

ACES Science 101 (FAQs)



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What is ACEs science?

ACEs science refers to the research on the prevalence and consequences of adverse childhood experiences, and what to do to prevent them. It comprises:

1. The CDC-Kaiser Permanente ACE Study and subsequent surveys that show that most people in the U.S. have at least one ACE, and that people with four ACEs—including living with an alcoholic parent, racism, bullying, witnessing violence outside the home, physical abuse, and losing a parent to divorce — have a huge risk of adult onset of chronic health problems such as heart disease, cancer, diabetes, suicide, and alcoholism.
2. Brain science (neurobiology of toxic stress) — how toxic stress caused by ACEs damages the function and structure of kids' developing brains.
3. Health consequences — how toxic stress caused by ACEs affects short- and long-term health, and can impact every part of the body, leading to autoimmune diseases, such as arthritis, as well as heart disease, breast cancer, lung cancer, etc.
4. Historical and generational trauma (epigenetic consequences of toxic stress) — how toxic stress caused by ACEs can alter how our DNA functions, and how that can be passed on from generation to generation.
5. Resilience research and practice — Building on the knowledge that the brain is plastic and the body wants to heal, this part of ACEs science includes evidence-based practice, as well as practice-based evidence by people, organizations and communities that are integrating trauma-informed and resilience-building practices. This ranges from looking at how the brain of a teen with a high ACE score can be healed with cognitive behavior therapy, to how schools can integrate trauma-informed and resilience-building practices that result in an increase in students' scores, test grades and graduation rates.

What are ACEs?

ACEs are adverse childhood experiences that harm children's developing brains and lead to changing how they respond to stress and damaging their immune systems so profoundly that the effects show up decades later. ACEs cause much of our burden of chronic disease, most mental illness, and are at the root of most violence.

“ACEs” comes from the [CDC-Kaiser Adverse Childhood Experiences Study](#), a groundbreaking public health study that discovered that childhood trauma leads to the adult onset of chronic diseases, depression and other mental illness, violence and being a victim of violence, as well as financial and social problems. The ACE Study [has published about 70 research papers since 1998](#). Hundreds of additional research papers based on the ACE Study have also been published.

The 10 ACEs the researchers measured:

- Physical, sexual and verbal abuse
- Physical and emotional neglect
- A family member who is:
 - depressed or diagnosed with other mental illness;
 - addicted to alcohol or another substance;
 - in prison
- Witnessing a mother being abused
- Losing a parent to separation, divorce or other reason

Subsequent to the ACE Study, other ACE surveys have expanded the types of ACEs to include racism, gender discrimination, witnessing a sibling being abused, witnessing violence outside the home, witnessing a father being abused by a mother, being bullied by a peer or adult, involvement with the foster care system, living in a war zone, living in an unsafe neighborhood, losing a family member to deportation, etc.

ACEs fall into three large categories:

- Adverse childhood experiences
- Adverse community experiences
- Adverse climate experiences

Resources:

[CDC ACE Study site](#)

[Wikipedia -- Adverse Childhood Experiences Study](#)

[The 10 ACE Questions \(and 14 resilience survey questions\)](#)

[The Pair of ACEs: The Soil in Which We're Rooted, the Branches on Which We Grow](#)

Why are ACEs significant?

1. The ACE Study revealed six main discoveries:

- ACEs are common...nearly two-thirds (64%) of adults have at least one.
- They cause adult onset of chronic disease, such as cancer and heart disease, as well as mental illness, violence and being a victim of violence
- ACEs don't occur alone....if you have one, there's an 87% chance that you have two or more.
- The more ACEs you have, the greater the risk for chronic disease, mental illness, violence and being a victim of violence. People have an ACE score of 0 to 10. Each type of trauma counts as one, no matter how many times it occurs. You can think of an ACE score as a cholesterol score for childhood trauma. For example, people with an ACE score of 4 are twice as likely to be smokers and seven times more likely to be alcoholic. Having an ACE score of 4 increases the risk of emphysema or chronic bronchitis by nearly 400 percent, and attempted suicide by 1200 percent.
- People with high ACE scores are more likely to be violent, to have more marriages, more broken bones, more drug prescriptions, more depression, and more autoimmune diseases. People with an ACE score of 6 or higher are at risk of their lifespan being shortened by 20 years.

- ACEs are responsible for a big chunk of workplace absenteeism, and for costs in health care, emergency response, mental health and criminal justice. So, the fifth finding from the ACE Study is that childhood adversity contributes to most of our major chronic health, mental health, economic health and social health issues.
- On a population level, it doesn't matter which four ACEs a person has; the harmful consequences are the same. The brain cannot distinguish one type of toxic stress from another; it's all toxic stress, with the same impact.

What's particularly startling is that the 17,000 ACE Study participants were mostly white, middle- and upper-middle class, college-educated, and all had jobs and great health care (they were all members of Kaiser Permanente).

Resources:

[ACE Study primer](#) -- KPJR Films, which came out with *Paper Tigers* in 2015 and *Resilience* in 2016, put together this five-minute overview of the ACE Study.

[ACE Study video](#) -- Three-minute trailer for a four-hour CD of interviews with ACEs researchers produced by the Academy on Violence and Abuse.

[How childhood trauma affects health across a lifetime](#) (16-minute TED Talk by Dr. Nadine Burke Harris)

[The Adverse Childhood Experiences Study – the largest public health study you never heard of – started in an obesity clinic](#)

Has anyone else done an ACE Study?

[Thirty-six states and Washington, D.C.](#) (infographic) have done one or more ACE surveys. [Here are links to some of their reports](#) (some states haven't produced reports).

There are numerous other ACE surveys, including cities, such as [Philadelphia](#); organizations, including the [Crittenton Foundation](#); schools, including [Spokane elementary schools](#); by pediatricians, including Dr. Nadine Burke Harris and Dr. Victor Carrion ([2011](#) and [2013](#)); several countries, including [England](#), [Saudi Arabia](#), and a World Health Organization ACE survey of university students in [Romania](#),; and [64,000 juvenile offenders in the Florida juvenile justice system](#). You can find a list of ACE surveys, including expanded ACE surveys with more questions, in the [Resources Section](#) of [ACEsConnection.com](#).

What's the neurobiology of toxic stress?

Brain science shows that, in the absence of protective factors, toxic stress damages children's developing brains. Stress is the body's normal response to challenging events or environments. Positive stress -- the first day of school, a big exam, a sports challenge -- is part of growing up, and parents or caregivers help children prepare for and learn how to handle positive stress, which is moderate and doesn't last long. It increases heart rate and the amount of stress hormones in the body, but they return to normal levels quickly.

But when events or the environment are threatening or harmful – we stumble across a bear in the woods – our brains instantly zap into fight, flight or freeze mode and bypass our thinking brains, which can be way too analytical to save us (Is the bear really mean? Is it more interested in berries or killing me? Should I wait until I see it charge?). With help from caring adults, children also recover from this tolerable stress.

Too much stress – toxic stress – occurs when that raging bear comes home from the bar every night, says pediatrician Nadine Burke Harris. Then a child's brain and body will produce an overload of stress hormones — such as cortisol and adrenaline — that harm the function and structure of the brain. This can be particularly devastating in children, whose brains are developing at a galloping pace from before they are born to age three. Toxic stress is the kind of stress that can come in response to living for months or years with a screaming alcoholic father, a severely depressed and neglectful mother or a parent who takes out life's frustrations by whipping a belt across a child's body.

Resources:

[Harvard University Center on the Developing Child](#)

[Video: Toxic Stress Derails Healthy Development \(2 min\)](#)

[An Unhealthy Dose of Stress \(Center for Youth Wellness white paper\)](#)

[The Science Behind PTSD Symptoms: How Trauma Changes the Brain](#)

[Brain Story Certification, Alberta Family Wellness Initiative](#)

What are the health effects of toxic stress?

Chronic toxic stress—living in a red alert mode for months or years — can also damage our bodies. In a red alert state, the body pumps out adrenaline and cortisol continuously. Over time, the constant presence of adrenaline and cortisol keep blood pressure high, which weakens the heart and circulatory system. They also keep glucose levels high to provide enough energy for the heart and muscles to act quickly; this can lead to type 2 diabetes. Too much adrenaline and cortisol can also increase cholesterol.

Too much cortisol can lead to osteoporosis, arthritis, gastrointestinal disease, depression, anorexia nervosa, Cushing’s syndrome, hyperthyroidism and the shrinkage of lymph nodes, leading to the inability to ward off infections.

If the red alert system is always on, eventually the adrenal glands give out, and the body can’t produce enough cortisol to keep up with the demand. This may cause the immune system to attack parts of the body, which can lead to lupus, multiple sclerosis, rheumatoid arthritis, and fibromyalgia.

Cortisol is also extremely important in maintaining the body’s appropriate inflammation response. In a normal response to a bee sting or infection, the body rushes antibodies, white blood cells and other cell fighters to the site and the tissues swell while the battle rages. But too much swelling damages tissue. Cortisol controls this fine balance. So without the mediating effects of cortisol, the inflammatory response runs amok and can cause a host of diseases.

If you’re chronically stressed and then experience an additional traumatic event, your body will have trouble returning to a normal state. Over time, you will become more sensitive to trauma or stress, developing a hair-trigger response to events that other people shrug off.

Biomedical researchers say that childhood trauma is biologically embedded in our bodies: Children with adverse childhood experiences and adults who have experienced childhood trauma may respond more quickly and strongly to events or conversations that would not affect those with no ACEs, and have higher levels of indicators for inflammation than those who have not suffered childhood trauma. This wear and tear on the body is the main reason why the lifespan of people with an ACE score of six or higher is likely to be shortened by 20 years.

Resources:

[Childhood Disrupted: How Your Biography Becomes Your Biology and How You Can Heal](#), by Donna Jackson Nakazawa

[The Body Keeps the Score: Brain, Mind and Body in the Healing of Trauma](#), by Bessel Van Der Kolk

[The Deepest Well: Healing the Long-Term Effects of Childhood Adversity](#), by Nadine Burke Harris, 2018.

[Scared Sick: The Role of Childhood Trauma in Adult Disease](#) by Robin Karr-Morse with Meredith S. Wiley

[Biological Embedding of Early Social Adversity](#), Proceedings of the National Academy of Sciences, 2012

[PubMed childhood adversity research publications](#)

What's epigenetics and how does that relate to historical or generational trauma?

Most people believe that the DNA we're born with does not change and that it determines all that we are during our lifetime. That's true, but the research from [epigenetics](#) — the study of how social and other environments turn our genes on and off — shows that toxic stress can actually change how our genes function, which can lead to long-term changes in all parts of our bodies and brains. What's more, these changes can be transferred from generation to generation.

Epigenetics means “above the genome” and refers to changes in gene expression that are not the result of changes in the DNA sequence (or mutations).

Resources:

[WhatIsEpigenetics.com](#) -- This New York-based blog and news aggregator covers the field of epigenetics and is funded by EpiGentek. It includes backgrounders, including [epigenetics fundamentals](#).

[Epigenetics](#) -- From the [Genetics Science Learning Center](#) at the University of Utah, this section includes explainers and an overview of how the social environment affects your epigenome.

[Epigenetics 101: A beginner's guide to explaining everything](#) (TheGuardian.com, 2014)

Resilience research: If you have a high ACE score, are you doomed? No!

The good news is that the brain is plastic, and the body wants to heal.

The brain is continually changing in response to the environment. If the toxic stress stops and is replaced by practices that build resilience, the brain can slowly undo many of the stress-induced changes.

There is well documented research on how individuals' brains and bodies become healthier through mindfulness practices, exercise, good nutrition, adequate sleep, and healthy social interactions.

Research on families shows that interventions -- such as [Nurse-Family Partnership](#), [Healthy Steps](#), and [Child First](#) -- can improve the lives of parents and children. Evidence-based parenting practices ([Incredible Years](#), [Triple P Parenting](#), etc.), increase the health of parents and children.

Research on communities and systems is emerging, but early data, especially from schools and juvenile detention centers, is showing promise.

Here's a good article that weaves the unified science of human development together: [Scars That Don't Fade](#), from Massachusetts General Hospital's Proto Magazine.

Who's using ACEs science?

Many people, organizations, agencies, systems and communities are beginning to implement trauma-informed, resilience-building practices based on ACEs science.

- [Pediatricians](#) (here's an [update on the Children's Clinic](#)) and [public health clinics](#) are screening patients for ACEs. By the end of 2017, between 1,000 and 2,000 pediatricians had integrated ACEs screening into their practices. Here's an [article about Kaiser Permanente pediatricians](#) in Northern California who have started screening kids for ACEs. [Dr. Jeffrey Brenner, MacArthur genius award winner, recommends physicians adding ACE screening](#) to measurement of other vital signs, such as blood pressure. A [rural health clinic in Pueblo, CO, changed its medical practice](#) after it integrated ACEs screening. A [family physician in Tennessee educates his opioid patients about their ACEs](#), and it helps motivate them to heal themselves. The physician also understands that ACEs leads to

damage that is chronic and, thus, he treats addictions as he does diabetes, as a chronic disease.

- Many schools – including schools in [San Francisco, CA](#), [Spokane, WA](#), [San Diego, CA](#), and [Walla Walla, WA](#) -- have integrated trauma-informed practices into classrooms, playgrounds and school policies. These schools have seen 90 percent drops in suspensions after one year; after three years, the schools no longer expel students and some no longer even have the need for in-school suspensions. The [grades, test scores and graduation rates increased](#), and the students most benefitted were those with the highest ACE scores. By the end of 2017, several hundred schools across the U.S. were integrating trauma-informed and resilience-building practices based on ACEs science.
- Head Start (early childhood education program) in Kansas City has integrated trauma-informed practices in a program called [Head Start Trauma Smart](#). ([NYTimes article about the program.](#))
- Home-based early childhood intervention, such as [Child First](#). ([NYTimes article about the program.](#))
- [Police departments](#) and [courts](#) have integrated trauma-informed approaches. [Safe Babies Courts have integrated ACEs science in resilience-building practices](#) that provide wrap-around services for families; a year after participating in Safe Babies Courts, 99 percent of the children suffer no further abuse.
- [Homeless shelters](#) and the [faith-based community](#) are integrating practices based on ACEs research. At the heart of their approach is educating those who are homeless and people in rescue missions about ACEs science; it often changes their whole understanding of their behavior, because they realize that they weren't born bad, that they had no control over what happened to them as children, that they coped appropriately, given what was available to them, and that they can change. [Batterers intervention programs that have integrated ACEs science](#) have reduced recidivism rates from what was accepted — 20 to 60 percent — to zero to four percent.
- [Cities](#) and [states](#) are integrating ACE-, trauma-informed practices and resilience-building practices. By the end of 2017, several hundred communities around the U.S. had launched ACEs initiatives. This report on [self-healing communities](#) describes how integrating ACEs science drastically reduced youth suicide, teen pregnancy, juvenile arrests, and high-school drop-out rates — all at the same time

— in communities in Washington State that integrated practices based on ACEs science.

Resources:

[Community Resilience Cookbook](#) (nine case studies of cities and states that are integrating ACEs research)

[Growing Resilient Communities 2.0](#) provides guidelines and tools for communities to launch, grow and measure the progress of their work.

What does trauma-informed mean?

According to the [Substance Abuse and Mental Health Services Administration](#) (SAMHSA), part of the U.S. Department of Health and Human Services, a trauma-informed approach refers to how an organization or community thinks about and responds to children and adults who have experienced or may be at risk for experiencing trauma. In this approach, the whole community understands the prevalence and impact of ACEs, the role trauma plays in people's lives, and the complex and varied paths for healing and recovery.

A trauma-informed approach asks: "What happened to you?" instead of "What's wrong with you?" It is designed to avoid re-traumatizing already traumatized people, with a focus on "safety first" (including emotional safety), and a commitment to do no harm. But a trauma-informed approach is most successful when an organization or community builds policies and practices based on a foundation of ACEs science.

Resources:

[SAMHSA overview of what trauma-informed is and isn't](#)

[National Center for Trauma-Informed Care](#)

[SAMHSA's Concept of Trauma and Guidance for a Trauma-Informed Approach](#) --

Introduces a concept of trauma and offers a framework for how an organization, system, or service sector can become trauma-informed. Includes a definition of trauma (the three "E's"), a definition of a trauma-informed approach (the four "R's"), 6 key principles, and 10 implementation domains.

Any legislation or federal policies?

Updates on U.S. state and federal legislation can be found in the [State ACEs Resolutions and Laws section](#) of [State ACEs Action](#) on ACEsConnection.com. Some examples:

[California legislature resolution to reduce ACEs](#)

[Massachusetts bill on trauma-informed schools](#)

[Vermont attempt to pass ACEs bill](#)

[Overview of state, federal legislation](#)

[US Department of Health and Human Services guidelines to state health directors](#) (and [the letter](#) to state health directors)

All resources:

[CDC ACE Study site](#)

[Wikipedia -- Adverse Childhood Experiences Study](#)

[The 10 ACE Questions](#) (and 14 resilience survey questions)

[Harvard University Center on the Developing Child](#) (neurobiology of toxic stress)

[Alberta Family Wellness Initiative](#) (Canada)

[ACEsTooHigh.com](#) – News site covering ACEs research and practices

[ACEsConnection.com](#) – Social network (with 18,000+ members across sectors) and more than 100 community sites that support ACEs initiatives in cities, counties, states, regions and nations.

[WhatIsEpigenetics.com](#) - News site covering epigenetics

[Epigenetics](#) -- Explainers and backgrounders about epigenetics

[National Center for Trauma-Informed Care](#)

[Community Resilience Cookbook](#) — Nine case studies of cities and states that are integrating ACEs research)

[SAMHSA's Concept of Trauma and Guidance for a Trauma-Informed Approach](#) -- Introduces a concept of trauma and offers a framework for how an organization, system, or service sector can become trauma-informed. Includes a definition of trauma (the three "E's"), a definition of a trauma-informed approach (the four "R's"), 6 key principles, and 10 implementation domains.

Videos:

[ACE Study video](#) (three minute trailer)

[Video: Toxic Stress Derails Healthy Development](#) (2 min)

[How childhood trauma affects health across a lifetime](#) (16-minute TED Talk by Dr. Nadine Burke Harris)

Books:

[Childhood Disrupted: How Your Biography Becomes Your Biology and How You Can Heal](#), by Donna Jackson Nakazawa

[The Body Keeps the Score: Brain, Mind and Body in the Healing of Trauma](#), by Bessel Van Der Kolk

[The Deepest Well: Healing the Long-Term Effects of Childhood Adversity](#), by Nadine Burke Harris, 2018.

[Scared Sick: The Role of Childhood Trauma in Adult Disease](#) by Robin Karr-Morse with Meredith S. Wiley

[The Last Best Cure: My Quest to Awaken the Healing Parts of My Brain and Get Back My Body, My Joy, and My Life](#), by Donna Jackson Nakazawa

For other books, [go to the ACEs Connection Books](#) community.

Documentaries:

[Paper Tigers](#) -- What does it mean to be a trauma-informed school? And how do you educate teens whose childhood experiences have left them with a brain and body ill-suited to learn? This film follows six students through a year in America's first trauma-informed high school.

[Resilience](#) -- *Resilience* chronicles how trailblazers in pediatrics, education, and social welfare are using cutting-edge science and field-tested therapies to protect children from the insidious effects of toxic stress.

[CAREgivers](#) -- How is the professional care provider affected emotionally and physically, and who helps them?

For a list of all documentaries addressing ACEs science, and how to access them, [go here](#).