

ACEs and Toxic Stress: A Public Health Crisis



Excerpt from *Roadmap for Resilience: The California Surgeon General's Report on Adverse Childhood Experiences, Toxic Stress, and Health*

ADVERSE CHILDHOOD EXPERIENCES

The landmark 1998 Centers for Disease Control and Prevention (CDC) and Kaiser Permanente Adverse Childhood Experience (ACE) Study among 17,337 adults identified a set of 10 adverse experiences occurring in the first 18 years that are important for health.¹⁻³ These experiences are categorized as:

- **Abuse**—physical, emotional, or sexual;
- **Neglect**—physical or emotional; and
- **Household challenges** (originally framed as “household dysfunction”; rephrased by the CDC in 2015)—growing up in a household with household member incarceration, mental illness, substance use, parental separation/divorce, or intimate partner violence.

KEY FINDINGS OF THE ACE STUDY AND SUBSEQUENT BODY OF RESEARCH INCLUDE:

1. **ACEs are highly prevalent.** Two-thirds of respondents in the landmark ACE Study reported at least one ACE, and one in eight reported four or more ACEs.¹
³ More representative national studies have shown that one in six individuals report four or more ACEs.^{4,5} Among California adults on Medi-Cal, 69% have experienced at least one ACE, and 23% have experienced four or more ACEs.⁶
2. **ACEs are strongly associated, in a dose-response fashion, with some of the most common and serious health conditions** facing our society, including nine of the 10 leading causes of death in the United States (US), and with earlier mortality (**Table 1**).^{4,7-11}



3. ACEs impact all communities; however, some populations are affected disproportionately. The original ACE Study was conducted among a population that was mostly White, middle class, college-educated, and privately insured.¹⁻³ Subsequent studies have found a higher prevalence of ACEs in individuals who are racially marginalized (Black, Latinx, Native American, or multi-racial), high school nongraduates, unemployed or unable to work, in lower income brackets, uninsured or underinsured, involved in the justice system, women, and/or identify as lesbian, gay, or bisexual.^{4,5,9,14-21}

Table 1. Association of ACEs with leading causes of death in the US

Leading causes of death in the U.S. (2017)	Odds ratios for ≥ 4 ACEs (relative to no ACEs)
1. Heart disease	2.1
2. Cancer	2.3
3. Accidents (unintentional injuries)	2.6
4. Chronic lower respiratory disease	3.1
5. Stroke	2.0
6. Alzheimer's disease or dementia	11.2
7. Diabetes	1.4
8. Influenza and pneumonia	unknown
9. Kidney disease	1.7
10. Suicide (attempts)	37.5

The extensive body of literature on the impacts of ACEs meets the Bradford Hill criteria for establishing likely causality (cause-and-effect) from observational data.^{12,13}



THE TOXIC STRESS RESPONSE

Stressors are normal parts of life, serving a valuable function in healthy development, but **toxic stress** is different from positive or tolerable stress (**Figure 1**). When significant doses of adversity are experienced during critical and sensitive periods of early life development, without adequate buffering protections of safe, stable, and nurturing relationships and environments, they can lead to dysregulation of the biological stress response, and to long-term disruption of neuro-endocrine-immune-metabolic and genetic regulatory mechanisms.

This is called the **“toxic stress response,”**⁶⁻¹² defined by the National Academies of Science, Engineering, and Medicine’s 2019 consensus report as “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 disorders.”²²

S T R E S S R E S P O N S E		
POSITIVE	TOLERABLE	TOXIC
Physiological response to mild or moderate stressor	Adaptive response to time-limited stressor	Maladaptive response to intense and sustained stressor
Brief activation of stress response elevates heart rate, blood pressure, and hormonal levels	Time-limited activation of stress response results in short-term systemic changes	Prolonged activation of stress response in children disrupts brain architecture and increases risk of health disorders
Homeostasis recovers quickly through body's natural coping mechanisms	Homeostasis recovers through buffering effect of caring adult or other interventions	Prolonged allostasis establishes a chronic stress response
<i>Tough test at school, playoff game</i>	<i>Immigration, natural disaster</i>	<i>Abuse, neglect, household dysfunction</i>

Figure 1. Examples of positive, tolerable, and toxic stress. Reproduced with permission from Elsevier; Bucci M, Marques SS, Oh D, Harris NB. Toxic stress in children and adolescents. *Advances in Pediatrics* 2016; **63**: 403-28.



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- ▶ ***Acting through the toxic stress response, exposure to ACEs can set up transmission of health risks across generations by altering parental biology and behavior in ways that can affect the development and health of their children, and for future generations to come.***
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ADDITIONAL RISK FACTORS FOR TOXIC STRESS

In addition to the original 10 ACEs, other types of adversity, including racism and poverty, are also potential risk factors for developing a toxic stress response.²³⁻³¹ Further research is currently underway to assess the extent to which these and other important social determinants of health, such as food and housing insecurity, may act directly through the toxic stress pathway or may mediate or moderate the toxic stress response.

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