Early Childhood Toxic Stress

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Over the years your bodies become walking autobiographies, telling friends and strangers alike of the minor and major stresses of your lives.

―Marilyn Ferguson

Learning Objectives:
1. Understand the dynamic concepts of positive, tolerable, and toxic stress
2. Review the body’s physiologic response to stress, the consequences of significant dysregulation of this response, and the effects on the developing brain of a child
3. Appreciate how early traumatic experiences, innate vulnerabilities and strengths, and the presence or absence of external supports interact to alter a child’s vulnerability to stress-related disease
4. Recognize the steps the pediatric provider can take to prevent the development of, ameliorate, and reduce damage from toxic stress

Primary Reference:

CASE ONE:

James is a 5-year-old boy with a history of moderate persistent asthma and expressive speech delay who presents to your office for a routine physical exam. He is accompanied by his mother for the first time in the last two years; during the last two years he was in the custody of his paternal grandmother after a child protective services investigation and substantiation for chronic exposure to intimate partner violence between his mother and father. James’ mother expresses no concerns about him.

James was born at 36 weeks to an 18-year-old primiparous mother. When James was in the care of his grandmother, his asthma improved, likely because she is not a smoker and his mother is. With your gentle but persistent questions, James’ mother shares that James’ father is currently incarcerated for robbery and that she and James are living in a small apartment in a neighborhood you know to be persistently plagued by gang-related violence. James is in kindergarten but will be repeating the year due to difficulties he has been having with learning and behavior in school. James’ mother grew up in state custody after being removed from her own parents’ care for neglect.

On examination, James is an especially beautiful child, with rosy cheeks and a mass of soft brown curly hair. He smiles winningly at you and gives you five, but then proceeds to be extremely active in your office and difficult to redirect. His mother occasionally shouts at him to “shut up” and “sit still” but James responds by ignoring her or attempting to slap her. His mother appears unable to control his behavior. James has an intermittent cough, exacerbated by deep inspiration and an otherwise clear lung exam.

Throughout the visit, his mother is quiet and has a flat affect. You find it difficult to engage her in conversation. When you inquire about James’ behavior and his cough, his mother answers with short, single word responses and frequently looks down at the floor.

1. Define positive, tolerable, and toxic stress.

Positive stress is common, brief, and relatively mild, occurs against the backdrop of caring and responsive adults who assist children with an appropriate response to stress, and can lead to growth
and learning. An example of such a positive stressor is entering a new childcare center or meeting a new caregiver.

Tolerable stress occurs when children are exposed to a more significant and atypical degree of adversity, threat, or loss, such as the death of a family member or a natural disaster, but undergo this exposure in the context of secure, loving relationships with adults who help them navigate the challenges they face. The presence of nurturing and supportive adults who can teach coping skills prevents unchecked activation of stress responses that can lead to long-term physiologic change and stress-related disease.

Toxic stress is defined as the extreme, frequent, or extended activation of the stress response, without the buffering presence of a supportive adult. It is thought that the development of toxic stress stems from anatomic and physiologic changes that take place during pivotal developmental periods in a child’s life. In other words, when developing children undergo adverse experiences in the absence of protective factors like supportive and nurturing adult caregivers, the state of extended, unmitigated and toxic stress that develops sets the stage for long-term physical and mental illness.

2. What are examples of the body’s normal response to stress? How are these responses protective and how may they become dysregulated?

The body has multiple physiologic responses to stress but among the best understood are the hypothalamic-pituitary-adrenocortical axis and the sympathetic-adrenomedullary system. When activated, these systems trigger increased circulating levels of stress hormones such as corticotropin-releasing hormone, cortisol, norepinephrine, and epinephrine. An adaptive activation of these stress response systems could occur in an acute context, such as when a child and family faced with a nighttime house fire might need to get up and move very quickly to find safety. When, however, ongoing external stressors chronically activate stress response in the absence of protective influences, excessively high levels of circulating stress hormones can be damaging, leading to chronic dysregulation of these systems. For example, children who have experienced physical maltreatment have increased methylation of their glucocorticoid receptor genes, compared to children without history of physical maltreatment. This increased methylation would lead to less cortisol regulation and higher inflammatory activity. In a separate study, children with greater psychosocial exposure in early childhood had higher cortisol levels in samples of hair at age one, and greater burden of childhood illness at age 10.

3. How does toxic stress alter the developing brain?

The plasticity of the growing and developing brain makes it especially sensitive to high levels of circulating stress hormones. Ongoing stress leads to both hypertrophy and overactivity in the amygdala and orbitofrontal cortex, and a decrease in neurons and neural connections in the hippocampus and medial prefrontal cortex, likely via epigenetic mechanisms.

The end results of these structural changes include impaired memory, disordered mood, and a lack of inhibitory control. Further, these structural changes limit the ability of children to learn actively from their environments and to display cognitive flexibility. In other words, children who develop in the context of toxic stress have a harder time distinguishing what is and is not a threatening environment. This in turn may lead to maladaptive behavioral responses. Consider a child in school who misperceives threats and responds by hitting and kicking other children.

Another useful concept in understanding a child’s developmental potential is that of the ecobiodevelopmental (EBD) framework. There are three components of the EBD model: ecology, biology, and health/development. Ecology describes the social and physical environment, which includes family and social relationships. Biology involves an individual’s genetic predispositions and physiological adaptations and disruptions. Health and development includes an individual’s physical and mental being, which is influenced by learning and behavior. A child’s development is determined by the interaction of the above three components. An illustration of this dynamic phenomenon is provided by studies in rats that have demonstrated that higher quality nurturing care (licking and grooming) of pups by their mothers results in a diminished stress response in adult rats. This effect is passed on to the following generation, suggesting an epigenetic mechanism. This, along with growing
knowledge about how a child’s learning environment, whether rich or deficient, can result in specific neural connections being formed (or not formed), forms a powerful and dynamic way to think about the ways a child’s environment and experiences with adversity set him or her up for lifelong effects in learning ability, behavior, health status, and life span.

4. **What are the risk factors for toxic stress in James’ life?**

James’ story reveals multiple sources of psychosocial stress. The violence he witnessed between his parents, the separation he had from his parents while in his grandmother’s care, the disruption of the changes in his living situation, and his father’s incarceration are all powerful stressors. James lives in a neighborhood where community violence is a significant problem and he may have been or could be exposed to significant stressors as a result. Living in a neighborhood with a high rate of violent crime or high density of locations that sell alcohol is a predictor for dysregulated cortisol response to a stressor. Further, his mother sustained significant exposure to stressors in her own childhood and may be seriously limited in her ability to help James cope with his own stress as a result. She is at risk for mental health problems and negative health behaviors, like smoking and possible substance use or abuse, as a result of her past experiences. Her affect in your office suggests she may be currently suffering these negative outcomes of her own childhood. This combination of significant psychosocial stress in the face of a potential limited caregiver ability to bolster, support, and nurture James, places him at high risk for toxic stress. Furthermore, his history of developmental delay adds an additional baseline vulnerability and layer of risk for James.

On the other hand, the warm smile and high five that James shared with you suggest he may have a baseline strength in being able to connect with others that could confer a degree of protection for him. Such qualities can contribute to a state of resilience, which may be understood as the capacity some children and adults have to adapt and be successful despite significant adversity. Recognizing qualities that contribute to a child’s resilience can be an important strength-based frame from which to address other problems. James has significant difficulties with learning and behavior but his friendliness and warmth are qualities to recognize, bolster, and encourage.

5. **Can James’ behavior be related to toxic stress?**

James’ early exposure to trauma and stress in the absence of stable, nurturing adult influence can definitely have contributed to a state of toxic stress and to resultant dysfunction in his behavior. As mentioned above, toxic stress may lead to structural brain changes which manifest as problems in early childhood and beyond. Specifically, memory issues may have a negative impact on his learning and school performance, lack of inhibitory control can cause him to fight with peers and act aggressively toward his mother, and poor cognitive flexibility may make him look as though he has ADHD. Indeed, trauma and stress in early childhood are predictors of academic and behavioral problems in kindergarten. Proper identification of the role of toxic stress in James’ difficulties can be crucial to the provision of effective treatments and the recognition of other symptoms that may be due to toxic stress, like sleep issues or hypervigilance.

6. **What measures can be taken to prevent the development of toxic stress and to ameliorate it once it is identified?**

Ideally, the development of toxic stress can be avoided if the psychosocial stressors that families face can be identified and mitigated. Pediatric providers are well positioned to ask about and offer help in combating problems such as intimate partner violence, substance use disorders, or the loss or incarceration of a family member by offering support and resources. Even problems as difficult to address as community violence may be diminished of their potency if brought into the open and discussed in the pediatric primary care setting. Parents may also be helped to recognize and nurture signs of resilience in their children. The “7 Cs of resilience” offer a useful mnemonic to assist the pediatric provider in identifying resilient behaviors that can be pointed out to parents. These are: competence, confidence, connectedness, character, contribution, coping, and control. Helping parents to adopt a strength-based view of their children can be an important step in promoting a nurturing and supportive parenting stance. In addition, efforts to bolster and strengthen parents themselves will always be useful in combating the development of toxic stress. Strong, empathic, and
supportive parents and caregivers are the best protection for children exposed to potent stressors. Remember that as pediatric providers we may be most helpful when we identify problems in parents, like untreated depression, and work to have these problems addressed.

Once a concern for toxic stress has been raised, pediatric providers can help by educating parents and caregivers about the link between trauma exposure and the development of symptoms. Education can reduce isolation and offer hope of solutions. Solutions exist in the form of evidence-based trauma-informed treatments such as trauma-focused cognitive behavioral therapy and parent-child psychotherapy. The pediatric provider may be instrumental and even uniquely positioned to identify symptoms associated with toxic stress and refer the children who display them to appropriate treatments. Prevention strategies that aim to support parents of infants (e.g., home visiting programs for first time, high-risk parents) are another potential defense against the development of toxic stress. These programs can employ both professionals, like nurses, and lay people, who are trained in positive parenting techniques and child development to provide in-home support to young and socially stressed parents. The evidence for home visitation is currently under study.

7. What health outcomes/diseases are children exposed to toxic stress at particular risk for developing as an adult?

Especially in the absence of protecting and nurturing adults in his life, James is at risk for developing numerous medical conditions. The Adverse Childhood Experiences (ACE) study of over 17,000 adults correlated negative experiences in childhood, such as being a victim of child abuse or losing a parent, with many adult health outcomes. This study generated an ACE score (see Resources section), a total of the number of adverse experiences that study participants experienced in childhood, and found that as that score increased, the risk of many negative adult health outcomes rose proportionally. Specifically, high ACE scores were associated with depression, alcoholism and drug abuse, ischemic heart disease, smoking and COPD, liver disease, adolescent pregnancy, sexually transmitted diseases, and early death. In addition to being associated with these adverse outcomes by way of unhealthy behaviors, like smoking and sexually risky behavior, childhood toxic stress has a direct impact on the physiologic functioning of adults. This process is thought to be mediated by alterations in the immune system and marked increases in inflammatory biomarkers.

Additionally, as the ACE score increases, individuals are less likely to achieve milestones that translate to social mobility. Increased rates of eventual high school dropout, juvenile arrest, and felony charges are seen in those with high ACE scores, with predictive value of adversity measured as early as age 5. These findings underscore the importance of prevention strategies at the level of the individual family as well as broader efforts to impact neighborhoods and communities.

CASE continued:

You are able to engage James’ mom in conversation by asking about how James’ behavior is affecting her. You listen attentively as she describes how challenging it is to handle his aggressive behavior but also how glad she is that she has custody of James once again. You introduce the idea of a referral for trauma-focused treatment for James, at which time his mother begins to cry. You offer her the response that although life has been hard on her, and on James, you hope to provide as much support as possible to them both now that they are reunited.

Additional References:

Resources: