



Understanding the Effects of Maltreatment on Brain Development

This issue brief provides basic information on brain development and the effects of abuse and neglect on that development. The information is designed to help professionals understand the emotional, mental, and behavioral impact of early abuse and neglect in children who come to the attention of the child welfare system.

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In recent years, there has been a surge of research into early brain development. New technologies, such as neuroimaging (e.g., magnetic resonance imaging or MRI), provide increased insight into how the brain develops and how early experiences affect that development.

One area that has been receiving increasing research attention involves the effects of abuse and neglect on the developing brain, especially during infancy and early childhood. Much of this research is providing biological explanations for what practitioners have long been describing in psychological, emotional, and behavioral terms. There is now scientific evidence of altered brain functioning as a result of early abuse and neglect. This emerging body of knowledge has many implications for the prevention and treatment of child abuse and neglect.

How the Brain Develops

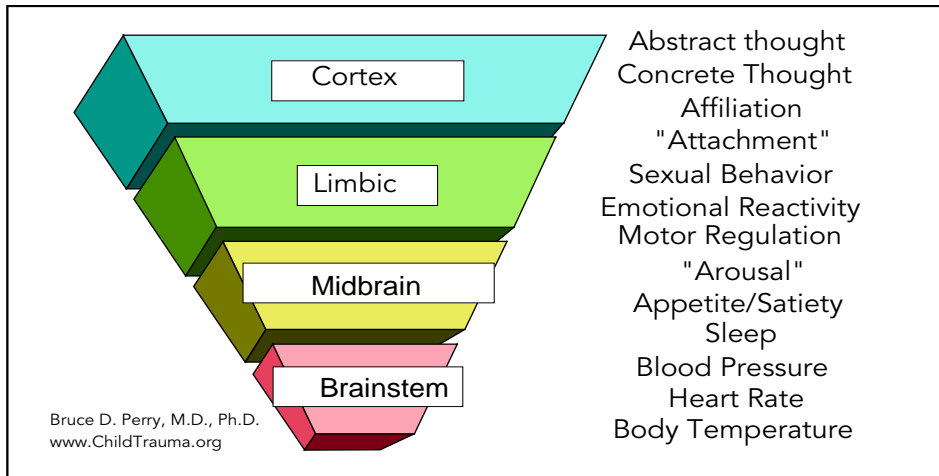
What we have learned about the process of brain development has helped us understand more about the roles both genetics and the environment play in our development. It appears that genetics predisposes us to develop in certain ways. But our experiences, including our interactions with other people, have a significant impact on how our predispositions are expressed. In fact, research now shows that many capacities thought to be fixed at birth are actually dependent on a sequence of experiences combined with heredity. Both factors are essential for optimum development of the human brain (Shonkoff and Phillips, 2000).

The Newborn Brain

The raw material of the brain is the nerve cell, called the *neuron*. When babies are born, they have almost all of the neurons they will ever have, more than 100 billion of them. Although research indicates some neurons are developed after birth and well into adulthood, the neurons babies have at birth are primarily what they have to work with as they develop into children, adolescents, and adults.

During fetal development, neurons are created and migrate to form the various parts of the brain. As neurons migrate, they also differentiate, so they begin to “specialize” in response to chemical signals (Perry, 2002). This process of development occurs sequentially from the “bottom up,” that is, from the more primitive sections of the brain to the more sophisticated sections (Perry, 2000a). The first areas of the brain to fully develop are the brainstem and midbrain; they govern the bodily functions necessary for life, called the autonomic functions. At birth, these lower portions of the nervous system are very well developed, whereas the higher regions (the limbic system and cerebral cortex) are still rather primitive (ZERO TO THREE, 2009).

Newborns’ brains allow babies to do many things, including breathe, eat, sleep, see, hear, smell, make noise, feel sensations, and recognize the people close to them. But the majority of brain growth and development takes place after birth, especially in the higher brain regions involved in regulating emotions, language, and abstract thought. Each region manages its assigned functions through complex processes, often using chemical messengers (such as neurotransmitters and hormones) to help transmit information to other parts of the brain and body (Perry, 2000a).



gradually discarded. This process of synapse elimination—or pruning—is a normal part of development (Shonkoff & Phillips, 2000). By the time children reach adolescence, about half of their synapses have been discarded, leaving the number they will have for most of the rest of their lives.

The Growing Baby's Brain

Brain development, or learning, is actually the process of creating, strengthening, and discarding connections among the neurons; these connections are called *synapses*. Synapses organize the brain by forming pathways that connect the parts of the brain governing everything we do—from breathing and sleeping to thinking and feeling. This is the essence of postnatal brain development, because at birth, very few synapses have been formed. The synapses present at birth are primarily those that govern our bodily functions such as heart rate, breathing, eating, and sleeping.

The development of synapses occurs at an astounding rate during children's early years, in response to the young child's experiences. At its peak, the cerebral cortex of a healthy toddler may create 2 million synapses per second (ZERO TO THREE, 2009). By the time children are 3, their brains have approximately 1,000 trillion synapses, many more than they will ever need. Some of these synapses are strengthened and remain intact, but many are

Brain development continues throughout the lifespan. This allows us to continue to learn, remember, and adapt to new circumstances (Ackerman, 2007).

Another important process that takes place in the developing brain is *myelination*. Myelin is the white fatty tissue that insulates mature brain cells by forming a sheath, thus ensuring clear transmission across synapses. Young children process information slowly because their brain cells lack the myelin necessary for fast, clear nerve impulse transmission (ZERO TO THREE, 2009). Like other neuronal growth processes, myelination begins in the primary motor and sensory areas (the brain stem and cortex) and gradually progresses to the higher-order regions that control thought, memories, and feelings. Also, like other neuronal growth processes, a child's experiences affect the rate and growth of myelination, which continues into young adulthood (Shonkoff & Phillips, 2000).

By the age of 3, a baby's brain has reached almost 90 percent of its adult size. The growth in each region of the brain largely depends on receiving stimulation, which spurs activity

in that region. This stimulation provides the foundation for learning.

Plasticity—The Influence of Environment

Researchers use the term *plasticity* to describe the brain's ability to change in response to repeated stimulation. The extent of a brain's plasticity is dependent on the stage of development and the particular brain system or region affected (Perry, 2006). For instance, the lower parts of the brain, which control basic functions such as breathing and heart rate, are less flexible than the higher functioning cortex, which controls thoughts and feelings. While cortex plasticity may lessen as a child gets older, some degree of plasticity remains. In fact, this brain plasticity is what allows us to keep learning into adulthood and throughout our lives.

The developing brain's ongoing adaptations are the result of both genetics and experience. Our brains prepare us to expect certain experiences by forming the pathways needed to respond to those experiences. For example, our brains are "wired" to respond to the sound of speech; when babies hear people speaking, the neural systems in their brains responsible for speech and language receive the necessary stimulation to organize and function (Perry, 2006). The more babies are exposed to people speaking, the stronger their related synapses become. If the appropriate exposure does not happen, the pathways developed in anticipation may be discarded. This is sometimes referred to as the concept of "use it or lose it." It is through these processes of creating, strengthening, and discarding synapses that our brains adapt to our unique environment.

The ability to adapt to our environment is a part of normal development. Children growing up in cold climates, on rural farms, or in large sibling groups learn how to function in those environments. But regardless of the general environment, all children need stimulation and nurturance for healthy development. If these are lacking—if a child's caretakers are indifferent or hostile—the child's brain development may be impaired. Because the brain adapts to its environment, it will adapt to a negative environment just as readily as it will adapt to a positive one.

Sensitive Periods

Researchers believe that there are sensitive periods for development of certain capabilities. These refer to windows of time in the developmental process when certain parts of the brain may be most susceptible to particular experiences. Animal studies have shed light on sensitive periods, showing, for example, that animals that are artificially blinded during the sensitive period for developing vision may never develop the capability to see, even if the blinding mechanism is later removed.

It is more difficult to study human sensitive periods. But we know that, if certain synapses and neuronal pathways are not repeatedly activated, they may be discarded, and the capabilities they promised may be diminished. For example, infants have the genetic predisposition to form strong attachments to their primary caregivers. But if a child's caregivers are unresponsive or threatening, and the attachment process is disrupted, the child's ability to form any healthy relationships during his or her life may be impaired (Perry, 2001a).

While sensitive periods exist for development and learning, we also know that the plasticity of the brain often allows children to recover from missing certain experiences. Both children and adults may be able to make up for missed experiences later in life, but it may be more difficult. This is especially true if a young child was deprived of certain stimulation, which resulted in the pruning of synapses (neuronal connections) relevant to that stimulation and the loss of neuronal pathways. As children progress through each developmental stage, they will learn and master each step more easily if their brains have built an efficient network of pathways.

Memories

The organizing framework for children's development is based on the creation of memories. When repeated experiences strengthen a neuronal pathway, the pathway becomes encoded, and it eventually becomes a memory. Children learn to put one foot in front of the other to walk. They learn words to express themselves. And they learn that a smile usually brings a smile in return. At some point, they no longer have to think much about these processes—their brains manage these experiences with little effort because the memories that have been created allow for a smooth, efficient flow of information.

The creation of memories is part of our adaptation to our environment. Our brains attempt to understand the world around us and fashion our interactions with that world in a way that promotes our survival and, hopefully, our growth. But if the early environment is abusive or neglectful, our brains will create memories of these experiences that may adversely color our view of the world throughout our life.

Babies are born with the capacity for *implicit memory*, which means that they can perceive their environment and recall it in certain unconscious ways (Applegate & Shapiro, 2005). For instance, they recognize their mother's voice from an unconscious memory. These early implicit memories may have a significant impact on a child's subsequent attachment relationships.

In contrast, *explicit memory*, which develops around age 2, refers to conscious memories and is tied to language development. Explicit memory allows children to talk about themselves in the past and future or in different places or circumstances through the process of conscious recollection (Applegate & Shapiro, 2005).

Sometimes, children who have been abused or suffered other trauma may not retain or be able to access explicit memories for their experiences. However, they may retain implicit memories of the physical or emotional sensations, and these implicit memories may produce flashbacks, nightmares, or other uncontrollable reactions (Applegate & Shapiro, 2005). This may be the case with very young children or infants who suffer abuse or neglect.

Brain Development in Adolescence

Studies using magnetic resonance imaging (MRI) techniques, involving brain scans at regular intervals, show that the brain continues to grow and develop into young adulthood (at least to the mid-twenties). Right before puberty, adolescent brains experience a growth spurt that occurs mainly in the frontal lobe, which is the area that governs planning, impulse control, and reasoning. During the teenage years, the brain again goes through a process of pruning synapses—somewhat

like the infant and toddler brain (National Institute of Mental Health, 2001). As the teenager grows into young adulthood, the brain develops more myelin to insulate the nerve fibers and speed neural processing, and this myelination occurs last in the frontal lobe. MRI comparisons between the brains of teenagers and the brains of young adults have shown that most of the brain areas were the same—that is, the teenage brain had reached maturity in the areas that govern such abilities as speech and sensory capabilities. The major difference was the immaturity of the teenage brain in the frontal lobe and in the myelination of that area (National Institute of Mental Health, 2001).

Another change that happens during adolescence is the growth and transformation of the limbic system, which is responsible for our emotions. Teenagers may rely on their more primitive limbic system in interpreting emotions and reacting, since they lack the more mature cortex that can override the limbic response (Chamberlain, 2009).

Effects of Maltreatment On Brain Development

Babies' brains grow and develop as they interact with their environment and learn how to function within it. When babies' cries bring food or comfort, they are strengthening the neuronal pathways that help them learn how to get their needs met, both physically and emotionally. But babies who do not get responses to their cries, and babies whose cries are met with abuse, learn different lessons. The neuronal pathways that are developed and strengthened under negative

conditions prepare children to cope in that negative environment, and their ability to respond to nurturing and kindness may be impaired (Shonkoff & Phillips, 2000).

Brief periods of moderate, predictable stress are not problematic; in fact, they prepare a child to cope with the general world. The body's survival actually depends upon the ability to mount a response to stress (Shonkoff & Phillips, 2000). Children learn to deal with moderate stress in the context of positive relationships with reliable adult caregivers. Greater amounts of stress may also be tolerable if a child has a reliable adult who can help to buffer the child. But prolonged, severe, or unpredictable stress—including abuse and neglect—during a child's early years is problematic. In fact, the brain's development can literally be altered by this type of toxic stress, resulting in negative impacts on the child's physical, cognitive, emotional, and social growth.

The specific effects of maltreatment may depend on such factors as the age of the baby or child at the time of the abuse or neglect, whether the maltreatment was a one-time incident or chronic, the identity of the abuser (e.g., parent or other adult), whether the child had a dependable nurturing individual in his or her life, the type and severity of the abuse, the intervention, and how long the maltreatment lasted.

The sections below give a brief description of abuse and neglect and are followed by descriptions of some of the consequences of maltreatment.

Abuse—Physical, Sexual, and Emotional

Abuse can refer to physical abuse, such as hitting, shaking, burning, or other forms of maltreatment that a parent or other caregiver might inflict. Sexual abuse is a subset of abuse that refers to any type of sexual behavior with a minor, while emotional abuse generally refers to any injury to a child's psychological or emotional stability (Child Welfare Information Gateway, 2008). Chronic stress may also qualify as emotional abuse. In some States, alcohol or substance abuse or domestic violence that affects the unborn child is considered child abuse.

Physical abuse can cause direct damage to a baby's or child's developing brain. For instance, we now have extensive evidence of the damage that shaking a baby can cause. According to the National Center on Shaken Baby Syndrome (2009), shaking can destroy brain tissue and tear blood vessels. In the short-term, shaking can lead to seizures, loss of consciousness, or even death. In the long-term, shaking can damage the fragile brain so that a child develops a range of sensory impairments, as well as cognitive, learning, and behavioral disabilities.

Babies and children who suffer abuse may also experience trauma that is unrelated to direct physical damage. Exposure to domestic violence, disaster, or other traumatic events can have long-lasting effects. An enormous body of research now exists that provides evidence for the long-term damage of physical, sexual, and emotional abuse on babies and children. We know that children who experience the stress of abuse will focus their brains' resources on survival and responding to threats in their environment.

This chronic stimulation of the brain's fear response means that the regions of the brain involved in this response are frequently activated (Perry, 2001a). Other regions of the brain, such as those involved in complex thought and abstract cognition, are less frequently activated, and the child becomes less competent at processing this type of information.

One way that early maltreatment experiences may alter a child's ability to interact positively with others is by altering brain neurochemical balance. Research on children who suffered early emotional abuse or severe deprivation indicates that such maltreatment may permanently alter the brain's ability to use serotonin, which helps produce feelings of well-being and emotional stability (Healy, 2004).

Altered brain development in children who have been maltreated may be the result of their brains adapting to their negative environment. If a child lives in a threatening, chaotic world, the child's brain may be hyperalert for danger because survival may depend on it. But if this environment persists, and the child's brain is focused on developing and strengthening its strategies for survival, other strategies may not develop as fully. The result may be a child who has difficulty functioning when presented with a world of kindness, nurturing, and stimulation.

Neglect—Lack of Stimulation

While chronic abuse and neglect can result in sensitized fear response patterns, neglect alone also can result in other problems. Malnutrition is a classic example of neglect. Malnutrition, both before and during the first few years after birth, can result in stunted

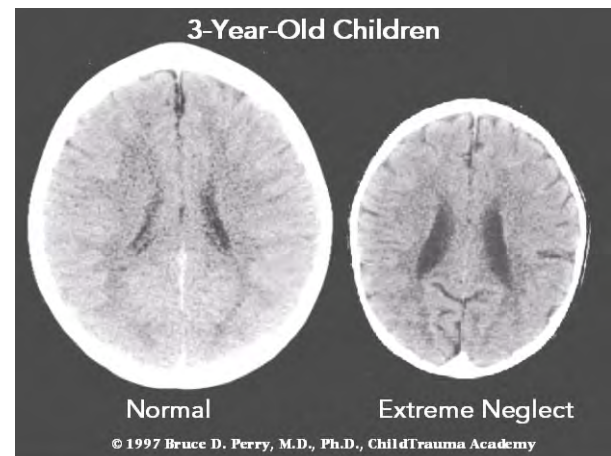
brain growth and slower passage of electrical signals in the brain (Shonkoff & Phillips, 2000). This is due, in part, to the negative effect of malnutrition on the myelination process in the developing brain (ZERO TO THREE, 2009). The most common form of malnutrition in the United States, iron deficiency, can affect the growing brain and result in cognitive and motor delays, anxiety, depression, social problems, and attention problems (Shonkoff & Phillips, 2000).

Although neglect often is thought of as a failure to meet a child's physical needs for food, shelter, and safety, neglect also can be a failure to meet a child's cognitive, emotional, or social needs. For children to master developmental tasks in these areas, they need opportunities, encouragement, and acknowledgment from their caregivers. If this stimulation is lacking during children's early years, the weak neuronal pathways that had been developed in expectation of these experiences may wither and die, and the children may not achieve the usual developmental milestones.

For example, babies need to experience face-to-face baby talk and hear countless repetitions of sounds in order to build the brain circuitry that will enable them to start making sounds and eventually say words. If babies' sounds are ignored repeatedly when they begin to babble at around 6 months, their language may be delayed. In fact, neglected children often do not show the rapid growth that normally occurs in language development at 18-24 months (Scannapieco, 2008). These types of delays may extend to all types of normal development for neglected children, including their cognitive-behavioral, socio-emotional, and physical development (Scannapieco, 2008).

Global Neglect

Researchers use the term "global neglect" to refer to deprivations in more than one domain, i.e., language, touch, and interaction with others. Children who were adopted from Romanian orphanages in the early 1990s were often considered to be globally neglected; they had little contact with caregivers and little to no stimulation from their environment—little of anything required for healthy development. One study found that these children had significantly smaller brains than the norm, suggesting decreased brain growth (Perry, 2002).



"These images illustrate the negative impact of neglect on the developing brain. In the CT scan on the left is an image from a healthy 3-year-old with an average head size. The image on the right is from a 3-year-old suffering from severe sensory-deprivation neglect. This child's brain is significantly smaller than average and has abnormal development of cortex." These images are from studies conducted by a team of researchers from the Child Trauma Academy (www.ChildTrauma.org) led by Bruce D. Perry, M.D., Ph.D. (Reprinted with permission.)

This type of severe, global neglect can have devastating consequences. The extreme lack of stimulation may result in fewer neuronal

pathways available for learning. The lack of opportunity to form an attachment with a nurturing caregiver during infancy may mean that some of these children will always have difficulties forming meaningful relationships with others (Perry, 2001a). But these studies also found that time played a factor—children who were adopted as young infants have shown more recovery than children who were adopted as toddlers (Rutter, et al., 2000).

Emotional and Behavioral Impact

New brain imaging technologies, research with animals, and studies of human growth in optimal and deprived conditions (such as institutions) continue to shed light on the impact of abuse and neglect on brain development. The sections below describe some of the major effects.

Persistent Fear Response. Chronic stress or repeated traumas can result in a number of biological reactions, including a persistent fear state (Perry, 2006). Neurochemical systems are affected, which can cause a cascade of changes in attention, impulse control, sleep, and fine motor control (Perry, 2000a; 2000b). Chronic activation of certain parts of the brain involved in the fear response (such as the hypothalamic-pituitary-adrenal [HPA] axis) can “wear out” other parts of the brain such as the hippocampus, which is involved in cognition and memory (Perry, 2000b). The HPA axis may react to chronic fear or stress by producing excess cortisol—a hormone that may damage or destroy neurons in critical brain areas (Putnam, 2006). Chronic activation of the neuronal pathways involved in the fear response can create permanent memories that shape the child’s perception of and response to the environment. While this adaptation may be necessary for survival in a hostile world,

it can become a way of life that is difficult to change, even if the environment improves.

Hyperarousal. When children are exposed to chronic, traumatic stress, their brains sensitize the pathways for the fear response and create memories that automatically trigger that response without conscious thought. This is called *hyperarousal*. These children have an altered baseline for arousal, and they tend to overreact to triggers that other children find nonthreatening (Child Trauma Academy, n.d.). These children may be highly sensitive to nonverbal cues, such as eye contact or a touch on the arm, and they may read these actions as threats. Consumed with a need to monitor nonverbal cues for threats, their brains are less able to interpret and respond to verbal cues, even when they are in a supposedly nonthreatening environment, like a classroom. While these children are often labeled as learning disabled, the reality is that their brains have developed so that they are constantly alert and are unable to achieve the relative calm necessary for learning (Child Trauma Academy, n.d.).

Dissociation. Infants or children who are the victims of repeated abuse may respond to that abuse—and later in life to other unpleasantness—by mentally and emotionally removing themselves from the situation. This coping mechanism of *dissociation* allows the child to pretend that what is happening is not real. Children who “zone out” or often seem overly detached may be experiencing dissociation. In some cases, it may be a form of self-hypnosis (Stien & Kendall, 2004). Dissociation is characterized by first attempting to bring caretakers to help, and if this is unsuccessful, becoming motionless (freezing) and compliant and, eventually, dissociating. Dissociation may be a reaction to

childhood sexual abuse, as well as other kinds of active, physical abuse or trauma. Children who suffer from dissociation may retreat to the dissociative state when they encounter other stresses later in life.

This type of response may have implications for the child's memory creation and retention. The brain may use dissociation to smother the memories of a parent's abuse in order to preserve an attachment to the parent, resulting in amnesia for the abuse (Stien & Kendall, 2004). However, the implicit memories of the abuse remain, and the child may experience them in response to triggers or as flashbacks or nightmares. In its most extreme form, the child may develop multiple personalities, known as dissociative identity disorder.

Disrupted Attachment Process. At the foundation of much of our development is the concept of attachment, which refers to the emotional relationships we have with other people. An infant's early attachment to his or her primary caregiver provides the foundation for future emotional relationships. It also provides the base for other learning, because babies and children learn best when they feel safe, calm, protected, and nurtured by their caregivers. If the attachment process is disrupted or never allowed to develop in a healthy manner, as can occur with abusive and neglectful caretakers, the child's brain will be more focused on meeting the child's day-to-day needs for survival rather than building the foundation for future growth (Applegate & Shapiro, 2005).

Disrupted attachment may lead to impairments in three major areas for the developing child (Cook et al., 2005):

- Increased susceptibility to stress

- Excessive help-seeking and dependency or excessive social isolation
- Inability to regulate emotions

Young infants depend on positive interactions with caregivers to begin to develop appropriate emotional control and response (affect regulation) (Applegate & Shapiro, 2005). For instance, lots of appropriate face-to-face and other contact helps infants recognize and respond to emotional cues. Infants whose caregivers are neglectful or abusive may experience affect dysregulation—meaning that these children are not able to identify and respond appropriately to emotional cues (Applegate & Shapiro, 2005). Ongoing maltreatment may result in insecure or anxious attachment because the child is not able to derive a feeling of security and consistency from the caregiver. Children who have experienced insecure or anxious attachments may have more difficulties regulating their emotions and showing empathy for others' feelings (Applegate & Shapiro, 2005). These children may have difficulties forming attachments later in life as well.

Impact of Abuse and Neglect on Adolescents

Adolescents who are abused or neglected were often maltreated at younger ages, as well. It can be difficult to isolate the effects of abuse and neglect during the adolescent years, because these youth often suffer from the cumulative effects of a lifetime of abuse and neglect.

Most teenagers who have not been victims of abuse or neglect find their teenage years to be exciting and challenging. Normal puberty and adolescence lead to the maturation of

a physical body, but the brain lags behind in development, especially in the areas that allow teenagers to reason and think logically. Most teenagers act impulsively at times, using a lower area of their brain—their “gut reaction”—because their frontal lobe is not yet mature. Impulsive behavior, poor decisions, and increased risk-taking are all part of the normal teenage experience.

For teens who have been abused, neglected, or traumatized, this impulsive behavior may be even more apparent. Often, these youth have developed brains that focus on survival, at the expense of the more advanced thinking that happens in the brain’s cortex (Chamberlain, 2009). An underdeveloped cortex can lead to increased impulsive behavior, as well as difficulties with tasks that require higher-level thinking and feeling. These teens may show delays in school and in social skills as well (Chamberlain, 2009). They may be more drawn to taking risks, and they may have more opportunity to experiment with drugs and crime if they live in environments that put them at increased risk for these behaviors. Teenagers who lack stable relationships with caring adults who can provide guidance and model appropriate behavior may never have the opportunity to develop the relationship skills necessary for healthy adult relationships or for becoming good parents.

Long-Term Effects of Abuse and Neglect

Maltreatment during infancy and early childhood can have enduring repercussions into adolescence and adulthood. As mentioned earlier, the experiences of infancy and early childhood provide the organizing framework for the expression of children’s intelligence, emotions, and personalities.

When those experiences are primarily negative, children may develop emotional, behavioral, and learning problems that persist throughout their lifetime, especially in the absence of targeted interventions. The Adverse Childhood Experiences (ACE) study is a large-scale, long-term study that has documented the link between childhood abuse and neglect and later adverse experiences, such as physical and mental illness and high-risk behaviors (Centers for Disease Control and Prevention, n.d.).

Some of the specific long-term effects of abuse and neglect on the developing brain can include (Teicher, 2000):

- Diminished growth in the left hemisphere, which may increase the risk for depression
- Irritability in the limbic system, setting the stage for the emergence of panic disorder and posttraumatic stress disorder
- Smaller growth in the hippocampus and limbic abnormalities, which can increase the risk for dissociative disorders and memory impairments
- Impairment in the connection between the two brain hemispheres, which has been linked to symptoms of attention-deficit/hyperactivity disorder

Implications for Practice and Policy

The knowledge we have gained from research examining the effects of maltreatment on brain development can be helpful in many ways. With this information, we are better able to understand what is happening within

the brains of children who have been abused and neglected. In fact, much of this research is providing concrete/scientific evidence for what professionals and caregivers have long been describing in behavioral, emotional, and psychological terms. We can use this information to improve our systems of care and to strengthen our prevention efforts.

The Role of the Child Welfare System

While the goal of the child welfare system is to protect children, many child welfare interventions—such as investigation, appearance in court, removal from home, placement in a foster home, etc.—may actually reinforce the child’s view that the world is unknown, uncontrollable, and frightening. A number of trends in child welfare may help provide a more caring view of the world to an abused or neglected child. These trends include:

- Family-centered practice and case planning
- Individualized services for children and families
- The growth of child advocacy centers, where children can be interviewed and assessed and receive services in a child-friendly environment
- The use of differential response to ensure children’s safety while providing nonadversarial support to families in low-risk cases

Prevention. Child welfare systems that devote significant efforts to prevention may be the most successful in helping children and families and promoting healthy brain development. Prevention efforts should focus on supporting and strengthening children’s families so that children have the best chance of remaining safely in their homes

and communities while receiving proper nurturing and care. The Centers for Disease Control and Prevention (CDC) has developed several publications that promote Safe, Stable, and Nurturing Relationships (SSNRs) between children and caregivers and prevent maltreatment.

By the time a child who has been abused or neglected comes to the attention of professionals, it is likely that some damage already has been done. Prevention efforts must reach out to families before this point. These efforts may target the general population (“primary” or “universal” prevention), educating the public and changing policies to promote healthy brain development. Prevention efforts also may target children and families considered to be at-risk of developing problems (“secondary” or “selected” prevention). Brain research underscores the importance of prevention efforts that target the youngest children—efforts such as early childhood home visiting programs for expectant and new mothers who might be at-risk because of their age, income, or other circumstances, and parent education programs that promote protective factors and lead to positive outcomes for both parents and children.

Prevention efforts for at-risk families should focus on strengthening the family and building on the family’s positive attributes. Recent prevention resource guides from the U.S. Department of Health and Human Services Children’s Bureau (2009) encourage professionals to promote five “protective factors” that can strengthen families, help prevent abuse and neglect, and promote healthy brain development:

- Nurturing and attachment

- Knowledge of parenting and of child and youth development
- Parental resilience
- Social connections
- Concrete supports for parents

Early Intervention. Intensive, early interventions are key to minimizing the long-term effects of early trauma on children's brain development (Committee on Early Childhood, Adoption and Dependent Care, 2000). In recognition of this fact, Federal legislation requires States to develop referral procedures for children ages 0-36 months who are involved in a substantiated case of child abuse or neglect. Once a child is identified, States must provide intervention services through Early Intervention Plans funded under Part C of the Individuals with Disabilities Education Improvement Act (IDEA). A number of States have developed innovative programs to meet these requirements and to identify and help the youngest victims of abuse and neglect (Child Welfare Information Gateway, 2007).

In order to heal a damaged or altered brain, interventions must target those portions of the brain that have been altered (Perry, 2000b). Because brain functioning is altered by repeated experiences that strengthen and sensitize neuronal pathways, interventions cannot be limited to weekly therapy appointments. Interventions must address the totality of the child's life, providing frequent, consistent replacement experiences so that the child's brain can begin to incorporate a new environment—one that is safe, predictable and nurturing.

Child welfare professionals can play a crucial role in helping children who have experienced abuse or trauma receive appropriate mental

health services. Even when the maltreatment occurred in the distant past, there are interventions that can help a child or youth heal. In fact, many types of interventions and therapies have emerged in recent years to help children and adults deal with past abuse and trauma. The Child Trauma Academy (www.childtrauma.org) provides some online trainings to help professionals become more familiar with the effects of abuse on brain development and the need for early interventions. The National Child Traumatic Stress Network, funded by the U.S. Department of Health and Human Services, offers resources for parents, caregivers, and professionals on helping children survive and recover from many kinds of trauma, including factsheets on trauma-focused interventions. Other resources are listed at the end of this paper.

The Role of Caregivers

Many children who have suffered abuse and neglect are removed from their homes by the child welfare system for their safety. These children may be temporarily cared for by extended family, foster parents, or group home staff, and some will be adopted. In these cases, educating caregivers about the possible effects of maltreatment on brain development may help them better understand and support the children in their care. Child welfare workers may also want to explore any past abuse or trauma experienced by parents that may influence their parenting skills and behaviors.

It is important for caregivers to have realistic expectations for their children. Children who have been abused or neglected may not be functioning at their chronological age in terms of their physical, social, emotional, and cognitive skills. They may also be displaying

unusual and/or difficult coping behaviors. For example, abused or neglected children may:

- Be unable to control their emotions and have frequent outbursts
- Be quiet and submissive
- Have difficulties learning in school
- Have difficulties getting along with siblings or classmates
- Have unusual eating or sleeping behaviors
- Attempt to provoke fights or solicit sexual experiences
- Be socially or emotionally inappropriate for their age
- Be unresponsive to affection

Understanding some basic information about the neurobiology underlying many challenging behaviors may help caregivers shape their responses more effectively. They also need to know as much as possible about the particular circumstances and background of the individual children in their care.

In general, children who have been abused or neglected need nurturance, stability, predictability, understanding, and support (Committee on Early Childhood, Adoption and Dependent Care, 2000). They may need frequent, repeated experiences of these kinds to begin altering their view of the world from one that is uncaring or hostile to one that is caring and supportive. Until that view begins to take hold in a child's mind, the child may not be able to truly engage in a positive relationship. And the longer a child lived in an abusive or neglectful environment, the harder it will be to convince the child's brain that the world can change. Consistent nurturing from caregivers who receive training and support

may offer the best hope for the children who need it most.

Summary

In 2007, approximately 794,000 children were determined to be victims of abuse and/or neglect (U.S. Department of Health and Human Services, 2009), but it is likely that many more children are actually suffering under adverse conditions. These children already may have suffered damage to their growing brains, and this damage may affect their ability to learn, form healthy relationships, and lead healthy, positive lives.

One lesson we have learned from the research on brain development is that environment has a powerful influence on development. Stable, nurturing caregivers and knowledgeable, supportive professionals can have a significant impact on these children's development. Focusing on preventing child abuse and neglect, helping to strengthen families, and ensuring that children receive needed services are some of the most important tasks we can undertake.

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Highlighted Resources

Child welfare professionals may find these resources particularly helpful:

Center on the Developing Child—Founded and directed by Jack Shonkoff, M.D., the Center publishes and links to research on early brain development, learning, and behavior and applying that knowledge to policies and practices.

www.developingchild.harvard.edu

Centers for Disease Control and Prevention—The CDC website offers several publications that promote Safe, Stable, and Nurturing Relationships to prevent child maltreatment. CDC also sponsors the Adverse Childhood Experiences (ACE) study.

www.cdc.gov/ViolencePrevention/childmaltreatment/index.html

www.cdc.gov/nccdphp/ACE/index.htm

Child Trauma Academy—This website offers free online courses and other trainings on early brain development and the impact of maltreatment. A wide variety of other resources also are available through the website, including books and articles by Bruce Perry, M.D., and other experts in the field.

www.childtrauma.org/

From Neurons to Neighborhoods: The Science of Early Childhood Development—This book was written in 2000 by a committee of experts (Committee on Integrating the Science of Early Childhood Development, J. P. Shonkoff and D. A. Phillips, eds). Not only does it pull together the findings of neurobiology, but the authors explore what the findings suggest for society in terms of how we can nurture and protect our young children.

Healing Trauma: Attachment, Mind, Body, and Brain (M. F. Solomon and D. J. Siegel, Editors)—This book covers both the development and treatment of trauma, including attachment trauma.

The National Child Traumatic Stress Network—This federally funded initiative is a collaboration of academic and community-based service centers whose mission is to “raise the standard of care and improve access to services for traumatized children.” The website includes an extensive list of factsheets of promising practices for treating child trauma.

www.nctsnet.org/ncts/nav.do?pid=ctr_top_trmnt_prom

ZERO TO THREE—This national nonprofit organization offers resources, training, and support for professionals and parents of young children. The online Baby Brain Map is a useful tool for showing how brain development parallels baby behavior.

www.zerotothree.org/site/PageServer?pagename=ter_util_babybrainflash