The Science of Adverse Childhood Experiences (ACEs) and Toxic Stress

The U.S. is experiencing an epidemic of mental health issues and chronic diseases such as obesity, diabetes, heart disease, chronic pain, anxiety, depression, and suicide. It spans all demographics. A growing body of research is demonstrating the ways in which toxic stress – the biological stress response of our bodies and brains to severe, prolonged, or repeated stressors – is a contributing factor. That is why it is critical to understand the impact of toxic stress on our health and well-being and learn effective strategies to manage it.

What are Adverse Childhood Experiences (ACEs)?

Adverse Childhood Experiences (ACEs) are potentially traumatic events that occur in a person's life by age 18 years. ACEs and the toxic stress that may occur as a result are at the root of some of the most common and serious health and social challenges facing our communities.[1–3] ACEs are strongly linked to nine of the 10 leading causes of death in the United States, including heart disease, cancer, and diabetes.[1,4–8] The life expectancy of individuals with six or more ACEs is 19 years shorter than that of individuals with none.[9]

The term "ACEs" refers to 10 categories of adversities in three domains experienced by 18 years of age that were identified in the landmark 1998 study by the Centers for Disease Control and Prevention (CDC) and Kaiser Permanente.[1,2]

ACEs are common. About two-thirds of U.S. adults have experienced at least one ACE, and 17% have experienced four or more ACEs.[10] ACEs affect all communities and cross racial, ethnic, socioeconomic, gender, and geographic lines. However, some populations are affected disproportionately. Individuals from communities that are exposed to racism, discrimination, and/or marginalization on the basis of identity by race, sexual orientation, and/or gender, for example, are at greater risk for exposure to societal and structural inequities and injustices that lay a foundation for additional increased risk for exposure to ACEs.[10]

It is important to recognize that the 10 ACEs are not the only risk factors for toxic stress. Other factors such as racial discrimination, separation from a parent or a caregiver for reasons like deportation or migration, or even a medical trauma may also be risk factors for toxic stress.[11]

> ### Using the terms parent and caregiver
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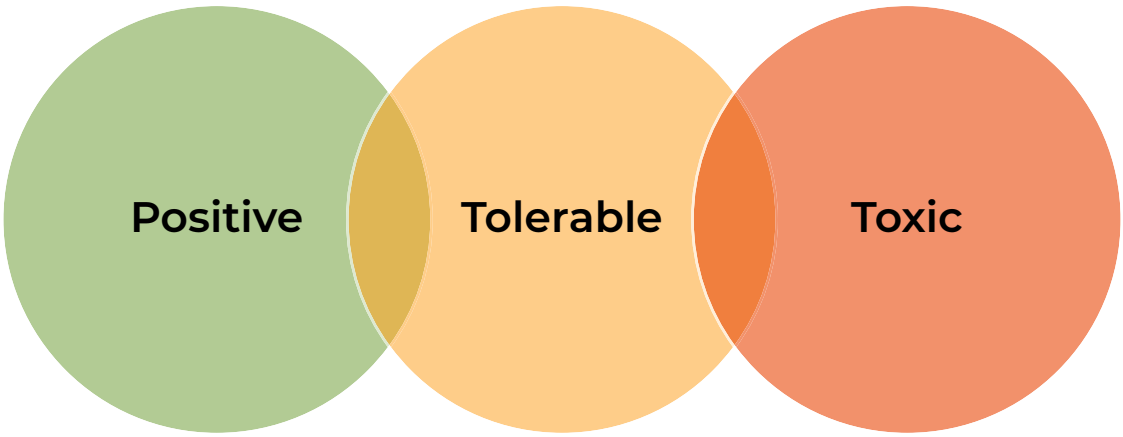
> The toolkit uses the words "parent" and "caregiver," to represent the primary caregiver of a child, including those of non-birth, non-biological or non-legal relationship such as grandparents, other relatives, or kinship caregivers (adults who are family-like such as neighbors and others).

What is toxic stress? Positive, tolerable, and toxic stress

One way to explain toxic stress is to describe stress as a spectrum of positive, tolerable, and toxic.[12] Some stress is good! We need stress to function and to get things done in our daily lives. However, too much stress happening again and again can lead to toxic stress, which can negatively affect our health and well-being.

Some clients may not be aware of how much stress is affecting their lives and health. The realization may be surprising or upsetting. It can help to explain the spectrum of stress and how the Stress Busters can help.



Positive Stress

A short-lived stress response with brief increases in heart rate and blood pressure have been called positive stress by The Center on the Developing Child.[12,13]

- A job interview, a test, playing a competitive sport, or facing social challenges like meeting or working with individuals with different lived experience, are all things that can activate our stress response system.
- We can use the energy from the positive stress to do better on our test or in that job interview.
- This type of short-lived stress response does not impact our long-term health and well-being.
- Stress Busters can be effective to help calm the stress response when needed. For example, use Stress Busters to get a good night's sleep before the big test or the big interview.

Tolerable Stress

Sometimes something more serious happens to us, such as the death of a loved one or pet, a serious injury, or a natural disaster event, and our stress response may be more activated for a longer period of time.

- Protective factors in our lives (such as a caring and dependable family member or friend), can make the stress tolerable because we have the capacity or tools we need to cope with the current stressor and lower the stress response.
- This toolkit provides tools and strategies to help make stress "tolerable," calming the stress response both in the moment and for long-term prevention of and healing from toxic stress.

Toxic Stress

Toxic stress isn't an event, experience, or stressor. Instead, toxic stress refers to the biological stress response of our bodies and brains to severe, prolonged, or repeated stressors, such as ACEs, and interpersonally or structurally experienced racism or discrimination.[11,13,14]

> The National Academy of Science, Engineering, and Medicine (NASEM) describes toxic stress as "the prolonged activation of the stress response systems that can disrupt the development of brain architecture and other organ systems, and increase the risk for stress-related disease and cognitive impairment, well into the adult years... For children, the result is the disruption of the development of brain architecture and other organ systems and an increase in lifelong risk for physical and mental health disorders."[14]

- If the stress response system is activated too often, our brains and bodies adapt and become very good at detecting and reacting to threats – even when the threat is no longer around. At some point, this heightened awareness may go from being adaptive and lifesaving to potentially damaging to our health.
- Extended periods of increased heart rate, blood pressure, immune system activation, elevated glucose levels, etc. (stress response), lead to increased risk for long-term changes in the health of our brains and bodies.
- It may take more support, tools, strategies, and interventions to cope with the current stressor, lower the stress response, and to address the longer-term changes to our brains and bodies.
- Stress Busters can be a framework for healing that can help prevent and heal the effects of toxic stress.

Impacts of toxic stress: ACE-Associated Health Conditions[1,5,15–17]

The more ACEs a person is exposed to, the higher the risk of experiencing toxic stress and having health conditions also known as ACE-Associated Health Conditions (AAHCs).[18] Many AAHCs have been identified for children and adults; the following list shows examples of common and serious AAHCs.

- **Anxiety and depression:** If our brain is constantly in stress mode, we may be more prone to anxiety, depression, impulsivity, and/or irritability.
- **Diabetes:** If our hormones are repeatedly telling our body to pump out extra sugar, our risk for diabetes may increase.
- **Heart disease:** Constantly having adrenaline telling our hearts to beat faster and harder, as well as activating our immune system, may increase the risk for high blood pressure, heart disease, auto-immune disease, and inflammation.
- **Attention Deficit Hyperactivity Disorder (ADHD):** Spending too much time with our emotional brain and not practicing enough with our thinking brain may increase our risk for executive function problems, learning issues, poor decision-making, and decreased emotional control and self-regulation skills, which can be mistaken for ADHD.
- **Substance misuse or dependence:** If our reward-processing centers have been disrupted, we may turn to cigarettes, alcohol, or drugs to self-medicate and attempt to regulate our stress hormones.

For a list of ACE-Associated Health Conditions for children and adults, see this ACEs Aware resource.

ACEs can affect multiple generations

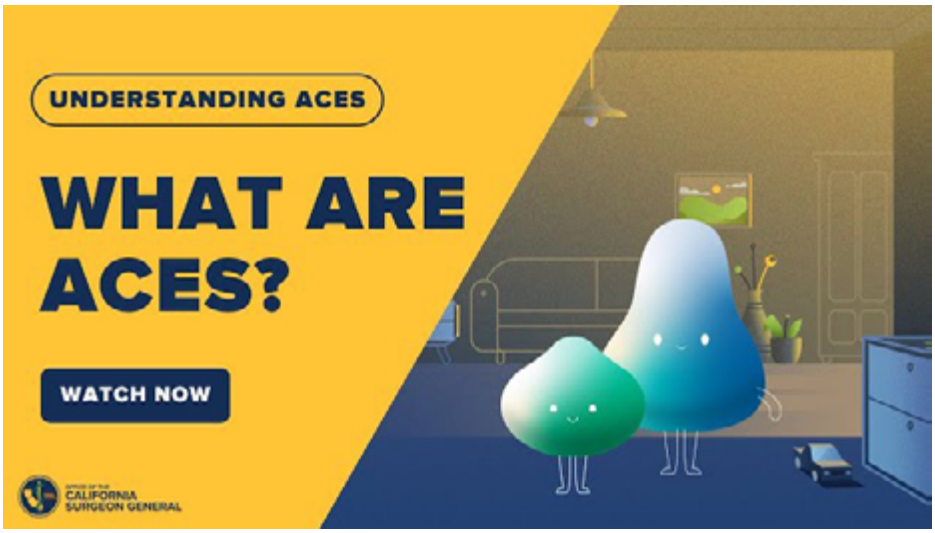
Having parents/caregivers with ACEs can increase the risk of an individual having ACEs. The intergenerational transmission of toxic stress from ACEs, other adversities, and trauma occurs when ACEs alter the parent/caregiver's body and brain or behavior in ways that affect the development and health of their children and grandchildren.[11] ACEs of parents and caregivers, through the prolonged activation of the stress response (i.e., toxic stress), can even alter how genes of both parents/caregivers and their children are read and how they function.[19,20] Adverse experiences can be related to interpersonal relationships, such as those in one's family, increasing the likelihood of intergenerational transmission.

In addition, historically unjust policies and practices have resulted in social and structural inequities across communities and populations, and in an accumulation of impacts for individuals, families, and communities over time.[11] Adversity can occur and be transmitted from generation to generation through individual and community-wide exposure to such injustices, as well as from historical traumatic events (e.g., the Holocaust,[21–23] Native American genocides,[24–27] slavery[28–30]), discrimination, and interpersonal and structural racism.

At the community level, transmission of the impacts of toxic stress perpetuates and exacerbates socially rooted inequities in community investment, yielding ongoing disparities in health, academic achievement, socioeconomic mobility, and mortality.[31]

All of these forms of adversity carry significant risk for the intergenerational transmission of toxic stress. CBOs can support the disruption of the intergenerational cycle of ACEs and toxic stress by contributing to the prevention and mitigation of systems-level inequities in the social drivers of health. Additionally, CBOs can provide individual-level support and services to meet immediate needs related to health and well-being.

Watch this video from the Office of the California Surgeon General to learn more about ACEs and toxic stress.



Watch this TED Talk by Dr. Nadine Burke Harris, former Surgeon General of California, about how childhood trauma affects health across a lifetime.

Toxic stress is preventable and treatable

The good news is that we can all prevent and heal from toxic stress no matter our age or life situation. For children, a consensus of scientific data demonstrates that early detection and intervention are associated with improved health outcomes.[32]

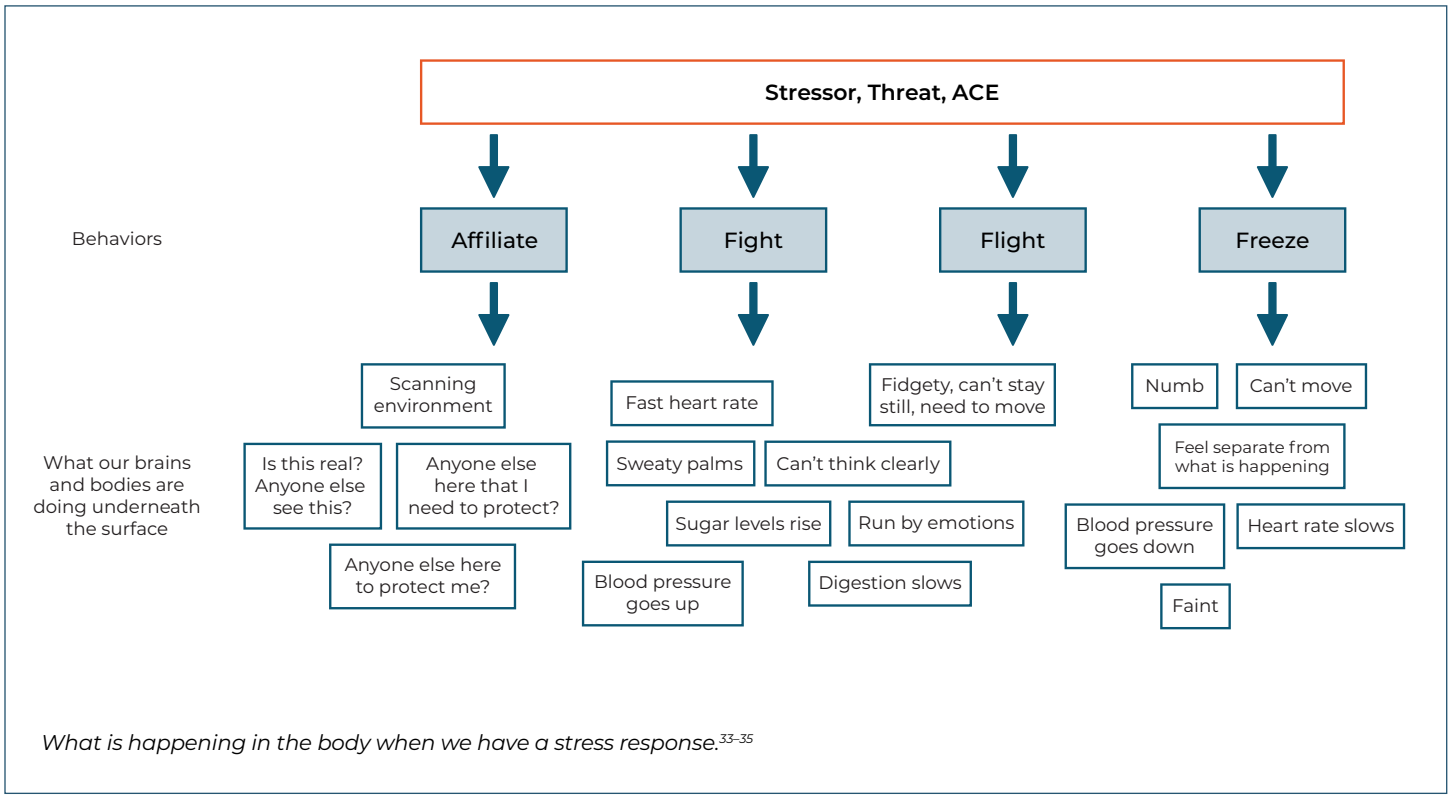
Even though we can't change what happened to us in the past, we can still heal toxic stress at any age. Using evidence-based, culturally sensitive, and trauma-informed approaches like the Stress Busters, we can significantly improve our own health and well-being, as well as that of generations to come.

Understanding the biological stress response: The brain and body

How does adversity in childhood become toxic stress and increase our risk for health problems later in life?

Our biological stress response system

When we experience an event as threatening, our stress response is activated. There are four main behavioral stress responses: 1) affiliate, 2) fight, 3) flight, and 4) freeze. Following is what happens in our bodies for each type of response.[32-35]



What is happening in the body when we have a stress response.[33-35]

1) Affiliate (also sometimes referred to as "fawn" or "tend and befriend")

- This response involves the action of protecting others (tend) and looking for support (befriend).
- If we did not receive this support in childhood and were not taught these skills or if we cannot find this support and protection in our current lives, we will more likely instinctually react with fight, flight, or freeze stress responses.

2) Fight or 3) Flight

- The sympathetic nervous system, which is responsible for the body's automatic "fight or flight" response, and the hypothalamic-adrenal-axis, which controls reactions to stress and regulates many body processes, are activated.
- Heart rate, blood pressure, and respiratory rate increase.
- Our thinking brain may go offline, and we are led by our emotional brain (the amygdala and limbic system take over).
- Digestion slows.
- Our body mobilizes energy (glucose, oxygen) to fight or flee.

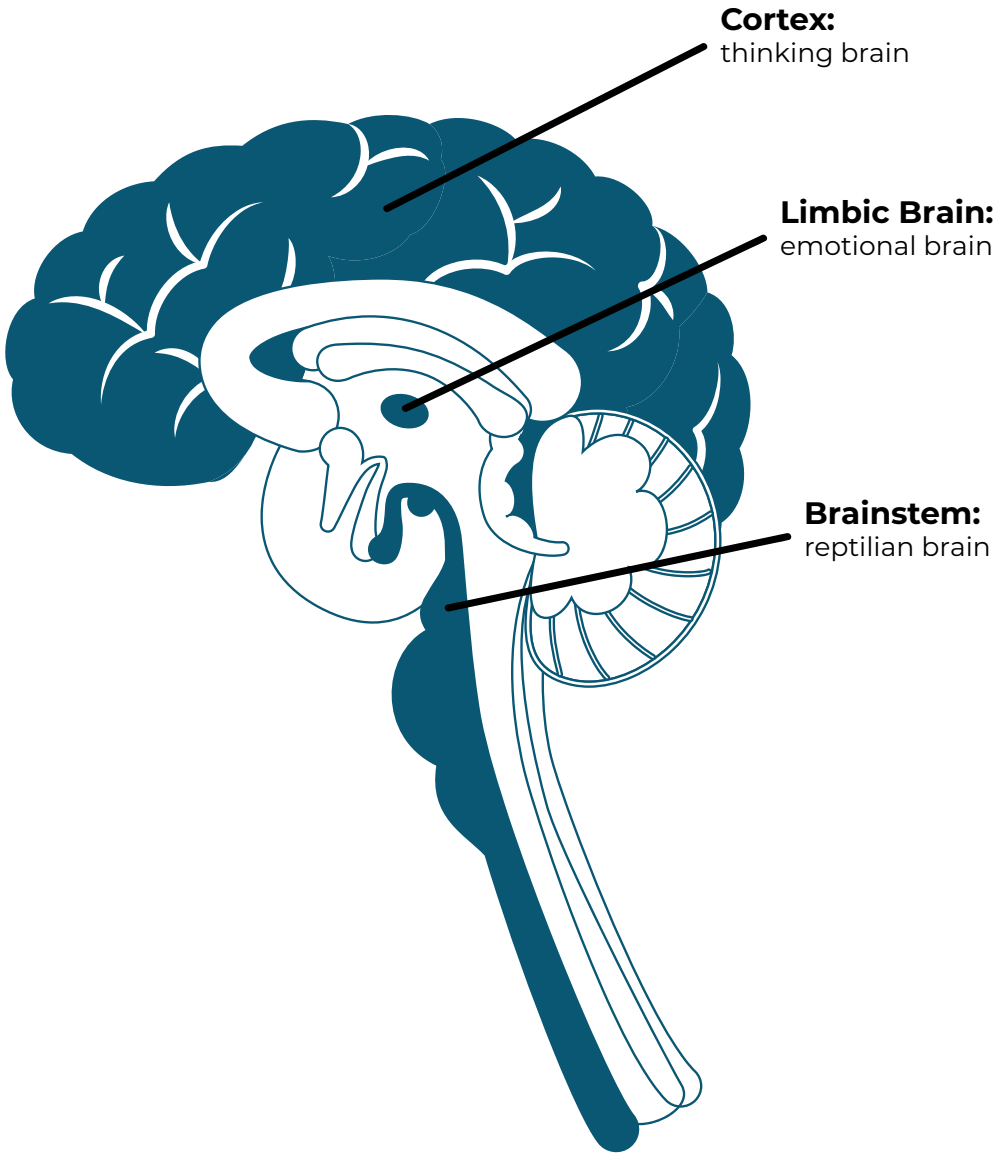
4) Freeze

- Two important neurologic processes are involved in the freeze response:
  - The parasympathetic nervous system, which is responsible for the body's automatic functions like heart rate and digestion, lowers heart rate and conserves energy.
  - Pain processing pathways help us feel numb and decrease pain.
- The freeze response can look and feel like:
  - Staying quiet, still, and withdrawn.
  - Being frozen in place.
  - Floating and disconnected from the trauma.
  - Collapsing or fainting.
- These are helpful, instinctual survival strategies to conserve energy and decrease pain while waiting for the threat to pass.
- This behavioral response is more likely activated when we feel powerless or helpless in the face of a threat.

How stress affects the brain

Children and adults can act differently and may not have full control over their actions when under stress. If someone becomes extremely angry, upset, or triggered, we can recognize this as a biological stress response. When we're in fight, flight, or freeze, our thinking brain may go offline and it can be very hard to reason, make good decisions, or act as we normally would. Knowing this can help us be more compassionate towards ourselves and others.

Why do we act differently when stressed? There is a lot going on in the brain. The "triune brain"[36] model is an oversimplified but helpful way to show how different behaviors and functions occur in three ("tri") regions of the brain.



The three regions of the triune brain

- **Cortex (thinking brain):** The top part of our brain is our cortex. It is involved with higher-level thinking and processing of information. The prefrontal cortex behind our forehead is particularly involved in planning, organizing, and complex thought. While it is important for learning and critical thinking, in an emergency we don't want to waste time planning – we want our instincts and emotions to take over. When there is a threat, this part of the "thinking brain" may essentially turn off. That is why we are more likely to respond reactively in a stressful situation, such as by yelling or screaming, shutting down, or spacing out. Using the Stress Busters to calm the stress response helps to get the thinking brain back online so that we can talk and problem solve.
- **Limbic brain (emotional brain):** The limbic system – which includes the amygdala, also known as the "threat detector" – is like an emotional processing center. It helps us have the emotional energy to respond to the threat. When we detect danger, it directs the rest of the brain to do what has to be done instinctually to keep us motivated and safe. Using the Stress Busters to calm the stress response helps to dial down emotional threat responses (e.g., reactivity and anger) and dial up emotional calming responses (e.g., calm and pleasure).
- **Brainstem (reptilian brain):** The brainstem controls our automatic functions – heart rate, breathing, blood flow, and temperature. It also is involved in instinctual processes to keep us safe and is critical for the fight, flight, and freeze responses. For example, it helps us speed up our heart rate and get energy to the muscles to prepare to fight or flee. Using the Stress Busters to calm the stress response helps to regulate bodily functions that originate in the brainstem, resulting in a more balanced state (e.g., deep breaths, stable and normal blood pressure levels, reduced muscle tension).

To explain to clients what happens in the brain during a stress response, use a visual tool: Dr. Dan Siegel's "Flipping our lid" model (**see the *Listen, Partner, Connect: Framework and skills for a trauma-informed approach with clients*** chapter of the toolkit).

> **Watch this video from the Dana Foundation to learn more about how stress affects the brain and body.**
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