Root of the Root :
Translating the Science of Toxic Stress to Transform Health

Surgeon General, State of California
May 20, 2019

DISCOVERY

Adverse Childhood Experiences

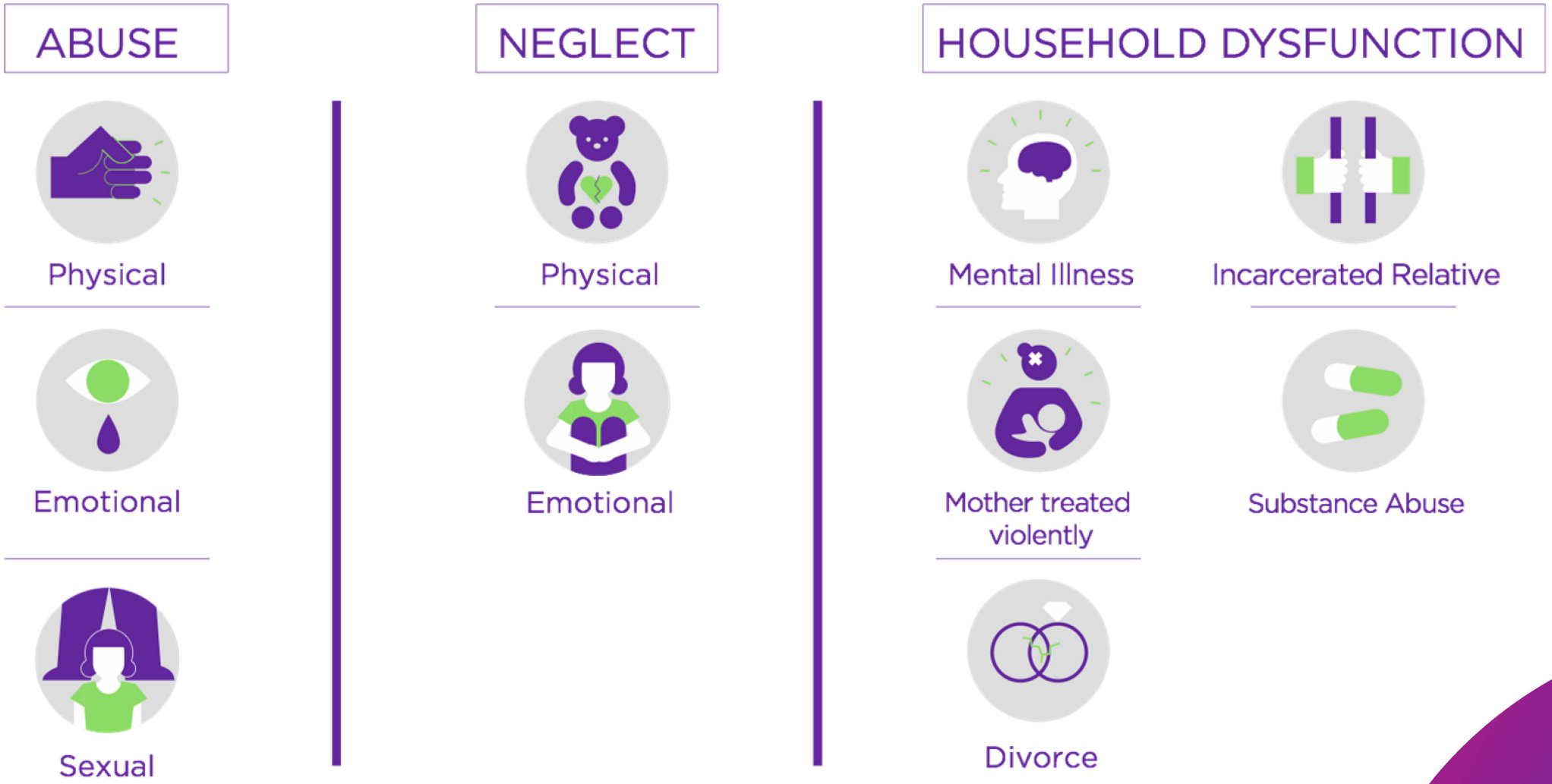


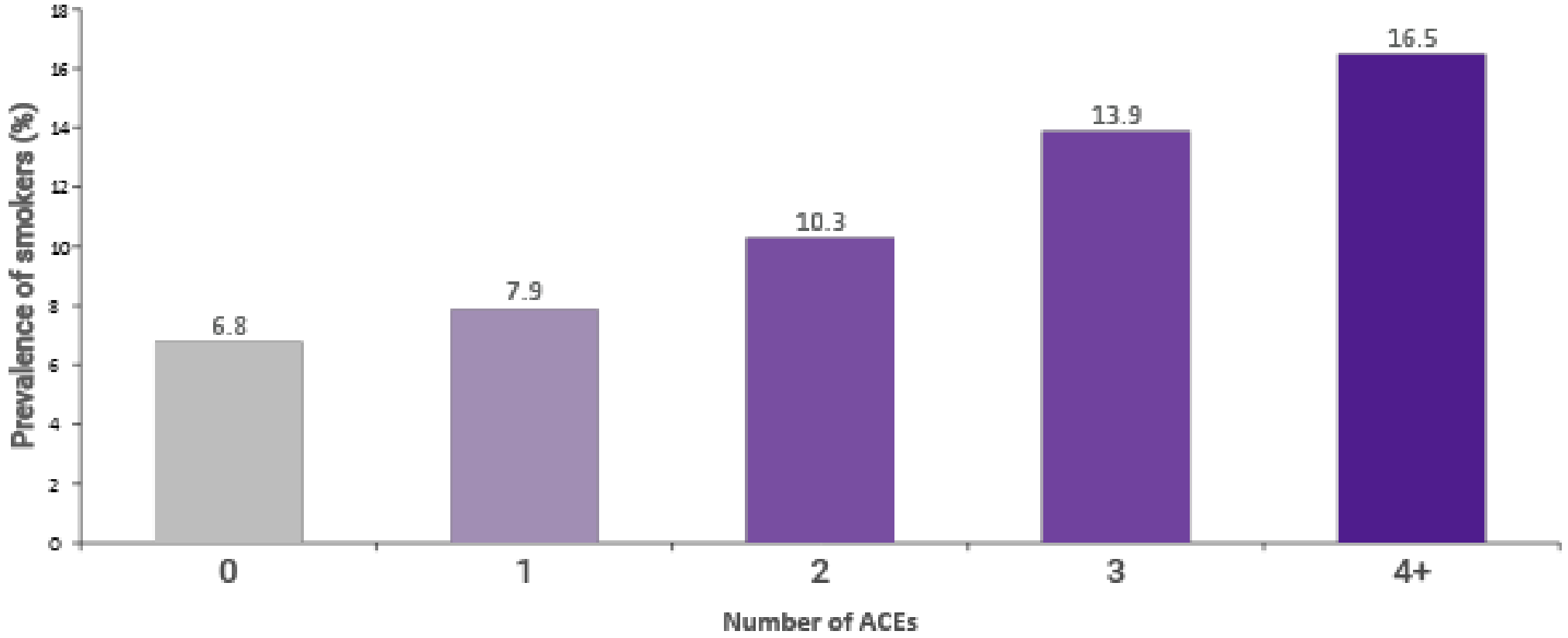
Image courtesy of the Robert Wood Johnson Foundation

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

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

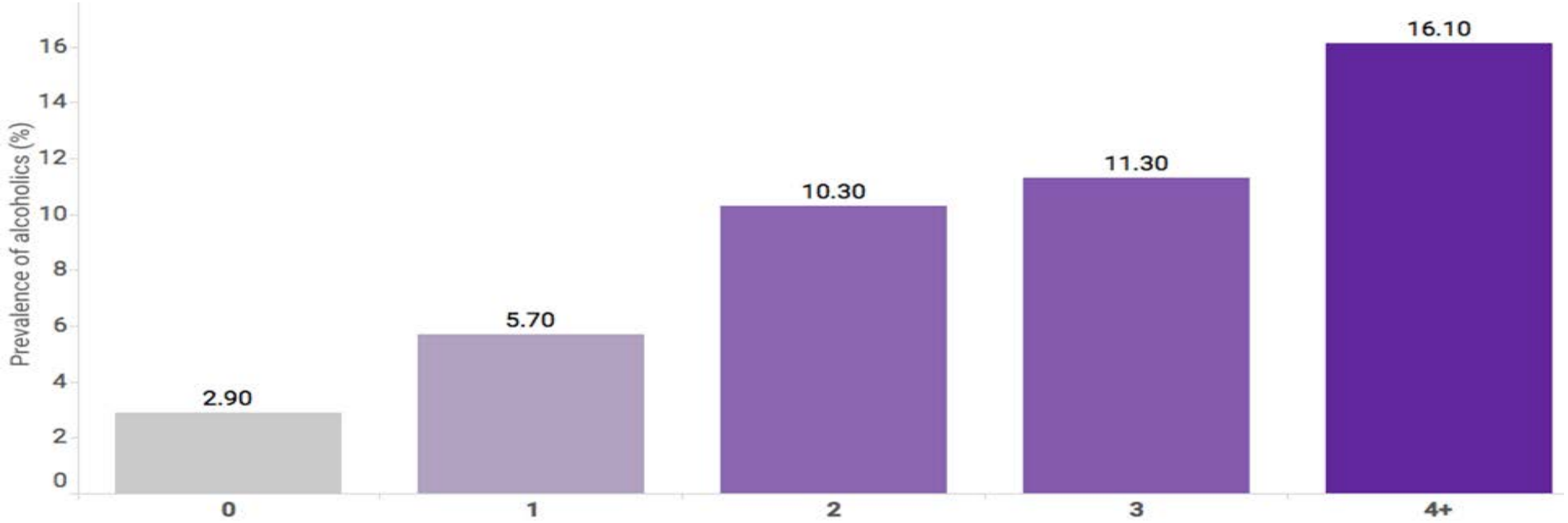
https://www.cdc.gov/nchs/fastats/leading-causes-of-death.htm, CDC 2016, Felitti 1998, BRFSS 2013, Odds Ratio associated with ≥ 4 ACEs -Hughes 2017

Prevalence of smoking in adults by ACE score



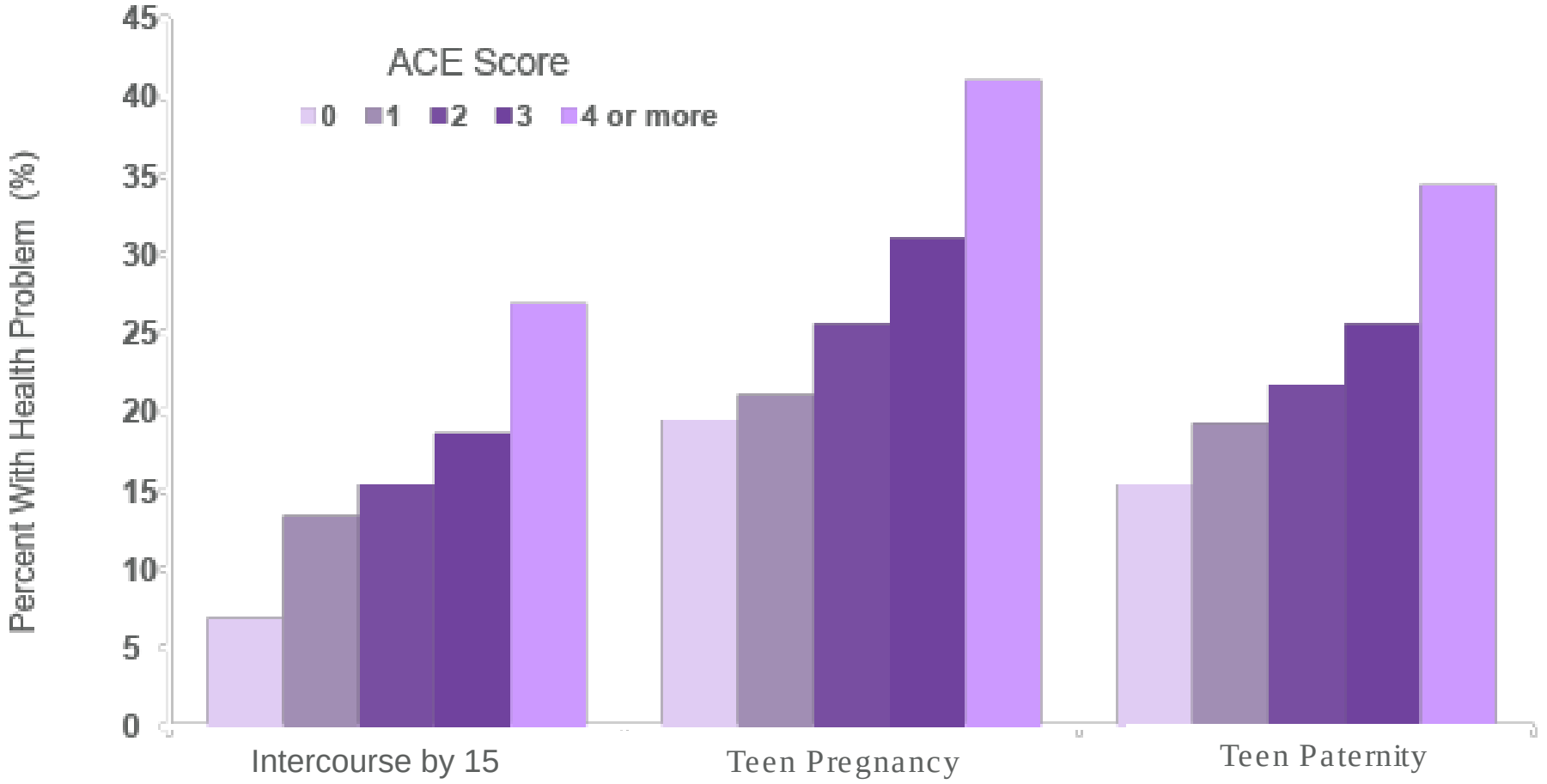
Source: Felitti, 1998

Prevalence of alcoholism in adults by ACE score



Source: Felitti, 1998

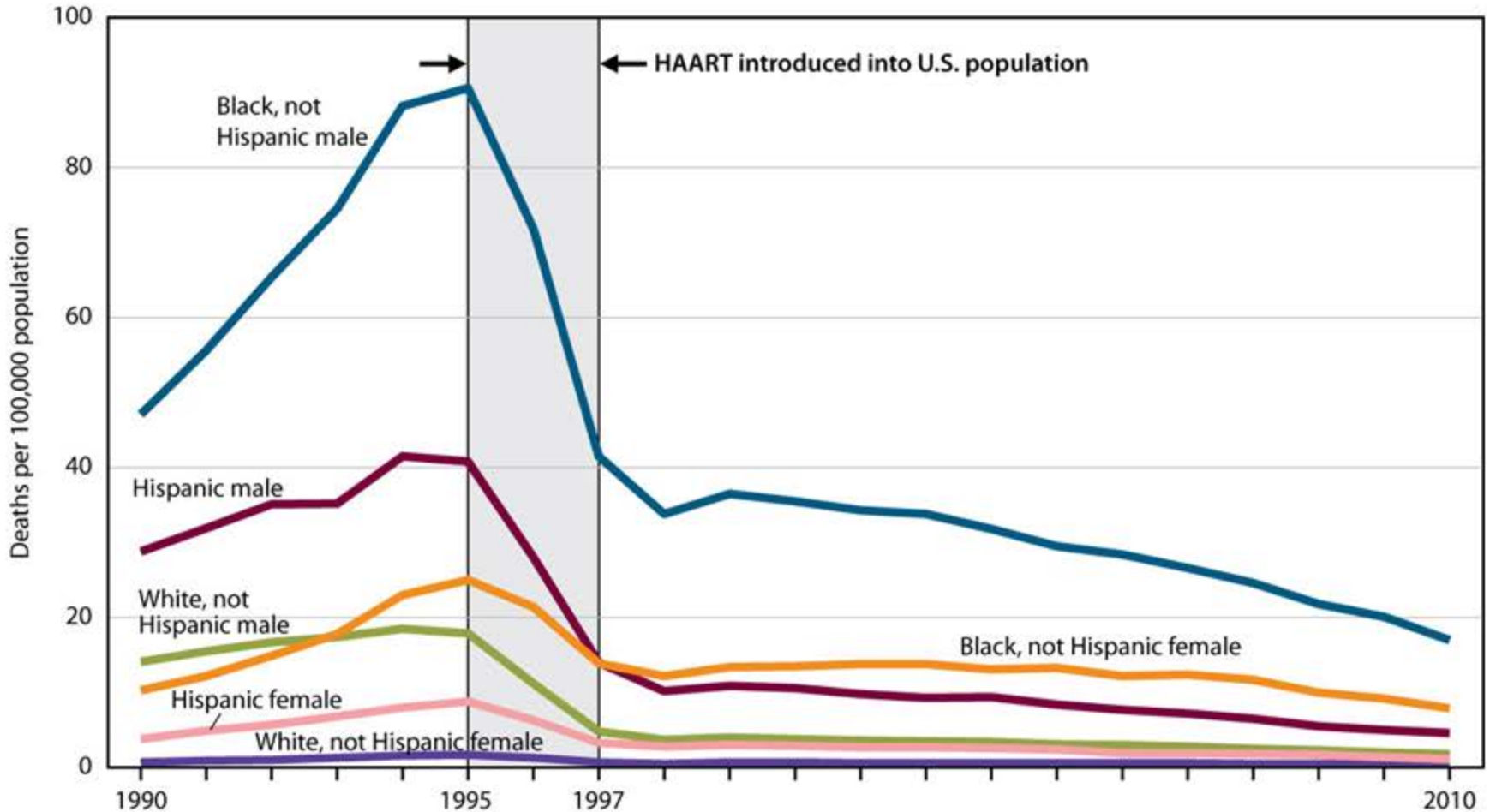
ACE score and teen sexual behaviors



Source: Felitti 1998

DIAGNOSIS

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

Ulrich-Lai 2009, Roth 1988, Iperato 1991, Charmandari 2005, McEwen 2010, McEwen 2007, Bierhaus et al. 2003; Kiecolt-Glaser et al. 2003

Multi-systemic Alterations

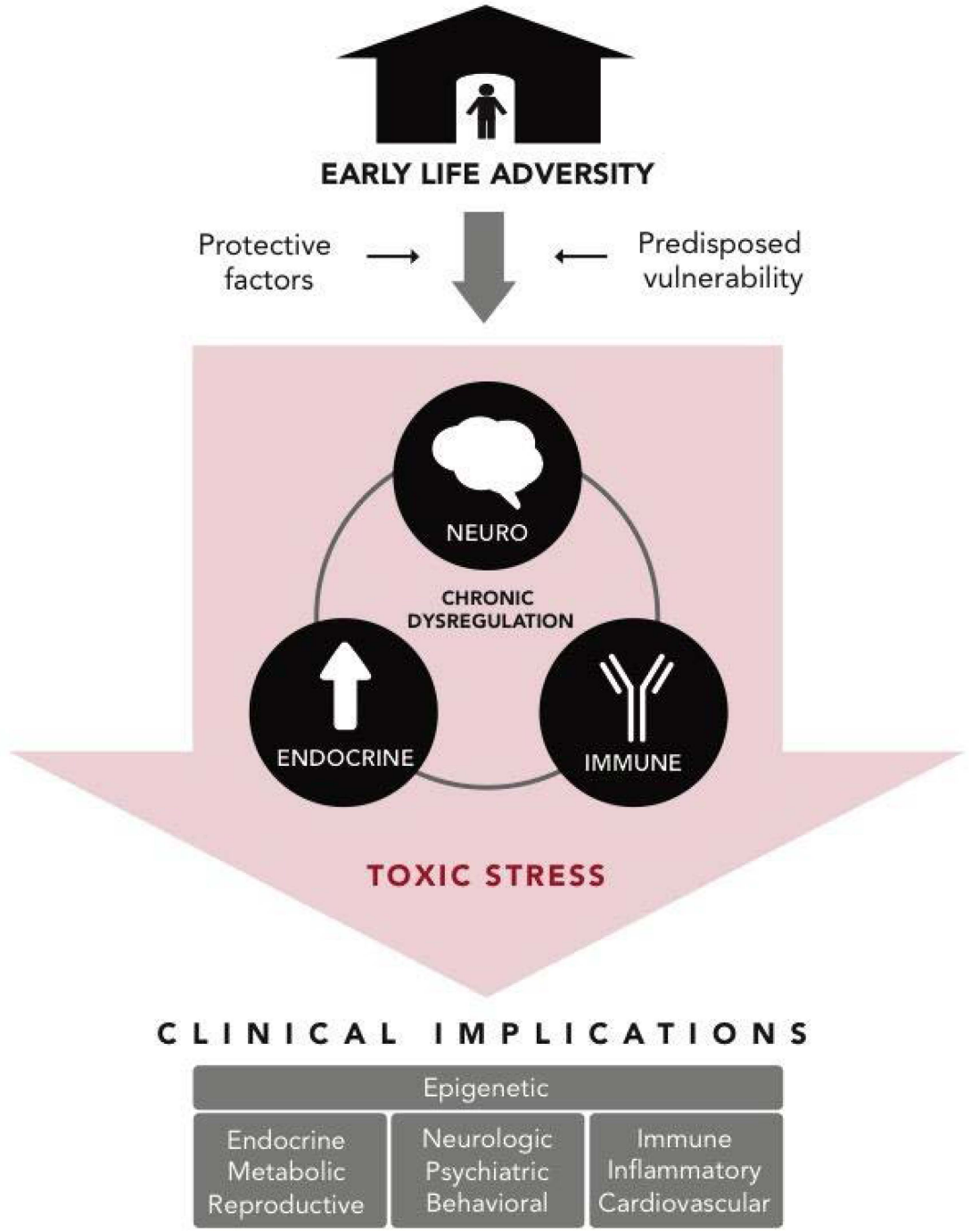
Endocrine

- 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

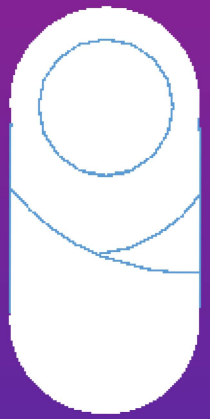
Miller 2007, Su 2014



Adapted from Bucci et al, 2016

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

Oh et al., in press, Matheson 2016, Kerker 2015, Shen 2016, Ryan 2015, Giordano 2014, Rhodes 2012, Thompson 2017, Bjorkenstam 2015

Prenatal and perinatal outcomes

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

Fetal loss
Pre-term birth
Low Birthweight

PRESCRIPTION

Early identification and intervention are critical

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.

Source: Bick et al, 2015, Feldman et al, 2014, Kandola et at, 2016

Buffering the Toxic Stress Response

Immunologic

- Meditation was associated with decreased IFN-γ 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.

Source: Bick et al, 2015, Feldman et al, 2014, Cohen et al 2015, Carlson et al, Irwin, et al. 2015 Boufleur et al, 2013

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

Source: Feldman et al, 2014, Cohen et al 2015, Boufleur et al, 2013

Buffering the Toxic Stress Response

Source: The Deepest Well, Healing the Long Term Effects of Childhood Adversity, Burke Harris 2018

CENTER FOR YOUTH WELLNESS
health begins with hope

UCSF Benioff Children's Hospital Oakland

UCSF University of California San Francisco

- 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."

- Has your child ever lived with a parent/caregiver who went to jail/prison?
- Do you think your child ever felt unsupported, unloved and/or unprotected?
- 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)
- Has a parent/caregiver ever insulted, humiliated, or put down your child?
- 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?
- 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)?
- Has your child ever seen or heard a parent/caregiver being screamed at, sworn at, insulted or humiliated by another adult? **Or** Has your child ever seen or heard a parent/caregiver being slapped, kicked, punched beaten up or hurt with a weapon?
- Has any adult in the household often or very often pushed, grabbed, slapped or thrown something at your child? **Or** Has any adult in the household ever hit your child so hard that your child had marks or was injured? **Or** 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?
- 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?
- 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?

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

- 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)
- 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)?
- 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)?
- 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?
- Has your child ever been separated from their parent or caregiver due to foster care, or immigration?
- Has your child ever lived with a parent/caregiver who had a serious physical illness or disability?
- Has your child ever lived with a parent or caregiver who died?

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

NPPC Model

Routine screening at the Well Child Exam

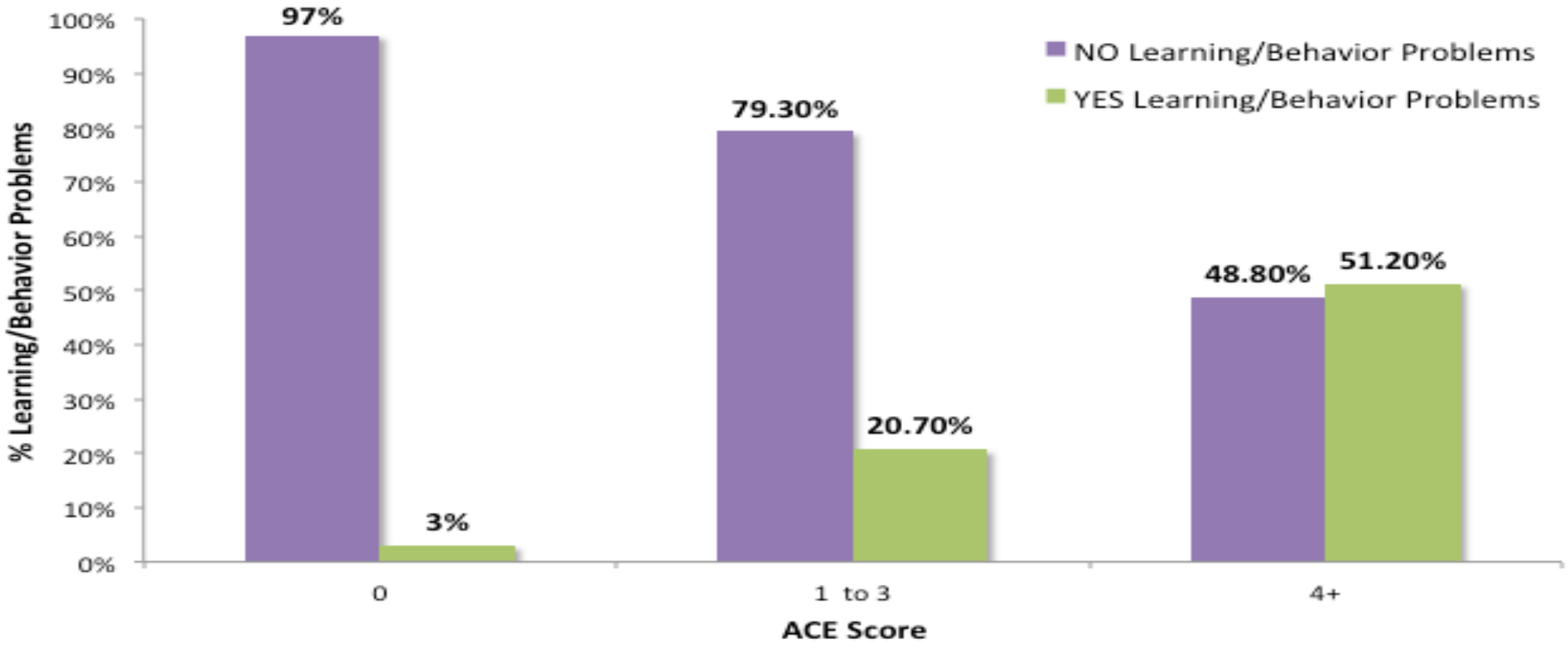
ACE Score 0-3 w/o symptoms

ACE 1-3 with symptoms or ≥4

Anticipatory guidance

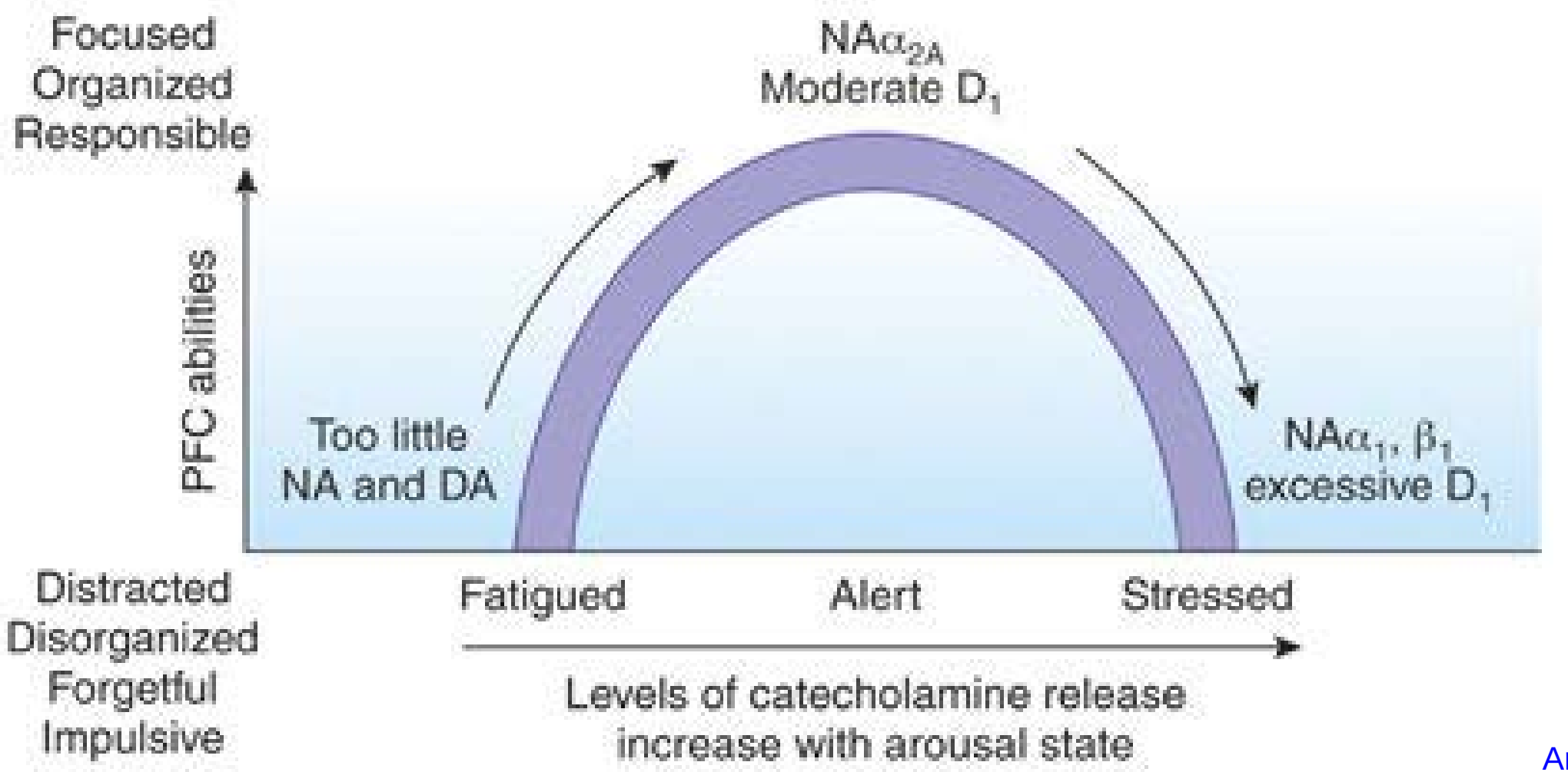
Toxic Stress Treatment

Learning/Behavior Problems in Youth



Adapted from Burke et al, 2011

PFC Activity Relative to Stress Hormones



Arnsten (2009)

34M

American Children At Risk for Toxic Stress

33,000

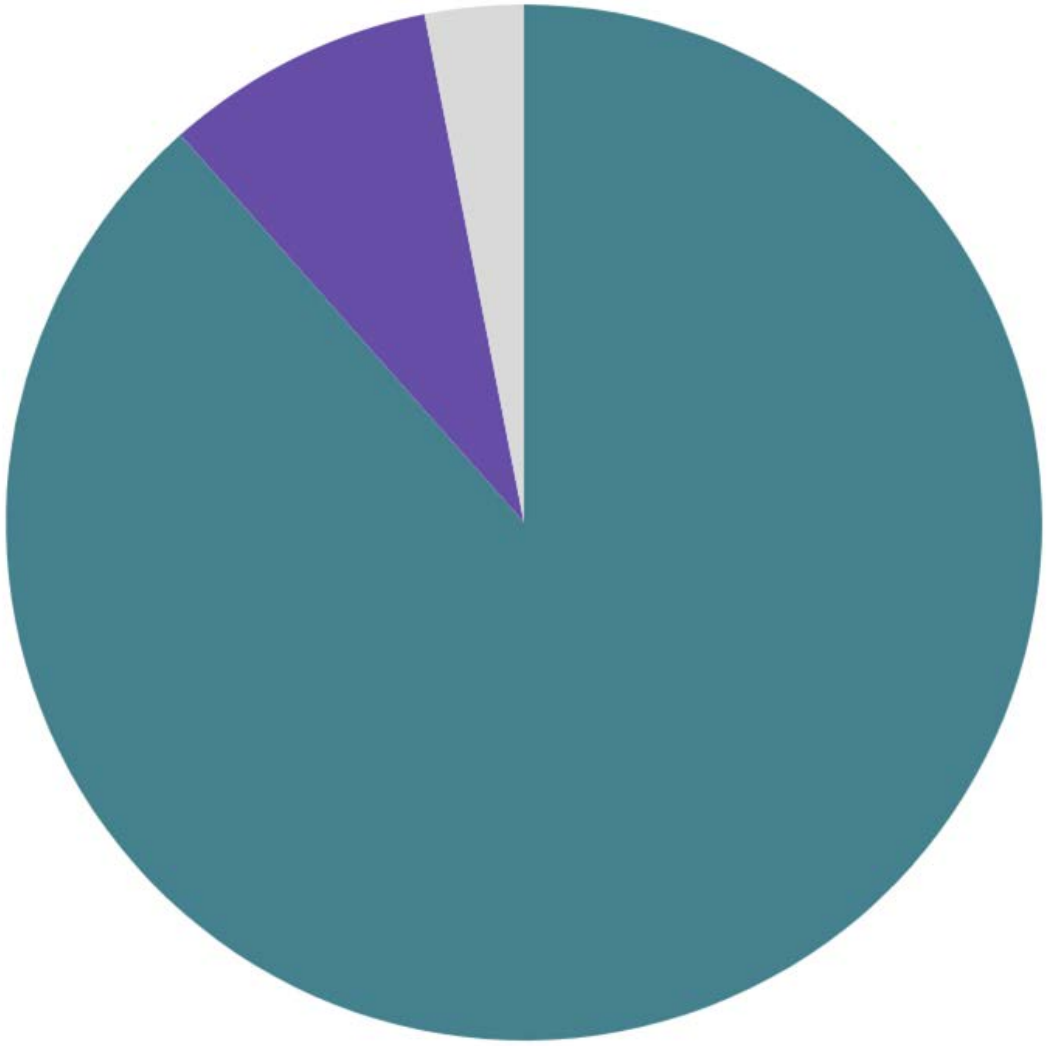
primary care pediatricians registered with the AAP

4%

screening for ACEs

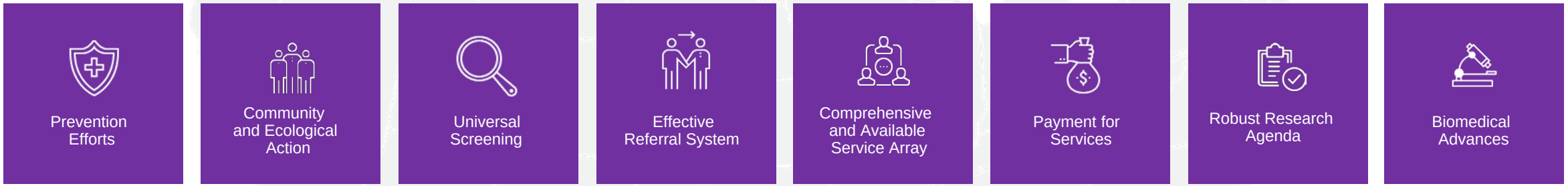
11%

familiar with the ACE research



ACADEMIC PEDIATRICS 2016;16:154-160

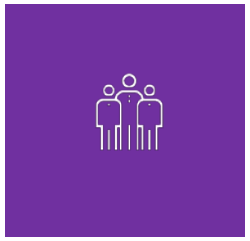
Key Drivers for Addressing Toxic Stress



Source: Center for Youth Wellness

Prevention Efforts

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



Collaborating across sectors (education, justice, health, faith, early childhood, human services, etc.) to create accountable communities and collective equitable action

Practice Transformation

Ensuring universal screening for ACEs & toxic stress (CA AB340)

Strengthening referral systems to help children and families access the right services ($100M home visiting)

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

Public and private reimbursement ($45M in proposed budget to pay primary care providers for ACE screening)

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


REVOLUTION