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

Surgeon General, State of California
May 20, 2019
Adverse Childhood Experiences

**ABUSE**
- Physical
- Emotional
- Sexual

**NEGLECT**
- Physical
- Emotional

**HOUSEHOLD DYSFUNCTION**
- Mental Illness
- Incarcerated Relative
- Mother treated violently
- Substance Abuse
- Divorce

Image courtesy of the Robert Wood Johnson Foundation
ACEs dramatically increase risk for 7 out of 10 leading causes of death

<table>
<thead>
<tr>
<th></th>
<th>Leading Causes of Death in US, 2015</th>
<th>Odds Ratio Associated with ≥ 4 ACEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Heart Disease</td>
<td>2.1</td>
</tr>
<tr>
<td>2</td>
<td>Cancer</td>
<td>2.3</td>
</tr>
<tr>
<td>3</td>
<td>Chronic Lower Respiratory Disease</td>
<td>3.0</td>
</tr>
<tr>
<td>4</td>
<td>Accidents</td>
<td></td>
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<tr>
<td>5</td>
<td>Stroke</td>
<td>2.4</td>
</tr>
<tr>
<td>6</td>
<td>Alzheimer’s</td>
<td>11.2</td>
</tr>
<tr>
<td>7</td>
<td>Diabetes</td>
<td>1.5</td>
</tr>
<tr>
<td>8</td>
<td>Influenza and Pneumonia</td>
<td></td>
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<tr>
<td>9</td>
<td>Kidney Disease</td>
<td></td>
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<tr>
<td>10</td>
<td>Suicide</td>
<td>30.1</td>
</tr>
</tbody>
</table>

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
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

Miller 2007, Su 2014
EARLY LIFE ADVERSITY

Protective factors

Predisposed vulnerability

TOXIC STRESS

NEURO

ENDOCRINE

IMMUNE

CHRONIC DYSREGULATION

TOXIC STRESS

Epigenetic

Endocrine Metabolic Reproductive

Neurologic Psychiatric Behavioral

Immune Inflammatory Cardiovascular

CLINICAL IMPLICATIONS

Adapted from Bucci et al, 2016
Health and behavioral outcomes in children

- Developmental 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

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
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.

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.

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

- Balanced Nutrition
- Regular Exercise/Physical Activity
- Mindfulness/Meditation Practices
- Psychotherapy and/or Psychiatric Care
- Supportive Relationships
- Quality Sleep

Source: The Deepest Well, Healing the Long Term Effects of Childhood Adversity, Burke Harris 2018
Pediatric ACEs and Related Life Events Screener (PEARLS) – Child (Parent/Caregiver Report)

To be completed by Caregiver

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

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.”

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Unknown</th>
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<tbody>
<tr>
<td>Has your child ever lived with a parent/caregiver who went to jail/prison?</td>
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<td>Do you think your child ever felt unsupported, unloved and/or unprotected?</td>
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<td>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)</td>
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<td>Has a parent/caregiver ever insulted, humiliated, or put down your child?</td>
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<td>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?</td>
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<td>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)?</td>
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<td>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?</td>
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<tr>
<td>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?</td>
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<tr>
<td>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?</td>
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<td>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?</td>
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</table>

Add up the “Yes” answers for this first section: ☐

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<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Unknown</th>
</tr>
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<tr>
<td>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)</td>
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<td>Has your child experienced discrimination (for example being harassed or made to feel inferior or excluded because of their race, ethnicity, gender identity, sexual orientation, religion, learning differences, or disabilities)?</td>
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<td>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)?</td>
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<td>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?</td>
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<td>Has your child ever been separated from their parent or caregiver due to foster care, or immigration?</td>
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<td>Has your child ever lived with a parent/caregiver who had a serious physical illness or disability?</td>
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<td>Has your child ever lived with a parent or caregiver who died?</td>
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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
Anticipatory guidance

ACE 1-3 with symptoms or ≥4
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
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

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