

WHITEPAPER

# AN UNHEALTHY DOSE OF STRESS

The impact of Adverse Childhood Experiences and  
toxic stress on childhood health and development





**The Center for Youth Wellness (CYW)** is a health organization imbedded with a primary care pediatric home serving children and families in the Bayview Hunters Point neighborhood in San Francisco. We were created to respond to a new medical understanding of how early adversity harms the developing brains and bodies of children. We prevent toxic stress by raising national awareness among those who have the power to make a difference – from parents to pediatricians to policymakers. We screen every young person we see for **Adverse Childhood Experiences (ACEs)**, which we know can lead to toxic stress and poor health outcomes in life. We heal children's brain and bodies by piloting the best treatment for toxic stress and sharing our findings nationally.

For more information, please visit our website at [www.centerforyouthwellness.org](http://www.centerforyouthwellness.org).

# INTRODUCTION

In communities across the nation, chronic adversity stands in the way of the health and success of many children. Now more than ever, we are beginning to understand the impact of these early childhood experiences on the developing brain and body of a child. Children's bodies adapt and develop in direct relation to their environments. Adverse Childhood Experiences, or ACEs, are traumatic experiences over which a child has no control – in fact a child can enter the world with multiple ACEs – but experiences that can have lifelong implications for her health and future success. While ACEs have been linked to poor health outcomes in adulthood, we are now beginning to understand the mechanism leading to disease and early death – toxic stress. Left unaddressed, toxic stress affects the fundamental biological functioning of the body and, in many children, the healthy development of their brain architecture.

While there is still much to be learned, the science is clear: Toxic stress caused by ACEs can profoundly alter the otherwise healthy development of a child. As Dr. Robert W. Block, former president of the American Academy of Pediatrics, noted: "Children's exposure to Adverse Childhood Experiences are the greatest unaddressed public health threat facing our nation today." This is a public health crisis with clear implications beyond health: from education to public safety to our economy. While this white paper is intended to be a resource, it is also a call to action. We, as a nation, must do more to promote the health and well-being of children by recognizing, preventing, and healing toxic stress in children exposed to ACEs.

## SASHA'S STORY

Sasha is an 11-year old girl who has grown up in the Bayview neighborhood in San Francisco – one of the city's poorest neighborhoods with high levels of community violence. Already in her young life, she knows three people who have been murdered. Her father went to prison last year for physically abusing Sasha since she was a little girl. Whenever her father drank too much, he would hit and verbally abuse Sasha and her mother.

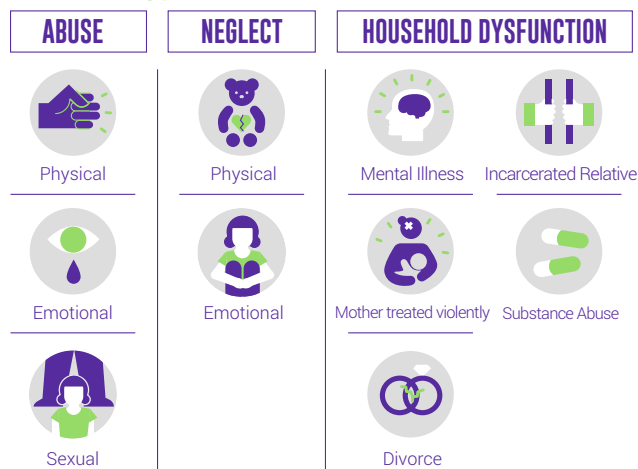
Sasha and her parents used to live in an apartment in the Bayview. However, soon after her father went to jail, Sasha's babysitter said that she could no longer watch Sasha in the evenings when her mother needed to work. Unable to leave Sasha alone, her mother soon lost her job and the family was forced to move out of their apartment. Sasha and her mother were homeless for several months until they were able to move into subsidized housing.

Sasha is ashamed that she is now living in subsidized housing and the family's difficult situation has created animosity between Sasha and her mother. Her mother is depressed, but, without health insurance, she cannot afford to get treatment. Most recently, Sasha has been getting into trouble at school – she was recently suspended for fighting. She is struggling academically and her teacher wants to refer her to special education.

# WHAT ARE ACES?

ACEs, or Adverse Childhood Experiences, are traumatic experiences that can have a profound effect on a child's developing brain and body with lasting impacts on a person's health throughout her lifespan. There are ten recognized ACEs, which fall into three types – abuse, neglect, and household dysfunction.<sup>1</sup>

## The three types of ACEs include



**FIGURE 1: Types of Adverse Childhood Experiences**  
Image courtesy of the Robert Wood Johnson Foundation

Additionally, research is currently underway to determine if other traumatic events, such as exposure to community violence, homelessness, bullying in school, or involvement in foster care, may also be ACE indicators.

## THE BEGINNING OF CHANGE: THE ADVERSE CHILDHOOD EXPERIENCES STUDY

First published in 1998, the Adverse Childhood Experiences Study (ACE Study) was a simple but profound study that has revolutionized how we understand the relationship between childhood and long-term health as adults. Led by researchers Dr. Vincent Felitti and Dr. Robert Anda, the ACE Study surveyed more than 17,000 adults, between 1995 and 1997, who were patients of Kaiser Permanente in San Diego.<sup>2</sup> Participants were asked to complete a questionnaire reporting traumatic experiences during childhood, and the responses were analyzed jointly with the participants' medical histories. Notably, the vast majority of the participants were white (74.8%) and had attained a college-level education or higher (75.2%).<sup>3</sup>

The results of the ACE Study were astonishing. Almost two-thirds (63.9%) of participants reported having one or more adverse childhood experience.<sup>4</sup> One in eight participants (12.5%) reported having four or more ACEs.<sup>5</sup> The most commonly reported ACEs were physical abuse (28.3%), substance abuse by a household member (26.9%), and parental separation or divorce (23.3%).<sup>6</sup>

Even more alarming, researchers found strong correlations between ACEs and poor health outcomes among participants. Researchers found increased risk for disease and negative health behaviors.<sup>7</sup>

### WHAT ACES DOES SASHA HAVE?

#### ACEs

- Physical abuse
- Verbal abuse
- Witness to domestic violence
- Parental incarceration
- Parental alcoholism
- Maternal depression
- **Total ACEs: 6**

#### Other possible ACEs

- Exposure to community violence
- Homelessness

### A PERSON WITH 4 OR MORE ACES IS:

- 2.2 times as likely to have ischemic heart disease
- 2.4 times as likely to have a stroke
- 1.9 times as likely to have cancer
- 1.6 times as likely to have diabetes

Moreover, researchers saw strong dose-response relationships between the number of ACEs and the risk of disease. Spanning virtually every cross-analysis, as the number of ACEs increased, the risk of the negative health outcomes increased as well.<sup>8</sup>

### A PERSON WITH 4 OR MORE ACEs IS:

- 12.2 times as likely to attempt suicide
- 10.3 times as likely to use injection drugs
- 7.4 times as likely to be an alcoholic

The ACE Study raised significant questions about the relationship between childhood and health in adulthood. For example, with an ACE score of six, research tells us that Sasha is at more than double the risk for heart disease, more than three times the risk for lung cancer, more than three times likely to become pregnant as a teenager, and her life expectancy is twenty years shorter than if she had an ACE score of zero.<sup>9</sup> The original ACEs pyramid<sup>10</sup> (shown below) illustrated an early hypothesis of how ACEs impact adult health.

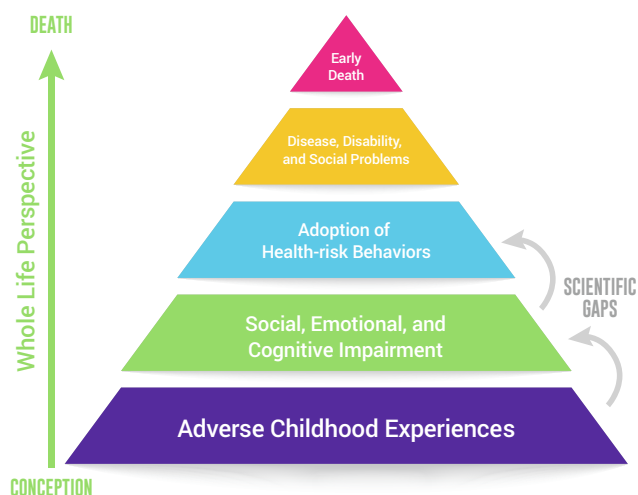


Figure 2: Original ACEs Pyramid

Notably, the original ACEs pyramid identified “scientific gaps” where scientists were unable to explain the mechanism underlying the outcomes evidenced by study participants.

Over the past fifteen years, the ACEs pyramid has been revised to reflect scientific breakthroughs in our understanding of early childhood brain and body development.<sup>11</sup> While there is a relationship between ACEs and the adoption of risky behaviors, recent research has shown a strong relationship between cardiovascular disease and ACEs after correcting for all conventional risk factors, such as smoking, obesity, and high cholesterol, suggesting that there is a direct link between ACEs and the development of chronic disease.<sup>12</sup>

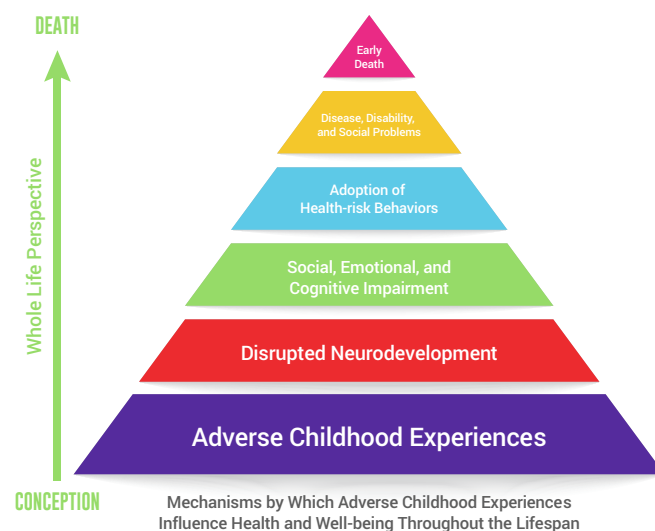


Figure 3: Revised ACEs Pyramid

While much work still remains, we now know that ACEs can have a profound impact on the fundamental development of a child’s brain and body – through a mechanism called “toxic stress.”

# WHAT IS TOXIC STRESS?

When we think about being stressed, we often think about having too much work to do or multiple responsibilities without enough time. For many children, stress comes from the big game, the important exam, or the first day of school. Stress caused by these types of events, known as **positive stress**, is a mild or moderate stress response and short-lived in duration, causing brief increases in heart rate or mild changes to the body's stress hormone levels.<sup>13</sup> Positive stress is normal and, in fact, an important part of growing up – helping us develop the capacity to handle stressful situations later on in life.

*Positive stress is a mild or moderate and brief stress response characterized by brief increases in heart rate and mild changes to the body's hormone levels.*

## POSITIVE STRESS IN SASHA'S LIFE:

Sasha's teacher has asked Sasha to recite a poem for the school talent show. Sasha is very nervous about speaking in front of an audience.

While positive stress is normal and necessary for healthy child development, **tolerable stress** is a more severe stress response that has the potential to impact a child's development over time but its negative effects are tempered by its limited duration which allows the child's brain to recover in time.<sup>14</sup> Tolerable stress, such as that caused by the death of a loved one, is made tolerable by its infrequency and the presence and guidance of a caring adult who can help the child through the difficult period.<sup>15</sup> However, tolerable stress can become toxic stress and cause long-term harm to the child's developing brain and body if there is no caring adult to help the child manage the stress.<sup>16</sup>

*Tolerable stress is a more severe stress response with the potential to harm a child's brain development but, due to its limited duration, a child's brain can recover from the negative effects over time.*

## TOLERABLE STRESS IN SASHA'S LIFE:

Sasha was very close to her grandmother and was very sad and had difficulty concentrating when she passed away a few years ago. However, her mother helped Sasha through her grieving.

**Toxic stress** is the "extreme, frequent or extended activation of the body's stress response without the buffering presence of a supportive adult."<sup>17</sup> Strong, frequent, and/or prolonged adversity, such as ACEs, without adequate support from an adult can cause a chronic and severe stress response in a child with serious implications for the child's developing brain and body.<sup>18</sup> Toxic stress is particularly harmful for children because of the changes and growth going on in the brain during childhood. Toxic stress has the potential to stunt healthy development.

*Toxic stress is the extreme, frequent, or extended activation of the body's stress response without the buffering presence of a supportive adult.*

## TOXIC STRESS IN SASHA'S LIFE:

Sasha grew up with an abusive father who would regularly hit her and her mother, especially if he was drunk. Sasha was always scared to go home in case her father had been drinking that day.



Figure 4: Spectrum of stress

## IMPORTANCE OF EARLY CHILDHOOD IN HEALTHY BRAIN DEVELOPMENT

Our brains change and adapt over the course of our lives. However, there are critical periods where significant brain development occurs.<sup>19</sup> These are known as **“windows of opportunity.”** One of the most important “windows of opportunity” is in early childhood between the ages of zero and five. During this time, significant developments are occurring in a child’s brain.

*Windows of opportunity are crucial periods when significant brain development is occurring.*

One of the most important developments occurring in a young child’s brain centers around neuroplasticity.

**Neuroplasticity** is the process by which our brains are shaped by our experiences. In children younger than five, there are two types of neuroplasticity underway – synaptic plasticity and cellular plasticity. **Synaptic plasticity** is the strength of connections between brain cells – think of the strength of your voice from a

whisper to a shout. **Cellular plasticity** is the number of those brain cell connections – think of one person shouting versus an entire stadium shouting. The phrase “Use it or lose it” is one way to understand neuroplasticity – the more we use neuronal connections, the stronger they become and vice versa.

*Neuroplasticity is the process by which the brain is shaped by experiences.*

*Cellular plasticity is the number of connections between brain cells.*

*Synaptic plasticity is the strength of the connections between brain cells.*

While synaptic plasticity occurs throughout our life, cellular plasticity primarily occurs during the first five years of life. Thus, there is a unique “window of opportunity” from ages zero to five because both types of neuroplasticity – cellular and synaptic – are occurring simultaneously.

While our brains are shaped by experiences throughout our life, experiences in early childhood play a crucial role in preparing our brains for the future. Because of the brain's unique plasticity in early childhood, positive and negative experiences can deeply impact brain development.<sup>20</sup> Positive experiences can promote healthy brain development in a young child, while negative experiences may promote unhealthy brain development as the brain adapts to the negative experiences.

There is early evidence of the impact of ACEs on the developing brains and bodies of children. In 2011, CYW Founder and Chief Executive Officer Dr. Nadine Burke Harris and Stanford University professor Dr. Victor Carrion published a study looking at the correlation

between the ACEs and health outcomes in an urban pediatric population – patients from the Bayview Child Health Center.<sup>21</sup> In a group of 702 patients where the median age was eight, Dr. Burke Harris and Dr. Carrion found that over two-thirds of the children had at least one ACE and 12 percent had four or more ACEs.<sup>22</sup> Moreover, they found that children who had four or more ACEs were 32.6 times as likely to have learning or behavior problems compared with children who had no ACEs.<sup>23</sup> They also found that children with 4 or more ACEs were twice as likely to be overweight or obese compared with children who had no ACEs.<sup>24</sup> Thus, we can already see the early impacts of ACEs on the healthy development of children's brains and bodies.

## THE TOXICITY OF TOXIC STRESS

### THIS IS YOUR BODY ON TOXIC STRESS

Most of us have heard of the “fight or flight response.” This is the body's most basic reaction in response to stress. Toxic stress, or stress resulting from strong, frequent or chronic adversity, leads to the over activation of the body's stress response.

Imagine that you're walking through the woods and suddenly you come across an angry bear. Your natural instinct is to run away from the danger. Within your body, you release a series of hormones that govern your response to stress – it is this hormonal process that triggers the innate reaction to “fight or flight” when you are in danger.

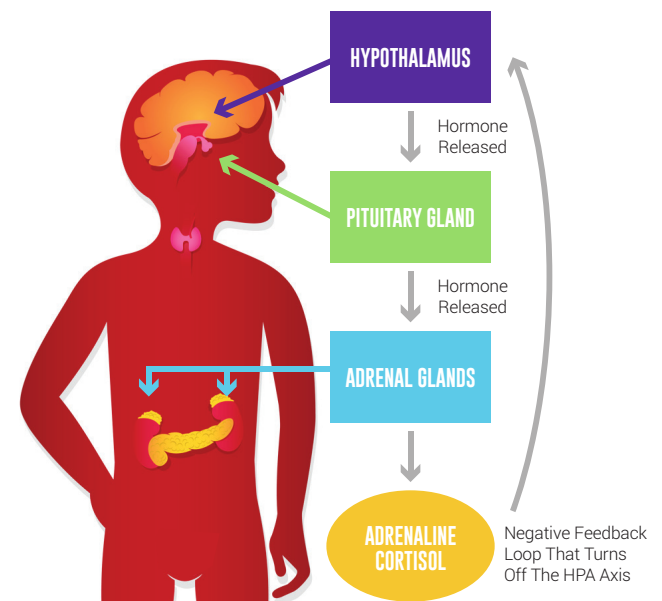


Figure 5: The hypothalamic-pituitary-adrenal (HPA) axis

When the body reacts to a threat or stressor – in this case, the angry bear in your path – the brain triggers a series of hormone releases that activate the production of adrenaline and cortisol. **Adrenaline** is a hormone that is central to the body's short-term response to stress – increasing the body's heart rate and causing pupil dilation so the body is better equipped to combat the threat. **Cortisol** is a critical hormone in the body's long-term response to stress – increasing blood pressure and blood sugar and regulating the body's metabolism and immune response.<sup>25</sup>

## THE HPA AXIS AKA THE BODY'S STRESS RESPONSE SYSTEM

The body's stress response is regulated by the hypothalamic-pituitary-adrenal axis, or the HPA axis.<sup>26</sup> When the body receives a threat or stressor, the brain signals the hypothalamus, which releases hormones that trigger the pituitary gland.<sup>27</sup> The pituitary gland then releases a different hormone that stimulates the adrenal gland to produce adrenaline and cortisol.<sup>28</sup>

*Adrenaline is a hormone, central to the body's short-term stress response, whose effects include increased heart rate and pupil dilation helping to prepare the body for "fight or flight".*

*Cortisol is a hormone, central to the body's long-term stress response, whose effects include increased blood pressure and blood sugar and regulation of the body's metabolism and immune response.*

However, too much or too little cortisol can be harmful for the body, so cortisol also acts as a regulator. Cortisol helps to turn off the body's stress response system thus creating a negative feedback loop that allows the body to maintain homeostasis, or balance.<sup>29</sup>

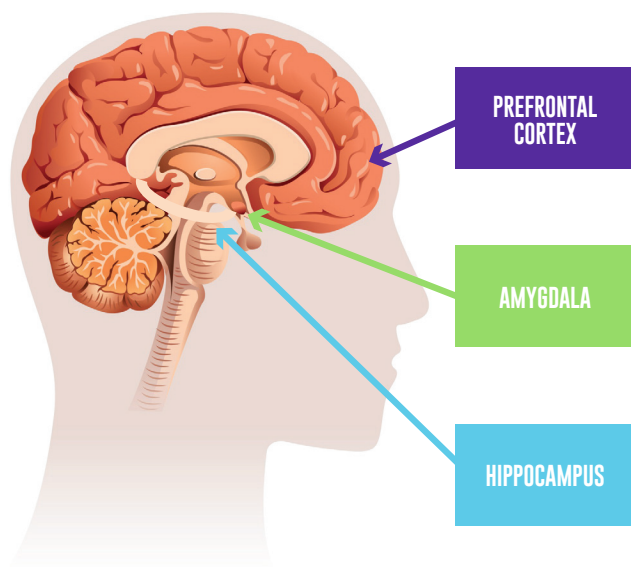
Let's go back to the bear example. Now imagine that the angry bear is a regular occurrence on your walks home, but you never know if you're going to see him or not. So every day, your body is producing cortisol to make sure that you're ready to run away in case you see the angry bear. Your body's stress response system is chronically activated. Our bodies are not meant to be in a state of constant stress response. As characterized by the term "fight or flight," the body's stress response developed as a response to short, periodic threats. Over time, this strong, frequent or chronic stress can lead to the dysregulation of the body's stress response system, meaning that the system responds in an unhealthy way - sometimes producing inappropriate amounts of cortisol and sometimes responding to small or inappropriate threats.<sup>30</sup> This is your body on toxic stress.

The dysregulation of the body's stress response system can have serious consequences for a person's basic immune system. When the body produces too much cortisol, the body's immune response is suppressed, increasing the chance of infection and disease.<sup>31</sup>

# IMPACT OF TOXIC STRESS ON THE DEVELOPING BRAIN

As noted above, early childhood, particularly ages zero to five, is an important “window of opportunity” for brain development. Toxic stress can have devastating effects on a child’s brain development particularly during these early years of life. Toxic stress can result in changes to crucial parts of the brain including the hippocampus, prefrontal cortex, and the amygdala.

Figure 6: Crucial parts of the brain impacted by toxic stress



## CHANGES IN BRAIN ARCHITECTURE DUE TO TOXIC STRESS INCLUDE:

- Loss of brain cells
- Damage to brain cell connections
- Enlargement or shrinking of certain parts of the brain
- Hyperactivity of certain parts of the brain

The **hippocampus** is responsible for learning, memory, and some types of stress response regulation. Changes to the hippocampus due to toxic stress can lead to impaired memory and mood control.<sup>32</sup>

## SASHA'S SYMPTOMS:

Sasha's mother has noticed that Sasha is easily irritated and the smallest thing can set off a tantrum.

The **prefrontal cortex** is responsible for decision-making, judgment, impulse control and attention.<sup>33</sup> Toxic stress can result in difficulty focusing, poor memory, and critical thinking difficulty.

## SASHA'S SYMPTOMS:

Sasha has a hard time focusing on assignments in class and struggles with reading and math. As a result, she often gets frustrated and acts out in class. Her teacher thinks that she may have attention deficit hyperactive disorder (ADHD) and has recommended Sasha for special education.

Toxic stress can also cause changes to the **amygdala**, which is responsible for processing emotional reactions such as anxiety and fear.<sup>34</sup> These changes may manifest as increased anxiety or proneness to fear.

## SASHA'S SYMPTOMS:

Sasha's mom has noticed that Sasha is jumpy and frequently looking around and wary of her surroundings. Sasha was recently suspended from school for fighting because she kicked another girl whom she thought was threatening her.

# THE DOCTOR'S OFFICE: BUILDING RESILIENCE FROM INFANCY ON

The preceding sections have illustrated the serious and lifelong consequences of toxic stress on a child's developing brain and body. Toxic stress can have a profound impact on children because of the "window of opportunity" occurring during this formative time in a child's brain development. During this period where a child's brain is absorbing a multitude of experiences and information from her environment, negative experiences such as ACEs can radically influence whether the child's brain develops in a healthy or an unhealthy way. While the human brain continues to grow and adapt over the course of a lifetime, recognizing the impacts of toxic stress in early childhood offers a unique opportunity to intervene and possibly shift a child's life trajectory.

The pediatric home offers a distinct entry point into addressing ACEs and toxic stress with families. Even before a child goes to school or interacts with other systems, a child usually visits a pediatrician for a routine well-child check. With the ability to touch countless numbers of children exposed to ACEs, pediatricians should be on the front line of preventing, screening for, and healing toxic stress. Moreover, as doctors, pediatricians are in a unique position to help children and families because of the trust that develops from caring for the health and wellbeing of a child. Left untreated, the implications of toxic stress can be seen across many systems – health, education, public safety, and even the economy. However, by recognizing and addressing toxic stress through the pediatric home, we can open opportunities for children to lead healthy and successful lives.

## RECOMMENDATIONS

Much more must be done to promote the health and success of our nation's children, particularly those facing chronic adversity.

**Gather more data on the prevalence of ACEs throughout the United States:** In order to craft an effective strategy to address ACEs and toxic stress, we must first understand the scope of the problem. Gathering data on the prevalence of ACEs throughout the nation and in our communities is a critical first step.

**Improve access to healthcare, including mental health, for all families:** Too often the mental health needs of families go undiagnosed and untreated. Limitations on healthcare coverage for mental health services and a dearth of community-based mental health service providers often lead to additional harms to children and families by causing mental illness to go untreated. By improving access to healthcare, including mental health services, for all families, we can prevent the harm of untreated mental illness to children and families through treatment and support.

**Advance the integration of behavioral and physical health care services:** Addressing the physical health of a child is not enough. More must be done to heal the whole child – body and mind – through enhancing the integration of behavioral and physical health care services.

**Support research to identify evidence-based interventions for toxic stress:** The impacts of toxic stress are not irreversible. However, more must be done to explore and evaluate innovative strategies to prevent and heal toxic stress.

**Educate pediatricians and other healthcare professionals who serve children on the effects of ACEs and impact of toxic stress on children's developing brains and bodies:** Pediatricians and other healthcare professionals, particularly those who work directly with children, such as school nurses, are in a unique position to screen for toxic stress and help families engage in services to heal the impacts of toxic stress.

# ENDNOTES

<sup>1</sup>Prevalence of Individual ACEs. Centers for Disease Control and Prevention, Prevalence of Individual Adverse Childhood Experiences, ADVERSE CHILDHOOD EXPERIENCES (ACE) STUDY (Jan. 18, 2013), available at <http://www.cdc.gov/ace/prevalence.htm>.

<sup>2</sup>Robert F. Anda, et al., The enduring effects of abuse and related adverse experiences in childhood: A convergence of evidence from neurobiology and epidemiology, 256 EUROPEAN ARCHIVES OF PSYCHIATRY AND CLINICAL NEUROSCIENCE 174 (2006).

<sup>3</sup>Centers for Disease Control and Prevention, ACE Study Participant Demographics, ADVERSE CHILDHOOD EXPERIENCES (ACE) STUDY (Jan. 18, 2013), available at <http://www.cdc.gov/ace/demographics.htm>.

<sup>4</sup>Supra Note 1, Prevalence of Individual ACEs.

<sup>5</sup>Id.

<sup>6</sup>Id.

<sup>7</sup>Vincent J. Felitti, et al., Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: The Adverse Childhood Experiences (ACE) study, 14 AMERICAN J. OF PREVENTATIVE MEDICINE 245 (1998).

<sup>8</sup>Id.

<sup>9</sup>Dong IHD Study. Maxia Dong, et al., Insights into Causal Pathways for Ischemic Heart Disease: Adverse Childhood Experience Study, 110 CIRCULATION 1761 (2011); David W. Brown, et al., Adverse childhood experiences are associated with the risk of lung cancer: a prospective cohort survey, 10 BMC PUBLIC HEALTH 20 (2010), available at: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2826284/pdf/1471-2458-10-20.pdf>; Maxia Dong, et al., Adverse childhood experiences and self-reported liver disease: New insights into a causal pathway, 163 ARCHIVES OF INTERNAL MEDICINE 1949 (2003), available at: <http://archinte.jamanetwork.com/article.aspx?articleid=215989>; Susan D. Hillis, et al., The association between adverse childhood experiences and adolescent pregnancy, long-term psychosocial consequences, and fetal death, 113 PEDIATRICS 320 (2004); David W. Brown, et al., Adverse Childhood Experiences and the Risk of Premature Mortality, 37 AM. J. PREV. MED. 389 (2009).

<sup>10</sup>Centers for Disease Control and Prevention, Pyramid, ADVERSE CHILDHOOD EXPERIENCES (ACE) STUDY (Jan. 18, 2013), available at <http://www.cdc.gov/ace/pyramid.htm>.

<sup>11</sup>Charles L. Whitfield, M.D., The Adverse Childhood Experience (ACEs) Study: A Summary, available at: <http://www.cbwhit.com/ACEstudy.htm> (last accessed May 12, 2014).

<sup>12</sup>Supra Note 9, Dong IHD Study.

<sup>13</sup>NSCDC Working Paper #3. National Scientific Counsel on the Developing Child, EXCESSIVE STRESS DISRUPTS THE ARCHITECTURE OF THE DEVELOPING BRAIN: WORKING PAPER #3 (2014), available at [http://developingchild.harvard.edu/index.php/resources/reports\\_and\\_working\\_papers/working\\_papers/wp3/](http://developingchild.harvard.edu/index.php/resources/reports_and_working_papers/working_papers/wp3/).

<sup>14</sup>Id.

<sup>15</sup>Id.

<sup>16</sup>Id.

<sup>17</sup>Sara B. Johnson, et al., The science of early life toxic stress for pediatric practice and advocacy, 131 PEDIATRICS 319 (2013), available at <http://pediatrics.aappublications.org/content/131/2/319.full>.

<sup>18</sup>Id.; Supra Note 13, NSCDC Working Paper #3.

<sup>19</sup>NSCDC Working Paper #5. National Scientific Counsel on the Developing Children, THE TIMING AND QUALITY OF EARLY EXPERIENCES COMBINE TO SHAPE BRAIN ARCHITECTURE: WORKING PAPER #5 (2007), available at [http://developingchild.harvard.edu/index.php/resources/reports\\_and\\_working\\_papers/working\\_papers/wp5/](http://developingchild.harvard.edu/index.php/resources/reports_and_working_papers/working_papers/wp5/)

<sup>20</sup>Supra Note 17, Johnson; Note 19, NSCDC Working Paper #5.

<sup>21</sup>Nadine J. Burke, et al., The impact of adverse childhood experiences on an urban pediatric population, 35 CHILD ABUSE & NEGLECT 408 (2011).

<sup>22</sup>Id.

<sup>23</sup>Id.

<sup>24</sup>Id.

<sup>25</sup>Supra Note 13, NSCDC Working Paper #3.

<sup>26</sup>Supra Note 17, Johnson.

<sup>27</sup>Id.

<sup>28</sup>Id.

<sup>29</sup>Id.

<sup>30</sup>Id.

<sup>31</sup>Id.

<sup>32</sup>Shonkoff. Jack P. Shonkoff, et al., The lifelong effects of early childhood adversity and toxic stress, 129 PEDIATRICS e232 (2012), available at <http://pediatrics.aappublications.org/content/129/1/e232.full.pdf>; Supra Note 13, NSCDC Working Paper #3.

<sup>33</sup>Supra Note 32, Shonkoff.

<sup>34</sup>Id.

## ACKNOWLEDGMENTS

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