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Neuropsychological Effects of the Traumatic Stress Response in Sexually Abused Adolescents throughout Treatment

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NEUROPSYCHOLOGICAL EFFECTS OF THE TRAUMATIC STRESS RESPONSE IN SEXUALLY ABUSED ADOLESCENTS THROUGHOUT TREATMENT

by

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NEUROPSYCHOLOGICAL EFFECTS OF THE TRAUMATIC STRESS RESPONSE IN SEXUALLY ABUSED ADOLESCENTS THROUGHOUT TREATMENT

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Child maltreatment is a pervasive problem in our society that has long-term detrimental consequences to the development of the affected child such as future brain growth and functioning. The alteration of the biochemical stress response system in the brain that changes an individual's ability to respond efficiently and efficaciously to future stressors is conceptualized as the traumatic stress response. The purpose of this research was to explore the effects of the traumatic stress response on sexually abused adolescents' through a two-tiered study of neuropsychological functioning throughout treatment. It was determined that there are measurable differences in neuropsychological processing in sexually abused adolescents throughout the course of treatment. These changes in neuropsychological functioning were related to changes in behavioral and emotional functioning; specifically, trauma-specific emotional functioning, self-report of memory functioning, and task performance of attention performance were consistently correlated. Thus there is corollary support for an underlying neuropsychological processing phenomenon consistent with the conceptualization of the traumatic stress response.

DEDICATION

This work is dedicated to my family.

I would like to thank them for their continued support.

Their love of learning is my inspiration.

Ancora Imparo.

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Child maltreatment is recognized as a widespread and pervasive problem in the United States. The U.S. Department of Health and Human Services (2007) reported 896,000 cases of substantiated maltreatment in 2005 alone. Clinicians, researchers and the general public share a common concern regarding the child victims of maltreatment. There is a dearth of literature on child maltreatment that supports the salience of preventative measures, effective interventions, and access to services for recovery from maltreatment. Despite the breadth and depth of information regarding child maltreatment, researchers are still exploring the vicissitudes of maltreatment in our society.

Child maltreatment occurs in several different forms. The Department of Health and Human Services (2004) defines the different forms of child maltreatment within a commission-omission paradigm. Physical and sexual abuse are acts of commission of excessive physical punishment of and inappropriate sexual contact with a child, respectively, whereas neglect is an act of omission, with harmful effects resulting from the lack of a caregiver's actions for a child's welfare (DHHS, 2007). Exposure to domestic violence diverges from the commission-omission definitional schema for child maltreatment in that the action is directed to someone other than the child, but is nonetheless resultantly harmful to the child's welfare (Fantuzzo & Mohr, 1999). Furthermore, it is also common for children to experience multiple forms of maltreatment (Carter, Weithorn, & Behrman, 1999; Hulme & Agrawal, 2004). In community studies, other researchers note a significant percentage of their sample to have experienced multiple forms of abuse (Bifulco Moran, Baines, Bunn, & Stanford, 2002; Silverman, Reinhherz, & Giaconia, 1996). With such a variety of definitional schema in the literature, many researchers are calling for and developing classification systems for child maltreatment (e.g., Cicchetti, 2007). For these purposes, it is important to approach maltreatment from the unifying definition of an experience outside the average expectable environment that has the potential to harm a child.

Maltreatment has a wide variety of effects. Some children experience short-term problems immediately following their maltreatment, while others go on to have pervasive problems for months or even years (e.g., Kendall-Tackett, Williams, & Finkelhor, 1993). Fortunately, there are also resilient children that do not exhibit any maladaptive effects to maltreatment. Children that do experience difficulties after enduring maltreatment may display one or several different types of problems. These types of problems can range from externalizing problems (i.e., conduct problems, aggression, risky sexual behavior), to internalizing problems (i.e., depression, self-harm, suicidality). Similarly, researchers estimate that 20-63% of maltreated children have an extremely aversive response and develop Posttraumatic Stress Disorder (Gabbay, Oatis, Silva, & Hirsch, 2004). While these behaviors may result from many different experiences, when the behavior is clearly preceded by child maltreatment it can be inferred that the stress of the maltreatment experience may have been causally involved in the behavioral response. In short, the effects of child maltreatment can be understood from a traumatic stress response framework.

There has been increasing attention to the traumatic stress response. Major contributions have been made in recent years to the child maltreatment literature base by psychiatrists, clinical psychologists, and neuropsychologists utilizing this framework.

The strength of this approach is that it allows different fields to synthesize findings from different populations and methodologies under a common philosophy to work towards understanding the common problem of child maltreatment. Further, a unifying philosophy can orient research in the field without impingement of DSM criteria on methodological design. With such a breadth of research contributions, there is also great depth added to the field. Clinical psychology has provided much thus far in terms of research on the individual psychological effects of child maltreatment (e.g., Cicchetti & Toth, 2005). Similarly, psychiatry has offered much advancement on the biochemical, brain structural, and physiological effects of maltreatment through neuroimaging work (e.g., Bremner et al., 2003; De Bellis, 2005; Teicher, 2002). Neuropsychology has afforded the opportunity to enhance our understanding of the brain-behavior relationship by systematically testing individuals' functional capacities that are hypothesized to be affected from the neuroimaging literature (e.g., Liberon & Martis, 2006; Shin, Rauch, & Pitman, 2006). And finally, animal studies allow for more experimental rigor and more direct examination of the casual effects of maltreatment than clinical studies (e.g., Cohen & Zohar, 2004; Harvey, Brand, Jeeva, & Stein, 2006).

Cicchetti and Lynch (1993) offer one of the most widely accepted frameworks for understanding the intricacies of child maltreatment in our society. Their ecological-translational model accounts for the dynamic child-environment relationship within a developmental framework. Child maltreatment is viewed as an adversity outside the realm of the average expectable environment. When a child is maltreated, her or his developmental trajectory is altered. This altered trajectory has innumerable costs (Cicchetti, 2007). These costs range from the immediate individual effects such as medical bills and the cost of therapeutic services for victims and perpetrators to the long term effects such as court costs of legal proceedings. Also important are the less tangible and more pervasive effects such as pain, suffering, and diminished quality of life for victims.

In order to elucidate how the traumatic stress response to child maltreatment affects children's neuropsychological functioning following child sexual abuse, it is important to review contributing areas of neurochemical and developmental literatures as well as the fledgling neuropsychological research with child populations. As it is understood that there is a systematic biochemical response to stress in the brain, psychologists need to understand the neurochemical cascade that results from a traumatic stress response (e.g., De Bellis, Hooper, & Sapia, 2005). Thus, the neurochemical effects of the traumatic stress response are first explained from adult clinical and animal studies. Second, it is important to gain a broad understanding of general brain development in children so as to have an appreciation for what an altered developmental trajectory could affect (Glaser, 2000). Third, specific studies of the traumatic stress response to child maltreatment are examined from the clinical psychology literature (e.g., Cohen, Perel, De Bellis, Friedman, & Putnam, 2002). Fourth, the biological response systems that were hypothesized to be altered by the traumatic stress response and linked to behavioral symptom response in maltreated children can be explored in terms of any manifested neuropsychological differences in functioning (e.g., Liberon & Martis, 2006). As such, this literature reviewed will follow the described format to illuminate the need for this research study of the neuropsychological effects of child sexual abuse throughout the course of treatment.

Definitional Concerns in the Traumatic Stress Response

While a major trend in the literature is utilization of a traumatic stress response framework, researchers use different working definitions of traumatic stress response. Many researchers in psychiatry and neuropsychology focus on the altered biological stress response system following trauma (e.g., Bevans, Cerebone, & Overstreet, 2005; Cohen et al., 2002; De Bellis, 2005; Delahanty & Nugent, 2006; Teicher, Andersen, Polcari, Andersen, Navalta, & Kim, 2003). For these reasons it is not uncommon to find that most stress response literature is located under the rubric of PTSD. This pathology focused framework allows for exploration of maladaptive outcomes following trauma so significant that it may permanently alters the stress response system. However, individuals are not equally affected by similar experiences. Cicchetti (e.g., 2005) postulates an ecological model that encompasses a variety of moderating factors on a child's maltreatment experience that allows for exploration of a variety of stress responses to the trauma. His line of developmental traumatology research addresses resiliency in responding. For the purposes of this research, *a traumatic stress response is defined as an alteration in the neurobiological cascade that usually acts to respond to stress by preserving homeostasis and allowing for the continuation along the developmental trajectory provided by the average expectable environment.*

Resultant Neurochemical Cascade of the Traumatic Stress Response

When individuals encounter a traumatic event they may respond to that trauma in a variety of ways. Cognitively, they are aware of threats to their integrity, safety, and well-being. Emotionally, they may experience intense feelings. Physically, they may notice their increased autonomic arousal. All of these responses are related to each other and the trauma through an intricate neurochemical feedback system that is designed to respond to threats against an individual's safety. The human body is designed to respond to stress in a manner that preserves the internal and external integrity of the individual. When this system faces a stressor so acutely traumatic or so chronic in nature that the stress response system itself is altered, the individual now experiences a traumatic stress response.

The traumatic stress response begins with an assessment of threat that serves to activate a cascade of neurochemical events to help the individual respond to that stressor and return the internal homeostasis (Bevans et al., 2005). The traumatic stress response differs from the regular stress response in that the neurochemical cascade outlives the threat of the original stressor, causing disruption of homeostasis (Weber & Reynolds, 2004). The structural and functional capacities of the brain are then locked into a maladaptive feedback cycle (Vasterling & Brailey, 2005). This cycle directly affects brain regions involved in the stress response system, regions that are influenced by the stress response system regions, and any developing brain areas that may be sensitive to neurochemical dysregulation (Cohen et al., 2002; Vermetten & Bremner, 2002a, 2002b).

Researchers differ between which brain regions are included in their models of the traumatic stress response. For example, Heim and Nemeroff (2001) outline the corticotrophin releasing factor neurotransmission effects on the hypothalamus, central nervous system, and autonomic nervous system in their working model. Disseth (2005) includes the hypothalamus-pituitary-adrenal axis, the sympathetic and parasympathetic nervous systems, and neurotransmitter systems in his broad approach to the traumatic stress response model. De Bellis (2005) describes the traumatic stress response to include the hypothalamus-pituitary-adrenal axis and limbic system. Logically, there is considerable overlap between models due to the genetically predetermined stress response. The human body is intricately interconnected, with alterations from the traumatic stress response theoretically leaving all other systems susceptible to dysregulation as well. However, there is also variability between models as based on which chain reaction of events is examined. Most researchers agree that the traumatic stress response is a neurochemical cascade that involves neurotransmitter activation of the hypothalamic-pituitary-adrenal axis, the locus coreulus, the prefrontal cortex, and the limbic system.

HPA-Axis

The hypothalamus-pituitary-adrenal axis (HPA-axis) is a system that is central to the stress response. The main function of the HPA-axis is to assess threat, trigger a neuroendocrine cascade to initiate behavior response, and to terminate that cascade with the cessation of the threat (Bevans et al., 2005). These actions are done primarily through increasing cortisol production, suppressing the immune system, increasing stimulatory glucose and lowering the fear response to avoid overreaction of these responses to preserve homeostasis (Disseth, 2005).

The hypothalamus is both part of the limbic system and the HPA-axis. Researchers differ as to whether it is included in discussion of the limbic system, the HPA-axis or both. Here it is discussed within the HPA-axis as it is central to its functioning, and so as to prevent redundancy of discussion in other sections.

The neuroendocrine cascade in the HPA-axis begins with stimulation of the hypothalamus from increased catacholamines following a stressor. When stimulated, the hypothalamus secretes corticotrophin-releasing-factor (CRF) (Vermetten & Bremner, 2002a, 2002b). CRF is integral to the stress response as it affects brain functioning in several ways. It facilitates brain functioning by increasing arousal, alertness, attention, and readiness, which can combine to create anxiety-like behavior (Vermetten & Bremner, 2002a, 2002b). CRF from the hypothalamus also serves to stimulate the pituitary to produce ACTH. Pituitary ACTH then stimulates the adrenal glands to produce the glucocorticoids cortisol and corticosterone. Of these two glucocorticoids, cortisol serves to initiate the behavior response (Disseth, 2005).

The HPA-axis functions in response to stressors and should stop cortisol production when the stressor is removed. One of the major means of detecting HPA-axis dysregulation is through cortisol changes. There is a natural diurnal fluctuation in cortisol and a natural cortisol increase when threat is assessed (Bevans et al., 2005). When there is a lack of diurnal fluctuation in cortisol or over-responsiveness or under-responsiveness to challenge, it is inferred that the HPA-Axis is not managing cortisol appropriately (Cohen et al, 2002; Disseth, 2005). In addition to the effects of cortisol, the HPA-Axis functioning has a reciprocal relationship with the prefrontal cortex, which is described below (Teicher et al., 2003).

Prefrontal Cortex

The main function of the prefrontal cortex (PFC) with regards to the traumatic stress response is to control attention, working memory, sort out sensory input for relevant information, and regulate inhibitory response (Weber & Reynolds, 2004). A healthy PFC functions to attend to threat and activate other brain regions to respond to threat. When the threat is removed or resolved, the PFC neurons stop sending excitatory neurotransmission to the other brain regions, such as the HPA-Axis. Thus, the PFC is the shut-off valve for the stress response in the HPA-axis. In order to serve this function, the PFC must be functioning properly.

The PFC has a high concentration of dopamine receptors and its functioning is susceptible to the functioning of these receptors. Excessive dopamine can cause dysregulation by blocking excitatory glutamate, enhancing inhibitory GABA, and thus causing the PFC hyporesponsiveness. This hyporesponsiveness translates to a lack of inhibitory communication to other brain regions such as a failure to stop the fear response in the HPA-axis (Cohen et al., 2002), failure to inhibit the amygdala from assigning emotional valence to sensory stimuli, and a failure to inhibit the hippocampus (Liberon & Martis, 2006; Shin et al., 2006). Clinically, the medial PFC has been observed to be smaller in adults with PTSD and hyporesponsive during symptomatic states and their performance of emotionally valenced cognitive tasks (Shin et al., 2006).

Limbic System

Another brain region that is of major focus in the traumatic stress response is the limbic system. The limbic system consists of the thalamus, hypothalamus, amygdala, and hippocampus. It is often considered the emotional control center of the brain. Threat stimulates the locus coeruleus to produce noradrenaline, which is the main stimulatory neurotransmitter of the limbic system (Vermetten & Bremner, 2002a, 2002b). When an individual experiences a situation that can induce the neurochemical cascade of the traumatic stress response, such as child abuse, the limbic system is directly effected. Of the areas of the limbic system affected by the traumatic stress response, there is a dearth of literature discussing the effects on the amygdala, hippocampus, and hypothalamus (which was discussed in the aforementioned section on the HPA-Axis).

One main function of the amygdala in the stress response system is to receive sensory input and assign emotional valence to the stimuli to engage a behavioral response to the threat. It is demonstrated that the amygdala may accomplish this by balancing glutamate-induced excitation with GABA-mediated inhibition to regulate the anxiety response (Shekhar, Truitt, Rainnie, & Sajdyk, 2005). First, stress stimulates the amygdala to produce corticotrophin-releasing factor (CRF). Then CRF serves to engage the autonomic and behavioral response systems (Weber & Reynolds, 2004).

When the amygdala is functioning properly, it works in conjunction with the hippocampus to encode emotional valence to memories to activate a defensive response when the threat is re-encountered. However, under extreme traumatic stress, the amygdala becomes sensitive to “kindling” effects, and assigns emotional valence to non-threatening stimuli (e.g., memories). Kindling resembles seizure-like behavior neurologically (Teicher et al., 2003) and is described clinically as dissociative symptoms (Disseth, 2005). It is hypothesized that kindling in the amygdala leads to eventual hyperarousal and diminished behavior inhibition. Thus the traumatic stress response dysregulates the amygdala to assign emotional valence to non-threatening stimuli and invoking unnecessary behavioral priming (Cohen et al., 2002; Shin et al., 2006).

Animal researchers have highlighted the interplay of the amygdala and other brain regions in emotional memory. A review of the animal literature by Phelps (2004) highlights the importance of the amygdala in emotional memory encoding such that the amygdala assigns emotional valence and directs hippocampal encoding of stimuli. This review also explains that the amygdala can trigger physiological arousal with emotional stimuli even if the physiological arousal was not experienced at encoding. Another review by Delgado, Olsson, and Phelps (2006) concludes that the amygdala is involved in all stages of fear learning and prefrontal areas during extinction of fear. Thus the amygdala works with the hippocampus in encoding emotional memories, the prefrontal cortex in extinction of fear associated with emotional memories, and directs emotional valence of memories in general.

As mentioned previously, the hippocampus is involved in encoding memories, among other functions. The hippocampus is composed of a high level of glucocorticoid receptors. These receptors are excited by cortisol, the major stress-response hormone, and are thus susceptible to the excitotoxic effects of cortisol through neuronal degradation (e.g., Harvey et al., 2006; Harvey, Bothman, Nel, Wegner, & Stein, 2005; Harvey, Oosthusizen, Brand, Wegner, & Stein, 2004; Shin et al., 2006). Most stressors produce increased cortisol levels that excite the glucocorticoid receptors in a manner that adaptively responds to the stressor. When an individual experiences an acutely traumatic or chronic stressor, part of the traumatic stress response entails elevating cortisol levels to the point of burning out the hippocampal neurons by over stimulation of the glucocorticoid receptors. When neurons are burned out, all connected neurons suffer damage from the loss of connection. Neurogenesis along preformed pathways is also diminished by the loss of the neurons that lead the pathway. The neurotoxic effects of a dysregulated hippocampus are not readily evident as it takes time to quantify noticeable differences in cell density. This is especially difficult in the hippocampus as neurogenesis occurs into the third decade of life and may mask any initial cell loss (Teicher, Tomodoa, & Andersen, 2006).

Thus, in adult human studies and animal studies, there is a neurochemical cascade of events in the brain that follows exposure to stress. This stress-response system is altered when the stressor is perceived as a serious threat to the integrity of the individual. This traumatic stress response affects many different regions of the brain including, but not limited to, the HPA-Axis, the PFC, and the Limbic System. Following traumatic stress, the HPA-Axis does not produce cortisol in response to subsequent stressors to the same extent or in the same direction as previously demonstrated. The PFC which, normally serves to regulate the neuroendocrine cascade triggered by the HPA-Axis, is dysregulated by traumatic stress such that it cannot properly assess for threat and provide neurofeedback to regulate the HPA-Axis response. To further exacerbate the dysregulated stress response system, the limbic system encodes emotional valence to disorganized sensory and visual memories such that individuals are primed to misperceive threat and engage their maladaptive stress response system. In sum, individuals are primed to misperceive threat, be overly emotionally response, ineffectually cognitively responsive, and present disorganized or maladaptive behavior responses to perceived threats following exposure to traumatic stress that has altered the neurochemical cascade response to stress.

Developmental Factors in the Traumatic Stress Response

While the traumatic stress response is relatively well-understood in mature animals, the contributions of developmental factors are just beginning to be explored. Individuals of a given species are born with most of the brain structures that will be present at maturity, yet functioning varies greatly across the life span. In terms of the traumatic stress response, there are many large questions in the early stages of exploration. First, developmental research has demonstrated how brain growth and maturation has a reciprocal relationship with the environment. Second, trauma researchers have compared functional differences in regions researched in adults. Third, functional differences have been observed in regions not found to be affected in adults. Once these bodies of research are understood, one can begin to conjecture how measured neuropsychological differences following trauma in children are related to the neurochemical cascade of the traumatic stress response within a developmental framework.

Experiential Effects on Brain Development

Normal brain development occurs within the average expectable environment. Experiences that are expected for normal brain development such as neuronal overproduction, synaptic pruning, and myelination are logically referred to as experience-expectant developmental phenomena (e.g., Greenough, Black, & Walker, 1987). Subsequently, experiences that shape brain development but are not needed for the development to occur are referred to as experience-dependent phenomena. In terms of maltreatment, the effects are deleterious on development when experience-expectant experiences are prevented or experience-dependent experiences alter developmental trajectory.

As a child's brain grows and develops, there are "sensitive periods" of development in which outside influences affect the brain's ability to develop certain capacities in the future. This may occur by either prevention of experience-expectant or incursion of experience-dependent phenomena. Deprivation of needed experiences for proper child development is neglect in approximation and definition (e.g., De Bellis, 2005). Heim and Nemeroff (2001) relay that neglect places children in a state of heightened stress from missing experience-expectant developmental experiences of caregiver enrichment, resulting in their cognitive and emotional deficits. Ford (2005) and Weber and Reynolds (2004) cite physical abuse as a type of experience that alters experience-dependent development when a child does not receive the reciprocal reinforcement of learning from interactions with caregivers in the average expectable environment. Cohen and Zohar (2004) postulate that a sudden onset of abuse in a previously nurturing relationship can be particularly traumatic to children. Such acute stress from experience-dependent experiences can alter a child's developmental trajectory through the traumatic stress response (Cicchetti, 2007).

Effects of Stressor Timing

Another important factor in brain development is the time in which the brain incurs a traumatic stressor. Prenatal exposure to stress and increased glucocorticoids has been linked to lower birth weight and increased basal HPA-Axis activity postnatally up to 10 years of age (Lupien, McEwan, Gunnar, & Heim, 2009). In early childhood, exposure to stress in the form of neglect has demonstrated the opposite effect on cortisol in the form of hyporesponsiveness, attention and behavior difficulties (e.g., Andersen & Teicher, 2008; Lupien, et al., 2009). Researchers also hypothesized that based on the increase of glucocorticoid mRNA in adolescents and early adulthood put adolescents at a risk for developing cognitive and emotional processing difficulties following stress exposure due to the increased sensitivity to glucocorticoids that are glucocorticoid receptor-mediated (e.g., Andersen & Teicher, 2008; Lupine, et al., 2009). Animal researchers have demonstrated that these effects are compounded when the brain is exposed to stress while developing and mature. Cohen and Zohar (2004) demonstrated that rats exposed to stress as juveniles and as adults exhibited increased maladaptive behavioral responses than those exposed only as juveniles or only as adults. Thus, there are differential outcomes related to timing that the brain encounters stress.

Neuroendocrine Dysregulation and Methodological Concerns

Research with traumatized children differs from research with adults in that studies with child samples tend to utilize mixed methods of salivary assays of cortisol and social, emotional, behavioral, and cognitive psychological assessments to allow for less intrusive exploration of neurobiochemical dysregulation and provides corollary individual functional information. Cortisol has been studied extensively with anxiety, depression, and the traumatic stress response because it is easy to sample and a key element in altering brain functioning. In adults, lowered cortisol levels are correlated with exacerbated PTSD symptoms (e.g., Altemus, Dhabhar & Yang, 2006). In children, the direction of cortisol dysregulation has not been as uniform across studies, though it is generally accepted that it is dysregulated. Though only a handful of studies have been conducted in this area thus far, research is indicating altered levels of cortisol at both morning and afternoon sampling times for maltreated children as well as an alteration in the expected amount of decrease from morning to afternoon cortisol as is found with natural circadian rhythm.

For example, Delahanty, Nugent, Christopher, and Walsh (2005) sampled 82 children (ages 8-18) twelve hours after admission to a hospital trauma unit and found children’s cortisol to be higher after trauma (“usually abuse or maltreatment”) and cortisol levels correlated with PTSD symptoms severity and duration. King, Mandansky, King, Fletcher, and Brewer (2001) recruited a community sample of ten sexually abused girls (ages 5-7) from the Department of Social Services and found lower morning cortisol compared to 10 non-abused controls. Dozier and colleagues (2006) sampled 55 foster children (ages 20-60 months) who had experienced a variety of types of maltreatment, but who were all arguably stressed by frequent placement changes within the foster care system, and found higher morning and lower evening cortisol than 104 comparison children.

Several studies have been conducted with school-aged children within the context of a summer day camp. Hart, Gunnar, and Cicchetti (1996) sampled cortisol levels and depression in 131 maltreated “school-aged” children and 66 non-maltreated children. They found depressed, maltreated children had lower morning cortisol levels when compared to non-depressed, maltreated children and showed a rise in afternoon cortisol levels. Cicchetti and Rogosch (2001a) sampled cortisol levels and psychopathology (internalizing and externalizing) of 167 maltreated and 204 non-maltreated “school-aged” children at a day camp and found that maltreatment serves as a moderator of the impact of internalizing problems on cortisol regulation. In a later expansion of the previous study, Cicchetti and Rogosch (2001b) also found that cortisol dysregulation patterns were specific to the type of maltreatment experienced. Maltreated children who had been physically and sexually abused exhibited higher morning cortisol levels, whereas children who had only been physically abused showed a lower level of morning cortisol and had a smaller decrease from morning to afternoon cortisol.

It is hypothesized by several researchers that cortisol dysregulation in children following maltreatment is dependent on the nature of the maltreatment as it evokes the initial traumatic stress response, but then is also shaped by the neurotoxic effects of heightened cortisol on developing brain regions during their sensitive periods (e.g., Weber & Reynolds, 2004). In particular, researchers describe the hippocampus, prefrontal cortex, and corpus callosum as being vulnerable to neuroendocrine dysregulation from the traumatic stress response in maltreated children.

Hippocampus

One of the brain regions that is particularly susceptible to the neurotoxic effects of increased cortisol is the hippocampus (Heim & Nemeroff, 2001). Several studies have examined hippocampal volume following trauma in both children and adults and have reported differences in hippocampal volume. Bremner and colleagues (2003) sampled 10 women with childhood sexual abuse and current PTSD, 12 women with childhood sexual abuse and no PTSD, and 11 women without childhood sexual abuse or PTSD. A reduction in hippocampal volume was found in women with a childhood sexual abuse history and PTSD compared to both other groups. Bonne and colleagues (2001) sampled 37 trauma survivors' hippocampal volume one week and six months post trauma, at which time they also assessed for PTSD. Ten subjects were determined to have PTSD at six months, but did not demonstrate any reduction in hippocampal volume compared to their earlier measured hippocampal volume nor the hippocampal volume of those who did not develop PTSD. De Bellis, Hall, Boring, Frustaci, and Moritz (2001) measured the hippocampal volumes of nine pre-pubertal maltreated subjects with maltreatment-related PTSD and nine matched non-maltreated control subjects at baseline and after two years. There was no difference found between groups' hippocampal volume at baseline, follow-up, or across time. Thus there appears to be a latent effect of the increased cortisol on hippocampal volume reduction.

Developmental traumatology researchers such as De Bellis and Teicher, attribute the latent effects of hippocampal volume reduction to a difference in the populations. The early identification, intervention, and treatment of maltreated children who are sampled do not continue to experience the chronic stress that results from unidentified and/or untreated maltreated children. Further, children who are maltreated during childhood are susceptible to the benefits and detriments of the effects of cortisol on a hippocampus that is in a sensitive period for development. De Bellis et al. (2001) relays that the hippocampus is still experiencing a high rate of neurogenesis during childhood that may mask initial cell loss as well as enabling volume reduction to be overcome if maltreatment is stopped during this sensitive period. Teicher et al. (2003) further explained the differences found between prepubertal and peripubertal children's literature of maltreatment-related hippocampal reduction to the fact that peripubertal children are past the point of increased neurogenesis and into a period of synaptic pruning. Thus, maltreatment experienced by peripubertal children is considered to be more detrimental to hippocampal volume than maltreatment experienced by prepubertal or postpubertal children. Teicher, Dumont, Ito, Vatiuzis, Giedd, and Andersen (2004) also relay different sensitive periods of hippocampal myelination by age and gender. The window of vulnerability for reduced hippocampal myelination is earlier for boys and later for girls. This correlates with findings of reduced hippocampal volume in neglected boys (which is more likely to occur at an earlier age) and sexually abused girls (which is more likely to occur at a later age). In Teicher's more recent work (2006) he described earlier child sexual abuse to be related to reduced hippocampal volume, while later child sexual abuse is related to decreased prefrontal cortex volume; a difference he attributes to the different sensitive periods of the different brain regions.

Prefrontal Cortex

The prefrontal cortex continues to develop into early adulthood and thus has an extended sensitive period. Reichert, Carrion, Karchemskiy, and Reiss (2006) compared 23 children (ages 7-14) with a history of "interpersonal trauma" and PTSD symptoms to a sample of 24 "age-equivalent, healthy" children. They found differences in prefrontal cortex grey matter volume in children with PTSD resulting from "interpersonal trauma." One reason that executive functioning abilities, such as planning and controlling behavioral responses, are thought to be effected by traumatic stress is that both are linked to prefrontal cortical functioning. Aberrations in prefrontal cortex size and/or functioning has been related both to traumatic experiences and poorer executive functioning. This area of the brain is rapidly developing during childhood, more susceptible to insult (i.e., traumatic stress), and its dysregulation effects future executive functioning capacity. Thus dysregulation in developing such capacities during childhood (e.g., learned helplessness from maltreatment experiences) have greater impact in how children will handle such situations in the future. It has also been hypothesized that as children gain a greater sense of self, they are more prone to depression following cognitive appraisal of their maltreatment experiences (Spaccarelli, 1994). Development of such cognitive appraisal abilities are also developed later in childhood and adolescence during a sensitive period of the prefrontal cortex.

Corpus Callosum

A third area that has been found to be particularly susceptible to the effects of maltreatment is the corpus callosum. The corpus callosum is the area connecting the two hemispheres of the brain. Its integrity is important for effective communication across the brain and integration of other brain functions. Though the corpus callosum is not a structure regularly included in the discussion of the traumatic stress response in adults, there is a substantial body of literature linking the effects of maltreatment during sensitive periods of brain maturation to differences in the structure and function of the corpus callosum. When there is a reduction in size of the corpus callosum, there is potential for lateralization of functioning such that one side of the brain may be over taxed or unusually taxed when an individual is trying to complete tasks (Weber & Reynolds, 2004).

In maltreated children and primates, researchers have found reduction in corpus callosum size following maltreatment (e.g., Teicher et al., 2006). Cohen et al. (2002) linked duration of maltreatment to corpus callosum size and IQ in their review of the literature. Teicher et al. (2004) sampled 115 children who were admitted consecutively to a large hospital. Of this sample, 51 were admitted for psychiatric reasons, and 28 of these children had a history of maltreatment. Corpus callosum size differences were found to be gender and maltreatment specific. Neglect was found to have the greatest reduction in corpus callosum size for boys, while sexual abuse was found to have the greatest effect for girls. Teicher further relays that these effects were related to maltreatment experiences but not PTSD diagnoses or symptoms. He explains these findings by the effects of maltreatment on the corpus callosum during sensitive periods, preventing myelination (Teicher et al., 2003). A lack of myelination in the corpus callosum causes dissociative effects similar to reported experiences of temporal lobe epileptics (Teicher et al., 2006). By preventing integration of sensory stimuli by inhibiting communication between brain regions, lateralization heightens arousal in emotional reactive areas, leading to increased behavioral problems and dissociative symptoms in maltreated children (Disseth, 2005).

Summary

Taken together, several researchers have found links between expreinces of child maltreatment, alterations in brain development, and clincial symptom presetnation. These findings are similar to adults but differe in brain regions affected and the latency of detectable change and symptom presentation due to exposure to traumatic stress during sensitive periods (Andersen & Teicher, 2008). Hippocampus and corpus callosum development were affect most by stress exposure during childhood; whereas adolescence appears to be a particular sensitive period for stress exposure affects on prefrontal cortical development (e.g., Lupien, McEwen, Gunnar, & Heim, 2009). These brain regions are affected by neuroendocrine dysreulgaiton that leads to cortisol dysregulation, retardations in synaptogensis, reductions in myelination, and ultimately reductions in brain volume, alterations in regional cerebral blood flow, and trauma symptom presentaiton (e.g., Sullivan et al., 2006).

Clinical Presentation of the Traumatic Stress Response and Child Maltreatment

There are a number of different studies that have linked children's behavioral response to trauma to neurochemical alterations that are both maladaptive and distinct from those of adults (e.g., Delanhanty et al., 2005; Dozier et al., 2006; King et al., 2001) . Of particular importance are studies of neuroendocrine dysregulation seen through studies of cortisol and structural alterations found in the hippocampus, corpus callosum, prefrontal cortex, and cerebral volume as a whole (e.g., Cicchetti & Rogosch, 2001; De Bellis et al., 2001; Reichert et al., 2006; Teicher et al., 2006). These alterations in children's brain functioning, though different from adults, are still closely linked to symptomatic presentation of the traumatic stress response in adults (e.g., Delahanty et al., 2005; Reichert et al., 2006).

One of the most notable differences following a traumatic stress response is the altered response of the individual to emotional stimuli. Many individuals, including children, are observed clinically to have an over or under-responsiveness to emotionally laden situations following trauma (e.g., Vermetten & Bremner, 2002b). Though symptoms of hyperarousal were discussed previously in relation to the traumatic stress response, it is also important to consider the effects of the traumatic stress response on emotional numbing. From Teicher's work with children, the dissociation effects of trauma are linked to reduced corpus callosum volume (e.g., Teicher et al., 2003; Tehcer et al., 2004; Teicher et al., 2006)..

Other researchers have used functional imaging to explore the brain mechanisms related to dissociative experiences. By using functional imaging such as MRI and PET scans, researchers can observe the regional cerebral blood flow (rCBF) in different brain regions following sensory stimuli. Weems, Saltzman, Reiss, and Carrion, (2003) measured rCBF and dissociative experiences in female survivors of sexual trauma. They found trauma scripts trigger dissociative experiences and simultaneously increase rCBF to areas of the brain associated with non-verbal patterns of recall. This finding, in conjunction with other trauma researchers' correlations between emotional numbing and symptoms of hyperarousal, avoidance, and re-experiencing, lead to hypotheses of memory disintegration (e.g., Salmon & Bryant, 2002). Similar to Weems, Bremner et al. (1999) studied the rCBF of adult women survivors of CSA with and without PTSD. As they listened to trauma scripts, dysfunction was found in the medial PFC, hippocampus, and visual association cortex and increased activation in the posterior cingulate and motor cortex of women with PTSD. Frewen and Lanius (2006) explain rCBF dysregulation and dissociative symptoms through an altered stress response system that engages brain areas associated with non-verbal, bodily arousal awareness, and episodic recall of memories as similar to the behavioral immobilization strategy of animals faced with inescapable predation. Thus the initial trauma altered the stress response system such that processing of subsequent emotional stimuli is misperceived as threatening and a maladaptive response is generated.

While it can be fairly easy to decipher a clinical presentation of dysregulated emotional processing from trauma history, the dysregulated processing of neutral stimuli can be more difficult. When a trauma history is unknown for a child, the symptoms of PTSD in children can be easily misinterpreted as behavior dysregulation, cognitive deficits, or ADHD. Several researchers point to the potential misdiagnosis of ADHD in maltreated children (e.g., Cook-Cotton, 2004; Disseth, 2005; Ford, 2005; Salmon &

Bryant, 2002; Weber & Reynolds, 2004). Other researchers hypothesize that the traumatic stress response following child maltreatment will not only affect emotional functioning, but cognitive and neuropsychological functioning in school and on a broader basis (Cook-Cotton, 2004; Danckwerts & Leathem, 2003; De Bellis, 2005; Horner & Hammer, 2002).

Neuropsychological Functioning in the Traumatic Stress Response

As mentioned previously, there are a number of potential implications of the traumatic stress response on a maltreated child's functioning. The neurochemical cascade of the traumatic stress response during sensitive periods of development for children can alter the developmental trajectory of children's emotional, behavioral and cognitive development. In particular, the hippocampus and prefrontal cortex are key structures involved in children's cognitive development that are affected by the traumatic stress response. Cell loss and delays in myelination cause structural damage that may lead to functional deficits in memory and spatial processing, and attention and executive functioning, in the hippocampus and prefrontal cortex, respectively. As with other effects of traumatic stress on emotional and behavioral development, alterations in cognitive processing can alter the cognitive developmental trajectory such that there is potential for delayed cognitive development (e.g., Cicchetti, 2007; Ford, 2005; Watts-English, Fortson, Gibler, Hooper, & De Bellis, 2006). Thus there is an imperative need for research on the affects of the traumatic stress response on the cognitive development, development of information processing, and neuropsychological functioning of children.

Much research has been done on the effects of the traumatic stress response on the neuropsychological functioning in adults. Most of this research was conducted within a PTSD framework, but is applicable through the universality of the traumatic stress response framework as both are based on the same cascade of neurochemical events. Though some differences have been noted in the traumatic stress response between children and adults (e.g., direction of cortisol dysregulation) the affected brain regions and functions are similar. Thus an exploration of the neuropsychological effects of the traumatic stress response can be examined in a manner similar to that which has been done with adults, including a review of the literature by neuropsychological functional domains. It is important to cover all functional domains whether or not there is hypothetical support for effects in those domains as sound research must explore confirmatory and disconfirmatory evidence. Further, in the beginnings of research into the neuropsychological effects of trauma in children, it is imperative to cover all functional domains to gain a complete picture of the breadth of effects as well as results that can be compared to adult findings and hypothesized findings for children. As such, the neuropsychological functioning within the domains of intellectual functioning and scholastic achievement, attention and executive functioning, learning and memory, visual-spatial processing, language, and motor functioning will be reviewed (e.g., Danckwerts & Leathem, 2003; Vasterling & Brailey, 2005). Within each section the findings of the adult literature are reviewed followed by a discussion of the findings of the child literature, if any, to provide the background literature base for this study.

Intellectual Functioning

Intellectual functioning and academic achievement were defined as general cognitive ability and achieved academic ability, respectively, as measured by standardized assessments. Intellectual functioning in the trauma literature is generally measured by IQ scores. Academic achievement in the trauma literature is usually measured by scholastic performance (i.e., grades). While IQ has been measured in both the adult and child literature, academic achievement has received no attention in the adult literature, predominantly due to the fact that most adults are not still in school.

In the adult literature, there have been several studies of IQ scores measured in adults who present clinically with PTSD. In general, a PTSD diagnosis has been correlated with lower full scale IQ scores in adults. This includes studies of with populations of combat veterans, adult rape victims, and adult survivors of child sexual abuse (Brandes, Ben-Schachar, Gilboa, Bonne, Freedman, & Shalev, 2002; Gil, Calev, & Greenberg, 1990; Gurvits et al., 1993; Macklin et al., 1998; Vasterling, Brailey, Constans, Borges, & Sutker, 1997, Vasterling et al., 2002). Two researchers, Gil (1990) and Vasterling (1997) have explored the differences between composite scores on IQ tests to finds that Verbal IQ Composite scores tend to be lower on both fluid and crystallized tasks. IQ remained correlated with PTSD diagnosis even when combat exposure was controlled for statistically in veterans (Macklin et al., 1998; McNally & Shin, 1995; Vasterling et al., 2002). Despite some statistical controls, a debate remains as to whether lower IQ was a result of PTSD and trauma exposure, or if it was a risk factor for developing PTSD following trauma exposure.

In children, fewer studies have been conducted, but findings have been similar to that of the adult literature. In a study by Jones, Trudinger, and Crawford (2004) children who were referred for sexual abuse investigations were found to show academic underachievement and intellectual impairment. Using standardized assessment measures (e.g., WPPSI, WISC-III, WIAT) the intelligence and achievement performance of a group of 21 sexually abused children was found to have higher than average percentage of “impaired” individuals compared to the population. It is hypothesized that this may be due to lack of parental concern with their children’s welfare both physically and academically as these children were receiving less academic support than they needed as determined by their performance. Further it was shown that these children tended to be underserved and were receiving less academic supports than non-abused children. Within a sample of child psychiatric inpatients, children with sexual abuse histories had the lowest performance IQ scores when compared to groups of non-abused and physically abused inpatients, though the trend was non-significant for between groups comparison of abuse types (Sadeh, Hayden, McGuire, Sachs, & Civita, 1994). A review by De Bellis in 2005 summarizes the effects of neglect as leading to delayed cognitive development. Though neurobiological effects of the traumatic stress response are likely to affect cognitive capacity in children similar to that demonstrated in the adult literature, a review by Cicchetti and Toth (2005) highlight other factors that mediate this association. They explain that while cognitive ability and perceived ability mediated academic performance in maltreated children, their dissociative and destructive behaviors could affect their ability to function in the school environment to limit their scholastic success.

Attention and Executive Functioning

One of the areas most susceptible to the aversive effects of the traumatic stress response is the prefrontal cortex. The prefrontal cortex is particularly open to insult during childhood and adolescence as this region of the brain is still undergoing some neurogenesis and synaptic pruning. More importantly, childhood and adolescence is a sensitive period for myelination in the prefrontal cortex. Without developed myelination, there cannot be effective information exchange between the prefrontal cortex and other brain regions (e.g., Teicher, Andersen, Polcari, Andersen, & Navalta, 2002). Because the prefrontal cortex is already the area of the brain serving individuals with their attention, concentration, and executive functioning capacities, it is essential that this area of the brain be able to communicate and coordinate other brain functions. Further, to study other functional capacities, such as memory, it is necessary to know how well an individual can attend to information before assessing their ability to remember it (Danckwerts & Leathem, 2003).

In the adult literature, it is generally accepted that attention and executive functioning are impaired in individuals with PTSD diagnoses (e.g., Horner & Hamner, 2002). In a study of adult survivors of child sexual abuse, Raskin (1997) found a main effect for poorer executive functioning in women with a history of child sexual abuse, and specific effects of poorer executive functioning and working memory in women with a history of CSA and mild traumatic brain injury. Similarly, other researchers have found deficits in performance-based attention tasks in adults with PTSD (e.g., Vasterling et al., 2002).

Several researchers use the Mirsky model of attention to describe performance on different types of memory-related measures of attention (e.g., Vasterling et al., 2006). The Mirsky model conceptualizes attention into four different areas: focus-execute, sustain, shift, and encode. Individuals with PTSD have also demonstrated deficits on encoding or working memory (Beckham, Crawford, & Feldman, 1989; Gil et al., 1990; Gurvits et al., 1993; Vasterling et al., 1997) and sustaining attention in continuous performance tasks (e.g., Gil et al.; 1990; Jenkins, Langlais, Delis, & Cohen, 2000; McFarlane, Weber, & Clark, 1993; Semple et al., 1996), but not consistently throughout the literature (Golier et al., 1997; Sullivan et al., 2003; Vasterling, Rogers, & Kaplan, 2000). On other measures of attention, no deficits were found in performance on focus-execute (Litz et al., 1996; Sullivan et al., 1993; Vasterling, Brailey, Constans, & Sutker, 1998; Vasterling et al., 2002) or attention-shifting tasks (Barrett, Green, Morris, Giles, & Croft, 1996; Gurvits et al., 1993; Jenkins et al., 2000; Sullivan et al., 2003; Vasterling et al., 2002).

One of the explanations given for the differences found in measure of attention and executive functioning is that attention is disrupted by cognitive intrusion (Koenen et al. 2001; Vasterling et al., 1998). Cognitive intrusion occurs when the individual's thought process is disrupted by unanticipated events. In individuals with PTSD, the exaggerated startle response is demonstrative of the effects of the traumatic stress response on an individual's ability to handle cognitive intrusions. In this manner, it is not the individual's capacity to attend that is affected, but rather their ability to handle these disruptions and continue to function effectively in response to sensory stimuli from their environment. Demonstratively, Shimamura (2002) found that prefrontal dysfunction is mitigated by imposed structure, allowing for individuals to better focus their attention on stimuli and not exert as much mental effort to sort out the stimuli to which they are supposed to attend.

In children, there have been fewer studies on the effects of the traumatic stress response on attention and executive functioning. Results in the child literature have been found to be generally similar to that of the adult literature, with maltreated children performing more poorly on measures of attention and executive functioning when compared to normative or comparison groups. In a study by Beers and De Bellis (2002), children with maltreatment-related PTSD performed more poorly on measures of attention and executive functioning. Similarly, diminished performance on attention and concentration tasks was found in a sample of sexually abused children compared to matched controls (Porter, Lawson, & Bigler, 2005). In a third study by De Bellis (2005) maltreated children and adolescents with PTSD demonstrated deficits in executive functioning, abstract thinking, and everyday memory. Though the child literature has not yet explored the specific domains of attention and executive functioning to the extent of the adult literature, consistent findings in functional deficits of samples of maltreated children have been reported across studies.

Learning and Memory

In the trauma literature, there has been much work done with the effects of memory. This is partially due to the fact that individuals who have experienced acute trauma often present with inability to remember details or important aspects of the trauma. Similarly, in the DSM-IV-TR (APA, 2003) one of the diagnostic criteria of posttraumatic stress disorder is an inability to recall important aspects of the trauma. While memory deficits surrounding the traumatic event(s) have been extensively studied elsewhere, memory deficits unrelated to trauma is a major functional domain of neuropsychology and are discussed here.

Memory and learning are very broad domains of neuropsychology. Within memory, there are several different domains, with some researchers circumscribing learning into memory. Zillmer, Spiers, and Culbertson (2008) break memory into sensory memory, short-term, and long term memory, with long-term memory further differentiated between declarative/explicit memory of semantic knowledge and episodic events and nondeclarative/implicit memories of habits and procedures. Memory is the ability to retain information, and learning can be viewed as the ability to retain newly presented information. With regards to a neuropsychological view of the traumatic stress response, it is hypothesized that declarative memory and learning may be damaged when the hippocampus is damaged. Researchers have found correlations between hippocampal damage following trauma and memory deficits. For example, in a study by Bremner et al. (2003) women with PTSD following child sexual abuse had reduced hippocampal volume and decreased hippocampal activation during verbal declarative memory tasks. Hippocampal dysfunction was also found to be associated with impaired memory retrieval under both structured and unstructured tasks.

Several researchers have documented explicit memory deficits following trauma exposure unrelated to the traumatic event. Horner and Hamner (2002) found everyday memory deficits in a sample of combat veterans who had PTSD. Barrett et al. (1996) found deficits in visual and verbal list-learning short-term memory for combat veterans with PTSD and another co-morbid diagnosis. It was also noted that there was little difference (non-significant) between structured and unstructured tasks.

Some researchers argue that memory problems only partially explain differences in performance on memory tests between individuals with PTSD and those without. One of the explanations for this is that the hypervigilance associated with PTSD heightens sensitivity in individuals to pro-active and retro-active interference on initial learning (Uddo, Vasterling, Brailey, & Sutker, 1993; Vasterling et al., 1998, 2000; Yehuda et al., 1995). Thus, PTSD is not associated with degraded retention when the initial formation is controlled for (Brandes et al., 2002; Bremner et al., 1993, 1995; Jenkins et al., 1998; Vasterling et al., 1998, 2000, 2002). With a variety of different methodologies used to assess differences in memory and learning following different traumatic experiences in different populations there is confusion within the literature as to whether true functional memory deficits have been observed following trauma. Theoretically, the traumatic stress response affects regions of brain functioning, such as the hippocampus, which could lead to functional memory deficits as have been demonstrated in the traumatic stress literature. In adults, there is still room for debate as to whether memory and learning are truly affected, or if there is dysfunction in the prefrontal cortex causing attentional and encoding deficits.

In children, there has been much less research on the effects of the traumatic stress response on memory and learning functioning. The two studies that have measured memory in children yield contrasting results. A study by Moradi, Doost, Taghavi, Yule, and Dagleish (1999) showed children with PTSD to have an overall poorer performance on the Rivermead Behavioral Memory Test than children without PTSD. However, in a study by Porter et al. (2005) no differences were found in memory functioning between child sexual abuse victims and non-abused controls when controlling for socioeconomic status, IQ, and attention and concentration. With such different comparison groups and such a limited amount of research, it is impossible to draw conclusive inferences on memory and learning in children following a traumatic stress response.

Visual-spatial Functioning

Visual-spatial functioning refers to an individual's ability to process visually and spatially presented information. It has been hypothesized that individuals would have altered visual-spatial functioning following a traumatic stress response due to hippocampal damage. It has been well documented that damage to the hippocampus has produced impairments in spatial processing. A question remains as to whether hippocampal damage following the traumatic stress response will lead to functional deficits in visual-spatial processing. In a study by Gurvits, Lasko, Repak, Metger, Orr, and Pitman (2002) individuals with PTSD were found to have decreased performance on measures of visual-spatial functioning when compared to individuals with a traumatic history and no PTSD. Other researchers could not attribute differences in visual-spatial performance solely to PTSD (e.g., Sullivan et al., 2003). Thus there is little and inconclusive evidence on the effects of visual-spatial performance in adults following traumatic stress, and no studies published to date with children or adolescents.

Language

Language functioning refers to an individual's ability to process and generate verbally presented information. Though there are no hypothesized effects of the traumatic stress response on language, language functioning must be explored nonetheless. By researching functional capacities that are not hypothesized to be effected by the traumatic stress response, the discriminant validity of the traumatic stress response can be explored. Gurvits et al. (1993) lends to the discriminant validity of the traumatic stress response with negative findings for dysgraphia and dysphasia following trauma in veterans. Most other researchers have found functional differences in language following trauma, though these are often attributed to other functional impairments. PTSD has been associated with performance decrements in word generation tasks for providing words that begin with a target letter (Bustamante, Mellman, & David, 2001; Gil et al., 1990; Koenen et al., 2001). There have been mixed results with categorical word generation tasks (Gil et al.,1990; Uddo et al., 1993). Shimamura et al. (2002) cautions that word-list generation tasks are sensitive to memory loss and prefrontal cortical dysfunction, a functional capacity that has been demonstrated to be compromised following the traumatic stress response. In juxtaposition, Matsuo, Taneichi, and Matsumoto (2003) relay that some regions may compensate for functional deficits in other regions and mask the effects of PTSD on functioning. Thus, similar to the debate in the visual-spatial traumatic stress response literature, language differences have not been parceled out from attention and executive functioning to draw conclusive inference as to the affects of the traumatic stress response on language functioning in adults. Also similar to the visual-spatial literature, there are no studies published to date with children or adolescents.

Motor Functioning

Motor functioning refers to an individual’s ability to execute intentional motor tasks and inhibit unintentional motor tasks. Motor functioning is not hypothesized to be affected by the traumatic stress response. Similar to language functioning, researching motor functioning following traumatic stress is valuable to exploration of the discriminant validity of the traumatic stress response hypothesis. Also similar to the language functioning literature, few studies have explored motor functioning following trauma in adults and no studies have sampled children or adolescents. In general, motor functioning was fond to not be affected following PTSD (Gurvits et al., 2000, 2002a, 2002b; Sullivan et al., 2003). However Vasterling and Brailey (2005) caution that executive functioning impairments resulting from PTSD can masquerade as motor functioning deficits. Similarly, motor tasks that require executive functioning are affected by PTSD (e.g., Gurvits 1993, 2000). In addition to executive functioning confounds, substance use, head injury, and presence of childhood ADHD diagnoses have been found to obfuscate correlations between PTSD and motor functioning deficits (Gurvits et al., 2000, 2002a, 2002b). Thus, the literature supports executive functioning deficits consistent with those hypothesized by the traumatic stress response while excluding motor functioning deficits, which is also consistent with the traumatic stress response.

Summary and Conclusions

The traumatic stress response is a comprehensive terminology for an individual's response to a stressor that alters their ability to respond to stress. It encompasses the context of the individual's environment, the nature of the traumatic event, the resultant neurochemical cascade within the brain, and the changes in the individual's functioning following that neurochemical cascade. When developmental considerations are taken into account, the traumatic stress response is an experience outside the average expectable environment that has the potential to alter an individual's developmental trajectory. While adults are susceptible to effects of neuroendocrine dysregulation of the HPA-Axis, Prefrontal Cortex, and Limbic system, children are also susceptible to effects on total brain volume, corpus callosum volume, and cortisol dysregulation. The occurrence of traumatic events during childhood can alter the developmental trajectory through prevention of experience-expectant phenomena (e.g., impairing myelination) or experience-dependent phenomena (e.g., preventing integration of environmental stimuli to reinforce children's seeking of positive adult interactions). Alterations of the developmental trajectory of children can lead to emotional, behavioral and cognitive difficulties. Neuropsychological research has linked neuropsychological deficits in cognitive capacity, attention and executive functioning in children to the traumatic stress response. Further, these deficits correlate with regions of the brain affected by the traumatic stress response that also correlate with clinical presentation of symptoms (e.g., Schwartz & Perry, 1994).

Different literature bases have made unique contributions to explore and explain the traumatic stress response in children. Much of the initial research was in adult literature, which contributed studies of diagnosis-based sample group comparisons. While many of these studies have helped to parcel out differences between individuals who do and do not meet diagnostic criteria for post-traumatic stress disorder, much sensitivity is lost in comparing populations on a dichotomous, categorical variable, such as diagnosis. Neuropsychological animal research has offered the most experimental rigor to the study of traumatic stress by using methodologies that control many more variables than would be possible with human research. Animal research often uses invasive techniques not allowed with human children and can only approximate the emotional and cognitive experiences of humans. Clinical neuropsychology has begun to parcel out these differences in performance of different functional domains, but again, most research has been conducted with adults. Developmental traumatology has offered the most studies of the traumatic stress response in children. Though this vein of research generally accounts for developmental contributions through an ecosystemic theoretical framework, most research has focused on clinical presentation and emotional functioning of children rather than the same domains accounted for with clinical neuropsychology research. Thus there is much room for future research studies to bridge the different findings of the different literature bases that contribute to the traumatic stress response framework in children.

Based on a review of the literature, the following are important considerations for future research. For one, future research should be careful to be more inclusive, rather than exclusive with subject recruitment. As such, traumatic experiences should determine inclusion criteria, with abuse experiences and individual responses examined as continuous, rather than categorical variables of diagnosis-based grouping. Another methodological consideration is more robust assessment of children's functioning. Future research of the traumatic stress response in maltreated children should include assessments of thoughts, feelings, and behaviors of participants. As such future research models should assess for and address ambiguous symptom presentation of behavior dysregulation that could be indicative of the traumatic stress response. Finally, future research should consider replicating or approximating adult studies with child and adolescent samples.

The potential for early behavior, information processing, and stress-response dysregulation has been hypothesized by developmental traumatologists to alter individual's developmental trajectory such that dsyregulation will be evident in adulthood. However, if neuropsychological capacities are affected by traumatic stress in childhood as hypothesized by psychiatry, clinical neuropsychology, and developmental traumatology research, treatment of traumatic stress response should lead to improved neuropsychological functioning. At this point in time, most research on the traumatic stress response has followed one of two veins. The first is a predominantly biological route of treating traumatized individuals psychopharmacologically and evaluating outcomes based on PTSD symptom alleviation and cortisol regulation (e.g., De Quervain, 2006). It should be noted that these studies have been conducted exclusively in the adult population. The second vein is a predominantly clinical psychotherapeutic evaluation of individual's response to individual therapy with evaluations based on alleviation of trauma-related psychological symptoms. While there have been many studies demonstrating the effectiveness of psychotherapy for reducing trauma symptoms in children and adolescents, a review of such literature is beyond the scope of this paper.

What has not yet been done is an evaluation of neuropsychological changes (i.e., changes in information processing and neutral stimuli) throughout the course of treatment for traumatic stress in youth.

Purpose of the Present Study

The purpose of this research was to explore the effects of the traumatic stress response on sexually abused adolescents' through a two-tiered study of neuropsychological functioning throughout treatment. Specifically, two primary research questions were addressed:

1. Are there measurable differences in neuropsychological processing in sexually abused adolescents throughout the course of treatment?
2. Are any changes in neuropsychological functioning related to changes in behavioral or emotional functioning?

Because these questions are novel to exploration within a treatment context, there was a need for a two-tiered study. First, an exploratory study was needed to determine the basic feasibility of conducting such research within a treatment intervention. An exploratory study allowed for trouble-shooting implementation of this research within a treatment setting such that the secondary study was designed to circumvent methodological problems of the first study. The aims of the second study focus directly on the research questions with feasibility questions addressed through the revised experimental design.

Aims for Exploratory Study

1. Determine feasibility of utilizing a repeated assessment of neuropsychological processing during sexual abuse treatment.
   a. A brief, computerized neuropsychological assessment was tested. It was hypothesized that such assessment would be feasible during the context of

sexual abuse treatment, but that unforeseeable obstacles would need to be addressed in future experimental design.

2. Detect changes of neuropsychological functioning in the domains of attention, memory, and executive functioning that can be assessed throughout the course of a 12-week sexual abuse intervention.

    a. It was hypothesized that improvements in neuropsychological functioning would be detected during the course of sexual abuse intervention. Given that the treatment is designed to improve emotional and behavioral functioning, as well as knowledge, neuropsychological changes were expected to be small for most youth. Youth who presented to treatment with more significant clinical symptoms that may be impacting neuropsychological functioning would show the most change.

3. Evaluate performances on repeated neuropsychological assessments for a priming effect from direct inquiry about personal trauma experiences immediately prior to neuropsychological assessment.

    a. It was hypothesized that individuals would demonstrate a decrease in performance on neuropsychological assessment when it follows completion of a self-report measure about the impact of trauma experiences.

Aims for Second Study

1. Determine if sexually-abused youth show improvements in emotional and behavioral functioning during the 12-week sexual abuse intervention.

a. Prior to examining changes in neuropsychological functioning it was important to examine changes in clinical symptoms over the course of treatment. It was hypothesized that a single-subject design would demonstrate improvements in emotional and behavioral symptoms. While all youth are expected to show improvements, those with the most significant clinical symptoms would show the most improvement.

2. Determine if there are changes in neuropsychological functioning in the domains of attention, memory, and executive functioning throughout the course of a 12-week sexual abuse intervention.

   a. It was hypothesized that improvements in neuropsychological functioning would be detected during the course of sexual abuse intervention. Youth who present to treatment with more significant clinical symptoms that may be impacting neuropsychological functioning would show the most change. Youth who present without clinical symptoms would be least likely to show neuropsychological change.

   b. Differences across types of neuropsychological functioning (attention, memory, executive functioning) were examined, but given the lack of research specific hypotheses were not proposed.

3. Evaluate changes in neuropsychological functioning related to changes in behavioral and emotional symptom presentation during the 12-week sexual abuse intervention.

   a. It was hypothesized that individuals with the most significant changes in behavioral and emotional functioning would also show the most significant changes in neuropsychological functioning throughout the course of treatment. These changes were predicted to be in the same direction. That is, if clinical symptoms improved, then neuropsychological functioning would show positive change. In the event of clinical symptoms worsening, then neuropsychological functioning was anticipated to show negative change.

b. Again, differences across types of neuropsychological functioning (attention, memory, executive functioning) were examined, but given the lack of research specific hypotheses were not proposed.

General Methodology

The methodology for this proposal is described in three parts. First, general methodology is described that is applicable to both tiers of the research. Then, methodology for the exploratory study is described. Finally, methodology specific to the second study is detailed after discussing the results of the initial study.

Participants

Participants for these research studies were adolescent participants in a 12-week sexual abuse group treatment program. Participants were between 12 and 17 years of age, both male and female. A total of 4 adolescents were included in each tier of the study, with a total of 8 adolescents. Participants were all female, except for one male in the exploratory study.

Measures

The measures used for both parts of this study are described in this section. The specific manner in which each measure is used is described in the Measures section of its respective study tier. Copies of the measures are included in the Appendix.

Automated Neuropsychological Assessment Metrics. The Automated Neuropsychological Assessment Metrics (ANAM) is a computerized neuropsychological battery that assesses change in participants' neuropsychological functioning with repeated administration over a period of time (Cernich, Reeves, Sun, & Bleiberg, 2007). The ANAM was originally designed for use with adult military populations to detect subtle changes in neurocognitive performance within an individual. The ANAM has been used with a variety of adult and adolescent populations. It has shown to be a valid and reliable means of detecting subtle changes in individuals' neurocognitive functioning

(Short, Cernich Wilken, & Kane, 2007; Roebuck-Spencer, Sun, Cernich, Farmer, & Bleiberg, 2007). A recent study demonstrated that the ANAM throughput scores were strongly correlated with performance on the Woodcock-Johnson Test of Cognitive Ability Cognitive Efficiency Cluster (Jones, Loe, Krach, Lager, & Jones, 2008). The ANAM is comprised of variety of subtests that can be selected to assess neuropsychological functional domains of interest. Each subtest is described as follows:

The Modified Stanford Sleepiness Scale is a self assessment of participant "sleep/fatigue state." The participant is given seven different statements describing alertness/sleepiness that range form "feeling very alert, wide awake, and energetic" to "very sleepy and cannot stay awake much longer." Participants select one statement that best describes their current state of alertness/sleepiness. This subtest takes less than one minute to administer.

Simple Reaction time is a measurement of simple reaction time to visually presented stimuli. The participant is presented with a series of asterisks (*) on the screen in irregular intervals. The participant is instructed to respond by clicking the left mouse button as quickly as possible when a stimulus is presented. This subtest takes 2-3 minutes to administer.

Standard Continuous Performance Test is a measure of sustained attention, concentration, and working memory. A randomly selected target letter is displayed for memorization to participants. A series of letters are then presented in sequence, including the target letter at random intervals. The participant is instructed to press the left mouse button only if the target letter is presented. This subtest takes 5-7 minutes to administer.

Code Substitution (Learning & Delayed) is a test of visual search, sustained attention, and working memory. Participants are presented with a set of nine digit-symbol pairs for reference at the top of the screen. Participants are then presented with a series of digit-symbol pairs in the middle of the screen that may or may not be incorrectly paired. Participants are instructed to press the left mouse button if pairs are correctly match and the right mouse button if pairs are incorrectly matched. This subtest takes 5-7 minutes to administer. After a delay interval of approximately 20 minutes, participants are presented with another series of digit-symbol pairs and asked to recall, from memory if stimuli are incorrectly paired and respond accordingly.

Logical Relations is a test of abstract reasoning and verbal syntax ability. This test is a verbal exercise in executive functioning. The participant is presented with a statement describing the order of two symbols displayed on the screen. The participant must press a button indicating whether or not the statement is true or false.

Matching to Sample is a test of spatial processing and visual-spatial working memory. The participant is presented with a colored grid to memorize. Then the participant is presented with two more grids side by side and asked to indicate which grid was presented previously.

Spatial Processing is a test of visual-spatial working memory and spatial processing. The participant is first presented with a target 4-bar histogram to memorize. Then a comparison 4-bar histogram is presented at a 90 degree clockwise or counter clockwise rotation. The participant must press a button indicating whether or not the comparison histogram matched the target histogram.

Tower Puzzle is a test of visual-spatial ability, motor control, rule adherence, spatial planning, and strategy development and execution. This is a visual test of executive functioning. It is a 2-D representation of the Tower of Hanoi. Three posts and five disks, each of a different size are presented on the screen. The participant is instructed to arrange the disks to match a presented stimulus while adhering to the rules of only moving one disk at a time and not placing larger disks on top of smaller ones.

Child Behavior Checklist. The Child Behavior Checklist - Parent Report Form (CBCL; Achenbach, 1991) is a 113-item checklist used to assess parents' perceptions of social and behavioral functioning of their children. Parents are asked to rate the presence of problem behaviors in the previous six months on a three-point scale ranging from 0 (*not true*) to 2 (*very true or often true*). The Child Behavior Checklist is designed for use with parents of children between the ages of 4 and 18, and its scales have been normed by age and gender. The Child Behavior Checklist is a widely used instrument with well-established reliability and validity (Achenbach, 1991). For the present studies, it is used as a means of comparing adolescents' social and behavioral functioning to an age and gender-matched normative sample.

Children's Depression Inventory. The Children's Depression Inventory (CDI; Kovacs, 1992) is a 27-item self-report measure that assesses depression symptoms in children ages 7 to 17. Children are asked to endorse statements reflecting the cognitive and somatic symptoms of depression as they relate to themselves. Respondents are instructed to rate how they felt in the past two weeks based on three choices that are keyed from 0 to 2 with the higher scores indicating higher symptom severity. This measure has been found to be reliable with adequate internal consistency ranging from

.71 to .89. Test-retest reliability has also been established (.72 to .84). T-score norms are available for boys and girls separately ages 7 to 12 and 13 to 17.

Children's Fear of Related to Victimization. The Children's Fears Related to Victimization (CFRV) is a 27-item subscale of the Fear Survey Schedule for Children – Revised (FSSC-R; Ollendick, 1983) and was previously known as the Sexual Abuse Fear Evaluation or SAFE; Wolfe & Wolfe, 1986). The Children's Fears Related to Victimization lists situations that sexually abused children may find distressing (e.g., people not believing me). Using a 3-point likert-type scale, children rate from *none* to *a lot* how upsetting they find each situation. Initial psychometric data is available on the SAFE revealing two subscales (labeled as sex-associated fears and interpersonal discomfort) with alphas of .81 and .80, respectively (Wolfe et al., 1986; Wolfe, Gentile, & Klink, 1988).

Child History Form. The Children's History Form (CHF) is an unstructured interview that surveys sexual abuse-related information. The Child History Form is completed by one of the Project SAFE staff members by first referencing forensic reports. Then the information gathered is checking information with caregivers fro accuracy and completeness. Abuse characteristics gathered include age at onset and end of abuse, abuse duration, relationship to perpetrator, frequency of abuse, number of times abused, nature of abuse, and intrusiveness of abuse. For the present studies, the Child History Form is used as standardized means of collecting participants' sexual-abuse history.

Children's Impact of Traumatic Events – Revised. The Children's Impact of Traumatic Events – Revised (CITES; Wolfe, Gentile, Michienzi, Sas, & Wolfe, 1991) is a structured interview that measures the impact of sexual abuse from the child's perspective. It was designed for use with children between ages 8 and 16. The Children's Impact of Traumatic Events – Revised items are grouped into four domains of Post-Traumatic Stress, Abuse Attributions, Social Reactions, and Eroticism. Moderate support has been demonstrated for the psychometric properties of the Children's Impact of Traumatic Events – Revised (Chaffin & Shultz, 1999). Specifically, the four main scales performed well whereas other subscales demonstrated more variability. The instrument's temporal stability was found to be low; however, Chaffin and Shultz (1999) question whether this finding may reflect the lack of stability in sexual abuse related characteristics (e.g., symptoms, attributions, or perceptions) rather than Children's Impact of Traumatic Events – Revised's unreliability over time. For the present study, a sensitive measure of the impact of sexual abuse from a child's perspective is needed such that it can detect change within an individual throughout treatment.

Multidimensional Anxiety Scale for Children. The Mulitdimensional Anxiety Scale for Children (MASC; March, Parker, Sullivan, Stallings, & Conners, 1997) is a 39-item self-report measure that assesses general anxiety in children and adolescents ages 8 to 19. Respondents are asked to responses to each item on a frequency-based Likert type scale. The Total Anxiety score is based on items pertaining to physiological, subjective, and motor symptoms of anxiety. The MASC has excellent internal reliability, good retest reliability at 3 and 6 months, and fair mother-child agreement (March et al., 1997).

Wechsler Abbreviated Scale of Intelligence. The Wechsler Abbreviated Scale of Intelligence (WASI; 1999) is a widely used cognitive assessment with well established reliability and validity. The WASI is designed for use with individuals ages 6-86 to generate an estimate of intelligence in a time efficient manner. For the purposes of this research proposal, of the WASI was used to estimate general cognitive ability.

Weekly Problems Rating Scale. The Weekly Problems Scale (WPS-C; Sawyer, Futa, Hecht, & Hansen, 2004 was developed by Project SAFE researchers to provide a brief, efficient means of assessing multiple domains of child functioning. The scale originally consisted of 11 statements that youth (ages 7-17) are asked to rate to best describe their feelings and interactions during the past week. Higher scores on each scale are indicative of problems in functioning in the assessed domain. Good internal consistency, temporal stability, and construct validity have been demonstrated (Sawyer, Tsao, Hansen, & Flood, 2006). Recently, the Weekly Problems Scale- Child Version was updated to include 3 items that assess daily neuropsychological functioning in adolescents (e.g., ”I have trouble paying attention”). The Weekly Problems Rating Scale-Child Version Revised (WPS-CR) is intended for use with Project SAFE adolescents (ages 12-17).

Youth Self Report. The Youth Self-Report is a 125-item checklist used to assess adolescents' social and behavioral functioning (Achenbach, 1991b) Adolescents are asked to rate the presence of problem behaviors in the previous six months on a three-point scale ranging from 0 (*not true*) to 2 (*very true or often true*). The Youth Self-Report is designed for use with adolescents between the ages of 12 and 18, and its scales have been normed by age and gender. The Youth Self-Report is a widely used instrument with well-established reliability and validity (Achenbach, 1991b). It is used as a means of assessing adolescents' self-reported emotional and behavioral functioning in this research.

Procedures

Described here are general procedures that were applied in both studies. For both studies, recruitment of participants, the facility in which research and treatment was conducted, the informed consent procedures, and the general procedure of data collection are described as follows.

Recruitment. All research participants were recruited from Project SAFE (Sexual Abuse Family Education), which is a 12-week intervention of concurrent group therapies for sexually abused youth and their non-offending family members. Project SAFE participants are all asked to participate in research to further the understanding of sexual abuse treatment. Families do not have to participate in research to receive Project SAFE therapeutic services.

Setting. Data collection for both parts of this study took place at the Child Advocacy Center (CAC) of Lancaster County. The CAC serves youth of Southeastern Nebraska who have been maltreated or witnessed a violent crime. The CAC provides forensic interviews, medical examinations, advocacy services, and service provider education services to youth and their non-offending family members. The CAC also has an interagency agreement with the University of Nebraska-Lincoln Psychological Consultation Center to provide on-site consultation and therapeutic services. All Project SAFE services (i.e., assessment, treatment, consultation, and research) are conducted at the CAC.

Informed Consent. Prior to beginning treatment, all Project SAFE participants undergo a pre-treatment assessment. At this time all confidentiality, treatment and research procedures are described to participants. Consent and confidentiality procedures for treatment are in accord with the policies of the Psychological Consultation Center. Consent and confidentiality procedures for research are in accord with the UNL Institutional Review Board. Under both bodies, anonymity is ensured for participants. Participants were given a chance to ask questions about research procedures and it is made clear that participants may withdraw from research participation at any time and still receive therapeutic services. Caregivers gave their consent and youth give their assent to participating in therapeutic services and completing research procedures.

Data Collection. Data collection for this research project occurred simultaneously with general Project SAFE data collection. Project SAFE data collection occurs primarily at four time-points (i.e., T1, T2, T3, T4) and secondarily on a weekly basis with select assessments. The first pre-treatment assessment occurred soon after the family was referred for services. At this time all assessment measures were administered to participants. Following the T1 pre-treatment assessment, some participants (depending on the phase of this research study when they participated) were asked to fill out the WPS-R on a weekly basis until group begins. Once Project SAFE group began, all participants in both phases of this research study filled out either the WPS or the WPS-R on a weekly basis at each session of group therapy. Participants in this research study completed an assessment battery midway through treatment (T2; sixth session), at the end of treatment (T3; twelfth session) and three months following treatment (T4; follow-up) as did all Project SAFE participants. Additionally, participants in the exploratory study took a computerized assessment (ANAM) on the third and ninth weeks of treatment.

Treatment Overview

Project SAFE is a 12-week intervention of concurrent group therapies for sexually abused youth and their non-offending family members (Hansen, Hecht, & Futa, 1998). Groups are concurrent in that a caregivers group meets simultaneously, but separately from the groups for sexually abused youth. Group therapy follows a standardized protocol of content modules with specific topics and activities planned for each session (see the Appendix for brief descriptions of each session). From a systematic review of the literature intervention was designed to address three content areas (i.e., individual, relationships, and sex). Psychoeducational, skill-building, problem-solving, and supportive therapeutic techniques are used. A developmentally appropriate adolescent protocol was developed from the original child protocol that was used with all adolescent participants in this research study. Each session is 90 minutes in length and is structured to include a check-in at the beginning of each session, psychoeducation, group discussion and activities as the main part of each session, and a check-in of one child therapist with the parents' group at the end of session.

Project SAFE services have been offered through the University of Nebraska-Lincoln Family Interaction Skills Clinic since 1998. Services were moved to the Child Advocacy Center of Lancaster County in 2000 to facilitate service access for families. Project SAFE have been reported by both child victims and non-offending parents to improve child functioning (Campbell, Wilson, Evans, Sawyer, Tavkar, & Hansen, 2006; Hsu, 2003; Sawyer, Yancey, Hsu Tsao, Wynne, Hansen, & Flood, 2005).

Therapists

All therapists for Project SAFE are clinical doctoral candidates at the University of Nebraska-Lincoln Clinical Psychology Training Program. Each group is facilitated by a lead therapist who has completed her/his Master's Degree in Clinical Psychology and has previously facilitated the group. Each group also has a co-facilitator that may or may not have met both of the lead therapist requirements. Therapists received weekly group supervision from a licensed clinical psychologist.

Exploratory Study Method

Participants

Four adolescents participated in the exploratory study. All adolescents were in the Spring 2007 Project SAFE group for adolescents. Group attendance was generally good for Participants A, B, C, and D. Participant A missed the first session as she had not yet been referred to Project SAFE. Participant B attended all sessions. Participant C missed three sessions due to illness and school commitments. Participant D also missed three sessions due to illness and school commitments. A fifth adolescent, Participant E, attended three sessions of Project SAFE with the other participants. Participant E elected to not participate in this research as she had previously completed a Project SAFE group.

Participant A is a Caucasian female. She lives with both her biological parents and a younger sister, who was abused by the same perpetrator. Her family lives in a rural community. Her parents' combined income was stated to be between $15,001 and $25,000 annually. Both of her parents completed high school. Participant A was 14 years old and in the 8th grade at the time of her participation in Project SAFE. She was abused by an adult male family friend who was residing in the family house. She was abused over a 2 month period, starting at age 13 years. Her abuse consisted of exposure, fondling, digital penetration, and penile-vaginal penetration. It is unknown whether force or coercion were used. Her abuse was disclosed by her younger sister, who was simultaneously being abused by the same perpetrator. The police were contacted and court involvement was anticipated. Her abuse ended 2 months prior to the start of Project SAFE. As Participant A was referred for Project SAFE services after the initial session, pre-treatment assessment data was not obtainable.

Participant B is a Caucasian female. She alternates between living with her mother and her father and step-mother. Her family lives within the metropolitan area. Her father's household income was stated to be between $60,001 and $100,000 annually. Her mother's household income was stated to be between $25,001 and $40,000 annually. Both of her biological parents completed high school. Participant B was 13 years old and in the 8th grade at the time of her participation. She was abused during a single incident by an older male peer. Her abuse consisted of vaginal-penile penetration. She denied force or coercion, but she sustained life threatening injuries that indicated otherwise. She disclosed her abuse immediately following the incident as her injuries warranted immediate medical attention. The police were contacted and court involvement was anticipated. This incident occurred a few weeks prior to the start of Project SAFE.

Participant C is a Caucasian female. She resides primarily with her mother in the greater metropolitan area. She has regular contact with her father, who also resides in the greater metropolitan area. Her mother's household income was stated to be between $25,001 and $40,000 annually. Her highest level of education was high school. Participant C was 15 years old and in the 9th grade at the time of her participation in Project SAFE. She was abused by her step father over a three-year period. Participant C was abused an estimated seven times from age 12 to 14 years. Her abuse consisted of exposure, exposure to pornography, and fondling with the use of force. She disclosed her abuse three months prior to the start of Project SAFE. The police were contacted and there was court involvement.

Participant D is a Caucasian male. He resides primarily with his mother in the greater metropolitan area. He has regular contact with his father, who also resides in the greater metropolitan area. His mother's household income was stated to be between $25,001 and $40,000 annually. Her highest level of education was high school. Participant D was 13 years old and in the 8th grade at the time of his participation. He was abused by his step father over a three year period. Participant D was abused an estimated 14 times from age 11 to 13 years. His abuse consisted of exposure to pornography and physical abuse. He disclosed his abuse three months prior to the start of Project SAFE. The police were contacted, but there was no court involvement for Participant D.

Measures

Measures for the exploratory study were selected to assess individual participants' sexual abuse history (CHF), the impact of their sexual abuse history (CITES), potential change in neuropsychological processing (ANAM), and change in general functioning (WPS-C; WPS-P). Detection of the feasibility of utilizing a repeated assessment of neuropsychological processing during sexual abuse treatment was assessed via unstructured observation and participant feedback. These measures were described previously; the following sections describe more specifically why and how each measure is used in this study.

ANAM. The ANAM Traumatic Brain Injury (ANAM TBI) battery was used for the exploratory study as a selection of available subtests that could detect subtle changes in neurocognitive processing (Kane, Roebuck-Spencer, Short, Kabat, & Wilken, 2007).

The ANAM TBI battery is comprised of the Modified Stanford Sleepiness Scale, Simple Reaction Time 1 and 2, Code Substitution Learning and Delayed, Standard Continuous Performance Test Matching to Sample, and Spatial Processing. The primary subtests of interest were Simple Reaction Time 1 and 2 as measures of attention, and Code Substitution Learning and Delayed as measures of short-term memory. These subtests were of interest because they assessed neuropsychological domains (attention and memory) that are hypothesized to be affected by the traumatic stress response. Matching to Sample and Spatial Processing are measures of visual-perceptual skill, which is not a neuropsychological domain hypothesized to be effected by the traumatic stress response. Thus these two subtests were not included in analyses. The ANAM was administered at baseline, 3 weeks into treatment, 6 weeks into treatment (mid-point assessment), 9 weeks into treatment, post-treatment, and at the 3 month follow-up assessment.

CHF. As previously described, the CHF was used to gather background information on abuse characteristics. The primary purpose for the CHF in this research study was to determine if sexual abuse had occurred. The CHF is used more broadly with Project SAFE to gain a sense of the severity of abuse and the circumstances surrounding disclosure such that treatment can be tailored towards the child's needs.

CITES. For the purpose of the exploratory study, the CITES (Wolfe et al., 1991) was used as a means of assessing impact of sexual abuse experiences and inducing emotional priming (i.e., intentionally sensitizing a participant to experience a heightened emotional reaction to a stimulus). Because the CITES asks participants to reflect on their own abuse experiences while assessing for emotional impact via their responses, it is a highly emotion-invoking instrument. Thus it was the best measure in the standard battery repertoire for trying to induce emotional priming. It was also important to choose a priming measure that would not increase the stress level of participants beyond what they would normally experience as part of the assessment process, so an assessment measure that would have been given regardless of participation in this research project was selected.

WPS-C and WPS-P. The WPS-C and WPS-P (Sawyer et al., 2004) were used as a means of repeated assessment of general emotional and behavioral functioning from the participant's perspective and the parent's perspective. WPS's were given at baseline, every week prior to session, at post-treatment, and follow-up.

Research Design

A single-subject design (A-B-A; Baseline-Treatment-Follow up) was used for the exploratory study. In addition to its feasibility and efficiency, a single-subject design was chosen as the research questions are concerned with neurocognitive change in the individual, not change of a group. Further, the heterogeneity of symptom presentation for sexually abused youth precludes the assumption that a given participant sample will be a homogenous group. A more rigorous single-subject design was not feasible in this exploratory study. Youth began assessments at approximately the same time and then joined a group treatment, which precluded options such as a multiple-baseline design. In addition, a return-to-baseline design (e.g., A-B-A-B) was not feasible as much of the treatment consists of psychoeducation that cannot be "unlearned."

Procedures

Each participant proceeded through Project SAFE assessment and treatment as usual with the addition of the ANAM assessment measure at all regular time-point assessments and two additional sessions mid-treatment (i.e., session 3 and session 9). Assessments were timed such that the ANAM would be taken on a monthly basis, on the same computer, and held constant as taken as either before or after treatment session.

Varied within the study was administration of the CITES, either before or after the ANAM to ascertain any potential priming effects on neurocognitive processing. A primed control (Participant C) received the CITES at each time-point prior to the ANAM, an unprimed control (Participant B) received the CITES at each time-point after the ANAM, and the two other participants (Participant D and Participant A) altered between receiving the CITES before and after the ANAM at each time-point. Participant D and Participant A were balanced such that they never received the same primed or unprimed condition together at the same time-point.

Exploratory Study Results

Aim 1: Feasibility

There were several observations made regarding the feasibility of implementing a repeated assessment of neuropsychological processing during sexual abuse treatment. First, completion of ANAM testing during treatment was burdensome to families. Families had to either arrive 30 minutes early or stay 30 minutes late to complete testing on weeks 3 and 9 of intervention. For some families, this meant that their children did not arrive home until after their bedtime or that it intruded into homework time. This was particularly cumbersome for rural families who traveled long distances and families with children who had academic difficulties, respectively. These constraints lead to the decision that future studies should ensure that repeated assessment measures are kept to a minimum to minimize the time impact on families. Further, with such a sensitive measure of participant functioning, it was important to not add stress through the experimental design that would obscure detection of the traumatic stress response as measured by adolescents' neurocognitive functioning performance throughout treatment.

Another set of observations were made regarding feasibility that involved testing conditions. As only one computer was available for the exploratory study, participants had to rotate between taking the ANAM and other assessment measures. With limited space at the Child Advocacy Center, all participants had to be in the same room throughout the testing procedure. Most of the time, therapists were present in the room with participants while testing. However, when therapists had to leave the room (e.g., for private administration of the CITES to participants in a separate area) participants would often break from testing to talk with each other or text message other friends. This obscured test results on timed ANAM subtests. In the future, participants will be in a more distraction-free environment. It is expected that given the constraints of the facilities, the most distraction-free environment will be obtained by simultaneous administration of ANAM to all participants on multiple computers. It should be noted that this is commonly how the ANAM is administered in sports-medicine environments.

A third observation regarding feasibility that was implied previously was participant boredom. Participants complained about the frequency with which they had to take ANAM and the length of time that taking ANAM added to their evenings. It should be noted that they did not complain about other individual assessment measures as they were administered less frequently and were more interesting than ANAM. As such three possible solutions were generated. One solution was to limit the number of ANAM administrations, as mentioned previously. A second possibility is simultaneous ANAM administration to cut down on the total assessment time. A third possible solution to keep motivation high despite boredom, would be to offer an additional small, reinforcer from the group “prize box” on days that assessments must be completed. It should be noted that reinforcers are regularly given to all Project SAFE youth for participation and that they are small in both size and monetary cost (e.g., a pencil or a sheet of stickers). Thus implementing all three solutions is suggested for future research.

Finally, a fourth observation was made regarding feasibility. Prioritizing clinical treatment precluded strict adherence to the assessment schedule. If participants arrived late, had to leave early, or could not attend session, the assessment had to be rescheduled. Though this was an anticipated possibility when the exploratory study was designed, it is probable that the impact of an additional repeated assessment measure can be minimized in future studies by incorporating these assessments during the regularly scheduled time-point assessment sessions at pre-treatment, mid-treatment, post-treatment, and follow-up. These sessions are scheduled on days with shorter therapy sessions (i.e., mid-treatment and post-treatment) and/or dates and times specified by each family (i.e., pre-treatment and follow-up).

Overall, it was determined that utilizing a repeated assessment measure of neuropsychological processing was feasible during sexual abuse treatment with the following suggestions given for streamlining the process in future studies. Future studies should have a predetermined schedule for therapy sessions and assessment sessions that limits the total amount of participant engagement to no more than the typical therapy session length (e.g., 45-75 minutes). Assessment administration should be minimized to guard against participant fatigue. To facilitate participant involvement in assessments, researchers may want to offer assessment sessions that alternate with therapy sessions or offer flexibility in assessments times for families with fluctuating schedules. If completing performance measures, adolescents should be tested simultaneously such that they minimize distraction to each other. Finally, an incentive system should be utilized to keep participants continually motivated to optimal performance.

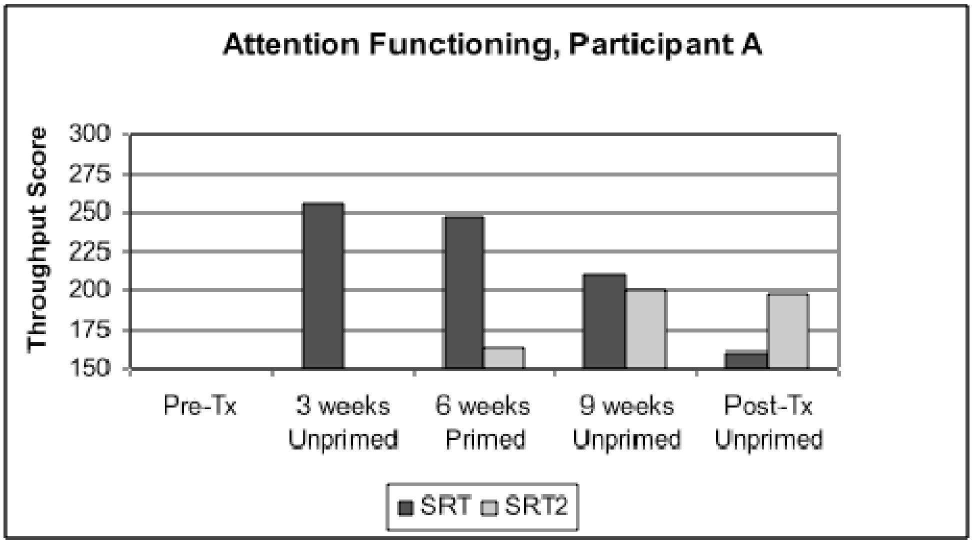
Aim 2: Detectable Changes

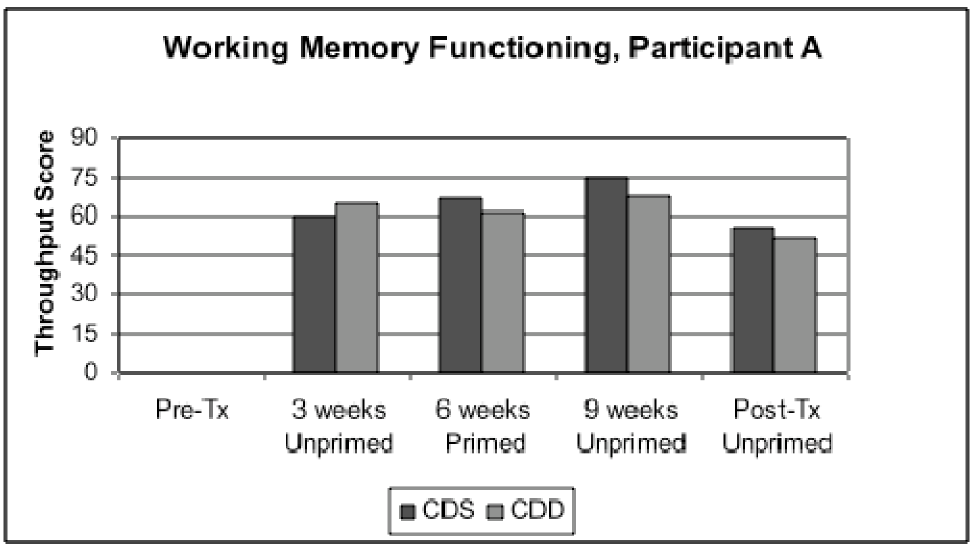
Detectable change in neuropsychological functioning was examined from performance on ANAM subtests. The ANAM Sports-medicine battery was available for use during the exploratory study. The subtests of Reaction Time 1 and 2 were used as measures of attention, and Code Substitution Learning and Delayed as measures of short-term memory. For each participant, performance on each subtest generated a "throughput" score as a measure of accuracy in response to stimulus divided by reaction time. Each participant has two graphs, one of their attention subtests (Reaction Time 1 and 2) and one of their memory subtests (Code Substitution Learning and Delayed). Graphs show participant performance on subtests across time. As such, the dependent variable of neuropsychological functioning as measured by throughput is displayed on the y-axis, and the independent variable of time as demarcated by assessment period (i.e., pre-treatment, week three, mid-treatment, week nine, post-treatment, follow-up). This display allowed for visual examination of trends in neuropsychological functioning across time for each individual.

Evaluation of data was conducted in accord with Kazdin's criteria for visual inspection of single-subject research design (Kazdin, 2003, pp. 290-299). Phases of treatment were defined as pre-treatment, during treatment, and post-treatment. Data were examined for change in means of phases (i.e., the mean of throughput performance increases from pre-treatment to treatment to post-treatment), changes in level between phases (i.e., the throughput score at the end of pre-treatment should be lower than the throughput scores at the first time-point during treatment and the throughput scores at the last time-point during treatment should be lower than the throughput scores at the beginning of post-treatment), and change in slope (i.e., the slope of the throughput scores during treatment should be positive).

Participant A. As participant was not referred to Project SAFE until after the first session, pre-treatment data is not available for analysis. Visual inspection of Participant A's graphs (see Figure 1) demonstrated a change in means from the treatment phase to the post-treatment phase for both measures of attention and working memory, indicating that Participant A’s attention and working memory functioning were generally better during treatment than immediately following treatment. A similar trend was observed for change in levels, and is likely more attributable to a general decrease in performance across time rather than indicative of a response to a change in phase. Participant A’s graphs show a different response to change in slope between measures of attention and measure of working memory, with measures of working memory showing a positive slope, and improved performance throughout treatment and measures of attention show a negative slope and decrease in performance throughout treatment.

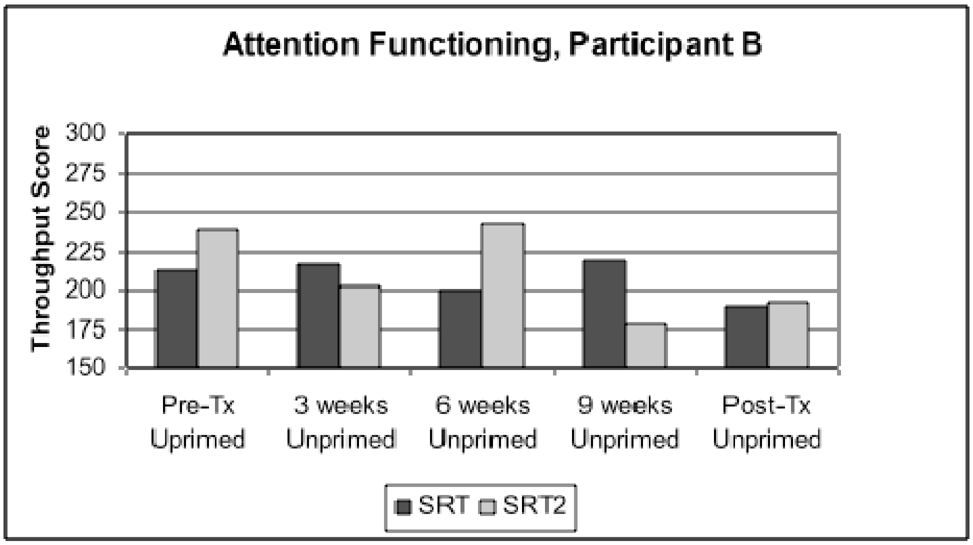
Figure 1: Performance on Measures of Neurocognitive Functioning, Participant A

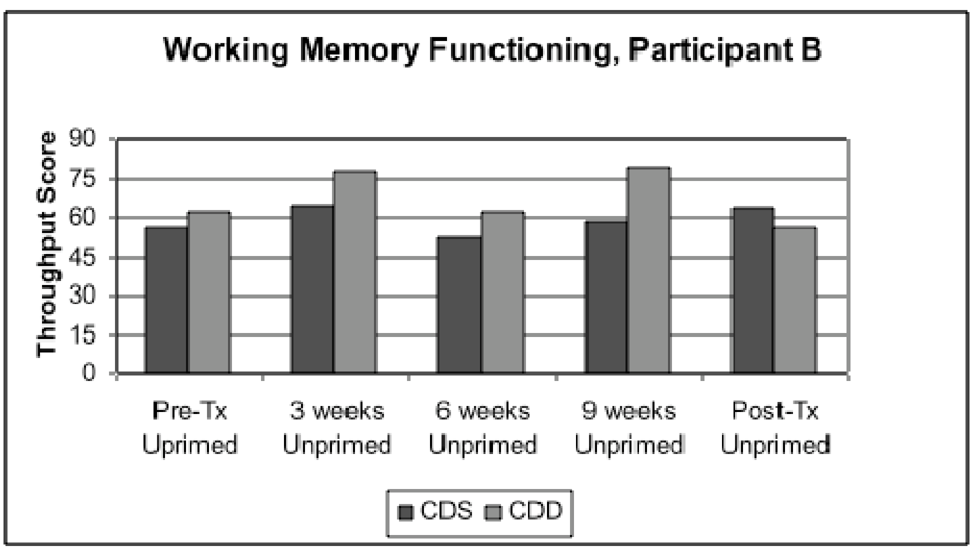




Participant B. Visual inspection of Participant B's graphs (see Figure 2) also demonstrated a continual, negative change in means from pre-treatment, through the treatment phase, and to the post-treatment phase for measures of attention, indicating that Participant B's attention performance generally declined throughout treatment. A different trend for change in means was noted for working memory in that Participant B's performance on measures of working memory was best during treatment than either at pre-treatment or post-treatment, which were similar to each other. A similar trend was observed in change of levels in that Participant B's performance on measures of attention was better at pre-treatment than at the first time-point during treatment, and better at the last time-point during treatment than at post-treatment. Change in levels mirrored the change in means for working memory measures for Participant B as well in that pre-treatment performance on measures of attention were worse than the first time-point during treatment and better at the last time-point during treatment than at post-treatment. Participant B's graphs do not show a change in slope during treatment for either measures of attention or memory. With the exception of performance on the Simple Reaction Time 2 subtest, Participant B's performance at Week 6 is noticeably poorer than her performance at either the Week 3 or Week 9 time-points.

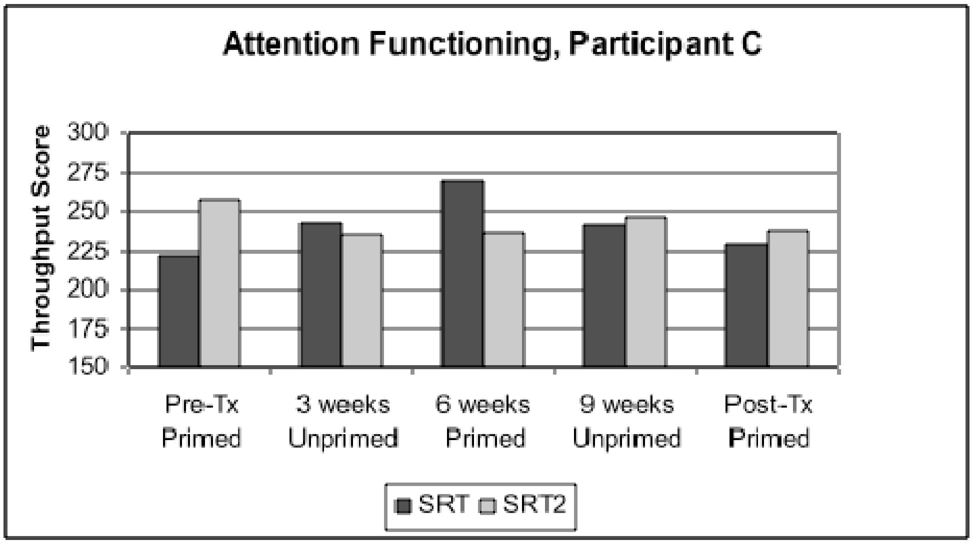
Figure 2: Performance on Measures of Neurocognitive Functioning, Participant B

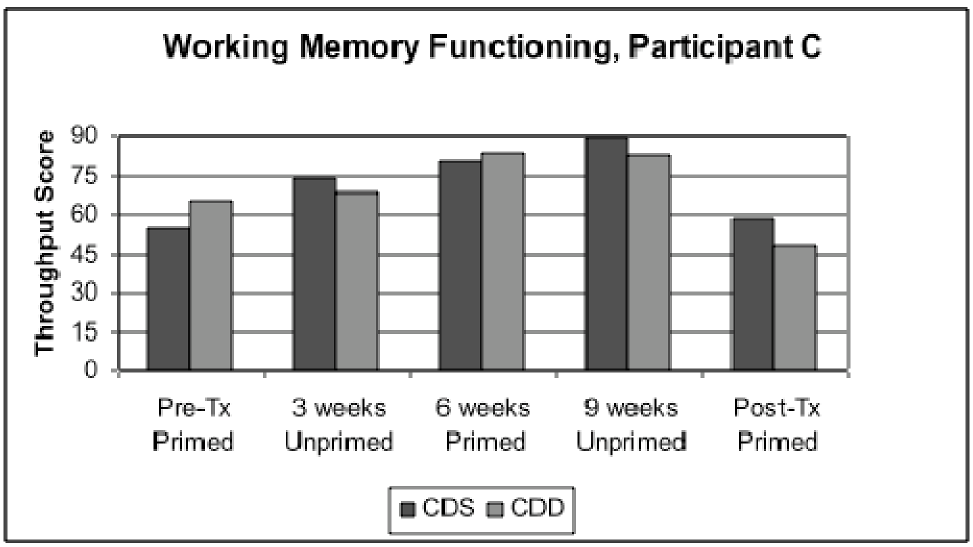




Participant C. Visual inspection of Participant C's graphs (see Figure 3) for a change in means of phases demonstrated better performance on measures of attention and working memory during treatment than either before or after treatment. A similar trend was observed for changes in levels in that Participant C's performance on measures of attention and working memory was better at pre-treatment than at the first time-point during treatment, and better at the last time-point during treatment than at post-treatment. During treatment, Participant C demonstrated a generally positive slope during treatment on measures of attention and working memory, with the exception of the Simple Reaction Time 1 subtest, in that her performance increased throughout treatment.

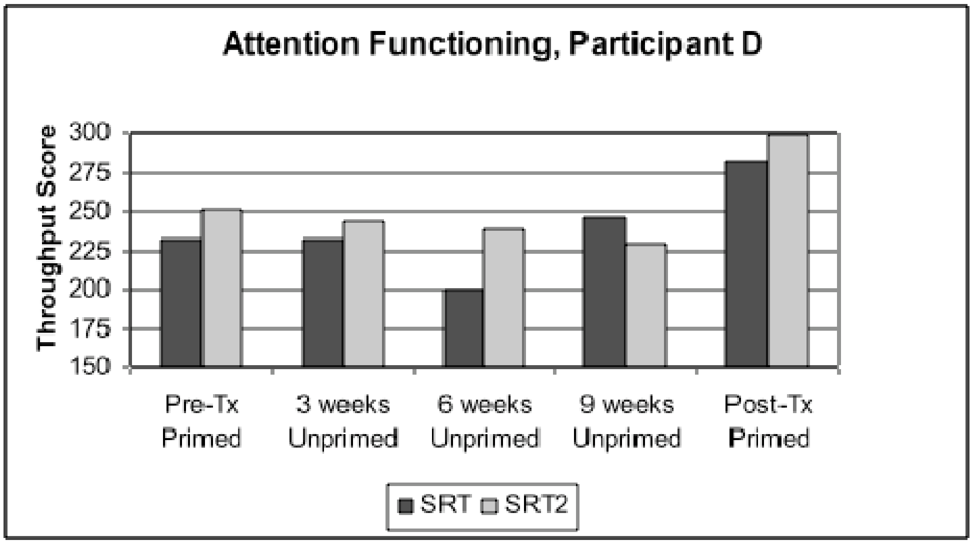
Figure 3: Performance on Measures of Neurocognitive Functioning, Participant C

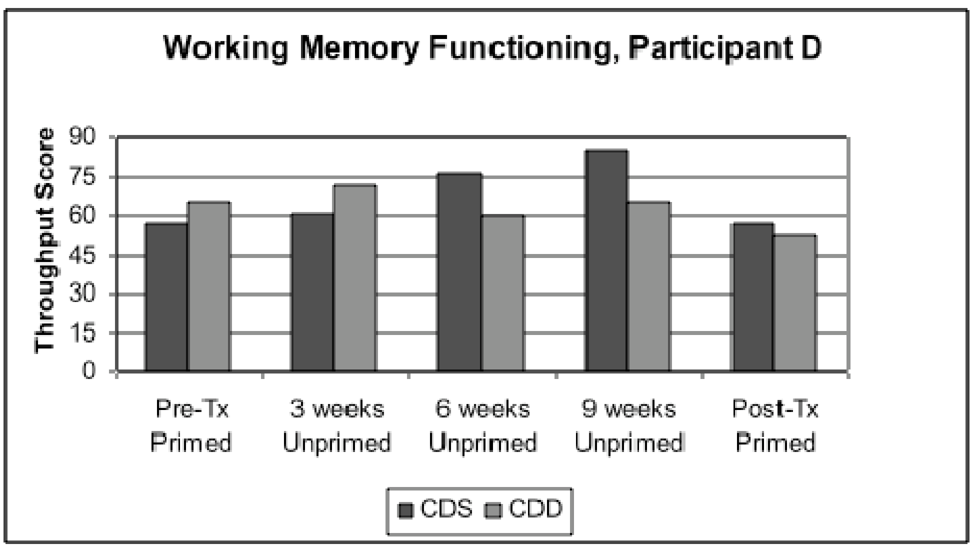




Participant D. Visual inspection of Participant D's graphs (see Figure 4) for a change in means of phases demonstrated that performance on measures of attention was best at post-treatment and worst during treatment. A different trend was observed on measures of working memory in that Participant D performed the best during treatment and worst post-treatment. Change in levels mirrored those observed for changes in means. Participant D's performance on measures of attention at pre-treatment was better than at the first time-point during treatment, and his performance at the last time-point during treatment was worse than his performance post-treatment. On measures of working memory, Participant D's performance at pre-treatment was worse than his performance at the first time during treatment, and better at the last time-point during treatment than at post-treatment. During treatment, Participant D demonstrated no discernible change in slope consistent across measures. Performance on the Simple Reaction Time 1 and Code Substitution Delayed subtests showed a dip in performance at Week 6 relative to Week 3 and Week 9 performance. Performance on the Simple Reaction Time 2 subtest showed a negative slope and decrease in performance during treatment. Performance on the Code Substitution subtest showed a positive slope and increase in performance during treatment.

Figure 4: Performance on Measures of Neurocognitive Functioning, Participant D



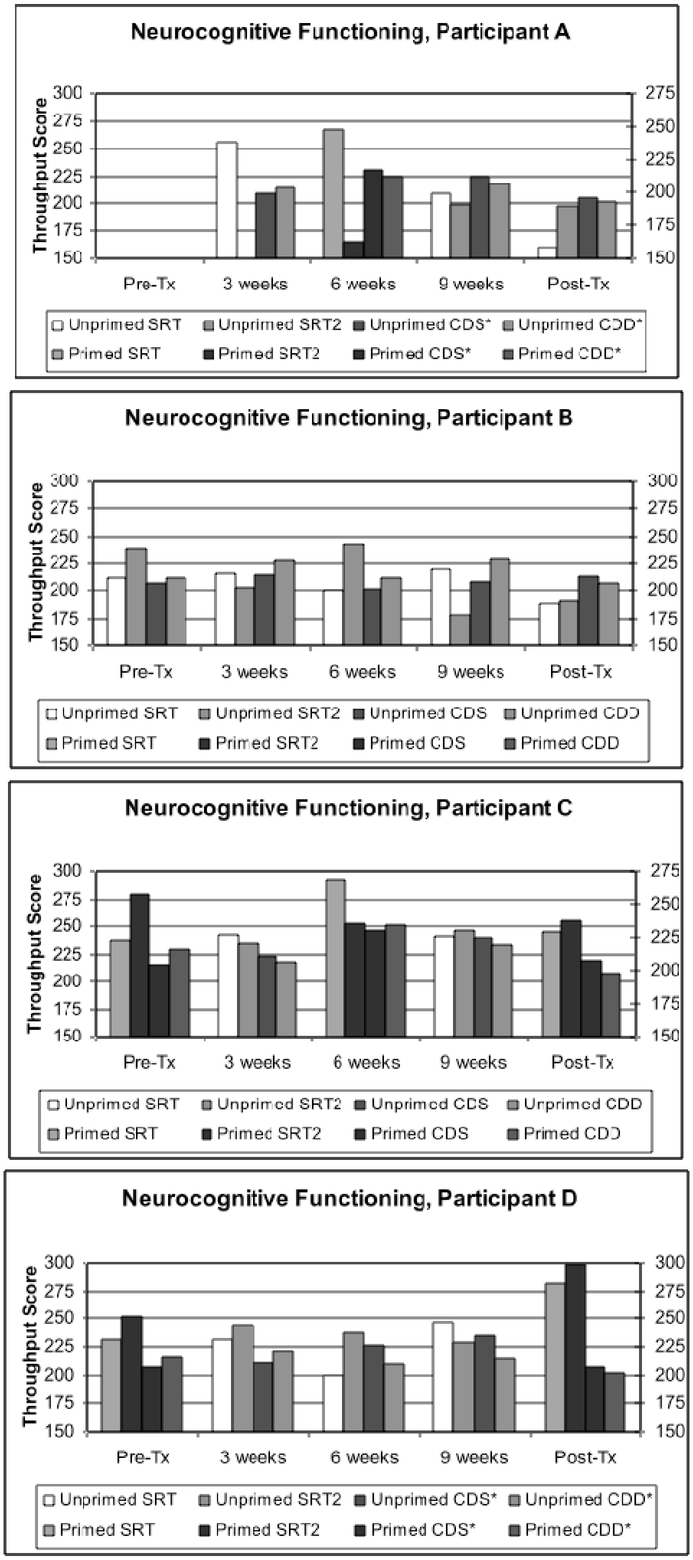


Aim 3: Priming Effect

Priming effects on neuropsychological functioning were examined visually from graphs similar to those described above (see Figure 5). For each participant, a graph was generated with multiple measures of neuropsychological functioning across time. The x-axis represents the independent measure of time demarcated by assessment session (identical to the above description). The y-axis represents the different dependent measures of neuropsychological functioning as measured by throughput on different ANAM subtests. These subtests were Simple Reaction Time 1 (SRT), Simple Reaction Time 2 (SRT2), Code Substitution Learning (CDS), and Code Substitution Delayed (CDD). All subtests are graphed together such that a main effect of change in neuropsychological performance can be assessed by visually comparing trends across an individual's subtest performances. To facilitate visual inspection of graphs, throughput scores of Code Substitution Learning and Delayed were uniformly increased by 150 such that the differences between these scores and those of Simple Reaction Time 1 and 2 did not skew interpretation. To facilitate examination of priming effects across participants, the four youths' graphs are displayed together on the same page. Primed subtests are noted by shaded bars. As noted previously, visual inspection of data was conducted using Kazdin's (2003) recommendations.

Visual inspection of all participants' graphs (Figure 5) for a change in means of phases between primed and unprimed phases did not reveal a significant difference between phase means that is unique to priming conditions. Similarly, a change in levels between pre-treatment and the first time-point of treatment and between the last time-point of treatment and post-treatment did not reveal a pattern unique to priming conditions. During treatment, there did appear to be an increase in performance on tests of neurocognition during Week 6 for participants in the primed condition relative to those in the unprimed condition. However, it is unclear as to whether this was an effect of priming and should be interpreted cautiously. Overall, priming was not found to have an effect on participants' performance on measures of neurocognition.

Figure 5: Performance on Measures of Neurocognitive Functioning, All Participants



Second Study Method

Participants

Five adolescents participated in the second study. All adolescents were in the late Spring 2008 Project SAFE group for adolescents. Group attendance was generally good for Participants W, X, Y, and Z. Participant W missed one session due to illness. Participant X had to miss three sessions due to a custody arrangement and court involvement. Participant Y missed two sessions due to chaotic family circumstances (e.g., house fire). Participant Z had to miss one session due to pregnancy-related issues. A fifth group member stopped attending sessions mid way through treatment for unknown reasons. Her family was unable to be contacted after this time. As such, her data were not included in analyses.

Participant W is a Caucasian female. She lives with her mother, step-father, and older siblings in rural community. Her family's combined income is stated to be between $60,001 and $100,000 annually. Her mother obtained her associate's degree. Participant W was 17 years old and in the 11th grade at the time of her participation in Project SAFE. Her general cognitive functioning was estimated to be in the Low Average range (WASI FSIQ = 82). She was abused by an older male peer when she was 16 years old. Her abuse consisted of a single incident of penile-vaginal penetration. Force was used. She disclosed her abuse to her brother, who in turn disclosed to their mother. The police were contacted, but court involvement in not anticipated. Her abuse occurred 3 months prior to receiving Brief Family Intervention services through Project SAFE, which was 7 months prior to the start of Project SAFE group.

Participant X is a Caucasian female. She lives with her mother in the greater metropolitan area. Her family's combined income is stated to be between $25,001 and $40,000 annually. Her mother obtained her associate's degree. Participant X was 13 years old and in the 8th grade at the time of her participation in Project SAFE. Her general cognitive functioning was estimated to be in the Average range (WASI FSIQ = 105). She was abused on six occasions over a two year period by an adult male family member from age 5 to 7 years. Her abuse consisted of exposure to pornography, fondling, and oral sex by force. She disclosed her abuse to her mother in the fall prior to the start of group. The police were contacted and court involvement occurred throughout the duration of group. The family received Brief Family Intervention services through Project SAFE, prior to the start of group. Participant X had to miss two sessions of group due to testifying in court and a custody arrangement.

Participant Y is a Caucasian female. She lives in a rural community with her biological parents who recently reconciled. She was intermittently residing with family friends during group as her house burned down near the start of group. Neither her family's combined income, nor was her parents' highest level of education disclosed. Participant Y was 14 years old and in the 9th grade during the time of her participation in Project SAFE. An estimate of her general cognitive functioning was not possible as the family was in crisis prior to group and unable to attend a pre-treatment assessment that would have measured her IQ. She was abused six times over a year period by an older male per. Her abuse consisted of exposure, exposure to pornography, fondling, digital penetration, and penile-vaginal penetration. Coercion was used, though the participant initially stated that all acts were consensual. Disclosure occurred when police confiscated the perpetrator's computer and found pornographic materials with Participant Y's image. Court involvement is anticipated. Disclosure occurred 4 months prior to the start of group. The family received Brief Family Intervention services through Project SAFE, prior to the start of group. Participant Y had to miss the last three sessions of group due to a custody arrangement. It should also be noted that caregiver weekly assessments were unavailable for the majority of group sessions as she was living separately from her family following loss of the family home in the fire.

Participant Z is a Caucasian female. She lives with her great aunt and an adult cousin in the greater metropolitan area. Her family's combined income is stated to be between $15,001 and $25,000. Her great aunt, who is her legal guardian, completed high school. Participant Z was 15 years old and in the 10th grade at the time of her participation in Project SAFE. Her general cognitive functioning was estimated to be in the Average range (WASI FSIQ = 98). She was abused by an adult male acquaintance. Her abuse consisted of a single incident of fondling and penile-vaginal penetration. It is unknown whether force or coercion was used. She disclosed her abuse to her great aunt. The police were contacted and court involvement is anticipated. Her abuse occurred 4 months prior to the start of Project SAFE. As Participant Z was referred for Project SAFE services after the initial session, pre-treatment multiple baseline assessment data was not obtainable.

Measures

Measures for the second study were selected to assess change in neuropsychological functioning throughout treatment (ANAM, WPS-CR, WPS-PR) and emotional and behavioral functioning (CBCL, CDI, CFRV, CITES, MASC, WPS-CR, WPS-PR, YSR).

ANAM. The ANAM Neuropsychological battery (Cernich et al., 2007; Roebuck-Spencer et al., 2007; Short et al., 2007) was used for the second study as a selection of available subtests that could detect subtle changes in neurocognitive processing. The ANAM Neuropsychological battery is comprised of the Modified Stanford Sleepiness Scale, Simple Reaction Time, Standard Continuous Performance Test, Code Substitution Learning and Delayed, Logical Relations, and Tower Puzzle. Subtests were selected to assess domains of interest as to minimize unnecessary testing of participants. The Simple Reaction Time and Standard Continuous Performance subtests were used as measures of attention. The Code Substitution Learning and Delayed subtests were used as measures of memory. The Logical Relations and Tower Puzzle subtests were used as measures of verbal and spatial executive functioning, respectively.

CBCL. The CBCL (Achenbach, 1991a) was used in the second study as a means of assessing parental perceptions of adolescents' emotional and behavioral functioning and comparing emotional functioning throughout treatment.

CDI. The CDI (Kovacs, 1992) was used in the second study as a measure of children's depressive symptoms. The CDI was used as a means of comparing depression functioning throughout treatment as well as a means of comparing individual emotional and behavioral functioning in reference to a normative group.

CFRV. The CFRV (Ollendick, 1983; Wolfe & Wolfe, 1986) was used in the second study as a means of gauging anxiety related to sexual abuse experiences. The

CFRV was used as a means of assessing emotional functioning in terms of adolescents' fears specifically related to revictimization throughout treatment.

CHF. As previously described, the CHF was used to gather background information on abuse characteristics. The primary purpose for the CHF in this research study was to determine the nature of the sexual abuse that occurred. The CHF is used more broadly with Project SAFE to gain a sense of the severity of abuse and the circumstances surrounding disclosure such that treatment can be tailored towards the child's needs.

CITES. For the purpose of the second study, the CITES (Wolfe et al., 1991) was used as a means of assessing impact of sexual abuse experiences throughout the course of treatment. Though there are four CITES domains assessed, in the second study the Post-Traumatic Stress domain was used as measures of sexual abuse impact on trauma symptom presentation.

MASC. The MASC (March et al., 1997) was used in the second study to broadly assess anxiety symptoms. The MASC was used as a means of comparing anxiety functioning throughout treatment as well as a means of comparing individual emotional and behavioral functioning in reference to a normative group

WPS-CR and WPS-PR. The WPS-C and WPS-P (Sawyer et al., 2004) was modified and used as a means of repeated assessment of general emotional and behavioral functioning from the participant's perspective and the parent's perspective, respectively, as in the exploratory study. With the addition of three items (see Appendix A) assessing attention, memory, and executive functioning, the WPS-CR and WPS-PR was also used as a repeated measure of neuropsychological functioning. The additional three items were needed to add ecological validity to the assessment of neuropsychological functioning in adolescents' regular environment.

YSR. The YSR (Achenbach, 1991b) was used in the second study as a means of assessing participants' emotional and behavioral functioning throughout treatment.

Research Design

The research design for the second study was also a single-subject design. This design fits the research questions of assessing change within the individual. A modification of a multiple-baseline across-subjects design was used. The design had to be modified as all youth were in the same group treatment. Staggered implementation of treatment by subject was not possible in a group intervention, so the baseline assessments were staggered by beginning baseline assessments at different intervals. This staggering was accomplished naturalistically, with baseline assessments beginning when participants were referred for treatment. Due to naturalistic staggering, two participants (B and C) had the same number of baseline assessments. Thus, youth had varied lengths of baseline but begin treatment at the same time. The baseline procedure for the second study included a more robust assessment of pre-treatment neuropsychological, emotional, and behavioral functioning. Pre-treatment baseline assessments included the entire battery of assessment measures. The WPS-CR and WPS-PR were administered on a weekly basis so that multiple baseline assessments could be obtained on individuals prior to treatment. Weekly administration of the WPS-CR and WPS-PR were continued throughout treatment. The entire assessment battery was repeated at mid-treatment, post-treatment, and 3-month post-treatment follow-up to assess for long-term change.

To minimize the impact of conducting this research within a treatment setting, repeated measures were kept to a minimum (i.e., only at regularly scheduled assessment intervals). Further, all adolescents received the same treatment conditions. As the priming effect in the exploratory study was not indicated by manipulating CITES administration with ANAM administration, this testing condition manipulation was not applied to the second study.

Second Study Results

Aim 1: Emotional and Behavioral Symptom Change

Detectable change in emotional and behavioral functioning was examined by responses to self-report and parent-report measures. Self-report measures of emotional and behavioral symptom presentation include the CDI, CFRV, CITES, MASC, WPS-CR, and YSR. Parent-report measures include the CBCL and WPS-PR. Two different graphical analyses were performed to examine change in emotional and behavioral functioning between participants and within participants. Change between participants was examined from graphical analyses of multiple baseline performance on WPS-R's. Each participant has their own bar graph and all participants' graphs are displayed on the same figure page (see Figure 6). The x-axis for graphs measures the independent variable of time, as demarcated by weekly increments (e.g., B-baseline, S-session, P-post-treatment). The y-axis displays the dependent variable of emotional and behavioral symptom presentation as measured by WPS-CR and WPS-PR total score responses. This display allows for visual examination of changes in emotional and behavioral symptom presentation within individual youth and across the varied multiple baselines between subjects.

Weekly Problems Scales-Revised evaluation. Evaluation of data was conducted in accord with Kazdin's criteria for visual inspection of single-subject research design (Kazdin, 2003). Phases of treatment were defined as baseline assessments, group treatment sessions, and post-treatment assessments. Data were examined for change in means of phases (i.e., the mean of total score decreases from baseline assessments to group treatment sessions to post-treatment assessments), changes in level between phases (i.e., the total score at the end of baselines assessments should be higher than the total scores at the first time-point during group treatment sessions and the total scores at the last time-point during group treatment sessions should be higher than the total scores at the beginning of post-treatment assessments), and change in slope (i.e., the slope of the total scores during baseline assessments, group treatment sessions, and post-treatment assessments should be negative).

Participant W. Visual inspection of Participant W's graph (see Figure 6) demonstrated a change in means from the baseline assessment phase to the group treatment phase for both self-report and caregiver-report measures, indicating that Participant W perceived her emotional and behavioral functioning as generally increasing from baseline assessment phase to group treatment phase to post-treatment assessment phase. Caregiver report indicated a general decrease in emotional and behavioral functioning from baseline assessment phase to group treatment phase, but an increase in functioning from group treatment phase to post-treatment assessment phase. A similar trend was observed for change in levels, and is likely more attributable to general functioning across time rather than an immediate reaction to the treatment phase. Participant W's graphs show a variable change in slope in the baseline assessment phase indicating an initial decrease and then increase in emotional and behavioral functioning as reported by both the participant and her caregiver. The change in slope for the group treatment and post-treatment assessment phases were generally decreasing, indicating a general increase in emotional and behavioral functioning throughout the group treatment and post-treatment assessment phases. A closer examination of the data reveals this to be attributable more to caregiver report indicating more significant improvement than participant report.

Participant X. Visual inspection of Participant X's graph (see Figure 6) demonstrated a change in means from the baseline assessment phase to the group treatment phase for both self-report and caregiver-report measures, indicating that Participant X perceived her emotional and behavioral functioning as generally increasing from baseline assessment phase to group treatment phase to post-treatment assessment phase. Caregiver report indicated a general decrease in emotional and behavioral functioning from baseline assessment phase to group treatment phase, but an increase in functioning from group treatment phase to post-treatment assessment phase. A similar trend was observed for change in levels, and is likely more attributable to general functioning across time rather than an immediate reaction to the treatment phase. Participant X's graphs show a negative change in slope in the baseline assessment phase indicating an increase in emotional and behavioral functioning as reported by both the participant and her caregiver. The change in slope for the group treatment phase was generally positive and the post-treatment assessment phase was generally negative, indicating a general decrease in emotional and behavioral functioning throughout the group treatment and an increase in functioning during the post-treatment assessment phase. The decrease in Participant X's emotional and behavioral functioning during the group treatment phase may be attributable in part, to learning of and preparing for testifying in court over the summer after treatment. The increase in functioning at the final post-treatment assessment is likely attributable in part, to a general increase in long-term emotional and behavioral functioning that was masked by the stress of the court appearance.

Participant Y. Visual inspection of Participant Y's graph (see Figure 6) demonstrated an increase in means from the baseline assessment phase to the group treatment phase and a decrease in means from the group treatment phase to the post-treatment assessment phase for self-report measures, indicating that Participant Y perceived her emotional and behavioral functioning as generally decreasing from baseline assessment phase to group treatment phase and increasing from the group treatment phase to the post-treatment assessment phase. Caregiver report demonstrated an opposite trend in phase means, indicating an opposite trend in perception of functioning. These opposite trends in change in mean of phases for emotional and behavior functioning was also mirrored by the change in level. Participant Y's graphs show a general increase in slope in the baseline assessment phase indicating a decrease in emotional and behavioral functioning as reported by both the participant and her caregiver prior to group. The change in slope for the group treatment phase was variable, but generally flat during the group treatment phase, indicating no change in emotional and behavioral functioning during group treatment as assessed by Participant Y and her caregiver. The change in slope during the post-treatment assessment phase was positive for self-report and negative for caregiver report, indicating that Participant Y assessed her emotional and behavioral functioning to have decreased but her caregiver assessed her functioning to have increased.

There are several reasons that may account for the opposite trends in emotional and behavioral functioning reported by Participant Y and her caregiver. For one, both

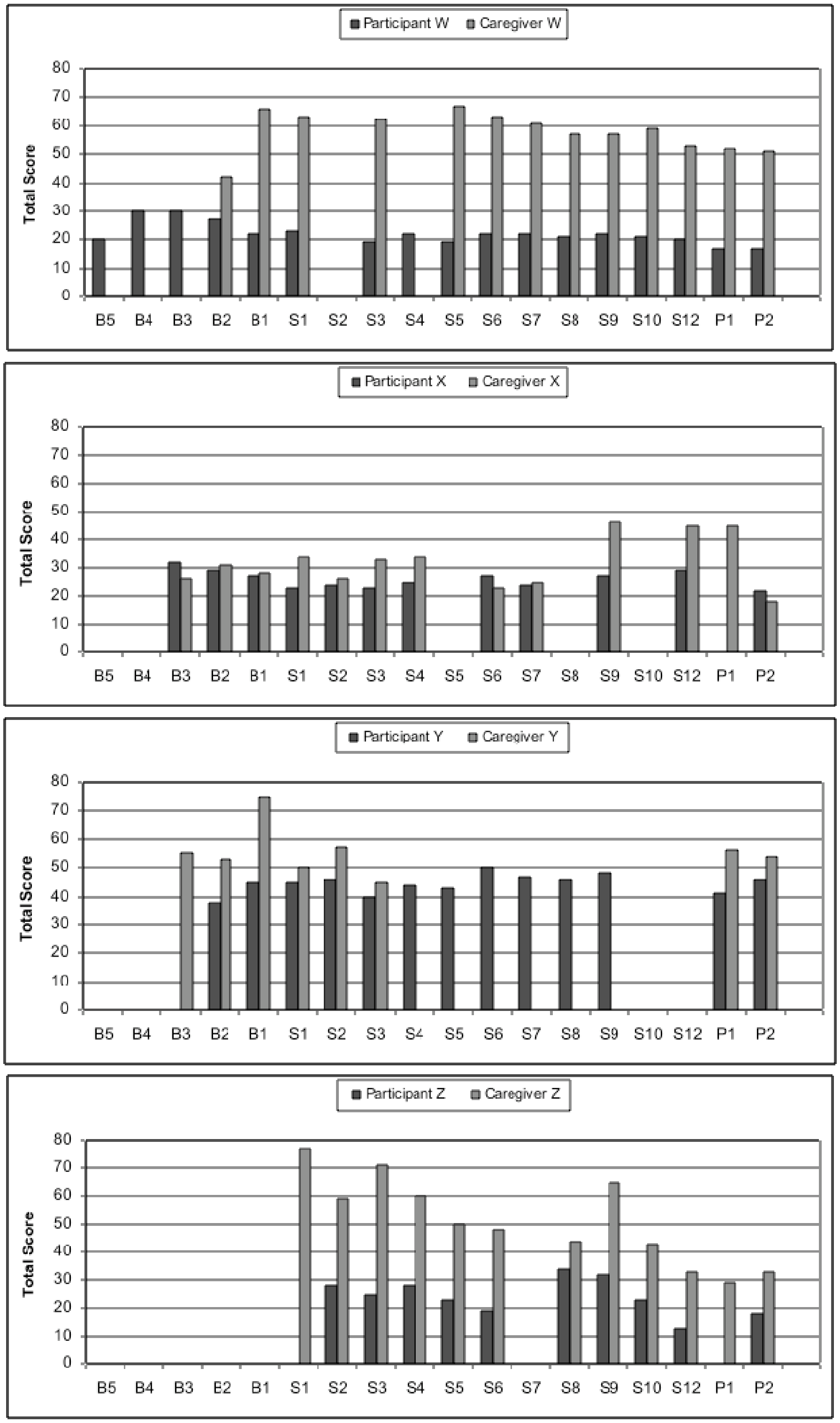
Participant Y and her caregiver described little communication between each other regarding emotional and behavioral functioning. For two, Participant Y and her caregiver resided separately for much of the group treatment sessions. Thus they had even less opportunity for communication than usual and Participant Y's caregiver declined to report on her functioning during this time. It is also important to highlight that no change in slope during treatment phase and a decrease in phase means may be more indicative of resilience following the added stress of the house fire and family separation than a decrease in functioning. If there had been a decrease in phase means from baseline assessment phase to group treatment phase and a decrease in slope of the group treatment phase then it would be more indicative of a decrease in emotional and behavioral functioning.

Participant Z. Visual inspection of Participant Z's graph (see Figure 6) demonstrated a decrease in means from the group treatment phase to the post-treatment assessment phase for both self-report and caregiver-report measures, indicating that Participant Z and her caregiver perceived her emotional and behavioral functioning as generally increasing from the group treatment phase to the post-treatment assessment phase. A similar trend was observed for change in levels according to caregiver report. However, there was an increase in change of levels according to Participant Z's self-report that indicated a decrease in emotional and behavioral functioning. As Participant Z gave birth in the interim between assessment points, this self-reported decrease in functioning is likely due, in part, to becoming a mother. Participant Z's graphs show a decrease in slope during the first half of the group treatment phase, then a sharp increase in mean, and another gradual decrease for both self-report and caregiver-report. The sharp increase in mean followed a session missed due to pregnancy-related health concerns. As slopes were decreasing both before and after the sharp increase, it is inferred that the change in slope for the group treatment phase is indicative of a general increase in emotional and behavioral functioning during the group treatment phase. As only a single time-point was available for Participant Z's self-report in the post-treatment phase, caregiver-report was utilized for evaluation of slope. Caregiver-report indicated a decrease in emotional and behavioral functioning following treatment. As previously mentioned, Participant Z gave birth after treatment and her decrease in functioning may be attributable, at least in part, to the stress of transitioning into motherhood.

Group. Utilization of a multiple baseline single-subject design allowed for evaluation of change in mean of phases, change in level, and change in slope of phases as a group (see Figure 6). Across participants, there was an overall decrease in means between baseline assessment phase and group treatment phase for participants according to self-report and an increase according to caregiver report. Thus participants viewed an increase in emotional and behavioral symptom functioning whereas their caregivers viewed a decrease in functioning from baseline assessment to group treatment. The change from group treatment phase to post-treatment assessment phase was negative for both self-report and caregiver-report, indicating an increase in emotional and behavior functioning. With regards to change in level, participants were variable in their self-report and no significant change was observable across the group. Caregivers reported increases from baseline assessment to group treatment and from group treatment to post-treatment, indicating a general increase in emotional and behavior functioning. The baseline assessment phase was generally negative for self-report and positive for caregiver report, indicating that participants viewed their emotional and behavior functioning increased during baseline and that caregiver viewed functioning as decreasing. During the group treatment phase, participants reported variable trends in slope and no over all pattern in slope could be determined. Caregivers reported an overall decrease in group treatment phase slope, indicating a general increase in emotional and behavior functioning throughout treatment. Both participants and caregivers reported an over decrease in slope during the post treatment assessment phase, indicating an overall increase in emotional and behavior functioning following the cessation of treatment.

Overall, participants reported an increase in their emotional and behavioral symptom functioning from the baseline assessment through group treatment to post-treatment. Their caregivers reported a decrease in participant emotional and behavioral symptom functioning from baseline assessment to group treatment, but an increase from group treatment to post-treatment.

Figure 6: Emotional and Behavioral Functioning, WPS-R Total scores: All Participants



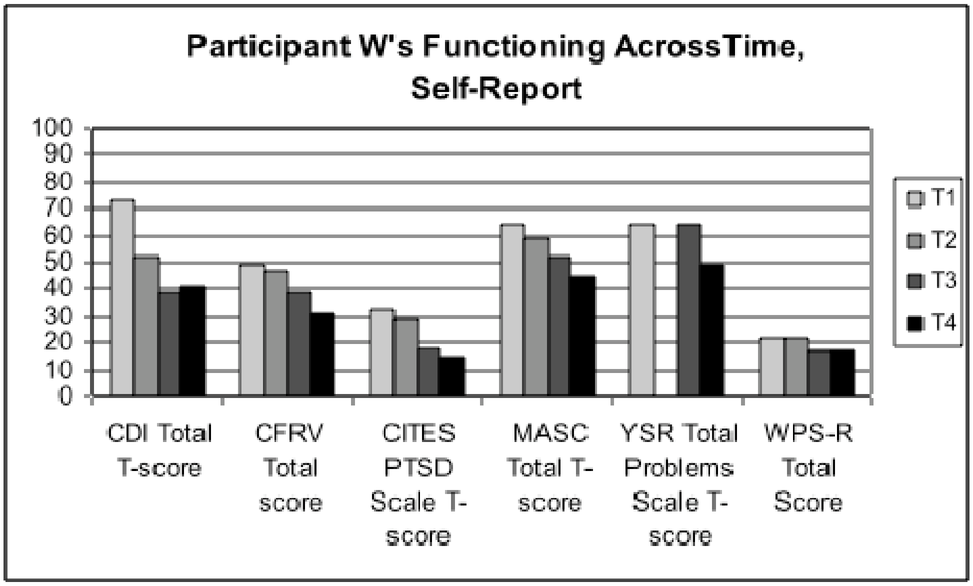
Note: B = Baseline Assessment, S = Therapy Session, P = Post-treatment Assessment

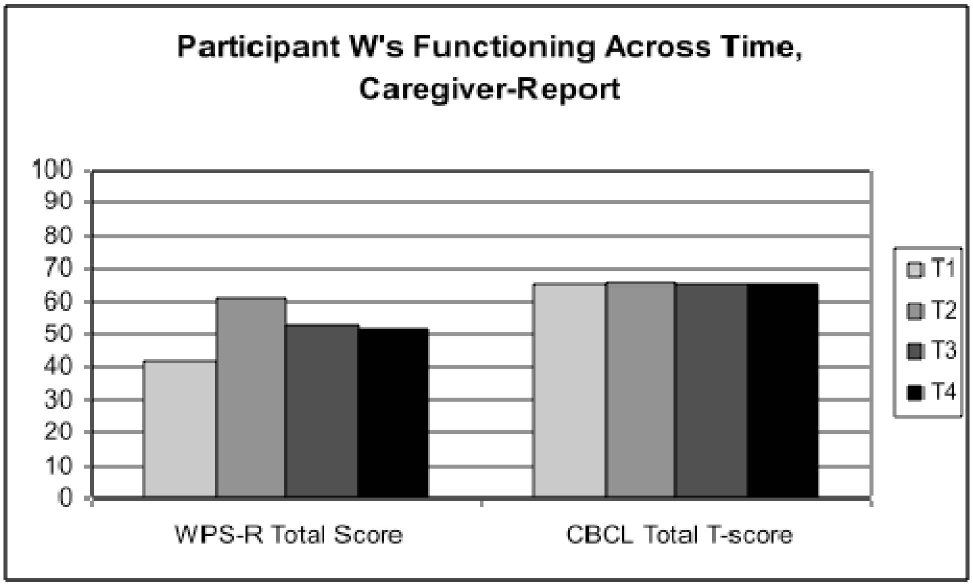
Time-point assessment evaluations. In addition to the aforementioned multiple-baseline display, each participant has their own bar graphs that display the responses to all emotional and behavioral assessment measures throughout treatment. The x-axis of these graphs shows the independent variables of time, as demarcated by assessment period (i.e., pre-treatment, mid-treatment, post-treatment, follow-up) and assessment measure. One graph depicts assessment measures filled out by the child (i.e., CDI, CFRV, CITES, RCMAS, WPS-CR, and YSR) and the other depicts assessment measures completed by the caregiver (CBCL and WPS-PR), yielding two graphs on each participants' figure page. On all graphs, different assessment periods are denoted by differences in bar shading, as relayed in the graph key. Each assessment measure has four differently shaded bars clustered next to each other to show change in performance on the measure throughout treatment. The y-axis of the bar graphs measures the total score on the assessment measures. This display allows for visual examination of changes in performance on measures of emotional and behavioral symptom presentation within a youth throughout treatment.

As previously described, evaluation of data was conducted in accord with Kazdin's (2003) criteria for visual inspection of single-subject research design. Phases of treatment were defined as baseline assessment (T1), mid-treatment assessment (T2), post-treatment assessments (T3), and follow-up assessment (T4). As T1 wand T3 were immediately preceding and following treatment, respectively, data are examined for overall trends in change of mean of phases (i.e., T1>T2>T3>T4), change in level from pre-treatment to follow-up (T1>T4), and the slope of time-points (i.e., a negative slope indicates an increase in emotional and behavioral functioning).

Participant W. Visual inspection of Participant W's graphs (see Figure 7) revealed an overall decrease in the mean of phases, a decrease in level from T1 to T4, and a consistently negative slope for all self-report measures. This indicated that Participant W viewed her emotional and behavioral functioning to have improved consistently throughout treatment. Visual inspection of Participant W's caregiver-report (Figure 7) demonstrated a subtle, but similar trend for CBCL total score. Caregiver-report of WPS-R total score indicated a general negative slope, but an increase in levels from T1 to T4. This suggested that Participant W's caregiver viewed her emotional and symptom functioning to have improved throughout treatment, but not in all areas to a level better than her pre-treatment functioning.

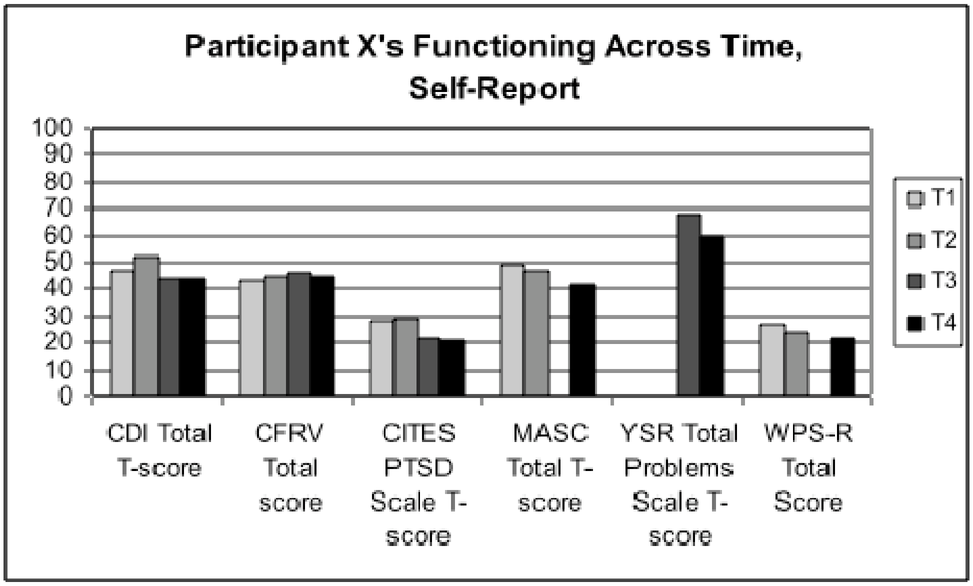
Figure 7: Emotional and Behavioral Functioning: Participant W

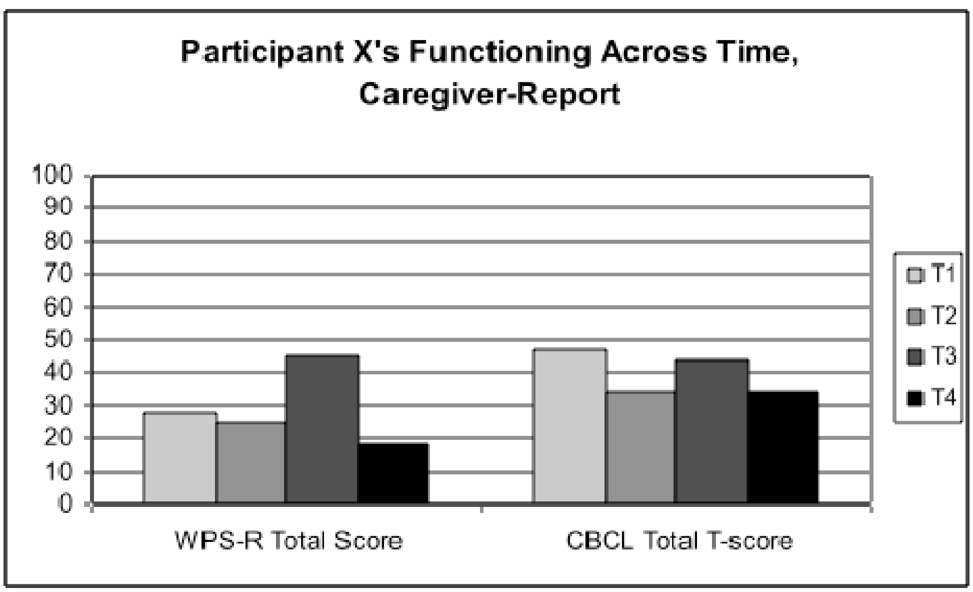




Participant X. Visual inspection of Participant X's graphs (see Figure 8) revealed variability in the change of mean of phases throughout treatment, a decrease in level from T1 to T4, and a variable, but generally negative slope for most self-report measures. This indicated that Participant X viewed her emotional and behavioral functioning to have fluctuated throughout treatment, but that she experienced a significant improvement from pre-treatment to post-treatment. Visual inspection of Participant X's caregiver-report (Figure 8) demonstrated a similar trend. Caregiver-report indicates variability in the change of mean of phases throughout treatment, a decrease in level from T1 to T4, and variable, but generally negative slope for caregiver-report. As such, caregiver report also indicated a fluctuation in the emotional and behavioral functioning of Participant X throughout treatment, but a general improvement in functioning from pre-treatment to follow-up.

Figure 8: Emotional and Behavioral Functioning: Participant X



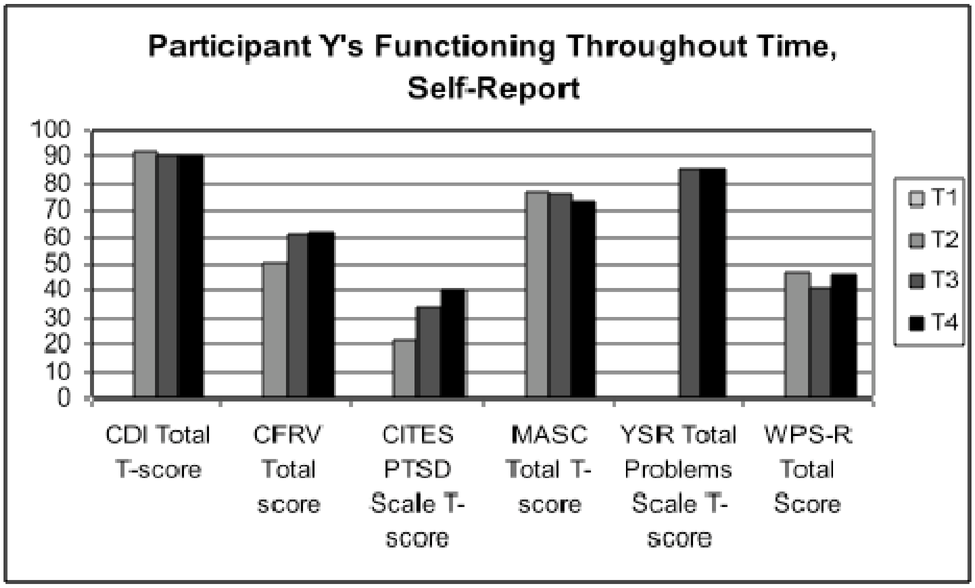


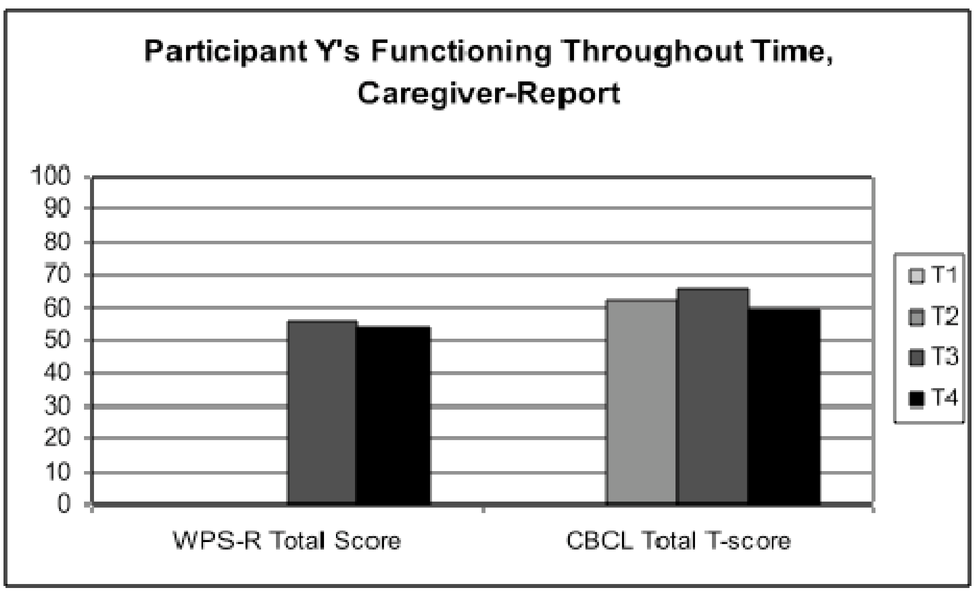
Participant Y. As previously mentioned, pre-treatment assessment was not possible for Participant Y as the family was in crisis at the time the assessment was scheduled and it would have been unethical to insist on assessment completion to begin group treatment. Thus, Participant Y's emotional and behavioral functioning was evaluated from mid-treatment (T2) to follow-up assessment (T4).

Visual inspection of Participant Y's self-report (see Figure 9) revealed a negative change in mean, level, or slope for CDI and MASC total scores. On the YSR and WPS-R, there is not change in mean, level, or slope. WPS-R total score. For the CFRV, CITES PTSD scale, and MASC total scores, a positive change in means, level, and slope is evident. Taken together, this indicated that Participant Y viewed her anxiety and depressive symptoms to have improved slightly throughout treatment, her general emotional and behavior functioning to remain generally constant throughout treatment, and her emotional and behavioral functioning with abuse-specific measures showing a decrease in functioning. These findings may be attributable in part to the change in perspective she experienced throughout treatment, Initially, she viewed her abuse as consensual but came to consider it coercive throughout treatment. As such, this was reflected in the increase in her CFRV and CITES PTSD scale total score increases. Additionally, it is important to remember that considering the high level of stressors she experienced during treatment (i.e., house fire, separation from family) a decrease in general functioning would be expected. As such, a lack of this decrease could be considered indicative of some resiliency in emotional and behavioral functioning.

Visual inspection of Participant Y's caregiver-report (see Figure 9) demonstrated a variable change in the mean of phases, a decrease in levels, and a slight, negative slope for both measures. This was indicative of a general improvement in emotional and behavioral functioning. However, this should be interpreted with caution as Participant Y's caregiver was stated that she was guessing at her functioning at T2 and T3 as they were not residing together at the time of the mid treatment assessment and had just returned to her household at the time of the post-treatment assessment.

Figure 9: Emotional and Behavioral Functioning: Participant Y

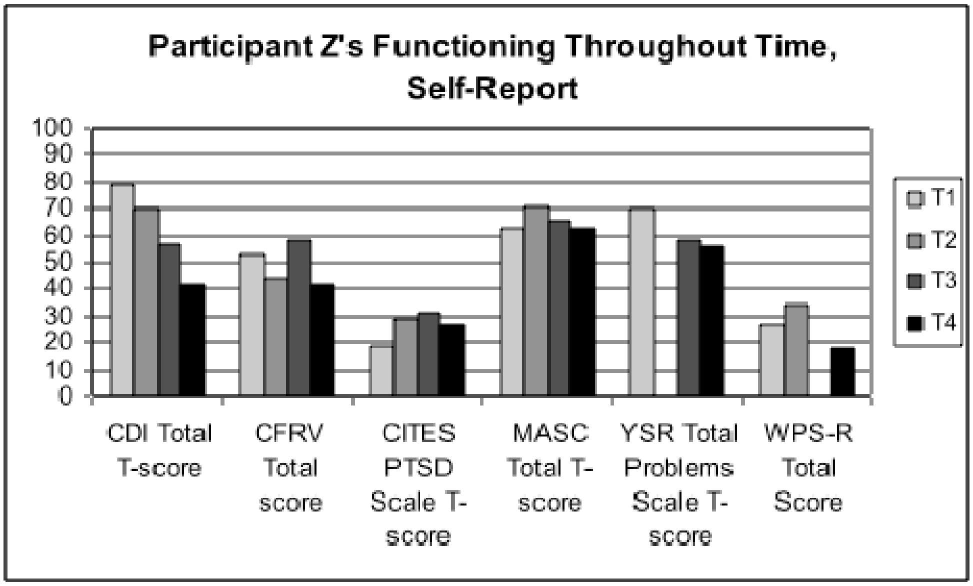


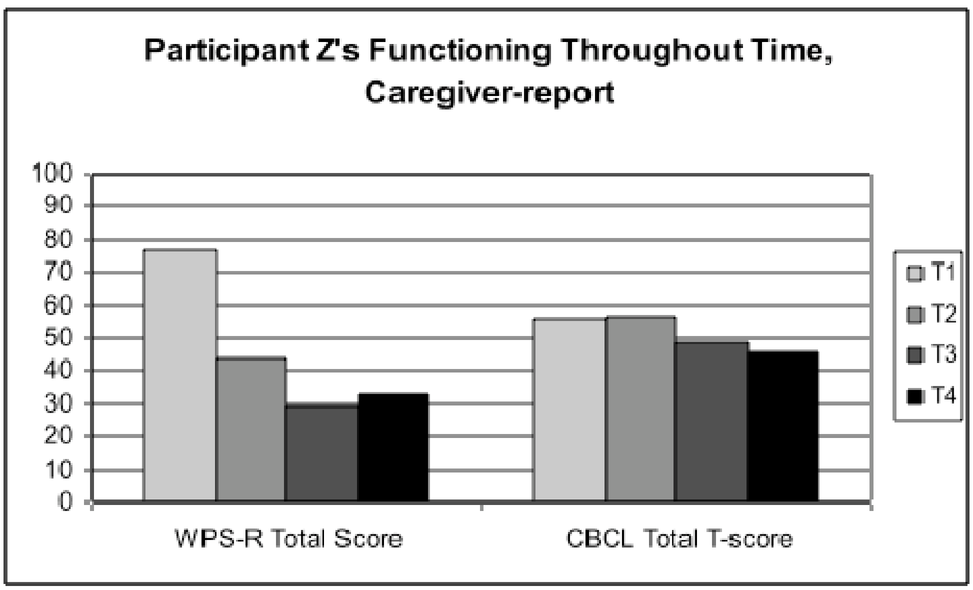


Participant Z. Visual inspection of Participant Z's graphs (see Figure 10) revealed variability in the change of mean of phases throughout treatment, a decrease in level from T1 to T4, and a variable, but generally negative slope for all self-report measures except for the CITES PTSD scale. This indicated that Participant Z viewed her emotional and behavioral functioning to have fluctuated somewhat throughout treatment, but that she experienced a significant improvement from pre-treatment to post-treatment. Increase in means, level, and slope of the CITES PTSD scale indicated a decrease in emotional functioning surrounding Participant Z's abuse experience. This may be attributable, in part, to the pregnancy resulting from her abuse.

Visual inspection of Participant Z's caregiver-report (Figure 10) demonstrated a similar trend. Caregiver-report indicated variability in the change of mean of phases throughout treatment, a decrease in level from T1 to T4, and a generally negative slope. As such, caregiver report indicated a general improvement in emotional and behavioral symptom functioning throughout treatment.

Figure 10: Emotional and Behavioral Functioning: Participant Z





Summary. Overall, participants demonstrated an overall improvement in emotional and behavioral symptom functioning throughout treatment. Their symptom presentation, as measured by self-report and caregiver-report, was affected by additional factors not related to abuse (i.e., house fire, separation from caregivers due to custody arrangements, court appearances, and pregnancy). With such significant extenuating circumstances, maintenance of emotional and behavioral symptoms functioning can be considered a sign of resiliency. Thus assessment measures were found to sensitive to individuals' functioning and accurate reflections of functioning over time.

Aim 2: Neuropsychological Change

Detectable change in neuropsychological functioning was examined by responses to neuropsychological items on the WPS-CR and WPS-PR, and performance on ANAM subtests. Item responses on the WPS-CR and WPS-PR and throughput scores on ANAM subtests were compared to determine change in neuropsychological symptom presentation.

Weekly Problems Scales-Revised evaluation. Multiple baseline performance on WPS-R's was examined graphically, with each participant having their own bar graph and all participants' graphs displayed on the same figure page. The x-axis for graphs measured the independent variable of time, as demarcated by weekly increments. The y-axis displayed the dependent variable of neuropsychological functioning as measured by WPS-CR and WPS-PR item responses. This display allowed for visual examination of changes in neuropsychological symptom presentation within individual subjects and across the varied multiple baselines between subjects.

As described previously, evaluation of data was conducted in accord with Kazdin's (2003) criteria for visual inspection of single-subject research design. Phases of treatment were defined as baseline assessments, group treatment sessions, and post-treatment assessments. Data were examined for change in means of phases (i.e., the mean of total score decreases from baseline assessments to group treatment sessions to post-treatment assessments), changes in level between phases (i.e., the total score at the end of baselines assessments should be higher than the total scores at the first time-point during group treatment sessions and the total scores at the last time-point during group treatment sessions should be higher than the total scores at the beginning of post-treatment assessments), and change in slope (i.e., the slope of the total scores during baseline assessments, group treatment sessions, and post-treatment assessments should be negative).

Participant W. Visual inspection of Participant W's graph (see Figure 11) demonstrated a decrease in means from the baseline assessment phase to the group treatment phase for both self-report and caregiver-report. This indicated that Participant W perceived her neurocognitive functioning as increasing from baseline assessment phase to group treatment phase to post-treatment assessment phase, whereas her caregiver reported a more subtle improvement. A similar, but more subtle trend was observed for change in levels with regard to self-report. No change in levels was observable with respect to caregiver-report. As such, improvement in neurocognitive functioning is likely more attributable to general functioning across time rather than an immediate reaction to the treatment phase. Participant W's graph shows an inconsistent change slope in the baseline assessment phase for self-report and an increase in slope for caregiver-report.

This indicated that Participant W viewed her neurocognitive functioning as variable during baseline and her caregiver view her neurocognitive function as decreasing during baseline. During the group treatment phase, Participant W's graph shows a variable and slightly decreasing slope, indicating a slight overall improvement in neurocognitive functioning as perceived by Participant W and her caregiver. In the post-treatment assessment phase, Participant W's graph shows a slight increase in slope for self-report and a slight decrease in slope for caregiver-report, indicating a slight decrease in self-reported neurocognitive functioning following treatment and an increase in caregiver-reported functioning. Overall, Participant W's graphs show variable, subtle changes in neurocognitive functioning. There is evidence of general improvement in neurocognitive functioning from baseline assessment to post-treatment assessment. Participant W reported higher neurocognitive functioning and more improvement in her neurocognitive functioning than her caregiver throughout treatment.

Participant X. Visual inspection of Participant X's graph (see Figure 11) demonstrated a decrease in means from the baseline assessment phase to the group treatment phase to post-treatment assessment phase for both self-report and caregiver-report. This indicated that Participant X and her caregiver perceived her neurocognitive functioning as increasing from baseline assessment phase to group treatment phase to post-treatment assessment phase. A similar trend was observed for change in levels for both self-report and caregiver-report, indicating an increase in neurocognitive functioning. Participant X's graph showed a decrease in slope for self-report and an increase in slope for caregiver-report during the baseline assessment phase. This indicates that Participant X perceived her neurocognitive functioning as increasing during baseline whereas her caregiver perceived a decrease in neurocognitive functioning. During the group treatment phase, Participant X's graphs showed an inconsistent slope for self-reported assessments and a generally negative slope for caregiver-reported assessments with the exception of a sharp increase in the final session. This indicated that Participant X perceived her neurocognitive functioning as variable throughout treatment and her caregiver perceived a general increase in neurocognitive functioning, except at that final session when a sharp decrease was reported. During the post-treatment phase, Participant X's graph showed a negative slope, indicating that her caregiver perceived an increase in neurocognitive functioning following treatment. Overall, Participant X's graph showed changing trends in neurocognitive functioning. There is evidence of a general increase in neurocognitive functioning from baseline assessment through group treatment to post-treatment. Participant X reported lower neurocognitive functioning overall, but a similar amount of improvement in her neurocognitive functioning than her caregiver throughout treatment.

Participant Y. Visual inspection of Participant Y's graph (see Figure 11) demonstrated a decrease in means from the baseline assessment phase to the group treatment phase and an increase in means from the group treatment phase to the post-treatment assessment phase for self-report measures, indicating that Participant Y perceived her neurocognitive functioning as generally increasing from baseline assessment phase to group treatment phase and decreasing from the group treatment phase to the post-treatment assessment phase. Caregiver-report demonstrated an opposite trend in phase means, indicating a continual decrease in neurocognitive functioning. With respect to change in levels, no change was observed for self-report from baseline assessment to group treatment, but an increase in levels was observed from baseline assessment to group treatment for both caregiver-report and from group treatment to post-treatment for both self-report and caregiver-report. This indicated that both Participant Y and her caregiver reported a decrease in neurocognitive functioning transitioning into group. Participant Y's graph showed no change in slope in the baseline assessment phase indicating no change in neurocognitive functioning as reported by both the participant and her caregiver prior to group. The change in slope for the group treatment phase was highly variable for caregiver report and generally flat for self-report during the group treatment phase. This indicated no consistent direction of change in neurocognitive functioning during group treatment as assessed by Participant Y and her caregiver. The slope during the post-treatment assessment phase was positive for self-report, indicating that Participant Y assessed her neurocognitive functioning to have decreased following treatment. Overall, Participant Y's graph showed a fluctuating neurocognitive functioning. There is evidence of a general increase in neurocognitive functioning from baseline assessment through group treatment to post-treatment. Participant Y reported lower neurocognitive functioning overall than her caregiver perceived throughout treatment.

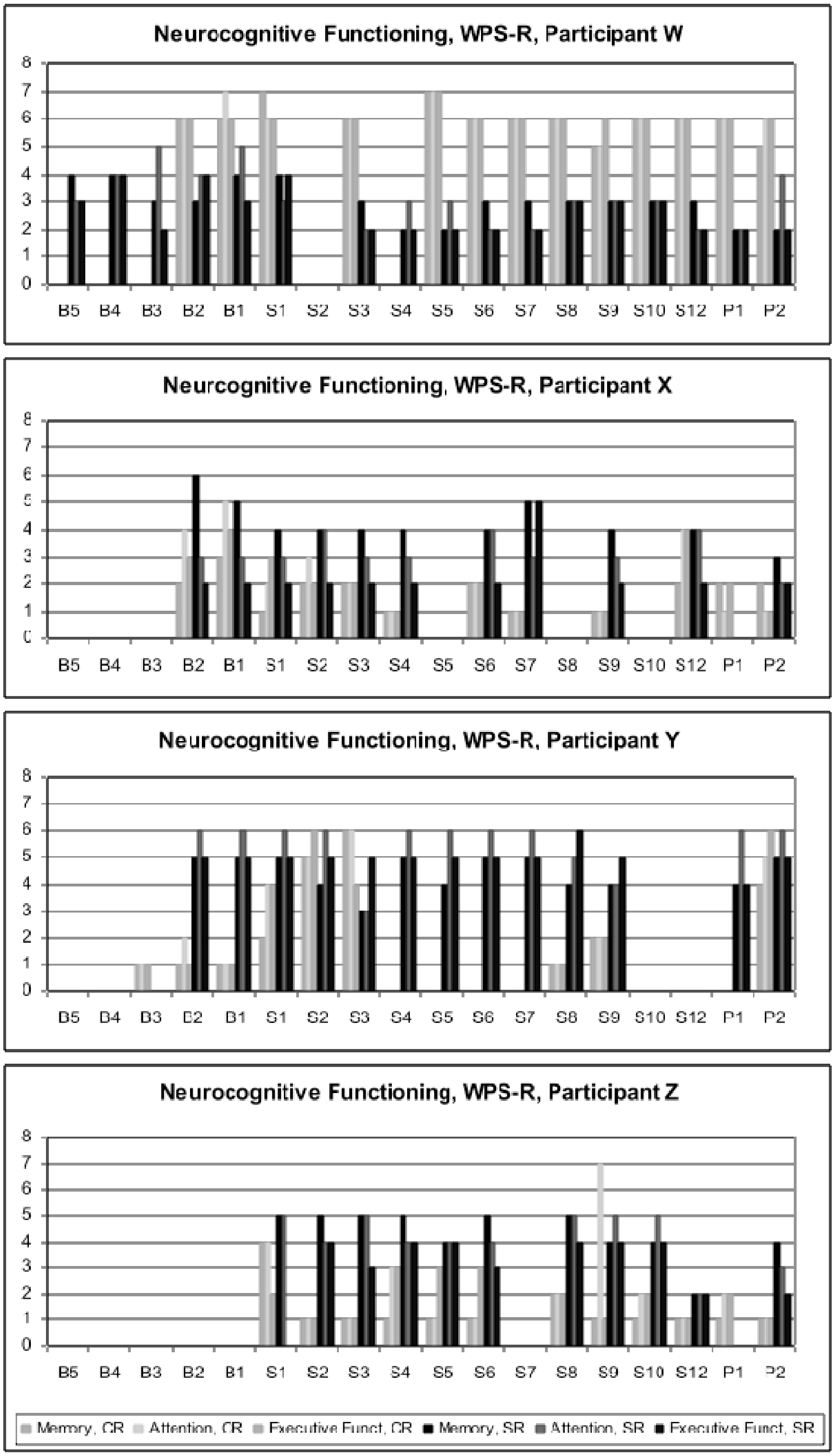
There are several reasons that may account for the opposite trends in emotional and behavioral functioning reported by Participant Y and her caregiver. For one, both Participant Y and her caregiver described little communication between each other regarding functioning. Second, Participant Y and her caregiver resided separately for much of the group treatment sessions. Thus they had even less opportunity for communication than usual and Participant Y's caregiver declined to report on her functioning during this time. It is also important to highlight that no change in slope during treatment phase and a slight decrease in phase means may be more indicative of resilience following the added stress of the house fire and family separation than a decrease in functioning. If there had been a decrease in phase means from baseline assessment phase to group treatment phase and a decrease in slope of the group treatment phase then it would be more indicative of a decrease in neurocognitive functioning.

Participant Z. Visual inspection of Participant Z's graph (see Figure 11) demonstrated a decrease in means from the group treatment phase to the post-treatment assessment phase for both self-report and caregiver-report measures, indicating that Participant Z and her caregiver perceived her neurocognitive functioning as generally increasing from the group treatment phase to the post-treatment assessment phase. An opposite trend was observed for change in levels that indicated a decrease in neurocognitive functioning from group treatment to post-treatment. As Participant Z gave birth in the interim between assessment points, this decrease in functioning is likely due, in part, to transitioning to motherhood. Participant Z's graph showed a general decrease in slope of self-report and little change in slope of caregiver-report during the group treatment phase. As only a single time-point was available for Participant Z's self-report in the post-treatment phase, caregiver-report was utilized for evaluation of slope. During the post-treatment assessment phase, caregiver-report revealed a negative slope. This indicated that Participant Z perceived her neurocognitive functioning to have increased throughout treatment, and her caregiver perceived no change during treatment and an increase in neurocognitive functioning following treatment. Overall, Participant Z's graph showed variable change in neurocognitive performance. There is evidence of a general increase in neurocognitive functioning from group treatment to post-treatment. Participant Z reported lower neurocognitive functioning and less change in neurocognitive functioning throughout treatment than her caregiver perceived throughout treatment.

Group. Utilization of a multiple baseline single-subject design allowed for evaluation of change in mean of phases, change in level, and change in slope of phases as a group (see Figure 11). Across participants, there was an overall decrease in means between baseline assessment phase to group treatment phase to post-treatment assessment phase for participants according to self-report and caregiver report. Thus participants and their caregivers viewed an increase in neurocognitive functioning from baseline assessment through group treatment to post-treatment. With regards to change in level, participants reported a decrease from baseline to group and no change from group to post-treatment while caregivers reported the opposite. This indicated that participants reported an increase in neurocognitive functioning when transitioning from baseline to group, and caregivers reported an increase in neurocognitive functioning from group to post-treatment. In terms of change in slope, participants reported an overall negligible change in slope during the baseline assessment phase, a decrease in slope during the group treatment phase, and an increase in slope during post-treatment assessment phase. Their caregivers reported an increase in slope during the baseline assessment phase, and decreases in slopes for both the group treatment and post-treatment assessment phases. This indicated that participants viewed their neurocognitive functioning as unchanging during baseline, improving during treatment, and decreasing during post-treatment. Their caregivers reported decreases in baseline neurocognitive functioning, but increases throughout treatment and post-treatment. In general, change in means of phases is the most robust measure of change in neurocognitive functioning across participants, indicating an increase in neurocognitive functioning from pre-treatment to post-treatment.

Overall, across participants and their caregivers there was a reported increase in neurocognitive functioning from baseline assessment through group treatment to post-treatment.

Figure 11: Neurocognitive Functioning via WPS-R Item scores: All Participants



Note: B = Baseline Assessment, S = Therapy Session, P = Post-treatment Assessment

Time-point assessment evaluation. In addition to the aforementioned multiple-baseline display, each participant had six bar graphs that display the neuropsychological assessment measures throughout treatment. The x-axis of the graphs showed the independent variables of time, as demarcated by assessment period (i.e., pre-treatment, mid-treatment, post-treatment, follow-up) and assessment measure. One graph depicted neuropsychological functioning within the domain of attention (i.e., ANAM Reaction Time subtest, ANAM Standard Continuous Performance subtest, WPS-CR attention item, WPS-PR attention item). A second graph depicted neuropsychological functioning within the domain of memory (i.e., ANAM Code Substitution Learning subtest, ANAM Code Substitution Delayed subtest, WPS-CR memory item, WPS-PR memory item). A third graph depicted neuropsychological functioning within the domain of executive functioning (i.e., ANAM Logical Relations subtest, ANAM Tower Puzzle subtest, WPS-CR executive functioning item, WPS-PR executive functioning item). As such, each participant had three graphs in their figure page. On all graphs, different assessment periods were denoted by differences in bar shading, as relayed in the graph key. Each assessment measure had four differently shaded bars clustered next to each other to show change in performance on the measure throughout treatment. The y-axis of the bar graphs measured the score on assessment measures. This display allowed for visual examination of trends in neuropsychological functioning within a subject throughout treatment.

As previously described, evaluation of data was conducted in accord with Kazdin's (2003) criteria for visual inspection of single-subject research design. Phases of treatment were defined as baseline assessment (T1), mid-treatment assessment (T2), post-treatment assessments (T3), and follow-up assessment (T4). As T1 wand T3 were immediately preceding and following treatment, respectively, data was examined for overall trends in change of mean of phases (i.e., T1>T2>T3>T4), change in level from pre-treatment to follow-up (T1>T4), and the slope of time-points (i.e., a negative slope indicates an increase in self-report and caregiver-report of neurocognitive functioning, a positive slope indicates an increase in neurocognitive performance).

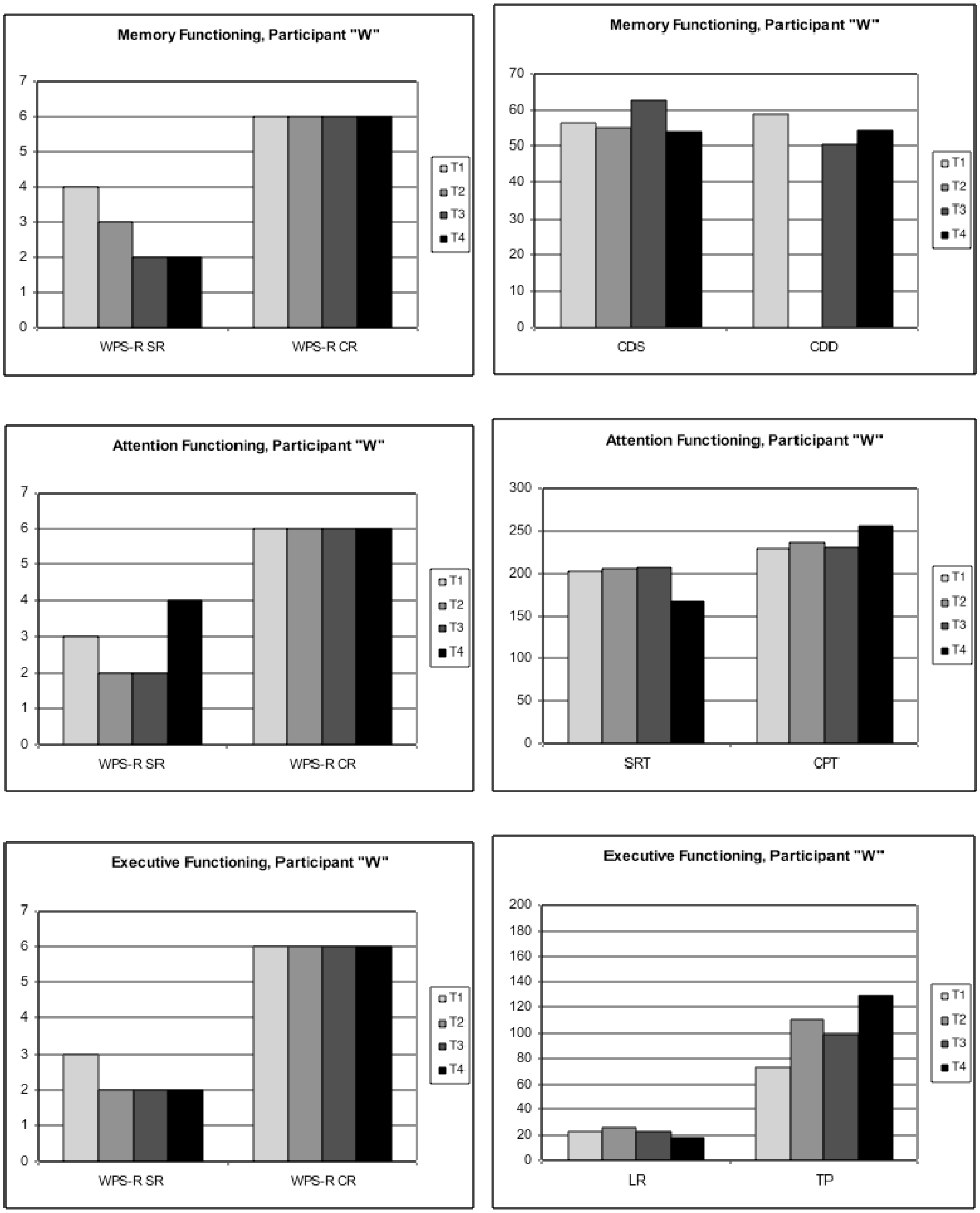
Participant W. Visual inspection of Participant W's Memory Functioning graphs (see Figure 12) revealed a decrease in the mean of phases, a decrease in level from T1 to T4, and a consistently negative slope for self-report. Visual inspection of caregiver report revealed no change in means of phases, level from T1 to T4, or slope. For performance measures of memory functioning, Participant W's scores demonstrated variable change in phase, a decrease in level from T1 to T4, and a slightly negative slope. This indicated that Participant W viewed her memory functioning to have improved consistently throughout treatment, her caregiver reported observing no change in memory functioning, and Participant W's performance indicated a decrease in working memory functioning.

Visual inspection of Participant W's Attention Functioning graphs (Figure 12) revealed a variable change in the mean of phases, an increase in level from T1 to T4, and a positive slope for self-report. Visual inspection of caregiver report revealed no change in means of phases, level from T1 to T4, or slope. For performance measures of attention functioning, Participant W's scores demonstrated variable change in phase, a decrease in level from T1 to T4 for SRT and an increase for CPT, and a slightly negative slope for SRT and a slightly positive slope for CPT. This indicated that Participant W viewed her attention functioning to have worsened throughout treatment, her caregiver reported observing no change in attention functioning, and Participant W's performance indicated a decrease in one measure of attention and an increase in another measure of attention.

Visual inspection of Participant W's Executive Functioning graphs (Figure 12) revealed an initial decrease in the mean of phases, a decrease in level from T1 to T4, and a negative slope for self-report. Visual inspection of caregiver report revealed no change in means of phases, level from T1 to T4, or slope. For performance measures of executive functioning, Participant W's scores demonstrated variable change in phase, a decrease in level from T1 to T4 for LR and an increase for TP, and a slightly negative slope for LR and a positive slope for TP. This indicated that Participant W viewed her executive functioning to have improved throughout treatment, her caregiver reported observing no change in executive functioning, and Participant W's performance indicated a decrease in one measure of executive functioning and an increase in another measure of executive functioning.

Overall, Participant W's self-report of neurocognitive functioning indicated improvement, but was contradicted by her performance on three of six measures. Her caregiver reported observing no change in Participant W's neurocognitive functioning across time.

Figure 12: Neurocognitive Functioning, Participant “W”



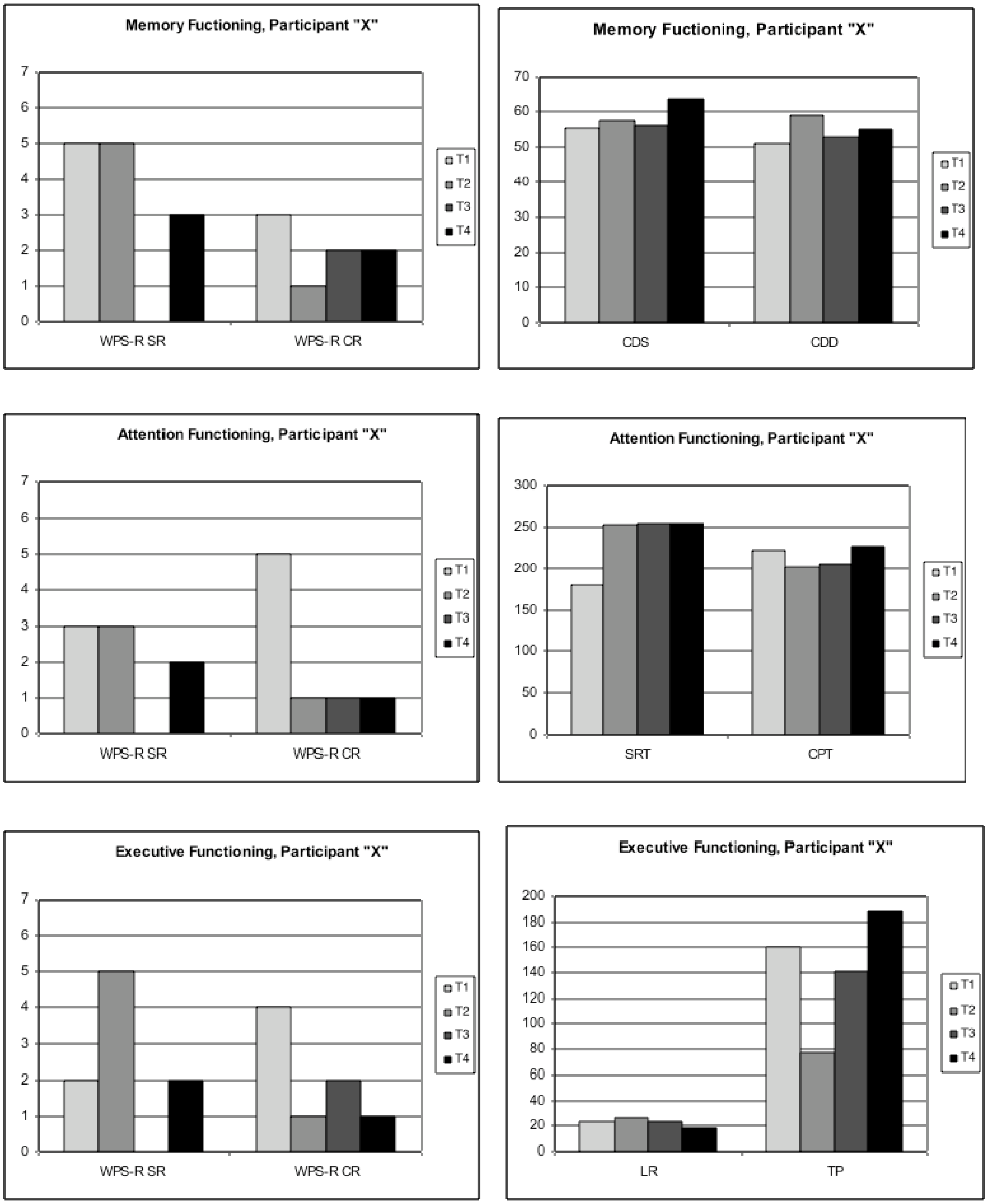
Participant X. Visual inspection of Participant X's Memory Functioning graphs (see Figure 13) revealed a decrease in the mean of phases, a decrease in level from T1 to T4, and a negative slope for self-report. Visual inspection of caregiver report revealed variability in means of phases, a decrease in level from T1 to T4, and a generally negative slope. For performance measures of memory functioning, Participant X's scores demonstrated variable change in phase, an increase in level from T1 to T4, and a slightly positive slope. This indicated that Participant X viewed her memory functioning to have improved throughout treatment, her caregiver reported observing this improvement in memory functioning, and Participant X's performance indicated an increase in working memory functioning.

Visual inspection of Participant X's Attention Functioning graphs (Figure 13) revealed a decrease in the mean of phases, a decrease in level from T1 to T4, and a negative slope for self-report. Visual inspection of caregiver report revealed an initial decrease in means of phases, a decrease in level from T1 to T4, and a negative slope. For performance measures of attention functioning, Participant X's scores demonstrated variable change in phase, an increase in level from T1 to T4, and a slightly positive slope. This indicated that Participant X viewed her attention functioning to have improved throughout treatment, her caregiver reported observing an improvement in attention functioning, and Participant X's performance indicated an increase in attention functioning.

Visual inspection of Participant X's Executive Functioning graphs (Figure 13) revealed a variable change in the mean of phases, no change in level from T1 to T4, and no change in slope for self-report. Visual inspection of caregiver report revealed a variable change in means of phases, a decrease in level from T1 to T4, and a negative slope. For performance measures of executive functioning, Participant X's scores demonstrated variable change in phase, a decrease in level from T1 to T4 for LR and an increase for TP, and a slightly negative slope for LR and a positive slope for TP. This indicated that Participant X viewed her executive functioning to have not changed from pre-treatment to post-treatment, her caregiver reported observing an improvement in executive functioning, and Participant X's performance indicated a decrease in one measure of executive functioning and an increase in another measure of executive functioning.

Overall, Participant X's self-report of neurocognitive functioning indicated improvement, and was supported by her performance on five of six measures. Her caregiver reported observing an increase in Participant X's neurocognitive functioning across time.

Figure 13: Neurocognitive Functioning, Participant "X"



Participant Y. As described previously, pre-treatment data was not available for Participant Y as her family was in crisis at the time of the scheduled assessment and it would have been unethical to withhold treatment contingent upon completion of pre-treatment assessment measures. Also as mentioned previously, Participant Y was not residing with her family through much of treatment and was out of town until immediately prior to the T3 assessment. As her caregiver declined to report on her functioning for these reasons at T2 and T3, analysis of caregiver-report in not possible based on a single time-point.

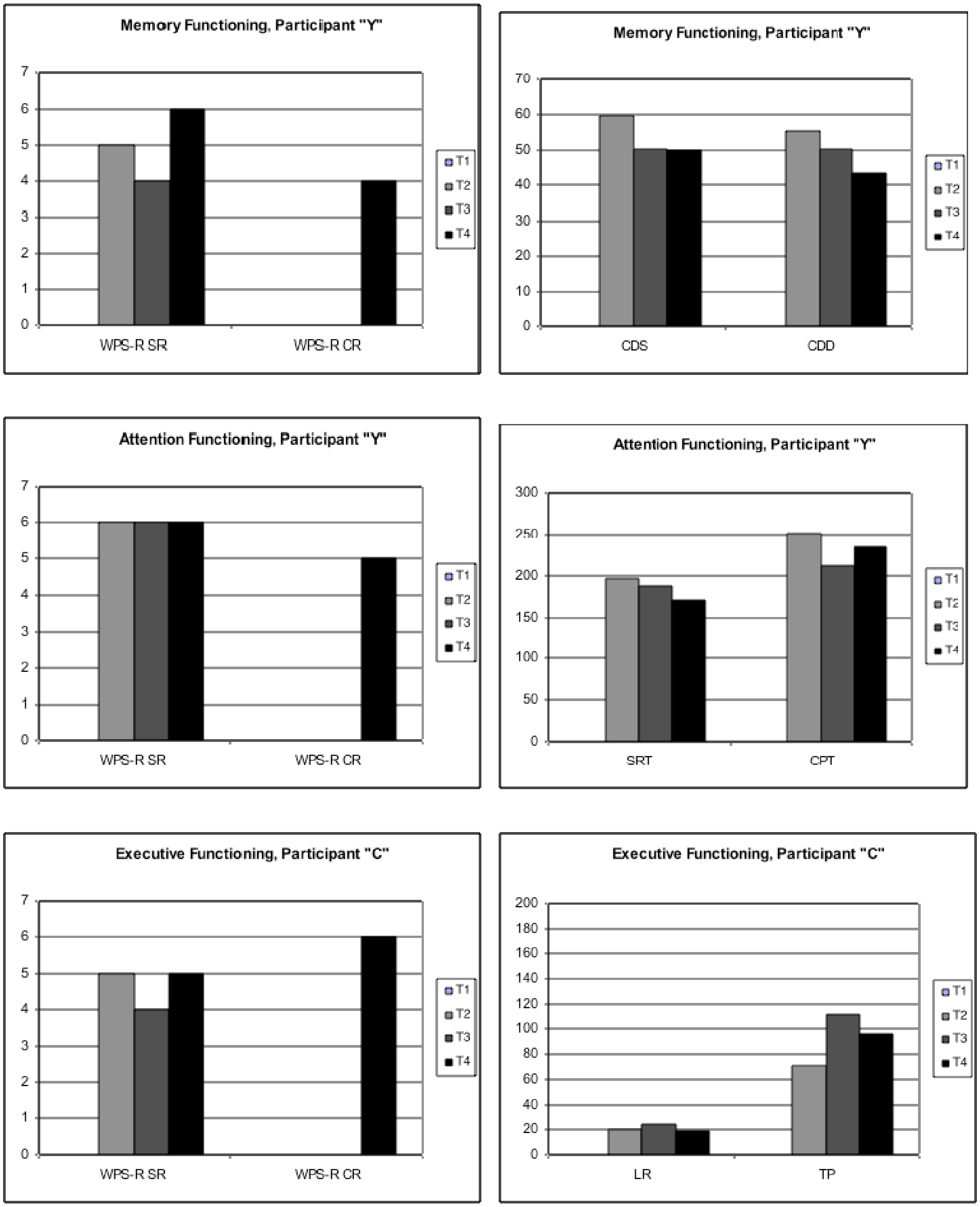
Visual inspection of Participant Y's Memory Functioning graphs (see Figure 14) revealed a variable change in the mean of phases, an increase in level from T2 to T4, and a negative slope for self-report. For performance measures of memory functioning, Participant Y's scores demonstrated negative change in phase, a decrease in level from T2 to T4, and a slightly negative slope. This indicated that Participant Y viewed her memory functioning to have worsened throughout treatment and Participant Y's performance reflected a decrease in working memory functioning.

Visual inspection of Participant Y's Attention Functioning graphs (Fig 14) revealed no change in the mean of phases, level from T2 to T4, or slope for self-report. For performance measures of attention functioning, Participant Y's scores demonstrated variable change in phase, a decrease in level from T2 to T4, and a negative slope. This indicated that Participant Y viewed her attention functioning to have decreased throughout treatment and Participant X's performance reflected a decrease in attention functioning.

Visual inspection of Participant Y's Executive Functioning graphs (Figure 14) revealed a variable change in the mean of phases, no change in level from T2 to T4, and no change in slope for self-report. For performance measures of executive functioning, Participant Y's scores demonstrated variable change in phase, a decrease in level from T2 to T4 for LR and an increase for TP, and a slightly negative slope for LR and a positive slope for TP. This indicated that Participant Y viewed her executive functioning to have not changed from mid-treatment to post-treatment, and Participant Y's performance indicated a decrease in one measure of executive functioning and an increase in another measure of executive functioning.

Overall, Participant Y's self-report indicated a decrease in her neurocognitive functioning. This was supported by her performance on five of six measures.

Figure 14: Neurocognitive Functioning, Participant “C”



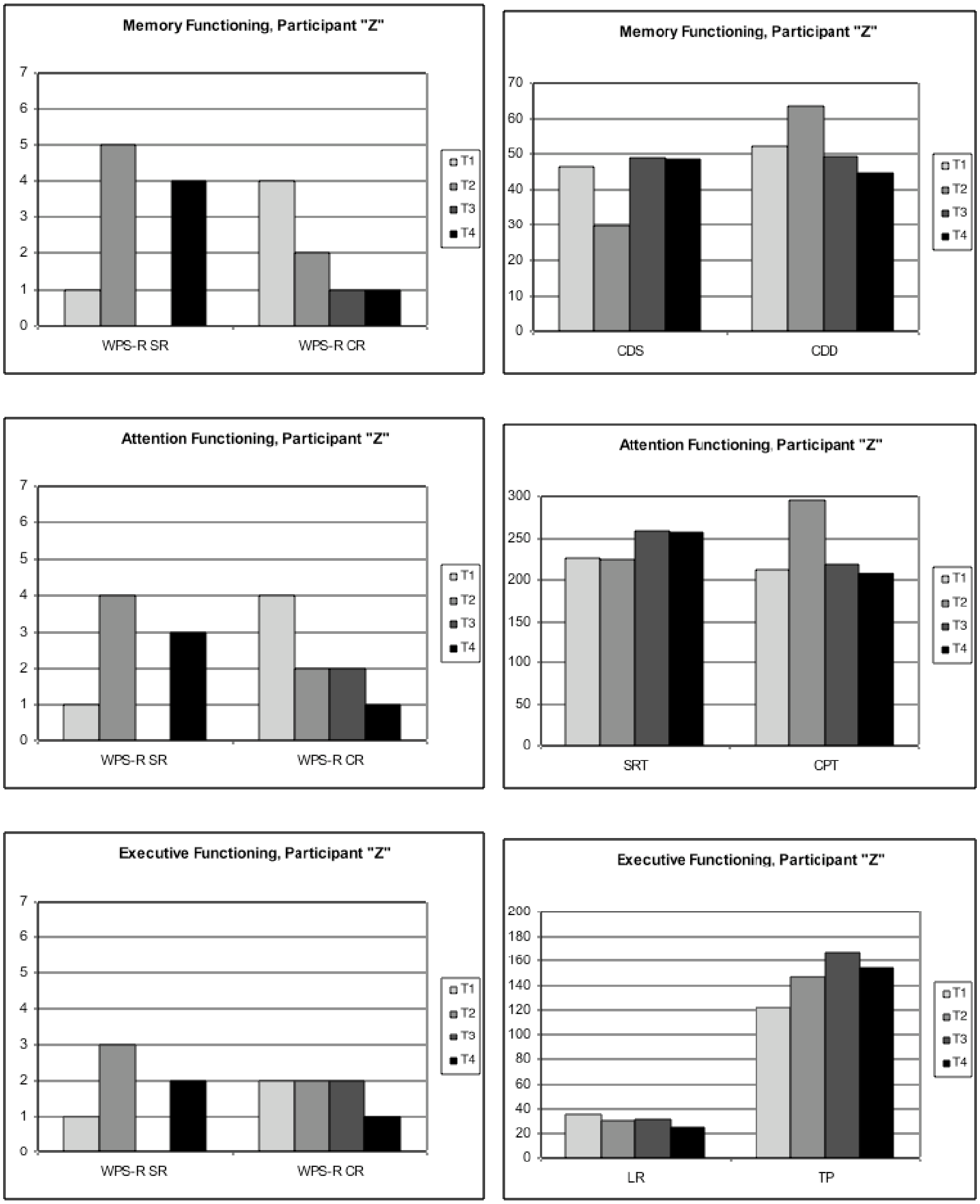
Participant Z. Visual inspection of Participant Z's Memory Functioning graphs (see Figure 15) revealed variable change in the mean of phases, an increase in level from T1 to T4, and a positive slope for self-report. Visual inspection of caregiver report revealed a decrease in the means of phases, a decrease in level from T1 to T4, and a generally negative slope. For performance measures of memory functioning, Participant Z's scores demonstrated variable change in phase, an increase in level from T1 to T4 for CDS and a decrease for CDD, and a positive slope for CDS and a negative slope fro CDD. This indicated that Participant Z viewed her memory functioning to have worsened, her caregiver reported observing an improvement in memory functioning, and Participant Z's performance indicated an increase in one measure of working memory functioning and a decrease in another.

Visual inspection of Participant Z's Attention Functioning graphs (Figure 15) revealed variable change in the mean of phases, an increase in level from T1 to T4, and a positive slope for self-report. Visual inspection of caregiver report revealed a decrease in the means of phases, a decrease in level from T1 to T4, and a generally negative slope. For performance measures of attention functioning, Participant Z's scores demonstrated variable change in phase, an increase in level from T1 to T4 for SRT and a decrease for CPT, and a positive slope for SRT and a negative slope for CPT. This indicated that Participant Z viewed her attention functioning to have worsened, her caregiver reported observing an improvement in attention functioning, and Participant Z's performance indicated an increase in one measure of attention functioning and a decrease in another.

Visual inspection of Participant Z's Executive Functioning graphs (Figure 15) revealed variable change in the mean of phases, an increase in level from T1 to T4, and a positive slope for self-report. Visual inspection of caregiver report revealed a decrease in the means of phases, a decrease in level from T1 to T4, and a generally negative slope. For performance measures of executive functioning, Participant Z's scores demonstrated variable change in phase, a decrease in level from T1 to T4 for LR and an increase for TP, and a slightly negative slope for LR and a positive slope for TP. This indicated that Participant Z viewed her executive functioning to have decreased from pre-treatment to post-treatment, her caregiver reported observing an improvement in executive functioning, and Participant Z's performance indicated a decrease in one measure of executive functioning and an increase in another measure of executive functioning.

Overall, Participant Z's self-report of neurocognitive functioning indicated improvement from T1 to T2, and a decrease from T2 to T4. Her caregiver reported a continual improvement in neurocognitive functioning. Her performance was variable, with three of six measures showing an increase in performance throughout time. It should be noted that her performance and self-report demonstrate a decline in neurocognitive functioning from T3 to T4, during which Participant Z gave birth. A decrease in functioning during this time may be attributable in part to the stress experienced with transitioning to motherhood.

Figure 15: Neurocognitive Functioning, Participant “D”



Summary. With regards to memory functioning, participants reported variable levels of functioning across time. Their caregivers reported a general increase in memory functioning. Their performance on a measure of working memory (CDS) was variable, while their performance on a measure of delayed memory (CDD) worsened. In general, delayed memory performance reflected self-report of memory functioning more closely than working memory. Further, caregivers' responses neither reflected self-report nor performance on either measure of memory.

With regards to attention functioning, participants reported a general decrease in functioning across time. Their caregivers reported a general increase in attention functioning. Their performance on both measures of attention was variable, with half of the participants improving on each and half participants worsening on each. In general, the performance on the CPT measure of attention reflected self-report of attention functioning more closely than the SRT measure. Further, caregivers' responses neither reflected self-report nor performance on either measure of attention.

With regards to executive functioning, participants reported variable functioning across time. Their caregivers reported a general increase in executive functioning. Their performance on a measure of verbal executive functioning (LR) worsened, while performance on a measure of visual-spatial executive functioning (TP) increased. In general, the performance on the TP measure of executive functioning reflected caregiver-report of executive functioning more closely than the LR measure. Further, self-report responses neither reflected caregiver-report nor performance on either measure of executive functioning.

Overall, performance on measures of neurocognitive functioning are highly variable throughout treatment. Participants reported a decrease in memory functioning and attention across time. Self-report of executive functioning was mixed. Caregivers reported an overall increase in all neurocognitive domains. Attention functioning was highly variable across participants, assessment measures, and time-points. This is attributable to the highly sensitive nature of the assessment measures and variable nature of the phenomenon at any given moment. Delayed memory functioning was reflected by self-report, possibly due to the phrasing of the question which assesses short-term memory more so than working memory. Visual-spatial executive functioning was reflected by caregiver-report, possibly due to the higher order problem-solving and forethought that caregivers must exercise in evaluating participants' problem-solving abilities that are more developed than those of the participants themselves. It is also possible that the learning effect for this assessment measure was significantly greater than for other performance measures, and skewed results.

Aim 3: Relationship of Changes in Neuropsychological Functioning with Behavioral and Emotional Symptom Presentation

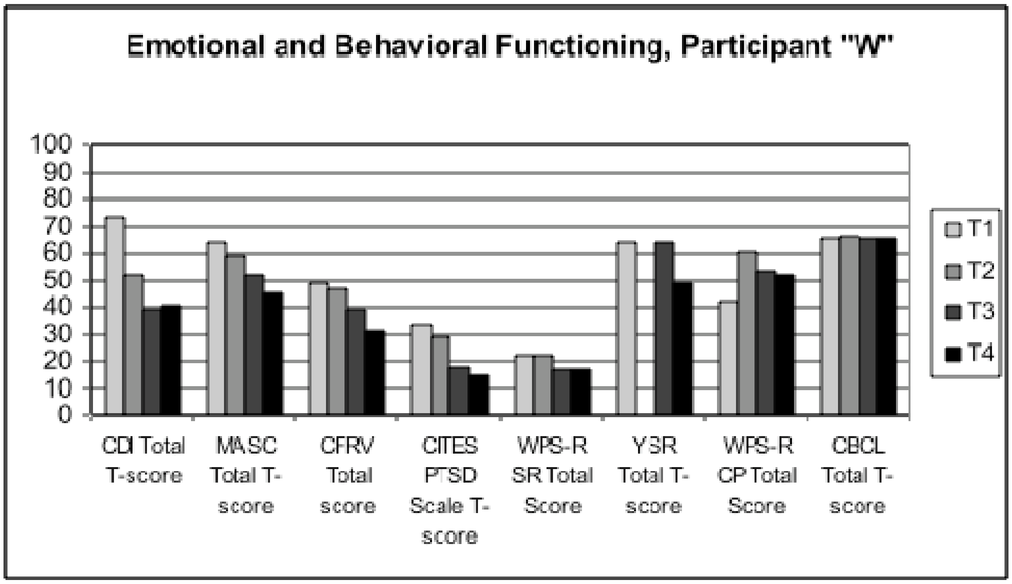
The relationship of changes in neuropsychological functioning and changes in emotional and behavioral symptom presentation throughout treatment were determined from visual examination of the composite graphs of graphical data generated for Aims 1 and 2. Patterns of change within and across youth were examined. As such, each participant had two graphs in their figure page. On all graphs, different assessment periods were denoted by differences in bar shading, as relayed in the graph key. Each assessment measure had four differently shaded bars clustered next to each other to show change in performance on the measure throughout treatment. The y-axis of the bar graphs measured the score on assessment measure. One graph depicted emotional and behavioral functioning (i.e., CDI, MASC, CFRV, CITES, WPS-CR, YSR, CBC, and WPS-PR). A second graph depicted neuropsychological functioning (i.e., ANAM Simple Reaction Time subtest, ANAM Standard Continuous Performance subtest, WPS-CR attention item, WPS-PR attention item, ANAM Code Substitution Learning subtest, ANAM Code Substitution Delayed subtest, WPS-CR memory item, WPS-PR memory item, ANAM Logical Relations subtest, ANAM Tower Puzzle subtest, WPS-CR executive functioning item, WPS-PR executive functioning item). This display allowed for visual examination of trends in emotional, behavioral, and neuropsychological functioning within and across subjects throughout treatment.

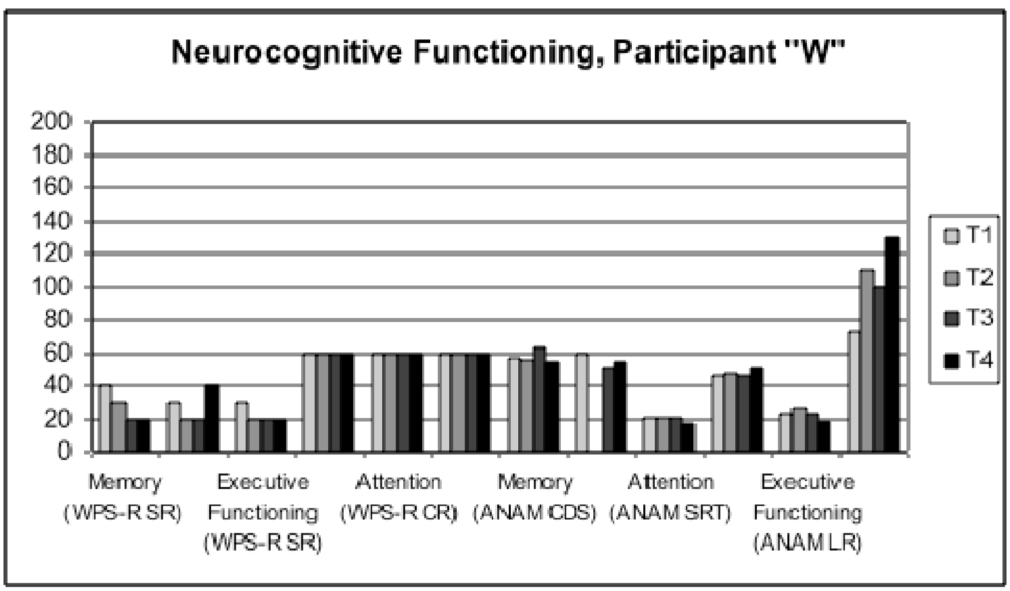
As previously described, evaluation of data was conducted in accord with Kazdin's (2003) criteria for visual inspection of single-subject research design. Phases of treatment were defined as baseline assessment (T1), mid-treatment assessment (T2), post-treatment assessments (T3), and follow-up assessment (T4). So as not to reiterate previously described visual analyses of data, findings relating changes in neuropsychological functioning with emotional and behavioral functioning are described.

Participant W. Visual inspection of Participant W's graphs (see Figure 16) indicate that Participant W viewed her emotional and behavioral functioning, memory, and executive functioning to have improved consistently throughout treatment. Attention is the one area of functioning that Participant W reported as worsening throughout treatment. Her caregiver reported Participant W's emotional and behavioral functioning to have improved slightly throughout treatment, and no change in her attention, memory, or executive functioning. On measures of neuropsychological performance, Participant W's working memory decreased throughout treatment, while her attention and executive functioning improved on one measure each, and decreased on one measure each.

Taken together, Participant W reported a correspondence between emotional, behavioral, memory, and executive functioning throughout treatment. Her self-report of her attention as decreasing throughout treatment was the only domain with correspondence between self-report assessment and task performance. Participant W's caregiver reported little change in emotional and behavioral functioning and neuropsychological functioning. Of the 20 measures of emotional, behavioral, and neurocognitive functioning, Participant W reported an increase in functioning on 9 measures, a decrease on 7 measures, and no change on 4 measures. This is consistent with her subjective reports of significant improvement in functioning throughout treatment and her continued struggles with lessened, but still present PTSD symptoms after treatment.

Figure 16: Emotional, Behavioral, Neuropsychological Functioning of Participant "W"

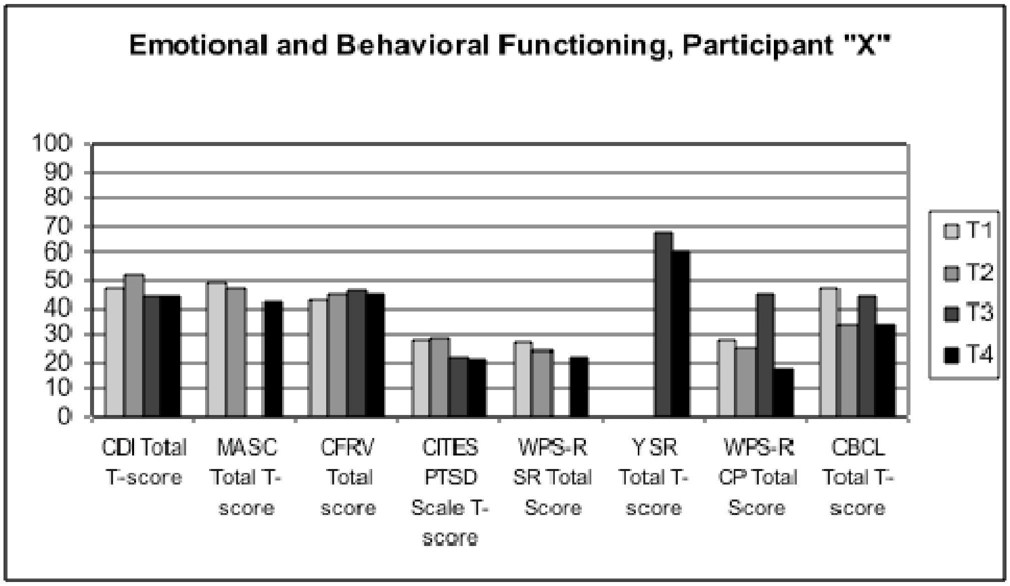


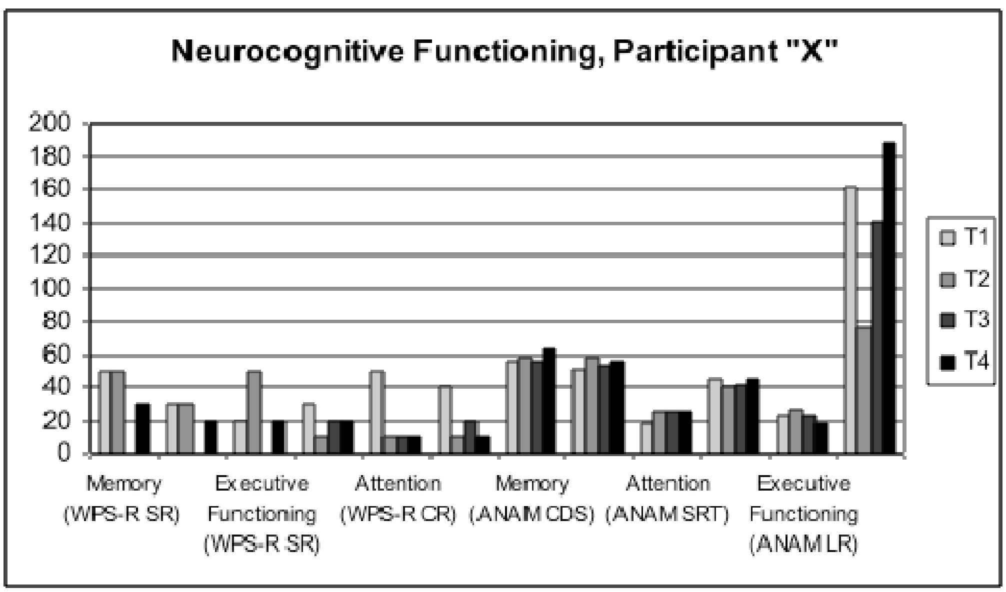


Participant X. Visual inspection of Participant X's graphs (see Figure 17) indicated that Participant X viewed her emotional and behavioral functioning, memory, and attention to have improved throughout treatment. Executive functioning is the one area of functioning that Participant X reported as not changing throughout treatment. Her caregiver reported Participant X's emotional and behavioral, memory, attention, and executive functioning to have improved throughout treatment. On measures of neuropsychological performance, Participant X's memory and attention increased throughout treatment, while her executive functioning improved on one measure and decreased on the other measure.

Taken together, Participant X and her caregiver reported a correspondence between emotional, behavioral, memory, and attention functioning throughout treatment. Her self-report of her memory and attention as increasing throughout treatment demonstrated correspondence between self-report assessment and task performance. Correspondence was also demonstrated for correspondence between caregiver-report and task performance for memory and attention functioning. Of the 20 measures of emotional, behavioral, and neurocognitive functioning, Participant X reported an increase in functioning on 17 measures, a decrease on 2 measures, and no change on 1 measure. This is consistent with her subjective reports of significant improvement in functioning throughout treatment.

Figure 17: Emotional, Behavioral, Neuropsychological Functioning of Participant “X”



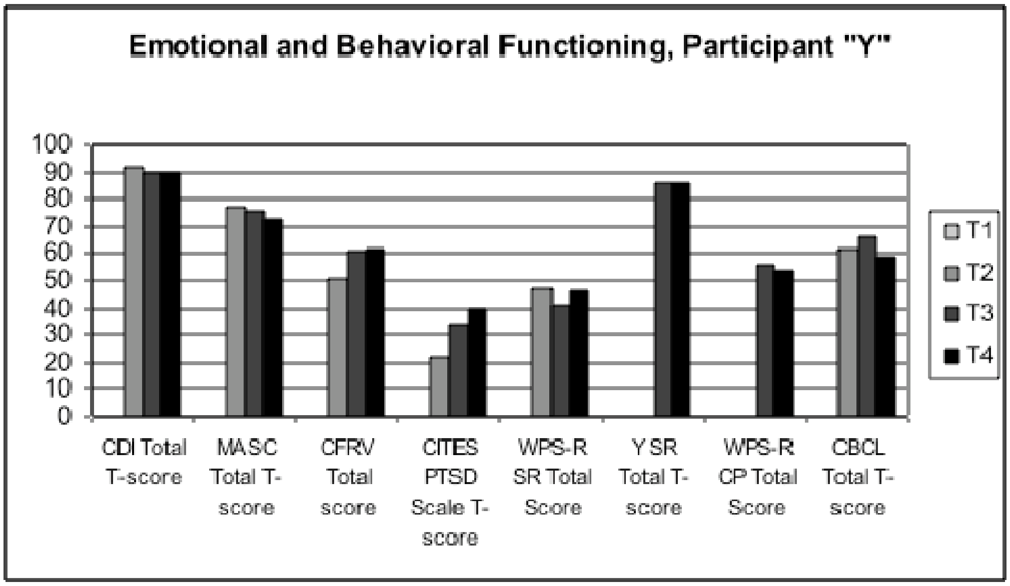


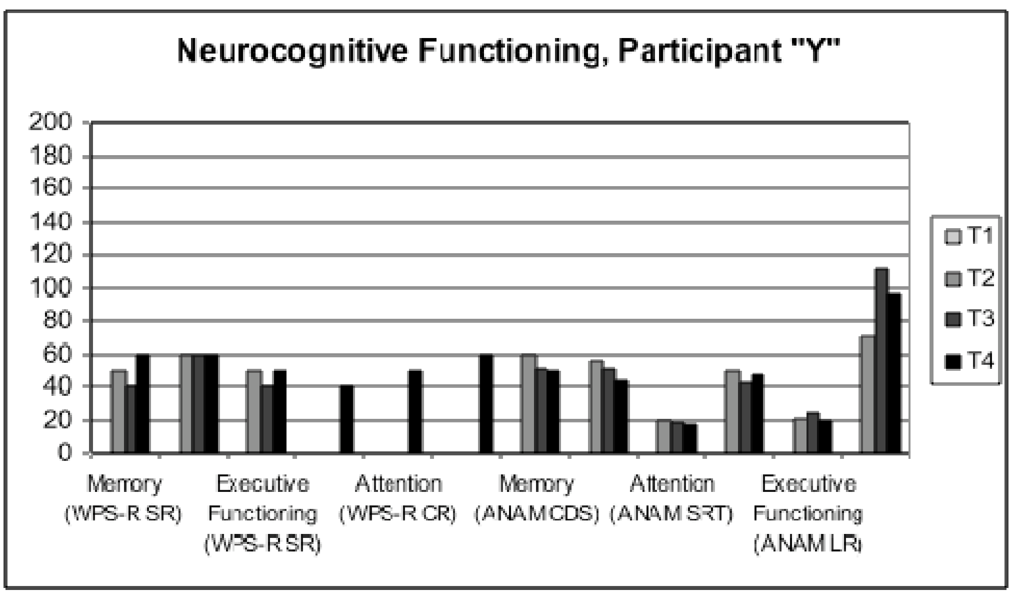
Participant Y. As Participant Y was not residing with her caregiver during the T2 assessment and had just returned to living with her caregiver immediately prior to the T3 assessment, Participant Y's caregiver either declined to report on Participant Y's functioning or stated that she was "guessing." For these reasons, Participant Y's caregiver-report is not included in analyses.

Visual inspection of Participant Y's graphs (see Figure 18) indicated that Participant Y viewed her anxiety and depressive symptoms to have improved slightly throughout treatment but her general emotional, behavior, and executive functioning remained generally constant throughout treatment. Further, she reported a decrease in her emotional and behavioral functioning related to coping with her abuse, as well as her memory and attention functioning. On measures of neuropsychological performance, Participant Y's memory and attention decreased throughout treatment, while her executive functioning improved on one measure and decreased on the other measure.

Taken together, Participant Y reported a correspondence between her abuse-related emotional and behavioral functioning, memory, and attention functioning throughout treatment. Her self-report of her memory and attention as decreasing throughout treatment demonstrated correspondence between self-report assessment and task performance. Of the 17 measures of emotional, behavioral, and neurocognitive functioning, Participant Y reported an increase in functioning on 5 measures, a decrease on 9 measures, and no change on 4 measures. This is consistent with her subjective reports of significant struggles to cope with life stressors during and after treatment.

Figure 18: Emotional, Behavioral, Neuropsychological Functioning of Participant “Y”

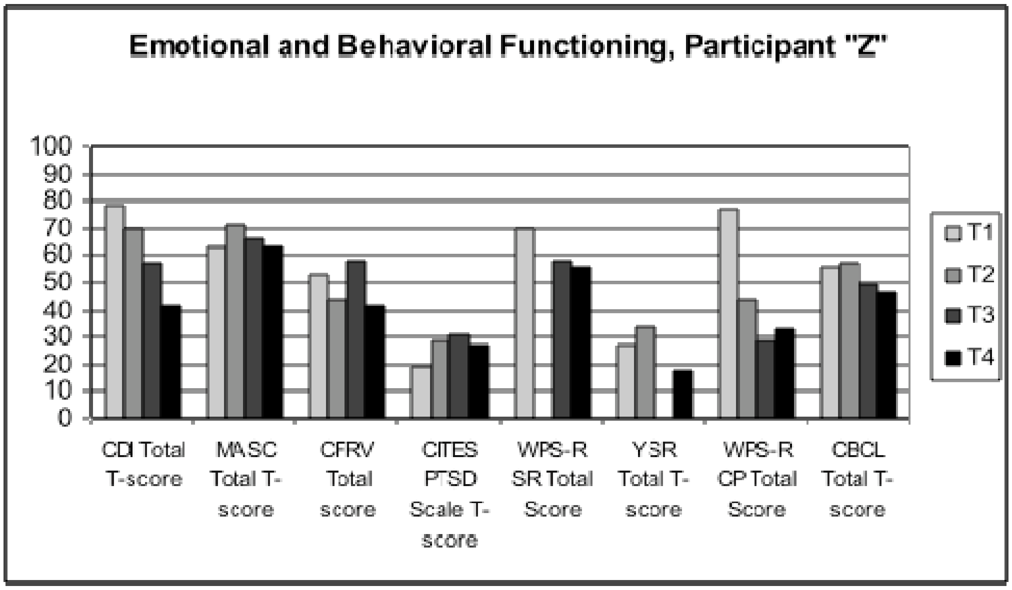


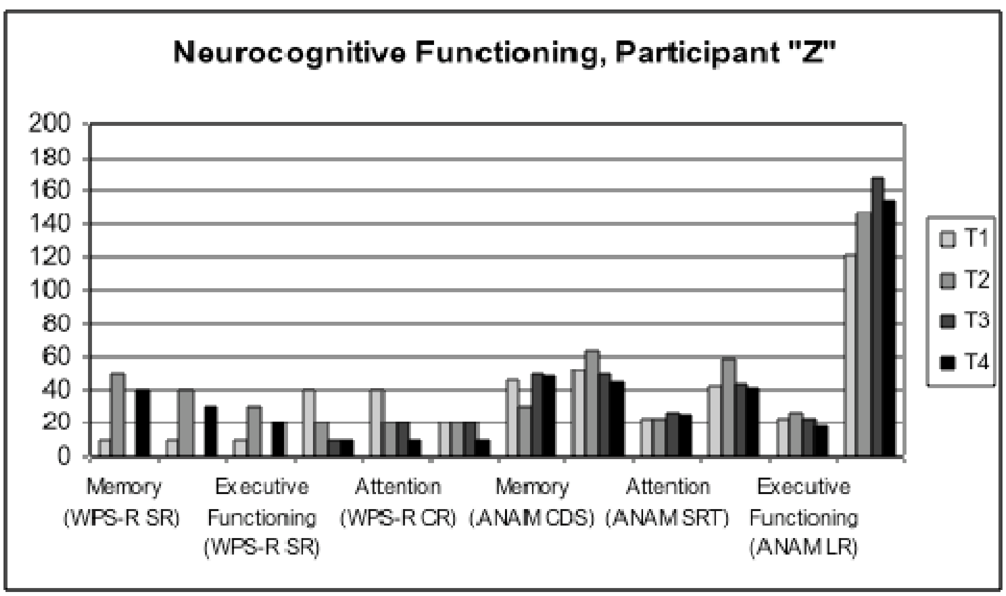


Participant Z. Visual inspection of Participant Z's graphs (see Figure 19) indicated that Participant Z viewed her emotional and behavioral functioning to have improved throughout treatment. She reported her trauma-related emotional functioning, memory, attention, and executive functioning to have decreased throughout treatment. Her caregiver reported an increase in emotional and behavioral, memory, attention, and executive functioning throughout treatment. On measures of neuropsychological performance, Participant Z's memory, attention, and executive functioning each improved on one measure and decreased on the other measure.

Taken together, Participant Z reported a correspondence between her trauma-related emotional functioning, memory, attention, and executive functioning throughout treatment. It is difficult to demonstrated correspondence between self-report assessment and task performance as change was not consistent between measures of neurocognitive performance. Similarly, correspondence between caregiver-report and task performance could not be demonstrated. Of the 20 measures of emotional, behavioral, and neurocognitive functioning, Participant Z reported an increase in functioning on 13 measures and a decrease on 7 measures. This is consistent with her subjective reports of struggles to cope with life stressors during and after treatment.

Figure 19: Emotional, Behavioral, Neuropsychological Functioning of Participant "Z"





Across Subjects. Correspondence between self-report of emotional, behavioral, and neuropsychological functioning, caregiver-report of emotional, behavioral, and neuropsychological functioning, and performance on neurocognitive tasks are presented for the group (see Figures 16-19). With regards to correspondence between self-report measures, only self-report of trauma-specific emotional functioning (CITES PTSD scale total score) corresponded with self-report of memory functioning (WPS-R SR Memory Item) for all participants. With regards to correspondence between self-report measures and task performance, only self-report of trauma-specific emotional functioning (CITES PTSD scale total score) corresponded with task performance of attention functioning (ANAM CPT) for all participants. No correspondence was found among caregiver report and any measures of task performance of neuropsychological functioning that was consistent across all participants.

Summary. Overall, there is much variability within and among individuals in terms of the relationship between their neuropsychological and emotional and behavioral symptoms functioning throughout treatment. Participants who reported a general change in emotional and behavioral functioning tended to also reported a change in neuropsychological functioning in the same direction (i.e., either improving or worsening). There was less correspondence between self-report of emotional and behavioral symptom functioning and performance on measures of neuropsychological functioning. No correspondence was found among caregiver report and any measures of task performance of neuropsychological functioning that was consistent across all participants.

Considering the variability in task performance across time, extenuating life circumstances that affected emotional and behavioral symptom functioning, and diversity among individuals' circumstances, any consistent findings across all participants is noteworthy. As such, the relationship between trauma-specific emotional functioning and self-report of memory functioning, as well as the relationship between trauma-specific emotional functioning and task performance of attention performance is significant. Taken together, there is support for an underlying neuropsychological phenomenon related to trauma processing that is expressed in attention task performance and reported in the form of memory functioning.

Discussion

At this point in the field of developmental traumatology, no research has yet examined the neurocognitive changes throughout treatment of sexually abused adolescents. Such research is needed to determine if there are changes in general information processing that produce cognitive effects in correlation with the emotional and behavioral effects supported in the traumatic stress response literature.

The potential for early behavioral, information processing, and stress-response dysregulation has been hypothesized by developmental traumatology to alter an individual's developmental trajectory such that dysregulation will be evident in adulthood (Cicchetti, 1993). If neuropsychological capacities are affected by traumatic stress in childhood as hypothesized by psychiatry (e.g., Cohen et al., 2002), clinical neuropsychology (e.g., De Bellis, 2005), and developmental traumatology research (e.g., Cicchetti & Toth, 2005), treatment of the traumatic stress response should lead to improved neuropsychological functioning. As such, the purpose of this research was to explore the effects of the traumatic stress response on sexually abused adolescents' neuropsychological functioning throughout treatment.

A sample of sexually abused participants was selected for several reasons. One, it allowed for examination of the traumatic stress response without the confounding of physical insults that could alter the brain functioning and development from injury in physical abuse or deprivation in neglect. Two, the sexually abused adolescents were receiving treatment through Project SAFE following disclosure of abuse allowing for access to an acute population. Three, as the participants were all receiving a manualized group treatment, confounding effects of different treatments and providers was minimized. Overall, a sample of Project SAFE participants allowed for examination of the phenomenon in a scientific manner, without compromising the care of sensitive population. At all times, participants' therapeutic needs were paramount to research endeavors.

To ensure that a sensitive population was protected throughout research, a two-tiered study was utilized. The exploratory study was conducted with the main goal of determining whether or not neurocognitive research on a population of sexually abused adolescents receiving treatment could be conducted without significantly impacting receipt of services. Secondary to the welfare of the clients, but of primary research interest was determining whether change in neurocognitive functioning was possible. A tertiary goal of exploring the priming effects of a trauma experience assessment measure was also utilized.

Exploratory Study

Overview of Study Results

Aim 1: Determine feasibility of utilizing a repeated assessment of neuropsychological processing during sexual abuse treatment. To determine the practicality of this research, an exploratory study was first carried out to determine the impact of altering the assessment procedure, increasing the frequency of assessments, and adding a computerized neuropsychological assessment into the treatment protocol. It was hypothesized that such methodological changes would be feasible during the context of sexual abuse treatment, but that unforeseeable obstacles would need to be addressed in future experimental design. Results of the exploratory study determined that adding a computerized assessment measure to the assessment battery was not particularly taxing on participants with regard to being too emotionally evocative. Rather, it was the nature of the repeated measure design that was problematic.

There were several reasons why repeated administrations of the ANAM was taxing to families. For one, the repeated assessment measure schedule required an extra time commitment from families that was potentially contraindicated for treatment effectiveness by causing additional stress to the families. Also, participants' complaints of multiple administrations of the ANAM as being "boring" threatened to confound results with suboptimal performance on such a sensitive measure. Third, with only one computer available and limited physical space, participants were distractible to each other when taking the ANAM in the same room as participants completing other assessment measures. Thus, minimizing participant time commitment, boredom, and distraction by limiting the administration of the ANAM was a modification made in the second treatment study.

Though participant "boredom" with the ANAM posed the potential confounds of decreased motivation and distractibility that would affect performance scores, this guarded against other potential confounds. For one, when assessing the effects of an emotional response, one does not want to be evoking an emotional response by the assessment measure itself. By stating that the ANAM is a "boring" assessment, participants are indicating that it is not producing an emotional response of extreme sadness, happiness, fear, or anger. Thus, it is a good means of assessing neurocognitive performance.

Overall, it was determined that it is feasible to utilize a repeated assessment of neuropsychological processing during sexual abuse treatment, if the assessment measure is administered within the regular assessment battery and families do not have to make additional trips, arrive early, or stay late to complete assessments on additional days.

Aim 2: Detect changes of neuropsychological functioning in the domains of attention, memory, and executive functioning that can be assessed throughout the course of a 12-week sexual abuse intervention. It was hypothesized that improvements in neuropsychological functioning would be detected during the course of sexual abuse intervention. Though this was found to be the case for some participants, the direction of change was not consistent across participants or within individual participants. Interestingly, the effects of neuropsychological functioning appeared to be as diverse as the individual. This individuality in response to trauma is similar to the effects of sexual abuse experiences on emotional and behavioral functioning following disclosure (e.g., Kendall-Tacket et al., 1993). This is also similar to the differences in direction and degree of cortisol changes in maltreated children (e.g., Cicchetti & Rogosh, 2001a, 2001b). Thus, each individual responds to stressors in their unique way. Just as one adolescent may be more cognitively, emotionally, or physically developed than another, they could demonstrate more resilience to a traumatic stressor than another adolescent with similar circumstances and chronological age.

Given that the manualized treatment was designed to improve emotional and behavioral functioning, as well as knowledge, neuropsychological changes were expected to be small for most youth as this was not the goal of the intervention. As expected, change was in neuropsychological processing was generally small. Another factor contributing to the small neurocognitive change may be due to the use of a measure that assesses changes in state when participants were undergoing changes more indicative of trait changes. The TBI battery, which was the version of the ANAM available for the exploratory study, was built to be sensitive to minor fluctuations in processing speed and reaction time (e.g., Short et al., 2007). The ANAM is typically given as a repeated measures assessment on a daily basis (e.g., Roebuck-Spencer et al., 2007). Thus, the ANAM may be too sensitive to measure trait changes. As adolescence is a time of large surges in development cognitively and emotionally, a measure that is too sensitive may not fully capture the adolescent's progress throughout treatment..

Another hypothesis of Aim 2 was that youth who presented to treatment with more significant clinical symptoms that may be impacting neuropsychological functioning would show the most neuropsychological change. Anecdotally, participant emotional and behavioral functioning did appear to be echoed by neurocognitive performance. Participant C and Participant B showed the most change in cognitive processing throughout treatment, though their change was in opposite directions.

Participant C was the oldest and most emotionally and cognitively mature participant in the exploratory study treatment group. She benefitted significantly from the cognitive behavioral interventions to the point of being a role model group member to the other participants. She was able to utilize coping skills, had the metacognitive abilities to explain to others in group how treatment strategies helped her, and was able to coach other participants to utilize appropriate coping skills. The change in her performance on the ANAM reflected the general neuropsychological processing development seen throughout treatment.

In contrast, Participant B was the youngest group member in treatment. She was not significantly less emotionally or cognitively developed than her group peers, but she did differ significantly in that she viewed her abuse as consensual for the majority of the treatment sessions. It was not until near the end of treatment, and after her peers had suggested multiples times that her abuse was coercive, that she began to consider that her abuser had been acting on a self-serving basis and that her abuse was not a mistaken act of affection. This was a rather devastating revelation for Participant B and her emotional and behavioral functioning declined in a corresponding manner.

These two participants, B and C, underwent the same group treatment simultaneously. Both reported themselves to be functioning about the same in terms of emotional and behavioral adjustment at the beginning of treatment. However, as both began to cognitively process their abuse experiences a contrast between their processing emerged. Participant C's view of her perpetrator's culpability was reaffirmed. Participant B's view of her abuser as not culpable was challenged. One of the core tenets of sexual abuse treatment is addressing cognitive distortions, such as blaming oneself for the abuse (e.g., Hansen et al., 1998). Though this is a basic tenet of cognitive restructuring, it can be highly evocative for the individual. For Participant B, her cognitive reprocessing led to a temporary decline in her emotional functioning. As such, her neuropsychological performance on the ANAM reflected this change in processing.

Overall, it was determined that changes in neuropsychological processing can be assessed throughout the course of a manualized 12-week group treatment for sexual abuse. These changes vary within and between individuals, as would be expected with any measure of an individual's response to a traumatic event. These changes appeared to roughly reflect the general changes in emotional cognitive processing observed anecdotally throughout treatment and warrant further investigation in the second study.

Aim 3: Evaluate performances on repeated neuropsychological assessments for a priming effect from direct inquiry about personal trauma experiences immediately prior to neuropsychological assessment. It was hypothesized that individuals would demonstrate a decrease in performance on neuropsychological assessment following completion of a self-report measure about the impact of trauma experiences. This was not found to be the case. No pattern of effects could be correlated solely with the effects of priming following the completion of the CITES. It is suspected that for many of these adolescents, just attending Project SAFE was evocative of their abuse experiences. The assessment measure questions do not differ from the content discussed in many of the sessions of the manualized treatment. Further, as the CAC is where all adolescents are interviewed and the families visit specifically and solely for abuse-related concerns, it is not surprising that such a setting would prime an individual to think about their abuse. The CITES may have caused additional priming effects beyond those already experienced in the milieu, but not at a level that could be detected by an indirect measure of an effect, such as the ANAM.

Limitations of the First Study

There were two major limitations of the first study. One limitation was the sample selection. It is difficult to access a population of sexually abused adolescents, who were referred for treatment within a similar enough time frame to participate in a group treatment together. Further, many adolescents referred for treatment decline to participate in group treatment or are unable to complete treatment for a variety of reasons. To combat historically high participant attrition in this population, all adolescents participating in group treatment were offered the opportunity to participate in research to increase the sample size. Though this had the benefit of examining treatment effectiveness, it did not allow for the rigorous sample selection traditionally associated with neuropsychological research. Participant handedness, medical history, medication usage, education level, or general cognitive ability were not controlled for and remain potential confounds.

A second significant limitation was the inability to examine the association between ANAM performance and other measures of neuropsychological functioning. Though convergent validity has been established for the ANAM and other measures of neurocognitive performance with adult populations, no studies have examined this with adolescent populations. Further, the only assessment measures specifically designed for assessing daily neurocognitive functioning on a regular, repeated basis for adolescents are designed for use within a sports medicine battery context and are only available for use with purchase (e.g., ImPACT; Lovell, Collins, Podell, Powell, & Maroon, 2000). Whereas the ANAM was available with permission from the authors and has been used in a wide variety of medical and performance contexts. Thus is was not possible, nor as applicable, to utilize additional or alternative measures of neuropsychological performance during this study.

Second Study

Methodological Adjustments Implemented in the Second Study

Several changes were made in the methodological design of the second study to incorporate the findings of the first study and address the limitations of the second study. For one, participants were given an abbreviated assessment of neuropsychological functioning prior to receiving services to determine if the participants' general intellectual functioning (i.e., IQ scores) are comparable to their same-aged peers. Though this did not afford the luxury of sample selection, it did offer a better descriptive picture of participants and allowed for a better perspective on the interpretability of findings.

A second change was the addition of specific questions addressing participants' neuropsychological functioning to the Weekly Problems Scale. A measure was not in existence to assess this phenomenon, nor was it feasible to develop a measure with sufficient reliability and validity checks to ensure its psychometric soundness in the time available. However, as there was a repeated measure with sound psychometric properties for measuring general emotional and behavioral functioning already in the assessment repertoire, it was feasible to add specific questions to this measure for the purpose of assessing these variables of interest. Further, adding three more questions to a single-page assessment measure is not significantly burdensome to participants.

Several adjustments were made in the second study specifically to reduce potential confounds associated with taking the ANAM on a repeated basis. For one, the number of ANAM administrations was limited to regular assessment periods. This reduced the time burden on families significantly. Two, a second computer was utilized to run the ANAM. This allowed for participants to take the assessment simultaneously, limited their distractions from each other, and expedited the assessment process to minimize boredom (i.e., no one having to wait around after finishing their paperwork assessments for another participant to finish on the computer for their turn on the computer). Also to keep participants motivated, a new “prize box” of adolescent-appropriate reinforces was implemented. The prizes were rotated such that motivation to receive a prize was maintained.

Finally, another methodical change occurred unexpectedly increasing the physical space for the second study. Most rounds of Project SAFE have simultaneous groups for parents, older children (adolescents), younger children, and siblings. With only four rooms available in the Child Advocacy Center for group treatment, each group must conduct its assessments with all participants present in the treatment room. The second study happened to fall in a round of Project SAFE that had neither a younger child group nor a sibling group. Thus participants could take computerized assessments in a quiet room with another participant also taking the same assessment, facing away from each other. Other participants not taking the computerized assessment were in a separate room. This dramatically reduced the distractibility of participants, and their effects on each others' performance during the second study.

Overview of Study Results

Aim 1: Determine if sexually-abused youth show improvements in emotional and behavioral functioning during the 12-week sexual abuse intervention. It was hypothesized that a single-subject design would demonstrate improvements in emotional and behavioral symptoms. Change in emotional and behavioral functioning throughout treatment was demonstrated, but effects within and between participants was variable. For participants with extenuating life stressors, this variability in functioning is expected (Silverman et al., 1996) and any improvement in functioning would call into question the ecological validity of the repeated assessment measure. Thus the general improvement in emotional and behavioral functioning throughout treatment for participants who did not have continued contact with their abusers, received treatment, and received appropriate caregiver support demonstrated improvement consistent with the literature on treatment of sexually abused youth (e.g., Dyregrov & Yule, 2006).

It was also hypothesized that youth with the most significant clinical symptoms would show the most improvement. This was not found to be the case as participants in the second study with the most significant emotional and behavioral symptoms were also facing the most significant, chronic, and continually exacerbating stressors. As extenuating life circumstances continued to add stress to participants, improvements in functioning or resiliency are likely masked. Further, participants who did not demonstrate a decline in emotion and behavioral functioning in the face of such stressors could be interpreted as improved functioning.

Aim 2: Determine if there are changes in neuropsychological functioning in the domains of attention, memory, and executive functioning throughout the course of a 12-week sexual abuse intervention. Neuropsychological functioning was measured three different ways: via self-report, parent-report, and individual performance on computerized assessment measures. There was little correlation between assessment methods, suggesting that perhaps each measure was measuring a slightly different phenomenon. For example, the WPS-R items assessing memory, was worded in a manner that is more evocative of short-term memory than working memory. As the ANAM Code Substitution task is more a measure of working memory than short-term memory like the Code Substitution Delayed, it would not be expected to correlate as well with self-report and caregiver-report assessments. A second example of different measures assessing different phenomenon is the lack of correlation between the self-report and caregiver-report executive functioning item on the WPS-R. While adolescents are certainly able to report on their problem-solving ability, their caregivers are able to provide a more omniscient perspective given caregiver experience, wisdom, and frontal lobe development. Thus adolescents' perspective on their executive functioning skills would not be expected to correlate with their caregivers' perspectives on these abilities. A third example of different measures assessing different phenomena is the correlation between self-report of attention and performance on the ANAM Simple Reaction Time subtest. This subtest is the purest measure of attention in the given battery. Whereas the Continuous Performance Test of the ANAM requires active processing of stimuli to inhibit responding. Thus participants performance on the SRT more closely matches their self-report of attention functioning than the CPT as this latter measure combined elements of executive functioning to attention functioning.

As hypothesized, changes in neuropsychological functioning were detected during the course of sexual abuse intervention. However, these changes were diverse between and within individuals. Overall, participants and their caregivers reported a general improvement in neuropsychological functioning throughout treatment. This was determined primarily by examining the change in means of phases from pre-treatment to follow-up. Examining changes in levels of phases was not particularly useful as the conditions of the phase were not defined by specific conditions (e.g., an active condition treatment that could be completely removed). As such, examining changes in levels added little to the graphical analyses. Examining change in slope was mostly helpful during the baseline and treatment phases for the WPS–R as the other phase contained too few time-points to capture change. This was also evident with the ANAM as it was only administered 4 times. Thus examination of changes in means of phases was the most useful measurement for graphical analyses.

It was also hypothesized that youth who presented to treatment with more significant clinical symptoms that may be impacting neuropsychological functioning would show the most change. An interesting confound obscured examination of this hypothesis: participants who presented to treatment with the most significant clinical symptoms were the ones who had ongoing extenuating circumstances that acted as continual stressors. As the hypothesis was generated from a working knowledge of the child maltreatment literature, it was formulated with the assumption that functioning following abuse could be examined in relative isolation from the terminated abuse experience. Unfortunately for the participants in this research study, the end of their abuse had little correlation with the subsequent abuse-related (e.g., pregnancy, testifying in court) and non-abuse-related stressors (e.g., custody disputes, house fires) they had to endure. There was only one participant who did not have the same extenuating stressors, Participant W, who did present with a high level of clinical symptoms that continually improved throughout treatment. It would be premature to speak to general improvements of the group based on one participant, particularly since the data collected to address this hypothesis was confounded by additional significant stressors for the majority of the group.

Another hypothesis generated for this aim was that there would be differences across types of neuropsychological functioning (i.e., attention, memory, executive functioning). Participants' memory performance generally worsened throughout treatment, their attention performance was variable between participants, and their executive functioning verbal performance worsened while their visual-spatial executive functioning performance increased. Participants perceived their attention and memory functioning to decrease throughout treatment, and their executive functioning performance to be variable. Due to the aforementioned extenuating circumstances, participants were essentially in a chronic stress condition from pre-treatment to follow-up. Thus it is likely that participants' attention and memory functioning, two symptoms well documented to be affected by stress (e.g., Beers & De Bellis, 2002; Moradi et al., 1999; Porter et al., 2005), was reflected by ANAM performance and self-report measure.

The difference in participants' performance on measures of executive functioning may be attributable in part to the verbal versus visual spatial processing nature of the tasks. Participants' performance on the ANAM Logical Relations, a measure that elicits verbal processing, worsened throughout treatment. This decrease in performance is consistent with the chronic stress participants experienced. It is also indicative of potential for poorly integrated sensory information. On this task participants must read to solve a logic problem. As reading requires both visual perception of information and verbal processing of that information, successfully solving a logic problem requires integrating those forms of processing for mental manipulation. Poorer performance on this measure may be attributable, in part, to difficulty integrating the different forms of processing. This is similar to the poor sensory integration documented in the traumatic stress literature (e.g., Teicher et al., 2002).

In contrast, the Tower Puzzle requires visually perceived information to be manipulated to solve a visual-spatial problem. As this task only elicits visual-spatial problem-solving, participants do not have to integrate different forms of processing. Thus task performance would not be affected by a difficulty in integrating different forms of processing information that is often seen with a traumatized population.

Aim 3: Evaluate changes in neuropsychological functioning related to changes in behavioral and emotional symptom presentation during the 12-week sexual abuse intervention. It was hypothesized that individuals with the most significant changes in behavioral and emotional functioning would show the most significant changes in neuropsychological functioning throughout the course of treatment, and that these changes would be in the same direction. The underlying assumption of this hypothesis was based an assumption that neuropsychological functioning as a whole would be affected by the traumatic stress response. Though there was much variation between and within individuals, an overall trend was observed that supported this interrelationship between more commonly assessed emotional and behavioral symptoms and neurocognition.

This finding is interesting for several reasons. For one, though cognitive reprocessing is targeted in many manualized cognitive-behavioral therapies, such as Project SAFE, this study demonstrates a change in general neurocognitive processing. While cognitive processing surrounding abuse-related experiences is specifically targeted during Project SAFE, changes in non-abuse-related cognitive processing were found to be a by product of the intervention. It is inappropriate to claim that these changes are indicative of global, developmental, or trait-like changes overall that will remain constant throughout time. Rather, it is more appropriate to frame these change in neurocognitive processing as evidence of a link between emotion, behavioral and cognitive processing.

A second reason this interrelationship between emotional/behavioral and cognitive processing is interesting is that it was consistent for participants who reported improvements throughout treatment as well as those who reported decreasing in functioning throughout treatment. If trends were found for only improvement on all measures, then this improvement could be attributed to overall cognitive development, maturation effects, or insensitive assessment measures. Because a decline in functioning was evident for some participants, and an increase in functioning was found for other participants, it can be inferred that the assessment measures were sensitive enough to detect the phenomenon of participant functioning as measured by a variety of measures assessing the same underlying phenomenon.

Finally, the most interesting finding in the interrelationship between emotional, behavioral and cognitive performance in the correlation between performance on trauma related measures. The traumatic stress response assumes a neuropsychological reaction to a traumatic event that impairs neuropsychological processing enough to impact functioning across a variety of domains. As it is impossible to objectively measure an individual's subjective response to their traumatic event, this study was designed to be inclusive of participants from a population at risk for traumatic reactions based on their experiences. Interestingly, the most consistent findings between emotional and neurocognitive functioning was found for trauma-related symptomatology. All participants reported a consistent correlation between change in means of phases among self-report of memory functioning, self-report of trauma symptoms on the CITES PTSD scale, and performance on the ANAM CPT test. This was the only permutation of variables which had such a consistent correlation in change of means between phases for all participants.

It is not surprising that individuals' self-report on a measure of trauma symptoms and their self-report of memory functioning would be similar as that is one of the symptoms descriptive of trauma response. More interesting perhaps is the correlation between these self-report measures and performance on a measure of attention which is not as affected by content overlap and self-perception. Taken together, this correlation suggested that these participants' change in processing of their traumatic experiences were reflected in multiple domains of neuropsychological functioning, as suggested by a traumatic stress response conceptualization.

Limitations of the Second Study

This study was designed to examine questions surrounding the neurocognitive processing of traumatic experiences. Providing free sexual abuse treatment services through the community allowed for access to a specially protected population that would otherwise be quite difficult to access. As a population of maltreated children are presenting to group treatment oftentimes as the only means of therapy available to them, special care had to be taken to ensure that service provision to clients was paramount to research endeavors at all times. As such, this was the impetus for a minimalist approach to data collection and many of the limitations surrounding this research.

From the exploratory study it was determined that clients found additional assessment periods to be taxing in family time and resources. Thus the second study pared down the number of ANAM assessment periods to match the regular time-point assessments. In making this accommodation for families, it was not possible to get as robust a picture of neurocognitive change as in the first study, particularly throughout the treatment and post treatment phases. As such, it is possible that there could be much change in neurocognitive performance within these phases that was not captured. Increasing the number of ANAM assessments would have also allowed for a more rigorous examination of construct validity with this assessment measure and the items added to the Weekly Problems Scale-Revised.

A second limitation regarding number of assessments was the lack of assessments between the post-treatment time-point assessment and the follow-up time-point assessment 3 months later. Initially, the second study research design considered including multiple administrations of the WPS-R between these two post-treatment assessments. However, there were three factors that prevented this. First, many of the adolescents stated during treatment that they "needed a break from thinking about it [their abuse]" and thus client needs were prioritized over research wants. Second, many of the adolescents in the second study were unlikely to be able to complete and return the forms due to their physical locations (e.g., out of state visiting non-custodial parent). Third, collecting baseline data in preparation for receipt of services was client-centered in that it allowed for preparation of client treatment whereas collecting such data post-treatment only serves the researcher. Thus to be client-centered, multiple time-points of data post-treatment were not collected.

Another limitation of this study was the means by which neurocognition was assessed. The ANAM, though well-suited as a measure of neurocognitive functioning for repeated single-subject assessment, is not traditionally used with non-medical populations. Further, most clinical neurocognitive evaluations would call for a battery of assessment measures. As there is not much research comparing adolescents' performance on the ANAM to their performance on other measures of neurocognition, findings of ANAM performance are not necessarily generalizable to performance on other measures of neurocognition. Therefore, some researchers could argue against construct validity between ANAM and more traditional measures of neurocognitive assessment that are traditionally utilized in neuropsychological assessment batteries to provide convergent validity of findings.

Also due to time constraints, ANAM subtests were selected to target neuropsychological domains theorized by the traumatic stress response to be effected by adolescents' abuse experiences. Without inclusion of domains hypothesized to not be affected, discriminate validity was sacrificed. Thus it is possible that other domains of functioning (e.g., motor abilities) may be affected. If these other domains were found to be affected it is possible that other neurochemical chain reactions could connected to the changes observed in this research than the involvement of the prefrontal cortex and limbic system proposed by the traumatic stress response.

Finally, there is a limitation in assuming that change in neurocognitive performance can be linked to change in emotional and behavioral functioning through a theoretical assumption driven by a biochemical explanation without directly measuring biochemistry. Assumptions about neurochemical changes that occur in the traumatic stress response are not supported by data from this research as no marker of biochemistry was measured. Thus correlation changes in the aforementioned phenomenon should be interpreted only as supporting a link between related fields of research and theory on traumatic stress.

Conclusions

Suggestions and Implications for Research

The first goal of this research was to determine if there are measurable differences in neuropsychological processing throughout treatment. As it was possible to measure changes in neurocognitive processing throughout treatment and this study is the first of its kind, there is a strong need for replication of the findings. Replication of this research with different populations, or different manualized treatments would allow for more causal discernment of the findings. Future research designs should consider replicating this research with children and adolescents of multiple age groups. As discussed by Teicher and colleagues (2002) developing brain structures are differentially affected by the traumatic stress response depending on maturation. Future researchers would also benefit from increasing the number of assessments during all phases of the research to allow for more closer examination of changes prior to, during, and after treatment.

Researchers should also consider including a more comprehensive neurocognitive battery in future research (e.g. intellectual, learning/memory, attention, executive, visual/spatial, language, and motor skill functional domains). Such a research design would allow for both convergent and discriminate validity of the effects of the traumatic stress response by comparing changes in functioning between domains hypothesized to be affected by the traumatic stress response and those domains hypothesized to not be affected. While a comprehensive neuropsychological assessment of 4 to 8 hours across 1 or 2 sessions may be too unwieldy to conduct within a treatment context, and certainly not feasible on a weekly basis, treating clinicians could collaborate with non-treating researchers to conduct pre-treatment and post-treatment assessments. This would allow for more thorough examination of the phenomenon of interest as well as parse out clinician bias in interpretation of performance results.

Another consideration for future researchers is the inclusion of biological or physiological assessments. Imaging studies could be conducted pre and post-treatment to explore regional cerebral blood flow during neutral stimuli performance tasks. Cortisol sampling, skin conductance, heart rate, and blood pressure could all add a dimension of physiological assessment in a less cost prohibitive manner.

Finally, it will be important to replicate this research with different manualized interventions that have demonstrated effectiveness in treating PTSD in youth (e.g., Trauma-Focused Cognitive Behavioral Therapy; Cohen, Deblinger, Mannarino, & Steer, 2004). As Project SAFE is a cognitive-behavioral intervention, the treatment components target cognitive processing of the abuse experience. It would be interesting to discover if sexual abuse treatment that is not cognitive behavioral has similar neurocognitive effects. Additionally, the group treatment format allowed for peer influence on processing. Future researchers may also want to consider comparative studies of individual and group therapy recipients.

Suggestions and Implications for Clinical Work

The second goal of this research was to determine if changes in neuropsychological functioning are related to changes in emotional and behavioral functioning. As support was found for this linkage, clinicians are encouraged to explore the implications of a broader symptom presentation of their sexually abused clients (e.g., Ford, 2005). This broader symptom presentation should be considered in the contexts of assessment/evaluation, treatment, and working with caregivers and the schools.

This linkage calls for inclusion of neuropsychological functioning in evaluations of sexually abused youth. Evaluations of sexually abused youth should include neuropsychological functioning assessment as part of a comprehensive assessment battery. These assessments need not be exhaustive, but should be inclusive of domains suspected to be affected by the adolescent's abuse experience. Similarly, specific neuropsychological domains that are believed to be impaired should be assessed repeatedly in youth presenting for treatment to measure treatment gains. Further, the potential effects of trauma on symptom presentation should be considered when evaluating an adolescent for executive functioning disorders (e.g., Attention-Deficit Hyperactive Disorder).

The effects of neurocognitive functional impairment should also be considered by clinicians treating adolescents for trauma. Traumatized clients with impaired attention functioning may benefit from shorter session times. Therapists may need to present psychoeducational information more slowly to clients whose trauma experiences have affected their processing speed; those with memory impairment may need repeated presentation of psychoeducational materials. Clients whose language functioning is diminished may benefit from pictures or visual aides to complement exchanges of verbal information. Such accommodations would allow traumatized clients to participate more fully in therapy sessions and make treatment gains more rapidly.

Similarly, traumatized clients may need accommodations in school to facilitate their ability to attend, retain information, and problem-solve in cognitively demanding environments (e.g., Cook-Cotton, 2004). At a minimal level, explaining the potential impact on neurocognitive functioning to teachers and caregivers will allow for a better understanding of the child and more appropriate expectations for the child's functioning.

Finally, the linkage of neuropsychological functioning to emotional and behavioral functioning should be a reminder to clinicians to look for resilience and strength in trauma survivors. Adolescents who have survived traumatic experiences are oftentimes referred to treatment because of their experiences, rather than their reaction to that experience. Many individuals referred in such a manner do not manifest clinically significant disturbances in functioning. For adolescents who present with emotional, behavioral, or neuropsychological impairments following trauma, clinicians should highlight non-impaired areas of functioning as evidence of resilience. This can provide families of trauma survivors hope through evidence of relative strengths and empowerment in utilizing these strengths while developing skills in other areas.

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APPENDIX A: WEEKLY PROBLEM S SCALES- REVISED

Weekly Problems Scale-Parent Version-Revised

The following is a list of statements that asks you to think about how you and your child have been doing during the past 7 days. Please rate each statement on a scale of 1 to 10 as described below. Choose the number that best describes you or your child and place your answer in the space to the left of each statement.

1 = never
2 = almost never
3 = very rarely
4 = rarely
5 = a little of the time
6 = some of the time
7 = frequently
8 = very frequently
9 = almost always
10 = always

1. ____During the past 7 days my child appeared unhappy, sad, or depressed.

2. ____During the past 7 days my child appeared nervous, tense, or anxious.

3. ____During the past 7 days my child appeared to feel good about herself.

4. ____During the past 7 days my child was noncompliant (e.g., did not follow my directions, did not follow my family rules).

5. ____During the past 7 days my child argued or fought with others (e.g., other kids).

6. ____During the past 7 days my child was restless, hyperactive, or could not sit still.

7. ____During the past 7 days my child interacted and got along well with friends her own age.

8. ____During the past 7 days my child interacted and got along well with the rest of the family.

9. ____During the past 7 days my child and I talked about sex related issues.

10. ____During the past 7 days my child and I talked about some aspect of sexual abuse.

11. ____During the past 7 days my child appeared to feel guilty or ashamed about the sexual abuse.

12. ____During the past 7 days I felt like I was a competent parent.

13. ____During the past 7 days my child and I were able to communicate well with one another.

14. ____During the past 7 days my child and I interacted well together.

15. ____During the past 7 days I felt stressed as a parent.

16. ____During the past 7 days my child displayed inappropriate sexual behavior.

17. ____During the past 7 days my child was forgetful.

18. ____During the past 7 days my child had difficulty paying attention.

19. ____During the past 7 days my child had difficulty planning ahead and following through with tasks

Weekly Problems Scale-Child Version-Revised

Please mark (X) the answer that best describes your feelings or interactions during the past week.

1. I feel sad

____never
____almost never
____a little of the time
____some of the time
____most of the time
____all of the time

2. I feel nervous or worry about things

____never
____almost never
____a little of the time
____some of the time
____most of the time
____all of the time

3. I like myself

____never
____almost never
____a little of the time
____some of the time
____most of the time
____all of the time

4. I argue or fight with people

____never
____almost never
____a little of the time
____some of the time
____most of the time
____all of the time

5. I get yelled at or get into trouble

____never
____almost never
____a little of the time
____some of the time
____most of the time
____all of the time

6. I get along with my friends

____never
____almost never
____a little of the time
____some of the time
____most of the time
____all of the time

7. I feel like I am as good as other kids

____never
____almost never
____a little of the time
____some of the time
____most of the time
____all of the time

8. I feel guilty about things that have happened

____never
____almost never
____a little of the time
____some of the time
____most of the time
____all of the time

9. I am forgetful

____never
____almost never
____a little of the time
____some of the time
____most of the time
____all of the time

10. I have trouble paying attention

____never
____almost never
____a little of the time
____some of the time
____most of the time
____all of the time

11. I having trouble planning ahead and following through on tasks

____never
____almost never
____a little of the time
____some of the time
____most of the time
____all of the time

Please answer these questions about the person who is bringing you to this group.

12. I have good talks with him or her

____never
____almost never
____a little of the time
____some of the time
____most of the time
____all of the time

13. I get along with him or her

____never
____almost never
____a little of the time
____some of the time
____most of the time
____all of the time

14. I feel like he or she is good to me

____never
____almost never
____a little of the time
____some of the time
____most of the time
____all of the time