# Effects of Child Maltreatment on the Developing Brain

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Infants and young children rely on their caregivers to play with them, to comfort them and keep them safe, to teach them about relationships, and to help them cope with scary or confusing situations. This sensitive, responsive caregiving is critical not only for children's immediate safety and happiness, but also to support normal brain development. While some parts of the brain continue to grow and change throughout childhood, the most rapid period of brain development is in the first five years of life. During these early years, the brain does not just develop automatically as if it had an internal clock. Instead, a child's experiences play an active role in shaping the brain's architecture (Black, 1998). By providing sensitive, responsive care, parents help their young children to build connections between brain regions. These neural pathways enable children to learn, pay attention, develop social skills, and manage their emotions.

Unfortunately, harsh or inconsistent care also leaves an enduring imprint on the developing brain, putting children who have experienced maltreatment at risk for physical disease, mental health problems, and substance abuse disorders later (Anda et al., 2006). Specifically, child maltreatment is associated with structural abnormalities in brain regions that control emotions and behavior, which may partially explain links between child maltreatment and adult psychiatric disorders (McCrory, De Brito, & Viding, 2010). For example, the corpus callosum, which links the left and right hemispheres, has been found to be smaller in maltreated children than in non-maltreated children (De Bellis, et al., 2002). There can also be abnormalities in the prefrontal cortex, which manages emotional and cognitive functioning (Carrion, et al., 2009; De Bellis, et al., 2002), and the cerebellum, which is involved in learned fear (De Bellis & Kuchibhatla, 2006). These abnormal brain structures may lead to emotional and behavioral problems. For instance, among children experiencing physical abuse, the orbitofrontal cortex, which is involved in regulating emotions, is smaller, and this brain abnormality is related to parent and child reports of difficulties with social functioning (Hanson, et al., 2010). Child maltreatment often leads to posttraumatic stress disorder and other psychiatric diagnoses, and it can be challenging to determine whether brain abnormalities are due to the maltreatment itself, or to associated psychiatric disorders, or to both (Hanson, et al., 2010). The specific effects on brain structure and function also depend on the type of adversity the child experiences (e.g., physical abuse, sexual abuse, or witnessing violence) and the child's age (McCrory, et al., 2010).

Child maltreatment alters the brain's perception and interpretation of facial expressions. A study measuring brain electrical activity found that children who have experienced physical abuse have a stronger brain response to angry faces and voices, and they are more distracted by these anger cues compared to non-abused children (Shackman, Shackman, & Pollak, 2007). Also, when shown ambiguous facial expressions, these children are very sensitive to even slight signs of anger (Pollak & Kistler, 2002). These children live in an environment where an angry face or voice can signal imminent danger of physical abuse, so it may be adaptive for their brains to be very vigilant to signs of anger. However, it is easy to imagine how this heightened vigilance to anger could be maladaptive in other settings such as daycare or school (Shackman, et al., 2007), putting children at risk for anxiety or conduct problems.

Young children's physiological stress systems are immature at birth and therefore vulnerable to maltreatment and neglect. From infancy through preschool, children depend on sensitive, responsive caregivers to help maintain the normal daily rhythm of the stress hormone cortisol, and to protect the developing brain from being exposed to too much cortisol (Gunnar & Donzella, 2002). By the end of the first year, children with sensitive, responsive parents show no cortisol increase to a stressful experience like getting immunizations, even though they cry: their parents' presence buffers them from stress hormone elevations (Gunnar & Donzella, 2002). When parents are not sensitive and responsive, however, toddlers do show cortisol responses to stressful experiences. Over time, chronic stresses such as abuse, neglect, and multiple foster care placements can distort the child's daily stress hormone rhythms, so that cortisol levels are either too high or too low (Fisher, Gunnar, Dozier, Bruce, & Pears, 2006). When evaluating intervention programs, it is critical to consider both behavioral and neurobiological outcomes. For example, when children with abnormal cortisol levels were placed in an intensive foster care intervention program, which provided extensive support and training to foster parents, the children's cortisol became more normal, whereas children in regular foster care placements continued to have abnormal cortisol rhythms (Fisher, et al., 2006). Such findings offer hope that intensive intervention programs to improve the quality of care young children receive may help to normalize some aspects of brain function.

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