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AAP News 2012;33:29
DOI: 10.1542/aapnews.2012331-29

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Mitigate ‘toxic’ stress
A new science of early childhood reveals urgency of protecting developing brains

by Andrew S. Garner, M.D., Ph.D., FAAP, and Jack P. Shonkoff, M.D., FAAP

The association between childhood adversity and adult impairments has been known for decades. Scientific advances now are helping us understand how early relationships, experiences and environmental influences can leave a lasting signature on the genetic predispositions that affect later learning, behavior, and both physical and mental health.

A new AAP policy statement and technical report present an enhanced framework for how early experiences become embedded biologically in the developing brain and other organ systems. They also highlight how pediatricians are well-equipped to educate parents, teachers and policymakers about this new knowledge.

The policy statement, Early Childhood Adversity, Toxic Stress and the Role of the Pediatrician: Translating Developmental Science Into Lifelong Health (Pediatrics. 2012; 129:e224-e231; http://pediatrics.aappublications.org/cgi/doi/10.1542/peds.2011-2662), discusses how pediatricians are ideally positioned to inform science-based policies and programs that prevent or mitigate the damage associated with such health-threatening adversities as poverty, maltreatment, parental depression and exposure to violence.

A look at the science
Two complementary biological mechanisms explain the linkages between early childhood experiences and life course trajectories.

The first comes from advances in neuroscience and the biology of stress that show how experiences interact with genetic predispositions in ways that affect a variety of organs and metabolic systems, including which neural connections in the developing brain are strengthened and which are weakened or eliminated. For example, chronic activation of stress response systems in the absence of protective relationships (i.e., toxic stress) can lead to extreme levels of cortisol (which disrupt circuits in the prefrontal cortex and hippocampus) and elevated inflammatory responses (which affect the cardiovascular system). This early adversity is incorporated into the body through lasting “biological memories” that are manifested in both pathophysiologica changes, such as accelerated atherosclerosis, and risky behaviors, such as poor self-regulation and later substance abuse.

The second and related mechanism at the molecular level is the focus of research in epigenetics. In the past, the influence of genes was thought to be biologically fixed. Now research is showing how experience plays a critical role in determining which parts of the genetic program are activated and which are suppressed.

Scientists liken the structural genome to the hardware of a computer, which determines the boundaries of what’s possible. Just as a computer requires an operating system to tell it what to do, the genome is instructed what to do by the epigenome. This system is built over time as positive experiences (e.g., rich learning opportunities) or negative influences (e.g., environmental toxins or stressful circumstances) leave a chemical “signature” on the genes that affects how easily they are switched on or off. Thus, marked by experiences during development, the epigenome determines which functions the genetic “hardware” does and does not perform, thereby influencing lifelong health and developmental outcomes.
Challenges ahead

The AAP technical report, *The Lifelong Effects of Early Childhood Adversity and Toxic Stress* (Pediatrics. 2012;129:e232-e246; http://pediatrics.aappublications.org/cgi/doi/10.1542/peds.2011-2663), proposes an instructive framework that helps us understand how the biological consequences of psychosocial adversity are no less real than the damaging physical effects of poor nutrition or exposure to lead. The implications of this framework are potentially transformative for both early childhood policy and pediatric practice.

From a policy perspective, early and sustained investments that reduce childhood adversity should generate positive financial returns in greater economic productivity, decreased rates of incarceration and lower health care costs in the future.

From a practice perspective, pediatricians are uniquely positioned to monitor the early childhood environment, but the most important challenges include how clinicians can influence the quality of that environment (e.g., positive parenting and enriched out-of-home settings), screen for threats to the developing brain (e.g., neglect, malnutrition and parental substance abuse), and locate or help develop evidence-based interventions to counter risks (e.g., local traumatic stress networks and early childhood mental health services).

The AAP Early Brain and Child Development Leadership Work Group is working with other AAP entities and national stakeholders to address these challenges.

**Dr. Garner**, lead author of the policy statement and co-author of the technical report, is a member of the AAP Committee on Psychosocial Aspects of Child and Family Health and the AAP Early Brain and Child Development Leadership Work Group. **Dr. Shonkoff**, lead author of the technical report and co-author of the policy statement, is the director of the Center on the Developing Child at Harvard University.

‘Brain-friendly’ tips

- **Educate yourself** and others about the association between childhood adversity and negative long-term outcomes, and how toxic stress affects the developing brain.
- **Partner with families and state policy-makers** to prevent or reduce toxic stress and to minimize its impact on life course trajectories through anticipatory guidance and referrals, along with more effective policies and supports that protect children from the impacts of adversity on maturing bodies and brains.
- **Focus on relationships** when assessing both risk and protective factors, and strengthen the ability of caregivers to buffer children from stress by promoting their coping skills and capacity for self-regulation.
- **Advocate and collaborate** with local child and family service providers to ensure that vulnerable children and their parents receive the evidence-based care they need.

**RESOURCE**

The Center on the Developing Child, http://developingchild.harvard.edu
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