Children and Youth Services Review 31 (2009) 831–839

Contents lists available at ScienceDirect

Children and Youth Services Review

journal homepage: www.elsevier.com/locate/childyouth

Developmental effects of exposure to Intimate Partner Violence in early childhood: A review of the literature

Georgia L. Carpenter, Ann M. Stacks *

Merrill-Palmer Skillman Institute, Wayne State University, United States

ARTICLE INFO

Article history:
Received 5 October 2008
Received in revised form 13 March 2009
Accepted 17 March 2009
Available online 25 March 2009

Keywords:
Intimate Partner Violence
Trauma
Infant
Development

ABSTRACT

Intimate Partner Violence (IPV) is a prevalent social problem in the United States and women of childbearing age are the most likely victims. The young children born to these women are impacted, however, women are not routinely asked about IPV even when there is evidence that their child has been abused. To highlight the importance of routinely screening for IPV in child welfare and other social service agencies this article reviews typical social-emotional development and physiological/neurological development in early childhood and the impact that IPV and trauma have on these domains of development. Early intervention with young children and caregivers living with IPV provides a significant buffer to the negative effects that witnessing IPV have on children's development and their relationships with caregivers.

1. Introduction

The Family Violence Prevention Fund (2008) defines Intimate Partner Violence (IPV) as physical, sexual or psychological harm by a current or former intimate partner or spouse; it includes a pattern of coercive or manipulative behaviors perpetrated by one intimate partner against the other in order to gain or maintain control in the relationship. These behaviors include psychological, verbal, financial, physical and/or sexual abuse concurrently or alone. Some examples of common tactics used by male or female intimate partners to control their partners include isolating their partners from friends or family, taking their partner's money and giving an "allowance" without consulting their partners, demeaning their partner in front of friends, or the threat of or actual physical or sexual assaults.

IPV is a prevalent social problem in the United States; approximately 44% of women experience domestic violence in their lifetime (Thompson et al., 2006). While the rates of IPV reported by women seem high, the actual numbers are most likely higher since the statistics are based on reported cases—which tend to be lower than the total number of victimizations (Rennison, 2003). Young women between the ages of 16 and 24 years appear to be at the greatest risk for experiencing IPV (Rennison, 2003; Thompson et al., 2006).

1.1. Risk factors for exposure to IPV

Research suggests that many young children are witnessing IPV (Borrego, Gutow, Reichert, & Barker, 2008; Gjelsvik, Verhoek-Oftedahl, & Pearlman, 2003; Rennison, 2003). For example, Rennison (2003) reported that almost half of all incidents of IPV occurred in homes with a child under the age of twelve, reflecting approximately 297,435 children in one year who were exposed to IPV. This estimate may be lower than the actual number of children who witness IPV. Straus (1979) believed that more than ten million children a year are exposed to domestic violence in the United States. Younger children are most likely to witness domestic violence and children under the age of 6 are at a higher risk than older children for exposure to IPV (Fantuzzo, Boruch, Beriama, & Atkins, 1997; Gjelsvik, Verhoek-Oftedahl, & Pearlman, 2003). If one considers that IPV often first occurs during pregnancy (Family Violence Prevention Fund, 2008) the number of children affected at a very young age is even larger. In addition to being more likely to witness IPV, children under the age of 3 years are also more likely than older children to experience abuse and neglect, which is also a risk factor for witnessing IPV (Moffitt & Caspi, 1998; Borrego, Gutow, Reichert, & Barker, 2008); Research by Edelson (1999) suggests that between 30% and 60% of families who are served by child welfare agencies also experience IPV.

1.2. Screening for IPV

In the United States, state child protection agencies define child exposure to IPV as a form of child abuse by commission or neglect by omission (De Bellis et al., 2002).Despite this and the large numbers of children exposed to IPV, less than half (43.1%) of child welfare agencies report that they assess 100% of all of the families who are referred to them and that most referrals take place at investigation. (Hazen et al., 2007). When IPV is discovered by child welfare agencies, services or referrals to address the violence are not always initiated. Bowker, Arbitell, and McFerron (1988) found that less than 10% of the time when IPV was occurring in a child welfare case, the caseworker

* Corresponding author.
E-mail address: amstacks@wayne.edu (A.M. Stacks).

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doi:10.1016/j.childyouth.2009.03.005

did the following: arranged for transportation to a safe place, referred children to services related to their witnessing of violent acts, provided written material on IPV or helped the victim obtain an order of protection.

There is a perception that infants and young children are not as affected by witnessing IPV as older children. However, evidence suggests that young infants can be affected more intensely by exposure to this trauma than previously believed (Cassidy & Mohr, 2001; Cook et al., 2005; De Bellis, Hooper, & Sapia, 2005; Edelson, 1999; Gaensbauer, 2004; Groves, 1999; Kaufman & Henrich, 2000; Koenen, Moffitt, Caspi, Taylor, & Purcell, 2003; Lehmann, 1997; Levendosky, Huth-Bocks, Semel, & Shapiro, 2002; Lieberman & Van Horn, 2004; Nelson & Carver, 1998; Osofsky, 2004; Pepler, Catallo, & Moore, 2000; Perry, 2001; Schore, 2002; Zeanah et al., 1999; Ziegler, 2002). Developmental models suggest that early experiences are important because they lay the foundation for later development (Sroufe & Rutter, 1984). Witnessing IPV between caregivers is a particular type of trauma for a child that may have devastating effects on development and can be a threat to infants and young children's sense of security and wellbeing, which influences all domains of development (Pepler, Catallo, & Moore, 2000).

Infants and young children who are living in violent homes witness a variety of abusive behaviors perpetrated against one caregiver by the other. These behaviors include emotional abuse, stalking, threats against their caregivers, threats to commit suicide, threats to take them away from their caregivers, violent sexual acts, physical assaults, and murder. Children and others are exposed to IPV in a variety of ways: by visually or audibly witnessing the violence, seeing the effects on the victim (bruises and wounds) or on the home (disarray, holes in the walls and doors) and having contact with child protective service workers, law enforcement, or hospital personnel; they can also be impacted by the way in which IPV effects their parent's mental health, level of stress, and trauma, which in turn may affect parenting behaviors.

In order to help children in the child protection system and children served by other programs/agencies, one must understand the consequences that exposure to IPV has on infants and young children. Although there are studies that address how IPV, in particular, influences development, much of what we know comes from research with rodents, non-human primates and older children as well as research on the effects of stress and trauma on early development; witnessing IPV is stressful and traumatic (Graham-Bermann & Levendosky, 1998; Scheeringa & Zeanah, 1995). Because development progresses rapidly it is important to understand typical social-emotional and physiological/neurological development. This will provide an understanding of typical child development for which one can use to compare the development of children who are exposed or witness IPV between their caregivers and begin to explore ways to provide services to this large population of children and families.

2. Typical development in infancy

2.1. Emotional development

Emotional development begins at birth and includes an infant's ability to express emotions, accurately interpret the emotions of others, regulate his or her emotions, and develop an attachment to an important caregiver. Most of the research on the effects of trauma and specifically witnessing IPV on early emotional development has focused on the effects on attachment and emotion regulation. As a result, this review will only include these aspects of emotional development.

Attachment. Attachment theorists maintain that humans are biologically predisposed to form attachments to caregivers (Bowlby, 1982; Sroufe, 2000), which results in the young child seeking out the caregiver when he or she is frightened, hurt, or sick (Bowlby, 1982; Dozier, Higley, Albus, & Nutter, 2002). Almost all infants will form an attachment with one or a small number of caregivers by 10 to 12 months of age (Sroufe, 2000). Ainsworth, Blehar, Waters, and Wall (1978) suggest that the way in which mothers respond to their infants is associated with the quality of the attachment relationship with three patterns of attachment relationships: secure, which is considered the most optimal, and two less optimal insecure patterns of attachment, insecure-avoidant, and insecure-ambivalent or resistant. Main and Solomon (1990) discovered a 4th pattern of attachment in infants, called disorganized/disoriented.

A large body of research has attempted to replicate Ainsworth's findings with regard to maternal sensitivity and to examine the association among maternal behavior, a mothers own representation of attachment, and infant attachment classifications. Two meta-analyses provide evidence for the relationships among maternal representations, maternal behavior, maternal sensitivity and infant attachment. In a meta-analysis of 14 studies that assessed the concordance between maternal representations of attachment and infant attachment security, van IJzendoorn (1995) found that there was a strong effect size for the relationships between maternal representations of attachment and infant attachment and that there was concordance among approximately 75% of parents and infants. This study also suggested a strong relationship between parent representations and parent behavior. Another analysis conducted by De Wolff and van IJzendoorn (1997) suggested that there was a moderately strong association between maternal sensitive behavior and infant attachment security.

A secure attachment relationship in infancy is associated with optimal infant development and prosocial outcomes, including higher levels of social competence, more advanced emotional understanding, higher cognitive and language skills, and less dependence on adults (Belsky & Fearon, 2002; Bohlin, Hagekull, & Rydell, 2000; Weinfeld, Sroufe, Egeland, & Carlson, 1999). Research suggests that infants who have formed a secure attachment with caregivers have most likely experienced sensitive and responsive caregiving when they were distressed (Belsky, Rovine, & Taylor, 1984; De Wolff & van IJzendoorn, 1997). Infants and children who are classified as having an insecure attachment relationship are typically at higher risk than secure children for less optimal outcomes; two patterns of insecure attachment, insecure avoidant and insecure ambivalent/resistant may develop when caregivers consistently ignore or reject infants' needs for comfort or exhibit inconsistent sensitivity and responsiveness (Ainsworth et al., 1978). While insecure children are considered to be at higher risk than secure children for non-optimal outcomes, some argue that these children are not the most likely to exhibit clinically significant social, behavioral and academic outcomes because they have a strategy for regulating their emotions and excluding painful attachment information (Main & Solomon, 1990).

A fourth pattern of attachment, disorganized/disoriented, was first identified by Main and Solomon (1990) when researchers conducting studies with high-risk populations were having difficulty classifying children into one of the original three patterns of attachment. Infants and very young children classified as disorganized exhibit fear, contradictory behavior, and or disorientation when they needed comfort from a parent. These behaviors, according to theory, are reflective of the child's fear or confusion about how to access their caregiver when they are under stress (Solomon & George, 1999; Teti, 1999). Research suggests that infants who are classified as disorganized are at the most risk for later behavioral problems, including clinical levels of externalizing and/or aggressive symptoms, and hostility in the classroom (Dozier, Stovall, Albus, & Bates, 2001; Lyons-Ruth, Alpern, & Repacholi, 1993; Moss et al., 2006; Solomon, George, & De Jong, 1995). Disorganized attachment has been associated with disrupted maternal affective communication, and parenting behaviors that are frightened, frightening, and helpless; these behaviors put the infant in a situation where the person on whom they should rely on for protection is a person who does not protect them (Lyons-Ruth,

Bronfman, & Atwood, 1999; Main & Hesse, 1990; Schuengel, Bakermans-Kraneburg, & van IJzendoorn, 1999).

A great deal of research has documented the protective effects of a secure attachment relationship in infancy. For example, infants who have consistently experienced sensitive maternal interactions and who have a developed a secure attachment style with their caregiver have fewer behavior problems and higher levels of social competence, language skills, and school readiness at age 3 than children who have consistent histories of insecure attachment styles and insensitive parenting (Belsky & Fearon, 2002). Security in infancy is associated with indicators of school readiness including the ability to attend to and explore the environment, as opposed to monitoring the caregiver (Cassidy, 1986; Hazen & Durrett, 1982). Babies who are securely attached to their caregivers are better able to soothe themselves in times of stress perhaps because of the increased connections made in the brain that decrease the amount of cortisol released during times of stress (Southwick, Rasmusson, Barron, & Arnsten, 2005). In contrast to the benefits associated with a secure pattern of attachment, an insecure pattern of attachment is associated with a need to monitor caregivers, resulting in decreased exploration which further impacts cognitive and meta-cognitive functioning associated with school readiness (Moss, Parent, Gosselin, & Dumont, 1993; Moss, Gosselin, Parent, Roussear, & Dumont, 1997). Moreover, children with insecure and disorganized attachment styles are at an increased risk for behavior problems (Dozier et al., 2001; Hubbs-Tait, Osofsky, Hann, & Culp, 1994; Lyons-Ruth et al., 1993; Solomon et al., 1995).

Cook and colleagues (2005) and Schore (2002) have begun making connections between patterns of attachment, physiological psychology, and emotional regulation; their investigations have provided insight on the interplay between these domains. For example, babies with secure attachment styles may have stronger connections between the areas in the brain due to consistent care and protection by caregivers (Cook et al., 2005; Schore, 2002). Schore's research (2002) on attachment and the regulation of brain activity provides strong evidence that a disorganized attachment style in babies is associated with problems in attention, regulation of emotions, the development of a positive and strong sense of self, and relationships with others throughout life. A baby who has established a secure attachment pattern with his/her caregiver will not have to focus so much energy on the attachment relationship as a baby who is classified as using an insecure or disorganized attachment style; the infant using a secure attachment style will learn through interactions with caregivers, that affect brain responses, how to regulate his arousal states.

Emotional Regulation. Emotional regulation is the learned ability to adapt and manage feeling states and physical arousal levels in response to stimuli (Cole, Martin, & Dennis, 2004). Emotional regulation can be seen as a way to maintain homeostasis of the biological and behavioral responses to emotions. Until an infant learns how to regulate his emotional arousal, he depends on caregivers to externally regulate his emotions so he is not overwhelmed (Schuder & Lyons-Ruth, 2004). Nelson and Bosquet (2004) propose that because the frontal lobe in the brain undergoes rapid development between the ages of 6- to 18-months and is highly involved in emotional regulation, these twelve months could be a vulnerable time for the infant to learn how to recognize and respond to emotions. At this time, infants are also very vulnerable if exposed to maternal depression because the mother's lack of positive affect and response to her infant influences the neurological foundation of the development of emotion regulation (Nelson & Bosquet, 2004). To illustrate, when a baby becomes upset and begins to cry, the caregiver will provide or not provide comfort and protection. The caregiver's lack of response to the baby can result in an inability to regulate the release of stress hormones in the brain, which further exacerbates the baby's physiological distress. When the caregiver responds to his or her needs, the baby's brain reacts by adjusting the levels of stress hormones, which in turn helps the baby learn how to self-soothe and adjust his or her emotional arousal level (Goldberg, 2000). When an infant is upset and is comforted by his/her caregiver, in addition to the neurological response in the brain, the infant is learning that when he is comforted, he is able to calm himself down and feel safe. He will soon learn ways to comfort himself and control his responses to stimulation; however, experiences with caregivers will affect the infant's ability to self-regulate (Goldberg, 2000).

A child who has begun to learn how to regulate his/her emotions might withdraw from stimulation to be able to bring his level of arousal back to a tolerable one or approach the stimulation if he/she wants to engage (Goldberg, 2000). When the preschool-aged child who is able to self-regulate begins to interact with other children, he will use those skills to interact with other children while learning how to share, take turns, and deal with difficult emotions such as anger and jealousy (Goldberg, 2000). A child who has difficulty with emotional regulation might have trouble focusing attention on tasks or making friends. Because the child might have difficulty excelling in school, he could be diagnosed with a learning disability or an attention disorder (Cook et al., 2005; Perry, 2001). Research has shown that labels placed on children have an influence on how they see themselves and how others see them as either competent or incompetent people (Thompson, 1999).

2.2. Overview of early brain development

Each area of the brain is made up of neurons, cells in the nervous system that develop very quickly in the first few weeks of gestation and move to their assigned position during the prenatal period and early in postnatal life. At birth infants have far more neurons than they need and neurons that are not used will be lost. In order for a neuron to survive, it needs to be stimulated by chemicals in the brain called neurotransmitters that are released in response to environmental and internal stimuli. Neurons communicate with each other by an exchange of neurotransmitters that travel from one neuron to the next and attach to specific receptors in the neuron. The more a neuron is stimulated by another neuron, the stronger the synapse (the space or connection between two neurons) becomes in both numbers and connections between neurons, resulting in more development in that area of the brain (Carlson, 2005). Conversely, if synapses between neurons are not used at all or infrequently, the neurons may eventually die. The more synapses present, the more neurons can develop, generating more activity in that part of the brain (Carlson, 2005).

When an infant is born, his/her brain is still developing. The brain begins to develop in the prenatal period from lower brain centers to higher brain centers and continues to develop throughout the lifespan (Nelson & Bloom, 1997). The areas of the brain from lower to higher centers are the spinal cord, brainstem (sometimes called the reptilian brain), diencephalon, limbic system, and the neocortex. All of the centers of the brain are developing at the same time yet at different rates; the development of each area of the brain is dependent on the development of another area (Carlson, 2005; Hetherington & Parke, 2003; Perry, 2001; Ziegler, 2002). For example, the completion of the development of the brainstem, which controls breathing, heart rate, blood pressure, and the regulation of body temperature, is necessary so that development in other areas of the brain occurs (Carlson, 2005).

Each area of the brain has a specific function; as discussed above, the brainstem controls the core functions of breathing, heart rate, blood pressure, and regulation of body temperature. If an infant is born prematurely, the brainstem may not have developed completely, and as a result, he might experience problems with the regulation of body temperature, breathing, heart rate, and blood pressure. The diencephalon, the area of the brain that includes the thalamus and the hypothalamus, controls motor movement and regulation, arousal, hunger and satiation, and the regulation of sleep (Carlson, 2005). The limbic system develops next and includes the basal ganglia, hippocampus, amygdala, and the cingulate cortex; these areas of the brain play major roles in the regulation of emotion and behavior,

memory, reproductive and sexual behavior, and the control of autonomic functions of the body. Another role thought to be controlled by this area is the ability to form emotional attachments to others (Carlson, 2005; Hetherington & Parke, 2003; Perry, 2001; Shore, 1997; Schore, 2002; Ziegler, 2002). The last area of the brain to complete development, the neocortex, is the most intricate (Carlson, 2005). The neocortex is referred to as the area of the brain that makes us human; it controls the motivation and reward centers, personality traits, abstract and concrete thinking, decision-making, learning and reasoning, as well as aspects of emotional regulation such as delaying gratification and developing empathy for others (Carlson, 2005; Hetherington & Parke, 2003; Perry, 2001; Schore, 2002; Ziegler, 2002). The limbic system and the neocortex are the areas of the brain that primarily influence the interactions with a baby's caregivers, and ultimately, the baby's social and emotional development.

The brain is divided into right and left hemispheres; most of the information that is relayed from one side of the brain to the other is facilitated by the corpus collosum (Carlson, 2005; Cook et al., 2005). The right side of the brain is able to interpret vision from the left field of vision, but the area of the brain that controls speech is on the left side of the brain. The right side of the brain develops first, which is why early infant memories cannot be described using language (Schore, 2001).

The sequence of brain development is the same for all humans; however, experiences and the environment can influence how areas of the brain develop. There are two ways that the environment impacts the development of the brain. The first, is called experience-expectant brain development, which means that there is a predetermined set of experiences required for the brain to develop properly and are likely the result of an evolutionary process that are species specific; synapses are wired and "expecting" certain interactions required for their survival (Greenough & Black, 1992). Humans require interaction with a variety of stimuli, for example different sights, sounds, smells and nurturing, predictable care (Perry & Pollard, 1997). Without these environmental inputs, for example in the case of neglect, there may be changes in the brain that result in cognitive deficits, visual impairment, or language difficulties. The second way in which the environment influences the brain is called experience-dependant development, which describes how new synapses are formed or changed by individual experience. For example, research with rats suggests that stress caused by restraint causes changes in the dendrites in the hippocampus and structural changes in the prefrontal cortex and amygdala (Sousa, Lukoyanov, Madeira, Almedia, & Paula-Barbosa, 2000).

Providing care to human infants also shapes the brain; when an infant is uncomfortable or distressed; the distress will signal specific areas of the brain to release the neurotransmitters epinephrine and norepinephrine along with stress hormones such as cortisol and norepinephrine (norepinephrine is both a neurotransmitter and a hormone) (Bevans, Cerbone, & Overstreet, 2005; Carlson, 2005; De Bellis & Thomas, 2003; Southwick et al., 2005). The infant will become progressively more upset until provided with comfort and care. The caregiver's care signals areas of the brain to secrete serotonin and other neurotransmitters and hormones that help to regulate the infant's emotional state (Carlson, 2005; Lieberman & Van Horn, 2008; Perry, 2001; Southwick et al., 2005). If the infant experiences a caregiver who consistently responds to his distress, his brain will become adept at responding in healthy ways to stressful situations. Implications for human infants who experience stress will be described in the section on stress, trauma and brain development.

The brain's amazing capacity to respond and adapt to the environment is called plasticity. The brain is the most plastic during a baby's first years and aids in neuronal death, synaptic pruning and synaptogenesis (Schore, 2001; Shore, 1997). Because of these processes, the size and levels of functions of a brain can be influenced by a person's experiences. To illustrate, Perry & Pollard (1997) found that the size of the brain of a severely neglected three-year-old child was significantly smaller than the brain of a non-neglected child the same age. They proposed that the experience of the severe neglect accounted for the smaller area in the neocortex (Perry & Pollard, 1997). Experiences in the first few years of life greatly influence brain development and the most influential ways a child's brain develops is through his or her relationships with caregivers (Cook et al., 2005; Goldberg, 2000; Schore, 2002). These experiences with caregivers and other aspects of the baby's environment, for example violence in the home, play an important role in social and emotional development and are imperative to investigate when working with infants and caregivers.

3. How exposure to Intimate Partner Violence influences early development

Exposure to IPV can have negative implications for the emotional and neurological development of infants and young children, who rely on caregivers to respond in a predictable sensitive way to their needs and to provide a safe and predictable environment in which they can explore. These predictable environments where infants learn that they are safe and that their caregiver can be counted on to soothe them provide the foundation for regulation at the biological and behavioral level. While there is as growing body of research on how exposure to IPV can negatively impact the emotional well-being of very young children, less is known about how witnessing IPV shapes the developing brain. However research with rodents and primates as well as existing research with young children who have experienced stress or maltreatment or have been traumatized by community violence, accidents or natural disasters can provide the foundation for what we know about the way in which witnessing IPV influences development. Based on this research it is likely that exposure to IPV can impact a very young child's neurological development in detrimental ways that in turn can impact other domains of development, including emotional development.

3.1. Exposure to IPV, attachment, and emotion regulation

Predictable, sensitive and responsive caregiving during times of stress is crucial for optimal emotional development. Infants who hear or see unresolved angry conflict or witness a parent being hurt may show symptoms of Posttraumatic Stress Disorder (PTSD), including eating problems, sleep disturbances, lack of typical responses to adults and loss of previously acquired developmental skills (Bogat, DeJonghe, Levendosky, Davidson, & von Eye, 2006; De Bellis & Thomas, 2003; Scheeringa & Zeanah, 1995; Schore, 2001). For example infants may refuse to eat or may have trouble keeping their food down; they may have extreme difficulty falling asleep or may wake frequently at night; or they may be difficult for adults to soothe or may respond with heightened irritability, fearful expressions, crying or blank expressions under circumstances that do not normally produce these effects (i.e. face to face play or efforts to comfort). Zero to Three has developed the *Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood Revised Edition* (DC:0-3R, 2005), that outlines criteria for PTSD in infancy and early childhood. These criteria include re-experiencing the traumatic event which might be evidenced by distress at reminders of the event, dissociation, or post-traumatic play; numbing of responsiveness, which may include social withdrawal or a restricted range of affect; and increased arousal, evidenced by hypervigilance, exaggerated startle response and sleep difficulties. In a study with children under the age of 4-years who experience a variety of trauma, Scheeringa and Zeanah (1995) suggest that threat to a caregiver could be one of the most psychologically destructive traumas for young children. Schore (2001), in his comprehensive research on right brain development and relational trauma, also

suggests that chronic and cumulative emotional abuse by an attachment figure is the underlying foundation of childhood trauma.

Not all infants and young children exposed to IPV will exhibit trauma symptoms or PTSD. Research suggests that there is substantial variability in the emotional outcomes of children exposed to IPV. An explanation for the range of observed outcomes includes the degree to which IPV impacts the parenting relationship. A large body of literature on non-maltreating families suggests that parenting, including maternal sensitivity, mental health, and stress impact infant and young children's attachment and behavior (Beardslee, Versagem, & Gladstine, 1998; De Wolff & van IJzendoorn, 1997; McKelvey, Fitzgerald, Schiffman, & von Eye, 2002; Pilowsky et al., 2006). Findings from studies that include women who have experienced IPV reflect the literature above. For example, Graham-Bermann & Levendosky, (1998) found a significant relationship between experiencing IPV and parenting stress, which was further related to parenting and child outcomes. In this study women who were experiencing more severe violence reported increased stress, which impacted internalizing and externalizing behavior in their school-aged children beyond the effects of the violence alone (Graham-Bermann & Levendosky, 1998). Huth-Bocks & Hughes (2008) also found that there was an interrelationship between parenting stress and ineffective parenting, however contrary to the findings of others, this study did not find that severity of IPV was associated with parenting stress. Other research suggests that mental health problems, for instance depression and anxiety, are associated with experiences of IPV (Bogat, Levendosky, Theran, von Eye, & Davidson, 2003; Levendosky, Leahy, Bogat, Davidson, & von Eye, 2006). While Bogat and colleagues (2003) did not find a significant relationship between maternal mental health and parenting, they did find that maternal mental health was directly related to infant externalizing behavior. In addition, findings suggest that the experience of IPV in the first year postpartum negatively impacts parenting behavior, including warmth and sensitivity, which supports earlier work with elementary school children (Levendosky & Graham-Bermann, 2000).

While the evidence that IPV negatively impacts children, in part because of the impact that it has on maternal stress, mental health, and parenting, is limited, especially with parent-infant dyads, there is a growing body of literature that suggests that witnessing IPV directly impacts infant and toddler emotional/behavioral outcomes. The relationship between maltreatment and infant attachment, behavior and capacity for emotion regulation is well documented (Barnett, Ganiban, & Cicchetti, 1999; Carlson, Cicchetti, Barnett & Braunwald, 1989; Herrenkohl & Russo, 2001). Witnessing IPV can be considered a form of child maltreatment, yet there has been less research on emotional and behavioral outcomes with infants and toddlers whose mothers experience violence. The research that does exist suggests that IPV is associated with infant attachment (Zeanah et al., 1999). In this study, 61.5% of the infants in the sample were classified as insecurely attached, most of whom were classified as having a disorganized attachment. Just over one-third of the infants in this study were classified as secure; those who were classified as having a secure attachment had mothers who reported less serious violence or whose mothers reported violence with a former partner.

The attachment relationship between an infant and his caregiver is vital for providing protection and emotional regulation for the infant during times of stress and trauma. As we have discussed, during times of stress, an infant will seek the protection and proximity of his caregiver by using the strategies that will maximize the chances that his caregiver will provide care and protection. In the event of IPV, however, the caregiver may be unavailable to offer protection and safety to the infant. If the caregiver is the source of the trauma, the infant or young child is presented with a dilemma: if the infant does not cry out, he will not be comforted by his caregiver; if the infant cries out for the attention of the caregiver and the caregiver responds, the infant might be presented with a caregiver who is herself emotionally dysregulated and as a result cannot help the infant regulate his emotions or responds in a way that is frightening to the infant which may further traumatize or dysregulate the infant or young child (Main & Hesse, 1990). As a result these infants may not be able to manage the overwhelming stress they experience (Cassidy & Mohr, 2001; Schore, 2002).

Emotional Regulation. An infant's ability to self-regulate, or manage emotions during times of stress, anger, or trauma can be severely compromised if a caregiver is not present to provide protection and care (Kaufman & Henrich, 2000). Hyperarousal symptoms that reflect the disruption of emotional regulation include frequent temper tantrums, crying that will not be calmed by attempts to comfort, intense anger reactions and heightened sensitivity to environmental cues that are related to the trauma, for example, an angry facial expression or tone of voice in infants and toddlers who witness IPV (Kaufman & Henrich, 2000). When exposed to simulated adult conflict, infants under 1-year of age whose mothers reported experiencing IPV displayed more facial expressions of distress than infants whose mothers reported that they had not experienced IPV, suggesting that these infants may have a heightened sensitivity to adult verbal conflict (DeJonghe, Bogat, Levendosky, von Eye, & Davidson, 2005) and perhaps a reduced ability to regulate emotions (Davies & Cummings, 1994). This finding supports the findings with samples of older physically abused children, which suggest that maltreated children are hypervigilant to environmental indications of threat (Pollak, Cicchetti, Hornung, & Reed, 2000) and have more problems with emotion regulation (Maughan & Cicchetti, 2002; Shields & Cicchetti, 1998). Problems with emotion regulation are correlated with lower levels of social competence, difficulties with peer relationships, aggressiveness, and disruptive behavior in elementary school children who have been maltreated (Shields, Cicchetti, & Ryan, 1994; Shields, Ryan, & Cicchetti, 2001; Teisl & Cicchetti, 2008). Indeed, studies of infants and toddlers who witness adult verbal conflict violence against a family member, and whose mothers experienced IPV during pregnancy show increased externalizing behavior and that more severe violence has a greater negative impact on child adjustment difficulties (Levendosky et al., 2006; McDonald, Jouriles, Rosenfield, Briggs-Gowan, & Carter, 2007).

3.2. The effect of stress and trauma on the development of the brain

While the research on the impact of witnessing IPV in infancy is limited, there is no research on the way in which witnessing IPV in infancy influences the developing human brain. It has been suggested, however that a threat to a caregiver is traumatic for infants and toddlers and may lead to PTSD (Scheeringa & Zeanah, 1995) and that caregivers who experience IPV also experience more stress (Graham-Bermann & Levendosky, 1998). While still in the early stages, research on the ways in which stress, trauma, and maltreatment impact the developing brain may help one understand the ways in which witnessing IPV as an infant may influence the developing brain.

Stress Response System. A healthy brain responds to stress by secreting stress hormones like cortisol to activate behaviors that protect the individual from threat as well as inhibiting the release of the hormones and deactivating the behaviors when the threat is gone (Kowalik, 2004). The catecholamine system/sympathetic nervous system (SNS) and the hypothalamic-pituitary-adrenal (HPA) axis, are the body's major stress systems (Bevans et al., 2005; De Bellis, Baum, et al., 1999; De Bellis, Keshavan, et al., 1999; Schore, 2002); the serotonin and dopamine systems are also involved in ways that regulate emotions. The catecholamine/SNS system and HPA axis work together to prepare the body for fight or flight from the stressor and help the body to recover after a stressful event. The catecholamine system (also called the locus coeruleus-norepinephrine [NE]/SNS]) is located in the brainstem and begins to develop very early in life. This system is stimulated by the release of corticotropin-releasing hormone (CRH) by the hypothalamus which in turn causes norepinephrine to be

released by the locus coeruleus and adrenaline and noradrenaline by the adrenal gland. These hormones affect the body by increasing blood pressure, heart rate and perspiration. The HPA axis works with the catecholamine system, and creates a physiological pathway that connects the brain to the adrenal cortex and is designed to mediate the fight–flight response. Like the catecholamine system, the stress response in the HPA axis begins when the hypothalamus produces and secretes CRH. CRH then stimulates the anterior pituitary gland to release adrenocorticotrophic hormone (ACTH) which in turn stimulates the production of glucocorticoids (Chrousos & Gold, 1992). Cortisol, a glucocorticoid, is a potent stress hormone in the body (Carlson, 2005; De Bellis et al., 1999; Kaufman & Henrich, 2000); cortisol affects the tissue and almost every organ in the body. For example, it suppresses the immune response, increases the level of glucose circulating in the body, and reduces fear responses to the stressor. The HPA axis follows a circadian rhythm; in humans, cortisol is high in the early morning, declines throughout the day and may peak after acute stress. Elevated cortisol at the end of the day, when cortisol should be at a low point, may be related to dysregulation of the HPA axis (Gunnar & Vasquez, 2001) Within seconds of the body sensing a stressor the sympathetic nervous system releases epinephrine and norepinephrine, which react immediately by secreting cortisol which can take several hours to take effect. Activity of these systems is essential for normal brain growth and survival when faced with acute stress.

Effects of Chronic Stress on the Brain. Most research on how violence and trauma can impact the human brain focuses on stress response in the HPA axis and the effects of cortisol. An increase in cortisol in response to stress is adaptive and important for survival because it aids in increases of energy and focused attention, while postponing processes that are less important for immediate survival like immune response, growth, reproduction, digestion and tissue repair (Johnson, Karmilaris, Chrousos, & Gold, 1992). However, chronic exposure to stress and atypically high or low levels of cortisol are associated with significant health problems and neurological damage (Flinn & England, 2003). Much of what we know about the effects of stress on the developing brain is the result of studies with rodents and non-human primates, which suggest that early adverse care may have the greatest impact on systems that are still developing.

Cortisol receptors exist in many areas of the brain including the hippocampus, the amygdala, and frontal brain regions. The hippocampus is perhaps the most sensitive and malleable regions of the brain and is responsible for memory. Rat pups who are exposed to chronic restraint stress for 21 days exhibited changes in the dendrites and synapses in the hippocampus that resulted in memory impairment (Sousa et al., 2000). Research with non-human primates also suggests that there are neuronal changes in the hippocampus as a result of sustained high levels of cortisol (Sapolsky, Uno, Rebert, & Finch, 1990). Some of what is known about how stress impacts the human brain comes from research with individuals suffering from PTSD and chronic depression, which may be precipitated by life stress and are associated with elevated cortisol. These studies indicate that in patients suffering from PTSD and chronic depression, there is decreased volume of the hippocampus (Bremmer, 2002; Sheline, Gado, & Kraemer, 2003).

High levels of stress can influence an unborn child before birth. IPV often begins or worsens during pregnancy (Family Violence Prevention Fund, 2008), when the brain is developing. Infants and young children exposed to IPV between their caregivers may have experienced the exposure since the time they were in utero, which may make them more vulnerable to later stress. During pregnancy, the HPA axis reacts to higher maternal stress by elevating the maternal levels of CRH that enter the fetus's brain via the placenta or the umbilical veins (Sandman, Wadhwa, Chicz-DeMet, Porto, & Garite, 1999).The placenta stimulates the production of cortisol by the seventh week of gestation; these amounts are approximately 10% of the maternal amounts of cortisol (Sandman et al., 1999). Animal studies suggest that an increase in cortisol during pregnancy may be associated with low birth weights and increased stress hormone levels in offspring and an alteration of the HPA axis in offspring if the stress is chronic and during a certain period of gestation (Seckl & Meaney, 2004; Weinstock, 2008).

Findings from human studies suggest that maternal anxiety during the earlier part of the prenatal period is associated with lower birth weight, shorter gestational age and smaller infant head circumference at birth, indicating a decrease in brain growth due to high levels of prenatal maternal stress (Lou, Hansen, Nordentoft, Pryds, Jensen, Nim, et al., 1994). In a longitudinal study with 7448 women, O'Connor, Heron, Golding, Beveridge, and Glover (2002) found a strong relationship between prenatal anxiety in late pregnancy and hyperactivity, inattention, behavioral, and emotional problems in the children at 4 years of age. Prospective studies suggest that maternal reports of anxiety during pregnancy are correlated with disruption of the diurnal pattern of cortisol in middle childhood and adolescence (O'Connor et al., 2005; Van den bergh, Van Calster, Smits, Van Huffel, & Lagae, 2008). Overall, the research on the detrimental effects of maternal stress on fetuses and newborns is abundant enough to warrant more attention by professionals who encounter pregnant women who might be under a great deal of stress due to IPV that tends to begin or intensify during pregnancy.

Child Maltreatment and Brain Development. Almost no research is available about the effects of witnessing IPV on brain development; however, findings from research which highlights the relationship between marital discord and child maltreatment and the stress response system and changes to brain regions may help one understand the ways in which witnessing IPV impacts neurological development. Research with infants, preschoolers, and school-aged children who are in foster care suggests that exposure to early adversity impacts the diurnal pattern of cortisol. Several studies have found that foster children have a blunted diurnal HPA axis activity, which means that they have low levels of cortisol in the morning and low levels that continue throughout the day or atypically high morning cortisol levels (Bruce, Fisher, Pears, & Levine, 2009; Dozier et al., 2006; Gunnar & Vazquez, 2001; Linares et al., 2008). Although different from witnessing IPV, research on marital discord suggests that young children and adolescents in families characterized as having low levels of marital discord have significantly lower average wake up and bedtime cortisol levels and a clearer diurnal pattern of cortisol than children whose parents have a highly conflictual marriage (Pendry & Adam, 2007).

Infants and young children exposed to chronic stress or traumas may have increased levels of the stress hormones cortisol, epinephrine and norepinephrine; chronic high levels of these hormones can have negative effects on emotional regulation, cognitive development, and brain development (De Bellis et al., 2005, De Bellis, Baum, et al., 1999; De Bellis, Keshavan, et al., 1999; Schore, 2001; van der Kolk, 1994; Ziegler, 2002).

The areas of the brain where many glucocorticoid receptors exist are in the limbic system and the frontal regions of the brain. The limbic system is involved in the regulation of emotion and behavior, effortful attention and inhibitory control, fear and stress reactions, memory, and learning (De Bellis, Baum, et al., 1999; Shore, 1997; van der Kolk, 1994). Researchers believe that the frontal regions control attentional abilities (Carlson, 2005; De Bellis, Baum, et al., 1999; De Bellis, Keshavan, et al., 1999; van der Kolk, 1994).The frontal regions of the brain include the frontal lobe (Broca's area), and the temporal lobe (Wernicke's area); Broca's and Wernicke's areas are responsible for the expression and learning of language (Carlson, 2005).

Chronic high levels of stress hormones are suspected to cause damage to these areas, which can result in behaviors such as problems in memory, learning, thinking, emotional regulation, expression and interpretation of emotions (Bevans et al., 2005; De Bellis et al., 2005; De Bellis, Baum, et al., 1999; De Bellis, Keshavan, et al., 1999; Kowalik, 2004; Schore, 2002; van der Kolk, 1994; Ziegler, 2002).

During development, the brain is at risk for the detrimental effects of stress and trauma that can result in neuronal death and lower levels of cognitive development (Bevans et al., 2005; Cook et al., 2005; De Bellis et al., 2005; De Bellis, Baum, et al., 1999; De Bellis, Keshavan, et al., 1999; Koenen et al., 2003; Nelson & Carver, 1998; Perry & Pollard, 1997; Schore, 2002; Ziegler, 2002) as well as possible delays in expressive and receptive language (Cook et al., 2005). It is important to note that some infants who have been exposed to IPV or other traumas continue to develop in appropriate and healthy ways. However, many infants who are exposed to trauma on a regular basis like ongoing IPV have responded neurologically by being hyperaroused—a chronic state of elevated alertness—or hypoaroused or dissociation—in a state of chronic disconnection from the immediate environment (Cook et al., 2005; Perry, 2001; Schore, 2002). According to Perry (2001) infants respond to stress and trauma more often by using the hypoarousal style while older children respond more with the hyperarousal style.

Factors that influence neurological responses to trauma. According to the National Scientific Council on the Developing Child (2005), the degree to which stressful events are harmful depends upon the following three things: 1) the amount and duration of the stress response, 2) whether the experience is controllable and how often the stress response system has been activated in the past, and 3) whether the child has a relationship with an adult that is safe and dependable. Early stressful experiences shape the stress response system's ability to be activated and deactivated. Exposure to IPV is a significant stressor that can result in varied consequences on the brain. Because the caregivers play critical role in helping infants regulate their emotions and stress response systems, sensitive and responsive care during infancy can buffer the effects of stress. Research suggests that non-abused infants who have a secure attachment have an appropriate hormonal response to stress and recover from stress more quickly than their disorganized counterparts who have higher levels of stress hormones after a frightening event (Gunnar & Donzella, 2002). Similarly, parental responsiveness and sensitivity is associated with infant physiological recovery after a stressful event while intrusive and insensitive parenting has been associated with higher stress system reactivity (Albers, Riksen-Walraven, Sweep, & de Weerth, 2008; Haley & Stansbury, 2003; Spangler, Schieche, Ilg, Maier, & Ackernam, 1994). As noted above, children who have experienced maltreatment exhibit atypical patterns of cortisol activity. Several studies suggest that intervention with caregivers that reduce their stress and increase their sensitivity toward the child is effective at returning children's cortisol activities to a typical diurnal pattern (Dozier et al., 2006; Fisher, Stoolmiller, Gunnar, & Burraston, 2007; Fisher & Stoolmiller, 2008).

In a study with Romanian orphans who had experienced global neglect (neglect in more than one developmental domain) Eluvathingal, Chugani, Behen, Juhasz, Muzik, Maqbool, Chugani, Makki and colleagues (2006) described the structural changes found in areas of the orphans' brains that persisted after adoption but noted that the caregiving environment and an enriched environment play important roles in reversing these effects. In a related study, Marshall, Reeb, Fox, Nelson, and Zeanah (2008) collected and analyzed data from electroencephalograms (EEG) from a small sample of orphans aged 6 to 32 months old living in institutions in Bucharest; they wanted to measure the effects of early intervention in the form of placement in foster homes at younger versus older ages. They found no clear indication that earlier placement into foster homes had a restorative effect for the orphans but noted that had they included more children in the study who had been placed into foster care at earlier ages, a correlation would likely have been found (Marshall et al., 2008).

4. Discussion and implications for practice

Estimates of young children exposed to IPV each year vary from the thousands to the millions (Rennison, 2003; Straus, 1979; Thompson et al, 2006). The effects that the trauma of exposure to IPV can have on children's physiological, emotional, and language-cognitive development are pervasive and complicated. Contrary to previous beliefs that exposure to or witnessing IPV has little effect on young children, we now know that such exposure can have negative influences on all levels of development and children's sense of safety (Pepler et al., 2000).

Research on the recovery or reversal of these negative effects of early trauma indicates that the outcomes may not be permanent. Professionals in the fields of mental health, foster care and child protection, antiviolence and advocacy, and early child development working with families must regularly assess for IPV, depression, and anxiety, especially during the prenatal period. Part of the assessment needs to include referrals to community organizations familiar with the field of IPV, safe housing, support, and a readiness to talk about the basic preparation of safety plans. In addition to assisting caregivers and children with appropriate information and referrals, professionals working with this population are in the unique position of providing support and guidance for both the caregiver and the children, which is a major factor in buffering the affects of exposure to IPV (Cook et al., 2005; Kaufman & Henrich, 2000). An important part of working with a survivor of IPV and his/her children is to recognize what the caregiver has done to protect him/herself and the children. Working as a team with the family and professionals from multiple organizations often returns the decision-making processes back to the abused caregivers when they may not have felt they had any control over decisions about themselves or their children. By listening to the caregivers and validating strengths and positive steps, their children will also begin to feel a stronger sense of control and hope in their lives.

Finally, professionals working with families who have experienced traumatic IPV and child abuse, should routinely participate in reflective supervision to discuss the vicarious traumas they may experience.

More research is needed in the field of how IPV influences early child development, the development of prevention and intervention programs for caregiver/victims, caregiver/perpetrators and their children in the forms of secure transitional living, counseling programs, parent-child interventions, batterer/abuser interventions, community education, and training for professionals. Glaringly missing from the research reviewed here are studies on the perpetrators of IPV; most of the research has focused on the victims and their children. Perpetrators who are caregivers for young children deserve the same level of attention in order to create prevention and intervention programs that result in a decrease in abusive behaviors and, at the same time, hold perpetrators accountable for their abuse.

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