Comparison of exposure to trauma and attention deficit/hyperactivity disorder in children

Tammy L. Whitlock

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Comparison of Exposure to Trauma and Attention Deficit/Hyperactivity Disorder in Children

Tammy L. Whitlock, M.A

A Dissertation
Submitted to the Faculty of Graduate Studies through the Department of Psychology in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy at the University of Windsor

Windsor, Ontario, Canada

2007

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ABSTRACT

Research suggests that children who have experienced trauma are often more likely to be diagnosed with ADHD than PTSD (Famularo et al., 1996). It has been suggested that many children who have experienced trauma may actually be misdiagnosed with ADHD, due to the overlap between ADHD and symptoms of trauma (Weinstein et al., 2000). The goal of this clinical exploratory study was to examine the comorbid features and to compare the behavioural and neuropsychological profiles of children with symptomatic trauma and children with ADHD. This goal was accomplished through three objectives: to determine the proportion of children with symptomatic trauma who also meet diagnostic criteria for ADHD; to compare children with symptomatic trauma with children with ADHD who have not experienced trauma on measures of intelligence, academic achievement, attention, memory, and executive functioning; and to compare the severity of the behavioural and emotional symptoms between these groups. Initial results revealed few significant differences on cognitive and behavioural variables between the two groups, which was believed to be associated with a 67% comorbidity of ADHD within the Trauma group. Thus, the Trauma group was subdivided into the Trauma only and ADHD/Trauma groups for further analyses. Overall, there were no significant differences between the ADHD and ADHD/Trauma groups on any of the cognitive or behavioural measures. The Trauma only group demonstrated very little impairment on cognitive and behavioural measures, with the exception of significantly lower performance on a memory composite score as compared to the normative sample. When compared to the two ADHD groups, the Trauma group demonstrated significantly higher scores on an executive functioning composite, and significantly fewer elevations on
BASC parent, teacher, and self-report measures of Behavioural Symptoms, Externalizing Problems, School Problems, Adaptive Skills, Locus of Control and Depression. These findings suggest that children with symptomatic trauma are at risk for developing behavioural symptoms similar to those seen in ADHD, as well as similar cognitive and behavioural profiles to children with ADHD without exposure to trauma.
ACKNOWLEDGEMENTS

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CHAPTER 1

INTRODUCTION

The lifetime prevalence of trauma exposure for both children and adults ranges from 25 to 90% using the Diagnostic and Statistical Manual of Mental Disorders -fourth edition, text revision (DSM-IV-TR) definition for a traumatic stressor (Breslau et al., 1998; Elklit, 2002). The lifetime prevalence of posttraumatic stress disorder (PTSD) using DSM-IV criteria has been reported to range from 8 to 18% (Breslau, Chilcoat, Kessler, & Davis, 1999), with rates as high as 34.5 to 36% for children and adolescents (American Academy of Child and Adolescent Psychiatry (AACAP) Practice Parameters, 1998; Fletcher, 1996).

Increasingly, research has shown that traumatic experiences in childhood are likely to produce a chronic stress response that can affect the child’s neurobiological, emotional, behavioural, cognitive, and interpersonal development (De Bellis, Hooper, & Sapia, 2005). Even in the absence of a PTSD diagnosis, partial PTSD responses commonly develop and contribute to substantial impairment and distress (Carrion, Weems, Ray & Reiss, 2001).

Some studies have determined that children who have experienced trauma are often more likely to be diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) than PTSD (Famularo, Fenton, Kinscherff, & Augustyn, 1996). Despite high prevalence rates and known cognitive, psychosocial, and biological impact of trauma there is no specific diagnostic category for trauma exposure within the DSM-IV. Thus, children exposed to trauma who do not meet criteria for PTSD are likely to be treated primarily for comorbid conditions, such as ADHD, while the treatment for trauma symptoms is
ADHD and Trauma

overlooked. It is hypothesized that many children who have experienced trauma may actually be misdiagnosed with ADHD, as these two groups tend to have similar behavioural profiles (Cuffe, McCullough, & Pumariega, 1994; Kinard, 1995; Livingston, Lawson, & Jones, 1993; Weinstein, Staffelbach, & Biaggio, 2000). Unfortunately, the potential for misdiagnosis between these two disorders may lead to inadequate or inappropriate treatment.

There is a paucity of research on the neuropsychological effects of trauma exposure in children and to date no study has compared the cognitive and behavioural profiles of children exposed to trauma with children diagnosed with ADHD to assist in understanding the association between these two conditions and the ways in which they might differ clinically. The present study, which is exploratory in nature given the lack of previous research to guide predictions, is an attempt to address several important clinical issues. The goal of this study was to examine the comorbid features and to discuss the differential diagnosis between symptomatic trauma and ADHD by comparing the behavioural and neuropsychological profiles of children with behavioural and emotional symptoms following exposure to trauma and children with ADHD. The objectives were to determine the comorbidity of ADHD and symptomatic trauma, as well as to compare neuropsychological and psychosocial profiles between children who are experiencing emotional or behavioural symptoms following exposure to trauma and children with ADHD who have not been exposed to trauma.

This paper begins by providing an in depth overview of trauma exposure that includes epidemiology, etiology, assessment and diagnosis, comorbidities and psychosocial features, treatment, neurobiology, and neuropsychological sequelae.
Although this study examined children who had experienced trauma, without necessarily being diagnosed with PTSD, all children experienced some PTSD symptoms. Due to the overlap of trauma exposure and PTSD in the research, much of the literature reviewed focuses on PTSD research. Following is an in depth overview of ADHD. Subsequently, an overview of the correlates and comorbidity between ADHD and symptomatic trauma and the importance of differential diagnosis are presented.

Trauma

Trauma is defined in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) as experiencing an event or events that involve “actual or threatened death or serious injury, or other threat to one’s physical integrity”; or witnessing or learning about “an event that involves, death, injury, or threat to the physical integrity of another person (Criterion A1). The person’s response to the event must involve intense fear, helplessness, or horror.” In children, this may be expressed instead by disorganized or agitated behaviour (American Psychiatric Association, 2000, p. 463).

Approximately 8 to 36% of individuals exposed to trauma will present with Post-Traumatic Stress Disorder (PTSD) depending on their age and gender, as well as the type of trauma experienced (AACAP Practice Parameters, 1998; American Psychiatric Association, 2000; Breslau et al., 1998; Fletcher, 1996). PTSD is described in the DSM-IV-TR as characteristic symptoms following exposure to an extreme traumatic stressor. The diagnosis of PTSD in adults includes a subjective component that stipulates that the individual must react to the traumatic experience with intense fear, helplessness, or horror (American Psychiatric Association, 2000). The type, duration, intensity, and frequency of the trauma and the individual’s physical proximity to the traumatic stressor are
believed to determine the likelihood of developing PTSD (American Psychiatric Association, 2000; Famularo et al., 1996). Despite a long history, and a large body of research on Vietnam War veterans, it was not until the 1980’s that PTSD became a formal diagnosis (American Psychiatric Association, 1980; Weinstein et al., 2000).

Although PTSD first appeared in the DSM-III (American Psychiatric Association, 1980), it was not until the introduction of the DSM-III-R (American Psychiatric Association, 1987) that criteria specific to children were incorporated into the definition. The DSM-IV-TR definition of PTSD contains a qualifier that children with PTSD may express disorganized or agitated behaviour rather than responding to a trauma with fear or helplessness (American Psychiatric Association, 2000). Despite the acceptance of the impact of trauma and development of PTSD in children, there is a paucity of research on the cognitive sequelae of PTSD in children (Beers & De Bellis, 2002; Salmon & Bryant, 2002; Weinstein et al., 2000).

Epidemiology

Prior to the introduction of the DSM-IV in 1994, trauma was defined in the DSM-III-R as an event that would be distressing to almost everyone and generally outside the range of usual human experience (American Psychiatric Association, 1987 as cited in Breslau 2002). In the DSM-IV the definition of a traumatic stressor was broadened as described above. It has been reported that the broadening of the trauma criterion increased the lifetime prevalence of trauma from approximately 68.1 to 89.6% (Breslau 2002).

A study of Danish eighth-grade youth with a mean age of 14.5 years reported that between 25 and 87% of youth report experiencing at least one traumatic, with girls
reporting significantly more episodes as compared to boys (Elklit, 2002). Many adults have experienced more than one traumatic event. The mean number of distinct traumatic events reported by adults (18 to 45 years) who have been exposed to any trauma was reported to be 4.8 (Breslau et al., 1998).

Approximately 8 to 18% of the adult population in the United States who have experienced trauma go on to develop PTSD. An epidemiological survey examining women alone found that 10% of women met criteria for PTSD at some point in their lifetime. Traditionally, the focus of PTSD has been on adults, but recent studies have shown that PTSD symptoms can occur at any age and usually begin within the first three months of the trauma. However, there may be a delay of months, or even years, before symptoms appear (American Psychiatric Association, 2000; Krupnick, 2002; Breslau et al., 1998; Sageman, 2002).

Many prevalence estimates of PTSD focus on the development of PTSD among different trauma groups. Unless otherwise reported, it can be assumed that studies reviewed utilized DSM criteria (American Psychiatric Association 1987, 2000) in order to determine prevalence rates of PTSD. The prevalence of PTSD among children who had been sexually abused ranged from 42.3 to 44.4% (McLeer, Deblinger, Henry, & Orvashel, 1992; McLeer et al., 1994). However, significantly more children (86.5%) were found to meet partial criteria of PTSD, defined by meeting one or two of the three symptom clusters consisting of hyperarousal, re-experiencing the trauma, and avoidance. In contrast, Kiser et al. (1988) found incidence ratings of PTSD to be 90% in children who have been sexually abused.
A review by Salmon & Bryant (2002) compared prevalence rates of PTSD in children as a function of the type of traumatic incident. They found that natural disasters have been reported to result in the lowest rates of PTSD in children with prevalence ratings as low as 5% (Shannon, Lonigan, Finch, & Taylor, 1994). In comparison, the highest reported prevalence ratings were from warfare (27-48%; Kinzie, Sach Angell, Manson, & Rath, 1986; Saigh, 1991), violent crimes (27-33%), exposure to maternal sexual assault, or exposure to parental homicide (100%; Malmquist, 1986). There is more difficulty reporting presence of PTSD in children who have experienced motor vehicle accidents due to the confounding effects of comorbid traumatic brain injury (TBI). Aaron, Zaglul, and Emery (1999) reported the incidence of PTSD to be 23% of children experiencing motor vehicle accidents.

A meta-analysis of 34 samples that included a total of 2,697 children who had experienced different types of trauma revealed the incidence of PTSD across traumas to be 36%. The author found no significant difference in incidence rates of PTSD across developmental levels of the children. Specifically, they reported that PTSD was diagnosed in 39% of preschoolers, in 33% of school-aged children, and in 27% of adolescents (Fletcher, 1996).

Duration of symptoms is reported to vary from months to years. Complete recovery occurs within 3 months in approximately half of the cases, whereas others have persistent symptoms for longer than 12 months after the trauma (American Psychiatric Association, 2000). In others, it is reported that symptoms wax and wane and symptom reactivation may occur in response to reminders of the original trauma, life stressors, or new traumatic events (American Psychiatric Association, 2000). However, there is no
evidence to suggest that remission of symptoms ameliorates all cognitive and physiological changes that may have occurred as a result of the trauma or development of PTSD.

Etiology

Although there are a number of possible sources of trauma, these are often grouped for research purposes. Some of the common traumatic experiences in both adults and children include being exposed to or directly experiencing a life-threatening accident, rape, acts of violence, war combat, kidnapping, hostage situation, terrorist attack, torture, concentration camps, burns, bombings, life threatening illness, and natural or manmade disasters (American Psychiatric Association, 2000; Cuffe et al., 1994; Famularo et al., 1996). Common sources of trauma in children include sexual or physical abuse, exposure to domestic violence, or parental neglect (Famularo, Fenton, Kinscherff, 1993; Gorham, 1997; James & Gilliland, 2001; Sageman, 2002). In addition, “for children sexually traumatic events may include developmentally inappropriate sexual experiences without threatened or actual violence or injury” (American Psychiatric Association, 2000, p. 464).

Research has revealed a number of risk factors thought to increase the likelihood of trauma exposure including male gender, younger age, and prior exposure to trauma (Breslau et al., 1998; Breslau et al., 1999; Duke & Vasterling, 2005; Fletcher 1996). A longitudinal study of a random sample of children assessed at 6 years and followed up to age 17 revealed that 6 year olds with self-report and teacher ratings of externalizing problems were 2.6 times more likely to be exposed to assaultive violence by the age of 17 (Breslau, Lucia, & Alvarado, 2006).
When examining relative risk of different trauma exposure in developing PTSD it was observed that children who had experienced sexual abuse or who had been exposed to serious domestic violence seemed to develop PTSD at a higher rate in comparison to those who had experienced physical abuse or parental neglect (Famularo et al., 1993). It is noted that PTSD may result not only from witnessing serious injury, accidents, or acts of violence or events experienced by others, but from vicarious exposure of traumatic events retold by others (American Psychiatric Association, 2000).

Less clear is what leads some trauma survivors to develop PTSD while others appear to be relatively unaffected by the trauma or do not develop the disorder. Some commonly identified risk factors for developing PTSD include female gender (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995), previous trauma exposure (Breslau et al., 1999), and a personal or family history of psychopathology (Breslau 2002; Perkonigg, Kessler, Storz, & Wittchen, 2000 as cited in Golier & Yehuda, 2002). It is believed that biological and developmental factors likely play a contributory role in the development of PTSD (Famularo & Fenton, 1994; Famularo et al., 1996; Golier & Yehuda, 2002). Specifically, it has been reported that a birth weight of less than 5 pounds, sleep problems, frequent crying, poor weight gain, fussiness, jumpiness, or an increased prevalence of jaundice, vomiting, diarrhea, or infections when within the first year of life significantly distinguished maltreated children who developed PTSD from children who did not develop PTSD (Famularo & Fenton, 1994). Further, analysis of mothers who had been diagnosed with PTSD revealed that the presence of PTSD in their children was significantly overrepresented (Famularo et al., 1993).
Other studies have examined the relative effect of premorbid IQ in developing PTSD following trauma exposure. A longitudinal study following children assessed at 6 years and then 17 years revealed that children with an IQ greater than 115 were at a decreased risk for exposure to tragic events (odds ratio = 0.3), a decreased risk for nonassaultive trauma (odds ratio = 0.6) and a decreased conditional risk for PTSD (odds ratio = 0.2). The risk for PTSD was increased for children with anxiety disorders and teacher ratings of externalized problems (Breslau et al., 2006). An analysis comparing the results of pre-exposure aptitude tests in Vietnam veterans revealed that intelligence significantly predicted PTSD symptoms, with lower premorbid intelligence being associated with greater risk for developing PTSD. However, it should be noted that the IQ scores in all veterans examined in the study were within the average range (Mackling et al., 1998). Similarly, it has been reported that Gulf War veterans with higher intellectual verbal skills would be more resistant to psychopathology following trauma exposure (Vasterling et al., 1997).

There is also evidence of an inherited component to PTSD (American Psychiatric Association, 2000). A study of 715 monozygotic twin pairs who were discordant for military service during the Vietnam War revealed that the prevalence of PTSD in twins who were combat veterans was 16.8%, while the prevalence of co-twins who were not combat veterans was 5%. Although the results suggest some heritable component to developing PTSD a diagnosis of PTSD was most strongly associated with combat exposure (Goldberg, True, Eisen, & Henderson, 1990).


Assessment and Diagnosis

Despite high prevalence rates and known cognitive, psychosocial, and biological impact of trauma there is no specific diagnostic category for trauma exposure with the DSM-IV. Thus, a review of the literature on assessment and diagnosis focuses on current diagnostic criteria for PTSD.

The DSM-IV identifies three clusters of symptoms that characterize individuals with PTSD. The first is re-experiencing the traumatic event through recurrent and intrusive thoughts, nightmares, or with children, a re-enactment of the traumatic event. The second symptom cluster is the persistent avoidance of stimuli associated with the trauma, such as efforts to avoid thoughts or conversations surrounding the incident, a feeling of detachment from others, or a restricted range of affect. The final symptom cluster is increased arousal, such as difficulty falling or staying asleep, irritability, difficulty concentrating, hypervigilance or an exaggerated startle response. In addition to these three symptom clusters, the duration of the disturbance must be for at least one month, and the disturbance must cause clinically significant distress or impairment in social, occupational, or other important areas of functioning. However, it may be days, months, or years before symptoms appear, in which case a delayed onset specifier would be added to the diagnosis (American Psychiatric Association, 2000).

Two types of PTSD have been described in relation to the duration of trauma: acute and chronic. An acute presentation of PTSD has been described as difficulty falling asleep, hypervigilance, nightmares, exaggerated startle response, generalized anxiety/agitation, and a tendency for spontaneous re-experiencing of the trauma. A chronic presentation, which results from longer duration of trauma exposure, has been
described as an over-representation of symptoms such as dissociative episodes, a
restricted range of affect, sadness and depression, emotional detachment, and a belief that
"life will be hard" (Famularo, Kinscherff, and Fenton, 1990). An additional specifier is
added to the diagnosis if the onset of symptoms is at least six months after the stressor
(American Psychiatric Association, 2000).

It has been hypothesized that individuals with PTSD resulting from chronic
trauma are more likely to maintain symptoms for a longer duration. A study of severely
traumatized children, who were Cambodian refugees between the ages 8 and 12 years,
revealed that 48% of the children retained criteria for PTSD three years post-trauma
(Kinzie, Sack, Angell, Clarke, & Ben, 1989). A more recent study of 156 children who
were removed from parent custody subsequent to severe child maltreatment revealed that
62 of these children met criteria for PTSD. Fifty-two of the children were examined two
years later. Results revealed that even in the presence of court ordered supervision and
treatment, 32.7% of these children continued to meet DSM-IV diagnostic criteria for
PTSD (Famularo, Fenton, Augustyn, & Zucherman, 1996).

Approximately 36% of children are thought to go on to develop PTSD depending
on the type of trauma (Fletcher 1996). In an attempt to provide a theory to understand
childhood responses to trauma, Salmon and Bryant (2002) highlight the difference
between child and adult reactions to trauma and the implications of these differences for
assessment of PTSD and treatment. When examining the three main symptom clusters
for diagnosis of PTSD it is important to take into consideration how these symptoms may
be expressed as a function of the developmental level of the child (Salmon & Bryant,
2002). In terms of re-experiencing symptoms it is noted that "in younger children,
distressing dreams of the event may, within several weeks, change into generalized nightmares of monsters, of rescuing others, or of threats to self or others.” Further, “younger children usually do not have the sense that they are reliving the past: rather, the reliving of the trauma may occur through repetitive play” (American Psychiatric Association, 2000, p. 466). Due to the fact that children may have difficulty reporting diminished interest in activities and constriction of affect, it is suggested that these symptoms be evaluated through reports from parents and teachers. Further it is noted that, “in children the sense of a foreshortened future may be evidenced by the belief that life will be too short to include becoming an adult.” It is also noted that there may be “omen formation,” which is “belief in the ability to foresee future untoward events” (American Psychiatric Association, 2000, p. 466). Finally, in terms of arousal symptoms it is noted that in addition to possible insomnia, irritability, difficulty concentrating, hypervigilance, or heightened startle response, “children may also exhibit various physical symptoms, such as stomach aches and headaches” (American Psychiatric Association, 2000, p. 466).

A significant influence on a child’s ability to report traumatic events verbally is the child’s level of language development. Eight of the DSM-IV criteria require verbal descriptions of experiences or emotional states from the child. It has been suggested that children who have experienced traumatic events prior to developing language are able to re-enact those memories behaviourally (Salmon & Bryant, 2002). An important factor when considering the diagnosis of PTSD in children is the suggestion that clinical and biological findings in children who meet fewer than three clusters of symptoms may be equivalent to those who meet full PTSD criteria (De Bellis, Hooper, & Sapia, 2005).
It is argued that a child’s lack of knowledge about a potentially traumatic event such as a young cancer survivor’s limited ability to perceive the threat of their illness may protect the child from the impact of the trauma. In contrast, this same lack of knowledge may make children more vulnerable to misinterpretations of the traumatic experience, making them more distressed (Steward, O’Conner, Acredolo, & Steward, 1996; Salmon & Bryant, 2002).

Comparisons of PTSD symptom profiles of adults and children with PTSD revealed comparable levels of intrusive memories, nightmares, reliving the event, avoidance of reminders, diminished interest of activities, concentration difficulties, hypervigilance, and exaggerated startle response (Yule, 1992; Fletcher, 1996). However, Fletcher noted that in addition, children who had been traumatized also experienced symptoms of dissociative responses (48%), low self-esteem (34%), depression (25%), separation anxiety (23%), and generalized anxiety (39%; Fletcher, 1996).

It is suggested that the comparability of PTSD symptoms in children and adults should not be interpreted as evidence that child and adult PTSD are identical conditions. Specifically, it is noted that preschool children demonstrated fewer cognitive symptoms and little avoidance in comparison to older children, adolescents and adults (Fletcher, 1996; Salmon & Bryant, 2002). It has been suggested that due to the difficulty of preschool children in describing emotions and memories, the diagnostic criteria of effortful avoidance and memory gaps should be removed and replaced with behavioural symptoms such as play re-enactment, separation anxiety, nightmares, and aggression when diagnosing PTSD in children younger than 7 years (Salmon & Bryant, 2002).
Overall, it has been suggested that the lack of developmental modification of PTSD symptoms for children may result in under diagnosis (Hawkins & Radcliffe, 2006).

Although there are many measures used in the assessment of PTSD and posttraumatic stress symptoms (PSS), there continues to be no “gold standard” (AACAP Official Action: Practice Parameters, 1998). Some assessment measures that have been found to be helpful in the diagnosis of PTSD include the Minnesota Multiphasic Personality Inventory (MMPI, Butcher et al., 1989; MMPI-A Butcher et al., 1992), the Posttraumatic Stress Diagnostic Scale (Foa, 1995), the Trauma Symptom Inventory (Briere, 1995), and the Personality Assessment Inventory-2 (Morey, 1996). A review of the most widely used assessment measures for the diagnosis of PTSD in children and adolescents used in research include clinical interviews such as the Diagnostic Interview for Children and Adolescents-Revised (DICA-R; Reich, Leacock, & Shanfield, 1994), the Kiddie Schedule for Affective Disorders and Schizophrenia for School-Age Children – Present and Lifetime version (K-SADS; Kaufman et al., 1997), the Clinician-Administered PTSD Scale for Children and Adolescents (CAPS-CA; Newman et al., 2004), and self-report inventories such as the Impact of Events Scale-Revised (IES-R; Weiss & Warmer, 1997), the Child Post-Traumatic Stress Disorder Reaction Index (CPTSD-RJ; Pynoos et al., 1987), the PTSD Symptom Scale (PSS; Foa et al., 1993), and the Trauma Symptom Checklist for Children (Briere, 1996). Overall, the review reveals little consensus in the type of measure used to assess PTSD or posttraumatic stress symptoms in children (Hawkins & Radcliffe, 2006).
Comorbidities and Psychosocial Features

Common psychiatric diagnoses of individuals exposed to trauma are depression, anxiety, and substance abuse (Breslau, 2002), as well as ADHD (Famularo et al., 1996). Further, adults and children who go on to develop PTSD, the diagnosis is often complicated by comorbid disorders such as mood and anxiety disorders, substance abuse, personality changes, problems with anger, rage, and aggression (American Psychiatric Association, 2000). More recent studies have also found significant comorbidity with ADHD in children (Famularo et al., 1996; McLeer et al., 1994; Weinstein et al., 2000).

Famularo et al. (1996) compared the psychiatric comorbidities of children who met criteria for PTSD with children who had experienced trauma but did not develop PTSD. They administered the Diagnostic Interview for Children and Adolescents (DICA-C-R; Reich, 1997) to 117 children who had experienced maltreatment. Of the 117 children in the study, 41 (35%) met criteria for PTSD. Results revealed that comorbid diagnoses of ADHD, brief psychotic disorder, and anxiety disorders were significantly more common in the PTSD group as compared to children who had not developed the disorder. In addition, significantly more children with PTSD (14.6%) endorsed suicidal ideation in comparison to 1.3% of the non-PTSD group.

Analyses of the psychosocial sequelae of children who had been sexually abused found the most frequent problems in this population to be fears, PTSD, behaviour problems, sexualized behaviour, and poor self-esteem (Kendall-Tackett, Williams, & Finkelhor, 1993; Green, 1993). However, a review by Dykman et al. (1997) suggests that no one symptom was found to characterize the majority of sexually abused boys and girls. Analyses of the psychological sequelae of sexual abuse in children found the most
frequent comorbid diagnoses in this group to be PTSD and ADHD (23.1%; McLeer et al., 1994). Similarly, other studies of abused children have revealed high rates of ADHD or attention problems in this population (Kinard, 1995; Livingston et al., 1993).

Fewer studies have examined the psychosocial sequelae of children who have experienced physical abuse. It has been argued that incidence of PTSD is smaller in this population. The review by Dykman et al. (1997) reported that only 1 to 33% of physically abused children have been found to meet criteria for PTSD in comparison to 21 to 52% of sexually abused children. A study of the prevalence of PTSD and other psychiatric disorders in 27 physically abused adolescents found that in comparison to controls, a higher proportion of the adolescents met diagnostic criteria for major depression, conduct disorder, and oppositional defiant disorder. Of the 27 adolescents, only three met criteria for PTSD, all of whom also reported extra-familial sexual assault. The authors suggested that the low incidence of PTSD in this group might be associated with the reported predictability of the physical assault (Pelcovitz et al., 1994).

Dykman et al. (1997) examined the presence of both externalizing and internalizing disorders in 109 boys and girls between the ages of 8 and 12 who had been physically abused, sexually abused, or both. Results revealed no significant difference in the presence of PTSD between those who had only been sexually abused and those who had been both sexually and physically abused (60% vs. 67%). However, children who had been sexually abused had a significantly higher prevalence of PTSD compared to those who had only been physically abused (23%). T-scores on the externalizing factor of the Child Behavior Checklist (CBCL; Achenbach, 1991) were significantly higher than on the internalizing factor in all groups. Boys received significantly higher externalizing
and internalizing problem T-scores regardless of type of abuse. Significantly more boys met criteria for ADHD, Conduct Disorder, and Oppositional Defiant Disorder as assessed by the Diagnostic interview for children and adolescents-revised- parent version (DICA-P; Reich, Shayka, & Taibleson, 1991) in comparison to girls, with no significant difference between the diagnostic groups. All abused children received higher caregiver ratings of Separation Anxiety, Overanxious Disorder, Major Depression, Dysthymia, and Avoidance in comparison to controls. Finally, girls received higher caregiver ratings of Separation Anxiety as compared to boys (55% vs. 31%).

Famularo et al. (1996) suggest that errors in differential diagnosis of children who have been exposed to trauma are common as a result of the wide array of clinical symptoms following trauma. Analysis of children who had received a clinical diagnosis of borderline personality disorder by DSM-III-R criteria revealed that 79% of the children reported significant traumatic experiences and 37% met criteria for PTSD (Famularo, Kinscherff, & Fenton, 1991). Some of the common differential diagnoses outlined in the DSM-IV-TR are Adjustment Disorder, Obsessive-Compulsive Disorder, and Acute Stress Disorder (ASD).

Studies of adults and adolescents revealed that some of the common psychosocial sequelae among refugee survivors are somatic complaints, attentional difficulties, mood changes, anxiety disorders, alcohol use, confusion, detachment, and apprehension. As might be expected, the severity of these symptoms was positively correlated to the duration and intensity of the trauma (Mollica, Poole, & Tor, 1998; Sutker, Winstead, & Galina, 1990). Comparisons of MMPI profiles between World War II and Korean prisoners of war and non-traumatized combat survivors revealed negative ruminations,
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heightened anxiety, anger, suspiciousness, low self-esteem, and less adaptive personality structures in the prisoners of war (Sutker, Thomason, & Allain, 1989).

Treatment

Many different therapeutic models have been proposed to treat trauma symptoms as well as PTSD. The difficulty is that many models are geared toward individuals suffering from a single traumatic event and do not focus on co-morbid conditions that may have led the individual to be more vulnerable to the trauma or conditions that may be associated with the trauma. Evidence-based treatments for exposure to trauma and PTSD include Eye Movement Desensitization and Reprocessing (EMDR), Cognitive Behavioural Therapy (CBT) involving exposure therapy, and Trauma Focus-CBT (TF-CBT).

EMDR is an integrative psychotherapeutic approach that addresses past experiences that have led to PTSD symptoms, the current triggers or exacerbations of the condition, and the creation of templates for appropriate future action (Shapiro, 2002). Some researchers have described EMDR as a largely atheoretical therapy that shares a number of treatment elements with well established cognitive therapies. During an EMDR session clients are asked to recall the events of their trauma as they are prompted to engage in repeated sets of lateral eye movement. After each set of lateral eye movements, the client is asked to monitor physiological responses to the memory, and identify alternative cognitive appraisals of the memory. There are inconsistent findings regarding the extent to which any of the therapeutic elements used contributes to patient recovery (Tarrier, Wells, & Haddock, 1998). When comparing different models for treatment of PTSD, the main weakness of the brief psychodynamic intervention models is
that they have shown to be most effective in cases of simple PTSD that is not associated with co-morbid diagnoses. As has been repeatedly stated, PTSD is often associated with many co-morbid diagnoses and therefore it would be rare to find patients suffering only from PTSD symptoms. As a strength, brief psychodynamic interventions did provide alleviation of PTSD symptoms in the case studies examined (Barnette, 2001; Kimble, Riggs, & Keane, 1998; Krupnick, 2002; Weinstein et al., 2000).

Although many therapeutic efficacy studies have reported that EMDR is effective in alleviating PTSD symptoms, there remains much controversy over whether it is the supportive therapy and imaginal exposure techniques that aid in symptom alleviation or the repeated sets of lateral eye movements that are facilitated by the therapist (Tarrier, Wells, & Haddock, 1998).

There are several different CBT approaches to psychotherapy with individuals diagnosed with PTSD but all of them are based on the principles that automatic thoughts affect behaviours and therefore changing maladaptive behaviours is associated with testing dysfunctional thought patterns (Tarrier, Wells, & Haddock, 1998).

Direct therapeutic exposure is one of the CBT models that have been found to successfully reduce PTSD symptoms in rape victims and combat veterans (Boudewyns et al., 1990; Foa et al., 1991). These models involve the use of desensitization, flooding, and prolonged exposure. This type of therapy requires the client to directly confront the traumatic triggers associated with the event in the supportive context of the therapeutic relationship (Tarrier, Wells, & Haddock, 1998). There have been inconsistent findings regarding the use of these techniques with individuals suffering from PTSD. Some studies have found that repeated or prolonged imaginal exposure leads to anxiety and can
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exacerbate PTSD symptoms (Kilpatrick & Best, 1984). Other researchers have found that imaginal exposure leads to anxiety reduction and changes in the cognitive appraisal of the event (Foa & Kozak, 1986). Another common CBT approach to treatment of PTSD is Anxiety Management Training (AMT), which is a group of interventions aimed at improving an individual’s ability to cope with anxiety symptoms. Studies have found AMT effective in reducing PTSD symptoms when used alone (Foa et al., 1991). One common AMT intervention is stress inoculation training (SIT), which has been adapted to meet the needs of rape victims. SIT teaches patients strategies that address physical, behavioural, and cognitive manifestations of anxiety. Some of the more common strategies are muscle relaxation and deep breathing for physical anxiety, modelling and role-playing for behavioural anxiety, and self-dialogue for cognitive anxiety (Tarrier, Wells, & Haddock, 1998).

A therapeutic model currently used to treat children who have been exposed to trauma is TF-CBT. TF-CBT is a ten-component treatment model that combines typical CBT techniques. The ten components include: psychoeducation, parenting skills, relaxation training, affective expression and modulation, cognitive coping and processing (cognitive triangle), creating a trauma narrative, cognitive coping and processing (processing traumatic experiences), in vivo mastery, conjoint child-parent sessions, and enhancing future safety and development (Cohen, Mannarino, & Deblinger, 2006).

CBT approaches appear to be associated with the most positive outcome research. These approaches are empirically based and directly target anxiety symptoms, maladaptive behaviours, and dysfunctional thought patterns associated with PTSD (Tarrier, Wells, & Gillian, 1998). Although the main weakness of CBT models is the
potentially harmful affects of prolonged or extensive imagined exposure, recent studies indicate that exacerbation of symptoms following imagined exposure is unrelated to dropout rates and ultimate outcomes of treatment (Foa et al., 2002).

Neurobiology of Trauma Exposure

It is now commonly accepted that chronic stress or severe trauma has a significant impact on the physiology and development of the brain aside from the physical trauma that may have occurred as a result of the traumatic event (Beers & De Bellis, 2002; Brewin, 2001; De Bellis et al., 1999; De Bellis et al., 2000; Sageman, 2002). It has been consistently shown that exposure to trauma can lead to changes in brain chemistry and morphology in both adults and children (Carrion et al., 2001; De Bellis, et al., 2002). These chemical and morphological changes are believed to be partially associated with the development of PTSD or subthreshold PTSD (De Bellis et al., 2005).

The mechanism by which trauma affects the central nervous systems is through the stress hormone cortisol and mediated by the hypothalamic-pituitary-adrenal (HPA) axis (King, 1996; Purves et al., 1997). Trauma exposure in childhood is thought to be associated with global chemical and morphological differences that are believed to result from chronic stress at a critical developmental period and may have adverse effects on a child’s brain maturation (De Bellis et al., 2005).

Studies have revealed that exposure to extreme or chronic stress or high doses of cortisone results in atrophy of neurons in subregions of the hippocampus in animals. This results in a decrease in memory performance in animals (Sapolsky, Uno & Finch; Arbel, Kadad, Silbermann, & Levy, 1994) and is likely involved in learning, memory, and emotional disturbance in individuals with PTSD (Miller, Chen, & Zhou, 2007).
Other physiological changes found in individuals with PTSD are sustained urinary norepinephrine and epinephrine elevations in comparison to a control group (Kosten, Mason, Giller, Osteroff, & Podd, 1987), which are thought to result in depletion of noradrenergic neurons and alterations in receptor function, which is consistent with chronic stress (Golier & Yehuda, 2002; Krystal, Southwick and Charney, 1995; Purves et al., 1997). Paradoxically, other studies have found reduced levels of corticosteroid in individuals with PTSD (Bourne, 1970). Despite inconsistent findings, overall physiological analyses suggest that symptoms of PTSD are associated with persistent alterations in the stress response system. A meta-analysis of the adult literature conducted by Miller et al. (2007) in order to understand inconsistency in cortisol studies found that time of onset (i.e. number of months since the stress first emerged) was negatively related to HPA activity; however, when chronic stressors were still present, morning, afternoon/evening, and daily cortisol output was significant higher. In contrast, when the stressful stimulus is no longer present, morning cortisol was significantly lower.

Structural and functional imaging studies are reported to have confirmed the importance of limbic structures, such as the hippocampus, amygdala, septum, fornix, and cingulated gyrus in adults with PTSD (Isaac, Cushway, & Jones, 2006). Neuroimaging studies of children with PTSD indicate smaller cerebral values and corpus collosum areas but no anatomical changes in limbic structures (De Bellis et al., 1999). More recent functional Magnetic Resonance Imaging (fMRI) studies have revealed some frontal lobe abnormalities in both children and adults with PTSD (Isaac et al., 2006). Specifically, abnormalities have been reported in the orbitofrontal cortex (Shin et al., 1999), medial prefrontal cortex (De Bellis et al., 2000), anterior cingulated cortex (Lanius et al., 2001), and insula (De Bellis et al., 2000).
et al., 2001; Shin et al., 1999), the medial prefrontal cortex (Lanius et al., 2001), and the
dorsolateral prefrontal cortex (Osuch et al., 2001).

Neuroimaging analyses of adult subjects have revealed smaller hippocampal
volumes in adults with chronic PTSD in comparison to healthy controls or trauma-
exposed survivors who did not develop PTSD (Bremner et al. 1993; Bremner et al., 1995;
Bremner et al., 1997; Stein, Koverola, Manna, Torchia, & McClarty, 1997). However, a
review by Golier and Yehuda (2002) suggests some of the limitations in these studies are
that subjects suffered from chronic PTSD with high rates of comorbid substance use and
other psychiatric disorders. Further it is reported that smaller hippocampal volumes have
also been observed in patients with depression, schizophrenia, substance abuse, and
normal aging (Bremner et al., 2000; Laakso, et al., 2000). Finally, it is difficult to
differentiate the relative effect of possible brain injury associated with combat exposure
and torture (Weinstein, Fucetola, & Mollica, 2001).

Gilbertson et al. (2002) examined hippocampal volumes in monozygotic twins, of
which one twin was a Vietnam combat veteran while the other had no combat exposure.
Results indicated that twins who have been exposed to combat, who had chronic PTSD
has smaller hippocampal volumes as compared to combat exposed twins who had never
developed PTSD. Results also revealed that non-combat exposed twins who developed
chronic PTSD had similar hippocampal volumes as their combat exposed twin and
significantly smaller volumes than twin pairs who had not developed PTSD.

Several researchers have attempted to use neurobiological correlates to explain
memory functioning in adults with PTSD. As reported, high levels of stress hormones
(such as cortisol) during traumatic events has been found to have adverse effects on
various brain structures such as the prefrontal cortex and the hippocampus, which have been found to be centrally involved in consciousness and conscious encoding of memories (Bremner et al. 1993; Bremner et al., 1995; Bremner et al., 1997; Brewin, 2001; Stein, Koverola, Manna, Torchia, & McClarty, 1997) and thus are likely to impact the declarative memory system and be directly related to post-traumatic amnesia.

Consistent with Brewin's (2001) situationally accessible memory theory, some researchers have suggested that the neurobiological response to trauma may enhance traumatic memories. Specifically, locus ceruleus and amygdaloid complex activation as a result of increased noradrenergic activity are both believed to enhance memory retrieval (Bremner et al., 1993; Friedman, 1989). As these structures are both part of the limbic system, which is most closely tied to emotions, stimulation of these brain regions as a result of stress may explain re-experiencing symptoms, particularly flashbacks (Purves et al., 1997).

**Neuropsychological Features of Trauma and PTSD**

Although there is strong evidence to suggest that chronic stress or severe trauma has a significant impact on the physiology and development of the brain, the majority of studies focus on the neuropsychological effects of adults with PTSD in lieu of children and adults with symptomatic trauma. Thus a review of neuropsychological features of symptomatic trauma must focus on neuropsychological sequelae of individuals diagnosed with PTSD.

Currently, there is a paucity of studies on the cognitive functioning of children with PTSD (McNally, 1998). For this reason the majority of studies reviewed examine the neuropsychological features of adults with PTSD. Neuropsychological studies of
adults with PTSD have revealed deficits in concentration, learning, and memory. In addition, studies have revealed impairment in intellectual functioning and verbal processing, as well as poor school performance in children exposed to extreme stress (De Bellis et al., 2005).

A difficulty in the interpretation of the neuropsychological features of PTSD is that individuals who receive a diagnosis of PTSD represent a very heterogeneous group, as there are several types of trauma that can lead to a diagnosis. Although, it has been suggested that some of the comorbid factors associated with different types of trauma would have a significant contributory effect on the neuropsychological features exhibited by the subjects (Golier & Yehuda, 2002), few studies have compared the neuropsychological profiles of individuals with PTSD who are victims of different types of trauma. However, given what is known about the effect of chronic stress on the central nervous system, it is suspected that neurobiological changes associated with the experience of trauma should be similar regardless of the type of trauma experienced.

The study of neuropsychological features of PTSD is further complicated by the overlap of symptoms with those of traumatic brain injury (TBI) that may have resulted as a function of the trauma (Weinstein et al., 2001). Thus, it must be considered that in many studies, particularly those involving combat veterans, torture victims, or victims of physical abuse, the possibility of TBI was not routinely examined. In some of these cases, neuropsychological and psychiatric symptoms may result from TBI alone and they may be exacerbated by the severity of the traumatic stressors (Weinstein et al., 2001).

For children, developmental factors should also play a significant role on the relative cognitive effects of trauma and PTSD. Salmon and Bryant (2002) examined the
cognitive effects of trauma in children with PTSD as they relate to information processing models. The authors argue that younger children encode less and more slowly in comparison to older children and adults, which would result in impaired memory retrieval. Additionally, younger children have more difficulty shifting attention from an arousal stimulus as compared to other aspects of the situation, which would further affect accurate encoding and representation of traumatic memories. Distortions in memory may affect a child’s emotional response or their ability to describe traumatic events.

Despite difficulties in the analysis of neuropsychological features of PTSD, it has been suggested that similar to adults, children with PTSD would demonstrate difficulty on measures of attention, memory, language development, executive functioning (Cahill, Kaminer, & Johnson, 1999). Beers and De Bellis (2002) examined the neuropsychological functioning in 14 medication-naïve children with PTSD secondary to maltreatment in comparison to 15 healthy children without PTSD who were matched by age, ethnicity, socioeconomic status (SES) and IQ. In comparison to control subjects, children with PTSD performed more poorly on measures of attention, problem solving and abstract reasoning, semantic organization, learning and memory, and visual spatial functioning.

**Psychometric Intelligence and Achievement**

Although studies have revealed that a lower IQ may be a predictor for the development of PTSD symptoms (Breslau et al., 2006), studies have consistently revealed that subjects with PTSD are not characterized by low intelligence (Golier & Yehuda, 2001; Mackling et al., 1998). In fact, several studies examining the neuropsychological profiles of adults and children with PTSD resulting from different
types of trauma have revealed no significant deficits in IQ as compared to health controls or trauma survivors who did not develop PTSD (Beers & De Bellis, 2002; Dalton, Pederson, Blom, & Besyner, 1986; Bremner et al., 1993).

A comparison of trauma exposed children with PTSD, trauma exposed children without PTSD, and non-exposed children without PTSD between the ages of 16 to 17, who were free of head injury or comorbid psychiatric disorders, revealed that children with PTSD scored significantly lower than all children without PTSD on the verbal subtests of the Wechsler Intelligence Scale for Children-III (WISC-III; Wechsler, 1997). There was no significant difference on WISC-III measures between children exposed to trauma without PTSD and children who had not been exposed to trauma. The authors suggest that these results indicate that PTSD and not a history of trauma exposure is associated with lower verbal IQ scores (Saigh, Yaski, Oberfield, Halamandaris, & Bremner, 2006).

An analysis of the cognitive functioning of adult Israeli trauma survivors with PTSD secondary to combat, accidents, or terrorist attacks revealed lower scores on measures of general intelligence (mean FSIQ = 88.1, SD = 11.4) as compared to healthy normal controls (mean FSIQ = 108.1, SD = 8.8). Subjects were free of substance abuse and head trauma. Performance was also significantly lower on measures of attention, memory, and verbal fluency in comparison to Gulf War and Vietnam veterans with PTSD (Gil, Calev, Greenberg, Kuglemass, & Lerer, 1990; Golier & Yehuda, 2002). Some possible reasons for group differences between Israeli trauma survivors and Gulf War and Vietnam veterans may be the duration and intensity of the trauma, the fact that the Israeli
PTSD group is made up of several different types of trauma victims, or lower premorbid IQ in the Israeli PTSD group.

**Attention**

Attention is a multifaceted process that allows someone to select and focus on a certain type of information while ignoring others. Neuropsychological measures of attention examiner to an individual’s ability focus on a set of information (e.g., a list of numbers) for a limited period of time. Measures of sustained attention examine a person’s ability to maintain alertness and focus for long periods (Banich, 1997).

Analyses of children with PTSD revealed more omission errors on a measure of sustained visual attention in comparison to matched controls (Beers & De Bellis, 2002). Comparison of child and adult studies suggest more inattention in children with PTSD as compared to adults; unfortunately, research focusing on children is lacking.

A review of research examining specific measures of attention in adults with PTSD conducted by Isaac et al. (2006) revealed inconsistent results. Three studies revealed impaired performance in digit span (Gilberston et al., 2001; Sachianvala et al., 2000, & Sutker et al., 2001), while a fourth study revealed unimpaired performance on digit span and impairment in spatial span (Uddo et al., 1993). A fifth study reviewed reported no deficits in either digit span or spatial span (Stein et al., 2002). Sutker et al. (1995) reported that impairment on both digit span and spatial span was positively correlated with severity of PTSD symptoms.

Review of more complex measures of attention in individuals with PTSD (Isaac et al., 2006) revealed impairments in simple reaction time (Sachinvala et al., 2000), sustained attention (Vasterling, Brailey, Constans, & Sutker, 1998; Jenkins et al., 2000),
as well as on the Attention and Concentration index of the Wechsler Memory Scale-Revised (WMS-R; Wechsler, 1987) in Vietnam veterans with PTSD compared to Vietnam veterans without PTSD (Gurvits et al., 1996).

The Continuous Performance Test (CPT; Conners, 1995) is a task that emphasizes sustained attention and impulse control. It is a computerized test that requires an individual to press a response key when it is followed by a target stimulus and to withhold responses for non-target stimuli. Errors include pressing the key when no target or a false target appears (Commission errors), or not pressing the response key when a target has appeared (Omission errors). Commission errors are believed to reflect impulsivity and omission errors reflect inattention (Conners, 1995).

Comparison of Gulf War veterans on the CPT revealed significantly more errors of commission with no significant difference in errors of omission. However, the authors do not report the performance of each group in comparison to norms (Vasterling et al., 1998). The authors hypothesized that the errors of commission are indicative of greater disinhibition, which was significantly positively correlated with re-experiencing symptoms. Therefore, it is suggested that errors of commission may reflect intrusive thoughts. Some authors argue that attention is more compromised than memory in combat veterans with PTSD and deficits in sustained attention result in compromised memory encoding (Weinstein et al., 2001).

Learning and Memory

Memory refers to the ability to consolidate and store information, which can be retrieved at a later time. Measures of memory examine an individual’s ability to store
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verbal or visual information, to learn with repetition, and to retrieve stored information either through free recall or recognition (Banich, 1997).

It has been suggested that many of the symptoms of PTSD are either directly or indirectly related to memory (Brewin, 2001; Golier & Yehuda, 2002). Specifically, intrusive traumatic memories are a significant factor in re-experiencing symptoms and likely have a significant impact on hyperarousal symptoms. In addition, avoidance symptoms are, in part, attempts at warding off distressing memories. Additionally, some individuals with PTSD are unable to recall certain aspects of the traumatic event and experience fragments in their memory, which is referred to as post-traumatic amnesia (PTA; Cohen, 1997). Although the etiology of post-traumatic amnesia is unclear it has been suggested that certain aspects of the trauma were never properly encoded as a function of the high stress situation (Brewin, 2001) or dissociation during the traumatic event (Golier & Yehuda, 2002).

Brewin and colleagues (Brewin et al., 1996; Brewin 2001) theorized that a second memory system, which the author refers to as situationally accessible memory, has a role in PTSD symptoms. This memory system is similar to sensory memory or implicit memory (Reisberg, 1997). Brewin (2001) describes this memory system as not verbally accessible but containing information obtained through sensory systems (visual, auditory, olfactory, and tactile-kinesthetic systems) and accompanied by emotional and physiological changes. It is hypothesized that this memory system is responsible for re-experiencing symptoms and that sensory or situationally accessible memories are retrieved automatically when a victim is exposed to trauma-related cues. Consistent with Brewin’s dual memory system, research suggests that declarative memory for material
unrelated to trauma, which is not as emotionally salient, appears to be impaired in adults with PTSD, whereas memory for material related to the trauma appears to be enhanced (Weinstein et al., 2001).

Regardless of the mechanism, memory disturbances appear to play a significant role in PTSD. It is common for individuals with PTSD to complain of short-term memory difficulties (Golier & Yehuda, 2002). Researchers question whether memory disturbances in individuals with PTSD are associated with more generalized cognitive disturbances such as deficits in attention, concentration, distractibility, and mental flexibility, which may affect encoding and consolidation of memories.

In one of the few studies examining memory and learning in children with PTSD, researchers compared 14 children with maltreatment-related PTSD with 15 healthy children who had not been exposed to trauma and were matched by age, SES, race and IQ. Comparisons of CVLT performance in children with PTSD revealed significant lower scores on measures of long-term verbal recall as compared to matched controls (Beers & De Bellis, 2002).

Analysis of California Verbal Learning Test (CVLT; Delis et al., 1994) performance in adult rape victims with PTSD as compared to both rape victims without PTSD and subjects who have not been victims of sexual assault has revealed significantly lower scores by the PTSD group on measures of total learning, as well as short-term delayed and long-term delayed recall. These results did not appear to be the result of comorbid anxiety or depression. Further, there was no difference in memory scores among rape victims without PTSD and control subjects. The authors suggest that this
finding indicates that the memory deficits exhibited can be attributed to the PTSD symptoms as opposed to the trauma of rape (Jenkins, Langlais, Delis, & Cohen, 1998).

A study comparing the neuropsychological performance of inpatient Vietnam veterans with PTSD who were free of alcohol use for up to two months, with matched controls (age, ethnicity, handedness, parental education, and years of alcohol abuse) found no significant difference on a measure of intelligence. However, there were significantly lower scores in the PTSD group on several measures of memory on the WMS-R. The Vietnam veterans demonstrated significantly lower scores on the immediate and delayed portions of the Logical Memory subtest, and on verbal memory and visual memory composite scores (Bremner, et al., 1993).

In contrast, another study comparing memory performance of outpatient Vietnam veterans with PTSD with healthy controls matched by IQ found no significant difference on measures of immediate memory and total learning of a word list as measured by the CVLT (Delis et al., 1994). However, the PTSD group was impaired on the free recall of the word list at both short and long delays. The PTSD group demonstrated greater retroactive interference than matched controls (Yehuda et al., 1995).

A third study compared the memory of Vietnam veterans with PTSD to the memory of Vietnam veterans without PTSD on the WMS-R. Results of the analysis revealed lower scores in the PTSD group; however, differences were not significant. It was suggested that the lack of difference between the groups may reflect the possibility that poor memory performance may be related to combat exposure or exposure to trauma as opposed to a diagnosis of PTSD per se (Gurvits et al., 1993).
On the Auditory Verbal Learning Test (AVLT; Schmidt, 1996), Gulf War veterans with PTSD obtained significantly lower scores than veterans without PTSD on measures of total, short-delay and long-delay recall. Similar to Vietnam veterans with PTSD, Gulf War veterans with PTSD also demonstrated greater retroactive interference as compared to veterans without PTSD (Vasterling et al., 1998).

The analysis of memory and learning among different types of trauma survivors suggests that overall deficits in these cognitive domains are not specific to type of trauma, but that the magnitude of the deficits differs among groups. It is also suggested that comorbid substance abuse, associated physical trauma, and greater duration of PTSD symptoms appear to exacerbate observed deficits (Golier & Yehuda, 2002).

**Visual-Spatial Abilities**

Visual-spatial abilities refer to a person’s ability to process and reason with visual stimuli. Examples include measures visual construction, visual abstract reasoning, scanning, and visual perception (Banich, 1997; Wechsler, 1997).

There is very little research that focuses on the visual-spatial abilities of individuals who have been diagnosed with PTSD. Analysis by Beers and De Bellis (2002) revealed that in comparison to matched controls, children with PTSD due to maltreatment obtained lower copy scores on the Rey-Osterrieth Complex Figure (ROCF; Lezak, 1983) and made more errors on the Judgement of Line Orientation test (JOLO; Benton, Varney, & Hamsher, 1978).

**Executive Functions**

Executive functions refer to cognitive processes, such as planning, problem solving, abstract reasoning, coordinating simultaneous activities, as well as monitoring
appropriate behavioral and emotional responses, which are thought to be subserved primarily by frontal lobe systems. Thus, executive dysfunction has been characterized by poor self-control, impulsivity, erratic careless responses, poor initiation and flexibility, and impaired problem solving (Anderson, 1998; Archibald & Kerns, 1999).

One measure of executive functioning measures impulsivity and cognitive flexibility by examining the subject's ability to suppress a dominant response in order to provide an alternative response. On the Stroop Word-Color interference task (Trenerry, Crosson, DeBoe, & Leber, 1989) a subject is asked to name the ink color of a series of printed words. In most versions of this test, the printed word is the name of a color different than the actual ink color (e.g., subjects are asked to name the ink color of the word "RED" that is printed in blue ink). In comparison to children without PTSD, children with PTSD performed more poorly on two measures of freedom from distractibility, namely the Stroop color/word score and the Stroop interference score (Beers & DeBellis, 2002).

Researchers have used an adapted Stroop paradigm in order to test whether individuals with PTSD process emotionally salient information differently than neutral information. A study using the Stroop paradigm on adult rape victims with PTSD revealed that the time between stimulus presentation and color naming was greater for words specifically related to the trauma (e.g., assault, attack) than for emotionally neutral words. In comparison, there was no difference in latencies in rape victims without PTSD and non-traumatized subjects. This phenomenon was consistently found with victims of disaster and with Vietnam combat veterans (Cassiday, McNally, & Zeitlin, 1992; Thrasher, Dalgleish & Yule, 1994; McNally, Kaspi, Riemann, & Zeitlin, 1990). The
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Authors suggest this pattern is an indication that the impairment is a function of PTSD rather than type of trauma exposure (Golier & Yehuda, 2002). Interestingly, children of war veterans were found to demonstrate greater Stroop interference latency scores to war-related stimuli as compared to children of non-veterans (Motta et al., 1997). Similarly, children of adults with PTSD as a function of differing traumatic events also showed higher interference latency scores as compared to children of control parents (Moradi et al., 1999). However, there is no indication in these studies of whether or not the children had themselves experienced trauma or were diagnosed with PTSD.

Studies with children have found that on measures of problem solving and abstract reasoning, children with PTSD completed fewer categories of the Wisconsin Card Sorting Test (WCST; Heaton, 1981) as compared to control children (Beers & De Bellis, 2002; Beckham, Crawford, & Feldman, 1998).

A review of studies examining performance of Vietnam veterans on the Trail Making Test (TMT; Reitan, & Wolfson, 1993), which measures visual search, attention, mental flexibility, motor functioning, and processing speed has suggested a lack of consistent findings (Golier & Yehuda, 2002). In the largest study reviewed, veterans with PTSD performed significantly worse than veterans without PTSD (10th and 25th percentiles, respectively). Due to the large samples, the authors were able to determine that age, education, medication use, and co-morbid psychiatric disorders did not significantly contribute to group differences.

Language

Language refers to an individual’s ability to both express themselves using words and the comprehension of words spoken by others. Neuropsychological measures of
language examine skills such as a person's ability to understand words and phrases, name pictures, generate words and sentences (Banich, 1997).

Children with PTSD have been found to show deficits on measures of semantic organization and verbal fluency. Specifically, in comparison to children without PTSD, children with PTSD generated fewer category members on the Controlled Oral Word Association Test (COWAT) and the Animal Naming subtest (Benton, Hamsher, & Sivan, 1983). They also demonstrated relative deficits in phonetic organization by generating fewer words beginning with target letters (i.e., F, A, S). Likewise, in comparison to children without PTSD, children with PTSD due to maltreatment obtained significantly lower scores on the WISC-III Similarities subtest (Beers & De Bellis, 2002).

Summary of Trauma literature

Epidemiology studies have reported the lifetime prevalence of trauma exposure for both children and adults ranges from 25 to 90% using the DSM-IV-TR definition for a traumatic stressor (Breslau et al., 1998; Elklit, 2002). Approximately 87% of adolescents report experiencing at least one traumatic event, with girls reporting significantly more episodes (Elklit, 2002). Common sources of trauma in children are sexual or physical abuse, exposure to domestic violence, or parental neglect (Famularo et al., 1993; Gorham, 1997; James & Gilliland, 2001; Sageman, 2002). It is now commonly accepted that chronic stress or severe trauma has a significant impact on the physiology and development of the brain. Specifically, exposure to trauma can lead to changes in brain chemistry and morphology (Beers & De Bellis, 2002; Brewin, 2001; Carrion et al., 2001; De Bellis et al., 1999; De Bellis et al., 2000; De Bellis, et al., 2002; Sageman, 2002).
It has been suggested that errors in differential diagnosis of children who have been exposed to trauma are common as a result of the wide array of clinical symptoms following trauma, including depression, anxiety, and substance abuse, and ADHD (Breslau, 2002; Famularo et al., 1996; McLeer et al., 1994; Weinstein et al., 2000). Analysis of internalizing and externalizing disorders in children who had been physically abused, sexually abused, or both revealed significantly higher T-scores on the externalizing factors of the CBCL were significantly higher than on the internalizing factor in all groups. Significantly more boys met criteria for ADHD, Conduct Disorder, and Oppositional Defiant Disorder as assessed by the DICA-P (Reich et al., 1991) in comparison to girls, while girls received higher caregiver ratings of Separation Anxiety as compared to boys (55% vs. 31%). All children received higher caregiver ratings of Separation Anxiety, Overanxious Disorder, Major Depression, Dysthymia, and Avoidance in comparison to controls (Dykman et al., 1997).

The majority of studies focus on the neuropsychological effects of PTSD on adults instead of children or on adults with symptomatic trauma. Neuropsychological studies have revealed that children with PTSD tend to experience problems with attention, problem solving and abstract reasoning, semantic organization, language development, learning and memory, and visual spatial functioning (Beers & De Bellis, 2002; Cahill et al., 1999). Even in the absence of PTSD, partial PTSD responses have been reported to substantially contribute to functional impairment and distress in children (Carrion et al., 2001).
Despite high prevalence rates and known cognitive, psychosocial, and biological impact of trauma there is no specific diagnostic category for trauma exposure with the DSM-IV, thus hindering research in this important area.

**Attention Deficit/Hyperactivity Disorder**

ADHD is one of the disruptive behaviour disorders, characterized by a persistent pattern of inattention or hyperactivity-impulsivity, or both, that is more frequent and severe than is typically observed in children at similar levels of development (American Psychiatric Association, 2000). Prevalence rates of ADHD range from 3 to 19% (American Psychiatric Association, 2000; Phelan, 2000; Pineda, Lopera, Palacio, Ramirez, & Henao, 2003). This large difference is likely associated with a lack of consensus over diagnostic criteria used and the changes in diagnosis within the last century.

One of the first descriptions of children with behavioural characteristics similar to those found in children diagnosed with ADHD was in 1902. George Frederick Still (1902) described a group of children who were aggressive, defiant, resistant to discipline, cruel, excessively emotional, showing decreased inhibition, lawless, spiteful, cruel, dishonest, sexually immoral, impaired in attention, overactive, and prone to accidents. The DSM-III was the first to describe Attention Deficit Disorder (ADD). The two subtypes of ADD were ADD with hyperactivity and ADD without hyperactivity (American Psychiatric Association, 1980). At that time it was felt that the ADD diagnosis de-emphasized the hyperactive and impulsive symptoms of ADHD and therefore the terminology was changed to AD/HD in the DSM-III-R (American Psychiatric Association, 1987; Phelan, 2000). Currently, the DSM-IV-TR (American
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Psychiatric Association, 2000) continues to the use the terminology ADHD; however, three subtypes replaced the two from the DSM-III (ADHD primarily inattentive, ADHD primarily hyperactive/impulsive, and ADHD combined).

Epidemiology

According to the DSM-IV-TR, prevalence rates of ADHD range from 3 to 7% (American Psychiatric Association). Barkley (1998) has estimated the prevalence of ADHD to be 5% of the childhood population with a male to female ratio of approximately 3:1. Some studies cite prevalence rates as high as 19.8%. An epidemiological study conducted by Pineda et al. (2003) reported prevalence rates of all three subtypes to be 16.1% in a Columbian sample. The authors reported that these numbers were consistent with other epidemiological studies in North America conducted by Lahey, Miller, Gordon, and Riley in 1999 (cited in Pineda et al., 2003). A similar study examining the relative prevalence of ADHD subtypes found that of the 17.1% of children diagnosed with ADHD, 9.4% met criteria for the combined subtype, 6.7% for the inattentive subtype, and 1% for the hyperactive-impulsive subtype (Pineda et al., 2003). This study may be an overestimation of the prevalence rates as diagnoses of ADHD were given even if symptoms were present in only one (parent or school) domain.

The male to female ratio of ADHD is reported to range from 2:1 to 9:1 depending on the subtype (American Psychiatric Association, 2000). It has been reported that boys are more likely to be diagnosed with the combined subtype, whereas girls are more likely to be diagnosed with the inattentive subtype (Phelan, 2000; Barkley, 1997a). Further, a comparison of the severity of ADHD symptoms among boys and girls has revealed that
girls diagnosed with ADHD may be more impaired in their cognitive functioning than boys with ADHD or control groups of either gender (Gaub & Carlson, 1997).

Etiology

Due to similarities in symptoms between individuals with ADHD and patients with frontal lobe lesions, ADHD is commonly believed to be a neurobiologically based disorder, primarily involving the prefrontal cortex (Barkley, 1997a, Casellanos et al., 1996; Filipek et al., 1997; Mattes, 1980; Murphy, Barkley, & Bush, 2001; Rubia et al., 1999; Zametkin, 1989). Further evidence for a neurobiological basis for the disorder is the high frequency of children with neurobiological disorders with comorbid symptoms of ADHD. Increased rates of ADHD are found in children with genetic disorders such as Fragile X syndrome, Angelman’s syndrome, and Down’s syndrome (Cuskelley & Dadds, 1992; Hagerman, 1999).

ADHD has also been described as an inherited disorder. Studies have found that the prevalence rates among siblings are approximately 30% (American Psychiatric Association, 2000). A review of the genetics of ADHD from numerous twin studies suggests heritability rates of ADHD ranging from 60 to 90%, small to moderate (10 to 40%) non-shared environmental influences, and little to no shared environmental influences (Waldman & Gizer, 2006; Walmoan & Rhee, 2002). A review of molecular genetic studies reports that the majority of genes currently studied are associated with the dopamine, norepinephrine, and serotonin neurotransmitter systems, as well as various aspects of brain and nervous system development (see Waldman & Gizer, 2006 for a review).
Assessment and Diagnosis

The DSM-IV-TR (American Psychiatric Association, 2000) defines ADHD as a disorder characterized by symptoms of developmentally inappropriate motor hyperactivity and impulsivity or poor concentration and distractibility, or both, with symptoms developing prior to age 7. Three types of ADHD are specified: ADHD primarily inattentive type, ADHD primarily hyperactive/impulsive type, and ADHD combined type. It has been suggested that hyperactive-impulsive symptoms tend to develop first, during the preschool years, while inattentive symptoms develop closer to school age (Applegate et al., 1997; Barkley, 1997d). Some researchers have hypothesized that the predominantly hyperactive-impulsive subtype of ADHD is a developmental precursor to the combined subtype. A review by Barkley (1997d) reports that in the field trials for the DSM-IV the primarily hyperactive-impulsive subtype was predominantly comprised of preschool children whereas the field trial sample for the combined subtype was comprised of predominantly school-aged children. Similarly, the field trial sample of the inattentive subtype was also comprised of nearly all school age children (Applegate et al., 1997). As such, Barkley suggests that the inattentive subtype and combined subtypes represent two qualitatively different disorders. Specifically, the inattentive subtype involves poor focus or selective attentive, whereas the combined subtype involves poor behavioural inhibition. A recent review by Milich et al. (2001) concurs with the theory that the predominantly inattentive subtype of ADHD is a distinct disorder that should not be lumped with the hyperactive/impulsive and combined subtypes of ADHD.
A condition in diagnosis of ADHD is that symptoms need to be present in at least two different domains, such as school, home, or social situations (American Psychiatric Association, 2000). Unfortunately, many studies include children in their treatment protocols that demonstrate symptoms in only one domain (home or school) under the diagnosis of ADHD—Not Otherwise Specified (NOS) (Froelich, Doepfner, & Lehmkuhl, 2002; Miranda & Presentation, 2000). In addition, studies continue to combine subtypes of ADHD in treatment protocols instead of examining the relative effects of treatments on different subtypes.

Levitt et al. (2007) reviewed assessment instruments in terms of their ability to accurately identify mental health problems. Instruments reported to accurately identify externalizing disorders (Doyle, Ostrander, Skare, Crosby & August, 1997), such as ADHD, include the CBCL (Achenbach, 1991) and the Behavior Assessment System for Children (BASC; Reynolds & Kamphaus, 1992; 1998). One of the most commonly used instruments in the assessment of ADHD is the Conners Parent and Teacher Rating Scales (CPTRS; Conners, 1990; 1997). Several well-designed studies exploring the predictive validity of the CPTRS report high sensitivity and specificity of the instrument (Levitt et al., 2007).

Levitt et al. (2007) reports that targeted instruments for particular diagnoses, such as the CPTRS and the Swanson, Nolam and Pelham Checklist (SNAP; Swanson, 1998) for the diagnosis of ADHD, are most useful in the context of comprehensive clinical assessments and are helpful in making diagnostic decisions and evaluating the severity of a particular problem. Research suggests that unlike internalizing disorders, parents and
teachers are the more accurate observers and reporters as compared to youth when diagnosing externalizing disorders (Loeber et al., 1991).

**Comorbidity and Psychosocial Features**

In addition to high rates of comorbidity with many biological conditions, comorbidity rates of children with ADHD have been reported to be 17 to 30% for Learning Disorders (Casey, Rourke, & Del Dotto, 1996; Faraone, Biederman, Monuteaux, Doyle, & Seidman, 2001), 14 to 45% for Conduct Disorder, 40% for Oppositional Defiant Disorder, 39% for Anxiety Disorders, 11% for Tic Disorder, and 20 to 49% for Depression (Angold, Costello, & Erkanli, 1999; Barkley, 1998; Jensen et al., 2001). Further, approximately one in six children with ADHD has been reported to develop Antisocial Personality Disorder by adulthood (Weiss & Hechtman, 1993). A more in-depth analysis of anxiety disorders in children with ADHD has revealed that anxiety as observed in these children appears to be primarily associated with poor emotional regulation as opposed to fear and panic (Barkley, 2002b). Further analysis of the comorbidity of Learning Disorders and ADHD suggests no significant difference between the prevalence of learning disabilities in ADHD subtypes. This result was consistent regardless of whether a learning disability diagnosis was made based solely on discrepancy between achievement and intelligence scores or whether the deficits in auditory processing as assessed by neuropsychological test results were incorporated into the diagnosis (Casey, Rourke, & Del Dotto, 1996).

Research on the comorbidity of ADHD and bipolar disorder in childhood remains controversial as there is significant symptom overlap between the two disorders in childhood. It has been argued that for some children the symptoms of ADHD may in fact
represent a paediatric presentation of bipolar disorder. However, reviews of the research suggest that the comorbidity of these two disorders is between 6 to 10% (Barkley 1998; Barkley 2002b).

A study conducted in Sweden with 7-year-olds revealed significant comorbidity between ADHD and Developmental Coordination Disorder (DCD). Results suggested that 50% of children with DCD met diagnostic criteria for ADHD (primarily hyperactive/impulsive and combined subtypes) and vice versa (Kadesjo & Gillberg, 2001).

As surmised by the high rates of comorbidity in ADHD with other behaviour disorders and mood disorders, it is not surprising that children with ADHD exhibit psychosocial difficulties. Children with ADHD have been found to exhibit high rates of both internalizing and externalizing psychopathology (Jensen, 1993). Specifically, ADHD is often associated with poor frustration tolerance, temper tantrums, bossiness, stubbornness, mood lability, demoralization, dysphoria, social problems, and low self-esteem (American Psychiatric Association 2000). A review of the major life outcomes of ADHD reports that most studies of the psychosocial stressors of ADHD focus primarily on the combined and primarily hyperactive-impulsive subtypes and do not accurately reflect the behavioural profiles of individuals with the predominantly inattentive subtype (Barkley, 2002b).

It has been reported that more than half of all children with ADHD will take part in delinquent activities or violations of the rights of others and as many as one-third will take part in early substance experimentation and abuse (Barkley et al., 1990). These behaviours result in the high comorbidity of Oppositional Defiant Disorder and Conduct
Disorder in children with ADHD (American Psychiatry Association, 2000; Jensen et al., 2001). Analysis of the CBCL in children with high scores on the delinquency, aggression, and anxiety/depression subscales revealed that they were between 9.6 and 18.1 times more likely to exhibit comorbid attention problems (McConaughy & Achenbach, 1994).

A child with ADHD often produces significant stress on the family system. The relationship between parents and children with ADHD is reported to be more conflicted and stressful in comparison to parent-child relationships where no one meets diagnostic criteria for ADHD (Barkley 1998). It has been reported that having a child with ADHD within the family leads to increased parental frustration, marital discord, and divorce (Phelan, 2000). Many children with ADHD have been found to have significant problems with peer relationships. It is suggested that problems with peers may stem from the child’s inability to participate in social exchanges like sharing, cooperation, and turn taking. Further, many children with ADHD tend to interact with peers through commanding, intrusive, hostile and self-centered behaviour (Barkley 1998; 2002b).

An analysis of behavioural correlates of subtypes of ADHD based on the BASC was conducted to compare the behavioural profiles of 155 children, between the ages of 6 to 11-years, with either ADHD – Primarily Inattentive (ADHD-PI) or ADHD – Combined Type (ADHD-CT; Oxley, 2000). Results revealed that children with ADHD-CT demonstrated significantly higher levels of depression, externalizing problems, and general behavioural problems in comparison to children with ADHD-PI. There was no significant difference in the two groups on measures of Internalizing Behaviour, School Problems, Anxiety, and Adaptive Skills. The author reported that the three best
predictors in distinguishing between ADHD-PI and ADHD-CT groups, using the BASC, were the Hyperactivity, Study Skills, and Externalizing Problems scales. Significant correlations between family loading for anxiety, depression, adversity, and internalizing psychopathology have also been shown in children with ADHD (Biederman et al., 1991a; 1991b). Further, parental antisocial behaviour, parental substance abuse, low parental education, male gender, and low verbal IQ have been found to be significantly correlated with externalizing psychopathology (Connor et al., 2003).

Connor et al. (2003) used parent and teacher CBCL scores in an attempt to examine the relative effects of age of onset and duration of ADHD symptoms on comorbid externalizing and internalizing psychopathology in 300 children with clinically identified ADHD. They controlled for known correlates of psychopathology, such as parental variables (substance abuse, antisocial behaviour, and educational level), child's verbal IQ, and male gender. After controlling for known risk factors, the results revealed that earlier age of onset was associated with parent-reported elevations on the aggression subscale and later age of onset was associated with parent-reported elevations in the anxiety/depression subscales. ADHD symptom severity, as measured by CBCL inattention/hyperactivity T-scores, was significantly correlated with elevations on the aggression, delinquency, and anxious/depressive subscales in both parent and teacher reports.

**Treatment**

Evidence-based treatment of ADHD includes behavioural modification therapy (which often includes parent training and school intervention) and stimulant medication. Additional treatments often employed include social skills training and, in some
instances, anger management. Due to the rising interest in the diagnosis and treatment of ADHD, there are many self-help, parent and teacher training manuals available. Most of these focus on teaching parents and teachers behavioural modification techniques (Barkley, 1997b; 2000; 2002; Jensen et al., 2001; Phelan, 2000).

Some generalizations across behavioural modification programs are an increase in task stimulation and novelty while reducing task complexity, and the use of tangible reinforcers as opposed to social reinforcers in the beginning. This can slowly be converted to more abstract or social reinforcers as the behaviours start to decrease and the child starts to mature (Barkley 2002). Some behavioural modification strategies that are described in several treatment manuals include 1-2-3 time out procedures, positive reinforcement, kitchen timers, docking systems, and token economies (Barkley, 1997a; 2000; Phelan 2000). For the sake of brevity these procedures will not be outlined in this paper. Several treatment manuals provide comprehensive reviews of these procedures (Barkley, 1997a; 1997b; 2000; Phelan, 2000). As children with ADHD tend to have difficulty generalizing across situations, it has been suggested that interventions be employed in all areas of their life to help them and their families better manage the behavioural difficulties associated with ADHD (Barkley, 2002; Phelan 2000).

The primary focus of parent training is to educate parents about ADHD and to teach them behavioural management approaches so they can be implemented at home. A review of parent training efficacy studies report improvements in parent ratings of problem behaviour and observed negative parent and child behaviours (Chronis, Jones, & Raggi, 2006). Studies have revealed that symptoms of ADHD tend to return after treatment has subsided (Barkley, 2002). Therefore, ongoing parental intervention is
necessary to maintain treatment objectives and aid in controlling ADHD symptoms over time.

Like parent training methods, school intervention is generally devoted to implementing behavioural modification strategies within the classroom. Common strategies include praise, planned ignoring, effective commands, time out, and daily report cards (Chronis et al., 2006). A meta-analysis of school intervention programs for ADHD revealed greater treatment effect sizes for interventions that are aimed at tailoring a child’s curriculum to their special needs, finding and preventing triggers that lead to noncompliant behaviours, and peer tutoring, as compared to CBT when used alone (DuPaul, & Eckert, 1997). As with parental intervention, the beneficial effects of school interventions rely on the consistent use of behavioural modifications techniques by teachers (Chronis et al., 2006).

A review by Chronis and colleagues (2006) reports estimates that at least 85% of children diagnosed with ADHD are treated with stimulants. The evidence for the efficacy of stimulants is reported to surpass the evidence for pharmacological treatment of any other child psychiatric disorder (Chronis et al., 2006). It is reported that stimulant medication has large beneficial effects on a number of outcome measures including reported ADHD symptoms. In addition, studies have reported reduced number of classroom disruptions, increased on-task behaviour, compliance, academic productivity, and decreased negative social behaviours (Swanson, McBurnett, Christian, & Wigal, 1995).

One of the largest and most reported studies on the treatment of ADHD is the NIMH collaborative multi-site multimodal treatment study or MTA study (Jensen et al., 2001).
This study compared behavioural modification (BEH), medication management (MEDMGT), combined behavioural treatment and medication (COMB), and a community care (CC) sample.

Results revealed that for most measures COMB treatment was more effective than MEDMGT, which was more effective than BEH, which in turn was more effective than CC. Interestingly, on many measures there was no statistically significant difference between COMB and MEDMGT. However, the COMB treatment was superior at reducing associated features of ADHD (e.g., defiance, aggression, oppositional behaviour, internalizing symptoms, and parent-child relationships) and children in the COMB group demonstrated similar results with lower dosages of psychostimulants than children in the MEDMGT group (Jensen et al., 2001). Overall, these results suggest that a combined behavioural modification and medication management approach is the most effective strategy for treating ADHD symptoms.

Despite evidence for the efficacy of behavioural interventions and the significant side effects of psychotropic medication, medication is often the first line of defence of medical practitioners in the treatment of ADHD (Barkley 2002, Brown, & La Rosa, 2002). Further, 8 to 25% of children are reported to not respond positively to stimulant medication (Barkley, 2000; Phelan, 2000). This however, does not mean that medication is not indicated and often necessary in many cases. Recent studies suggest that pharmacological intervention and combined treatments are more effective than behavioural therapy alone. Further, combination therapy results in the need for lower doses of medication (Jenson et al., 2001; Phelan, 2000).
Neurological Findings

A review of neurological correlates of ADHD (Krain & Castellanos, 2006) reports evidence of decreased cerebral volume in children with ADHD as compared to age and gender-matched controls. It is suggested that this volumetric difference is nonprogressive and is presumed to result from early genetic or environmental factors, or a combination of the two. Neuroimaging studies suggest decreases in frontal lobe volumes, reported most often on the right, as well as changes in basal ganglia, which are non-lateralized (Krain and Castellanos, 2006). Reduced volume in the caudate nucleus is suggested to be age-dependent, as these volumetric differences appear to be no longer detected after mid-adolescence (Castellanos et al., 2002).

Similarities in symptoms between individuals with ADHD and patients with frontal lobe lesions have led to hypotheses that ADHD is a neurological disorder affecting the frontal cortex (Fuster, 1989; Mattes, 1980). Thus, the conceptualization of ADHD as a developmental brain disorder with deficits in disinhibition (Barkley, 1994) and executive functioning as revealed on neuropsychological tests (Barkley 1997c, Pennington & Ozonoff, 1996; Tannock, 1998) has led to several neuroanatomical studies that have focused on the role of the prefrontal cortex in ADHD.

Neuroimaging studies of children with ADHD have shown that the prefrontal regions have been found to be smaller and less active in comparison to control groups (Casellanos et al., 1996; Filipek et al., 1997; Rubia et al., 1999). It has been argued that if the central deficit in ADHD is behavioural disinhibition, then children with ADHD should show underactivity in the stress response system as measured by their physiological responses to reward and punishment. This hypothesis is based on the
theory that the behavioural inhibition system is monoaminergically mediated and activated by signals of punishment and frustration (Gray, 1987). As the stress response system is mediated by the HPA axis, King, Barkley, and Barrett (1998) hypothesized that underactivity of the stress response system in children with ADHD and comorbid Oppositional Defiant Disorder or Conduct Disorder would result in blunted cortisol levels after psychological testing in comparison to children without ADHD. Analysis of cortisol levels from saliva samples before and after psychological testing revealed lower cortisol levels in the ADHD group before and after testing. Further, there was no significant change in cortisol levels before and after testing in the ADHD group, as compared to significant elevations in cortisol levels after testing in children who did not meet diagnostic criteria for ADHD. It is reported that these results suggest blunting of the stress response in children with ADHD that results in an underactive behavioural inhibition system. According to the authors, these results are consistent with other findings suggesting lower secretions of epinephrine in boys with ADHD as compared to controls (Hanna et al, 1996).

Although there has been significant progress in investigating the neurobiology of ADHD, the precise etiology of the disorder remains unclear. Overall, evidence from neuropharmacology, genetics, neuropsychology, and neuroimaging all imply involvement of the fronto-striatal circuitry. However, there is also evidence to suggest involvement of more posterior cerebral areas. Specifically, anatomical studies have revealed widespread reductions in volume throughout the cerebrum and cerebellum. Further, fMRI studies report that individuals with ADHD appear to employ more diffuse cerebral areas during cognitive tasks, as compared to controls (Durston, 2003). Krain and Castellanos (2006)
suggest that the most robust difference between the brain of individuals with and without ADHD appears to be in the cerebellum, particularly the posterior-inferior cerebellar vermis. The posterior-inferior lobules of the cerebellar vermis are reported to selectively contain dopamine-transporter-like immunoreactive axons (Melchitzky & Lewis, 2000), which is consistent with the hypothesis of dopamine involvement in ADHD. These differences are reported to be associated with the cerebellum's influence on cortico-striatal-thalamo-cortical circuits, which are reported to choose, initiate, and carry out complex motor and cognitive responses (Graybiel, 1998).

Krain and Castellanos (2006) report numerous inconsistencies in the current neuroanatomical literature. It is suggested that differences may be related to the heterogeneity of sample characteristics such as age, gender, medication status, and ADHD subtypes. Further, it has been suggested that the inattentive subtype of ADHD may be a different neural basis as compared to the combined subtype (Solanto, 2000). Thus, MRI studies comparing children with different ADHD subtypes will be necessary in order to make these comparisons (Krain & Castellanos, 2006).

**Neuropsychological Features**

Although the diagnosis of ADHD is based on behavioural reports from parents and teachers, it is often suggested that behaviours exhibited by children with ADHD reflect underlying cognitive impairments. As such, examination of the neuropsychological features of ADHD may aid in understanding this disorder. The main difficulty is that ADHD represents a highly heterogeneous group, which is likely characterized by different patterns of neuropsychological assets and deficits that have been shown to undergo alterations across the lifespan (American Psychiatric Association,
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2000; Barkley et al., 1992; Har et al., 1995; Murphy et al., 2001). Unfortunately, few studies have compared the neuropsychological profiles of children with the primarily inattentive, primarily hyperactive/impulsive, and combined subtypes.

Psychometric Intelligence and Achievement

Children with ADHD have frequently been found to score at least 7 to 10 points lower than same-aged peers on the WISC-III (American Psychiatric Association, 2000; Barkley, 1997a). Children with ADHD have been reported to carry a significant risk of school failure (90%), retention in grade (35-50%), and failure to graduate from high school (32-36%; Barkley, 1998; Weiss & Hechtmann, 1993). Further, only approximately 22% of individuals with ADHD in the United States are reported to enter post-secondary education and only approximately 5% actually graduate (Barkley, 2002b). It is unclear whether these difficulties are primarily a result of comorbid learning disabilities and cognitive deficits or behavioural characteristics of ADHD; however, it is most likely a combination of these factors.

Children with ADHD, both with and without hyperactivity have been found to demonstrate significantly lower scores on measures of single word reading, spelling, and arithmetic in comparison to normal controls (Barkley, DuPaul, & McMurray, 1990; Casey et al., 1996). As such there is a high comorbidity of ADHD and learning disabilities (Barkley et al., 1990; Casey et al., 1996). Casey et al. (1996) compared school performance, Wide Range Achievement Test-Revised (WRAT-R; Jastak & Wilkinson, 1984) achievement scores, and neuropsychological test scores of 62 children with Attention Deficit Disorder and Hyperactivity (ADD + H) and 22 with ADD without Hyperactivity (ADD-H) between the ages of 6 and 11. Using the current DSM-IV
nomenclature, the subgroups used in this analysis are most similar to the ADHD—combined subtype (ADD+H) and the ADHD—primarily inattentive subtype (ADD−H). Comparisons of school performance revealed similar proportions of children in both groups had been retained in a grade at least once (25.8% and 27.3%; ADD+H and ADD−H groups, respectively). Additionally, the two groups did not differ significantly in teacher ratings of academic performance with both groups rated as performing more than 1 standard deviation below the mean.

In the Casey et al. study, two methods were used to determine the presence of a learning disability (LD). The first method required achievement scores at least 1 standard deviation below the mean and an IQ-Achievement discrepancy score of at least 15 standard score points favoring IQ. Using this method, which is most consistent with the definition of Learning Disorders as defined in the DSM-IV (American Psychiatric Association, 2000), approximately 20 to 30% of the children with ADD met criteria for Learning Disorders, with no significant differences between the two subgroups.

The second method used to determine LD was to compare the performance of the two ADD groups on neuropsychological measures of auditory-linguistic processing previously found to be associated with a combined reading and spelling disability (Casey et al., 1996). Specifically, a child was diagnosed with an auditory-linguistic processing disorder if they obtained low average scores on the Auditory Closure Test (Kass, 1964), the Sentence Memory Test (Benton, 1965), and the Auditory Analysis Test (Rosner & Simon, 1971), coupled with a Performance IQ score of no more than 1 standard deviation below the mean. Based on these criteria, 19.7% of children in the ADD+H group and 9.1% of the children in the ADD−H group met criteria for an auditory processing
disorder, with no significant difference between the two groups (Casey et al., 1996).

Equally significant, more recent comparisons of academic achievement in children with ADHD using diagnostic criteria from the DSM-IV revealed no significant difference in reading, written expression, and mathematics scores between the ADHD -primarily inattentive and ADHD-combined subtypes (Oxley, 2000).

**Language**

Children with ADHD (primarily hyperactive/impulsive and combined subtypes) reportedly have difficulties with expressive language, especially with the pragmatics of language. It has been reported that 10 to 54% of children with ADHD have speech problems (Barkley, 1998). As expected, Barkley (2002b) suggests that speech problems exhibited by children with ADHD are yet another consequence of the executive functioning deficits that are believed to characterize these children. In an analysis of language skills in children between the ages of 6 and 8 years, 11 children with ADHD were compared with 11 control children in their performance on the Peabody Picture Vocabulary Test (PPVT; Dunn & Dunn, 1997), the Test of Language Development-2 (TOLD-2; Hammill, & Newcomer, 1988), and the Test of Pragmatic Language (TOPL; Phelps-Teraski, & Phelps-Gunn, 1992). Results revealed no significant difference between the two groups on a measure of receptive vocabulary (PPVT). However, children with ADHD displayed significantly lower scores on measures of sentence imitation, word articulation, speaking quotient, and overall speech and language quotient subtests of the TOLD-2. Additionally, children with ADHD were found to produce more inappropriate pragmatic behaviours in conversational interactions (Kim & Kaiser, 2000).
Attention

Logically, it would be assumed that children with ADHD would exhibit primary deficits in the cognitive domain of attention; however, behavioral observations of children with ADHD are often not strongly related to cognitive measures designed to measure pure “attention” (Denckla, 1996). Further, exhibiting problems with attention does not necessarily lead to a diagnosis of ADHD (Sergent, Gueurts, & Oosterlann, 2002). Specifically, it has been suggested that deficits on measures of attention in children with ADHD do not reflect problems with perception of information or information processing. Instead, they are a result of deficits in motor inhibition, control, and anticipatory responses (Schatchar, Tannock, & Logan, 1994). It is these observations that have led theorists to suggest that ADHD is not a disorder of attention but a disorder of inhibition (Barkley 1997; Pennington & Ozonoff, 1996).

More recent studies specify sustained attention as a particular deficit in ADHD (Barkley, 1997a; McGee, Clark, & Symons, 2000). The CPT, which is a sustained attention task, as well as a measure of impulsivity, has been hypothesized to be effective in the diagnosis of ADHD (Corkum & Siegel, 1993). Comparisons of children with and without ADHD have found that those with ADHD tend to display slower reaction times, and more omission or commission errors (Corkum & Sigel, 1993). These results are consistent with deficits in attention (omission) and impulsivity (commission) as well as slower processing speed (Conners, 1995).

In contrast, a study by McGee et al. (2000) examined the diagnostic accuracy of the CPT in the diagnosis of ADHD in children between the ages of 6 and 11. Results revealed no significant difference in mean CPT performance in the ADHD group versus
controls. However, CPT performance was most correlated with phonological awareness scores as measured by four Woodcock-Johnson-R subtests (Woodcock & Johnson, 1989/1990) and significantly predicted children diagnosed with Reading Disorder. Therefore, the CPT may lead to false negatives when used as a diagnostic tool for ADHD.

Similar tests, such as the Test of Variables of Attention (TOVA), require the participant to press a button when a geometric figure appears on the screen and to suppress a response (do not press the button) when a similar but different geometric figure appears on the screen. Unlike the other continuous performance measures, the TOVA uses squares as opposed to letters or numbers to minimize the effects of culture or learning disorders. Finally, as with the CPT, similar analyses of omission and commission errors are used to measure inattention and impulsivity, respectively (Dupuy & Greenberg, 1993). An analysis of the sensitivity of the TOVA in the diagnosis of ADHD revealed that the TOVA indicated significant attentional problems in 85% of children who had received a clinical diagnosis of ADHD. However, attentional problems were also found in 30% of control children (Shatz, Ballantyne, & Trauner, 2001). Thus, compared with the CPT, the TOVA if used as a diagnostic tool may lead to more false positive diagnoses of ADHD. Overall, analyses of both the CPT and TOVA suggest that although these instruments may predict symptoms of inattention and impulsivity, they should not be relied upon exclusively in the diagnosis of ADHD.

Learning and Memory

Research has suggested difficulties with verbal learning and encoding, mental manipulation (working memory), and retrieval of memories. However, it has been
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reported that there is little evidence to suggest deficits with memory consolidation or storage in children with ADHD (Barkley, Grodzinsky & DuPaul, 1992; Oie, Sundet, & Rund, 1999). It likely that memory difficulties exhibited by individuals with ADHD are either the result of, or are exacerbated by deficits in sustained attention, and executive functions such as set-shifting and response inhibition. Comparisons of different types of memory skills were conducted in 30 children with ADHD and 30 control children matched by school and grade. The Learning Efficiency Test was used to compare global recall, visual recall, and auditory recall. Results revealed significantly lower scores in the ADHD group on measures of visual and auditory recall in comparison to the control group. However, the exact nature of the deficits was not described (Killoran, 1997). Analysis conducted by Grozinsky and Diamond (1997) revealed that although children with ADHD demonstrated an average performance on recall scores of the ROCF and COWAT, they are more likely to use a disorganized approach on list learning tasks and on the ROCF copy task. This suggests that difficulties observed on measures of memory may be associated with deficits in executive functioning such as planning.

Executive Functions

Most studies on the neuropsychological features of children with ADHD focus on impairments in executive functions (i.e. response inhibition, working memory, set shifting, planning, and interference control). It has been observed that children with ADHD demonstrate difficulties with working memory, planning and forethought, goal-directed behaviour, problem solving, flexibility, response inhibition, and self-directed private speech (Barkley 1997a, 1997b; Barkley et al., 1992; Lazar & Frank, 1998). An analysis of the performance of children with ADHD on several measures of executive
functioning revealed significantly impaired performance on the WCST, the Stroop test, and the ROCF in both the younger (< 15) and older (>15) age groups. Impairments appeared to be irrespective of various psychiatric and cognitive comorbidities (Seidman et al., 1997). Despite the bulk of evidence that executive functions are impaired in children with ADHD, some researchers have noted that these deficits are not exclusive to children with ADHD. Further, a review by Seidman (2006) notes that although the hypothesis of executive function impairment has received substantial attention in the literature, several studies have failed to find executive function deficits in children with ADHD and other studies have found that children with ADHD perform poorly on some measures of executive functioning and not others. Seidman (2006) reported that when examining numerous clinical studies of executive functioning in children with ADHD as a group, children with ADHD exhibit below average or relatively weak performance in set-shifting, planning and organization, complex problem solving, and response inhibition.

In examination of the hypothesis that poor response inhibition is the central feature of ADHD, Gray (1987) adopted a formulation of the neuropsychological theory of anxiety disorders to argue that deficits in response inhibition occur as a result of an inadequate functioning of the physiological responses to reward and punishment. Barkley (1997c; 1997d) adapted this theory to develop his model of ADHD as a behavioural disinhibition disorder. Barkley’s model focuses primarily on the behavioural characteristics of children with the combined subtype of ADHD, as it is his belief that the mainly inattentive subtype is a qualitatively distinct disorder with primary deficits in selective attention as opposed to behavioural inhibition. Barkley hypothesizes that the
primary deficit in ADHD is behavioural disinhibition, which contributes to deficits in four specific executive functions: nonverbal working memory; verbal working memory or internalized speech; self-regulation of affect, motivation, and arousal; and reconstitution. In turn, these deficits lead to reduced motor control, fluency, and syntax.

Barkley refers to nonverbal working memory as the capacity to hold information in mind or online to be used in formulating a response (1997d). He hypothesized that deficits in working memory should lead to individuals with ADHD being more influenced by context and less controlled by internally represented information in comparison to same-age peers. Barkley (1997d) suggests that deficits in working memory are a result of being unable to inhibit dominant responses. Impairments in stop-signal inhibition, or the inability to stop a planned or ongoing activity, have been consistently observed in children with ADHD (Oosterlaan, Logan, & Sergeant, 1998). Behaviourally, this deficit is likely to be best interpreted as impulsivity within this group.

Barkley (1997d) refers to verbal working memory as the ability to use internalized speech. Internalized speech is a process that appears to begin to develop from speech directed to others before the age of 3 to inner or self-directed speech, which becomes increasingly silent until about the age of 9, and finally develops into covert speech or verbal thought (Berk, 1992). It is suggested that children with ADHD have difficulty employing self-speech as compared to other children their age. As a result, the verbal thinking of individuals with ADHD is hypothesized to be more disorganized and less likely to result in the verbal regulation of behaviour. Therefore, it is predicted that individuals with ADHD would rely less on self-reflection before responding to events. Barkley (1997d) hypothesized that as a result children with ADHD would demonstrate
deficiencies in their ability to formulate rules to govern their behaviour and would therefore have difficulty constructing novel or complex behavioural chains and executing them.

Barkley (1997d) describes the self-regulation of affect, motivation, and arousal as the capacity of the two working memory systems (verbal and nonverbal) to elicit and modulate affective and motivational states in relation to the information that is being internally represented. According to Barkley (1997d) this provides the drive in the absence of external rewards that motivates behaviour and allows the individual to conceptualize future reinforcers. He suggests that children with ADHD are more dependent on external reinforcers and have significant difficulties in their ability to delay gratification. The inability to form a visual representation of consequences of current behaviour also leads to a diminished capacity to delay or control both dominant responses (e.g., reading in the Stroop paradigm) and emotional responses.

In terms of regulation of affect, an inability to delay an emotional response prevents an individual from modifying emotional reactions; as a consequence, individuals with ADHD are less able to control reactions to emotionally charged events (Barkley, 1997d). It has been suggested that poor emotional regulation may explain the high comorbidity of ADHD and the other destructive behaviour disorders and anxiety disorders (Barkley, 2002b).

Finally, reconstitution is defined as the capacity to take mentally represented information (analysis) and recombine it (synthesis) into novel sequences from which novel behavioural structures can be generated. As a consequence, individuals are unable to create new behavioural sequences to attain future goals and thus have more difficulty
with flexibility and creativity (Barkley 1997c; 1997d). Therefore, if children with ADHD have difficulty with visual representations, and inhibiting behavioral responses, then they are less able to break down previously learned behavioral sequences in order to create novel behavioral sequences for successful problem solving.

As a component of Barkley’s behavioral disinhibition model, Barkley, Koplowitz, and Anderson (1997) hypothesized that children with ADHD would exhibit impairments in their perception of time. Specifically, it is suggested that children with ADHD would be unable to represent events in their proper temporal order. As a result, hindsight, forethought, planning, and sequencing goal directed actions would be affected, and thus individuals with ADHD should display less control of behavior and more deficient organization of behavior relative to time. For instance, when asked to wait, children with ADHD perceive the interval as lasting longer than it does and when asked to do something within a given period of time, they act as if they have more time available to do the work (Barkley 1997d).

In their analysis, children were presented with a light stimulus for 12, 24, or 60-second intervals, without knowing its length and were asked to reproduce the time span by turning on a flashlight. For half of the trials, a distraction was introduced in the middle of the trial. Results revealed that children with ADHD made significantly more errors in their reproduction of the time span, across all time intervals, in comparison to children in the control group. Specifically, children in the ADHD group tended to overestimate the time intervals, whereas children in the control group tended to underestimate the time intervals. Further, the performance of the children with ADHD was significantly impaired during distraction trials, whereas children in the control group
made no significant difference in errors between the distraction and no distraction trials. Of interest is the finding that stimulant medication was found to have no significant effect on the time perception task (Barkley et al., 1997).

Summary of ADHD Literature

ADHD is one of the disruptive behaviour disorders characterized by a persistent pattern of inattention or hyperactivity-impulsivity, or both, that is more frequent and severe than is typically observed in children at similar levels of development (American Psychiatric Association, 2000). Prevalence rates of ADHD range from 3 to 19% (American Psychiatric Association; Phelan, 2000; Pineda et al., 2003). A review of neurological correlates of children ADHD reports evidence of nonprogressive decreased cerebral volumes, particularly in the right frontal lobe as well as changes in basal ganglia, which are non-lateralized (Krain & Castellanos, 2006).

Comorbid conditions associated with ADHD include Learning Disorders (Casey, Rourke, & Del Dotto, 1996; Faraone, Biederman, Monuteaux, Doyle, & Seidman, 2001), Conduct Disorder, Oppositional Defiant Disorder, Anxiety Disorders, Tic Disorder, Developmental Coordination Disorder (Kadesjo & Gillberg, 2001), and Depression (Angold, Costello, & Erkanli, 1999; Barkley, 1998; Jensen et al., 2001). Children with ADHD have been found to exhibit high rates of both internalizing and externalizing psychopathology (Jensen, 1993). Specifically, ADHD is often associated with poor frustration tolerance, temper tantrums, bossiness, stubbornness, mood lability, demoralization, dysphoria, social problems, and low self-esteem (American Psychiatric Association 2000).
Neuropsychological studies have revealed that children with ADHD are likely to demonstrate lower than average IQ scores and achievement scores, deficits on measures of auditory processing, expressive language, sustained attention, working memory, and executive functions such as planning and forethought, goal-directed behaviour, problem solving, flexibility, response inhibition, and self-directed private speech (American Psychiatric Association, 2000; Barkley, 1997a, 1997b, 1998; Barkley et al., 1990; Barkley et al., 1992; Kim & Kaiser, 2000; Lazar & Frank, 1998; McGee et al., 2000; Murphy et al., 2001; Oie et al., 1999).

Comorbidity of Symptomatic Trauma and ADHD

ADHD and symptomatic trauma are both complex clinical entities that have posed diagnostic challenges to the mental health community due to ongoing debates regarding definition, diagnosis, and treatment (Phelan 2000; Weinstein et al., 2000). Some studies have reported that children who have experienced trauma are often more likely to be diagnosed with ADHD than PTSD (Famularo, Fenton, Kinscherff, & Augustyn, 1996). Further, diagnoses of ADHD and PTSD have often been found to co-occur. Although research and clinical evidence suggests that both ADHD and PTSD have significant comorbidities with other psychiatric disorders, little attention has been paid to the comorbidity between ADHD and PTSD (Cuffe, et al., 1994; Weinstein et al., 2000). Unfortunately the consequences of confusing these two diagnoses are likely to have a significant impact on treatment, among other concerns (Weinstein et al., 2000).

It has been suggested that seriously traumatized children with symptoms of hyperarousal and hypervigilance would be expected to have problems with attention and hyperactivity even though these symptoms may be secondary to the trauma and may not
reflect an underlying ADHD (Cuffe et al., 1994; Kinard, 1995; Livingston et al., 1993). Further, both disorders are often characterized by concentration difficulties, restlessness, irritability, sleeplessness, and impulsivity (Blank, 1994b). Despite the high degree of symptom overlap and comorbidity between ADHD and PTSD, the DSM-IV-TR (American Psychiatric Association, 2000) does not include PTSD as a possible differential diagnosis for ADHD (Weinstein et al., 2000).

In comparing symptoms of ADHD and PTSD, Weinstein et al., (2000) describes how the three main symptom clusters of ADHD (inattention, hyperactivity/impulsivity, and externalizing disorders) may be manifested in children with PTSD. Acting out or feeling as if the traumatic event was recurring, extreme distress or avoidance of cues resembling an aspect of the trauma, and difficulty concentrating as a result of these experiences may be misperceived as inattention. Similarly, acting or feeling as if the trauma were recurring, distress at exposure to cues resembling the trauma, inability to inhibit responses due to hypervigilance and physiological reactivity to cues symbolizing aspects of the trauma may be misperceived as hyperactivity or impulsivity. Finally, acting or feeling as if the trauma were recurring, becoming distressed at exposure to cues resembling the trauma, avoiding people and places, having a diminished interest in activities, feeling detached (manifested as uncooperative), having a restricted range of affect, as well as exhibiting an exaggerated startle response, irritability, and anger outbursts may be misperceived as externalizing behaviours related to ADHD or one of the other disruptive behaviour disorders.

In the literature pertaining to children who have been sexually abused, it has been suggested that these children may be at a heightened risk for developing PTSD as
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compared to exposure to other traumatic stressors. Analyses of the psychological features of sexual abuse in children found the most frequent comorbid diagnoses in this group to be between PTSD and ADHD (23.1%; McLeer et al., 1994). Similarly, other studies of abused children have revealed high rates of ADHD or attention problems in this population (Kinard, 1995; Livingston et al., 1993). It has been suggested that children may be misdiagnosed with ADHD, as the ADHD symptoms are likely to reflect underlying anxiety (Famularo et al., 1992). Further, for children who have been sexually abused and have been properly diagnosed with PTSD, prevalence estimates of ADHD are reported to range from 14 to 46% (McLeer et al., 1994; Weinstein et al., 2000).

Two models have been used in an attempt to explain the high comorbidity between ADHD and PTSD (Cuffe et al., 1994; Famularo et al., 1992). The first model postulates that as a result of similarities in symptoms, children who have experienced significant trauma may exhibit symptoms consistent with inattention and hyperactivity, but secondary to the trauma (Cuffe et al., 1994). The second model postulates that the symptoms of inattention and hyperactivity expressed by children who have experienced significant trauma are directly related to an underlying ADHD; thus, the children should be diagnosed with both PTSD and ADHD (Cuffe et al., 1994; Famularo et al., 1992). Cuffe and colleagues (1994) do not suggest that children may be misdiagnosed with ADHD due to symptom overlap between the two disorders. It may be that the ADHD-like symptoms expressed initially in PTSD may resolve once the PTSD is treated. Finally, it has also been suggested that pre-existing externalizing disorders, such as ADHD, may increase a child’s risk of being physically abused (Cicchetti & Toth, 1995), of being exposed to trauma and tragic events, or both (Breslau et al., 2006).
A review of the literature by Weinstein et al., (2000) describes three ways in which PTSD symptoms may resemble ADHD. The first suggestion is that PTSD symptoms, particularly hyperarousal symptoms, may mimic ADHD symptoms (Famularo et al., 1992). The second hypothesis, similar to that of Cuffe and colleagues (1994), is that ADHD and PTSD in some children co-occur (Blank, 1994a). Thirdly, it is suggested that specific symptoms, such as difficulty with concentration, restlessness or irritability, and impulsivity, may be common to both disorders, which complicates the differential diagnosis (Blank, 1994a).

Analysis of the cognitive differences between the two disorders may help with a differential diagnosis. Children with ADHD are likely to demonstrate lower than average IQ scores and achievement scores, as well as deficits on measures of auditory processing, expressive language, sustained attention, and working memory. However, the primary deficits described in children with ADHD are in executive functions such as planning and forethought, goal-directed behaviour, problem solving, flexibility, response inhibition, and self-directed private speech (American Psychiatric Association, 2000; Barkley, 1997a, 1997b, 1998; Barkley et al., 1990; Barkley et al., 1992; Kim & Kaiser, 2000; Lazar & Frank, 1998; McGee et al., 2000; Murphy et al., 2001; Oie et al., 1999). In comparison, children with PTSD are likely to experience problems with sustained attention, problem solving and abstract reasoning, semantic organization, language development, learning and memory, and visual spatial functioning (Beers & De Bellis, 2002; Cahill et al., 1999). Although concurrent comparisons of neuropsychological functioning of children with ADHD and of children with PTSD have not been done, a review of the literature suggests that the primary deficit described in individuals with
PTSD is on measures of memory consolidation and storage (Brewin, 2001; Golier & Yehuda, 2002), which are less likely to be impaired in children with ADHD (Barkley, Grodzinsky & DuPaul, 1992; Oie et al., 1999).

Weinstein and colleagues (2000) agree that misdiagnosis of ADHD in children who have experienced trauma is likely to occur, especially in the absence of a detailed history. This is especially the case given that an assessment protocol for ADHD is more likely to focus on specific behaviour problems and, unlike a diagnostic interview for PTSD, place little attention on identifying a specific traumatic event that may have triggered the symptoms.

The misdiagnosis of ADHD would have a significant consequence on treatment. Treatment for ADHD is generally focused on behavioural management and stimulant medication (Barkley, 1997b, 1998, 2000, 2002a) whereas treatment for PTSD generally consists of management and alleviation of emotional distress (Foa et al., 1991; Krupnick, 2002; Lyons, 1987). A major concern is the effect of stimulant medication on children with PTSD. It has been suggested that side effects of increased irritability, agitation, and tearfulness may indicate the presence of an affective disorder or anxiety disorder, such as PTSD. Therefore, children with PTSD placed on stimulant medication may experience exacerbated irritability and anxiety symptoms (Weinstein et al., 2000).

Another consequence related to treatment might be that children with PTSD who are misdiagnosed may never have an opportunity to process trauma symptoms in therapy. Therefore, symptoms may continue or even become exacerbated despite the implementation of behavioural modification strategies. Failure to address and treat
trauma symptoms with no alleviation of disruptive behaviour is likely to negatively affect self-esteem (Weinstein et al., 2000).

Weinstein et al. (2000) suggests that the key to the differential diagnosis of ADHD and PTSD is more detailed assessment procedures. The first suggestion is to routinely assess children with ADHD for potential trauma exposure through clinical interviews with the child, the parents, and the child’s teacher. Clinicians should not assume that children have not been abused or exposed to trauma if the child does not readily disclose the abuse. Further, Weinstein et al. (2000) point out that symptoms resulting from sexual abuse may not emerge for several months. The authors suggest that the best way to screen for trauma is to include routine questions about trauma experiences on intake forms that are used at the onset of treatment.

A second suggestion by Weinstein et al. (2000) for improving diagnostic accuracy is to increase attention to symptom overlap between PTSD and ADHD by including questions related to both disorders according to symptom clusters of attention, hyperactivity/impulsivity, and externalizing behaviours. As an example, interviews might include inquiries about the thoughts, feelings, and situational factors related to symptoms of inattention, hyperactivity, or impulsivity. Such questions may help differentiate between symptoms of inattention and re-experiencing and symptoms of hyperactivity/impulsivity and hypervigilance.

Finally, Weinstein et al. (2000) reiterated that although it may appear easy to attribute a child’s surface behaviours such as difficulty paying attention, sitting still, or inappropriate interactions with peers to ADHD, it is important to obtain the child’s
perspective of the problem when these symptoms are occurring, as this may help clarify the clinician's understanding of the etiology of the behavioural problems.

Despite a history of issues related to the diagnosis of both ADHD and PTSD, both disorders continue to provide diagnostic challenges due to changes in nomenclature, diagnostic criteria, and the usual presence of numerous comorbid diagnoses (Angold et al., 1999; Barkley, 1998; Casey et al., 1996; Famularo et al., 1996; Jensen et al., 2001). In addition to high rates of comorbidity between ADHD and PTSD or even subthreshold PTSD there remains a high degree of symptom overlap between the two diagnoses. For this reason, it is likely that many children who have experienced trauma may be misdiagnosed with ADHD, which could have significant implications for treatment (Famularo et al., 1996; McLeer et al., 1994; Weinstein et al., 2000). Although the neuropsychological symptoms of children with ADHD or of adults who have been exposed to trauma (or diagnosed with PTSD) have been studied at length, there remains limited literature on the cognitive and neuropsychological effects of PTSD or even exposure to trauma on children. Comparisons of the neuropsychological profiles of children with ADHD who have not experienced trauma with those children who have been exposed to trauma who may or may not have PTSD might eventually aid in the differential diagnosis of ADHD and PTSD.

**Purpose and Hypotheses**

The goal of this study was to examine the relationship and discuss the differential diagnosis between symptomatic trauma and ADHD by comparing the behavioural and neuropsychological profiles of children with behavioural and emotional symptoms following exposure to trauma and children with ADHD. Due to the lack of research in
this area as well as the clinical nature of the current study that makes it difficult to control for the many factors that could potentially influence the results, the present study is considered exploratory in nature. For the purposes of this study, symptomatic trauma is defined as behavioural or emotional symptoms following exposure to a traumatic event, which was measured objectively as a T-score of 65 on the PTSD, Dissociative, or the Sexual Concerns subscales of the Trauma Symptom Checklist for Children.

The objectives of the study were threefold: 1) to explore the proportion of children with emotional and or behavioural symptoms following exposure to trauma (Trauma group) to children with ADHD who have not been exposed to trauma (ADHD only group); 2) to compare children with ADHD and children with symptomatic trauma on measures of intelligence, academic achievement, attention, memory, and executive functioning; and 3) to compare the severity of the behavioural and emotional symptoms within these populations. Five predictions were advanced.

Prediction 1. As reported in the literature (Weinstein et al., 2000), it was predicted that a significantly greater percentage of children with symptomatic trauma would meet diagnostic criteria for ADHD as compared to the general population prevalence of 5%.

Prediction 2a. Based on neuropsychological findings of adults with PTSD it was predicted that children with symptomatic trauma would obtain significantly lower scores on measures of attention, memory, and executive functioning (problem solving, response inhibition, abstract reasoning) in comparison to the normative sample.

Prediction 2b. As previously observed in the literature, it was predicted that children with ADHD only would obtain significantly lower scores on measures of
intelligence, academic achievement, attention, and executive functioning (problem solving, response inhibition, abstract reasoning) as compared to the normative sample.

Prediction 3. It was predicted that children with symptomatic trauma would obtain significantly lower memory scores in comparison to children with ADHD only. In turn, it was predicted that children with ADHD only would obtain significantly lower scores executive functioning scores in comparison to children with symptomatic trauma.

Prediction 4. It was predicted that children with symptomatic trauma and ADHD would demonstrate more general impairment on a composite measure of neuropsychological domains as compared to children with ADHD only and children with symptomatic trauma only.

Prediction 5. Based on previous research using the BASC it was predicted that children with ADHD only would show at risk or clinically significant elevations on the Hyperactivity, Attention Problems, Depression, Externalizing Problems, and Behavioural Symptom Index scales of the BASC as compared to the general population. Based on research from other psychosocial measures it was predicted that children with symptomatic trauma would receive at risk or clinically significant elevations on the Attention Problems and Internalizing Problems scales of the BASC as compared to the general population. Exploratory analyses compared BASC profiles in children with ADHD only, children with symptomatic trauma only, and children with both. No a priori hypotheses were advanced for these comparisons.
CHAPTER 2
METHOD

Participants

Subjects recruited for this study were boys and girls between the ages of 8 and 14 who had regular or periodic contact with a children’s mental health agency, a children’s welfare agency, or a pediatrician in the Windsor area. Agencies included the Children’s Health Care Network, Glengarda Child & Family Services, Windsor Essex Children’s Aid Society (WECAS), and the Learning Disabilities Association of Windsor. Participants were also recruited from the offices of several pediatricians. Recruitment was also attempted through the University of Windsor Psychology Participant Pool. To be considered, a student who was also a parent needed to respond positively to the question, “I have a child between the ages of 8 and 14 who has been diagnosed with Attention Deficit/Hyperactivity Disorder.”

A child was included in the study if it had been confirmed that he or she had experienced trauma or if the child had been diagnosed with Attention Deficit/Hyperactivity Disorder, without a report of trauma, by a physician or psychologist. Exclusionary criteria included children with a known acquired brain injury, as well as children with severe neurological deficits and sensory impairment such as blindness for which their mental or motor disability was too severe to allow for full neuropsychological testing. Additionally, children who carried comorbid psychiatric diagnoses of bipolar disorder, childhood schizophrenia, or who had a history of substance or alcohol abuse were excluded.
Children and guardians\(^1\) were recruited by the agency or clinician with which they had regular or periodic contact. Children for the Trauma group were recruited through the Windsor Essex Children’s Aid Society. A letter was sent to the Director of Children's Services and Resources outlining the study, as well as exclusionary criteria and requesting a list of children who have experienced trauma. Trauma was defined as: exposure to or witness to events that present real or imagined threat to personal integrity (i.e. emotional or physical scarring) or death to self or others. The Director of Children’s Services requested that social workers in the service to provide a list of possible subjects from their caseloads. All children were crown wards whose legal guardian was the Children’s Aid Society. Names were then provided to the researcher who looked through their charts to determine: 1) that they had been exposed to trauma and 2) they did not meet exclusionary criteria. The examiner contacted the social workers of all eligible children, who helped to schedule an assessment date with the foster parents.

Children in the ADHD group were recruited from Children’s Health Care Network, Glengarda Child & Family Services, the Learning Disabilities Association of Windsor, and the University of Windsor participant pool, as well as from the offices of several pediatricians. Letters were sent to the recruitment sites outlining the study, as well as exclusionary criteria and requesting a list of children who have been diagnosed with ADHD. For recruitment through the University of Windsor, a similar letter was posted on the University of Windsor’s participant pool website. All participants were screened by the researcher to ensure that the children had 1) been diagnosed with ADHD by a pediatrician and 2) did not meet exclusionary criteria.

\(^{1}\) Guardian refers to a parent or other adult who has guardianship of the child.
In order to recruit children through the Children's Health Care Network and Glengarda Child and Family Services, the Manager of Clinical Services from each agency asked social workers to provide lists of possible subjects from their case load. The social workers contacted families to ask them if they would be willing to participate in the study. At Glengarda Child and Family Services appointments were scheduled through the social worker and participants were screened by the researcher during the initial appointment. At the Children’s Health Care Network participants were screened and appointments were scheduled by the researcher via telephone. In order to recruit children through the Learning Disability Association, the Executive Director contacted potential subjects asking if they would be willing to participate in the study and then providing the list of willing participants to the researcher. Guardians were called by the researcher and screened by phone to ensure that their children did not meet exclusionary criteria and appointments were scheduled. For recruitment by paediatricians, physicians posted the letter written by the researcher in their waiting room. They also discussed the study with potential clients. Guardians were directed by their paediatrician to contact the researcher by telephone and were screened over the telephone by the researcher. For subjects recruited through the University of Windsor, guardians of children who had been diagnosed with ADHD by a physician or psychologist contacted the researcher via email and were screened by the researcher either by telephone or email.

Assessments were conducted at the University of Windsor, Glengarda Child and Family Services, the Children’s Health Care Network, or the Windsor Essex Children’s Aid Society in one- or two-day sessions. All guardians were instructed to give their children their medication as usual the morning of the assessment.
The assessment began with a brief structured interview with either the child’s social worker (WECAS recruited) or guardian. The researcher asked a series of questions in order complete the General Information Sheet (Appendix C). Questions were designed to determine whether the child has experienced a traumatic event, whether this event was acute or chronic, whether the child had been diagnosed with ADHD, and if the child had been prescribed psychotropic medication. Guardians were asked to complete the Conners’ Parent Rating Scale-Revised: Long Form (CPRS-R: L; Conners, 1997), the BASC–Parent Rating Scales (BASC-PRC, 1995), and the Behavioral Rating Inventory of Executive Functioning (BRIEF; Gioia, Andrews, Isquith, Guy, & Kenworthy, 2000).

The child’s teacher was asked to fill out the Conners’ Teacher Rating Scale – Revised: Long Form (CTRS-R: L) and the BASC –Teacher Rating Scales (BASC-TRS). Teacher forms were taken to the teacher by the guardian and returned to the researcher when completed. The children were asked to complete the TSCC (Briere, 1996) and the BASC -Self Rating Scale (BASC-SRC; Reynolds and Kamphaus, 1992). For children with a reading impairment, the examiner read the questions aloud to the child who then circled their responses on another form. Children were administered a series of neuropsychological tests measuring intellectual functioning, academic achievement, memory, and executive functioning. Tests administered are listed in Table 1.

The original sample consisted of 39 children. Seven children were excluded from the majority of the analyses because they could not be contacted to complete neuropsychological testing. The remaining sample consisted of 32 children, 21 males and 11 females. The mean age was 10.10 (SD = 1.77). The mean FSIQ of the sample was 93.34 (SD = 11.67) and scores ranged from 68 to 122. Their guardian’s highest level
of education was considered the measure of SES and the majority of children (56.7%) had one or both guardians who had completed a college or university degree. A total of 10 children were in foster care and had been placed with the same family for over a year (eight recruited from the WECAS, one recruited from the University of Windsor, and one recruited from the Children's Health Care Network). The length of time children were placed in foster care was estimated by the number of months since their last traumatic event. The mean length of time in foster care was estimated to be 2.97 years.

Eight children were referred because they had experienced trauma (i.e., experienced or witnessed a significant event that may have been perceived as life threatening) and 24 children were referred because they had been diagnosed with ADHD by a physician or psychologist. Of the children referred because they had experienced trauma, two met diagnostic criteria for ADHD. Of the 24 children referred because they had been diagnosed with ADHD, nine had experienced trauma.

Ethics

This study was reviewed and received ethics clearance through the University of Windsor Research Ethics Board. Prior to beginning the study all legal guardians read though and completed the consent form (Appendix A), which was explained by the examiner. Legal guardian refers to the child’s custodial parent, or the child’s social worker in the case of Windsor Essex Children’s Aid Society Crown Wards. The children completed an assent form (Appendix B), which was explained by the examiner. For children who were unable to read, the examiner read through assent form with them.
Prior to signing consent forms and beginning the structured interview, the examiner highlighted the limits of confidentiality that were outlined in the consent and assent forms. Specifically, guardians and children were informed that if at any time it seems that the child was in danger of abuse or physical harm from themselves or others, the researcher is obligated to report their concerns to the appropriate authorities.

After going through the consent forms, all guardians and children agreed to participate. No subjects asked to have their data withdrawn from the study at a later time. At no time did it become necessary for the researcher to call the WECAS in order to report a suspicion of maltreatment.

As the Trauma Symptom Checklist for Children has questions pertaining to suicidal ideation and intent, the examiner scanned these questions before the child left the assessment. In two instances children endorsed suicidal ideation. After a discussion with the child it was determined that this was passive suicidal ideation (e.g. expressed thoughts that others may be better off without them but had no intention of harming themselves). At that time, the examiner reminded the child of the limits of confidentiality and stated that this would have to discuss this with their guardian. The information was shared with the guardian who was encouraged to discuss this with the clinician involved in their case.

A non-interpretative report was written outlining the results of the assessment. Accompanying this report was a letter explaining the non-interpretive nature of the report (Appendix D). A feedback session was scheduled with guardians and in some instances social workers during which the examiner reported the assessment results. Again, it was emphasized that the results were non-interpretative and no diagnoses could be provided.
Parents and social workers were encouraged to share results with a registered psychologist for further clarification of results if they felt it was necessary. In several instances the name of a registered psychologist was provided. For other cases, a psychologist was already associated with the agency. Guardians signed a release of information form and the report, as well as raw test scores (when requested) were shared with the psychologist.

**Grouping Procedures**

Subjects were put in the ADHD only or the Trauma groups based on responses from behavioral questionnaires administered as part of the research protocol. Children were placed in the Trauma group if (1) it had been reported by the clinician, guardian, or child that they had experienced or witnessed a significant event that may have been perceived as life threatening and (2) their score on the PTSD, Dissociative, or the Sexual Concerns subscales of the TSCC were above a T-score of 65. Seventeen children were identified as having experienced trauma. They constituted the Trauma Group. Although it could not be determined whether the children in the sample met DSM-IV diagnostic criteria for PTSD given the behavioural measures available, all children within the Trauma group were experiencing some emotional symptoms consistent with PTSD and thus may have met criteria for either PTSD or subthreshold PTSD.

Children were identified with ADHD if (1) they had been previously diagnosed by a physician and (2) the responses from either the Parent or Teacher form on the DSM-IV items that are embedded within the CPRS-R: L and CTRS-R: L were consistent with a diagnosis of ADHD. That is, parents and or teachers endorsed either 6 out of 9 criteria for ADHD-Inattentive subtype or 6 out of 9 criteria for both ADHD—Inattentive subtype
ADHD and Trauma

and ADHD-Hyperactive/Impulsive subtype (consistent with ADHD-Combined subtype). Of the 32 children in the sample, a total of 15 were identified with ADHD who had not experienced trauma. They constituted the ADHD group.

Due to the high comorbidity of ADHD and symptomatic trauma, as well as the exploratory nature of this aspect of the study, the Trauma group was divided into the Trauma only subgroup and the ADHD/Trauma subgroup for some analyses in order to further explore neuropsychological and psychosocial characteristics of both diagnoses. The Trauma only subgroup \((n = 6)\) included children who met criteria for symptomatic without ADHD, and the ADHD/Trauma subgroup \((n = 11)\) included children who met criteria for both symptomatic trauma and ADHD.

Measures

The WISC-IV is a standardized psychometric measure of intellectual functioning designed to evaluate children between the ages of 6 to 16 years. For the overall standardization sample, the average internal consistency reliability coefficients for the subtests ranged from 0.78 to .88, and reliability coefficients for composite scores ranged from .90 to .96. Content validity for the WISC-IV was established via comprehensive literature and expert reviews, as well as examination of response process and internal structure (Wechsler, 2003).

The WIAT-II is a standardized psychometric measure an individual’s academic achievement across skill areas. Results can be determined relative to age or grade based norms. In this study are standard scores were calculated with respect to age based norms. The WIAT-II is designed to evaluate individuals from Kindergarten to University or College age (4 to 19 years). Internal consistency reliability coefficients for the subtests
ranged from 0.80 to 0.97. Reliability coefficients across ages ranged from .94 to .98, with an overall reliability of 0.94. Content validity for each subtest of the WIAT-II was established by ensuring that each item corresponded to the curriculum objectives of the subtest as determined by the Individuals with Disabilities Education Act (IDEA) Amendments of 1997 (ERIC Development Team, 1999) as well as by examination of items by expert reviewers. Criterion validity was examined by correlating subtests of the WIAT-II with the WIAT, the Wide Range Achievement Test –Third Edition (WRAT-3; Wilkinson, 1993), the Differential Abilities Scales (DAS; Elliot, 1990), and the PPVT-Third Edition (PPVT-3; Dunn & Dunn, 1997). Correlations of WIAT-II scores across other achievement test scores were moderate to high and consistent across a variety of individually and group administered tests, ranging from 0.29 to 0.91 (Wechsler, 2001).

The Test of Memory and Learning (TOMAL) is a standardized psychometric measure of a child's memory as compared to same-age peers. The TOMAL is designed to evaluate children between the ages of 5 to 19. Internal consistency for subtest and index scores ranged from .74 to .98. Test-retest reliability correlations following a six week interval ranged from .71 to .91. Construct validity for the TOMAL was established by factor analysis and through the scrutiny of reviewers and practitioners within the field (Reynolds & Bigler, 1997).

The WCST is a standardized measure of executive functioning, or problem solving and flexibility in thinking, which measures an individual's ability to generate, verify, and monitor hypotheses through ongoing feedback regarding the accuracy of his or her responses. Both manual and computer administration versions are available for the WCST. For this study the WCST was administered manually. The WCST has been
standardized and normed for use with children, adolescents, and adults from 6½ to 89 years of age. Interscorer reliability based on hand scoring ranges from 0.75 to 0.93. For this study computer scoring was used. Test-retest reliability ranged from 0.91 to 0.96. The WCST has been validated with several clinical groups including subjects with focal and diffuse brain injury, seizure disorders, Parkinson’s disease, multiple sclerosis, and schizophrenia. Construct validity was demonstrated with factor analysis by comparing its factor structure with a measure of Piagetian formal operational reasoning ability, the Halstead Category Test, and several measures of concept formation (Heaton, 1981).

The BRIEF is a standardized rating inventory consisting of several scales that provide clinicians with the parent’s or the teacher’s perception of the child’s executive functioning abilities. The BRIEF was standardized and validated for use with boys and girls, ages 5 through 18, and is appropriate for school age children in a wide range of social and demographic contexts. Internal consistency for both Parent and Teacher Forms of the BRIEF ranged from .80 to .98. In the parent normative subsample (n = 54), test-retest reliability correlations for the clinical scales ranged from .76 to .85. Content validity was established by seeking agreement among a panel of 12 pediatric neuropsychologists as to the fit of each item within the intended scales. As the BRIEF is the only rating scale of executive functioning, its construct validity was evaluated against certain scales within other behavior rating inventories that measure behaviors that should correlate with related BRIEF scales (e.g. BRIEF working memory scale and Attention scale of the BASC) (Gioia et al., 2000). Therefore, a table of correlations was used to compare BRIEF scales with a variety of other measures with which it should and should not correlate. For example the BRIEF inhibit scale was expected to correlate with the
Table 1

*Neuropsychological and Psychosocial Tests Administered*

<table>
<thead>
<tr>
<th>Test</th>
<th>Functions Assessed</th>
<th>Completed by the</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wechsler Intelligence Scale for Children-IV (WISC-IV)</td>
<td>Verbal Comprehension</td>
<td>Child</td>
</tr>
<tr>
<td></td>
<td>Perceptual Reasoning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Working Memory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Processing Speed</td>
<td></td>
</tr>
<tr>
<td>Wechsler Individual Achievement Test-II (WIAT-II)</td>
<td>Word Reading</td>
<td>Child</td>
</tr>
<tr>
<td></td>
<td>Numerical Operations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spelling</td>
<td></td>
</tr>
<tr>
<td>Test of Memory and Learning (TOMAL)</td>
<td>Immediate Verbal Memory</td>
<td>Child</td>
</tr>
<tr>
<td></td>
<td>Immediate Visual Memory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Delayed Memory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Attention and Concentration</td>
<td></td>
</tr>
<tr>
<td>Wisconsin Card Sorting Test (WCST)</td>
<td>Executive Functioning</td>
<td>Child</td>
</tr>
<tr>
<td></td>
<td>Problem Solving</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Set Maintenance</td>
<td></td>
</tr>
<tr>
<td>Behavioural Rating Inventory of Executive Functioning (BRIEF)</td>
<td>Executive Functioning</td>
<td>Guardian</td>
</tr>
<tr>
<td></td>
<td>Emotional Regulation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Metacognition</td>
<td></td>
</tr>
<tr>
<td>Behavioral Assessment Scale for Children (BASC)</td>
<td>Internalizing Behaviour</td>
<td>Guardian</td>
</tr>
<tr>
<td></td>
<td>Externalizing Behaviour</td>
<td>Teacher</td>
</tr>
<tr>
<td></td>
<td>Adaptive Skills</td>
<td></td>
</tr>
<tr>
<td>Conners' Rating Scale-Revised (CRS-R)</td>
<td>Attention</td>
<td>Guardian</td>
</tr>
<tr>
<td></td>
<td>Hyperactivity/Impulsivity</td>
<td>Teacher</td>
</tr>
<tr>
<td></td>
<td>Emotional Regulation</td>
<td></td>
</tr>
<tr>
<td>Trauma Symptom Checklist for Children</td>
<td>Trauma Symptoms</td>
<td>Child</td>
</tr>
</tbody>
</table>
BASC Hyperactivity Scale and the CBCL Aggression Scale and not to correlate with measures of anxiety and somatic complaints. Finally, to assess convergent and divergent validity, individual BRIEF scales and summary indices were correlated in a variety of clinical samples with other rating scales of attentional and behavioural functioning.

The Conners' Rating Scale-Revised (CRS-R) is a standardized parent/teacher-report measure that evaluates problem behaviors for children aged 3 to 17 years. The focus is on the month that precedes the completion of the form. Internal consistency for the long forms (used in this analysis) ranged from 0.728 to 0.942 for the parent form (CPRS-R: L) and 0.77 to 0.94 for the teacher form (CTRS-R: L). In a subsample of 50 children and adolescents (25 males, 25 females) retested over an interval of 6 to 8 weeks, the test-retest reliability coefficients for the subscales of the CPRS-R: L and CTRS-R: L ranged from 0.47 to 0.88. Construct validity for the CRS-R was evaluated by first examining intercorrelations between subscales to see if these met theoretical expectations, and then examining intercorrelations for males and females separately to determine if the same factorial framework emerged for both genders. Analysis of intercorrelation matrices met predetermined criteria and correlation matrices for the CPRS-R: L and CTRS-R: L was virtually identical for male and females. Discriminant validity for the CPRS-R: L and the CTRS-R: L was established by comparing children diagnosed with ADHD according to DSM-IV criteria, children randomly selected from the normative sample and children rated by a psychologist or psychiatrist as having “emotional problems”. The main effect for group was significant for all subscales and the ADHD group scored significant higher than the non-clinical group on all subscales except Perfectionism. Significant differences were also found between the ADHD group and the emotional problems group on all
subscale except Anxious-Shy, Psychosomatic, and the Emotional Lability Index (Conners', 1997).

The BASC is a standardized measure consisting of a number of rating scales designed to evaluate parent, teacher, and self-perceptions of a child’s behavioural and emotional adjustment. The BASC is designed to evaluate boys and girls between 2½ and 18 years of age. Mean internal consistency of the subscales was greater than .80 and test-retest reliability was approximately .80. The BASC has been found to be valid with many samples. It measures constructs that directly map onto diagnostic criteria for childhood disorders (e.g. ADHD, Conduct Disorder, Oppositional Defiant Disorder, Major Depression, and Generalized Anxiety Disorder) listed in the Diagnostic and Statistical Manual for Mental Disorders (American Psychiatric Association, 2000; Reynolds & Kamphaus, 1992). The BASC has several clinical scales depending on the age of the children including, Attention Problems, Hyperactivity, Conduct Problems, Depression, Anxiety, Somatization, Atypicality, Withdrawal, and Aggression. In addition, the BASC has 2 to 3 adaptive Scales including Adaptability, Social Skills, and Leadership. Scores are reported as T-scores, which have a mean of 50 and a standard deviation of 10. Scores are considered to be within the at risk range at $T = 60$ to 69 for the clinical scales and at $T = 31$ to 40 for adaptive scales. Scores are considered to be within the clinically significant range at $T > 69$ for clinical scales and $T < 31$ for adaptive scales.

Data Analysis

The first prediction was that a significantly higher percentage of children in the Trauma group would meet diagnostic criteria for ADHD as compared to the prevalence
in the general population (i.e., 5%). In order to test this prediction, a Chi-Squared goodness of fit test was conducted with expected frequencies of .05 for ADHD and Trauma and .95 for Trauma only.

For analyses pertaining to predictions 2 and 3 several composite measures were created to represent each cognitive area. Composite measures were created in order to reduce the number of analyses for comparison between the groups in an attempt to prevent further reduction in statistical power. The WISC-IV FSIQ was used as a measure of intelligence. An academic achievement composite was created by calculating the mean standard score from the WIAT-II Word Reading, WIAT-II Spelling, and WIAT-II Numerical Operations standard scores. A memory composite was created by calculating the mean scaled score of the Memory for Stories, Memory for Stories Delay, Word Selective Reminding, Word Selective Reminding Delay, Facial Memory, Facial Memory Delay, Visual Selective Reminding, and Visual Selective Reminding Delay subtests of the TOMAL. A z-transformation was used to convert scaled scores into standard scores with a mean of 100 and a standard deviation of 15. An attention and working memory composite was created by calculating the mean standard score from the TOMAL Attention/Concentration Index and the WISC-IV Working Memory Index. An executive composite was created by calculating mean standard scores from the BRIEF Global Executive Composite, WCST Perseverative Errors, and WCST Percent Conceptual Level Response. A z-transformation was used to convert T-scores (BRIEF) into standard scores with a mean of 100 and a standard deviation of 15.

For prediction 2, the neuropsychological functioning of children in the Trauma and ADHD only groups was compared with the normative sample. Prediction 2a was
that children in the Trauma group would obtain significantly lower scores on measures of attention, memory, and executive functioning (problem solving, response inhibition, abstract reasoning) in comparison to norms. Prediction 2b was that children in the ADHD only group would obtain significantly lower scores on measures of intelligence, academic achievement, attention and working memory, and executive functioning in comparison to norms. A series of one-sample t-tests were conducted to compare mean WISC-IV FSIQ and mean composite scores (academic achievement, memory, attention and working memory, executive functioning) for each group to the normative sample ($\mu = 100$).

For prediction 3, the neuropsychological functioning of children in the Trauma group and the ADHD only group were compared with each other. Children in the Trauma group were predicted to obtain significantly lower scores on measures of memory in comparison to children in the ADHD only group. Children in the ADHD only group were predicted to obtain significantly lower scores on measures of executive functioning in comparison to children in the Trauma group. A series of independent sample t-tests were conducted on WISC-IV FSIQ and composite scores comparing the performance of children in the ADHD only and Trauma groups.

The fourth prediction stated that children in the Trauma group who met criteria for ADHD (ADHD/Trauma subgroup) would demonstrate more general impairment on a composite measure of neuropsychological functioning in comparison to children in the ADHD only group and children in the Trauma only subgroup. For this analysis, a general cognitive composite score (GCC) was derived for each subject by calculating the mean of WISC-IV Full Scale IQ, achievement composite, memory composite, attention
and working memory composite, and executive composite. A one-way ANOVA was conducted comparing performance of children in the ADHD, Trauma only, and ADHD/Trauma groups.

Based on Prediction 5 it was expected that profiles of children in the ADHD only group would exhibit at risk or clinically significant elevations on the Hyperactivity, Attention Problems, Depression, Externalizing Problems, and Behavioural Symptom Index scales of the BASC as compared to the general population. Based on research conducted on other psychosocial measures it is predicted that children in the Trauma group would show at risk or clinically significant elevations on the Attention Problems and Internalizing Problems scales of the BASC as compared to the general population. Exploratory analyses were conducted to get a preliminary idea of differences in BASC profiles among the ADHD only group, the Trauma only subgroup, and the ADHD/Trauma subgroup. Due to the paucity of information available from prior studies, no specific predictions were advanced.
CHAPTER 3
RESULTS

Preliminary analysis of the data revealed significant comorbidity between ADHD and symptomatic trauma. Two (25%) of the eight children initially referred because they had experienced trauma met criteria for a diagnosis of ADHD. Further, 38% of the 24 children initially referred because they had been diagnosed with ADHD by a physician had experienced trauma. Demographic data for ADHD only group and two Trauma subgroups (Trauma only, and ADHD/Trauma) are reported in Table 2. Results of one-way ANOVA revealed no significant difference in mean age $F(2, 29) = 1.188, p > 0.05$; Full Scale IQ $F(2, 29) = 1.271, p > 0.05$; or guardian level of education between the three groups.

Table 2
Demographic Information by Group

<table>
<thead>
<tr>
<th></th>
<th>ADHD only</th>
<th>Trauma only</th>
<th>ADHD/Trauma</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>15</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>9.69</td>
<td>10.00</td>
<td>11.00</td>
</tr>
<tr>
<td><strong>SD</strong></td>
<td>1.93</td>
<td>1.73</td>
<td>2.45</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FSIQ</strong></td>
<td>92.57</td>
<td>99.83</td>
<td>91.88</td>
</tr>
<tr>
<td><strong>SD</strong></td>
<td>10.55</td>
<td>7.96</td>
<td>8.56</td>
</tr>
<tr>
<td><strong>Maternal Guardian</strong></td>
<td>College/University</td>
<td>Some</td>
<td>Some</td>
</tr>
<tr>
<td>Level of Education</td>
<td>Degree</td>
<td>College/University</td>
<td>College/University</td>
</tr>
<tr>
<td>(Median)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Paternal Guardian</strong></td>
<td>College/University</td>
<td>College/University</td>
<td>College/University</td>
</tr>
<tr>
<td>Level of Education</td>
<td>Degree</td>
<td>Degree</td>
<td>Degree</td>
</tr>
<tr>
<td>(Median)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
As depicted in Table 3, approximately 70% of the children in the Trauma group had experienced chronic versus acute trauma. The vast majority of children experienced physical or sexual abuse, or had witnessed violence toward a parent, or some combination of these three. The number of months since the last traumatic event ranged from 1 to 72 months with a mean of 21.38 months. There is no significant difference between the Trauma only subgroup and ADHD/Trauma subgroup in mean number of months since the last traumatic event $t(11) = 0.920, p > 0.05$, or the breakdown of chronic and acute trauma corrected $\chi^2 = 0.029 (1), p > 0.05$. All of the children in the Trauma only subgroup experienced physical or sexual abuse, or had witnessed violence towards a parent, or some combination of these. This was expected as all of these children were referred to the study by Windsor Essex Children's Aid Society. For four of the children in the ADHD/Trauma subgroup caregivers were unaware of the traumatic event, or the emotional and behavioural symptoms associated with the event, before being recruited for the study. In these cases, the type of trauma experienced was bullying or physical assault from peers (Table 3).

Approximately three quarters (73.7%) of the children in the sample were prescribed stimulant medication. Of the 15 children in the ADHD only group, just over 73% were prescribed stimulant medication. Just over 33% of children in the Trauma only subgroup were prescribed stimulant medication, while almost 82% of children in the ADHD/Trauma subgroup were prescribed medication.
Table 3

Type of Trauma and Duration Since Last Traumatic Event within the Trauma Group, and the ADHD/Trauma and Trauma only Subgroups

<table>
<thead>
<tr>
<th>n</th>
<th>Trauma only subgroup</th>
<th>ADHD/Trauma subgroup</th>
<th>Trauma group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Months since last traumatic event</td>
<td>32.00</td>
<td>18.33</td>
<td>18.20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>n</th>
<th>Acute</th>
<th>Chronic</th>
<th>Acute</th>
<th>Chronic</th>
<th>Acute</th>
<th>Chronic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical/Sexual Abuse/witness violence toward a parent</td>
<td>6</td>
<td>6</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical assault from peers</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bullying</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Violent death of family member</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Prediction 1

A Chi-Squared Goodness of Fit test was conducted in order to determine whether a greater proportion of children in the Trauma group also met criteria for ADHD than would be expected in the general population. Results revealed that 66.7% of children in the Trauma group also met diagnostic criteria for ADHD, which is over 13 times more than the reported prevalence of ADHD in the general population (5%) $\chi^2 = 144.11 \ (1)$, $p < 0.001$. The comorbidity of ADHD and symptomatic trauma was present in children
who experienced both acute and chronic trauma, as well as all four types of trauma represented in this sample (see Table 3). In addition, the comorbidity of ADHD and symptomatic trauma was present across referral sources (Windsor Essex Children’s Aid Society, Children’s Health Care Network, Glengarda Child & Family Services, University of Windsor, Learning Disabilities Association of Windsor, Pediatrician’s Offices) even though only the Windsor Essex Children’s Aid Society referred subjects primarily because they had experienced trauma whereas the other sources referred subjects primarily because they had been diagnosed with ADHD.

Prediction 2

For prediction 2, a series of one-sample t-tests were conducted in order to compare mean scores on neuropsychological variables of children in the ADHD only and Trauma groups with the normative samples.

It was predicted (2a) that children in the Trauma group would obtain significantly lower scores on measures of attention, memory, and executive functioning in comparison to norms. As depicted in Figure 1, although children in the Trauma group performed within the average range (Standard Score = 90 to 110) on most neuropsychological composite measures, results of one-sample t-tests revealed that the Trauma group demonstrated significantly lower performance in four out of five cognitive domains including academic achievement, memory, attention and working memory, and executive functioning as compared to the normative sample (Table 4).

Children in the ADHD only group were predicted (2b) to obtain significantly lower scores on measures of intelligence, academic achievement, attention, and executive functioning in comparison to norms. As depicted in Figure 1, children in the ADHD only
group performed within the average range on the WISC FQIQ and the memory composite and within the low average range on the achievement, attention and working memory, and executive functioning composites. Results of one-sample t-tests revealed that the ADHD only groups demonstrated significantly lower performance in all five cognitive domains (intelligence, academic achievement, memory, attention and working memory, and executive functioning) as compared to the normative sample (Table 4).

Table 4

<table>
<thead>
<tr>
<th></th>
<th>ADHD only</th>
<th>Trauma</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>15</td>
<td>17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>Sig.</th>
<th>Mean</th>
<th>SD</th>
<th>T</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>WISC-IV FSIQ</td>
<td>90.93</td>
<td>11.98</td>
<td>-2.930*</td>
<td>.011</td>
<td>95.47</td>
<td>11.32</td>
<td>-1.650</td>
<td>.118</td>
</tr>
<tr>
<td>WIAT-II Achievement</td>
<td>84.77</td>
<td>14.11</td>
<td>-4.178**</td>
<td>.001</td>
<td>90.94</td>
<td>13.24</td>
<td>-2.822*</td>
<td>.012</td>
</tr>
<tr>
<td>TOMAL Memory Composite</td>
<td>93.10</td>
<td>5.48</td>
<td>-4.877**</td>
<td>.000</td>
<td>93.88</td>
<td>5.50</td>
<td>-4.588**</td>
<td>.000</td>
</tr>
<tr>
<td>Attention/Working Memory</td>
<td>85.93</td>
<td>10.78</td>
<td>-5.055**</td>
<td>.000</td>
<td>90.91</td>
<td>8.90</td>
<td>-4.209**</td>
<td>.001</td>
</tr>
<tr>
<td>Executive Composite</td>
<td>83.44</td>
<td>10.53</td>
<td>-6.089**</td>
<td>.000</td>
<td>83.17</td>
<td>10.37</td>
<td>-6.693**</td>
<td>.000</td>
</tr>
</tbody>
</table>

Note: All scores were transformed into standard scores with M = 100 and SD = 15 to aid comparisons. * p < 0.05 ** p < 0.01
Prediction 3

For prediction 3, a series of independent sample t-tests were conducted in order to compare the differences in means scores on neuropsychological variables between children in the ADHD only and the Trauma groups.

Results of independent samples t-tests comparing the Trauma and ADHD only groups are provided in Table 5. Children in the ADHD only group were predicted to score lower on measures of executing functioning in comparison to children in the Trauma group, while children in the Trauma group were predicted to score lower on measures of memory in comparison to the ADHD only group. Results from the analysis revealed no significant differences between the Trauma and ADHD only groups on any of the neuropsychological composite measures.

Table 5

Comparisons of Neuropsychological Measures for ADHD only and Trauma groups

<table>
<thead>
<tr>
<th></th>
<th>ADHD only</th>
<th>Trauma</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>15</td>
<td>17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WISC-IV FSIQ</td>
<td>90.93</td>
<td>11.98</td>
<td>95.47</td>
<td>11.32</td>
<td>-1.101</td>
<td>.280</td>
</tr>
<tr>
<td>WIAT-II Achievement Composite</td>
<td>84.77</td>
<td>14.11</td>
<td>90.94</td>
<td>13.24</td>
<td>-1.275</td>
<td>.212</td>
</tr>
<tr>
<td>TOMAL Memory Composite</td>
<td>93.10</td>
<td>5.48</td>
<td>93.88</td>
<td>5.50</td>
<td>-0.398</td>
<td>.693</td>
</tr>
<tr>
<td>Attention/Working Memory Composite</td>
<td>85.93</td>
<td>10.78</td>
<td>90.91</td>
<td>8.90</td>
<td>-1.431</td>
<td>.163</td>
</tr>
<tr>
<td>Executive Composite</td>
<td>83.44</td>
<td>10.53</td>
<td>83.17</td>
<td>10.37</td>
<td>.074</td>
<td>.942</td>
</tr>
</tbody>
</table>

Note: All scores were transformed into standard scores with M = 100 and SD = 15 to aid comparisons.
Figure 1. Mean standard scores for neuropsychological measures for the ADHD only (n = 15) and Trauma groups (n = 17). Note: All scores were transformed into standard scores with $M = 100$ and $SD = 15$ to aid comparisons.
It is suspected that the lack of significant differences on neuropsychological measures is associated with the high comorbidity of ADHD within Trauma group. Although this would significantly reduce the sample sizes for some groups, children in the Trauma group were subdivided into the Trauma only and ADHD/Trauma subgroups for further exploratory analysis. A series of one-sample t-tests were conducted to compare the means performance of the Trauma only and ADHD/Trauma subgroups on neuropsychological composite measures to the normative sample (Table 6). Results of the comparison of the ADHD/Trauma subgroup to normative sample ($\mu = 100$) were very similar to that of the original Trauma group (combined ADHD/Trauma and Trauma only subgroups). Specifically, the ADHD/Trauma subgroup demonstrated significantly lower performance in all cognitive domains with the exception of intelligence. In contrast, analysis of the Trauma only subgroup revealed a different pattern. The Trauma only subgroup demonstrated no significant difference in four out of five cognitive domains when compared to the normative sample. Children in the Trauma only subgroup demonstrated significantly lower performance on a composite measure of memory as compared to the normative sample (see Table 6).

Figure 2 depicts mean scores on neuropsychological measures for the ADHD only group and two Trauma subgroups. In order to further explore cognitive differences between the ADHD group, Trauma only subgroup, and ADHD/Trauma subgroup, a series of one-way ANOVAs were conducted on neuropsychological measures. Results of the analysis are described in Table 7.

As depicted in Figure 2, the ADHD only group and ADHD/Trauma subgroup demonstrated similar patterns of performance on most cognitive domains. Children in
the Trauma only subgroup demonstrated higher scores on all neuropsychological
cognitive domains as compared to the ADHD only and ADHD/Trauma subgroup (Figure
2). However, results of the one-way ANOVA between the three groups revealed that all
but one of these differences were not significant, the exception being a between groups
effect on the Executive Composite. Bonferroni post-hoc analysis revealed that children
in the ADHD/Trauma subgroup performed significantly lower on the Executive
composite as compared to the Trauma only subgroup (see Table 7). There were no
significant differences between the ADHD group and ADHD/Trauma subgroup.

Table 6

Results of One-Sample t-tests for Comparison of ADHD/Trauma and Trauma only
Subgroups to the Normative Sample

<table>
<thead>
<tr>
<th></th>
<th>ADHD/Trauma</th>
<th>Trauma only</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>µ = 100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>Sig.</th>
<th>Mean</th>
<th>SD</th>
<th>T</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>WISC-IV FSIQ</td>
<td>93.09</td>
<td>12.48</td>
<td>-1.836</td>
<td>.096</td>
<td>99.83</td>
<td>7.96</td>
<td>-0.051</td>
<td>.961</td>
</tr>
<tr>
<td>WIAT-II Achievement Composite</td>
<td>88.12</td>
<td>13.66</td>
<td>-2.884*</td>
<td>.016</td>
<td>96.11</td>
<td>11.74</td>
<td>-0.811</td>
<td>.454</td>
</tr>
<tr>
<td>TOMAL Memory Composite</td>
<td>93.83</td>
<td>6.22</td>
<td>-3.290**</td>
<td>.008</td>
<td>93.97</td>
<td>4.41</td>
<td>-3.349*</td>
<td>.020</td>
</tr>
<tr>
<td>Attention/Working Memory Composite</td>
<td>88.64</td>
<td>9.48</td>
<td>-3.977**</td>
<td>.003</td>
<td>95.08</td>
<td>6.46</td>
<td>-1.864</td>
<td>.121</td>
</tr>
<tr>
<td>Executive Composite</td>
<td>78.08</td>
<td>5.76</td>
<td>-12.617**</td>
<td>.000</td>
<td>92.50</td>
<td>10.77</td>
<td>-1.705</td>
<td>.149</td>
</tr>
</tbody>
</table>

Note: All scores were transformed into standard scores with M = 100 and SD = 15 to aid comparisons. * p < 0.05 ** p < 0.01
Figure 2. Mean standard scores for neuropsychological measures for the ADHD only (n = 15), Trauma only (n = 6) and ADHD/Trauma (n = 11) groups. Note: All scores were transformed into standard scores with M = 100 and SD = 15.
Table 7.

Comparison of Neuropsychological Measures between ADHD only Group, and Trauma only and ADHD/Trauma Subgroups

<table>
<thead>
<tr>
<th></th>
<th>ADHD only</th>
<th>Trauma only</th>
<th>ADHD/Trauma</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N = 15</td>
<td>N = 6</td>
<td>N = 11</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
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<tr>
<td>FSIQ</td>
<td>90.93</td>
<td>11.98</td>
<td>99.83</td>
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<tr>
<td>Achievement</td>
<td>84.77</td>
<td>14.11</td>
<td>96.11</td>
</tr>
<tr>
<td>Composite</td>
<td>Memory</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>93.10</td>
<td>5.48</td>
<td>93.97</td>
</tr>
<tr>
<td>Attention/Working</td>
<td>Memory</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>85.93</td>
<td>10.78</td>
<td>95.08</td>
</tr>
<tr>
<td>Composite</td>
<td>Executive</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>83.44</td>
<td>10.53</td>
<td>92.50</td>
</tr>
</tbody>
</table>

Note: * Represents Significance at p < 0.05. All scores were transformed into standard scores with M = 100 and SD = 15.

Prediction 4

Prediction 4 was that children with symptomatic trauma and ADHD (ADHD/Trauma subgroup) would demonstrate more general impairment on a composite measure of neuropsychological domains in comparison to children with ADHD without exposure to trauma (ADHD only group) and children in the Trauma only subgroup.

Results from a one-way ANOVA revealed no significant difference on a composite cognitive variable between the ADHD only ($M = 87.23, SD = 5.98$), Trauma only ($M = 94.32, SD = 7.15$), and ADHD/Trauma ($M = 87.18, SD = 6.77$) groups, $F (2, 29) = 2.942$, $p > 0.05$. 
Prediction 5

It was predicted that children in the ADHD only group would show at risk or clinically significant elevations on the Hyperactivity, Attention Problems, Depression, Externalizing Problems, and Behavioural Symptom Index scales of the BASC as compared to the general population, and that children in the Trauma group would show at risk or clinically significant elevations on the Attention Problems and Internalizing Problems scales of the BASC as compared to the general population. Figures 3 through 8 depict BASC Parent, Teacher, and Self-Report Profiles for the ADHD only and Trauma groups.

As observed through Figures 3-5, guardians of children in the ADHD only group reported more concerns on the BASC regarding their children’s behaviour as compared to teacher reports or self reports. Thus, BASC teacher reports and BASC self report rating scales were removed from subsequent analyses. Guardian reports of children in the ADHD only group (Figure 3) revealed scores in the at risk range (see description of the BASC on p. 88) on the Behavioural Symptom Index and Externalizing Problems indices resulting from at risk elevations on the Hyperactivity, Aggression, Conduct, as well as the Depression and Attention Problems subscales. All other subscales were within the normal range.

Guardian reports also revealed scores in the at risk range (T-score < 40) on the Adaptive Skills Index with scores in the at risk range on the Adaptability and Leadership subscales will all other subscales within the normal range.
Figure 3. Mean BASC-PRS profiles for children in the ADHD only group (n = 15). Note: Scores are represented at T-Scores (M= 50, SD = 10). BSI: Behavioural Symptom Index. For the Adaptive Skills, Adaptability, Social Skills, and Leadership subscales lower scores represent lower functioning. For all other subscales higher scores represent greater impairment.
Figure 4. Mean BASC-TRS profiles for children in the ADHD only group \((n = 15)\). Note: Scores are represented at T-Scores \((M = 50, SD = 10)\). BSI: Behavioural Symptom Index. For the Adaptive Skills, Adaptability, Social Skills, Leadership, and Study Skills subscales lower scores represent lower functioning. For all other subscales higher scores represent greater impairment.
Figure 5. Mean BASC-SRP profiles for children in the ADHD only group \((n=15)\). Note: Scores are represented at T-Scores \((M=50, SD=10)\). For the Personal Adjustment, Interpersonal Relations, Self-Esteem, and Self Reliance subscales lower scores represent lower functioning. For all other subscales higher scores represent greater impairment.

Similar to the ADHD only group, guardians of children in the Trauma group reported more concerns regarding their children’s behaviour as compared to the children’s teachers or the children themselves (see Figures 6-8). As with the Trauma group BASC Teacher report and BASC Self-Report rating scales were removed from subsequent analyses.

BASC Parent reports of children in the Trauma group (Figure 6) revealed at risk elevations on the Behavioural Symptom Index, Externalizing and Problems Indexes,
resulting from *at risk* elevations on the Hyperactivity, Aggression, and Conduct Problems, as well as the Attention Problem subscales. Guardians also endorsed *at risk* concerns on the Adaptive Skills index (T-score < 40) resulting from at risk scores on the Adaptability subscale. All other subscales were within the normal range.

*Figure 6*. Mean BASC-PRS profiles for children in the Trauma group (*n* = 17). Note: Scores are represented at T-Scores (*M* = 50, *SD* = 10). BSI: Behavioural Symptom Index. For the Adaptive Skills, Adaptability, Social Skills, and Leadership scales lower scores represent greater impairment. For all other scales higher scores represent lower functioning.
Figure 7. Mean BASC-TRS profiles for children in the Trauma group ($n = 17$). Note:
Scores are represented at T-Scores ($M= 50, SD = 10$). BSI: Behavioural Symptom Index. For the Adaptive Skills, Adaptability, Social Skills, Leadership, and Study Skills scales lower scores represent greater impairment. For all other scales higher scores represent lower functioning.
Figure 8. Mean BASC-SRP profiles for children in the Trauma group (n = 17). Note:
Scores are represented at T-Scores ($M= 50$, $SD = 10$). ESI: Emotional Symptom Index. For the Personal Adjustment, Interpersonal Relations, Self-Esteem, and Self Reliance scales lower scores represent greater impairment. For all other scales higher scores represent greater impairment.
Due the exploratory nature of the analysis and paucity of research comparing these two populations there were no *a priori* predictions as to the differences in BASC measures between children with emotional and or behavioural symptoms following exposure to trauma and children with ADHD. For this analysis the children were divided into three groups (ADHD only group, Trauma only subgroup, and ADHD/Trauma subgroup). Figure 9 depicts comparisons between BASC Parent profiles among the three groups. An inspection of Figure 9 reveals a general pattern suggesting few significant differences between the ADHD only group and ADHD/Trauma subgroup, with children in the Trauma only subgroup experiencing the fewest number of problem behaviours. A series of one-way ANOVAs were conducted in order to compare scores between the ADHD only group, Trauma only subgroup, and ADHD/Trauma subgroup on BASC measures (Tables 8).
Figure 9. Comparisons of mean BASC-PRS profiles between the ADHD only group \((n = 15)\), Trauma only subgroup \((n = 6)\), and ADHD/Trauma subgroup \((n = 11)\). Note: Scores are represented at T-Scores \((M = 50, SD = 10)\). BSI: Behavioural Symptom Index. For the Adaptive Skills, Adaptability, Social Skills, and Leadership scales lower scores represent greater impairment. For all other scales higher scores represent lower functioning.
Table 8.

Comparison of Mean BASC-PRS Profiles between ADHD only Group and, Trauma only and ADHD/Trauma Subgroups

<table>
<thead>
<tr>
<th></th>
<th>ADHD only</th>
<th>Trauma only</th>
<th>ADHD/Trauma</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>15</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>Behavioural Symptom Index</td>
<td>65.60&lt;sup&gt;a&lt;/sup&gt;b</td>
<td>53.67&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.29</td>
</tr>
<tr>
<td>Externalizing Problems</td>
<td>65.87&lt;sup&gt;b&lt;/sup&gt;</td>
<td>53.17&lt;sup&gt;a&lt;/sup&gt;</td>
<td>12.77</td>
</tr>
<tr>
<td>Internalizing Problems</td>
<td>54.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>49.83&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.85</td>
</tr>
<tr>
<td>Hyperactivity</td>
<td>65.87&lt;sup&gt;b&lt;/sup&gt;</td>
<td>45.45&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.85</td>
</tr>
<tr>
<td>Aggression</td>
<td>63.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>57.33&lt;sup&gt;a&lt;/sup&gt;</td>
<td>14.58</td>
</tr>
<tr>
<td>Conduct Problems</td>
<td>61.93&lt;sup&gt;a&lt;/sup&gt;</td>
<td>55.33&lt;sup&gt;a&lt;/sup&gt;</td>
<td>10.54</td>
</tr>
<tr>
<td>Anxiety</td>
<td>49.20&lt;sup&gt;a&lt;/sup&gt;</td>
<td>54.50&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.40</td>
</tr>
<tr>
<td>Depression</td>
<td>60.13&lt;sup&gt;a&lt;/sup&gt;</td>
<td>53.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.58</td>
</tr>
<tr>
<td>Somatization</td>
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<td>42.17&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.86</td>
</tr>
<tr>
<td>Atypicality</td>
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<td>54.67&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.17</td>
</tr>
<tr>
<td>Withdrawal</td>
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<td>49.50&lt;sup&gt;a&lt;/sup&gt;</td>
<td>12.41</td>
</tr>
<tr>
<td>Attention Problems</td>
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<td>51.33&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.91</td>
</tr>
<tr>
<td>Adaptive Skills</td>
<td>38.33&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>45.83&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.13</td>
</tr>
<tr>
<td>Adaptability</td>
<td>39.23&lt;sup&gt;a&lt;/sup&gt;</td>
<td>46.80&lt;sup&gt;a&lt;/sup&gt;</td>
<td>10.64</td>
</tr>
<tr>
<td>Social Skills</td>
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<td>48.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.21</td>
</tr>
<tr>
<td>Leadership</td>
<td>39.27&lt;sup&gt;a&lt;/sup&gt;</td>
<td>46.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.06</td>
</tr>
</tbody>
</table>

Note: Scores are represented as T-Scores (Mean = 50, SD = 10). For Adaptive Skills, Adaptability, Social Skills, and Leadership scales lower scores represent greater impairment. For all other scales higher scores represent greater impairment. *p < 0.05. **p < 0.01. Means that share superscripts do not defer significantly.
Results of BASC-PRS profiles (Figure 9) revealed significant between group
differences on the Behavioural Symptoms, Externalizing Problems, and Adaptive Skills
Indices, including the Hyperactivity, Attention Problems, and Social Skills subscales
(Table 8). Bonferroni post-hoc analysis revealed that for the BASC-PRS, guardians of
children in the Trauma only subgroup reported significantly fewer problems as compared
to guardians for the ADHD only group and ADHD/Trauma subgroup. The
ADHD/Trauma subgroup was reported to have significantly more problems on the
Behavioural Symptoms, Externalizing Behaviors, and Adaptive Skills Indices, as well as
the Social Skills subscale as compared to children in the Trauma only subgroup. For the
BASC-PRS Hyperactivity and Attention Problems subscales both the ADHD only group
and ADHD/Trauma subgroup were reported to have significantly more problems as
compared to the Trauma only subgroup. There were no significant differences on BASC-
PRS scales between the ADHD only group and ADHD/Trauma subgroup.
CHAPTER 4

DISCUSSION

Previous research suggests that children who have experienced trauma are often more likely to be diagnosed with ADHD than PTSD (Famularo et al., 1996). It has been suggested that many children who have experienced trauma may actually be misdiagnosed with ADHD due to the overlap between ADHD and symptoms of trauma (Weinstein et al., 2000). The goal of this study was to examine and compare the psychosocial and neuropsychological profiles of symptomatic trauma and ADHD as they present in childhood, as well as to discuss the comorbidity and differential diagnosis between these two disorders. This was accomplished through three objectives: 1) to explore the proportion of children with emotional and behavioural symptoms following exposure to trauma with children diagnosed with ADHD who have not been exposed to trauma in a clinical sample; 2) to compare children with ADHD and children who have experienced trauma on measures of intelligence, academic achievement, attention, memory, and executive functioning; and 3) to compare the severity of the behavioural and emotional symptoms between children with ADHD who have not been exposed to trauma (ADHD only group), children with symptomatic trauma with ADHD (ADHD/Trauma subgroup), and children with symptomatic trauma without ADHD (Trauma only subgroup). Five predictions were proposed.

The first prediction was that a significantly greater proportion of children with symptomatic trauma would meet diagnostic criteria for ADHD in comparison to the general population (5%). Not only were results consistent with the prediction but the majority of children with symptomatic trauma met symptomatic criteria for ADHD.
The comorbidity of ADHD and symptomatic trauma was present in children who experienced both acute and chronic trauma, all four types of trauma represented in this sample, and across referral sources (Windsor Essex Children’s Aid Society, Children’s Health Care Network, Glengarda Child & Family Services, University of Windsor, Learning Disabilities Association of Windsor, and Peadiatrician’s Offices). This comorbidity occurred across referral sources despite the fact that only the Windsor Essex Children’s Aid Society was asked to refer subjects who had experienced trauma whereas the other sources were asked to refer subjects who had been diagnosed with ADHD.

The high comorbidity of ADHD in children who have been exposed to trauma is consistent with the results of published studies (e.g., Cuffe et al., 1994; Weinstein et al. 2000, McLeer et al., 1994). McLeer and colleagues (1994) described that the most frequent comorbid diagnosis of children who have experienced maltreatment is PTSD and ADHD (23.1%), with comorbidity rates as high as 43% for children who have been sexually abused. Although the highest rate of comorbidity reported by McLeer et al. (1994) is 1.5 times less than that found in the present analysis, a formal diagnosis of PTSD was not made in this study. Instead, the current study examined children with emotional and or behavioural symptoms (as defined by the TSCC; Briere, 1996) following exposure to trauma. Some studies have proposed that a diagnosis of ADHD is more prevalent than a diagnosis of PTSD in children exposed to trauma (Famularo et al., 1996), a view that may be supported by the present results. Although, it was not possible to diagnoses PTSD based on measures used in this study, some children recruited for the study because they had experienced trauma had previously received a diagnosis of PTSD.
However, many more children in the sample with symptomatic trauma had been diagnosed with ADHD.

For several of the children referred because they had been diagnosed with ADHD, it was discovered during the study that they had experienced significant trauma. In four cases the guardians were unaware of the trauma, in others caregivers appeared unaware of the symptoms associated with the trauma and the impact of the traumatic event(s) on the child. Even though all children in Trauma group demonstrated emotional and or behavioural symptoms following exposure to trauma, these symptoms were untreated in the majority of cases. Thus children were only receiving treatment for ADHD, while trauma symptoms were overlooked. This finding may be related to difficulties diagnosing PTSD in children, the fact that symptomatic trauma is not a formal diagnosis, or a lack of appropriate screening measures being used during diagnosis.

The nature of the comorbidity between symptomatic trauma and ADHD in the population remains unclear. Three models have previously been proposed to explain the comorbidity between ADHD and symptomatic trauma or PTSD (Cicchetti & Toth, 1995; Cuffe et al., 1994; Famularo et al., 1992). The first model postulates that as a result of similarities in symptoms, children who have experienced significant trauma may exhibit symptoms consistent with inattention and hyperactivity, but secondarily to the trauma (Cuffe et al., 1994). Thus, symptoms associated with trauma mirror symptoms of ADHD and it may be assumed that if the trauma symptoms are treated, the child may no longer meet criteria for ADHD.

The second model postulates that the symptoms of inattention and hyperactivity expressed by children who have experienced significant trauma are directly related to an
ADHD and Trauma

underlying ADHD (Cuffe et al., 1994; Famularo et al., 1992). Thus, the child meets criteria for both ADHD and symptomatic trauma; however, these two factors are unrelated. The third model suggests that pre-existing externalizing disorders, such as ADHD, may increase a child’s risk of being physically abused (Cicchetti & Toth, 1995), of being exposed to trauma and tragic events, or both (Breslau et al., 2006). Thus, the child meets criteria for both ADHD and symptomatic trauma with the view that the presence of ADHD increased the child’s risk of experiencing trauma. Both the second and third model represent a dual-diagnosis of ADHD and symptomatic trauma, meaning that if symptoms of trauma were treated, the child would continue to meet diagnostic criteria for ADHD.

Although it is not possible to know for certain, it is suggested that there were cases representing all three of these possibilities in the present study. Through informal conversations with the parent and child surrounding the assessment it became apparent in at least four instances that the child experienced trauma (i.e. bullying or assault from peers) after being diagnosed with ADHD and possibly were at greater risk of being targeted by peers due to their ADHD symptoms.

For the remaining children with comorbid ADHD and symptomatic trauma it is impossible to tell whether or not the symptoms of ADHD were secondary to the trauma or represented an underlying ADHD. Thus, it is assumed that in some children treatment of trauma symptoms may result in alleviation of ADHD symptoms; however, in other children ADHD symptoms would persist once trauma symptoms are addressed. However, addressing trauma symptoms should be an important component in the treatment of all children who have experienced trauma.
The second prediction compared the neuropsychological functioning of children with symptomatic trauma and children who have been diagnosed with ADHD to the normative sample. It was predicted that children in the Trauma group would obtain significantly lower scores on measures of attention, memory, and executive functioning in comparison to norms.

Consistent with prediction children with symptomatic trauma obtained significantly lower scores as compared to the normative sample on measures of academic achievement, memory, attention and working memory, and executive functioning. These findings are generally consistent with the Beers and De Bellis (2002) analysis of the neuropsychological sequelae of children with PTSD, with the exception of additional deficits in academic achievement in the present study. Based on the high comorbidity of learning disabilities and ADHD reported in the literature (Casey et al., 1996; Faraone et al., 2001), additional deficits in academic functioning in the Trauma group is likely associated with the high comorbidity of ADHD within this sample.

It was also predicted that children with ADHD who have not experienced trauma would receive significantly lower scores on measures of intelligence, academic achievement, attention, and executive functioning (problem solving, response inhibition, abstract reasoning) in comparison to norms. Results revealed that children in the ADHD group demonstrated significantly lower performance on all five cognitive domains (intelligence, academic achievement, memory, attention and working memory, and executive functioning) as compared to the normative sample. These results are consistent with predictions and previous research (Barkley, 1997a, 1997b, 1998; Barkley et al., 1990; Barkley et al., 1992; Kim & Kaiser, 2000; Lazar & Frank, 1998; McGee et al.,
2000; Murphy et al., 2001; Oie et al., 1999). The exception is the addition of significantly lower performance on a composite memory measure within the current study. Although the performance of the ADHD only group on a composite measure of memory was significantly lower than norms, mean performance in memory was within the average range and the highest mean among the five measured cognitive domains.

Although sample sizes were small due to the high comorbidity of ADHD in the Trauma group, the sample was divided into the ADHD/Trauma and Trauma only subgroups for further exploratory comparisons. Comparison of the ADHD/Trauma subgroup to the normative sample revealed significantly lower performance in all cognitive domains with the exception of intelligence in the ADHD/Trauma subgroup. These results are similar to comparisons of the original Trauma group (combined ADHD/Trauma and Trauma only subgroups) to the normative sample. This suggests that within the Trauma group (combined ADHD/Trauma and Trauma only subgroups) deficits in attention and executive functioning may be associated with a diagnosis of ADHD. However, this hypothesis is inconsistent with results from Beers and De Bellis (2002), as only one of the 14 children from their sample was diagnosed with ADHD. It was suggested that deficits in attention and executive functioning found in their sample were related to involvement of prefrontal cortex in PTSD.

Comparison of the Trauma only group to the normative sample revealed significantly lower performance only on a composite measure of memory. Lower scores on measures of memory in children with symptomatic trauma (without ADHD) is consistent with predictions and previous research on the neuropsychological functioning
of children and adults who have been diagnosed with PTSD (Beers & De Bellis, 2002; Bremner, et al., 1993; Golier & Yehuda, 2002; Yehuda et al., 1995).

Prediction 3 compared the neuropsychological functioning of children with symptomatic trauma and children who have been diagnosed with ADHD who have not experienced trauma. It was predicted that children with symptomatic trauma would obtain lower scores on measures of memory in comparison to the ADHD only group, and that children in the ADHD only group would obtain lower scores on measures of executive functioning in comparison to children with symptomatic trauma. Contrary to predictions there were no significant differences between the Trauma and ADHD only groups. It is proposed that this lack of difference may be related to the high comorbidity of ADHD in the Trauma group. Therefore, the Trauma group was subdivided into the Trauma only and ADHD/Trauma subgroups for further analyses.

Comparisons of neuropsychological composite variables between the ADHD only group, and ADHD/Trauma and Trauma only subgroups revealed very little difference on neuropsychological measures between the ADHD only group and ADHD/Trauma subgroup. The Trauma only subgroup performed better in all cognitive domains; however, most of these differences did not meet clinical significance. This lack of significance may be associated with poor power due to the small sample size of children in the Trauma only subgroup (n = 6). Despite the small sample size, children in the ADHD/Trauma subgroup demonstrated significantly lower scores in executive functioning as compared to the Trauma only subgroup. Difficulties with the executive skills measured would be consistent with a diagnosis of ADHD (Barkley 1997a, 1997b;
Barkley et al., 1992; Lazar & Frank, 1998) and the prediction that children with ADHD are expected to show greater impairment on measures of executive functioning.

The fourth prediction was that children in the Trauma group who meet diagnostic criteria for ADHD would demonstrate more general impairment on a composite measure of neuropsychological domains in comparison to children in the ADHD only and Trauma only groups. Contrary to prediction, results revealed no significant difference between the ADHD only group, Trauma only subgroup, and ADHD/Trauma subgroup. Overall, the Trauma only subgroup obtained a higher overall composite score in comparison to the ADHD only group and ADHD/Trauma subgroup; however, this difference did not meet significance. The lack of significant difference between groups may be associated with small samples sizes in this study and therefore insufficient power.

For prediction 5, behavioural symptoms as measured by the BASC were examined for the ADHD only and Trauma groups. It was predicted that children in the ADHD only group would show at risk or clinically significant elevations on the Behavioural Symptom Index, Externalizing Problems, Hyperactivity, Attention Problems, Depression, scales of the BASC as compared to the general population. Results revealed that children in the ADHD only group were reported to show at risk or clinically significant elevations on the Behavioural Symptom, Externalizing Problems, and Adaptive Skills Indices, including the Hyperactivity, Aggression, Conduct Problems, Depression, Attention Problems, Adaptability and Leadership subscales of the BASC-PRS. Results are generally consistent with predictions, with additional elevations on the Adaptability and Leadership subscales. These additional findings are generally consistent with what would be expected in an ADHD population given the association of
ADHD with school related difficulties (Barkley et al., 1990; Connors et al., 2003; Jensen, 1993).

Children in the Trauma group were predicted to show *at risk or clinically significant* elevations on the Attention Problems and Internalizing Problems scales of the BASC as compared to the general population. Results revealed that children in the Trauma group were reported to have at risk elevations on the Behavioural Symptom, Externalizing Problems, and Adaptive Skills indices, including the Hyperactivity, Aggression, Conduct Problems, Atypicality, Attention Problems, and Adaptability subscales on the BASC-PRS. Thus children in this study were reported to demonstrate more externalizing behaviours (Aggression, Conduct problems) and fewer internalizing problems as compared to predictions. Again, this finding may reflect the high comorbidity of ADHD within the sample.

Due the exploratory nature of the analysis and paucity of research comparing these two populations there were no *a priori* predictions as to the differences in BASC measures between the ADHD only group, ADHD/Trauma subgroup, and the Trauma only subgroups. Results of the comparison revealed that as with cognitive variables, children in the Trauma only subgroup demonstrated less impairment overall as compared with the ADHD only group, and ADHD/Trauma subgroup, with no significant difference between the two ADHD groups. Specifically, as compared to the Trauma only subgroup, children in the ADHD only group, and ADHD/Trauma subgroup were reported by their guardians to have significantly more problems on the Hyperactivity and Attention problems subscales. Finally, the ADHD/Trauma subgroup was reported to have more
problems as compared to the Trauma only subgroup on BASC-PRS Behavioural Symptoms, Externalizing Behaviors, and Adaptive Skills Indices.

Overall, there were no significant differences between children with symptomatic trauma and children with ADHD who have not experienced trauma on cognitive variables and few significant differences on behavioural variables. This is most likely associated with the high comorbidity of ADHD in children with symptomatic trauma. When the Trauma group was subdivided into the ADHD/Trauma and Trauma only subgroups, there were few differences between the ADHD and ADHD/Trauma groups on both cognitive and behavioural variables; however, these two groups demonstrated significantly lower scores on most cognitive domains and significant elevations on Behavioural Problems, Externalizing Problems, and Adaptive Skills as reported on the BASC parent reports.

In general, children in the Trauma only subgroup showed very little overall impairment on cognitive and behavioural measures, and generally received higher mean scores than the ADHD only group and ADHD/Trauma subgroup. In comparison, the ADHD only group and ADHD/Trauma subgroup were very similar in both cognitive and behavioural measures. It appears that within the current sample, the majority of cognitive and behavioural symptoms are associated with a diagnosis of ADHD and that there is no additional impairment in functioning associated with exposure to Trauma. However, it must be considered that the majority of children in this study (73.7%) were taking stimulant medication for treatment of ADHD, but continued to experience a significant number of symptoms of ADHD as well as associated cognitive deficits.

The majority of the children in the ADHD/Trauma group were being treated primarily for symptoms of ADHD through either stimulant medication, use of
behavioural modification strategies or both while trauma symptoms were being overlooked. Of the eleven children in the ADHD/Trauma group 82% were prescribed stimulant medication. Further 33% of children in the Trauma only group were prescribed stimulant medication. Although there is the possibility that the lack of ADHD symptoms in this group may be associated with the effectiveness of prescribed medication, these children as a group did not experience a cognitive profile that is typical of ADHD (Barkley 1994, Barkley 1997c). Previous studies have suggested a reduced effect of stimulant medication in children with anxiety disorders (DuPaul, Barkley, & McMurray, 1994; Pliszka, 1989). In addition, DuPaul, Barkley and McMurray (1994) reported that for some children with comorbid symptoms of ADHD and internalizing disorders such as anxiety may be at a higher risk for side effect of stimulant medication as compared to patients with ADHD without internalizing symptoms.

One important finding of this study concerns the memory performance of children who experienced trauma but did not meet symptomatic criteria for ADHD. Although children in the Trauma only group performed within the average range on most cognitive and behavioural measures, their performance on a composite measure of memory was significantly lower than the normative sample. This result is consistent with previous research on the neuropsychological functioning of children and adults with PTSD (Beers & De Bellis, 2002; Bremner, et al., 1993; Golier & Yehuda, 2002; Yehuda et al., 1995). Further, this finding is consistent with neurobiological studies reporting decreased hippocampal volumes in individuals with PTSD or subthreshold PTSD (De Bellis et al, 1995; Stein et al., 1997).
Reasons for the lack of further impairment in cognitive and behavioural measures in the Trauma only group remain unclear. All children who made up this group were referred by the Windsor Essex Children’s Aid Society and therefore they had all been identified as having experienced trauma, were removed from the source of the trauma, and at least some of the children were receiving psychotherapy to address trauma symptoms. In addition, there was a lower comorbidity of ADHD within this group (25%). This may be a coincidence due to small sample size (only 8 children were referred by the CAS) or it may reflect the fact that these children had been identified as experiencing trauma, were removed from the source of their trauma, and in most cases were receiving some form of treatment.

There are several possible explanations for the lack of additional cognitive and behavioural impairment in children in the Trauma only group. One possibility may be that these children were receiving some form of treatment and thus behavioural and cognitive symptoms were ameliorating. A second related possibility is that children with symptomatic trauma without comorbid ADHD represent a more resilient group and without this resiliency these children would experience symptoms which mirror those found in ADHD. A third possibility may be that only certain children who are exposed to trauma have a genetic or biological predisposition for developing comorbid symptoms of ADHD and that the majority of cognitive and behavioural symptoms experienced by individuals exposed to trauma are associated with ADHD.
Limitations and Future Directions

Due to the paucity of research comparing children with symptomatic trauma and children with ADHD this analysis is exploratory in nature, thus there are several limitations which must be considered.

Some comorbidity between ADHD and Trauma was expected in this analysis; however, the magnitude of this finding could not be predicted. The comorbidity between ADHD and symptomatic trauma is a significant and important finding. However, it resulted in difficulty comparing the neuropsychological and behavioural similarities and differences between children in the two groups, as well as small sample sizes when children exposed to trauma with and without ADHD were examined separately.

A significant limitation of this study is the small sample sizes for the subgroups, particularly the Trauma only and ADHD/Trauma subgroups. However, recruitment for this study took place over two years and across multiple local sites. Small sample sizes in this study may be a reflection of complications associated with recruitment for clinical studies. Sample sizes may also reflect the prevalence of ADHD and symptomatic trauma without additional comorbidity (i.e. those ruled out by exclusionary criteria) or additional complicating factors (i.e. physical trauma) within the Windsor community.

Due to the small sample size the Trauma group was very heterogeneous in nature. As a result we were unable to investigate in this study the role of several important factors known to have an effect on cognitive and emotional functioning, such as type of trauma, acute versus chronic trauma, gender, and duration since the last traumatic event (Famularo et al., 1993; Kessler et al., 1995; Kinzie et al., 1989; Salmon & Bryant, 2002).
Although the Trauma only subgroups demonstrated little impairment on both cognitive and behavioural variables there was often a lack of a significant difference between the Trauma only and both ADHD groups, particularly in cognitive variables, which may be related to small sample sizes, which therefore reduce the power of this analysis. Consequently, to address the above limitations, multi-site research involving larger urban areas would be necessary in order to create sample sizes of sufficient numbers in order to analyse statistically such dimensions, which was beyond the scope of this study.

As all children recruited for this study had already been identified as in need of care by a social service agency because of trauma, in need of treatment for ADHD, or both, these children may differ from each other and other children who have not been identified in other ways apart from a diagnosis of ADHD or history of trauma. For instance, the behavioural symptoms and cognitive profiles of these children may be related to genetic or environmental differences shared by these children that are not causally related to symptomatic trauma of ADHD. Some examples pertaining to children recruited through the Windsor Essex Children’s Aid Society include possible neglect in infancy and early childhood, likely presence of alcohol and drug abuse in the biological home, possible unreported physical injuries or other illnesses in the same time frame. Issues related to genetic and environmental factors are further confounded within this population as many children recruited for this study (particularly children in the Trauma only subgroup) were not being raised by their biological parents.

Further, children with known or suspected developmental disability, learning disability, or unknown neurological injury that may or may not be associated with
previous physical abuse or assault were included in the study so long as they were able to complete standardized testing. Thus the possibility exists that these findings may be related to these disabilities and dysfunctions rather than causally relating to trauma or ADHD. However, given the high comorbidity of ADHD and trauma with other diagnoses (e.g. Learning Disabilities, Depression), children in this sample may be an accurate reflection of children with ADHD and trauma within the general population.

Assessments were not conducted anonymously. Guardians and children were made aware that a non-interpretive report would be written based on the results of the cognitive measures and their responses on the behavioural questionnaires. Both guardians and children were informed that only the examiner would look at their responses to individual questions. However, they were also informed that if they reported suicidal ideation or that they were of any threat to themselves or others that their responses could not be kept confidential. For these reasons it is possible that some children may have underreported symptoms of the BASC or the TSCC. The study was conducted in this manner to assist with recruitment. Many guardians agreed to involve their children in the study so that assessment results could be used clinically by registered psychologists that may be involved with the children in the future.

There is the possibility of a referral bias due to the method in which children were recruited for this study, particular those recruited by the Children's Health Care Network, the Learning Disabilities Association, or a paediatrician. Specifically for children recruited because they had been identified with ADHD, it is likely that guardians agreed to or requested recruitment for the study in order to benefit from a free neuropsychological assessment. It is suggested that many of these children may have
been struggling in school and likely meet criteria for a learning disability (Casey et al., 1996; Faraone et al., 2001).

Distinguishing between those children with comorbid ADHD and symptomatic trauma who represent a true comorbidity and those where symptoms of trauma mirror symptoms of ADHD is beyond the scope of this study. It would be impractical to conduct a longitudinal study to determine whether or not a child experienced symptoms of ADHD before being exposed to trauma. However, treatment studies could be conducted to determine whether or not treatment of symptoms associated with trauma results in an alleviation of ADHD symptoms.

In summary, results from this study suggest that children with symptomatic trauma appear to be at greater risk for comorbid symptoms of ADHD than the general population. Further, children with symptomatic trauma and comorbid ADHD demonstrated similar cognitive and emotional profiles to children with ADHD who had not been exposed to trauma. The reasons for this comorbidity are as yet unclear; however, previous research suggests three possible models and it is suggested that all three possibilities were represented in this study (Cicchetti & Toth, 1995; Cuffe et al., 1994; Famularo et al., 1992). In a few instances (4/11 children) exposure to trauma followed symptoms of ADHD. It is hypothesized that social difficulties typically experienced by children diagnosed with ADHD (Angold et al., 1999; Barkley, 1998; Barkley 2002b; Jensen, 1993; Jensen et al., 2001) may have been a significant factor in the bullying and physical assault of these children. In the remaining cases (7/11 cases), it is unknown whether ADHD symptoms represent a true dual diagnosis, or whether treatment of trauma symptoms would result in alleviation of ADHD symptoms.
Another important finding is that children with symptomatic trauma who did not meet diagnostic criteria for ADHD appeared to be higher functioning overall as compared to children with comorbid symptomatic trauma and ADHD, and children with ADHD who have not been exposed to trauma. Possible explanations include the fact that for all these children the trauma has been identified, the majority of these children were receiving treatment, or these children represent a more resilient group and without this resiliency they would experience symptoms which mirror those found in ADHD, or these children do not have a genetic or biological predisposition for developing comorbid symptoms of ADHD.

A theoretical implication is that although it was not possible to formally diagnose PTSD within this sample it is suspected that several children in this study who had been exposed to trauma would not meet diagnostic criteria for PTSD; however, they experienced behavioural and emotional symptoms as a result of trauma. Perhaps a barrier in the appropriate identification and treatment of these children is that there is no formal diagnosis of symptomatic trauma or what has been otherwise referred to subthreshold PTSD.

A practical implication of this research is that many of the children recruited for this study who were identified with ADHD had also experienced a traumatic event that was significant enough to cause behavioural and cognitive symptoms. For several of these children it was not known that they were experiencing symptomatic trauma prior to being recruited for this study. The majority of these children were receiving treatment for ADHD, while trauma symptoms were not being addressed. Over 70% were prescribed stimulant medication for the treatment of ADHD yet continued to experience a
significant number of symptoms as well as associated cognitive side effects. It is suggested that regular screening of exposure to trauma as well as symptoms of trauma is necessary in order to identify and appropriately treat these children. Further, it is also hypothesized that for many children treatment of trauma symptoms could either assist in the treatment of more resistant ADHD or result in an amelioration of ADHD symptoms.
REFERENCES


ADHD and Trauma


chronic presentation of childhood posttraumatic stress disorder. Child Abuse &
Neglect, 12, 439-444.

children clinically diagnosed as borderline personality disorder. Journal of
Nervous and Mental Diseases, 179, 428-431.

children: Preliminary finding. Journal of the American Academy of Child and
Adolescent Psychiatry, 31, 863-867.

Faraone, S. W., Biederman, J., Monuteaux, M. C., Doyle, A. E., & Seidman, L. J.
(2001). A psychometric measure of learning disability predicts educational failure
four years later in boys with attention deficit hyperactivity disorder. Journal of
Attention Disorders, 4, 220-230.

Computer Systems.

of a brief instrument for assessing post-traumatic stress disorder. Journal of
Traumatic Stress, 6, 459-473.

posttraumatic stress disorder in rape victims: A comparison between cognitive
behavioral procedures and counseling. Journal of Consulting and Clinical
Psychology, 59, 715-723.


ADHD and Trauma


Sachinvala, N., von-Scotti, H., McGuire, M., Fairbanks, L., Bakst, K., McGuire, M.,
function and mood among patients with chronic posttraumatic stress disorder.
Journal of Nervous and Mental Disease, 188, 818-823.

Sageman, S. (2002). Women with PTSD: The psychodynamic aspects of
psychomarmocologic and “hands-on” psychiatric management. Journal of the

different modes of traumatization. Behavior Research and Therapy, 29, 213-216.

The intellectual performance of traumatized children and adolescents with or
without posttraumatic stress disorder. Journal of Abnormal Psychology, 115, 332-
340.

influence of developmental factors. Clinical Psychology Review, 22, 163-188.

Schatchar, R. J., Tannock, R., Logan, G. (1993). Inhibitory control, impulsiveness, and

Psychological Services.

Seidman, L.J. (2006). Neuropsychological functioning in people with ADHD across the


CONSENT TO PARTICIPATE IN RESEARCH

Title of Study: COMPARISON OF POSTTRAUMATIC STRESS DISORDER AND ATTENTION DEFICIT HYPERACTIVITY DISORDER

You are asked to give permission for your child to participate in a research study conducted by Tammy Whitlock from the Department of Psychology at the University of Windsor. Tammy Whitlock is a doctoral student in the Department of Psychology and results of this investigation will contribute to her dissertation. This research will be supervised by Joseph Casey, Ph.D., Assistant Professor from the Department of Psychology at the University of Windsor.

If you have any questions or concerns about the research, please feel to contact the primary investigator, Tammy Whitlock at XXX-XXXX or faculty supervisor, Dr. Casey at XXX-XXXX ext. XXXX.

PURPOSE OF THE STUDY

The purpose of this study is to examine and compare the possible long-term effects on thinking and behaviour of children between the ages of 8-12 who have experienced traumatic events and children experiencing symptoms of Attention Deficit/Hyperactivity Disorder (ADHD).

PROCEDURES

If you give permission for your child to participate in this study they will be asked to fill out two paper and pencil questionnaires and general information form. Whenever possible these questionnaires will be filled out in a group format with the examiner reading out the questions. In some instances the questionnaires may be administered individually and the examiner will read the items if necessary. The total time required to fill out these forms will be approximately 30 minutes. In addition, you will be asked to complete two paper and pencil questionnaire about your child’s behaviour (approximately 30 minutes) and, with your permission, your child’s teacher will be asked to complete similar questionnaires (approximately 30 minutes).

Some subjects may be contacted by the primary investigator by telephone and asked to participate in another phase of this research project. During this second evaluation the child will be asked to perform a number of tasks and activities that are designed to measure their thinking ability, including intelligence, academic achievement, memory, attention, and problem solving. This testing will last approximately 3 to 4 hours.

POTENTIAL RISKS AND DISCOMFORTS

Although this is a rare occurrence, there is the possibility that filling out some of the questionnaires may bring up difficult memories for your child and could potentially cause them distress. All the children will be made aware of this possibility and both you and your child will be given a pamphlet of information on some of the psychological effects of trauma. It is recommended that if you or your child feels that you need help coping with these stressful experiences you contact the clinician from whom your child is currently undergoing treatment. In addition, the pamphlets will include phone numbers to call if you or you child needs additional support.

POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY

A comparison of the behaviour and thinking of children who have experienced trauma or experienced Post Traumatic Stress Disorder (PTSD) and children with ADHD will help clinicians to understand the cognitive and behavioural profiles of these children and better differentiate between these two conditions. This will help to recognize children with PTSD and/or ADHD to help in early and appropriate intervention of these disorders.

PAYMENT FOR PARTICIPATION

All subjects who participate in the testing will be entered in a draw. Two names will be drawn and each of the children whose names are drawn will receive a $50 gift certificate for Silvercity. In addition, for each part
of this research study the clinician associated with your child's case will receive a brief report summarizing your child's behavioural strengths and weaknesses. This report will be used as appropriate to help with your child's care.

CONFIDENTIALITY
Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will not be disclosed without your permission. All subjects will be associated with a case number. Only the case number will be on the child's file and individual questionnaires. The subject's name will only appear on their general information form, which will be kept separate from the questionnaires in a locked cabinet in the researcher's home. This general information form will only be used to contact you and your child for participation in the second phase of this study, to provide prizes for the people who won the draw and to provide appropriate feedback to the clinician involved in your child's case. Only the primary investigator and research supervisor will have access to any identifying information. The data will be recorded into a database using only the case number and no identifying information. However, if at any time it seems that the child is in danger of abuse or physical harm from themselves or others, I am obligated to report my concerns to the appropriate authorities.

PARTICIPATION AND WITHDRAWAL
You and your child will choose whether to take part in this study. If you agree to give permission for your child to volunteer for this study, your child may withdraw at any time without consequences of any kind. In addition, you may choose to remove your child from this study at any time. You may also exercise the option of removing your child's data from the study at any time. Your child may also refuse to answer any questions they do not want to answer and still remain in the study. The investigator may also withdraw your child from this research if circumstances arise which warrant doing so.

FEEDBACK OF THE RESULTS OF THIS STUDY TO THE SUBJECTS
With your permission, the clinician directly involved in your child's care will receive a brief report outlining behavioural characteristics and neuropsychological strengths and weaknesses revealed during testing to be used as appropriate. All adult participants, including parents/guardians and clinicians will also receive a summary of behavioural and neuropsychological strengths and weaknesses of children within the three groups (PTSD/ADHD, PTSD, ADHD) upon completion of the study.

SUBSEQUENT USE OF DATA
The data will be used in subsequent studies.

Do you give consent for the subsequent use of the data from this study? □ Yes □ No

RIGHTS OF RESEARCH SUBJECTS
You may withdraw your consent at any time and discontinue participation without penalty. This study has been reviewed and received ethics clearance through the University of Windsor Research Ethics Board. If you have questions regarding your rights as a research subject, contact: Research Ethics Coordinator, University of Windsor, Windsor, Ontario N9B 3P4; telephone: 519-253-3000, ext. 3916; e-mail: lbunn@uwindsor.ca.

SIGNATURE OF RESEARCH SUBJECT/LEGAL REPRESENTATIVE
I understand the information provided for the study A Comparison of Symptomatic Trauma and Attention Deficit Hyperactivity Disorder as described herein. My questions have been answered to my satisfaction, and I agree to participate in this study. I have been given a copy of this form.

Name of Subject

Signature of Subject Date

SIGNATURE OF INVESTIGATOR
These are the terms under which I will conduct research.

Signature of Investigator Date
Research Study Comparing the Effects of Trauma and Attention Deficit/Hyperactivity Disorder

The people I work with and I are interested in learning about how some of the tough things in our lives affect the way children think and feel. We are asking you and a lot of other kids to work with us to find out about it.

If you agree to participate in our project, we will ask you to fill out some questionnaires for us that ask about you. One of your parents and your teacher will also be asked to fill out similar questionnaires about you.

Some kids who fill out questionnaires for us will be called and asked to be part of the second part of the study. In the second part of the study you will be asked to do a bunch of different activities. These activities will help us to learn about how you think.

This is not a test. You won’t be graded on anything you do and your answers will not affect your taking part in this program. All we ask is that you try to answer the questions honestly.

Your parents and the other children will not know how you answered different questions. It will be just between you and me and the people I am working with on this project. Your parents will be given a summary of your thinking abilities and how you are feeling. This will help them have a better idea about how to help you if that is what you need. Also, if I think that you are being hurt or abused or that you may hurt yourself, I will need to tell someone else who can help you.

Of course, you don’t have to do this if you don’t want to, even if your parents say it is okay. If you do not want to do this or your parents asked you not to do this, just tell me and you do not have to participate. It is OK with me if you don’t want to be in the study.

If you have any question at any time please ask me. You can change your mind at any time about whether or not you want to participate.

This study was explained to me and any questions I had have been answered. I would like to take part in the study.

Name (please print)

__________________________________________
Signature

__________________________________________
Date

__________________________________________
Signature of Researcher

__________________________________________
Date
Appendix C

Comparison of Exposure to Trauma and Attention Deficit/Hyperactivity Disorder in Children

GENERAL INFORMATION SHEET

Child’s Name: ________________________ Number: __________

Date: ___________________________

DOB: ___________________________ Age: ______

Parent/Guardian 1, Level of Education: ______________________

Parent/Guardian 2, Level of Education: ______________________

1. Has your child experienced/witnessed a significant event that may be perceived as life threatening? (Check appropriate)

Yes _____ No _____ (If No, proceed to Question 4.)

2. Was this event a single occurrence? (Check appropriate)

Yes _____ No _____

3. What is the approximate duration since the last traumatic event experience by your child?

4. Has your child ever been diagnosed with ADHD?

Yes _____ No _____

5. If you answered No to question 4, has any professional or teacher ever suggested that your child may have ADHD?

6. Is your child currently on any medication? If yes, please provide the names of the medication.

________________________________________________________________

________________________________________________________________
Appendix D

Letter to Accompany Assessment Reports

<DATE>

To whom it may concern,

My name is Tammy Whitlock, a doctoral candidate in Clinical Neuropsychology. Recently a psychological assessment was conducted with <child’s name> at the <location of the assessment>. This assessment was conducted for research purposes using standard procedures. This research study is being conducted under the supervision of Dr. Joseph Casey, from the University of Windsor. The attached report, gives results of this assessment; however, it is non-interpretative. These results can be interpreted by a registered psychologist. <Child’s guardian> has requested that I forward a copy of the raw data to you for interpretation. In addition to the assessment report and raw data I have attached copies of the consents to release information signed by <Child’s Guardian>. I would be happy to provide any further documentation or details to help with the interpretation of these results. I could be contacted at (XXX)XXX-XXXX.

Thank you,

Tammy Whitlock, M.A.
Doctoral Candidate in Clinical Neuropsychology
VITA AUCTORIS

Tammy Lyn Lorretta Whitlock was born on April 5th, 1976 in Sudbury, Ontario. Throughout her childhood she has lived in Trenton, Ontario, Lahr Germany, and Ottawa, Ontario. In June 2000, she obtained a Bachelor of Science degree with highest honours in Neuroscience from Carleton University. In October 2002, she obtained a Master of Arts in Clinical Psychology with subspecialty in Neuropsychology from the University of Windsor. She is currently a candidate for the Degree of Doctor of Philosophy at the University of Windsor and is expected to graduate in June 2008.