American Academy of Pediatrics
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Adverse Childhood Experiences and the Lifelong Consequences of Trauma

Many people can identify a person in their lives who struggles with a chronic illness like heart disease, diabetes, or hypertension. Most people also know someone who struggles with mental illness, substance abuse, or relationships in general. Traditionally, the health care system would point to high-risk behaviors such as poor diet, drug use, or a sedentary lifestyle as the primary causal factors. Questions for patients have focused on "What's wrong with you?" rather than "What happened to you?" A 1998 study from the Centers for Disease Control and Prevention (CDC) and Kaiser Permanente is leading to a paradigm shift in the medical community's approach to disease. This study of more than 17,000 middle-class Americans documented quite clearly that adverse childhood experiences (ACEs) can contribute significantly to negative adult physical and mental health outcomes and affect more than 60% of adults.[1,2] This continues to be reaffirmed with more recent studies.

Adverse childhood experiences include

- *Emotional abuse*
- *Physical abuse*
- *Sexual abuse*
- *Emotional neglect*
- *Physical neglect*
- *Mother treated violently*
- *Household substance abuse*
- *Household mental illness*
- *Parental separation or divorce*
- *Incarcerated household member*

Along with the original 1998 ACE Study, there are known predictive factors that make sense to include in the list of adverse experiences. These can be single, acute events or sustained over time. Examples include death of a parent and the detrimental effect of community violence and poverty, among others.[3] Adverse childhood experiences occur regularly with children aged 0 to 18 years across all races, economic classes, and geographic regions; however, there is a much higher prevalence of ACEs for those living in poverty.

While some stress in life is normal—and even necessary for development—the type of stress that results when a child experiences ACEs may become toxic when there is "strong, frequent, or prolonged activation of the body's stress response systems **in the absence of the buffering protection of a supportive, adult relationship."**[4,5] The biological response to this toxic stress can be incredibly destructive and last a lifetime. Researchers have found many of the most common adult life-threatening health conditions, including obesity, heart disease, alcoholism, and drug use, are directly related to childhood adversity. A child who has experienced ACEs is more likely to have learning and behavioral issues and is at higher risk for early initiation of sexual activity and adolescent pregnancy. These effects can be magnified through generations if the traumatic experiences are not addressed. The financial cost to individuals and society is enormous.[6]

Never before in the history of medicine have we had better insight into the factors that determine the health of an individual from infancy to adulthood, which is part of the **life course perspective**—a way of looking at life not as disconnected stages but as integrated across time.

What happens in different stages of life is influenced by the events and experiences that precede it and can influence health over the life span. An expanding body of convergent knowledge generated from distinct disciplines (neuroscience, behavioral science, sociology, medicine) provides child health care professionals the opportunity to reevaluate what care is needed to maximize the effect on a child's lifelong health. Importantly, an extensive body of research now exists demonstrating the effect of traumatic stress on brain development. Healthy brain development can be disrupted or impaired by prolonged, pathologic stress response with significant and lifelong implications for learning, behavior, health, and adult functioning.[4]

WHAT IS THE ROLE OF STRESS?

Stress in itself need not result in injury and is, by its nature, a subjective experience. Stress in a supportive environment may not be toxic. The perception of stress varies from child to child; serious threats may not disturb one child, while minor ones may be traumatic to another. This variability is multifactorial depending on a child's previous trauma, social-emotional support, and genetic predisposition.

Just as the stress of ambulation helps promote bone and muscle growth, a child needs to experience some emotional stress to develop healthy coping mechanisms and problem-solving skills. Experts categorize stress as *positive*, helping to guide growth; *tolerable*, which, while not helpful, will cause no permanent damage; or *toxic*, which is sufficient to overcome the child's undeveloped coping mechanisms and lead to long-term impairment and illness.[5]

Toxic stress response can occur when a child experiences strong, frequent, or prolonged adversity, such as physical or emotional abuse, chronic neglect, caregiver substance abuse or mental illness, exposure to violence, or the accumulated burdens of family economic hardship, in the absence of adequate adult support. This kind of prolonged activation of the stress response systems can disrupt the development of brain architecture and other organ systems and increase the risk of stress-related disease and cognitive impairment well into the adult years.

The National Child Traumatic Stress Network (NCTSN) definition of *traumatic stress* encompasses the physical and emotional responses of a child to events that threaten the life or physical integrity of the child or of someone critically important to the child (eg, parent, sibling). It is this out-of-control physiological arousal that is the hallmark of stress that becomes traumatic and can incite what is initially an adaptive response to the stressor that ultimately becomes maladaptive and destructive. While a single event like a natural disaster or an assault by a stranger may constitute toxic stress, the effects multiply when the trauma continues, whether by repetition of similar stresses (eg, an environment of domestic violence or parental drug abuse) or accumulation of disparate ones (eg, parental illness and a hurricane hits town). In other words, there is a dose-response relationship. The effect may be particularly severe when trauma involves the child's primary caregiving system. Termed *complex trauma* by the NCTSN, this reaction develops over time, as subsequent events reinforce the lessons learned previously.[7]

The effect of toxic stress resulting from trauma may not be immediately visible or appear as one would expect. In addition, some traumatic sources of toxic stress may not be readily apparent to the clinician. Psychological maltreatment can be traumatic and stressful.[8] Neglect can also be traumatic. Neglect is almost always chronic, as basic needs such as food, shelter, or emotional security are continually not being met. Neglect is often seen in conjunction with abuse and may be exceptionally severe; 71% of child maltreatment fatalities are due to neglect exclusively or in combination with another maltreatment type.[9]

For most children who have experienced trauma and toxic stress, the experiences began at an early age. As a result, the events may be remote and documented history is often buried among old records or nonexistent. Prenatal exposures that influenced brain development may not be detectable in obstetric records. Pediatricians should understand that presentations of attention deficits, emotional dysregulation, and oppositional behaviors may have their roots in early abuse or neglect or other sources of toxic stress. Recognition of the power of early adversity to affect the child's perceptions of and responses to new stimuli may aid the pediatrician or other clinician in appropriately understanding the causes of a child's symptoms.

THE BIOLOGY OF TRAUMA

The past few years have brought a dramatic improvement in our understanding of how a healthy brain develops and the effect, positive or negative, that a child's environment has on that process. Several systems—social/behavioral, neuroendocrine, and even genetic—are all influenced by early experiences and interact with each other as a child grows and develops. The ability of an individual to successfully overcome negative experiences from trauma depends on many factors related to the complex interaction between these systems. Several key observations have emerged from recent research.

- *The brain is not structurally complete at birth.*
  - Myelination, proliferation of synaptic connections, and development of glial and circulatory support systems all continue long after a child has entered the world. Nature gives children a chance to adapt to the specific needs presented by the environment into which they have been born.

  > Among other things, optimal development of the neuroendocrine system is dependent on adequate nutrition and absence of toxins like lead, mercury, alcohol, other drugs, and toxic stress.

- *Structural development is guided by environmental cues.*
  - An infant's brain adapts to what it sees, hears, and feels. Researchers have demonstrated critical periods for effective development of many brain systems.

  > Proper structural growth depends on a nurturing, loving, and stimulating environment, one that prepares the child for future circumstances.

- *Effective stimulation requires interaction with other people.*
  - Children can't be expected to provide their own high-quality stimulation. They learn from every person encountered—especially primary caregivers.

  > Other people must be present, attentive enough, and consistent or predictable enough to teach the lessons the developing brain needs. Stimulation from television, smartphones, or tablets does not replace interaction with people.

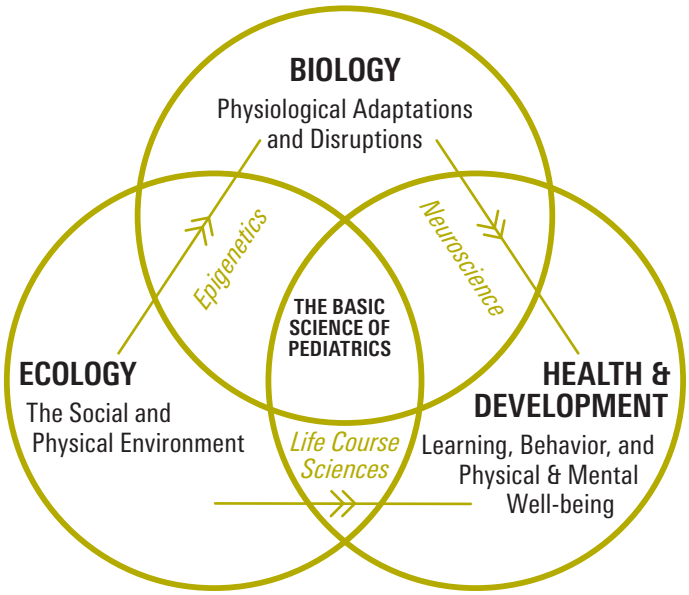
- ***Gene expression determines neuroendocrine structure and is strongly influenced by experience.***
  - Genetic research has identified a variety of alleles that appear to protect against, or predispose to, long-term sequelae of traumatic stress by varying the sensitivity of stress hormone receptors in the limbic system.[10,11,12] An increasing body of evidence points to the ability of early life experience to trigger epigenetic modifications, effectively altering brain structure by changing gene transcription.[13,14]

> One way, then, that early adversity can affect long-term change is by altering the way an individual's genetic blueprint is read, thus influencing the stress response.

- *The body's systems are mutually interactive.*
  - Social interactions (or the lack thereof) may affect neuroendocrine development, which can alter observed behaviors (Figure 1). Behavior, in turn, produces social feedback, which stimulates a neuroendocrine response (a physiological response) and, if severe, may cause modifications in brain structures (an anatomic response). Another word for this complex system of interactions is *learning*. When the body learns under conditions of extreme stress, epigenetic modifications in gene transcription can be produced and cause structural changes in the developing brain.[12,15] This process can operate both ways. The epigenetic modifications to gene transcription ultimately determine the brain's structure, which governs behavior. The behavior can result in interactions that reinforce or reactivate the stress response, causing additional negative modifications to the brain architecture. This interactive cascade of responses among social/behavioral, neuroendocrine, and genetic/epigenetic systems has recently been dubbed the ecobiodevelopmental model.[4]

> The more emotionally charged a learning situation is, the more likely it is to result in long-term modifications.

Figure 1.



EFFECT OF TRAUMA ON PARENTING ABILITY

Adults who have experienced ACEs in their early years can exhibit reduced parenting capacity or maladaptive responses to their children. The physiological changes that have occurred to the adult's stress response system as a result of earlier trauma can result in diminished capacity to respond to additional stressors in a healthy way. Adverse childhood experiences increase the chance of social risk factors, mental health issues, substance abuse, intimate partner violence, and adult adoption of risky adult behaviors. All of these can affect parenting in a negative way and perpetuate a continuing exposure to ACEs across generations by transmission of epigenetic changes to the genome.

RESILIENCE AND OTHER REASONS FOR OPTIMISM

Adverse experiences and other trauma in childhood, however, do not dictate the future of the child. Children survive and even thrive despite the trauma in their lives. For these children, adverse experiences are counterbalanced with protective factors. Adverse events and protective factors experienced together have the potential to foster resilience. Our knowledge about what constitutes resilience in children is evolving, but we know that several factors are positively related to such protection, including cognitive capacity, healthy attachment relationships (especially with parents and caregivers), the motivation and ability to learn and engage with the environment, the ability to regulate emotions and behavior, and supportive environmental systems,

Figure 1. *The basic science of pediatrics. An emerging, multidisciplinary science of development supports an ecobiodevelopmental framework for understanding the evolution of human health and disease across the life span. In recent decades, epidemiology, developmental psychology, and longitudinal studies of early childhood interventions have demonstrated significant associations between the ecology of childhood and a wide range of developmental outcomes and life course trajectories. Concurrently, advances in the biological sciences, particularly in developmental neuroscience and epigenetics, have made parallel progress in beginning to elucidate the biological mechanisms underlying these important associations. The convergence of these diverse disciplines defines a promising new basic science of pediatrics.*

including education, cultural beliefs, and faith-based communities.[16] The **protective factors framework** developed by Strengthening Families[16] as well as the **Essentials for Childhood** program from the CDC[17] provide more detail.

There are additional reasons for optimism. There now exist several evidence-based, effective clinical treatments to call on in intervening with children who have experienced trauma and adversity, including Trauma-Focused Cognitive-Behavioral Therapy[18] and Parent-Child Interactive Therapy.[19] Each of these programs includes attention to parenting ability and works on establishing behaviors that promote resilience in the child and parent. Proactive initiatives like home visitation programs for high-risk families, though not widely disseminated, have incredible promise for the prevention or mitigation of parent- and environment-mediated ACEs specifically because they are focused on critical periods in human development—prenatal through the first 2 to 3 years of life.[20]

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The recommendations in this toolkit do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.