Childhood exposure to conjugal violence: Developmental considerations

Childhood exposure to conjugal violence: Developmental considerations and consequences for behavior and neural development.

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Symposium: "The Biology of Family Law: The Impact of Neuroscience and Behavioral Genetics on Family Law"
DePaul University College Of Law
Chicago, IL

March 3, 2006

ABSTRACT

The effects of exposure to conjugal violence are dramatic and measurable. Children in homes where aggression is present are not only at risk of personal injury or death, but this exposure presents a wide range of psychological and physical symptoms that can be long term in duration. These children suffer from a host of side-effects including trauma symptoms, physical complaints, academic difficulties, relational complications, and they are at risk for becoming aggressors themselves in their future relationships. Individuals, especially infants and toddlers, who are exposed to the stress response over extended periods of time can suffer distinct changes in brain structure. This paper addresses the physical and psychological effects of viewing violence on the brain of the developing child.

Introduction

There is no question that viewing domestic violence has detrimental effects on children. Not only are these children at risk for physical neglect and injury, but they are also at risk for both short-term problems such as post-traumatic stress disorder as well as long-term issues such as behavioral problems, mental health problems, sleep difficulties, and school problems. Even infants who are incapable of social awareness of the violence occurring in their presence, suffer long-term effects. In fact, research indicates that infants and toddlers through age three may be at higher risk for permanent damage than older children due to the plasticity of their developing brains. Measurable structural differences exist in the brains of children who have witnessed conjugal violence as infants and toddlers and these changes may be the source of a host of adolescent and adult psychiatric disorders. The following discussion addresses basic neurodevelopment, the chemical make-up of the brain, and the role of the limbic system. The effects of stress and maternal depression on attachment are also addressed. Finally, research on the many short- and long-term outcomes for children who view domestic violence is presented.

Brain Structure and Development

Very generally, the brain consists of four major areas: the interbrain, the midbrain, the hindbrain, and the cortex. The interbrain (diencephalon) includes the thalamus and hypothalamus. The thalamus directs information throughout the brain while the hypothalamus organizes behavior, controls fight/flight, hunger and the drive to reproduce, and it also controls the autonomic system and the endocrine system. The midbrain (mesencephalon) includes part of the brain stem. Its primary function is motor regulation, arousal, appetite/satiety, and sleep. The brainstem generally controls autonomic functions (blood pressure, heart

rate, body temperature) and directs information from the peripheral nervous system to the appropriate areas of the midbrain and cortex. The hindbrain (metencephalon) includes the pons, the cerebellum, and the medulla oblongata (the medulla is technically the myelencephalon). Its primary function is balance and motor control as well as integration of visual and somatosensory information with muscular movements.

A human can survive with only these three components in tact, but the thing that makes one distinctly human and what gives one a distinct personality is the cortex. The cortex, also called the forebrain or telencephalon, is responsible for problem-solving, coping, reasoning, and abstract thinking. It includes the limbic system and the integrated neural networks that allow all other parts of the brain (i.e. vision, auditory function, and interpretation of stimuli) to work in harmony. "These various brain areas develop, organize, and become fully functional at different stages in childhood" (Perry, 1997, p. 128), a point that will be important further in this discussion. While humans and chimpanzees have brains that are very similar, differences in the cortex between the two organisms is what makes it impossible that non-human primates will ever be able to function at the same cognitive level as humans.

Each area of the brain is intricately wired to other areas creating an amazing web of neural networks. These networks allow for an infinite number of possible connections between neurons and these permutations allow a number of systems within the brain to develop. These systems include the limbic system and memory, systems that are not identified by a single area or set of cells, but instead are defined by chemical traces, re-used routes through which information routinely passes. Understanding the neuro-biological effects of viewing violence requires that one recognize that these systems are interrelated and they function in union with one another. Neurological functioning is a combination of development, anatomy, chemistry, neural integration, and, as this article will demonstrate, social interaction.

Neuro-development. Following conception, the brain is one of the first things to develop. It continues to add cells at a fantastic rate from second week of prenatal development through birth. During some stages of prenatal development, as many as a half million neurons are produced every second (Balbernie, 2001, p.240). By the second trimester, the convolutions of the cortex begin to appear. The convolutions, called sulci, provide the cortex with more surface area, which in turn allows more neurons to be tightly packed into the confined space of the cranium.

During prenatal development, neurons literally migrate into a predetermined position. By the time babies are born most of the brain's neurons are where they are supposed to be (Glaser, 2000, p. 99). Therefore, babies are born with all the neurons they will ever have – approximately 100 billion of them (Berger, 1999, p. 268). Even so, their brains only have about 25% of their weight at birth compared to the weight of an adult brain, whereas the chimpanzee is born with a brain weight 45% of its adult counterpart (Berger, 1999, p. 269). In fact, human brains are the only ones that "continue to grow at a fetal rate after birth," a rate that "continues for the first two years of life before it begins to show any signs of abating" (Berger, 1999, p. 268). The growth of the brain from approximately 400gm at birth to 1000gm at 12 months of age is accounted for by the development of connections between neurons, glial cells, and myline (Glaser, 2000, p. 99). During the first year of life the cortex triples in thickness and at its peak "15,000 synapses are produced on every cortical neuron, which corresponds to a rate of 1.8 million new synapses per second between two months of gestation and two years after birth" (Balbernie, 2001, p. 240).

This growth spurt continues at least through age 24 months and, even though it slows significantly after birth, continues through the first ten years of life. The infant and toddler brain is not only growing, but it is also active. For the first four years of life, the cerebral cortex consumes glucose at a rate more than twice the glucose usage of an adult's brain and this process continues through age ten (Glaser, 2000, p. 99). Even though this process continues for many years, the first two years of life are especially critical because it is during these months that proliferation and "overproduction of axons, dendrites, and synapses" occur (Glaser, 2000, p. 99). Many of these synapses will eventually be lost, but overproduction is necessary to

ensure enough neurons survive into adulthood to maintain normal functioning.

By age two, a child's brain "has as many synapses as an adult" and by age three, nearly 1,000 trillion synapses will have developed (Balbernie, 2001, p. 240). Many of these connections, however, will not survive. Neural connections that are used are maintained and those that are not are pruned and lost. In everyday language, the child either uses these cells or loses them. By age ten a child's brain will have lost half the neural connections he had at age three and will maintain about 500 trillion throughout life. These many changes in the early years demonstrate the plasticity of the child's brain. The brain literally is prepared for many different outcomes and, in essence, the brain learns how it is supposed to use the physical structures that exist. In other words, a newborn has the basic brain tissue necessary for developing the things that people would consider important parts of what makes us a most unique, but it isn't until after birth, through social interaction, that the "unique person" begins to take form based on structural changes in the brain. Therefore, environmental interaction is critical. As will be demonstrated, chronic stress, severe abuse, and neglect cause atrophy of these neural connections (Balbernie, 2001).

The various regions of the brain develop in a sequential and hierarchical fashion and these areas "develop, organize, and become fully functional at different times during childhood" (Perry, Pollard, Blakley, Baker, & Vigilante, 1995, p. 276). Some areas of the brain, especially in the cortex, are present structurally many years before they will be fully functional (Perry, et al., 1995, p.276). During these first years of life, the brain is trained how to respond, when to respond, to what it should respond, and at what level it should respond. This process of training the brain how to respond, in essence, changing its own structure, is called neuroplasticity (Balbernie, 2001).

As mentioned above, well-used pathways in the brain are made permanent and strengthened. The development of these pathways, connections between neurons, is called connectivity and the infant's interaction with a primary caregiver is critical to this process. Through one-on-one interactions, the child not only learns, but this learning literally involves transformation of cerebral tissue and chemical traces. By responding "sensitively to the infant" and by "gauging their emotion accurately," the caregiver teaches the infant to regulate emotions, frustrations, and attention (Glaser, 2000, p. 101). It is the development and reinforcement of these structures that make up the "primary task" of the development of the brain for the first few years of life (Balbernie, 2001, p. 239).

By late adolescence the brain is complete in all of its structures and has fully matured. Unused pathways are pruned away while well-used pathways are strengthened and will remain indefinitely. At this point it has become "an amazingly complex organ composed of over 100 billion neurons and ten times as many glial cells, all organized into systems designed to sense, process, store, perceive, and act on information from the external and internal environment" (Perry, et al., 1995, p. 273).

Therefore, when babies are born, they have unlimited cerebral potential. The systems that affect the most important parts of what makes us human develop last and are dramatically affected by environment. For example, the frontal cortex is most seriously at risk when the child is neglected, abused, or when he/she views aggressive behavior in the home because it is one of the last areas to mature.

In summary, the anatomic brain structures that govern personality traits, learning processes, and coping with stress and emotions are established, strengthened, and made permanent in early childhood (Committee on Early Childhood, Adoption, And Dependent Care, 2000, p. 1145). As this paper will demonstrate, neglect, lack of stimulation, negative environmental conditions, abuse, and violence within the family threaten neural development (Berger, 1999; Committee on Early Childhood, Adoption, And Dependent Care, 2000). There is little doubt that "emotional and cognitive disruptions in the early lives of children have the potential to impair brain development" (Committee on Early Childhood, Adoption, And Dependent Care, 2000, p. 1145).

The Chemical Brain

It is important to recognize that even though they are closely related, the structure of the brain is not synonymous with chemical production and transmission in the brain. The chemicals of the brain, neurotransmitters, allow the structures to communicate and do their respective jobs. Not only are structural changes in the brain likely when the child is exposed to conjugal violence, an issue that will be explored in a moment, but research also demonstrates how the brain functions chemically in children who are exposed to stressful events, such as conjugal violence.

Balbernie (2001) describes the chemical process in the brain:

Any perception of danger causes the hypothalamus to trigger the sympathetic nervous system, at the same time catecholamines (neurotransmitters) are released by sympathetic nerves and the adrenal medulla (the interior). The body is being prepared for action. These amines also activate the amygdala, which is central in orchestrating the behavioral reactions to a stressful event, but their prolonged release in the prefrontal cortex can cause cognitive defect. If stress continues, the hypothalamus secretes corticotrophin-releasing hormone so that adrenocorticotropic hormone enters the bloodstream and, when it reaches the adrenal cortex (the shell of the adrenal gland), it stimulates the release of corticosteroids, the major one being cortisol. (p. 249)

Increases in cortisol and other neurotransmitters appear to be the adaptive result of continued exposure to stressful events (i.e. coping strategies of the mind) and yet these same functions produce long-term emotional reactions in children that are less than desirable (Gunnar, 1992, p. 496). For example, Nachmias and colleagues (1996) found elevations in cortisol in toddlers with insecure attachment relationships. Once these circuits are established and strengthened through repeated exposure to the stressful events, they become engrained patterns of processing (Balbernie, 2001, p. 245) and, therefore, very difficult to reverse. This relationship between cortisol and attachment appears especially critical in infants between ages six and eighteen months (Nachmias, Gunner, Mangelsdorf, Parritz, & Buss, 1996).

According to Perry and colleagues (1995), repeated exposure to stress also results in a hypersensitivity to stimuli. "Everyday stressors that previously may not have elicited any response now elicit an exaggerated reactivity…This means that the child will very easily be moved from being mildly anxious to feeling threatened to being terrorized" (Perry, Pollard, Blakley, Baker, & Vigilante, 1995, p. 278). These effects are present even when no threat exists. "Cortisol can also be produced in response to danger that has not been consciously registered, galvanizing implicit memory held in the right hemisphere. Once programmed in, the reactions that went with the initial period of abuse or neglect are immediately reactivated whenever a reminder occurs, whether or not the threat is real" (Balbernie, 2001, p. 249). This can easily lead to threat-response symptoms (PTSD-like behaviors) and yet the subject may be completely unaware of any threat.

Limbic system

The limbic system, including the amygdala and the hippocampus, directs emotion and behavior, controls the fight/flight response, controls interpretation of events, and involves a complex dance between the physical brain (neurons and neural tissue) and the chemicals that flow between them. The limbic system is also critically involved in memory. These are not insignificant issues. The fact that memories are closely tied to emotion has huge ramifications for trauma. An individual's memory of past events is inseparable from the emotion of those same events. Van der Kolk (1994) notes that the amygdala and the hippocampus are critical in processing "emotionally charged memories" as well as "the evaluation of the motional meaning of incoming stimuli" which is then integrated as "internal representations of the external world." In essence, the brain is trained to decide not only what memories mean, but the affective response that is

appropriate for those memories. As the child's limbic system develops, he/she learns to recognize and identify emotion, read body language, vocal tone, and interpret eye contact (Balbernie, 2001). These skills are critical as the child gets older and has to determine appropriate behavioral responses to social interactions. The child whose system has learned dysfunctional interpretations and responses will exhibit dysfunctional behaviors.

Environment and Neural Response

In normal development, brain tissue and the systems within it are programmed to respond appropriately to stimuli within a given socio-cultural setting. While initial responses to aggression or threat are effective and they serve a purpose at the time, the child who is exposed to conjugal violence generalizes this response, thus programming his/her brain to respond inappropriately to various stimuli outside of the threatening context and these programming errors lead to a host of behavioral and psychological symptoms. The following discussion addresses how the environment affects the development of the brain and, subsequently, the child's behavior.

Numerous animal studies have demonstrated a direct result of environmental variables on the mass of animal brains – up to 30% more brain mass in rats raised in enriched environments as well as more synaptic connections than those in deprived environments (Perry, 1997; Glaser, 2000). Van den Hove (2006) and colleagues found that prenatal stress also affects brain size. They discovered that maternal prenatal stress in laboratory animals resulted in "an approximately 50% decrease in cell proliferation" after delivery (Van den Hove, Steinbusch, Scheepens, Van de Berg, Kooiman, Boosten, Prickaerts, & Blanco, 2006). These changes are likely the result of increased release of neurohormones such as cortisol, epinephrine, and norepinephrine in the stress response (van der Kolk, 1994). Not only does environment contribute to slowed proliferation in laboratory animals, but deprivation and neglect can also cause cell atrophy. Glaser (2000) notes that in laboratory studies with rats, a single day of maternal deprivation (equivalent to six months in humans) can result in "preprogrammed cell death" in the hippocampus (p. 103).

While these controlled studies cannot ethically be replicated in humans, the data on human brain development demonstrates that numerous environmental variables do, in fact, affect brain development. Of specific interest are the effects of stress and maternal depression on attachment and how attachment issues result in psychological and behavioral problems in children, adolescents, and adults.

Stress. At the very least, viewing conjugal violence is stressful both for the victim and the viewer. Stress results in elevated catecholamines (i.e. norepinephrine and epinephrine) and low seratonin in animals and these neurotransmitters are directly related to the inability to modulate arousal (van der Kolk, 1994). This means that a likely outcome of stress is an inability to control ones arousal – an issue that is symptomatic of attention-deficit/hyperactivity disorder. Animal studies have demonstrated that maternal behavior can produce this response in offspring, which appears to wire the developing brain for the stress response (Lui & Diorio, 1997). During the first few years of life a child learns how to cope with his/her environment and these skills become fixed response patterns in the brain. A child who experiences chronic threat can respond with apathy and withdrawal while a child experiencing acute stress may resort to tantrums and aggression (Committee on Early Childhood, Adoption, And Dependent Care, 2000, 1146).

These neurochemical changes in response to stress affect the prefrontal cortext "making children less able to govern their behavior" (Arnsten, 1999, p. 220). This obviously would have marked behavioral, social, and educational ramifications. DeBellis and colleagues noted numerous affects of these neurochemical changes including intrusive thinking, avoidance, hyperarousal and dissociation (De Bellis, Keshavan, Clark, Casey, Giedd, Boring, Frustaci, & Ryan, 1999, p. 1271). These researchers also noted measurable physical changes in brain structure of subjects who had experienced post-traumatic stress disorder including "smaller intracranial and cerebral volume," smaller lateral ventricles, and smaller corpus collosum and they

concluded that overwhelming stress of maltreatment experiences in childhood is associated with adverse brain development" (De Bellis, Keshavan, Clark, Casey, Giedd, Boring, Frustaci, & Ryan, 1999, p. 1271). Although individual differences in threshold, intensity, duration and recovery of the stress response exist (Boyce, Barr, & Zeltzer, 1992, 485), the preponderance of the research demonstrates that chronic stress has detrimental affects on children.

Maternal Depression. It has been demonstrated that a home where domestic violence is present is not only a home where the possibility of physical injury could reduce one's parenting abilities, but it is also a home where maternal depression is likely (Tajima, 2004; Fergusson, Horwood, & Ridder, 2005; Jarvis, Gordon, & Novaco, 2005; Matud, 2005). A depressed mother will have more difficulty meeting her own needs as well as the needs of her child, making child neglect more probable. Numerous research studies have demonstrated that maternal depression has an effect on the developing brain in ways described above (Glaser, 2000; Dawson, Frey, Panagiotides, Yamada, Hessl, & Osterling, 1999). Children of depressed mothers have numerous other physical responses including EEG asymmetry (Jones, Field, Davalos, & Pickens, 1997), and atypical frontal brain electrical activity (Dawson, et al, 1999). Davidson (1994) suggests that asymmetric activity in the brain "may be importantly influenced by early environmental factors, resulting in enduring changes in brain function and structure" (p. 741).

Mothers can also inadvertently "transmit" their depression to their young charges. For example, in an examination of the literature, Balbernie (2001) found that, "having a depressed mother between 6 and 18 months of age can lead to emotional and cognitive difficulties that persist through the early school years, whether or not the mother continued to be troubled by depression" (p. 249). In brief, maternal depression brought about by domestic violence exposes children not only to the potential for injury and/or neglect, but also predisposes them for a variety of difficulties that are directly related to structural changes in the brain.

Attachment. Caregivers who are victims of violence in the home are likely to experience stress, PTSD, and depression and these effects could reduce a caregiver's ability to perform normal parenting behaviors, not to mention the potential that domestic violence could completely incapacitate a caregiver. The argument I have made so far is that violence in the home increases stress in both parent and child. Conjugal violence also increases the likelihood that the mother will experience depression. These dysfunctions lead to neglect, poor parent-child interactions, and they have measurable effects in the child's developing brain. Perhaps the most significant result of stress and/or maternal depression in infancy is its effects on attachment. Even if the child is unaware of violence occurring in the home, the resulting marital stress could produce results in the infant as if the child had, in fact, witnessed violence him/her self. For example, in their study of foster care, Johnson and colleagues (2006) claim that "neglect and damage caused by early privation and deprivation is equivalent to violence" (Johnson, Browne, & Hamilton-Giachristis, 2006, 34).

The relationship between neglect and attachment disorders in children in foster care has been demonstrated for decades and children are most at risk for attachment problems during their earliest years. They are likely to suffer "delays in physical growth, neural atrophy, and abnormal brain development" and "infants who are placed in institutional care will suffer harm to their development if they are not moved to family-based care by the age of 6 months" (Johnson, Browne, & Hamilton-Giachristis, 2006, 34). Glaser (2000) also notes that children in foster care are at risk for delays in their cognitive and social functioning (p. 98). It is generally believed that these risks are due to lack of personal contact with primary caregivers that is not uncommon in foster care. Once again, it is well established that interpersonal communication through eye contact is particularly important in the first year of life (Balbernie, 2001,p. 243). Children not only need interpersonal eye contact, but they need a caregiver who is sensitive to their emotional states in order to help the child learn to modulate their own emotional states (Balbernie, 2001, p. 242). Child abuse and neglect results in fewer "sensitive interactions between the parent(s) and the young child" that are necessary for emotional bonding (Glaser, 2000, p. 101).

Interaction between parent and child, or lack thereof, during sensitive developmental periods has a direct affect on the developing brain. Balbernie (2001) notes that orbitofrontal cortex is strongly affected by the quality of the care-giving relationship and it governs the individual's social interactions (p. 242). Balbernie (2001) also notes, as has long been believed, that early "impoverished environments" provide correlational evidence between early trauma and "both adult borderline personality disorder and dissociative disorders" (p. 242).

In summary, Berger (1999) argues that "early experiences of trauma or abuse – whether in utero or after birth – can interfere with development of the subcortical and limbic area of the brain, resulting in extreme anxiety, depression, and/or the inability to form healthy attachments to others" (p. 270). Wismer-Fries and colleagues (2005) reach a similar conclusion. These researchers found that "the pervasive social and emotional difficulties observed in many children who have experienced aberrant care-giving" demonstrate that "there is a critical role for early experience in human development of the brain systems underlying basic aspects of human social behavior" (p. 1723). In other words, attachment is biological and is directly related to social interaction.

Outcomes

I have made the case that due to neuralplasticity, the child's brain is pliable and vulnerable to dysfunctional development when regularly exposed to conjugal violence –due to neglect and abuse, but also because of stress and maternal depression. These issues lead to attachment problems and even though attachment disorders are serious, there are many other potential outcomes as well. Perry and colleagues (1995) note that, trauma leads to psychological disorders. Others have found that early adverse life experiences, including viewing domestic violence, increase the likelihood of depression in later life (Beatson, & Taryan, 2003) as well as aggression in childhood, anger, and anxiety (Johnson, Kotch, Catellier, Winsor, Dufort, Hunter, & Amaya-Jackson, 2002, p. 179). Ongoing stress has been linked to "developmental, cognitive, and behavioral disorders, and possible onset of psychopathology in later life" (Koubovec, Geerts, Odendaal, Stein, & Vythilingum, 2005, 274). Balbernie (2001) argues that changes in the brain in children being reared in a hostile environment are "associated with hyperactivity, impulsive behavior, anxiety and poor emotional control" (p. 246). Children who are also maltreated have shown elevated cortisol concentrations (Hart, Gunnar, & Cicchetti, 1996) and causing cell loss in the "hippocampus, damaging learning and explicit memory," increasing the likelihood of emotional and attachment problems, and, if adverse conditions persist, threatening "general mental health and cognitive ability" (Balbernie, 2001, p. 249).

Glaser (2000) also notes that general health can be compromised because the regular presence of the stress response suppresses the immune system. Modulating one's own affect is a life skill that also has ramifications for one's health. For example, Lewis (1992) found that an infant's ability to "suppress responding to acutely painful events (an inoculation) was negatively related to illness, such that the more the infant was unable to suppress his or her response, the more the incidence of illness" (p. 490).

Exposure to conjugal violence has other behavioral risks. Perry (1997) describes reactions in three-year-olds due to changes in the brain noting that the unorganized cortex in a frustrated child causes difficulties "modulating the reactive, brainstem-mediated state of arousal;" therefore, "they will scream, kick, bite, throw, and hit" (Perry, 1997, p. 128). Changes in the brain structure in children who are exposed to conjugal violence find themselves in a "persisting 'fight-or-flight' state" (Perry, 1997, p. 136). By adolescence, this persistent state is one in which the child is unable to escape. In essence, what was originally an adaptive mechanism to situational stress becomes a day-to-day response that results in a neural system that is "overactive and hypersensitive" (Perry, 1997, p. 136). Balbernie (2001) also notes that, "the chronic overactivation of neurochemical responses to threat in the central nervous system, particularly in the earliest years of life, can result in lifelong states of either dissociation or hyperarousal" (p. 247).

Among those outcomes listed above, changes in brain structure as well as chemical changes in the brain lead to numerous other negative outcomes including an increased likelihood of exhibiting symptoms consistent with Attention Deficit/Hyperactivity Disorder (Glaser, 2000), bonding problems and loss of social skills (Henry, 1993), lack of empathy and increased probability of sociopathy and borderline personality disorder (Henry, 1993), less self-control and language delays (Balbernie, 2001), motor hyperactivity, anxiety, mood swings, impulsiveness, and sleep problems (Committee on Early Childhood, Adoption, And Dependent Care, 2000), depression (Beatson, & Taryan, 2003), more inhibited behaviors and non-empathetic behaviors in response to mock distress of mothers (Jones, et al, 1997), increased likelihood of post-traumatic stress disorder (PTSD) (Brisch, 2005), differences in emotional expression and infant emotional behavior (Gunnar & Nelson, 1994), as well as problems with "gross motor skills, fine motor skills, cognition, speech and language function, self-help abilities, emotional well-being, coping skills, and relationships" (Committee on Early Childhood, Adoption, And Dependent Care, 2000, p. 1147).

The evidence for neurological changes due to the exposure to conjugal violence may have even further implications. Many of the behavioral effects in older children that have been cited in the literature may have a biological cause. In a prior publication, I have noted that numerous studies have demonstrated the many problems exhibited by children who witness domestic violence (Moffatt, 2002). These problems are grouped into five categories including externalized reactions, internalized reactions, intellectual and academic reactions, social developmental reactions, and physical reactions. Within these categories are included aggression, phobias, insomnia, conduct problems, depression, anxiety, lower levels of social competence, lower levels of self-esteem, poor academic performance, and symptoms consistent with post traumatic stress disorder (PTSD) (Moffatt, 2002). These effects vary depending on the child's age and perhaps some of these effects, even esteem issues, have their root in neurological changes during critical developmental periods.

These neurological and behavioral effects are likely outcomes when a child is exposed regularly to conjugal violence, maternal depression, and stress. The effects of neglect and/or trauma, as Balbernie (2001) argues, "can be indirect as in witnessing domestic violence" and this exposure alters "the developing central nervous system, predisposing to a more impulsive, reactive, and violent individual" (p. 245).

CONCLUSIONS

In conclusion, the most likely cause-effect relationship is this: viewing conjugal violence causes trauma/stress in the viewer and stress leads to brain structure changes. Infants are especially at risk because of the neuroplasticity of the brain during the early years of development. Perry (1997) notes that brain development involves critical periods where "specific sensory experience is required for optimal organization and development of any brain area" (p. 132). When these critical periods are missed, delay in development or even failure to develop critical skills may be permanent. These critical periods exist in utero (Als, Duffy, McAnulty, Rivkin, Vajapeyam, Mulkern, Warfield, Huppi, Butler, Conneman, Fischer, & Eichenwald, 2004) leading to the conclusion that maternal stress could be an issue on the developing child even before birth. Gunnar (1998) addresses the complex interaction of brain activity and emotional outcomes stating that the data clearly "provide yet more support for the importance of fostering safe, secure care for children early in their development" (p. 208).

Neurology, environment, and resulting behavior involve complex interactions that cannot easily be reduced to simple cause-effect dyads, but the evidence is clear that children in homes where conjugal violence exists are at risk for multiple problems that are not simple or short-term. In short, children learn how to interpret information and respond based on their early environments. Once these response patterns are established, they potentially remain life-long response patterns even when they have outlived their original adaptive purpose.

REFERENCES

Als, H., Duffy, F.H., McAnulty, G.B., Rivkin, M.J., Vajapeyam, S., Mulkern, R.V.,Warfield, S.K., Huppi, P.S., Butler, S.C., Conneman, N., Fischer, C., & Eichenwald, E.C. (2004). Early experience alters brain function and structure. Pediatrics, 113, 846-857.

Arnsten, A. (1999). Development of the cerebral cortex: XIV. Stress impairs prefrontal cortical function. Journal of the American Academy of Child & Adolescent Psychiatry, 38, 220-222.

Balbernie, R. (2001). Circuits and circumstances: the neurobiological consequences of early relationship experiences and how they shape later behaviour. Journal of Child Psychotherapy, 27, 237-255.

Beatson, J., & Taryan, S. (2003). Predisposition to depression: the role of attachment. Australian and New Zealand Journal of Psychiatry, 37, 219-225.

Berger, E.H. (1999). Supporting parents with two essential understandings: attachment and brain development. Early Childhood Education Journal, 26, 267-270.

Boyce, W.T., Barr, R.G., & Zeltzer, L.K. (1992). Temperament and the psychobiology of childhood stress. Pediatrics, 3, 483-486.

Brisch, K.H. (2005). The importance of early traumatic experiences for the development of the infant's brain. MMW Fortschritte der Medizin, 147, 39-42. Committee on Early Childhood, Adoption, And Dependent Care (2000). Developmental issues for young children in foster care. Pediatrics, 106, 1145-1150.

Davidson, R. (1994). "Asymmetric brain function, affective style, and psychopathology: the role of early experience and plasticity. Developmental and Psychopathology, 6, 741-758.

Dawson, G., Frey, K., Panagiotides, H., Yamada, E., Hessl, D., & Osterling, J. (1999). Infants of depressed mothers exhibit atypical frontal electrical brain activity during interactions with mother and with a familiar, nondepressed adult. Child Development, 70, 1058-1066.

De Bellis, M.D., Keshavan, M.S., Clark, D.B., Casey, B.J., Giedd, J.N., Boring, A.M., Frustaci, K., & Ryan, N.D. (1999). A.E. Bennett research award. Developmental traumatology. Part II: Brain development. Biological Psychiatry, 15, 1271-1284.

Fergusson, D.M., Horwood, L.J., & Ridder, E.M. (2005). Partner violence and mentaL health outcomes in a New Zealand birth cohort. Journal of Marriage & Family, 67, 1103-1119.

Glaser, D. (2000). Child abuse and neglect and the brain – a review. Journal of Child Psychology and Psychiatry, 41, 97-116. Gunnar, M.R. (1992). Reactivity in the hypothalamic-pituitary-adrenal system to stressors in normal infants and children. Pediatrics, 90, 491-497.

Gunnar, M.R. (1998). Quality of early care and buffering of neuroendocrine stress reactions: potential effects on the developing human brain. Preventive Medicine, 27, 208-211.

Hart, J., Gunnar, M., & Cicchetti, D. (1996). Altered neuroendocrine activity in maltreated children related to symptoms of depression. Development and Psychopathology, 81, 201-214.

Henry, J.P. (1993). Psychological and physiological responses to stress: the right hemisphere and the hypothalamo-pituitary-adrenal axis, an inquiry into problems of human bonding. Integrative Physiological

and Behavioral Science: the Official Journal of the Pavlovian Society, 28, 369-389.

Johnson, R.M., Kotch, J.B., Catellier, D.J., Winsor, J.R., Dufort, V., Hunter, W., & Amaya-Jackson, L. (2002). Adverse behavioral and emotional outcomes from child abuse and witnessed violence. Child Maltreatment, 7, 179-187.

Johnson, R., Browne, K., & Hamilton-Giachristis, C. (2006). Young children in institutional care at risk of harm. Trauma, Violence & Abuse, 7, 34-60.

Jones, N.A., Field, T., Davalos, M., & Pickens, J. (1997). EEG stability in infants/children of depressed mothers. Child Psychiatry and Human Development, 28, 59-70.

Koubovec, D., Geerts, L., Odendaal, H.J., Stein, D.J., & Vythilingum, B. (2005). Effects of psychological stress on fetal development and pregnancy outcome. Current Psychiatry Reports, 7, 274-280.

Jarvis, K., Gordon, E., & Novaco, R. (2005). Psychological distress of children and mothers in domestic violence emergency shelters. Journal of Family Violence, 20, 389-402.

Lewis, M. (1992). Individual differences in response to stress. Pediatrics, 90, 487-490. Lui, D., & Diorio, J. (1997). Maternal care, hippocampal glucocorticoid receptors, and hypothalamic-pituitary-adrenal responses to stress. Science, 277. Retrieved from EBSCOHOST January 23, 2006. Moffatt, G.K. (2002). Viewing domestic violence: a summary of research and what we know. Georgia Journal of Professional Counseling, 10, 7-24.

Matud, M.P. (2005). The psychological impact of domestic violence on Spanish women. Journal of Applied Social Psychology, 35, 2310-2322.

Nachmias, M., Gunner, M.R., Mangelsdorf, S., Parritz, R.H., & Buss, K. (1996). Behavioral inhibition and stress reactivity: the moderating role of attachment security. Child Development, 67, 508-522.

Perry, B.D. (1997). “Incubated in terror: neurodevelopmental factorsin the ‘cycle of violence.” In Children in a Violent Society, ed. Joy D. Osofsky. New York: Guilford Press, pp. 124-147.

Perry, B.D. (2002). Childhood experience and the expression of genetic potential: what childhood neglect tells us about nature and nurture. Brain & Mind, 3, 79-100.

Perry, B.D., Pollard, R.A., Blakley, T.L., Baker, W.L., & Vigilante, D. (1995). Childhood trauma, the neurobiology of adaptation, and “use-dependent” development of the brain: How “states” become “traits.” Infant Mental Health Journal, 16, 271-291.

Tajima, E. (2004). Correlatese of the co-occurance of wife abuse and child abuse among a representative sample. Journal of Family Violence, 19, 391-402. Van den Hove, D.L.A., Steinbusch, H.W.M., Scheepens, A., Van de Berg, W.D.J., Kooiman, L.A.M., Boosten, B.J.G., Prickaerts, J., & Blanco, C.E. (2006). Prenatal stress and neonatal rat brain development. Neuroscience, 137, 145-155. van der Kolk, B.A. (1994). The body keeps score: memory and the evolving psychobiology of post traumatic stress. Retrieved 2/1/2006, http://www.trauma-pages.com/vanderk4.htm

Wismer-Fries, A.B., Ziegler, T.E., Kurian, J.R., Jacoris, S., & Pollak, S.D. (2005). Early experience in humans is associated with changes in neuropeptides critical for regulating social behavior. Proceedings of the National Academy of Sciences of the United States of America, 102, 17237-17240.