

# How persistent fear and anxiety can affect young children's learning, behaviour and health

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**Evidence from neuroscience is increasingly helping us to understand exactly how fear and anxiety in childhood – such as that occasioned by exposure to violence in the family – shape the young child's developing brain, with lasting effects on learning and development. In this article<sup>3</sup> Professors Nathan A. Fox and Jack P. Shonkoff review the evidence and its implications for public policy.**

Ensuring that young children have safe, secure environments in which to grow, learn, and develop healthy brains and bodies is not only good for the children themselves but also builds a strong foundation for a prosperous, just, and sustainable society. That said, science shows that early exposure to violence and other circumstances that produce persistent fear and chronic anxiety can have lifelong consequences by disrupting the developing architecture of the brain. While some of these experiences are one-time events and others may reoccur or persist over time, all of them have the potential to affect how children learn, solve problems, relate to others, and contribute to their community.

All children experience fears during childhood, including fear of the dark, monsters and strangers. These fears are normal aspects of development and are temporary in nature. In contrast, threatening circumstances that persistently elicit fear and anxiety predict significant risk for adverse long-term outcomes from which children do not recover easily. Physical, sexual or emotional abuse; significant maltreatment of one parent by the other; and the persistent threat of violence in the community

are examples of such threatening circumstances.

Unfortunately, many children are exposed to these kinds of experiences. Child maltreatment has been shown to occur most often in families that face excessive levels of stress, such as that associated with community violence, parental drug abuse, or significant social isolation (Centers for Disease Control and Prevention, 2009). Research also tells us that nearly half of children living in poverty in the United States witness violence, or are indirectly victims of violence (Finkelhor *et al.*, 2005). Globally, despite more limited data, the risks are as bad or worse. In 2006, the United Nations Secretary-General's Study on Violence against Children reported that more than 130 million children have witnessed intimate partner violence in the home, and over 200 million have suffered some form of sexual abuse. For children living in such circumstances, frequent and repetitive threats create the potential for heightened fear and chronic anxiety.

Behavioural neuroscience research in animals tells us that serious, fear-triggering experiences elicit physiological responses that affect the architecture of the developing brain.

Chronic activation of the body's stress response systems has been shown to disrupt the efficiency of brain circuitry and lead to both immediate and long-term problems in learning, behaviour, and both physical and mental health. This is especially true when stress-system overload occurs during sensitive periods of early brain development. Despite this rapidly increasing knowledge base, however, significant gaps continue to exist in how societies respond to the developmental needs of children who regularly experience serious, fear-inducing events.

### The science of fear and anxiety

**Some types of fear are normal aspects of development.** Infants begin to experience feelings of fear and differentiate them from other emotions between 6 and 12 months of age (Lewis and Michalson, 1983; Nelson and De Haan, 1996). Over the course of the early childhood period, toddlers and pre-schoolers typically express fear of a wide variety of events or individuals. Generally speaking, normal pre-school fears do not disrupt a child's life, and they dissipate by age 7 or 8. That is, while children may express these fears at certain times (such as bedtime) or in response to certain events (for example, when confronted by a stranger), their overall behaviour does not otherwise suggest that they are generally fearful or distressed.

The emergence and course of typical childhood fears are different from the

fears and anxiety elicited by traumatic situations such as physical or sexual abuse or exposure to family violence. While typical fears disappear with age, the fear and anxiety elicited by maltreatment and other threatening circumstances do not. Scientific research provides an explanation for why children outgrow normative fears. Many result from the difficulty young children have in distinguishing between the real and the imaginary. As they get older, children get better at understanding what is real and what it means for something to be 'make believe'. They also develop the cognitive and social skills needed to better understand predictability in their environment and, therefore, gain a greater sense of control.

**Early exposure to extremely fearful events affects the developing brain, particularly in those areas involved in emotions and learning.** A large and growing body of research, including animal studies as well as recent neuroimaging studies of human adults, has revealed groundbreaking insights into the brain circuitry that underlies how we learn to be afraid (Phelps and LeDoux, 2005; Delgado *et al.*, 2006) and how we come to associate a specific event or experience with negative outcomes. Two extensively studied structures located deep in the brain – the amygdala and the hippocampus – are involved in fear conditioning. The amygdala detects whether a stimulus, person or event is threatening and the

hippocampus links the fear response to the context in which the aversive stimulus or threatening event occurred (LeDoux, 2000; LeDoux and Phelps, 2008; Kim and Fanselow, 1992). Studies also show that both the amygdala and the hippocampus play an important role in how the body then responds to this threat. Elevated stress hormones such as cortisol have been shown to affect the growth and performance of the hippocampus and the activity of the amygdala in rodents and non-human primates, and early and persistent activation of the stress response system adversely affects brain architecture in these critical regions.

Beyond its impact on these two brain structures, heightened stress has also been shown in animals to impair the development of the prefrontal cortex, the brain region that, in humans, is critical for the emergence of executive functions – a cluster of abilities such as making, following and altering plans; controlling and focusing attention; inhibiting impulsive behaviours; and developing the ability to remember and incorporate new information in decision making. These skills continue to develop and become increasingly important throughout the school years and into adulthood. Behavioural neuroscience research in animals tells us that the prefrontal cortex is highly sensitive to the detrimental effects of excessive stress exposure and that its developing architecture is vulnerable to the negative effects of chronic fear (Arnsten, 2009).

**When young children experience serious fear-triggering events, they learn to associate that fear with the context and conditions that accompanied it.** Very young children can actually learn to be fearful through a process called ‘fear conditioning’, which is strongly connected to the development of later anxiety disorders (Grillon and Morgan, 1999; Pine, 1999). In the typical circumstances of early childhood, fear responses are activated quickly and then dissipate. However, when young children are chronically exposed to perceived or real threat, such as ongoing violence in the family environment, fear-system activation can be prolonged. Conditioned fear is apparent when individuals come to experience and express fear within *the context in which the learning occurred*. For example, a child who is physically abused by an adult may become anxious in response to both the person and the place where the fear learning occurred. Over time, the fear elicited and the consequent anxiety can become generalised, and subsequent fear responses may be elicited by other people and places that bear sometimes only small resemblances to the original conditions of trauma. Consequently, for young children who perceive the world as a threatening place, a wide range of conditions can trigger anxious behaviours that then impair their ability to learn and to interact socially with others. The extent to which these problems affect physical and mental health is influenced by the frequency

of the stressful exposure and/or the emotional intensity of the fear-eliciting event.

**Unlearning fear is a fundamentally different process from fear learning.**

The process of unlearning conditioned fear is called 'extinction' and actually involves physically separate and distinct areas of the brain's architecture from those into which fear responses are first incorporated. Generally speaking, the unlearning process involves activity in the prefrontal cortex, which decreases the fear response by regulating the activity of the amygdala (Quirk *et al.*, 2006; Phelps *et al.*, 2004). Research tells us that fears are not just passively forgotten over time, they must be actively unlearned. Studies show that fear *learning* can occur relatively early in life (Sullivan *et al.*, 2000), whereas fear *unlearning* is only achieved later, when certain structures in the brain have matured (Carew and Rudy, 1991; Kim and Richardson, 2008). Consequently, the effects of family violence in early childhood can have a significant impact on physical and mental health that can take years to remediate – something that is extremely important to understand in designing interventions for children and families who are experiencing violence.

**Chronic and intense fear early in life affects the development of the stress response system and influences the processing of emotional memories**

(Sanchez *et al.*, 2001; Nemeroff, 2004).

When an individual is confronted with a threat, stress systems are activated and elevate the levels of several different stress chemicals that are circulating throughout the body (McEwen, 2007). An increase in one of those chemicals, cortisol, can have a dramatic impact on how memories are processed and stored (de Kloet *et al.*, 2008). The production of cortisol and adrenalin (as well as noradrenaline in

**Persistent fear can distort how a child perceives and responds to threat.**

Fear learning typically takes place in specific contexts and results in those fears becoming associated with the places where the learning occurred. Children may also express fear in response to situations that are similar (not identical) to those initially learned or to situations that are similar to the contexts in which the original learning occurred. These are called 'generalised'

When young children are chronically exposed to perceived or real threat, such as ongoing violence in the family environment, fear-system activation can be prolonged.

the brain) in a normal stress response leads to memory formation for events and places that signify danger. More specifically, elevated cortisol levels can strengthen the formation of memories of emotional events (McGaugh *et al.*, 2006), block the ability to unlearn fear memories (Yang *et al.*, 2007), and enhance the formation of memories of the surrounding context in which the fearful event occurred (Brinks *et al.*, 2008). Interestingly, too much cortisol can also have the opposite effect and actually impair memory and learning in non-threatening contexts (Rooszendaal *et al.*, 2009). Thus, the biological response to stress is intimately involved in both fear learning and unlearning.

fear responses, and they are thought to underlie the expression of later anxiety disorders, including post-traumatic stress disorder (PTSD) (Grillon and Morgan, 1999; Grillon, 2002; Davis, 2006). Indeed, children who have had chronic and intense fearful experiences often lose the capacity to differentiate between threat and safety. This impairs their ability to learn and interact with others, because they frequently perceive threat in familiar social circumstances, such as in their home or neighbourhood. These responses inhibit their ability to learn and often lead to serious anxiety disorders (Grillon *et al.*, 1998; Reeb-Sutherland *et al.*, 2009).

Young children who have been exposed to traumatic circumstances

While typical fears disappear with age (for example, when confronted by a stranger), the fear and anxiety elicited by maltreatment and other threatening circumstances do not.

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also have difficulty identifying and responding to different expressions of emotions and, therefore, have trouble forming healthy relationships (Wisner Fries *et al.*, 2005). These deficits lead to general problems with social interaction, such as understanding others' facial expressions and emotions. For example, children raised in physically abusive households show heightened sensitivity (compared with non-abused children) to angry faces, which negatively affects their brain function and behaviour (Pollak and Kistler, 2002; Pollak *et al.*, 2000). Learning to identify anger – quickly and successfully – in order to avoid being harmed is a highly adaptive and appropriate response to an abusive environment. However, an increased tendency to assume someone is angry when his or her facial expression is ambiguous can be inappropriate and maladaptive in a typical, non-threatening social setting and even dangerous in unfamiliar social settings (Pollak, 2008). Thus, the extent to which children view the world as a hostile and threatening place can be viewed as both a logical adaptation to an abusive or violent environment and a potent risk factor for behaviour problems in later childhood, adolescence and adult life.

**Early exposure to intense or persistent fear-triggering events affects children's ability to learn.** There is extensive and growing scientific evidence that prolonged and/or excessive exposure to

fear and states of anxiety can cause levels of stress that can impair early learning and adversely affect later performance in school, the workplace and the community. Multiple studies in humans have documented problems in cognitive control and learning as a result of toxic stress (National Scientific Council on the Developing Child, 2005; Shonkoff *et al.*, 2009). These findings have been strengthened by research evidence from non-human primates and rodents that is expanding our understanding of the brain mechanisms underlying these difficulties.

The brain region in animals that appears highly vulnerable to adversity in this regard is the prefrontal cortex, which is the critical area for regulating thought, emotions, and actions as well as for keeping information readily accessible during the process of active learning. For example, researchers have found that elevations in brain chemicals like noradrenaline, an important neurotransmitter, can impair functions that are controlled by the prefrontal region by altering the activity of neurons in that area of the brain. In a related fashion, humans experiencing chronic stress have been shown to perform poorly on tasks related to prefrontal cortex functioning (such as working memory or shifting attention) and their ability to control their emotions is typically impaired (Arnsten, 2009).

#### **Implications for policy and practice**

Many policymakers, educators, and even medical professionals are unaware

of the potentially significant, long-term risks to children of exposure to fear-provoking circumstances – including family violence – and lack information about the prevalence of these situations in their communities. This can lead to widespread misconceptions of how children experience and respond to fear.

The scientific knowledge around fear and anxiety points to three important implications:

- Young children *can* perceive threat in their environment but, unlike adults, they do not have the cognitive or physical capacities to regulate their psychological response, reduce the threat, or remove themselves from the threatening situation. As a result, serious fear-triggering events such as family violence can have significant and long-lasting impacts on the developing child, beginning in infancy.
- Children do not naturally outgrow early learned fear responses over time. If young children are exposed to persistent fear and excessive threat during particularly sensitive periods in the developmental process, they may not develop healthy patterns of threat/stress regulation. When they occur, these disruptions do not naturally disappear.
- Simply removing a child from a dangerous environment will not by itself undo the serious consequences or reverse the negative impacts of early fear learning. Children who

have been traumatised need to be in responsive and secure environments that restore their sense of safety, control, and predictability – and supportive interventions are needed to assure the provision of these environments.

As a result, it is important for policies and programmes to take into account children's developmental needs, beginning in early infancy, particularly focusing more attention on preventing persistent fear and anxiety.

Children who live in violent homes or communities have been shown to have more behaviour problems, greater evidence of post-traumatic stress disorder, and increased physical symptoms such as headaches and stomach aches, as well as lower capacity for empathy and diminished self-esteem (Huth-Bocks *et al.*, 2001). Programmes focused on the reduction of domestic violence, substance abuse, neighbourhood violence and poverty are examples of the kinds of community-based services whose impacts could be enhanced by incorporating targeted interventions to explicitly address the emotional needs of young children living under these conditions. When delivered effectively, such interventions could have a multiplier effect into the next generation by reducing both the individual and societal costs of the negative developmental effects of persistent fear, including mental health impairments, antisocial behaviour, physical disease and violent crime.



### Notes from authors

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