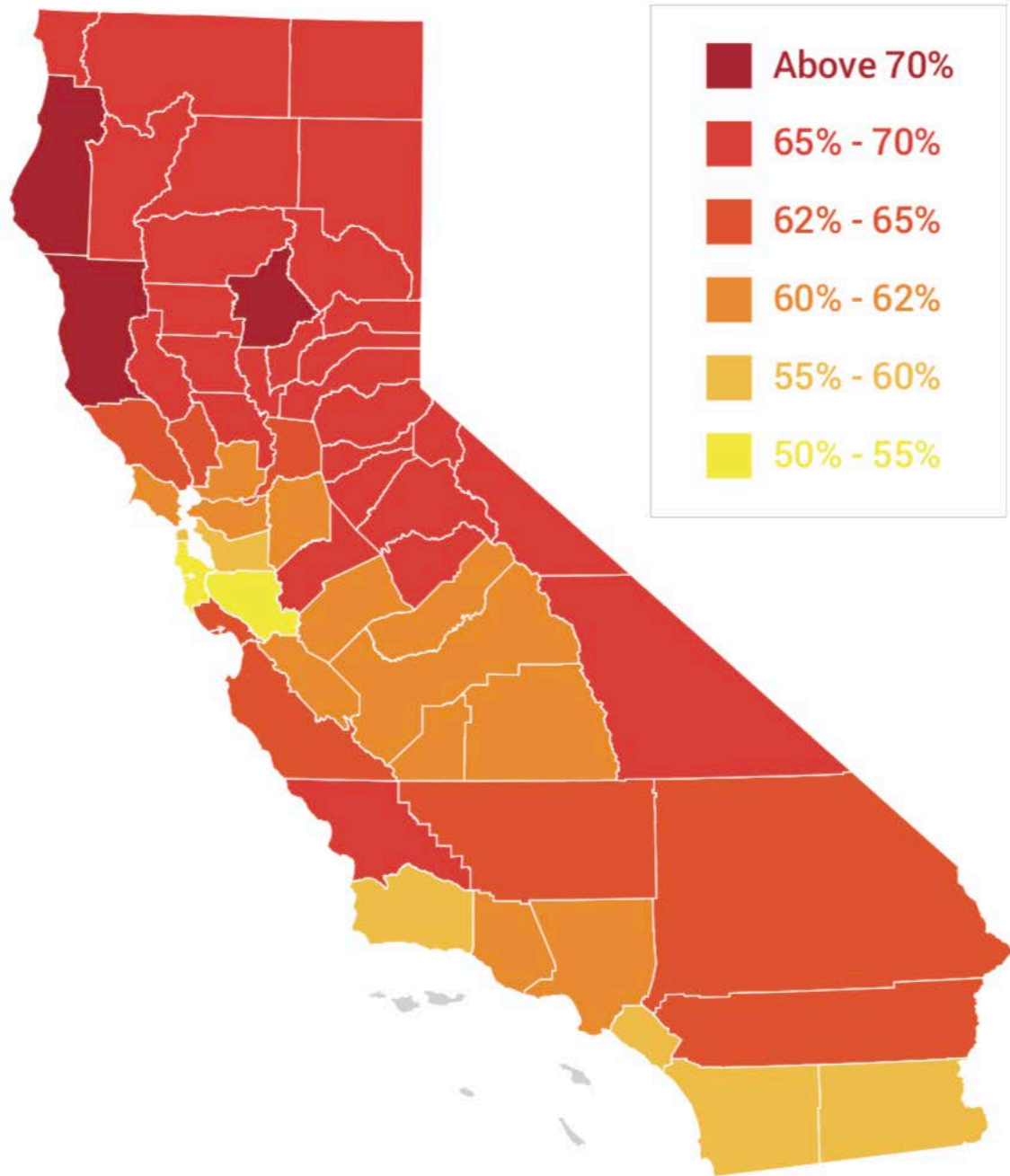
Mother treated violently



Substance Abuse

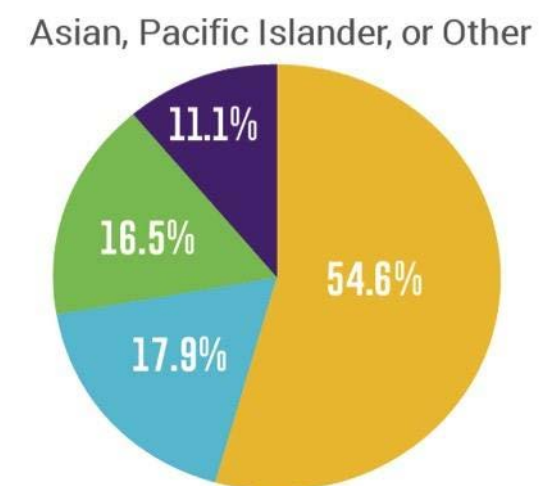
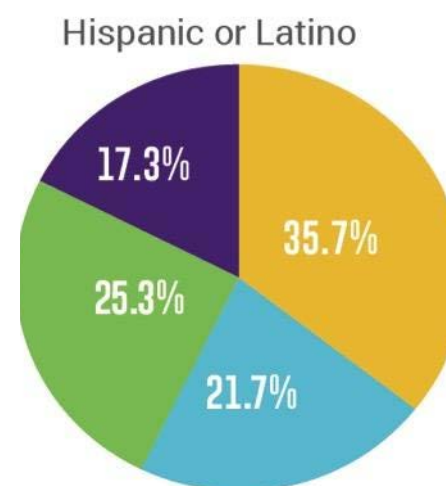
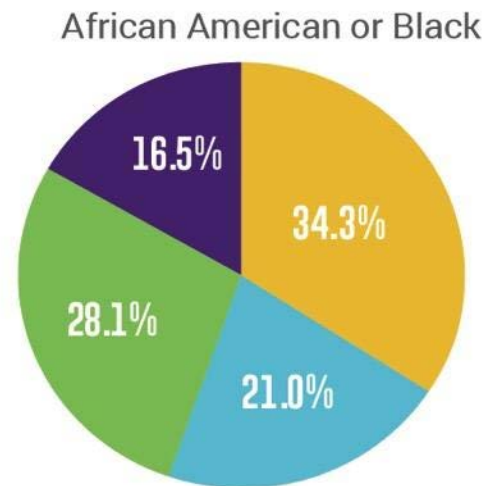
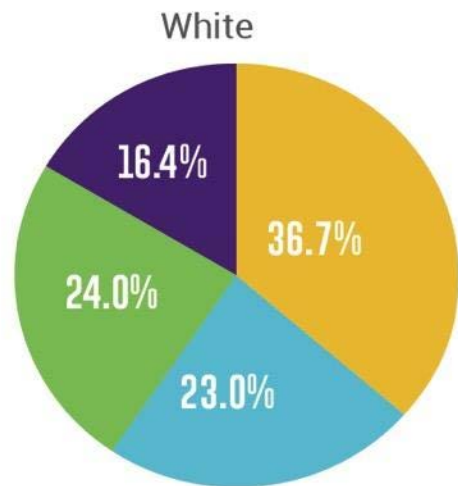


Divorce



**61.7% of California's adults have at least one ACE and 16.7% have 4 or more ACEs**

# The Face of ACEs in California



# ACEs dramatically increase risk for 7 out of 10 leading causes of death

	Leading Causes of Death in US, 2015	Odds Ratio Associated with $\geq 4$ ACEs
1	<b>Heart Disease</b>	<b>2.1</b>
2	<b>Cancer</b>	<b>2.3</b>
3	<b>Chronic Lower Respiratory Disease</b>	<b>3.0</b>
4	Accidents	
5	<b>Stroke</b>	<b>2.4</b>
6	<b>Alzheimer's</b>	<b>11.2</b>
7	<b>Diabetes</b>	<b>1.5</b>
8	Influenza and Pneumonia	
9	Kidney Disease	
10	<b>Suicide</b>	<b>30.1</b>

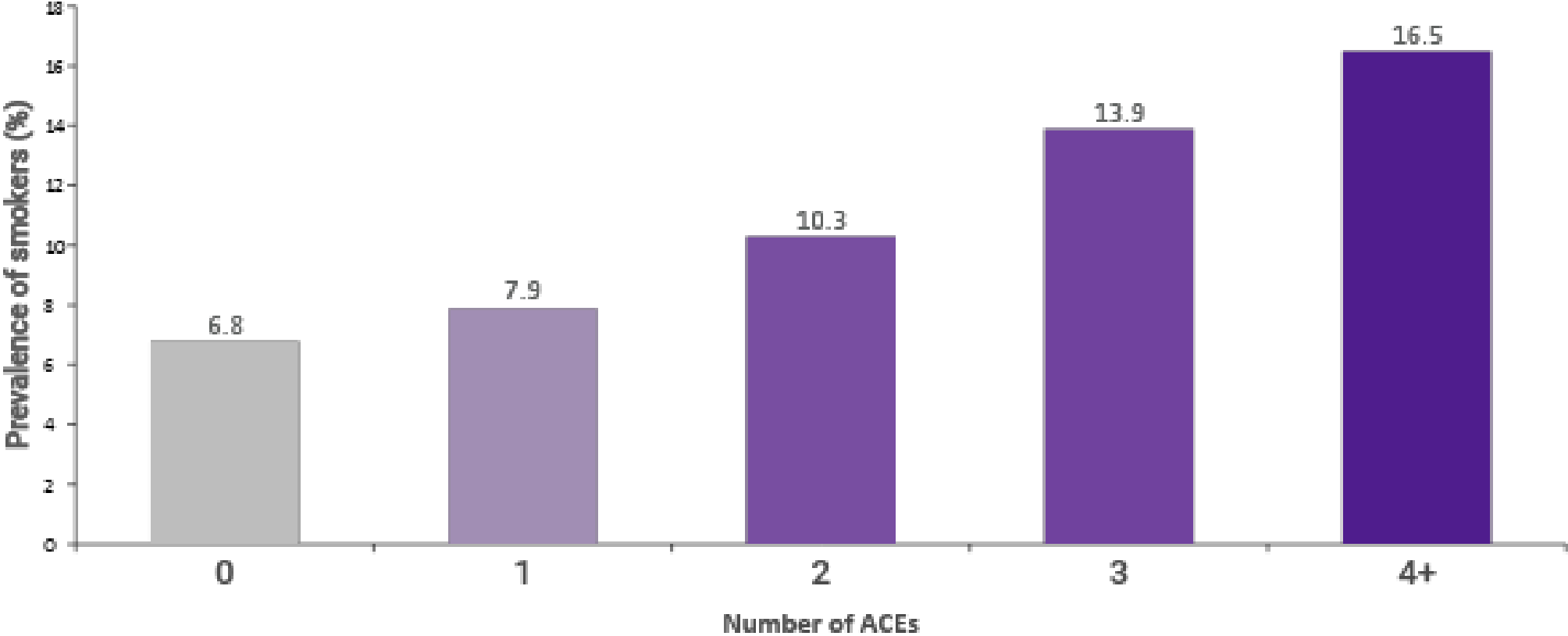
# ACEs dramatically increase risk for 7 out of 10 leading causes of death

	Leading Causes of Death in US, 2015	Odds Ratio Associated with $\geq 4$ ACEs
1	<b>Heart Disease</b>	<b>2.1</b>

Without intervention, there can be a 20-year difference in life expectancy

6	<b>Alzheimer's</b>	<b>11.2*</b>
7	<b>Diabetes</b>	<b>1.5</b>
8	Influenza and Pneumonia	
9	Kidney Disease	
10	<b>Suicide</b>	<b>30.1</b>

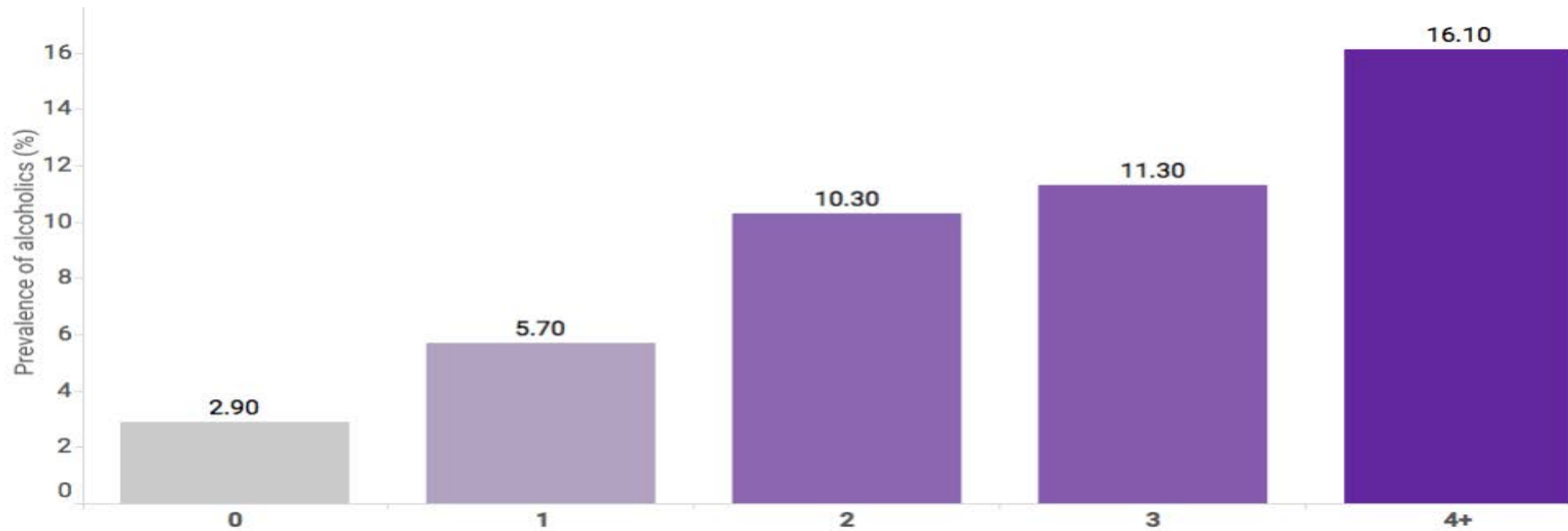
# Prevalence of smoking in adults by ACE score



Source: Felitti, 1998

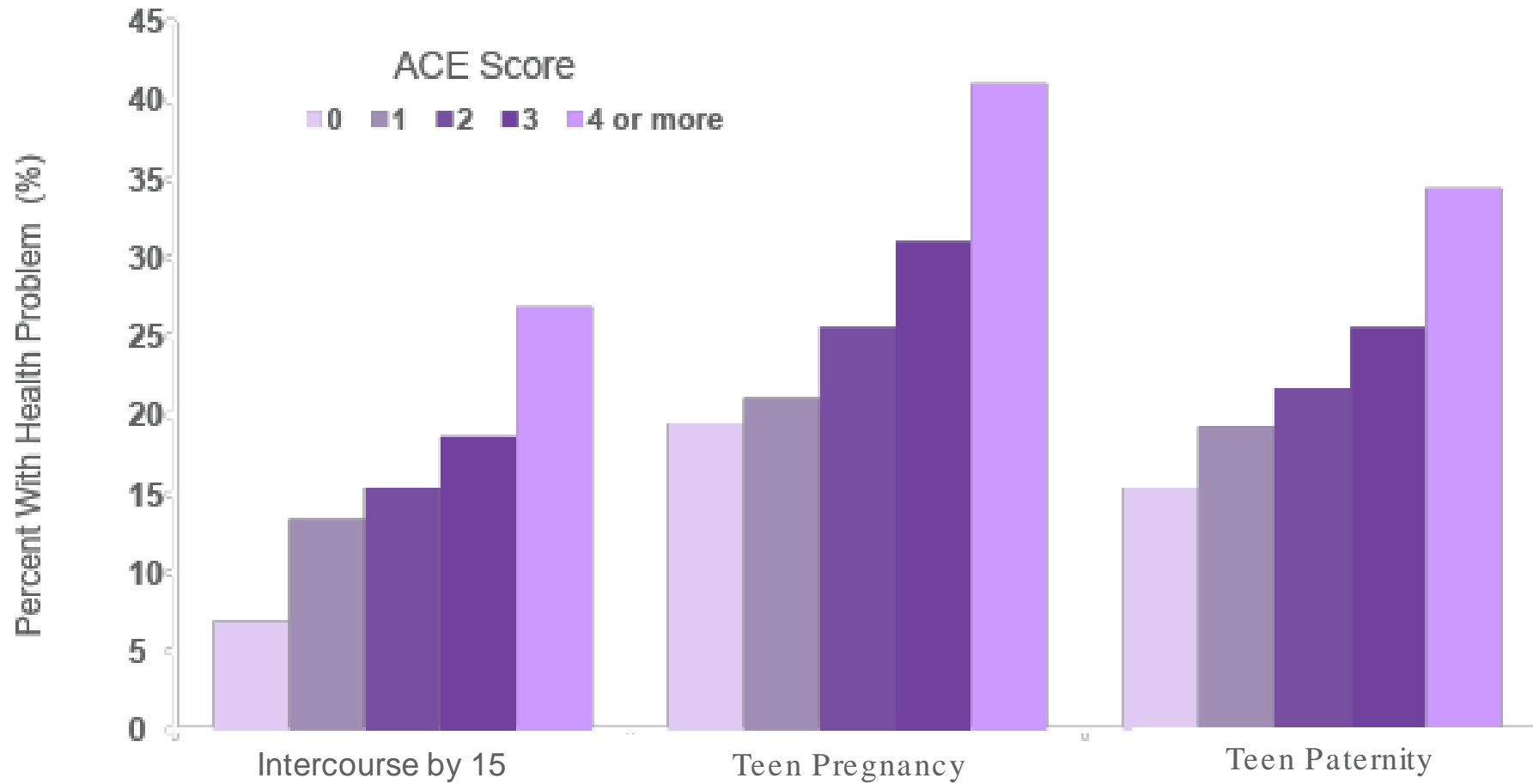


# Prevalence of alcoholism in adults by ACE score

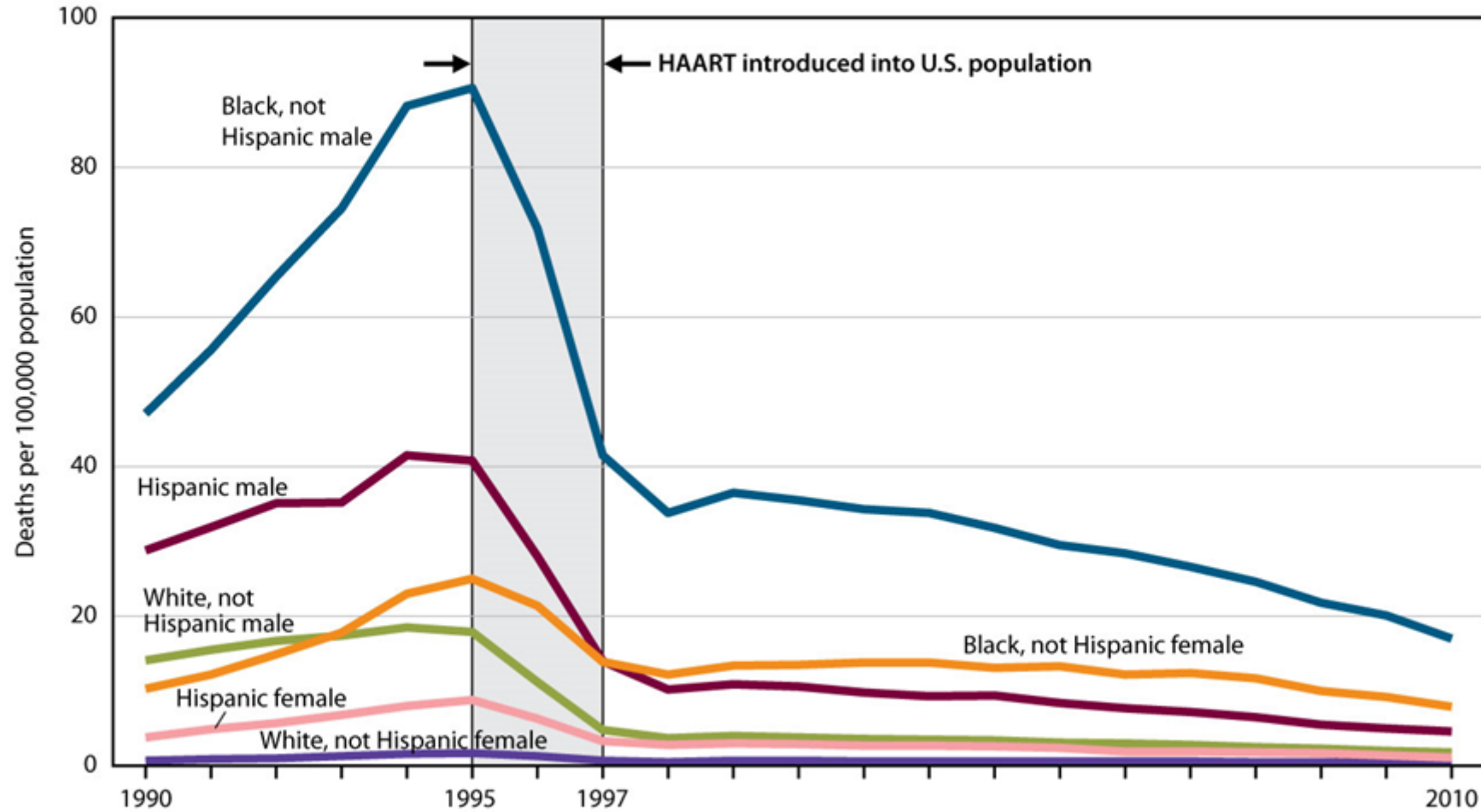


Source: Felitti, 1998

# ACE score and teen sexual behaviors



# Death rates for HIV disease for all ages



NOTE: HAART is highly active antiretroviral therapy.

SOURCE: CDC/NCHS, Health, United States, 2013, Figure 24. Data from the National Vital Statistics System.

“Proper diagnosis is half the cure.”





# Multi-systemic Alterations



## Neurologic

- Long term changes to the fight or flight response
- Overactive fear response
- Changes to brain structure and function can interfere with learning
- Changes to brain biology lead to increased risk of addiction/high risk behavior



## Immunologic

- Long term changes in the function of the immune system lead to increased risk of infections, inflammation and chronic diseases

# Multi-systemic Alterations



## Endocrine

- Long-term changes in hormones can lead to changes in growth, reproductive hormones, risk of obesity, and changes to metabolism



## Epigenetic

- Changes in the way DNA is read and expressed leads to changes in the way the brain and organ systems respond to stress.
- Premature cellular aging leads to increased risk of disease and cancer
- Increased risk can be passed down from generation to generation

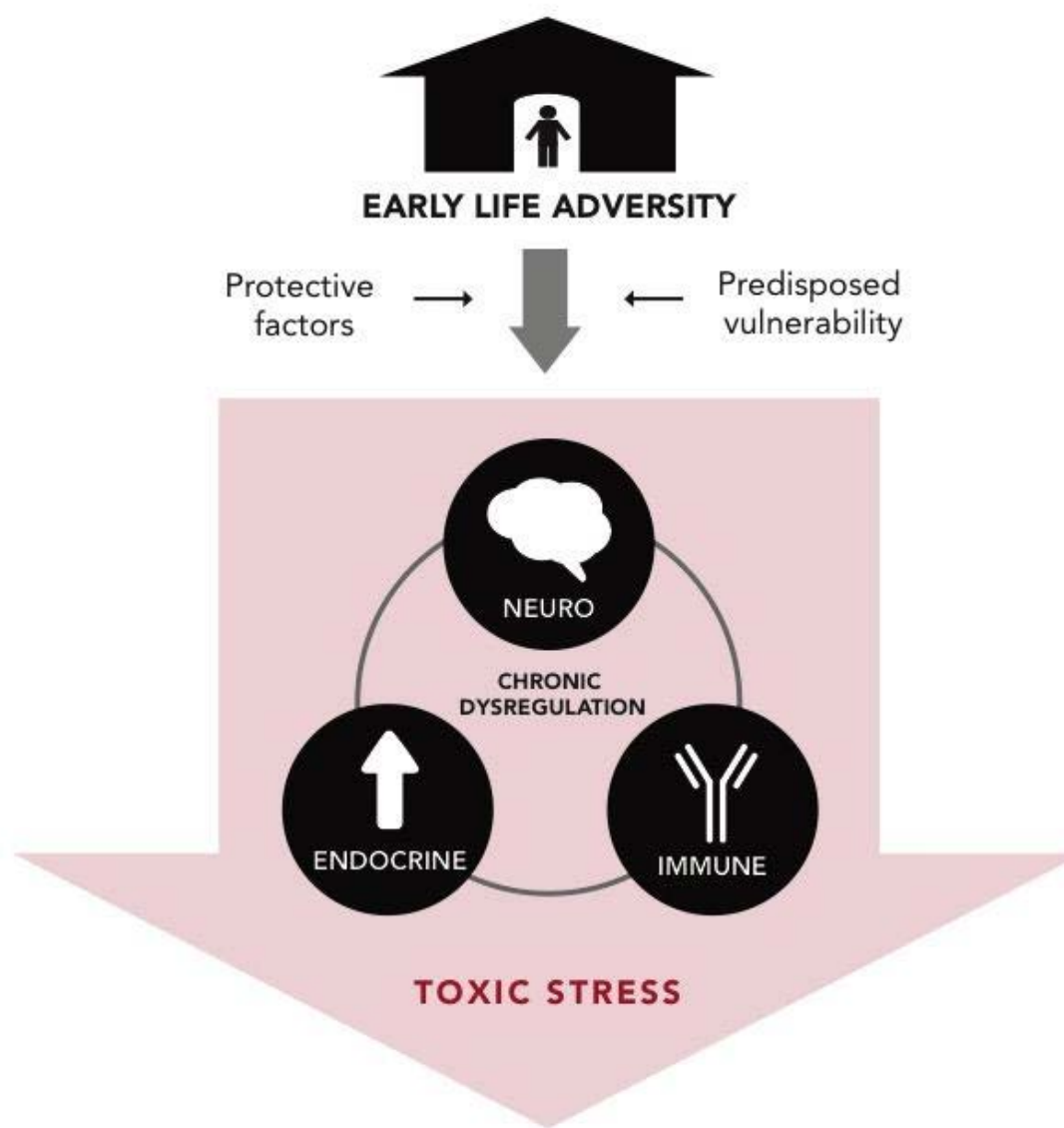


# Multi-systemic Impacts



## Cardiovascular

- Repeated activation of the stress response leads to increased wear on tear on vascular endothelium.
- Increased plasma endothelin 1, total peripheral resistance, DBP and pulse wave velocity.



**CLINICAL IMPLICATIONS**

Epigenetic		
Endocrine Metabolic Reproductive	Neurologic Psychiatric Behavioral	Immune Inflammatory Cardiovascular

# Prenatal and perinatal outcomes

Pre-eclampsia  
Impaired Fertility  
Altered microbiome  
Pregnancy intention  
Maternal Risk Behaviors  
Maternal chronic diseases

Fetal loss  
Pre-term birth  
Low Birthweight



# Health and behavioral outcomes in children

dev. delay  
growth delay  
failure to thrive  
sleep disruption



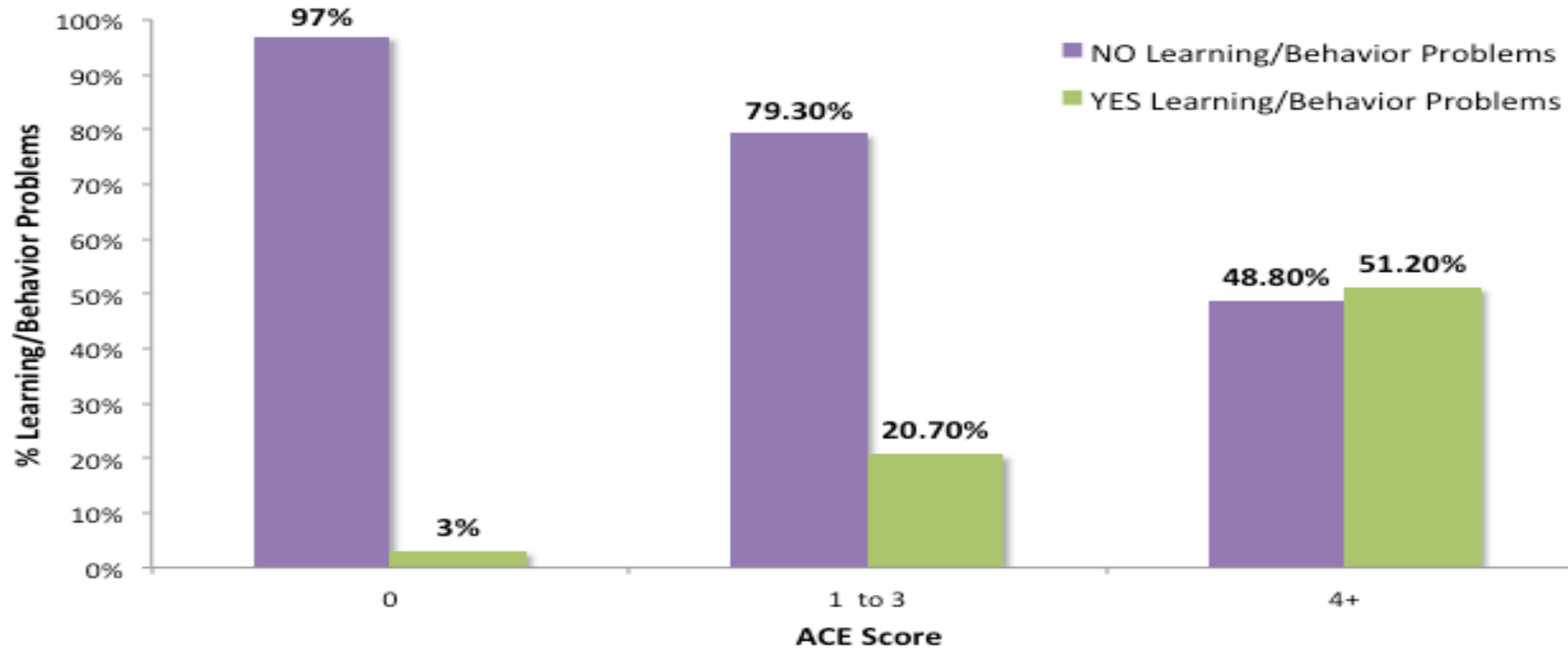
asthma  
pneumonia  
viral infection  
atopic disease  
learning difficulties  
behavioral problems



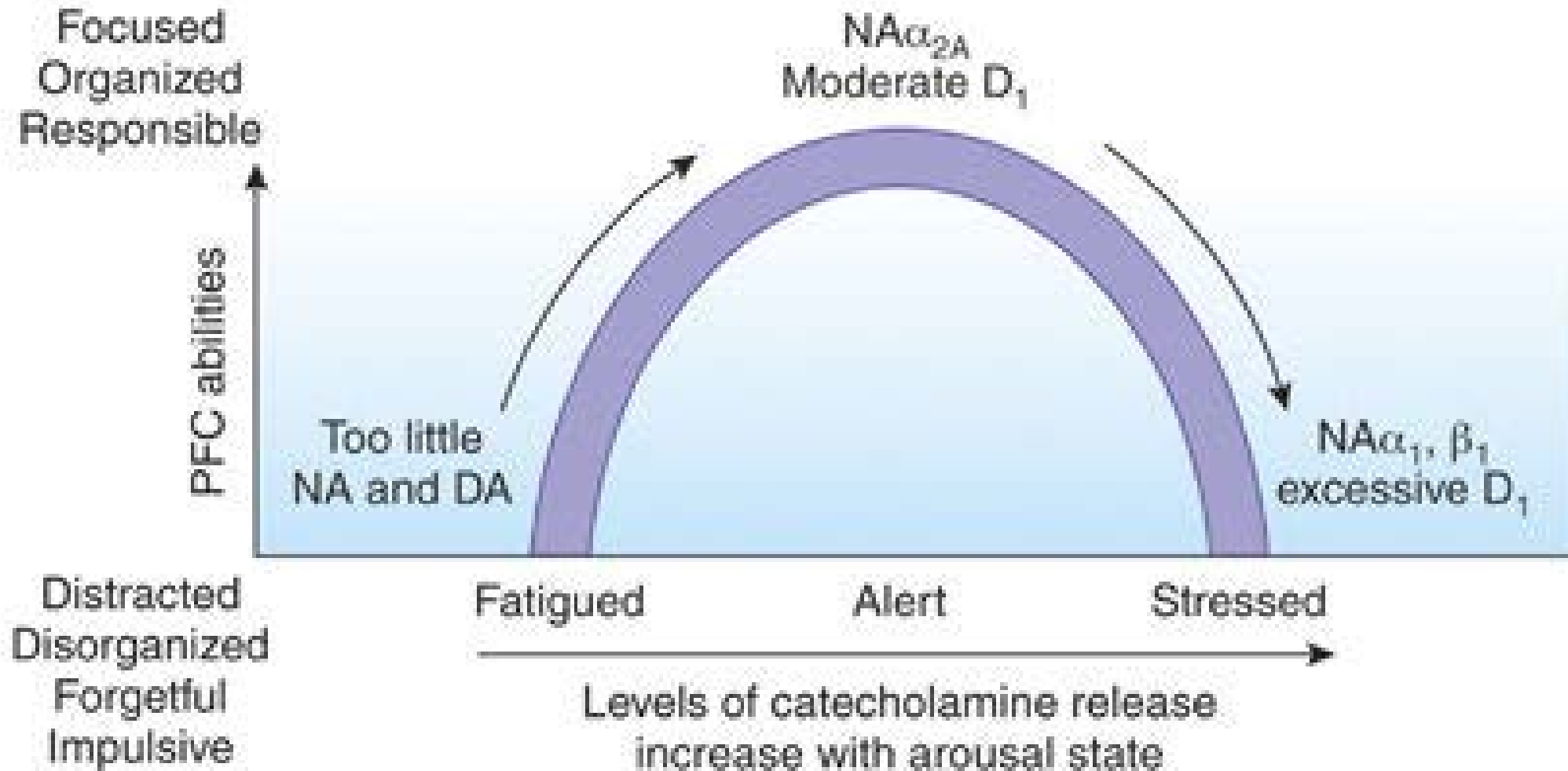
obesity  
diabetes  
headache  
abdominal pain  
teen pregnancy  
hyperthyroidism  
pubertal changes



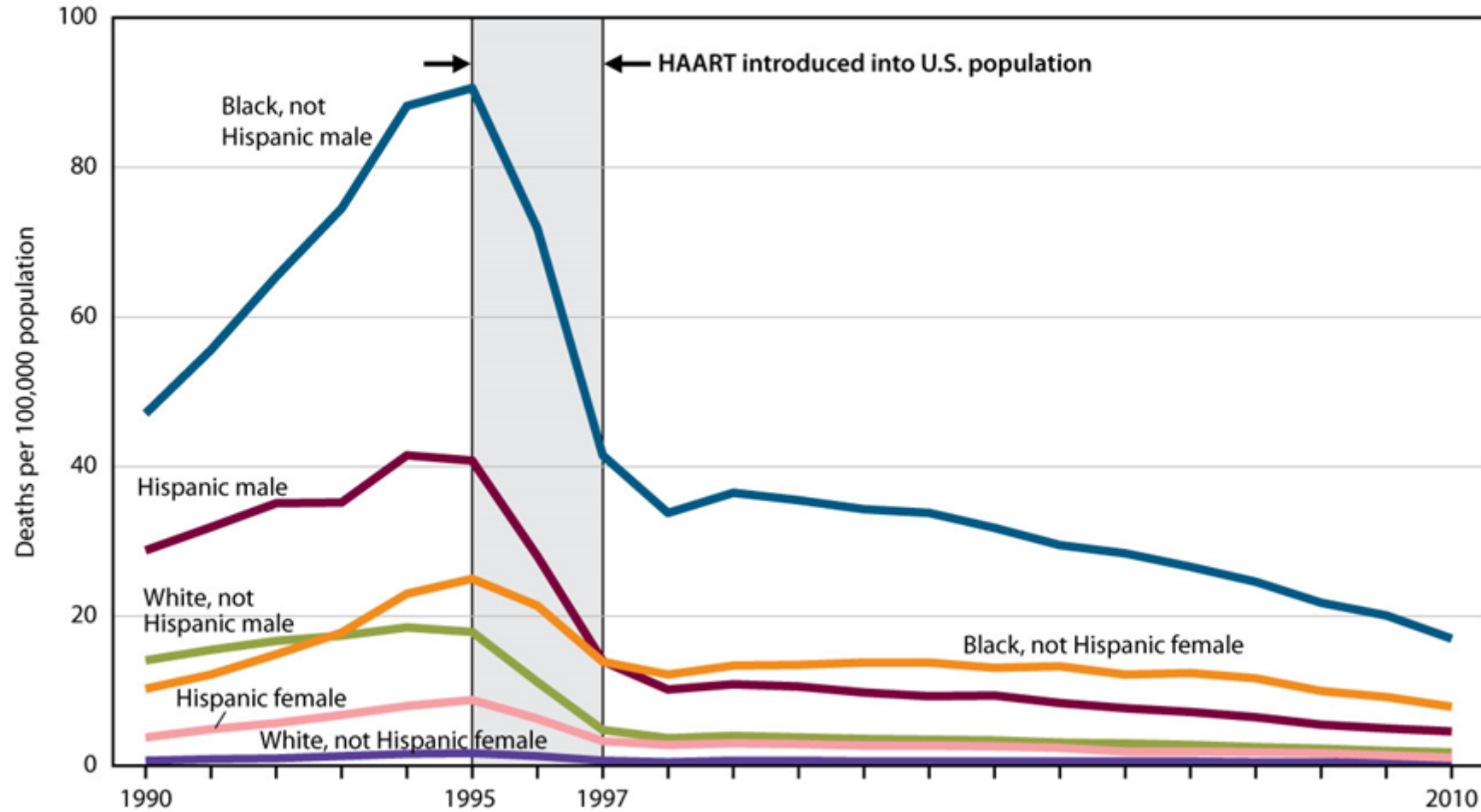
# Learning/Behavior Problems in Youth



# PFC Activity Relative to Stress Hormones



# Death rates for HIV disease for all ages



NOTE: HAART is highly active antiretroviral therapy.

SOURCE: CDC/NCHS, Health, United States, 2013, Figure 24. Data from the National Vital Statistics System.



**PRESCRIPTION**



# Buffering the Toxic Stress Response



## Neurologic

- Newborns receiving skin to skin contact, nurturant care had showed **improved stress reactivity, autonomic functioning, sleep patterns, and maturation of the prefrontal cortex** and its effects on cognitive and behavioral control from 6 months to 10 years.
- MRI studies found that children randomized to high quality nurturant caregiving showed **normalization of the developmental trajectory of white matter structures.**
- Omega-3-fatty acids associated with enhanced neuroplasticity
- Aerobic exercise enhances neuroplasticity and improves hippocampal functioning.

# Buffering the Toxic Stress Response



## Immunologic

- Meditation was associated with decreased IFN- $\gamma$  and NK cell production of IL-10 with increased T cell production of IL-4 (anti-inflammatory)
- Social support **protected against the rise in infection risk** associated with increasing frequency of conflict.
- Sleep has a profound effect on innate and adaptive immunity
- Regular exercise can induce immuno-neuroendocrine stabilization.

# Buffering the Toxic Stress Response



## Endocrine

- Therapeutic touch (massage) associated with significantly ↓HR, cortisol and insulin levels.
- Oxytocin inhibits the stress response, enhances bonding, protects against stress-induced cell death, has anti-inflammatory effects, enhances metabolic homeostasis and protects vascular endothelium.



## Epigenetic

- Meany and colleagues found that nurturant caregiving was associated with epigenetic changes that led to greater stress tolerance, more normal functioning of the stress response, improved cognitive performance in increased caregiving

# Buffering the Toxic Stress Response



Early identification and intervention are critical



- Child and teen versions
- Self-report / caregiver report
- Responses de-identified

Pediatric ACEs and Related Life Events Screener (PEARLS) – Child (Parent/Caregiver Report)

To be completed by Caregiver

Today's Date: \_\_\_\_\_

Child's Name: \_\_\_\_\_ Date of Birth: \_\_\_\_\_

Your Name: \_\_\_\_\_ Relationship to Child: \_\_\_\_\_

**Many families experience stressful life events. Over time these experiences can affect your child's health and wellbeing. We would like to ask you questions about your child so we can help them be as healthy as possible. At any point in time since your child was born, has your child seen or been present when the following experiences happened? Please include past and present experiences. Please note, some questions have more than one part separated by "OR." If any part of the question is answered "Yes," then the answer to the entire question is "Yes."**

<ul style="list-style-type: none"> <li>▪ Has your child ever lived with a parent/caregiver who went to jail/prison?</li> </ul>
<ul style="list-style-type: none"> <li>▪ Do you think your child ever felt unsupported, unloved and/or unprotected?</li> </ul>
<ul style="list-style-type: none"> <li>▪ Has your child ever lived with a parent/caregiver who had mental health issues? (for example depression, schizophrenia, bipolar disorder, PTSD, or an anxiety disorder)</li> </ul>
<ul style="list-style-type: none"> <li>▪ Has a parent/caregiver ever insulted, humiliated, or put down your child?</li> </ul>
<ul style="list-style-type: none"> <li>▪ Has the child's biological parent or any caregiver ever had, or currently has a problem with too much alcohol, street drugs or prescription medications use?</li> </ul>
<ul style="list-style-type: none"> <li>▪ Has your child ever lacked appropriate care by any caregiver (for example, not being protected from unsafe situations, or not cared for when sick or injured even when the resources were available)?</li> </ul>
<ul style="list-style-type: none"> <li>▪ Has your child ever seen or heard a parent/caregiver being screamed at, sworn at, insulted or humiliated by another adult? <b>Or</b> Has your child ever seen or heard a parent/caregiver being slapped, kicked, punched beaten up or hurt with a weapon?</li> </ul>
<ul style="list-style-type: none"> <li>▪ Has any adult in the household often or very often pushed, grabbed, slapped or thrown something at your child? <b>Or</b> Has any adult in the household ever hit your child so hard that your child had marks or was injured? <b>Or</b> Has any adult in the household ever threatened your child or acted in a way that made your child afraid that they might be hurt?</li> </ul>
<ul style="list-style-type: none"> <li>▪ Has your child ever experienced sexual abuse? For example, anyone touched your child or asked your child to touch that person in a way that was unwanted, or made your child feel uncomfortable, or anyone ever attempted or actually had oral, anal, or vaginal sex with your child?</li> </ul>
<ul style="list-style-type: none"> <li>▪ Have there ever been significant changes in the relationship status of the child's caregiver(s)? For example a parent/caregiver got a divorce or separated, or a romantic partner moved in or out?</li> </ul>

Add up the "yes" answers for this first section:

<ul style="list-style-type: none"> <li>▪ Has your child ever seen, heard, or been a victim of violence in your neighborhood, community or school? (for example targeted bullying, assault or other violent actions, war or terrorism)</li> </ul>
<ul style="list-style-type: none"> <li>▪ Has your child experienced discrimination (for example being hassled or made to feel inferior or excluded because of their race, ethnicity, gender identity, sexual orientation, religion, learning differences, or disabilities)?</li> </ul>
<ul style="list-style-type: none"> <li>▪ Has your child ever had problems with housing (for example being homeless, not having a stable place to live, moved more than two times in a six-month period, faced eviction or foreclosure, or had to live with multiple families or family members)?</li> </ul>
<ul style="list-style-type: none"> <li>▪ Have you ever worried that your child did not have enough food to eat or that the food for your child would run out before you could buy more?</li> </ul>
<ul style="list-style-type: none"> <li>▪ Has your child ever been separated from their parent or caregiver due to foster care, or immigration?</li> </ul>
<ul style="list-style-type: none"> <li>▪ Has your child ever lived with a parent/caregiver who had a serious physical illness or disability?</li> </ul>
<ul style="list-style-type: none"> <li>▪ Has your child ever lived with a parent or caregiver who died?</li> </ul>

Add up the "yes" answers for the second section:

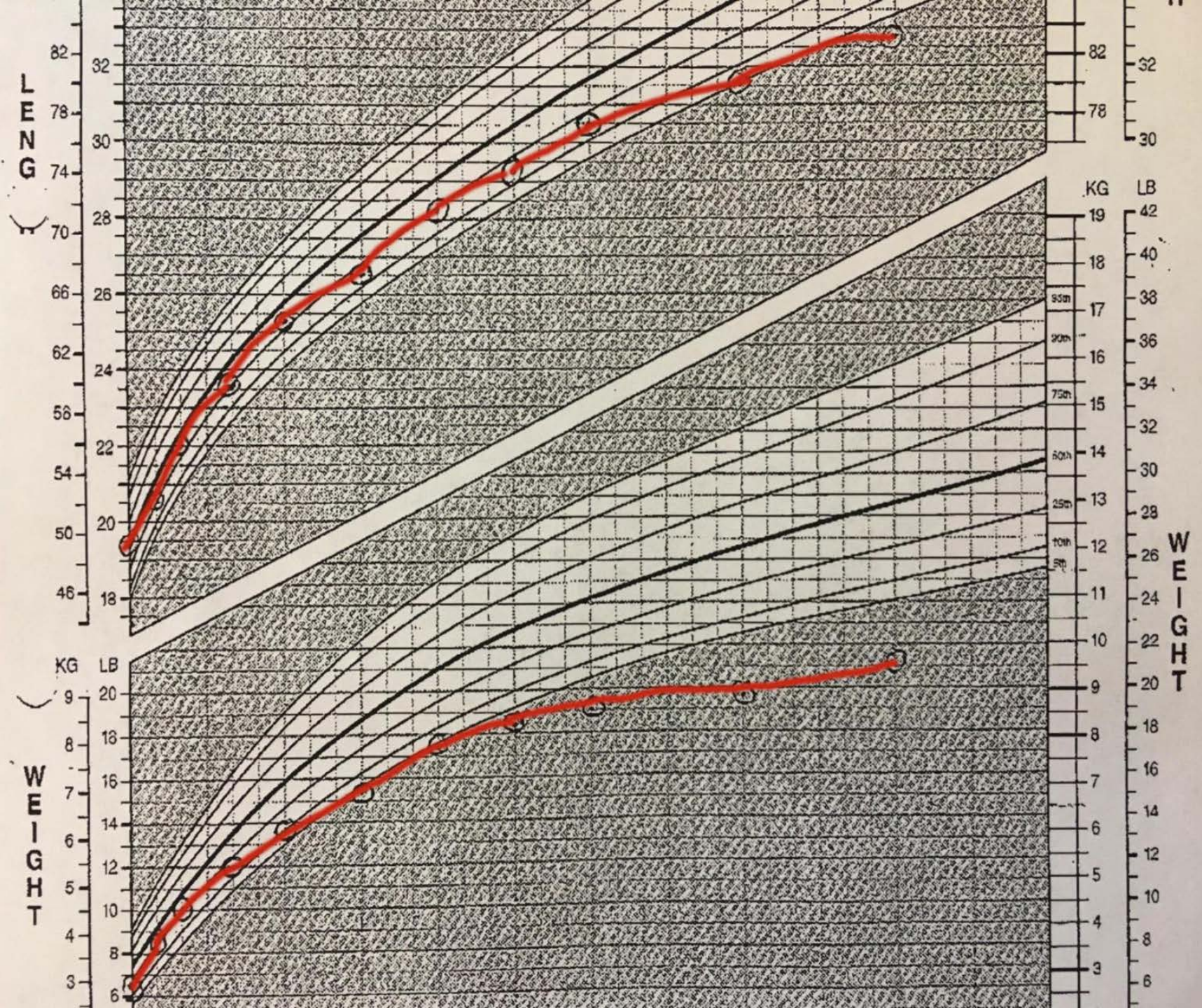
# Clinical Presentation

- 2 year 9 mo female presents for Well Child Exam
- Presenting concern: Growth – Patient is “small”. Previously had diarrhea when she started on cow’s milk. Symptoms went away when mom changed to almond milk.
- Otherwise well. No other complaints.

# History

- BHx: Full term, NSVD, BW: 25%ile
- Dev Hx: Normal development. **No behavioral concerns.**
- Growth Hx: Went from 50% height and 25% weight to progressively decreasing until until she was consistently below the 3rd percentile for height, weight and OFC.
- Previous doctor recommended PediaSure but it didn't seem to help.
- Mom's height is at 30% , dad's height is at 20%





## Initial Evaluation

- Normal physical exam and initial labs.
- ASQ: WNL
- MCHAT: WNL
- ACE Score – 7+0

## Assessment

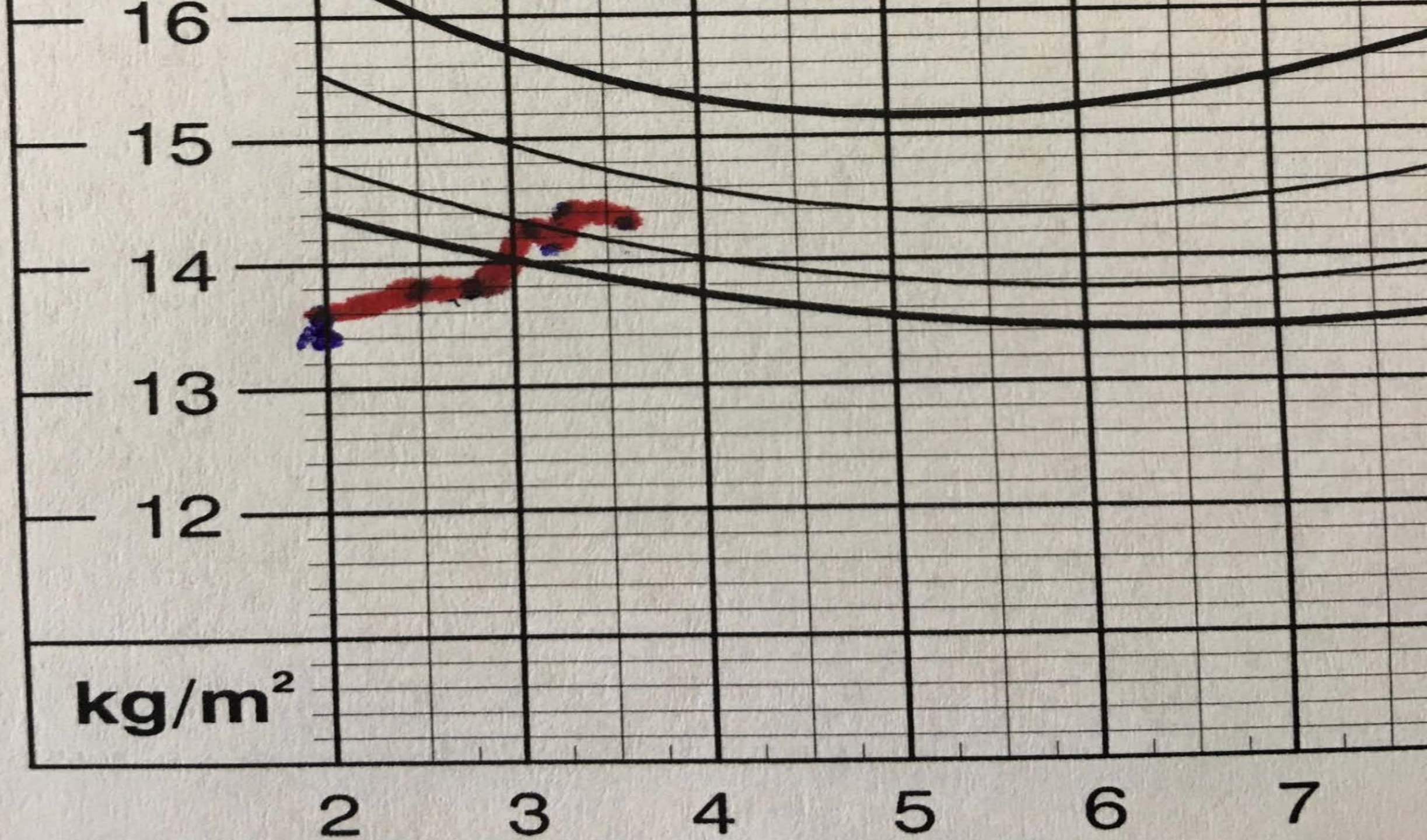
- 2 yr 9 month female with failure to thrive. Likely due to toxic stress physiology.

# Plan

1. Patient Education
2. Interventions targeted at regulating the stress response: such as Sleep, Exercise, Nutrition, Mindfulness, Mental Health, Healthy Relationships
  - Referral to Child Parent Psychotherapy (CPP)
3. Treatment of secondary and co-morbid conditions
  - Pediasure, 1 can BID, Referral to WIC
4. Regular follow up to evaluate progress re: presenting clinical manifestation

# Patient Education

- Explanation to mom about the pathophysiology of toxic stress:
  - “I think that because of what your daughter has experienced, her body is making more stress hormones than it should and this may be what’s affecting her growth.
  - I want to refer you to a specialist that help you learn how to support her and reduce the amount of stress hormones that her body is making.”
  - “We also know that a healthy caregiver is one of the most important ingredients for healthy children, so an important part of helping your daughter heal will involve managing your own stress level and practicing taking care of yourself.”



# Discussion

- **Toxic Stress Response:**
  - Neuro-endocrine-immune and genetic regulatory disruption (Don't forget to look for sx beyond behavior)
  - There is currently no established clinical diagnostic criteria for toxic stress.
  - An ACE screen can help us identify patients who are at high risk of experiencing a toxic stress physiology and deliver more effective and efficient care.

## Discussion

- Treatment strategy:
  - **Reducing the dose of adversity** – decreased activation of the HPA and SAM axes, decrease adrenaline and cortisol dysregulation
  - **Enhancing the ability of the caregiver to provide a safe, stable and nurturing environment**, as well as regulate her own physiology so that she can biologically buffer the child's stress response is critical, especially for younger kids.
  - The 2-generation nature of the CPP intervention was important for this age range.

## Corollary

- 9 month-old brother, who was not the index patient, also had 4 ear infections and 2 pneumonias in his first year of life.
- Seemed like he was “always sick”, per mom.
- Referred to ENT for evaluation of frequent ear infection.
- After CPP intervention started, patient had no more ear infections and many fewer URI's in the subsequent year.





**34M**

**American Children At Risk for Toxic Stress**

California will lead the way in responding to this global public health crisis.

# Executive Order: N-02-19

**WHEREAS** California faces serious health challenges rooted in early social determinants of health; and

**WHEREAS** these challenges are not only serious but inequitable, disproportionately impacting low-income Californians and communities of color; and

**WHEREAS** some of the most pernicious, but least addressed, health challenges are the upstream factors that eventually become chronic and acute conditions that are far more difficult and expensive to treat; and

**WHEREAS** the overwhelming scientific consensus is that these upstream factors, including toxic stress and the social determinants of health, are the root causes of many of the most harmful and persistent health challenges facing Californians; and

**WHEREAS** California is home to many of the world's leading experts on proactively addressing these root causes, including State and local health officials; and

**WHEREAS** these experts are endeavoring to identify and implement solutions proven successful by our best science; and

**WHEREAS** medical and policy experts cannot effectively do this work alone—they must leverage the expertise of Californians whose lived experience is critical to the development of working solutions; and

**WHEREAS** it is time that California appoints a leader who can marshal the insights and energy of medical professionals, public health experts, public servants, and everyday Californians to solve our most pressing health challenges with surgical focus.

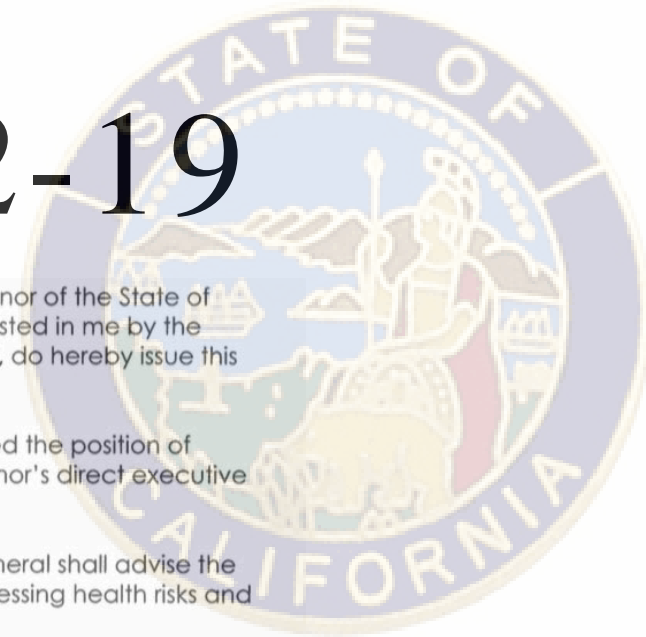
**NOW, THEREFORE, I, GAVIN NEWSOM**, Governor of the State of California, by virtue of the power and authority vested in me by the Constitution and statutes of the State of California, do hereby issue this Order to become effective immediately.

**IT IS HEREBY ORDERED** that there is established the position of Surgeon General, a public entity within the Governor's direct executive authority.

**IT IS FURTHER ORDERED** that the Surgeon General shall advise the Governor on a comprehensive approach to addressing health risks and challenges as effectively and as early as possible.

**IT IS FURTHER ORDERED** that the Surgeon General shall marshal the insights and energy of medical professionals, scientists and other academic experts, public health experts, public servants, and everyday Californians to solve our most pressing public health challenges.

**IT IS FURTHER ORDERED** that the Surgeon General shall be a key spokesperson on public health issues throughout the State of California by providing Californians with the best medical and scientific evidence through public health reports and other tools of communicating widely to the public.





CALIFORNIA  
ALL

CONSTITUTION

# Key Drivers for Addressing Toxic Stress



Prevention Efforts



Community and Ecological Action



Universal Screening



Effective Referral System



Comprehensive and Available Service Array



Payment for Services



Robust Research Agenda



Biomedical Advances

Prevention

Practice Transformation

Research + Innovation

# Prevention Efforts



Preventing ACEs and toxic stress by raising awareness, reducing risk factors and promoting protective factors



Collaborating across sectors to create accountable communities and collective equitable action

# Practice Transformation (AB340)



Ensuring universal screening for ACEs & toxic stress



Strengthening referral systems to help children and families access the right services



Coordinating comprehensive services to address ACEs and toxic stress (esp. in underserved communities)



Public and private insurer payment for ACEs and toxic stress screening and treatment

# Research and Innovation



Putting toxic stress at the top of the research agenda to leverage talent and resources

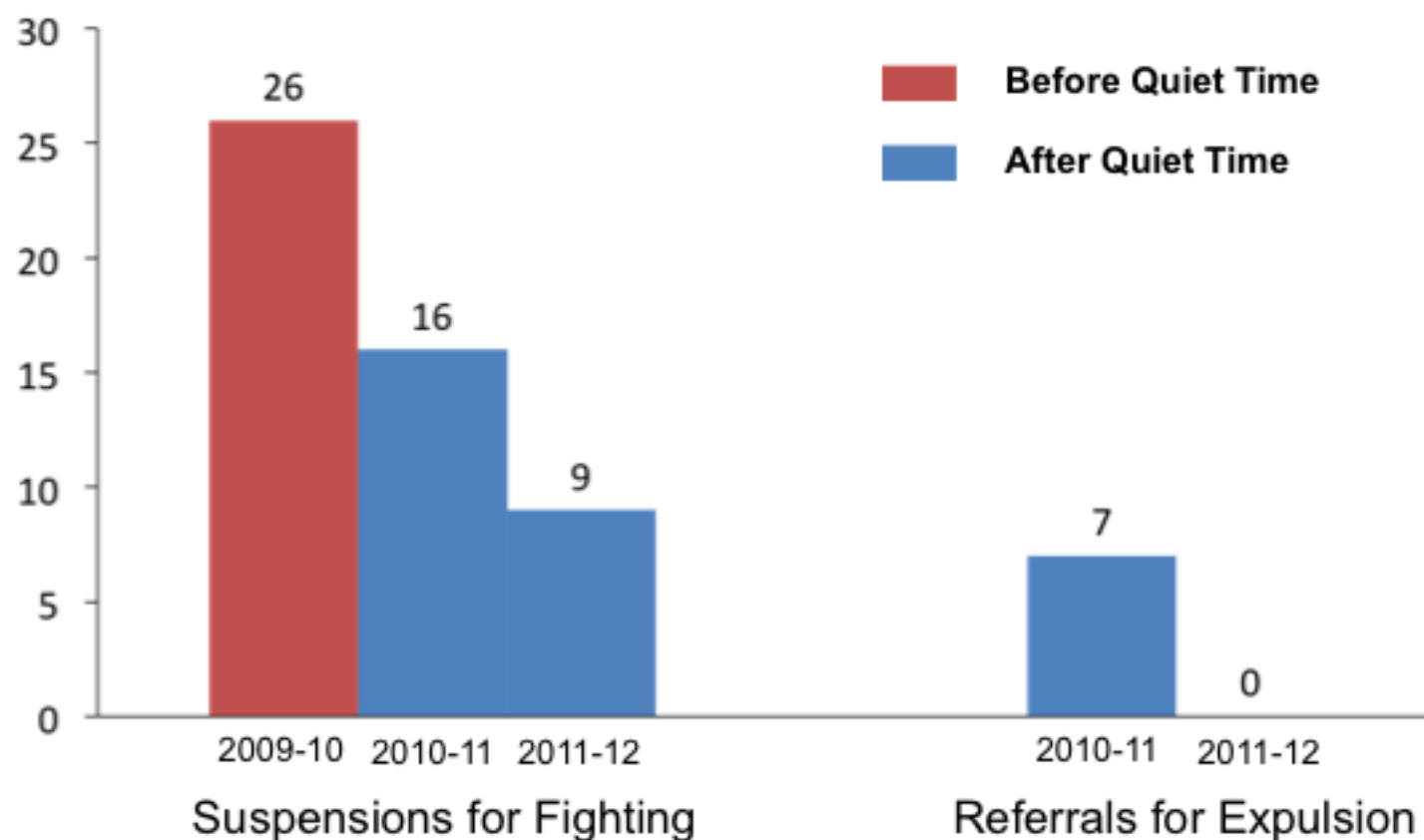


Advancing the science to measure, mitigate, and heal the toxic stress response

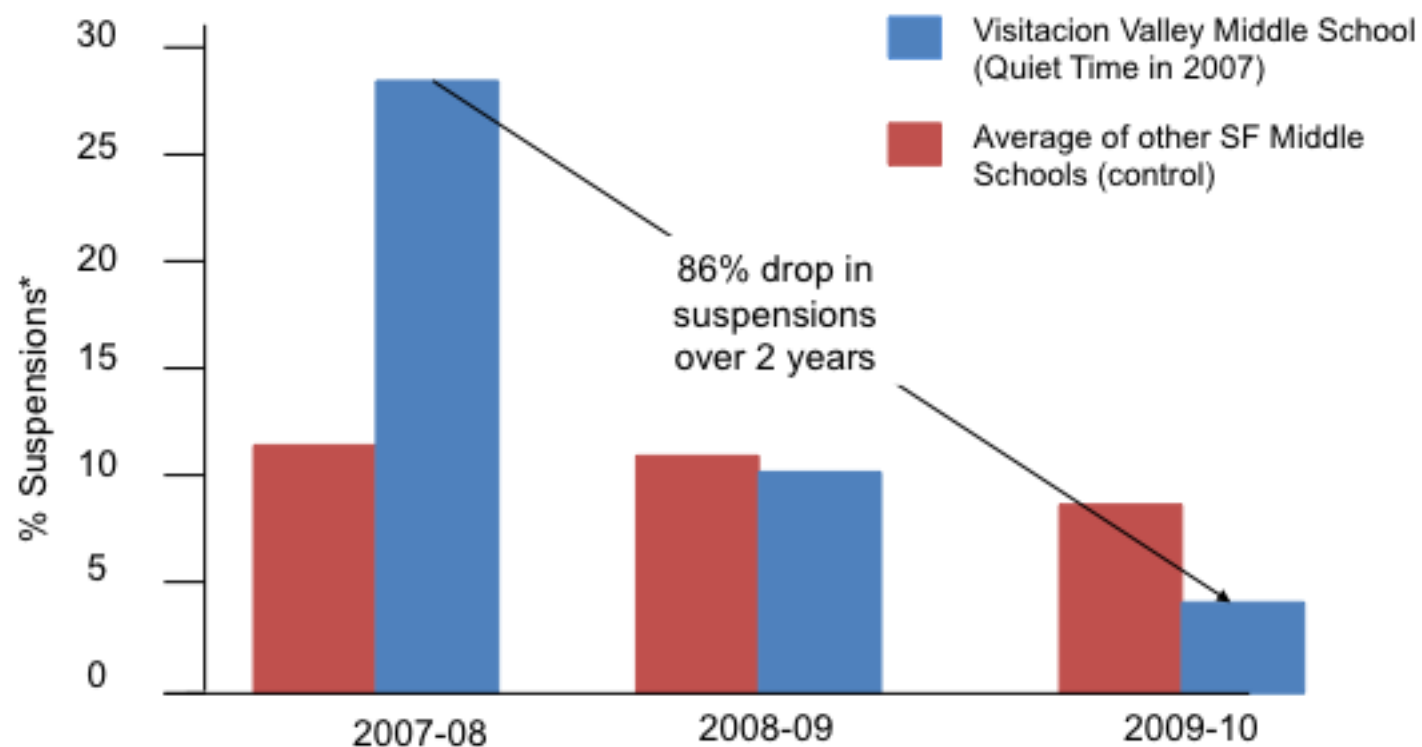




## Reduction in School Violence John O'Connell High School



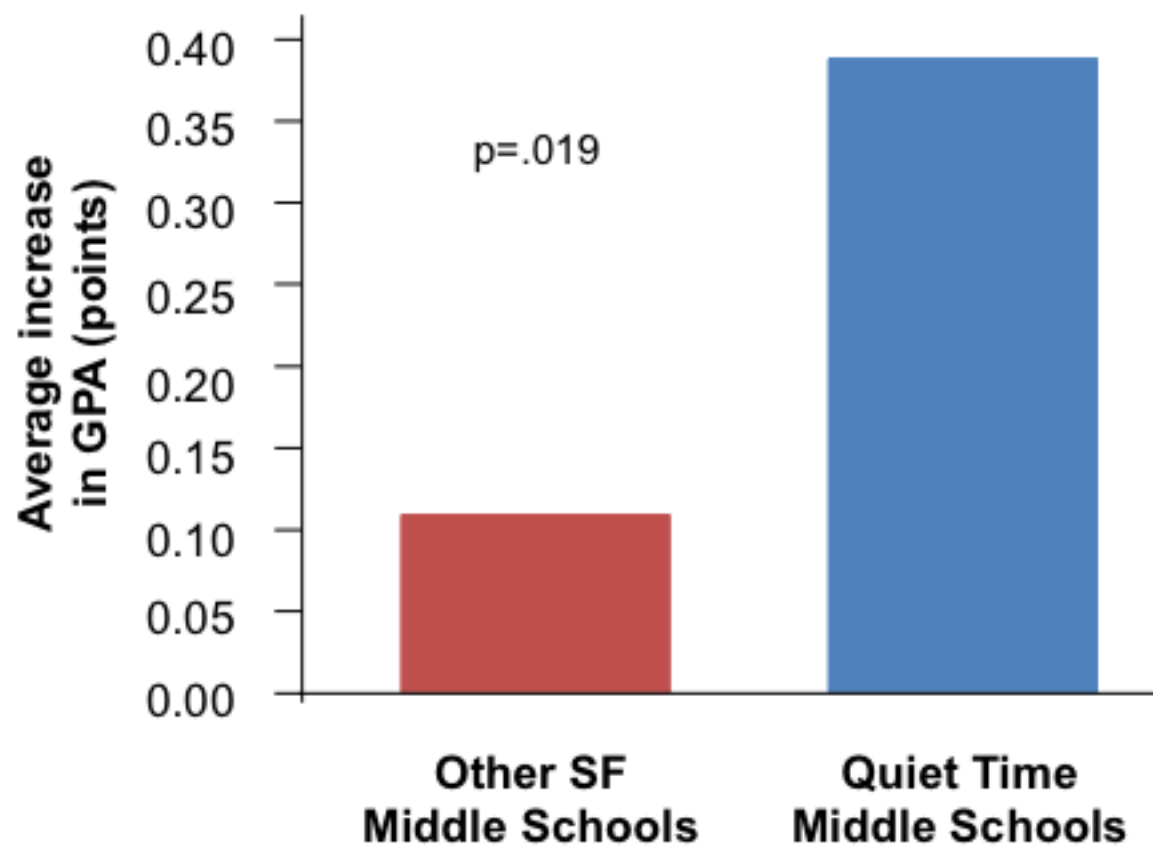
## Substantial Drop in Suspension Rate compared to SF Middle School Average



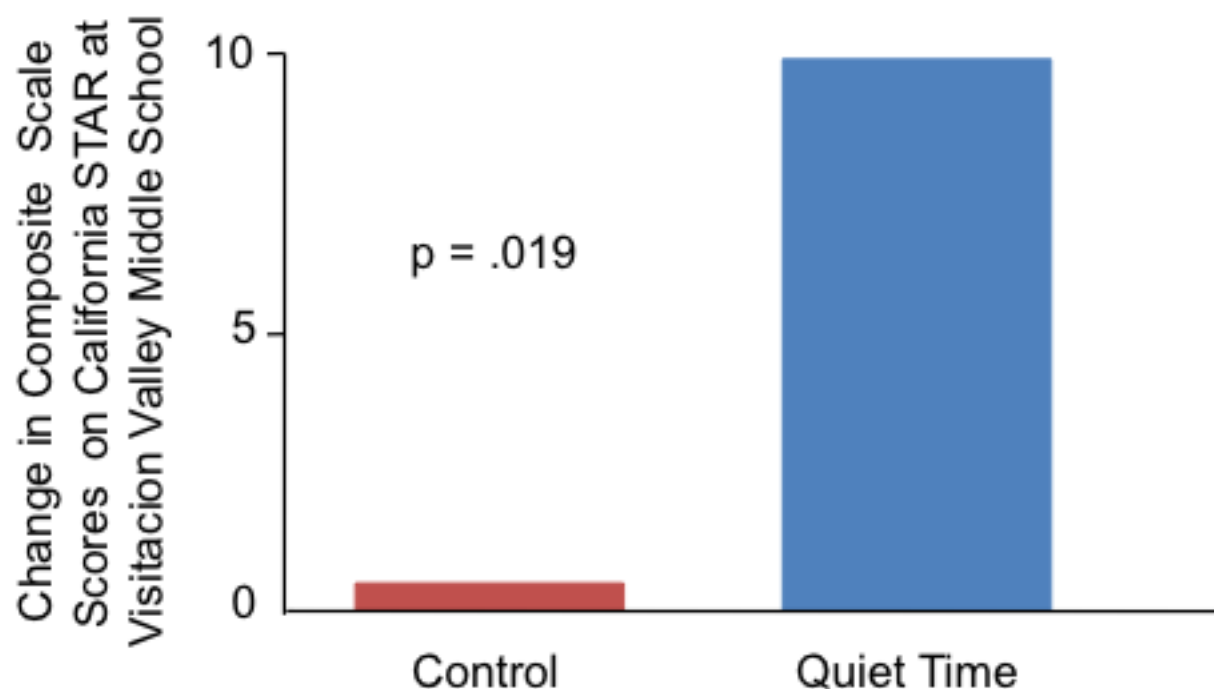
\*Suspension calculated as total number of incidents divided by total school enrollment

Source: SFUSD Middle School Accountability Report Cards published 2010-11

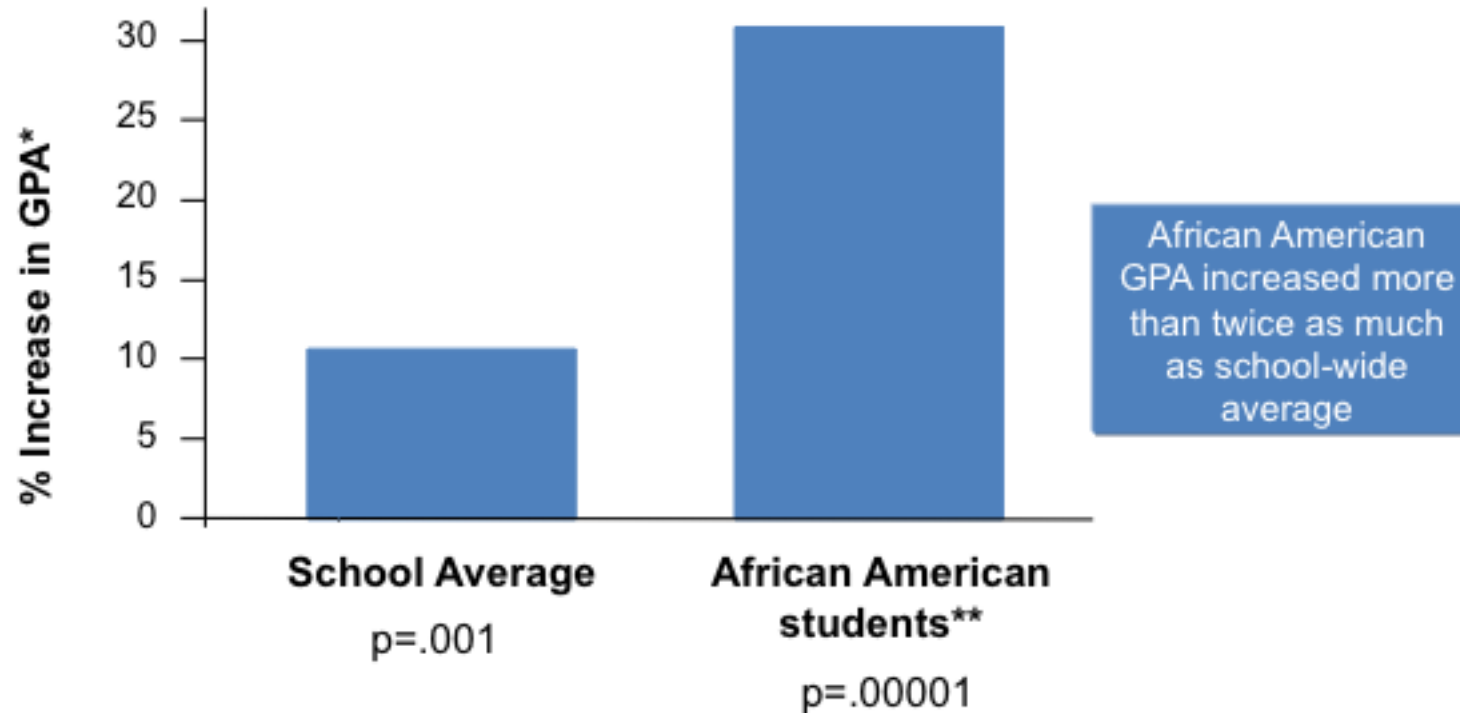
## Increase in GPA Fall 2007-2009



## Increased Composite STAR Test Scores 2006-2007, in First Year of Implementation of Quiet Time for Below Basic and Far Below Basic Students



## African American Achievement Gap Reduced after First Year of Quiet Time Program

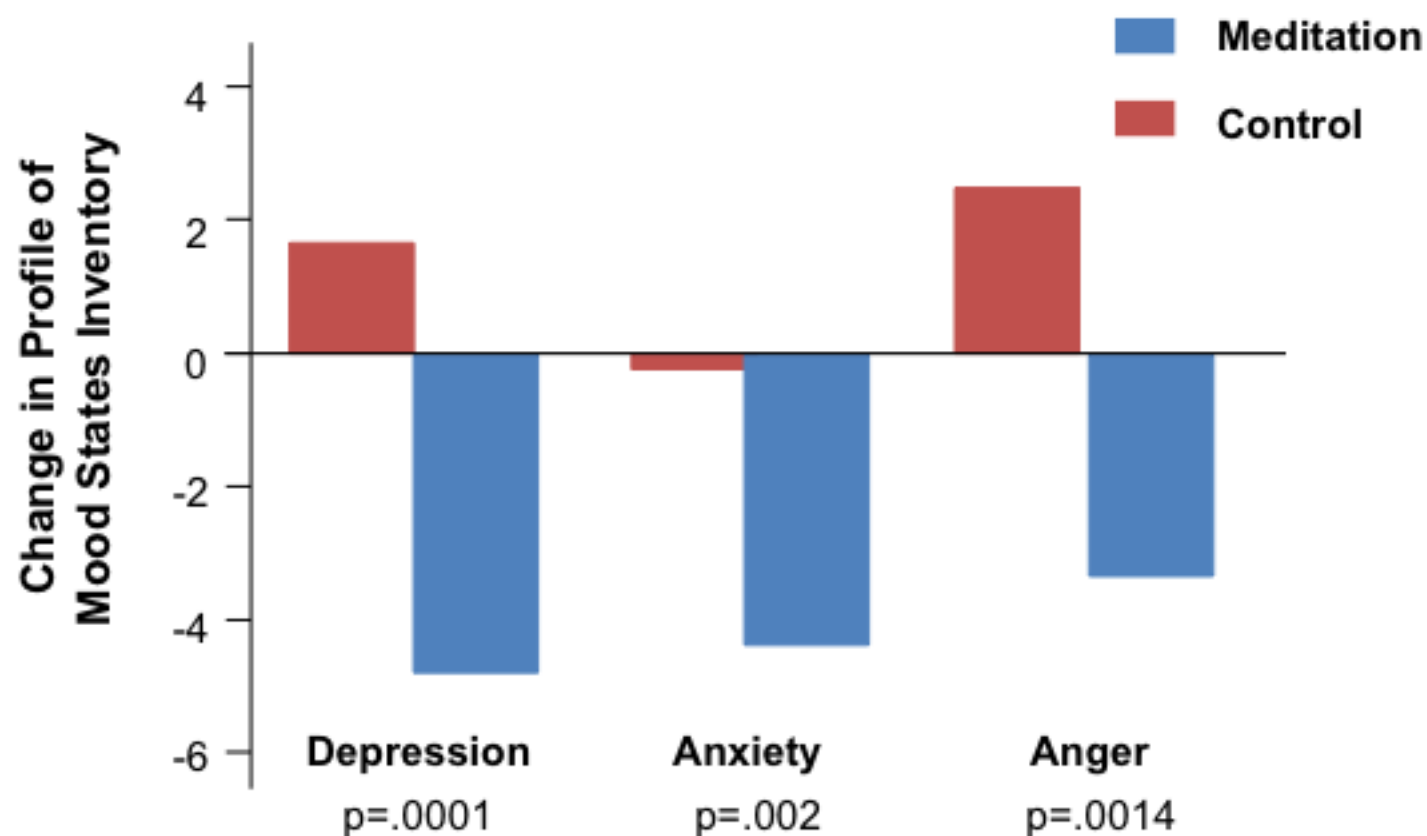


\* Between Fall 2007 & 2008 at Visitation Valley Middle School

\*\* African American GPA started 30% lower than school average in Fall 2007

Source: SFUSD

## Decreased Psychological Distress in Administrators and Teachers, over 4 Month Period





# REVOLUTION





# Resources



## Resources for Clinicians

AAP STAR Center  
<https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/Screening/Pages/default.aspx>

National Pediatric Practice Community on ACEs  
[nppcaces.org](http://nppcaces.org)



## For Home Visitors

Thrive Washington – NEAR@Home ACEs Toolkit:  
<https://thrivewa.org/work/trauma-and-resilience-4/>



## For 2-Gen Practitioners

National Crittenton Foundation ACEs Toolkit for Providers  
<http://www.nationalcrittenton.org/aces-toolkit-for-providers/>



## For Mental Health Providers

CANarratives  
<http://www.CANarratives.org>

National Child Traumatic Stress Network  
<https://www.nctsn.org>



## Community Networks

ACEs Connection  
<http://www.acesconnection.com>