Adverse Childhood Experiences (ACEs): An Important Element of a Comprehensive Approach to the Opioid Crisis

Elizabeth Cuervo Tilson

Adverse childhood experiences (ACEs) are traumatic life events that are linked to more than 40 poor adult health outcomes. Up to two-thirds of drug use problems may be traced back to ACEs [1]. Investing in the resiliency of our children is an important component of a comprehensive approach to the opioid epidemic.

Adverse Childhood Experiences and Their Relationship to Health Outcomes

ACEs are traumatic or stressful life events experienced before age 18 and include 8 domains of childhood abuse and household dysfunction, such as physical, sexual, and emotional abuse; adult substance abuse; and household domestic violence (see Figure 1). The landmark 1998 study by Felitti and Anda showed ACEs to not only be common, but also to increase the risk of many of the leading causes of death in adults [2]. A graded dose-response relationship was demonstrated between the number of ACEs a person experienced and their health-risk behaviors (eg, smoking, multiple sexual intercourse partners), health risk factors (eg, physical inactivity, severe obesity), behavioral health and substance use disorders (eg, alcoholism, drug abuse, depression, suicide attempts), and physical health disorders (eg, ischemic heart disease, cancer, chronic lung disease, skeletal fractures, and liver disease).

Since that initial study, the strength of the literature and evidence has grown, and ACEs have now been linked, in the same graded dose-response relationship, to more than 40 health outcomes [3] (see Figure 2). Additionally, ACEs are often interrelated and co-occur [4]. People who experienced 3 or more ACEs are more likely to have an increase in poor health outcomes. People with 6 or more ACEs have been found to have a 20-year shorter life expectancy than those with no ACEs [5].

FIGURE 1.
Adverse Childhood Experiences (ACEs)

Adverse Childhood Experiences (ACEs)
Traumatic or stressful life events experienced before age 18

Childhood abuse
- Physical abuse
- Sexual abuse
- Emotional abuse

Household dysfunction
- Household member who was depressed, mentally ill, or suicidal
- Alcohol or drug abuse in household
- Incarcerated household member
- Violence between adults in the household
- Parental divorce or separation

Source. Felitti and Anda, 1998

The Science and Biology of Toxic Stress

Brief and temporary episodes of stress and adversity, balanced by a supportive environment of adults, are important components in the development of a healthy stress response system. However, when stress and threats are prolonged and not buffered by a protective environment, the physiological response, including the prolonged release of stress hormones like cortisol, acts as a toxin and can damage the brain and other organ systems. This toxic exposure can disrupt brain architecture, especially in the areas of the brain dedicated to higher-order skills, and can increase the risk for cognitive impairment and stress-related disease into adulthood [6-8].

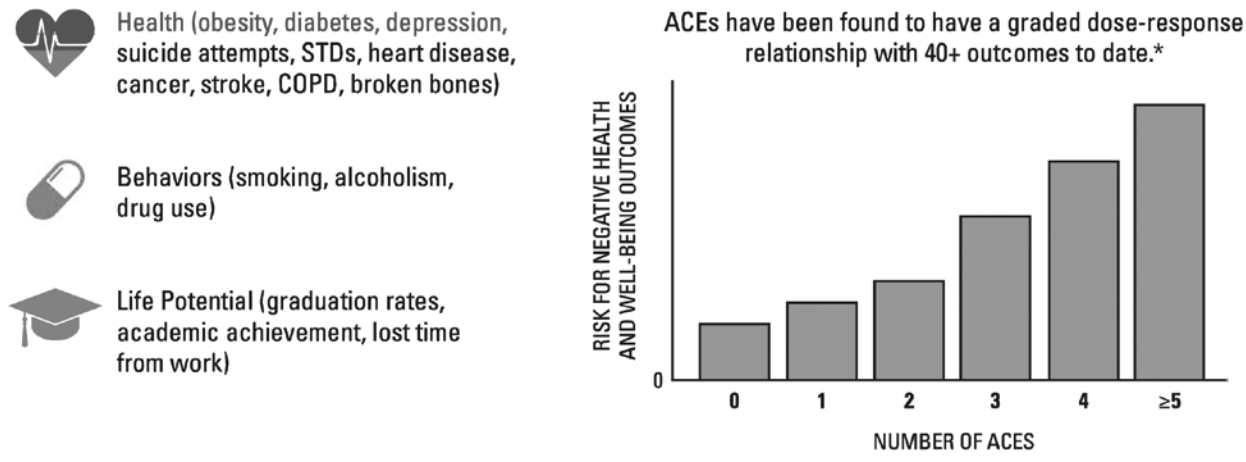
Early childhood is a particularly vulnerable time for the neurotoxic effect of prolonged, unbuffered stress. During the first few years of life, the brain experiences rapid growth and proliferations of neural connections. It is also the time during which the foundation and laddering of executive

Electronically published May 7, 2018

Address correspondence to Elizabeth Cuervo Tilson, North Carolina Department of Health and Human Services, 2001 Mail Services Center, Raleigh NC 27699-2001 (Betsey.Tilson@dhhs.nc.gov).

N C Med J. 2018;79(3):166-169.
0029-2559/2018/79307

FIGURE 2.
ACES Effects into Adulthood



Source. https://www.cdc.gov/violenceprevention/acestudy/ACE_graphics.html
*This pattern holds for the 40+ outcomes, but the exact risk values vary depending on the outcome.

function and self-regulation skills are laid. These cognitive skills, including working memory, mental flexibility, and self-control, are important elements of successful adult cognitive functioning [9]. Disruption of neurodevelopment during this time can lead to lasting effects. Figure 3 depicts this mechanism by which ACEs influence health and well-being throughout the life span [10].

In addition, gene expression is not set in stone at birth. Environmental exposures, including stress and stress hormones, can influence gene expression. This mechanism is known as epigenetic modification. Epigenetic modification of gene expression can not only further direct brain and organ development and architecture but can also be passed on to future generations. So, in a sense, children can inherit the trauma of their parents [9, 11, 12].

Importance of ACEs for Population Health in NC and the Opioid Epidemic

North Carolina data on ACEs first became available in 2012 when questions about ACEs were included on the North Carolina Behavioral Risk Factor Surveillance System (BRFSS) survey. The BRFSS is a telephone survey of non-institutionalized adults aged 18 and older and is sponsored by the Centers for Disease Control and Prevention. The findings of the North Carolina report mirror the findings of the original ACE study. ACEs were found to be common among North Carolinians: 58% reported at least one ACE and 22% reported 3 or more ACEs. Over a quarter of North Carolinians reported having grown up with an adult with a substance use disorder, and 1 in 10 reported that they had been sexually abused by an adult [13].

In addition, ACEs were found to cluster or co-occur among North Carolinians. If a person reported having experienced one ACE, it was highly likely that he or she had also experienced additional ACEs [13]. Further unpublished analysis of the data demonstrated differences in ACE prevalence by insurance coverage type. ACEs were reported more often among adults covered by Medicaid and uninsured adults than those covered by other insurances. Forty-one percent of respondents who were covered by Medicaid reported 3 or more ACEs as did 32% of uninsured respondents. This compares to 25% of respondents covered by military insurance, 19% of respondents covered by private insurance, and 15% of respondents covered by Medicare.

Because of the prevalence of ACEs in our overall population and the profound impact ACEs can have on many adult health outcomes, addressing this issue as we work toward improving overall population health is important. In addition, recognizing the role that ACEs play as a fundamental underlying issue specific to the opioid epidemic and substance use disorder in general can inform our response and prevention activities. Similar to many health outcomes, research has demonstrated a link and strong graded relationship of ACEs and lifetime drug use [1]. Each ACE increased the likelihood for early initiation of drug use by 2- to 4-fold. Compared with people with no ACEs, people with > or = 5 ACEs were 7- to 10-fold more likely to report drug use problems, addiction, and parenteral drug use. The portion of drug use problems, addiction, and IV drug use that could be attributed to ACEs was calculated to be 56%, 64%, and 67%, respectively. Basically, one-half to two-thirds of drug use problems could be traced back to ACEs [1]. These findings are consistent with the Opioid Risk Tool, which can help clinicians assess which patients may have a higher risk of opioid abuse if they

are exposed to opioids [15, 16]. Risk factors in the Opioid Risk Tool include family history of substance abuse and personal pre-adolescent sexual abuse, both of which are categories of ACEs.

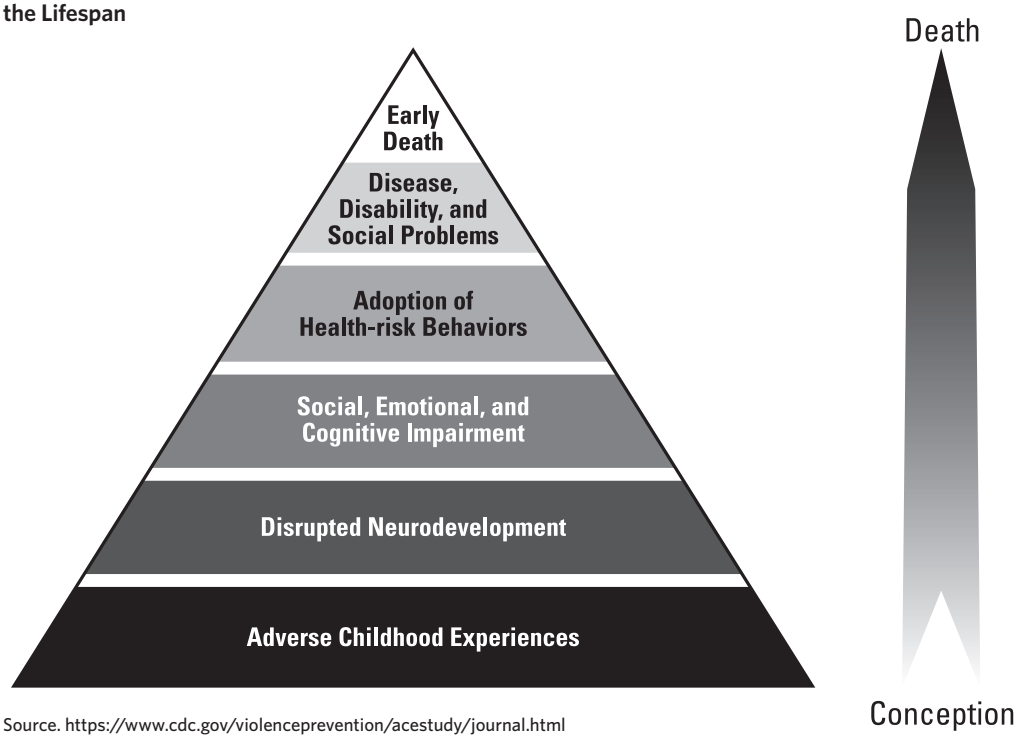
Breaking the Cycle of Addiction and Promoting Resiliency

In caring for a person struggling with addiction, we must understand their own history of trauma and the resultant effect on their neurobiology. Providing trauma-informed care as part of treatment for addiction, as well as treatment for other chronic conditions and other aspects of their health, is important to create a therapeutic and effective approach for the individual and to prevent re-traumatization [17]. But we must also think about health in a multigenerational view if we want to try and break the cycle of addiction for future generations. In households where parents are currently struggling with their own addiction, influenced by their own past ACEs, are children who are currently experiencing their own ACEs, greatly increasing their likelihood of future addiction. If we want to truly turn the tide of our opioid crisis and break the cycle of substance use and addiction issues, we have a major opportunity to do so by addressing the underlying cause.

The good news is that we can do this by supporting resiliency. Despite the strong evidence that ACEs increase the risk of poor health outcomes, they do not necessarily serve as a guaranteed predictor of outcomes. Many factors can help a child build resiliency and mitigate the negative effects of ACEs. These factors include, among others, a positive school environment, extracurricular activities, hobbies, and high-quality peer relationships. However, the most important of these protective factors is a safe, stable, and supportive relationship with a caring adult. A relationship with a responsive adult helps a child learn how to cope with adversity and return his or her stress response system to baseline rather than leaving it continually activated [8, 18].

Investing in our young families can be powerful in changing the trajectory of a child, as well as our state's health. Studies have shown that home-visiting programs, quality child care, early education, and other support of young families can reduce the prevalence of ACEs. They can also promote positive early childhood development and result in long-term benefits for a variety of other outcomes for both mother and child, including raising earnings and improving adult health status and preventing unintended pregnancies, the use of welfare, and criminal involvement [2, 19-23]. The Centers for Disease Control and Prevention identifies multiple strategies for intervention around ACEs, including home visiting to pregnant women and families with newborns, parenting training programs, intimate partner violence prevention, social support for parents, parent support programs for teens and teen pregnancy prevention programs, mental illness and substance abuse treatment, high-quality child care, and sufficient income support for lower-income families [24]. Similarly, others have identified core components

FIGURE 3.
Mechanism by Which Adverse Childhood Experiences Influence Health and Well-being Throughout the Lifespan



Source. https://www.cdc.gov/violenceprevention/acestudy/journal.html

of an effective multigenerational approach to include education, economic support, and social capital [25].

Conclusion

There is an often-used metaphor in public health that describes downstream and upstream interventions. The metaphor describes a dangerous raging river into which people have fallen and are struggling. Rescue workers rush to the shore of the river and work as hard as they can to pull out as many people as possible, but still people are going under. Our current opioid epidemic is that raging river. We rescue many of our fellow North Carolinians, but 4 go under and drown every day [26]. While we need to keep our rescue response intense, we also must think about our upstream approach, lest people just keep coming down the river needing to be rescued. In the public health metaphor, one of the rescue workers leaves the shore and starts to walk upstream. When asked why by a fellow rescue worker, he says, "I am going to find out where the bridge is broken and repair it, so people will stop falling into the river in the first place." Addressing ACEs is one way of repairing that bridge and protecting our people. In addition, because ACEs are a shared risk factor for so many health outcomes, it is a potentially effective lever to pull to improve population health as a whole. As Frederick Douglass is quoted to have said, "It is easier to build strong children than to repair broken men." NCMJ

Elizabeth Cuervo Tilson state health director and chief medical officer, North Carolina Department of Health and Human Services, Raleigh, North Carolina.

Acknowledgments

Financial support comes from the state of North Carolina.

Potential conflicts of interest. The author has no relevant conflicts of interest.

References

1. Dube S, Felitti V, Dong M, Chapman D, Giles W, Anda R. Childhood abuse, neglect, and household dysfunction and the risk of illicit drug use: the adverse childhood experiences study. Pediatrics. 2003;111(3):564-572.
2. Felitti VJ, Anda RF, Nordenberg D, 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. Am J Prev Med. 1998;14(4):245-258.
3. Centers for Disease Control and Prevention. Adverse childhood experiences journal articles by topic area. CDC website. https://www.cdc.gov/violenceprevention/acestudy/journal.html. Accessed January 8, 2018.
4. Dong M, Anda RF, Felitti VJ, et al. The interrelatedness of multiple forms of childhood abuse, neglect, and household dysfunction. Child Abuse and Negl. 2004;28(7):771-784.
5. Brown DW, Anda RF, Tiemeier H, et al. Adverse childhood experiences and the risk of premature mortality. Am J Prev Med. 2009;37(5):389-396.
6. Garner AS, Shonkoff JP; Committee on Psychological Aspects of Child and Family Health; Committee on early Childhood, Adoption, and Dependent Care; Section on Developmental and Behavioral Pediatrics. Early childhood adversity, toxic stress, and the role of the pediatrician: translating developmental science into lifelong health. Pediatrics. 2012;129(1):e 224–e231.
7. National Scientific Council on the Developing Child. Excessive Stress Disrupts the Architecture of the Developing Brain: Working Paper No. 3. Cambridge, MA: National Scientific Council on the Developing Child, Harvard University Center on the Develop ing Child; 2014. http://developingchild.harvard.edu/wp-content/uploads/2005/05/Stress_Disrupts_Architecture_Developing_Brain-1.pdf. Accessed January 14, 2018.
8. Center on the Developing Child, Harvard University. Science. Center on the Developing Child website. https://developingchild.harvard.edu/science. Accessed January 15, 2018.
9. Nelson C. Neural plasticity and human development: the role of early experience in sculpting memory systems. Developmental Science. 2000;3(2):115-136.
10. Centers for Disease Control and Prevention. Adverse childhood experiences presentation graphics. CDC website. https://www.cdc.gov/violenceprevention/acestudy/ACE_graphics.html. Accessed January 8. Accessed February 9, 2018.
11. Berens AE, Jensen SKG, Nelson CA. Biological embedding of childhood adversity: from physiological mechanisms to clinical implications. BMC Med. 2017;15(1):135.
12. Shonkoff JP, Garner AS; Committee on Psychosocial Aspects of Child and Family Health; Committee on Early Childhood, Adoption, and Dependent Care; Section on Developmental and Behavioral Pediatrics. The lifelong effects of early childhood adversity and toxic stress. Pediatrics. 2012;129(1):e232-e246.
13. Austin A, Herrick H. The Effect of Adverse Childhood Experiences on Adult Health: 2012 North Carolina Behavioral Risk Factor Surveillance Survey. Raleigh, NC: State Center for Health Statistics; 2014. http://www.schs.state.nc.us/schs/pdf/SCHS_Study_167_FIN_20140505.pdf. Accessed February 9, 2018.
14. Webster L, Webster R. Predicting Aberrant Behaviors in Opioid-Treated Patients: Preliminary Validation of the Opioid Risk Tool. Pain Med. 2005;6(6):432–442.
15. National Institute on Drug Abuse. Opioid Risk Tool. Bethesda, MD: National Institute on Drug Abuse. https://www.drugabuse.gov/sites/default/files/files/OpioidRiskTool.pdf. Accessed January 16, 2018.
16. Substance Abuse and Mental Health Services Administration. SAMHSA's Concept of Trauma and Guidance for a Trauma-Informed Approach. Rockville, MD: Substance Abuse and Mental Health Services Administration; 2014. https://store.samhsa.gov/shin/content/SMA14-4884/SMA14-4884.pdf. Accessed January 24, 2018.
17. Haskett M, Nears K, Ward CS, McPherson AV. Diversity in adjustment of maltreated children: factors associated with resilient functioning. Clin Psychol Rev. 2006;26(6):796–812.
18. Campbell F, Conti G, Heckman JJ, et al. Early childhood investments substantially boost adult health. Science. 2014;343(6178):1478-1485.
19. Olds D, Eckenrode J, Henderson C, Kitzman et al. Long-term effects on home visitation on maternal life course and child abuse and neglect. Fifteen-year follow-up of a randomized trial. JAMA. 1997;278(8):637-643.
20. U.S. Advisory Board on Child Abuse and Neglect. Child abuse and neglect: critical first steps in response to a national emergency. Washington, DC: U.S. Government Printing Office; 1990.
21. U.S. Advisory Board on Child Abuse and Neglect. Creating caring communities; blueprint for an effective federal policy on child abuse and neglect. Washington, DC: U.S. Government Printing Office; 1991.
22. Luby J. Poverty's most insidious damage: the developing brain. JAMA Pediatr. 2015;169(9):810-811.
23. Centers for Disease Control and Prevention. Child abuse and neglect: prevention strategies. CDC website. https://www.cdc.gov/violenceprevention/childmaltreatment/essentials.html. Accessed January 24, 2018.
24. The Aspen Institute. An Ascend at the Aspen Institute Report: Two Generations, One Future. Moving Parents and Children Beyond Poverty Together. Washington, DC: ASCEND Family Economic Security Program, The Aspen Institute; 2012. https://assets.aspeninstitute.org/content/uploads/files/content/docs/ascend/Ascend-Report-022012.pdf. Accessed February 1, 2018.
25. N.C. State Center for Health Statistics, Vital Statistics-Deaths. Raleigh, NC: N.C. State Center for Health Statistics; 2015-2016; http://www.schs.state.nc.us/data/vital.cfm. Accessed February 19, 2018.