

The Impact of ACEs on Young Children

Early Ripples: The Effects of ACEs on Children 0-5

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2021

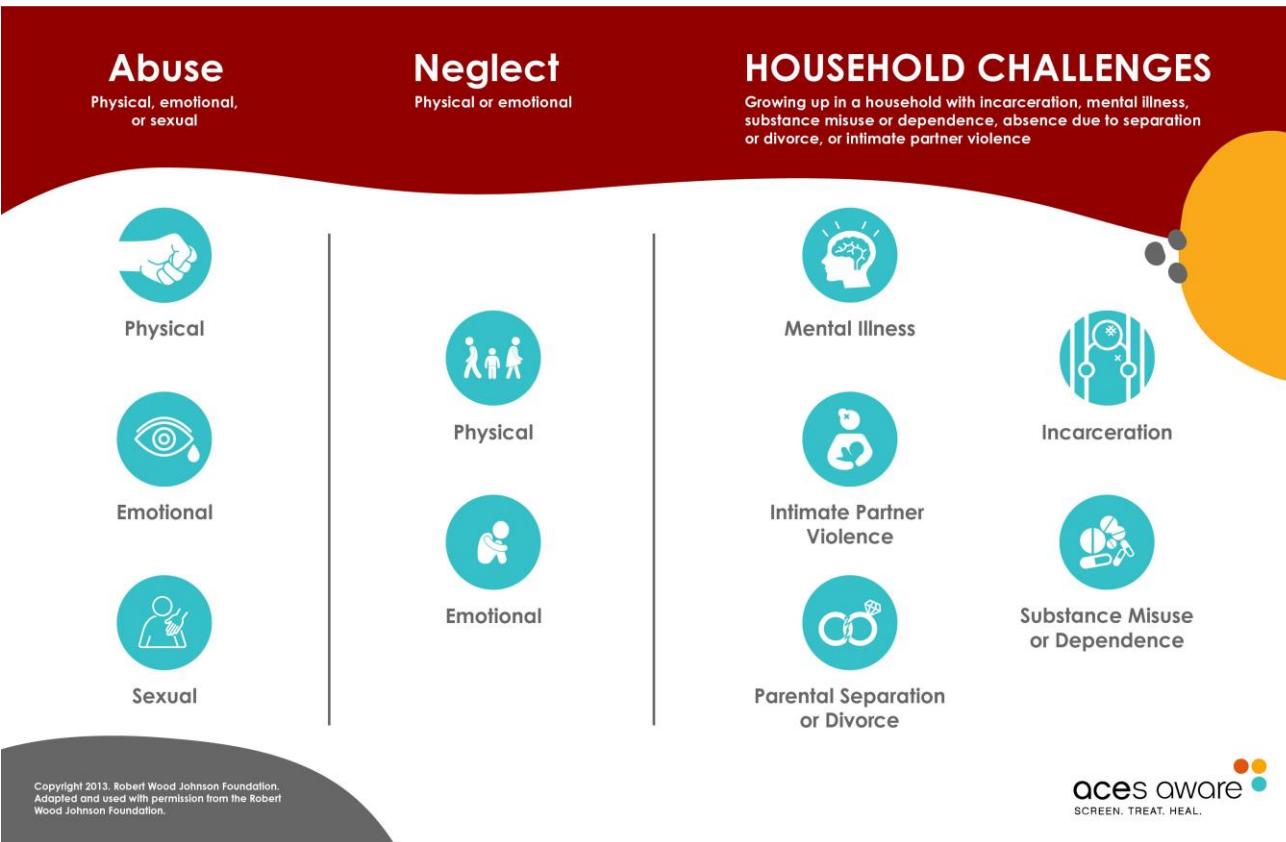
Learning Objectives

- As a result of this training, participants will be able to:
 - Define ACEs (Adverse Childhood Experiences)
 - Describe the prevalence of ACEs in California and Humboldt County
 - Describe the developmental impact of ACEs and toxic stress on children 0-5
 - Describe the impact of ACEs and toxic stress on children's physical health

Definition of ACEs

- The term ACEs (Adverse Childhood Experiences) comes from the landmark 1998 study by the Centers for Disease Control and Prevention (CDC) and Kaiser Permanente (Felitti, Anda, Nordenberg D, et al., 1998).
- ACEs and toxic stress are strongly associated with the most common yet severe health and social consequences in a *dose-response fashion* (Bhushan, et al., 2020).

Ten Categories of ACEs



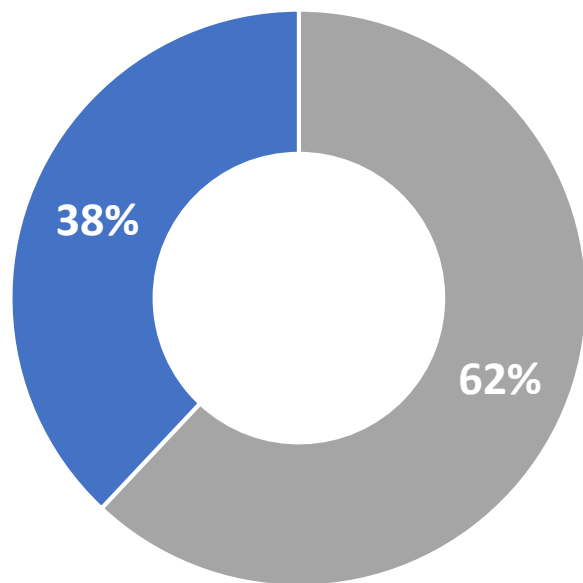
- Ten categories of adversities experienced by age 18 years include abuse, neglect, and/or household challenges (Felitti, Anda, Nordenberg, et al., 1998)
- Other traumatic experiences and adversities, not just limited to these 10 ACEs, can lead to a toxic stress response (Bhushan, et al., 2020).

Figure 1. The 10 ACE categories investigated in the landmark study by the CDC and Kaiser Permanente. Image reproduced with permission from ACEs Aware,²⁶ which adapted this with permission from the Robert Wood Johnson Foundation.

Prevalence of ACEs in California

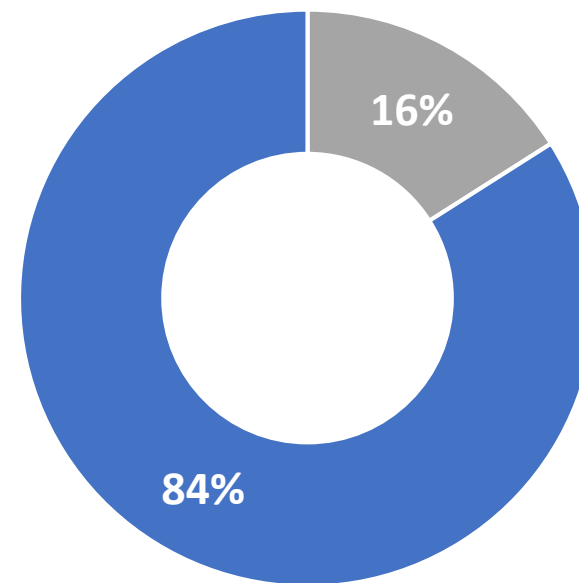
Californians who have experienced at least 1 ACE

■ Have experienced at least 1 ACE



Californians who have experienced 4 or more ACEs

■ Have experienced 4 or more ACEs

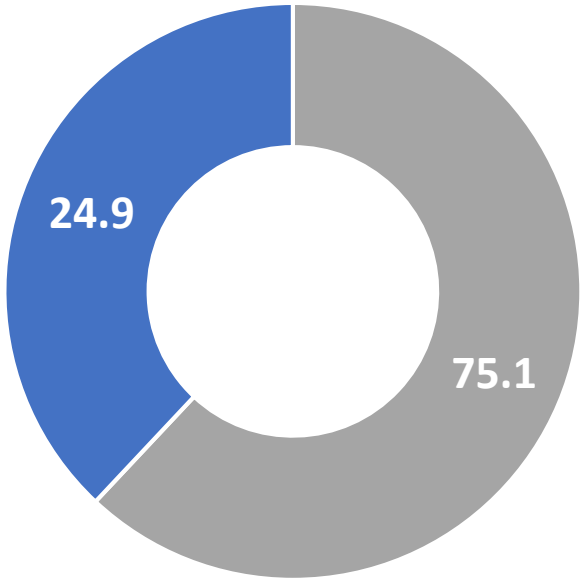


California Department of Public Health, Injury and Violence Prevention Branch (CDPH/IVPB), University of California, Davis, Violence Prevention Research Program, California Behavioral Risk Factor Surveillance System (BRFSS), 2011-2017.

Prevalence of ACEs in Humboldt and Mendocino, California

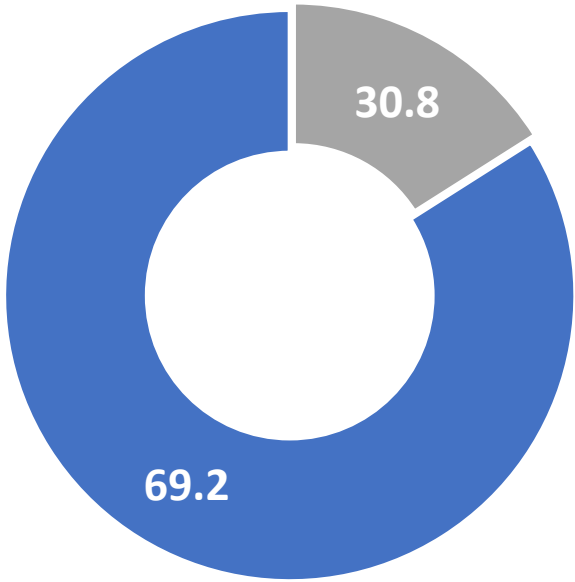
**Residents in Humboldt and Mendocino
Counties who have
experienced at least 1 ACE**

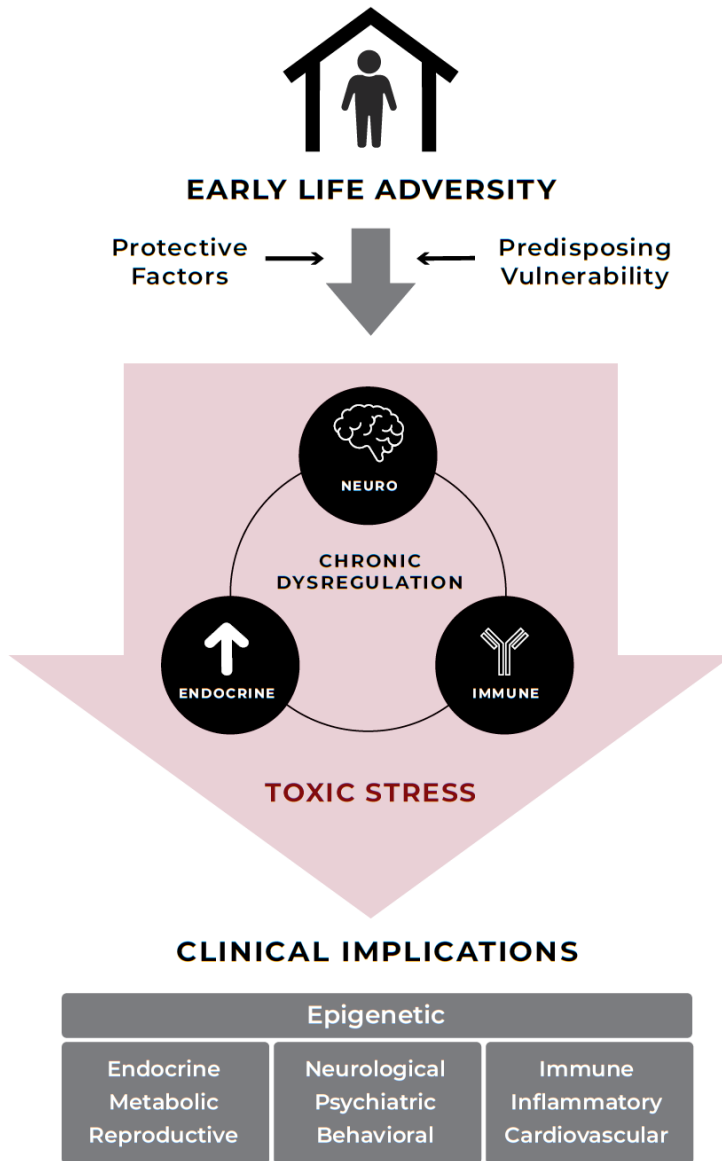
■ Have experienced at least 1 ACE



**Residents in Humboldt and Mendocino
Counties who have
experienced 4 or more ACEs**

■ Have experienced 4 or more ACEs



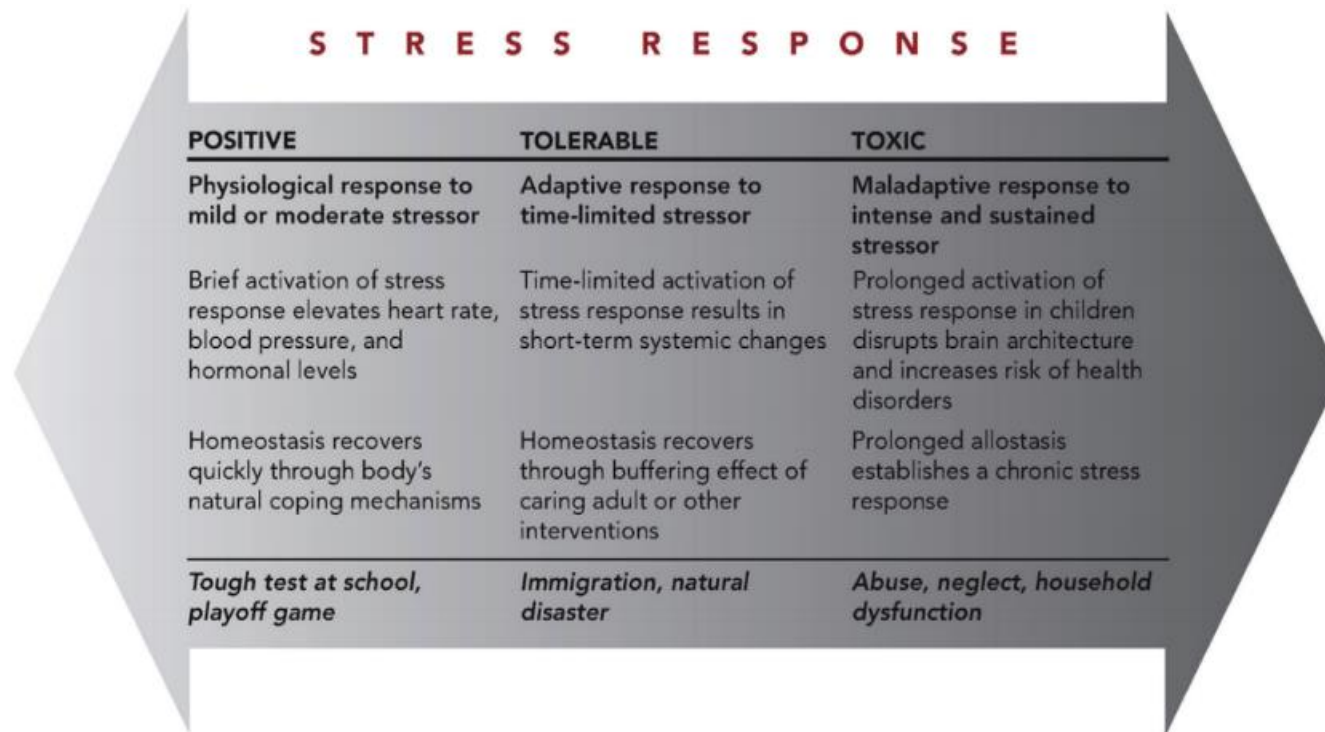


Toxic Stress Response

A consensus of scientific evidence demonstrates that high doses of cumulative adversity experienced during critical and sensitive periods of early life development, without the buffering protections of safe, stable and nurturing relationships and environments, can lead to long-term disruptions of brain development, immune and hormonal systems and genetic regulatory mechanisms—a condition now known as the **“toxic stress response.”**

Adapted from Bucci M, Marques SS, Oh D, Harris NB. Toxic Stress in Children and Adolescents. *Advances in Pediatrics* 2016; **63**: 403–28. DOI: [10.1016/j.yapd.2016.04.002](https://doi.org/10.1016/j.yapd.2016.04.002).

The Spectrum of Positive, Tolerable, and Toxic Stress



Source: Bucci M, Marques SS, Oh D, Harris NB. Toxic Stress in Children and Adolescents. *Advances in Pediatrics* 2016; **63**: 403–28. DOI: [10.1016/j.yapd.2016.04.002](https://doi.org/10.1016/j.yapd.2016.04.002). Reproduced with permission.

Fig. 2. Spectrum of the stress response: positive, tolerable, and toxic.

Developmental Impacts of ACEs and Toxic Stress on Children 0-5

- Physical development and health
- Social/emotional development
- Cognitive development



Impact of ACEs on Physiology and Physical Development

- Extended exposures to ACEs without adequate support can interrupt child's physiology, affecting physical health and development (e.g., neuroendocrine, immune, endocrine, and epigenetic systems) and stress response system (Bhushan, et al., 2020; NASEM, 2019).
- Development and refinement of neurological systems (e.g., SAM, HPA, amygdala, prefrontal cortex, hippocampus, etc.) can be disturbed (Bhushan, et al., 2020; Fenoglio, Brunson, & Baram, 2006; Hanson, et al., 2015)

System	Mechanism(s)	Health Impact
Neurologic; neuroendocrine	Dysregulation of the sympatho-adrenomedullary (SAM) and hypothalamic-pituitary-adrenal (HPA) axes, with long-term changes in regulation of key hormones, including cortisol and adrenaline; autonomic imbalance	Difficulty modulating, sustaining, or dampening the stress response; heightened or blunted stress sensitivity
	Altered reactivity and size of the amygdala	Increased fear responsiveness, impulsivity, and aggression
	Inhibition of the prefrontal cortex	Impaired executive function, with poorer planning, decision-making, impulse control, and emotion regulation
	Hippocampal neurotoxicity	Difficulty with learning and memory
	Ventral tegmental area (VTA) and reward processing dysregulation	Increased risky behaviors and risk of addiction

Source: Bhushan D, Kotz K, McCall J, Wirtz S, Gilgoff R, Dube SR, Powers C, Olson-Morgan J, Galeste M, Patterson K, Harris L, Mills A, Bethell C, Burke Harris N, Office of the California Surgeon General. Roadmap for Resilience: The California Surgeon General's Report on Adverse Childhood Experiences, Toxic Stress, and Health. Office of the California Surgeon General, 2020. DOI: 10.48019/PEAM8812. (p. 21, Table 2)

Impact of ACEs on Physiology and Physical Development (cont'd.)

- Disrupted immunologic system (e.g. gut microbiome, growth hormone, thyroid hormone) can affect overall growth and health, infection, basal metabolism (Bhushan, et al., 2020; McKelvey, et al., 2017; NASEM, 2019)
- Endocrine system can be affected, increasing risk for overweight and obesity, diabetes, (Aggarwal, & Vandana, 2018; Bhushan, et al., 2020; NASEM, 2019)
- Epigenetic changes can occur, increasing susceptibility for illness and early mortality (Bhushan, et al., 2020; Lang, et al., 2020; NASEM, 2019)

System	Mechanism(s)	Health Impact
Immunologic; inflammatory	Increased inflammatory mediators and markers, especially of the Th2 response; inhibition of anti-inflammatory pathways; gut microbiome dysbiosis Changes in growth hormone, thyroid hormone, and pubertal hormonal axes	Increased risk of infection, auto-immune disorders, cancers, chronic inflammation; cardiometabolic disorders Changes in growth, development, basal metabolism, and pubertal events
Endocrine; metabolic	Changes to leptin, ghrelin, lipid and glucose metabolism, and other metabolic pathways Sustained changes to the way DNA is read and transcribed	Increased risk of overweight, obesity, cardiometabolic disorders, and insulin resistance Mediates all aspects of the toxic stress response
Epigenetic; genetic	Sustained changes to the way DNA is read and transcribed Telomere erosion, altered cell replication, and premature cell death	Mediates all aspects of the toxic stress response Increased risk for disease, cancer, and early mortality

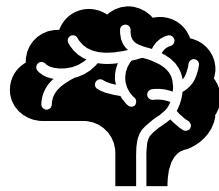
Source: Bhushan D, Kotz K, McCall J, Wirtz S, Gilgoff R, Dube SR, Powers C, Olson-Morgan J, Galeste M, Patterson K, Harris L, Mills A, Bethell C, Burke Harris N, Office of the California Surgeon General. Roadmap for Resilience: The California Surgeon General's Report on Adverse Childhood Experiences, Toxic Stress, and Health. Office of the California Surgeon General, 2020. DOI: 10.48019/PEAM8812. (p. 21, Table 4)

Pediatric Health Impacts



- Malnutrition and chronic stress can make children more prone to infectious diseases (Bhushan, et al., 2020)
- Children exposed to parental psychosocial stress (i.e., parent psychiatric symptoms, stressful life events and conditions, family conflict, and attachment problems) have shown one and half times more susceptibility to fever (Caserta, O'Connor, & Wyman, et al., 2008).
- Children with four or more ACEs have an increased risk of asthma (1.7-2.8 times higher compared to those without ACEs) (Hamer, Kivimaki, & Stamatakis, 2019; Wing, et al., 2015).

ACE- Associated Health Conditions



ADHD
Aggression/fighting
Alcohol/Drug Use
Anxiety
Depression
Developmental Delay
Enuresis
Encopresis
Headaches
Learning Problems
Pain
PTSD



Cardiovascular
Disease
Diabetes
Failure to Thrive
Hepatitis
Late menarche
Overweight
Obesity
Stroke



Allergies
Arthritis
Asthma
COPD
Eczema
Increased
infections
Urticaria

Source: Rachel Gilgoff Presentation. Bhushan D, Kotz K, McCall J, Wirtz S, Gilgoff R, Dube SR, Powers C, Olson-Morgan J, Galeste M, Patterson K, Harris L, Mills A, Bethell C, Burke Harris N, Office of the California Surgeon General. Roadmap for Resilience: The California Surgeon General's Report on Adverse Childhood Experiences, Toxic Stress, and Health. Office of the California Surgeon General, 2020. DOI: 10.48019/PEAM8812. (p. 12-32)

ACE-Associated Health Conditions

- ACE-Associated Health Conditions are health conditions that have empirical evidence showing associations between ACE exposure and the health outcome.
- They include cardiovascular, pulmonary, immune, metabolic, mental health, and substance use conditions.*
- While the relationship between ACEs and mental health outcomes is most commonly recognized, a recent meta-analysis demonstrates that the single greatest driver of ACE-associated health care costs is cardiovascular disease.**

Source: *Waehrer, Geetha M., et al. "Disease burden of adverse childhood experiences across 14 states." *PLoS one* 15.1 (2020): e0226134. Hughes, Karen, et al. "The effect of multiple adverse childhood experiences on health: a systematic review and meta-analysis." *The Lancet Public Health* 2.8 (2017): e356-e366.

Bellis MA, Hughes K, Ford K, Ramos Rodriguez G, Sethi D, Passmore J. Life course health consequences and associated annual costs of adverse childhood experiences across Europe and North America: a systematic review and meta-analysis. *Lancet Public Health* 2019; **4: e517–28. DOI: [10.1016/S2468-2667\(19\)30145-8](https://doi.org/10.1016/S2468-2667(19)30145-8).

ACE-Associated Health Conditions – Pediatrics

For more details, see the ACEs and Toxic Stress Risk Assessment Algorithm at:
ACEsAware.org/clinical-assessment

*Odds ratio represents at least one ACE, but also includes other adversities

**Prevalence ratio represents at least one ACE, but also includes other adversities

Symptom or Health Condition	For ≥ X ACEs (compared to 0)	Odds Ratio
Asthma ^{26, 33}	4	1.7 - 2.8
Allergies ³³	4	2.5
Dermatitis and eczema ³⁹	3*	2.0
Urticaria ³⁹	3*	2.2
Increased incidence of chronic disease, impaired management ²⁵	3	2.3
Any unexplained somatic symptoms ²⁵ (eg, nausea/vomiting, dizziness, constipation, headaches)	3	9.3
Headaches ³³	4	3.0
Enuresis; encopresis ⁵	–	–
Overweight and obesity ³	4	2.0
Failure to thrive; poor growth; psychosocial dwarfism ^{5, 2, 41}	–	–
Poor dental health ^{16, 22}	4	2.8
Increased infections ³⁹ (viral, URIs, LRTIs and pneumonia, AOM, UTIs, conjunctivitis, intestinal)	3*	1.4 - 2.4
Later menarche ⁴⁰ (≥ 14 years)	2*	2.3
Sleep disturbances ^{5, 31}	5**	PR 3.1
Developmental delay ³⁰	3	1.9
Learning and/or behavior problems ³	4	32.6
Repeating a grade ¹⁵	4	2.8
Not completing homework ¹⁵	4	4.0
High school absenteeism ³³	4	7.2
Graduating from high school ²⁹	4	0.4
Aggression; physical fighting ²⁸	For each additional ACE	1.9
Depression ²⁹	4	3.9
ADHD ⁴²	4	5.0
Any of: ADHD, depression, anxiety, conduct/behavior disorder ³⁰	3	4.5
Suicidal ideation ²⁸	For each additional ACE	1.9
Suicide attempts ²⁸	For each additional ACE	1.9 - 2.1
Self-harm ²⁸	For each additional ACE	1.8
First use of alcohol at < 14 years ⁷	4	6.2
First use of illicit drugs at < 14 years ¹⁰	5	9.1
Early sexual debut ²¹ (<15-17 y)	4	3.7
Teenage pregnancy ²¹	4	4.2

Impact of ACEs on Social/Emotional Development

- Early ongoing exposure to adversities (e.g., abuse, neglect, and household challenges) can affect children's social emotional development, disturbing stress response system and increasing internalizing and externalizing behaviors (Shonkoff, et al., 2012)
 - Depression, impulsivity, aggression, impaired executive function (i.e., planning, organizing, and regulating emotion and behaviors) (Bhushan, et al., 2020)
- Child maltreatment may influence child's attachment with primary caregiver (e.g., disorganized/disoriented attachment), which can interrupt child's optimal development of emotional capacity (i.e., interpretation of affective experiences with others, emotional regulation, & coping strategies) (Cooke, Kochendorfer, et al., 2019; Thompson-Walsh, et al., 2021)
- Parents' past ACEs can be associated with insecure and/or disorganized attachment that may adversely impact the parent-child relationship and, in turn, can negatively affect children's emotional development (Cooke, Racine, et al., 2019; McDonnell & Valentino, 2016).
 - Importance of predictable, warm, and responsive relationship between infants and their primary caregivers (Cooke, Kochendorfer, et al., 2019; Meins, Bureau, & Fernyhough 2018).

Impact of ACEs on Social/Emotional Development (Cont'd.)

- Under chronic threats and stress from ACEs without adequate support, young children may be in “fighting or fleeing” mode; hyperarousal state. They may be seen as hypervigilant, aggressive, anxious, and/or defiant (Perry, 2004; Shonkoff et al., 2012).
- Young children experiencing ongoing ACEs without adequate support may misinterpret others’ intention and have difficulty expressing emotions in socially acceptable ways (e.g., hostile, violent, defensive, withdrawn, or frequent and overblown temper tantrum). They may be seen as timid or nervous (McKelvey, et al., 2017; Perry, 2004).
- Young children experiencing ongoing ACEs without adequate support may demonstrate maladaptive attention seeking or inhibitory control (Skowron, et al., 2014). It is possible this may manifest in difficulty making friends, seeking support from other adults (Blaustein & Kinniburgh, 2010; Choi, Wang, & Jackson, 2019; McKelvey, et al., 2017).

Impact of ACEs on Social/Emotional Development (Cont'd.)

- A cross-sectional study of a nationally representative sample of young children receiving welfare services (ages of 18-71 months) (n=912), drawn from the National Survey of Child & Adolescent Well-Being II showed (Kerker et al. 2015):
 - Nearly all (98%) of these children had at least one ACE and on average they had 3.6 ACEs
 - ACEs associated with poor childhood mental health, chronic medical conditions, and poor social development.

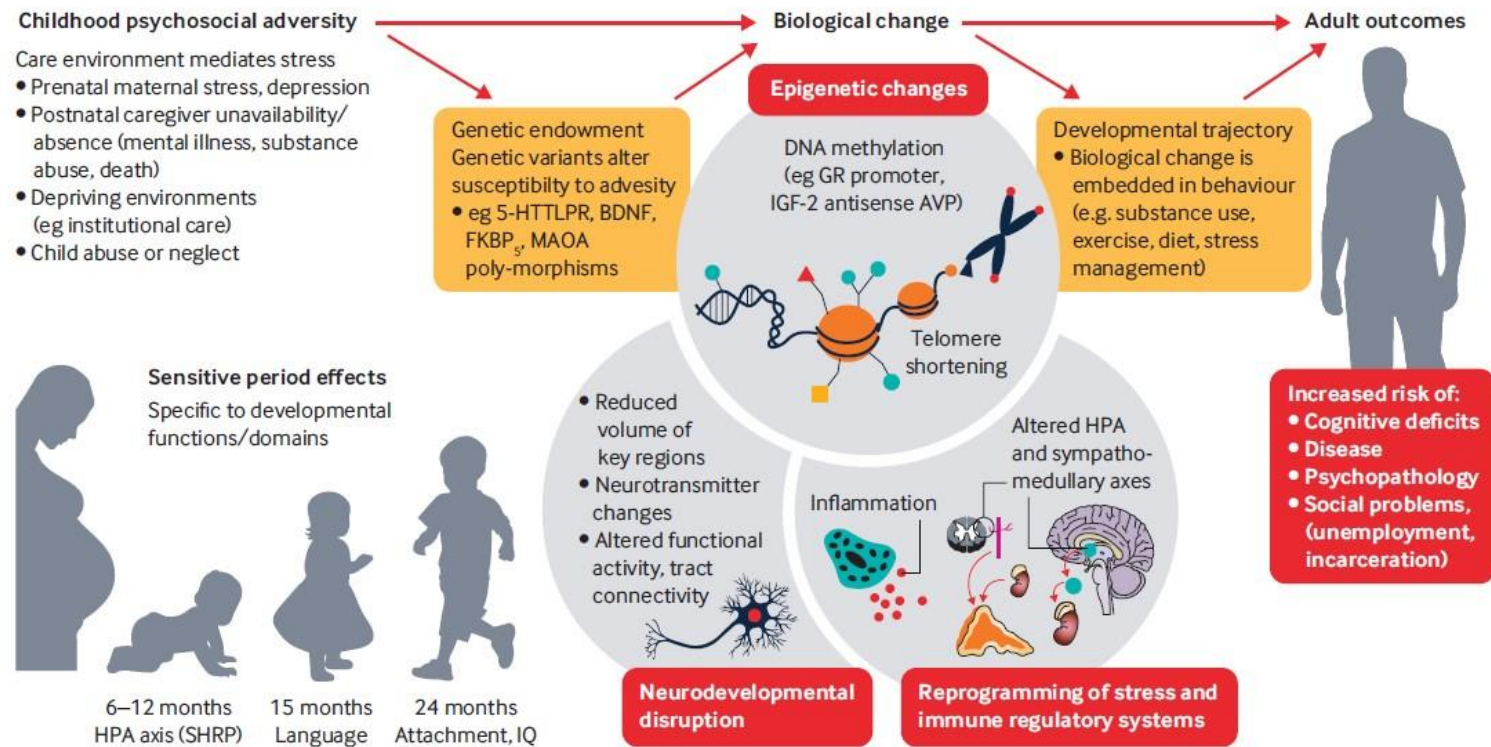
Impact of ACEs on Cognitive Development

- Extended exposures to ACEs without adequate support can interrupt young children's neurological physiology (e.g., the prefrontal cortex) and cognitive development (Bhushan, et al., 2020; McKelvey, et al., 2017; NASEM, 2019).
- A toxic stress response in young children can lead to either being in a constant hyperarousal state (e.g., fight or flight) or in a dissociative state (e.g., tuning out), may delay or interfere their cognitive skills; attention, concentration, cognitive self-regulation, exploration, curiosity, and overall learning (NASEM, 2019).
 - A dose-response relationship was found: Additional ACEs can increase the risk of developmental delays by 17% in children under age 5 (Cprek, et al., 2020)
 - Potentially related to learning issues (Burke et al., 2011) and related disability/disorder (e.g., developmental disabilities, learning disability, Attention Deficient Hyperactivity Disorder) (Kerker, et al., 2015)

Impact of ACEs on Cognitive Development (cont'd.)

- Mechanism behind the impact of ACEs on Cognitive Development
 - Prolonged ACEs without adequate support interferes children's:
 - Opportunity to expand their development as they construct their knowledge of the world
 - Ability to interact with their social and cultural environment
 - Neurological process of attention, memory, categorization, and executive function (Cuevas & Bell, 2014; NSCDC, 2020; Rogoff, et al., 2011)
 - Limit opportunities for young children to make meaningful connections and nurturing interactions (e.g., serve and return) with primary caregivers, which are known to strengthen young brain circuits and executive functioning (National Scientific Council on the Developing Child, 2004).

Impact of ACEs: Epigenetic Changes, Neurodevelopmental Disruption, and Stress Response System Dysregulation



Source: Bhushan, McCall, & Gilgoff, et al., (2020, page. 16)

Summary

- ACEs (Adverse Childhood Experiences) are associated with negative health outcomes, as shown by the landmark 1998 study by Centers for Disease Control and Prevention (CDC) and Kaiser Permanente
- ACEs include ten categories of adversities experienced by age 18 years include abuse, neglect, and/or household challenges.
- ACEs without adequate support can lead to a toxic stress physiology affecting physical, social/emotional, and cognitive health through changes in neurologic, immune, endocrine, and epigenetic systems.

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