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The Impact Of Trauma On Children's Functioning And The Utility Of The CBCL PTSD Profile

Nicola Ashton Herting

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THE IMPACT OF TRAUMA ON CHILDREN'S FUNCTIONING AND THE UTILITY
OF THE CBCL PTSD PROFILE

by

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Submitted to the Graduate Faculty

of the

University of North Dakota

in partial fulfillment of the requirements

for the degree of

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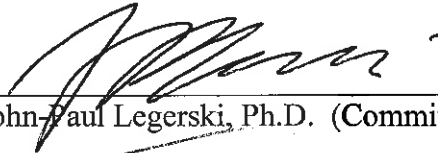
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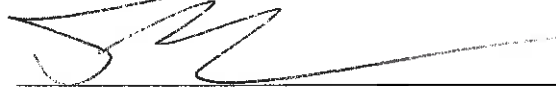
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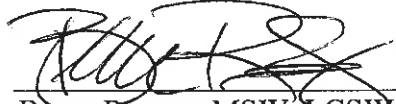
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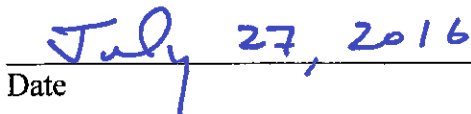


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Nicola Herting
06/30/2016

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ABSTRACT

The high rates of trauma exposure among children and adolescents is a major public health concern due to the many ways trauma can adversely impact cognitive, emotional, and social development and functioning. The high rates of comorbidity between posttraumatic stress symptoms (PTSS) and other mental health disorders translate to complex diagnostic pictures. When conducting psychological, educational, or neuropsychological evaluations it is therefore imperative that clinicians assess for trauma to accurately diagnose, but ultimately to ensure appropriate recommendations for treatment and interventions are made. Several challenges to screening and assessing PTSS among children and adolescents have prompted the identification of efficient and economic screening measures. A few studies have examined the utility of the Child Behavior Checklist (Achenbach & Edelbrock, 1983) in screening for PTSS among children and adolescents, but the results have been largely mixed. The aims of this study were to further examine the validity and utility of the CBCL PTSD profile as a screening tool for PTSS within psychological assessment and whether the CBCL-PTSD profile is associated with neuropsychological, academic, and emotional/behavioral impairment in children and adolescents that have experienced trauma. Data from comprehensive psychological evaluations of 287 eligible outpatients at a private psychological clinic located in a primary care facility were analyzed. The results of the study provide evidence as to whether the CBCL-PTSD can accurately identify PTSS and therefore be

used to screen for PTSS in comprehensive evaluations. As well as provide evidence of the neuropsychological, academic, and emotional/behavioral impairment in children and adolescents that have experienced trauma. Results, limitations, and implications for clinical practice and further research are be discussed.

Keywords: Child Trauma, PTSD, Methodology, Assessment, CBCL, Screening

CHAPTER I

INTRODUCTION

The high rates of trauma exposure among children and adolescents is a major public health concern due to the many ways trauma may adversely impact cognitive, emotional, and social development and functioning. Trauma, as defined by the fifth version of the Diagnostic and Statistical Manual for Mental Disorders (DSM-V; American Psychiatric Association, 2013), involves a person being exposed to actual or threatened death, serious injury, or sexual violence through either direct exposure, witnessing in person, learning news about the trauma, or repeated exposure to details of the trauma. Traumatic experiences can be chronic and pervasive (e.g. continuous abuse, war, torture) or time-limited (e.g. natural disaster, isolated shooting, car accident) (American Psychiatric Association, 2013). Not all individuals that experience trauma develop psychopathology, however a significant proportion experience posttraumatic stress symptoms (PTSS). It is hypothesized that the development of Posttraumatic Stress Disorder (PTSD) may be the mechanism by which traumatic experiences lead to functional impairment (Carrion, Wong, & Kletter, 2012). PTSD is characterized by symptoms in four categories. The four categories of symptoms include 1) continual re-experiencing of the event, e.g. nightmares or flashbacks; 2) persistent avoidance of associated stimuli, e.g. avoidance of places, people, situations associated with the trauma; 3) negative alterations in cognitions and mood, e.g. feelings of detachment, dissociative

amnesia, exaggerated negative beliefs; 4) hyperarousal and reactivity, e.g. insomnia, concentration difficulties, recklessness (American Psychiatric Association, 2013). PTSD requires the presence of symptoms for longer than one month, significant distress and impairment in functioning as a result of symptoms, and that the symptoms are not attributable to substance or co-occurring medical condition.

There are several challenges to screening and assessing PTSD, specifically among children and adolescents. The high rates of comorbidity between posttraumatic stress symptoms (PTSS) and other mental health disorders translate to complex diagnostic pictures. When conducting psychological, educational, or neuropsychological evaluations it is therefore imperative that clinicians assess for trauma to accurately diagnose, but ultimately to ensure appropriate recommendations for treatment and interventions are made. The difficulties with screening and assessing PTSS among children and adolescents have prompted the identification of efficient and economic screening measures. A few studies have examined the utility of the Child Behavior Checklist (Achenbach & Edelbrock, 1983) in screening for PTSS among children and adolescents, but the results have been largely mixed.

The specific impact of trauma exposure on cognitive, emotional, and social development and functioning has therefore become an important area of inquiry. Much research has been conducted to examine the impact of trauma exposure on neuropsychological and educational achievement with adults and strong evidence of the resulting deficits exists (Horner & Hammer, 2002; Golier & Yehuda, 2002). However, the impact of trauma on the neuropsychological and academic functioning of children has not been as extensively researched as with adults. Therefore, much of what is known

about the impact of trauma exposure on neuropsychological and academic functioning is from studies with adults. The surge in developmental research on trauma strongly suggests that what is learned from research involving adults may not necessarily be applicable to children and adolescents since the brain is not yet fully developed in childhood (Beers & Bellis, 2002). As a result, research in this area has been expanding over the last two decades, however there continues to be a need for further research on the impact of trauma on the neuropsychological, academic, and emotional functioning of children.

The goal of the following review is to 1) report epidemiological data on trauma and PTSD; 2) discuss the challenges of diagnosis and assessment of PTSD; 3) review the validity and utility of the CBCL PTSD profile; 4) review neurobiological differences associated with trauma exposure and PTSD; 5) examine previous research on the neuropsychological, academic, and emotional deficits associated with trauma exposure in adults and children; and 6) present the research aims and hypotheses.

Epidemiology of Trauma & PTSD

Much research has been conducted to estimate how many individuals experience trauma, however this is challenging due to the many different types of traumatic experiences and low disclosure rates of assault, abuse and neglect (Pechtel, Diego, & Pizzagalli, 2011; Pereda et al., 2009). The National Comorbidity Survey (NCS; Kessler et al., 1995) is a nationally representative face-to-face survey that was conducted to examine prevalence of mental health disorders within the United States. The original survey was conducted with a civilian sample of 2800 men and 3000 women, aged 15 to 54 years old. The events associated with the experience of trauma according to DSM-III-

R were assessed and 61% of men and 51% of women reported experiencing at least one traumatic event in life. The most prevalent type reported was witnessing someone being injured or killed (36% men, 15 % women), fire or natural disaster (19% men, 15% women), and experiencing a life threatening accident (25% men, 14% women). A recent study by Kilpatrick and colleagues (2013) was conducted to examine prevalence rates of civilian adults exposed to traumatic events according to DSM-5 criteria events. Of the 3000 U.S. civilian adults in the sample, 89% reported exposure to one or more DSM-5 criteria events. The most prevalent type reported was physical or sexual assault (52%), accident or fire (50%), death of a close family member or friend due to violence (49%), natural disaster (48%), threat or injury to a close family member of friend (32%), and witnessing physical or sexual assault (31%).

The studies discussed show high rates of exposure to trauma, however not all individuals exposed to trauma develop PTSD. For instance, the NCS (Kessler et al., 1995) reported estimated lifetime prevalence rates for DSM-III-R PTSD of 10% for female adults and 5% for male adults. Similar prevalence rates have been reported in more recent studies with larger and more representative samples, for instance the National Comorbidity Survey-Revised (NCS-R; Kessler & Merikangas, 2004) estimated the lifetime prevalence of DSM-IV PTSD in female adults to be 9.7% and male adults to be 3.5%.

The epidemiology of trauma in military and veteran populations has also been examined. The 2001 National Survey of Veterans (NSV; U.S. Department of Veteran Affairs, 2014) found that of the 20000 surveyed, 41% of men and 12% of women reported exposure to combat. The RAND survey focused on examining trauma exposure

in individuals previously deployed as part of Operation Enduring Freedom or Operation Iraqi Freedom (Schell & Marshall, 2008). The survey reported the most prevalent types of trauma were the death or injury of a friend (50%), viewing dead or seriously injured noncombatants (45%), witnessing an accident resulting in serious injury or death (45%), smelling decomposing bodies (37%), experiencing an explosion (23%), being injured without hospitalization (23%), experiencing a blow to the head (18%), being injured with hospitalization (11%), engaging in hand to hand combat (10%), witnessing brutality toward detainees or prisoners (5%), and being responsible for the death of a civilian (5%). Research indicates that veteran populations tend to show higher prevalence rates of PTSD than civilians. For instance, the RAND study reported 14% of the sample met criteria for possible PTSD and that length deployment and more extensive exposure to combat was associated with increased risk of developing PTSD. The National Vietnam Veterans Readjustment Study (NVVRS) was mandated by the U.S. Congress in 1983 to establish the prevalence and incidence of PTSD among Vietnam Veterans. With prevalence rates of 31% for men and 27% for women, the NVVRS also showed higher PTSD lifetime prevalence rates for veterans (Kulka et al., 1990). The NVVRS noted that prevalence was higher for those in the army compared to other branches, and that diagnoses were more likely when serving longer than 12 months and entering the service between 17 and 19 years old.

There is considerably less research on the epidemiology of trauma and PTSD in children and adolescents, which makes it difficult to accurately estimate prevalence rates among these populations. However, the research that exists also reports high incidence of trauma exposure for children and adolescents. The U.S. Department of Health and

Human Services Children's Bureau reports that in 2012, over 4 million children in the U.S. were subjects of at least one child protective services report for alleged maltreatment, with about one-fifth determined to be victims of abuse or neglect. The Developmental Victimization Study (DVS; Finkelhor et al., 2005), which examined victimization of 2030 children ages 2 to 17 in the U.S., found that 71% of the sample had been exposed to one or more victimization incidents (e.g. sexual assault, dating violence, property theft, assault by peers). The New York City, NY Department of Education Survey assessed children in grades 4 to 12 in public schools following the terrorist attacks on the World Trade Center (Hoven et al., 2005). Results showed that over 60% of the students had experienced at least one trauma prior to the terrorist attacks. The survey also reported estimated PTSD prevalence rates of 10.6% at 6 months after the attacks. The National Survey of Adolescents (NSA; Kilpatrick & Saunders, 1999), a telephone survey, examined trauma exposure in a sample of 4023 children aged 12 to 17. The survey reported that 39.4% had witnessed serious interpersonal violence, 17.4% had experienced physical assault, and 8.1% experienced sexual assault. Prevalence estimates for PTSD were 3.7% for males and 6.3% for females. The National Comorbidity Survey-Adolescent Supplement (NCS-A) was conducted with 10,123 adolescents aged 13-18 years old in the U.S. (Merikangas et al., 2010). The survey estimated the lifetime prevalence of PTSD in the U.S. among female adolescents to be 8% and male adolescents to be 2.3%. The survey reported that lifetime prevalence is estimated to be the highest for adolescents between 17 and 18 years (7%) compared to adolescents 13-14 years (5.1%) and 15-16 years old (3.7%).

Collectively the data shows that exposure to trauma is very common and that by age 45 the majority of the population may have experienced at least one traumatic event. It is also clear that only a proportion of those exposed to trauma develop PTSD. The lifetime prevalence of PTSD is around 7% for adults and 4% for adolescents, with about 3.5% of adults and 1.4% of children having PTSD in a given year (National Institute of Mental Health; Firbank, 2008; Norris & Slone, 2013).

Diagnostic & Assessment Challenges Related to PTSD

The first step in assessing and diagnosing PTSD is determining whether the individual has been exposed to actual or threatened death, serious injury, or sexual violence through either direct exposure, witnessing in person, learning news about the trauma, or repeated exposure to details of the trauma. This is particularly challenging because individuals, specifically children and adolescents, are often hesitant and unwilling to endorse and discuss exposure to trauma. PTSD is also difficult to assess because it involves a mixture of internalizing and externalizing symptoms, and the recognition of internalizing symptoms requires a degree of insight. Researchers note that children and their caregivers tend to not easily recognize internalizing symptoms such as feeling detached, which highlights one of the ways PTSD presents differently in children than adults (Scheeringa, Zeanah, Drell, Larrieu, 1995). Most internalizing symptoms require verbal expression of internal states, which is often beyond the cognitive and expressive language developments of children (Kaminer, Seedat, & Stein, 2005). This complicates the process of diagnosis, as sometimes certain criteria involving internalizing symptoms cannot be met, such as the avoidance and numbing criteria. Children with PTSD may present with other symptoms in addition to the standard symptom clusters.

Common additional symptoms may include loss of acquired developmental skills (i.e. regression in toileting), new fears, re-activation of old fears, increase in reckless behavior, separation anxiety, psychosomatic complaints (i.e. stomach aches, headaches), and temper tantrums (Kaminer, Seedat, & Stein, 2005). Since PTSD often presents differently in children compared to adults, the DSM-IV criteria did not always capture PTSD in children. However, researchers state that changes in DSM-5 criteria for PTSD are expected to be more sensitive to diagnosing PTSD in children (De Young, Kenardy, Cobham, 2011). Accuracy in diagnosis is further complicated by the difficulty of differential diagnosis in PTSD, because PTSD shares symptoms with other psychiatric disorders such as hyperarousal and difficulty concentrating in ADHD (Sim et al., 2005). Research shows high co-morbidity rates between PTSD and of a number of other disorders, such as depression (Spinhoven et al, 2014), anxiety (Ginzburg, Ein-Dor, & Solomon, 2010), ADHD (Biederman, et al., 2013), and substance abuse (Giaconia et al, 2000), which also makes identification and assessment of PTSD difficult.

Another challenge of diagnosis and assessment is that some measures deem further assessment of PTSD unnecessary if a trauma cannot be specified. When using such measures, this might result in high false positives. Due to the sensitivity of the issue and the need for valid and reliable assessment and diagnosing, it is important to use multiple methods of assessment such as interviews, self-report measures, and/or gathering information from multiple sources. However, the structured clinical interviews available for PTSD are very time-consuming and so are often not included in routine assessment. Due to all these challenges, researchers and clinicians are interested in finding an efficient and economic measure that can be used for screening for PTSD.

Common practice is to use self-report measures to screen for a range of symptoms and then follow-up with measures of specific symptoms and a structured or unstructured clinical interview to gather more information and detail surrounding the symptoms endorsed. As a result, researchers have begun examining measures that are routinely used in standard assessment to determine whether they could be used to reliably screen for PTSD. One measure routinely used by both researchers and clinicians is the Child Behavior Checklist (CBCL; Achenbach & Edelbrock, 1983). Several studies have therefore been conducted to examine the use of the CBCL as a measure to screening for PTSD.

Validity and Utility of the CBCL PTSD Profile

A few research groups have developed CBCL-PTSD subscales to screen for PTSD in children. For instance, Wolfe, Gentile, & Wolfe (1989) proposed a 20-item subscale by selecting CBCL items mirroring the DSM-III criteria for PTSD. The authors studied 71 school-aged participants with a history of sexual abuse and compared the CBCL-PTSD Profile scores to a normative sample. The results showed that those participants with a history of sexual abuse scored five times higher than the normative sample. The creation of this profile prompted other researchers to examine the utility of the profile and modify it. For instance, Ruggiero & McLeer (2000) evaluated the Wolfe et al. (1989) by comparing 63 sexually abused children with a non-abused clinical sample and a non-abused community sample of children ages 6-16. Ruggiero & McLeer (2000) findings indicated the profile had adequate internal consistency (Cronbach's $\alpha = .85$), but questionable convergent and discriminate validity, good sensitivity, and moderate specificity. In terms of convergent validity, the CBCL-PTSD profile scores of the sexual

abuse history group correlated significantly with number of PTSS endorsed on the Schedule for Affective Disorders and Schizophrenia for School-Age Children (K-SADS-E). The scale did not discriminate between the group with sexual abuse history and the non-abused clinical group. However, significant differences in CBCL-PTSD profile scores were found between those positive for abuse with PTSD and those positive for abuse without PTSD. Using a cut-off score of 8, a sensitivity of .87 was found and specificity of .62.

Levendosky et al. (2002) and then Dehon and Scheeringa (2006) both removed the items from the Wolfe et al. (1989) PTSD subscale that were exclusive to the CBCL Ages 6-18 form so that the profile could be used with the 3-5 and 6-18 year old forms. What resulted was a 14-item profile for Levendosky and a 15-item profile for Dehon and Scheeringa (2006). Levendosky et al. (2002) studied 62 children between 3 and 5 years of age exposed to domestic violence and compared scores on the the modified Wolfe et al. (1989) CBCL-PTSD to scores on the PTSD-PAC based on the DSM-IV criteria for PTSD. No significant correlation between the scores were found. Dehon and Scheeringa (2006) studied 62 children between 2 and 6 years of age with a history of trauma and similarly compared scores on the the modified Wolfe et al. (1989) CBCL-PTSD to number of PTSS endorsed on the Posttraumatic Stress Disorder Semi-Structured Interview and Observational Record for Infants and Young Children (Scheeringa et al., 2003). Results indicated the profile had adequate internal consistency (Cronbach's $\alpha = .87$), good convergent and discriminate validity, fair sensitivity, and good specificity. In terms of convergent validity, the CBCL-PTSD profile scores correlated significantly with number of PTSS endorsed on the interview. The CBCL-PTSD profile scores were

significantly higher for those with PTSD than those without PTSD, showing the profile discriminated well between those with trauma history with and without PTSD. Using a cut-off score of 9, a sensitivity of .75 was found and specificity of .84.

Sim et al. (2005) took a different approach by selecting items based on expert ratings of all CBCL items and then conducting confirmatory factor analysis on selected items with 1700 children. Experts categorized items as reflecting PTSD only, dissociation only, both PTSD and dissociation, or not related to PTSD/Dissociation. Three scales were derived, a PTSD subscale (7 items), dissociation subscale (3 items), and a PTSD/dissociation subscale (16 items). Sim et al. (2005) then examined the validity of the new subscales by comparing sexually abused children with a non-abused clinical sample and a non-abused community sample of children ages 4-12. In terms of convergent validity, the CBCL-PTSD dissociation subscale and combined PTSD/dissociation subscale scores were significantly correlated with the self-report measure Trauma Symptom Checklist for Children (TSCC). However, the scale did not discriminate between the group with sexual abuse history and the non-abused groups. Hulette and colleagues (2008) examined the factor structure and discriminant validity of the three Sim et al (2005) CBCL-PTSD subscales with maltreated preschoolers in foster care. The results confirmed validity for 2 PTSD related factors on the CBCL, PTSD (10 items) and Dissociation (3 items). Hulette et al. (2008) also compared the scores on these two profiles with the maltreated preschoolers in foster care and a non-abused community sample. Results indicated significantly higher CBCL PTSD and Dissociation scores for the foster care group compared to the community group. Milot and colleagues (2013) examined the factor structure and convergent validity of Sim et al (2005) CBCL-PTSD

subscales, but with maltreated children aged 6-18. Milot et al. (2013) findings proposed two profiles, a PTSD profile with 12 items and a Dissociation profile with 6 items. In terms of convergent validity, the CBCL-PTSD profile was significantly correlated with the parent report measure Trauma Symptom Checklist for Young Children (TSCYC). A handful of studies have examined the validity and reliability of the discussed CBCL-PTSD profiles. The discriminant validity of the profiles has been examined by comparing CBCL-PTSD scores of various groups, such as abused, non-abused clinical, and non-abused community samples. Most of these studies report that the abused children score higher on the CBCL-PTSD scales compared to non-abused clinical and non-abused community samples. Although the abused groups tend to have higher CBCL-PTSD profile scores than non-abused clinical and non-abused community groups, the difference between the abused group and non-abused community group is only significant (Loeb et al, 2011; Sim et al, 2005; Hulette et al, 2008). Researchers conclude that the nonsignificant finding between abused children and non-abused clinical children may indicate that the CBCL-PTSD scale is more of a measure of general distress and maladjustment than trauma-specific distress (Sim et al, 2005). The discriminate validity of the profiles has also been examined by comparing the CBCL-PTSD scores of those with abuse histories with and without PTSD. Both Ruggiero & McLeer (2000) and Dehon and Scheeringa (2006) demonstrated that versions of the Wolfe et al. (1989) CBCL-PTSD profile discriminated well between those positive for abuse with PTSD and those positive for abuse without PTSD.

The convergent validity of the discussed CBCL-PTSD profiles has been examined by comparing participants' profile score to a variety of assessment methods such as other

self-report scales, other caretaker ratings, caregiver semi-structured interviews, or clinician diagnosis. For instance, Loeb et al. (2011) specifically looked at convergent validity of the Dehon and Scheeringa (2006) CBCL-PTSD profile and compared results from the CBCL PTSD profile score to the UCLA-PTSD Index, clinician diagnoses using the DSM-IV, and the Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood (Rev. ed.; DC 0-3, 2005). Loeb et al. (2011) reported concern for the 60% sensitivity of the Dehon and Scheeringa (2006) CBCL-PTSD profile in identifying children with PTSD compared to the structured interview. The results from this study highlight the importance of using the CBCL as a screener and not a stand-alone diagnostic measure, as well as the value of a thorough interview in assessment of PTSD. The convergent validity of the CBCL-PTSD profiles with self-report measures of PTSD has good support. Researchers have reported significant correlations between the number of symptoms reported on the CBCL-PTSD scales and Children's Impact of Traumatic Events Scale (Wolfe et al, 1989), Schedule for Affective Disorders and Schizophrenia for School-Age Children (Ruggiero & McLeer, 2001), Trauma Symptom Checklist for Young Children (Milot et al, 2013), Trauma Symptom Checklist for Children (Sim et al., 2005), and the UCLA PTSD Index (Loeb et al, 2011).

Rosener and Colleagues (2012) were interested in the utility of CBCL-PTSD profiles in screening for PTSD. The sample included 36 children ages 10-18 in foster care. PTSD diagnoses were determined based on DSM-IV criteria for PTSD. Rosener et al. (2012) ran ROC analyses on the Sim et al (2005), Dehon and Scheeringa (2006), and Wolfe et al. (1989), CBCL-PTSD profiles. The Dehon and Scheeringa (2006) profile had the highest AUC (.81) and the only profile with a significant AUC. Using a cut-off score

of 8, a sensitivity of 1.00 and specificity of .69 were found. The authors concluded that although the results seem to suggest the Dehon and Scheeringa (2006) CBCL-PTSD profile is useful, the predictive utility is not sufficient due to several limitations of the study. The authors suggest research with larger and more representative samples and concentration on specificity to discriminate general distress and PTSS are needed to further examine the profile's predictive utility. Overall the results from the discussed studies examining the validity and reliability of the various CBCL-PTSD profiles are variable and therefore inconclusive, which demonstrates the need for further research on the CBCL-PTSD profiles with larger and more representative samples.

Biological Studies of PTSD

Over the past few decades there has been a surge of studies examining the biological components of PTSD. As a result, several studies have found biological abnormalities associated with PTSD, however the direction of causation is still being debated due to the difficulty of conducting pre- and post-trauma studies. Although by definition PTSD is caused by a psychologically traumatic event, it is possible that the associated biological abnormalities may either be traumatically induced or present prior to the traumatic event indicating such an abnormality is a risk factor in the development of PTSD. Regardless, the research clearly indicates biological abnormalities, which contribute to better understanding of the symptoms and impairments associated with PTSD.

Research examining the clinical neurobiology of PTSD suggests the existence of specific structural and functioning neuroimaging differences compared to individuals without PTSD. For adults, the most common finding in studies examining brain structure

has been reduced hippocampal volume in those with PTSD (Horner & Hammer, 2002). The hippocampus is part of the limbic system and is located in the medial temporal lobe. The hippocampus plays an integral role in memory, specifically the consolidation of information from short-term to long-term memory. Therefore, reduced hippocampal volume is expected to contribute to memory dysfunction. Several studies have reported reduction in hippocampal volume in adults with PTSD that were exposed to traumas such as combat and childhood abuse (see Woon, Sood, & Hedges, 2010 for review). Findings from imaging studies vary in where the reduced volume is found, some find significant reduction in both hemispheres, and others in either the right or the left. High resolution MRI's have found the most substantial hippocampal volume reduction in the CA3 and dentate gyrus subfields (Pitman et al., 2012). Although the studies discussed vary in their findings, they consistently implicate altered hippocampal volume in PTSD (Woon et al, 2010). There has been much debate over the causal nature of the relationship between reduced hippocampal volume and PTSD and whether smaller hippocampal volume is the result of trauma exposure or a pre-trauma risk factor to PTSD. Much research supports the notion that stress can result in hippocampal neuronal damage due to the stress-induced alterations in the hypothalamic-pituitary-adrenal axis and release of cortisol (Horner & Hammer, 2002; Lucassen et al, 2014, Woon et al., 2010). However, studies examining hippocampal volume of identical twins discordant for combat exposure in Vietnam have also found that the unexposed, non-PTSD twins had comparable hippocampal volume to that of their co-twins exposed to combat with PTSD and lower hippocampal volume compared to other veterans exposed without PTSD and their unexposed twin (Myslobodsky et al., 1995; Pitman, et al., 2012; Lucassen et al., 2014).

Research therefore seems to suggest that for adults, smaller hippocampal volume may be both a risk factor for PTSD and be impacted as a result of trauma.

Reviews report the most common findings in functional imaging studies with adults exposed to trauma with PTSD have been changes in functioning in the amygdala, ventral medial prefrontal cortex, dorsal anterior cingulate cortex, medial prefrontal cortex, hippocampus, and insular cortex (Pitman et al., 2012; Shin, Rauch & Pitman, 2006; Horner & Hamner, 2002). The amygdala is involved in the assessment and processing of threatening stimuli. Studies show individuals with PTSD have heightened responsiveness of the amygdala when presented with sights and sounds associated with trauma, which may implicate exaggerated emotional and behavioral responses to conditioned stimuli (See Shin et al., 2006 and Pitman et al., 2012 for review). The ventral medial prefrontal cortex is involved in executive functioning and fear conditioning. Studies have found that for individuals with PTSD, there is lower activation or failure to activate the medial prefrontal cortex when presented with sights and sounds associated with PTSD, which may result in difficulties with tasks involving executive functioning (See Shin et al., 2006 and Pitman et al., 2012 for review). The dorsal anterior cingulate cortex is involved in attention, error detection, and fear learning and expression. Studies show that individuals with PTSD have increased activation of the dorsal anterior cingulate cortex during fear conditioning. Dysfunction of the anterior cingulate cortex is hypothesized to also facilitate exaggerated emotional and behavioral responses to conditioned stimuli, as well as contribute to attentional difficulties. Findings from studies examining hippocampal functioning are more mixed. Some studies report lower activation or failure to activate during cognitive tasks and increased activation at rest and

during cognitive tasks (See Shin et al., 2006 for review). The insular cortex is involved in monitoring internal bodily states. Studies show that individuals with PTSD show greater insular cortex activation, which may contribute to the heightened detection of bodily arousal (see Pitman et al., 2012 for review).

Some researchers have hypothesized that experiencing trauma in childhood and adolescence may have a more detrimental and permanent impact on brain development than experiencing trauma in adulthood (De Bellis, 200; Nikulina & Widom, 2013). A recent review reported that abnormalities in the hippocampus, corpus callosum, prefrontal cortex, total brain, sensory cortex, and cerebellum are most frequently reported in structural MRI studies (Rianne-Albers, van der Wee, Lamers-Winkelmann, & Vermeire, 2013). De Bellis and Colleagues (2002) conducted a study comparing brain structures of 28 children and adolescents with PTSD and 66 sociodemographically similar healthy controls. Interestingly, no hippocampal differences between the groups were found by De Bellis (2002), which is consistent with other similar studies. Rianne-Albers, et al. (2013) reported in their review that the the reduction in hippocampal volume found in adults cannot be confirmed with children and adolescents due to several inconsistent results. De Bellis et al. (2002) found participants with PTSD had smaller areas of the corpus callosum; smaller intracranial, cerebral, and prefrontal cortex; smaller prefrontal cortical white matter; smaller right temporal lobe volumes; and larger frontal lobe cerebrospinal fluid (CSF) volumes than control subjects. Several other studies have also found reductions in regions of the corpus callosum and total brain volume in children and adolescents with trauma histories (Rianne-Albers, et al. 2013). Richert and Colleagues (2006) examined the prefrontal cortex of children with PTSD and found that significantly

greater grey matter volume in the middle-inferior and ventral regions of the prefrontal cortex. These regions of the prefrontal cortex are involved with social functioning, fear conditioning, and social-emotional functioning and may therefore explain heightened fear, emotion dysregulation, and difficulties in socialization that are often associated with PTSD. Rianne-Albers, et al. (2013) report that findings on structural abnormalities in the prefrontal cortex and amygdala of children and adolescents with trauma histories are still too limited to be confirmed. Rianne-Albers, et al. also reported that studies are starting to show that early life traumatization may impact the sensory cortex and its connections to limbic areas.

Very few functional imaging studies have been conducted with children and adolescents with trauma histories. However, the findings of reduced activation in the hippocampus and increased insular cortex activation for individuals with PTSD are consistent with previous research with adults (Rianne-Albers, et al., 2013). Experiencing trauma early on in development is thought to affect HPA axis activity and cortisol levels (Black et al., 2012; Bemner et al., 2003; Wilson, Hansen & Li, 2011). Cortisol plays an important role in regulating the body's stress system and serotonin levels. De Bellis (2001) found increased levels of the hormone cortisol in adolescents with history of neglect.

Neuropsychological, Academic, Emotional Deficits & Trauma Exposure in Adults

Previous research on neuropsychological functioning in adults exposed to trauma has identified impairments in a variety of domains, namely memory, executive functioning and attention. In terms of memory, much research using standardized measures has demonstrated strong associations between trauma exposure and

impairments in immediate recall, long-term recall, and recognition memory (see Horner & Hammer, 2002; Golier & Yehuda, 2002 for review). Bremner and colleagues (1993) compared intelligence and memory functioning of Vietnam veterans with a diagnosis of PTSD to healthy controls, the groups were matched on age, race, sex, years of education, socioeconomic status, handedness, and alcohol abuse. The battery of tests included the subtests Logical Memory Immediate and Delayed (verbal memory of stories) and Figure Memory Immediate and Delayed (visual reproduction memory of designs) of the Wechsler Memory Scale-Revised (WMS-R; Wechsler, 1987); Verbal (verbal memory for lists) and Visual (visual memory of designs) components of the Selective Reminding Test (SRT); and the Arithmetic, Vocabulary, Picture Arrangement, and Block Design subtests of the Wechsler Adult Intelligence Scale-Revised (WAIS-R; Wechsler, 1987). Veterans with PTSD scored significantly lower on the tasks involving verbal memory: immediate and delayed verbal memory for stories (WMS-R; Wechsler, 1987) and short-term recall, long-term storage, and long-term retrieval of word list (SRT; Hannay & Levin, 1985). Combat veterans with PTSD also performed poorer than controls on the visual SRT component, however performance between the groups did not differ significantly on the WMS-R visual memory component. Bremner and colleagues (1995; 2004) conducted similar studies, using the same measures, with adult survivors of childhood abuse with PTSD. The findings were analogous to the study conducted in 1993 with veterans, with the exception that no significant differences were found on the visual component of the SRT. Impaired verbal memory recall has also been documented among rape victims with PTSD compared to rape victims without PTSD and matched non-trauma control on the California Verbal Learning Test (CVLT; Delis, Kramer, Kaplan, Ober, 1987), a test of

verbal memory for lists (Jenkins et al., 1998). Rape victims with PTSD performed significantly poorer than the two controls on the number of words learned and short-delay free recall, however no significant differences were found in recognition hits and learning strategy.

Various other studies have found both verbal and visual memory deficits when comparing veterans with PTSD and without PTSD. For instance, Vasterling et al. (1998) found Gulf War veterans with PTSD performed poorer than controls on Rey Auditory Verbal Learning Test (RAVLT; Lezak, 1995), a test of verbal memory for lists, and Continuous Visual Memory Tests (CVMT; Trahan & Larrabee, 1988), a test of visual memory for abstract designs. The Veterans performed significantly poorer than controls on learning the list, short-delay recall, and long-delay recall of the RAVLT, and the initial learning phase and long-delay recall of the CVMT. Jelinek et al. (2006) also described attenuated performance of immediate, long-term, and recognition in both verbal and nonverbal memory in Operation Desert Storm Veterans with PTSD (different trauma exposures, such as rape) compared to healthy controls using the Picture Word Memory Test (PWMT; Jelinek et al., 2006). The PWMT uses a similar format to the RAVLT, however it measures both memory and reproduction of visual stimuli (drawing an abstract design) and verbal stimuli (writing a list of words). Gilbertson and colleagues (2001) measured performance on the WMS-R and Rey-Osterreith Complex Figure (ROCF; Osterreith, 1944), a test of visual memory, to Vietnam veterans with and without PTSD. The group with PTSD performed significantly poorer on WMS-R verbal and visual immediate and delayed memory subtests, but not on the ROCF immediate and delayed visual memory tests.

A number of studies have examined the impact of exposure to trauma on executive functioning. Executive functioning refers to a set of higher order processes involved in planning, organization, monitoring situations, problem solving, working memory, alternating/shifting attention, and regulation of emotions and behavior. Impairments in tasks involving executive functioning and attention are common findings of studies examining neuropsychological functioning of individuals exposed to trauma. For instance, Vasterling et al. (2002) compared performance of Vietnam Veterans with PTSD and those without mental disorders on tests of executive functioning and attention, learning and memory, and estimated intelligence. The tests included the Stroop Test (Stroop, 1935), a test of selective attention; Continuous Performance Test (CPT; Conners, 1992), a test of sustained attention; Wisconsin Card Sorting Test (WCST; Berg, 1948), a test of executive functioning and alternating attention; WAIS–R Digit Span Arithmetic Subtests, tests of divided attention; learning and memory tests RAVLT and CVMT; and WAIS-R Information and Vocabulary Subtests, tests of verbal intelligence. The PTSD group performed significantly poorer on the WAIS Digit Span subtest; had significantly higher omission errors on the CPT; and recalled significantly fewer words on the learning stage of the RAVLT. The groups did not differ significantly on the Stroop and WCST. Overall results showed cognitive deficits on tasks of sustained attention, divided attention, and initial learning independent from intellectual functioning for the PTSD group. However, other studies have found significant differences in performance on the WCST and WAIS-R Digit Span Subtest with combat veterans with PTSD compared to those without PTSD (Gilbertson et al., 2001). When examining attention and executive functioning of female victims of intimate partner violence (IPV) with PTSD, without

PTSD, and non-victimized controls, Stein and Colleagues (2002) found that regardless of PTSD status, the victims of IVP performed significantly poorer on the Paced Auditory Serial Attention Test (PASAT; Levin et al., 1987), a test of sustained and divided attention, and the Stroop Test. Significant differences between non-victimized controls and those with PTSD were however found on the Trail Making Test Part B (Reitan, 1992), a test of alternating attention. These results are mostly consistent with a recent review of 18 studies examining PTSD and executive functioning (Polak, Witteveen, Reitsma, & Olf, 2012). The review reported that differences in impairment in executive functioning were more pronounced for trauma-exposed individuals with PTSD than trauma-exposed individuals without PTSD or healthy controls. Across the studies, significant differences were frequently found between the PTSD and control groups on the Digit Span subtest and TMT part B, and not on WCST and Stroop. Male gender, higher age, war trauma, and higher severity of co-morbid depressive symptoms were found to be predictive of poorer executive functioning in trauma exposed PTSD individuals compared to exposed controls.

Schweizer & Dalgleish (2011) examined working memory performance among individuals who were exposed to trauma who were experiencing PTSD, those exposed to trauma not currently experiencing PTSD but have in the past, and those who were exposed to trauma and have not experienced PTSD. Emotional working memory was assessed in adults with PTSD by measuring the ability to remember word lists in the context of trauma sentences (e.g. “My reactions since the event mean that I am going crazy”), relative to neutral sentences (e.g. “A racing horse can run much faster than a tortoise”). Performance for the PTSD group was significantly impaired compared to

controls on trauma sentences, but not on neutral sentences. These findings suggest individuals with a history of PTSD may have difficulty with working memory in emotion-related contexts.

Previous research examining the impact of trauma on adults shows PTSD symptomology is associated with educational underachievement. Boyraz and Colleagues (2015) conducted a study examining academic performance with 928 college students. About 52% of the sample had a history of trauma and 12% met criteria for PTSD. Boyraz et al. found those with higher PTSD symptomatology in the 1st semester of college had lower levels of motivation, 1st-year GPA, and 2nd year enrollment rates. Other studies have similarly shown that entering college with high PTSD symptomatology is associated with poor academic performance and an increased likelihood of dropping out of college (Boyraz et al., 2013; Duncan, 2000). Bachrach & Read (2012) found that those students that developed PTSD during the 1st year of college obtained lower GPAs that year. Fergusson and Colleagues (2012) found in their longitudinal study that at age 30 child sexual abuse history was associated with lower education qualifications, increased welfare dependence and lower gross personal income. Similarly, Lisak & Luster (1994) found that sexually abused men reported significantly more difficulties in grade school, high school and college compared to those not abused. Noll and Colleagues (2010) examined language acquisition and educational attainment in females with and without trauma histories over 18 years. Females with trauma histories had significantly lower receptive language score, rates of high school graduation, and overall educational attainment compared to those females without trauma histories. Another longitudinal study that followed individuals with substantiated cases of childhood physical and sexual

abuse through adulthood found that those with trauma histories had lower levels of education, employment, gross personal income, and fewer assets compared to matched controls (Currie & Widom, 2010).

Extensive research demonstrates the strong relationship between trauma history and psychiatric problems. Recent reviews by Mandelli, Petelli & Serretty (2015) and Verdolini, Attademo, Agius, Ferranti, Moretti, & Quartesan (2015) discuss the overwhelming evidence showing childhood trauma is associated with a broad range of mental health problems. The relationship between childhood sexual abuse and psychiatric problems is well established and numerous studies document the significant association between child sexual abuse and the likelihood of experiencing depression, anxiety, low self-esteem, self-harm behavior, and suicidality in adulthood (See Putnam, 2003 and Verdolini, et al., 2015 for review). Similarly, studies show a strong positive relationship between childhood physical abuse and psychological problems in adulthood (See Mandelli et al., 2015 and Springer, Sheridan, Kuo, & Carnes, 2007 for review). For instance, childhood physical abuse predicted depression, anxiety, anger, physical symptoms, and medical diagnoses (Springer et al., 2007). Mandelli et al. (2015) found strong associations between depression and emotional abuse, neglect, sexual abuse, domestic violence, and physical abuse. A systematic review by Carr and Colleagues (2013) reported that most of the forty-four articles selected demonstrate that early life stress was associated with several psychiatric disorders: physical abuse, sexual abuse, and unspecified neglect with mood disorders and anxiety disorders; emotional abuse with personality disorders and schizophrenia; and physical neglect with personality disorders.

Neuropsychological, Academic, Emotional Deficits & Trauma Exposure in Children

It is valuable to understand how trauma impacts adults, however considering the brain is not yet fully developed in childhood, trauma in childhood may have differing effects on neuropsychological, academic, and emotional functioning compared to trauma in adulthood (Beers & De Bellis, 2002). Therefore, it is important to examine and understand how trauma may impact neuropsychological, academic, and emotional functioning in children.

Earlier studies focused on differences between maltreated children with PTSD, maltreated without PTSD, and controls on more global measures of IQ and academic performance, or specific domains in isolation instead of examining neuropsychological functioning comprehensively. For instance, Eckenrode and colleagues (1993) conducted a cross-sectional study comparing academic performance of maltreated and non-maltreated children in kindergarten to 12th grade on standardized tests of math and English, as well as overall grades. Children were placed in the maltreated group if a report was filed with social services, therefore including children exposed to neglect, physical abuse, and/or sexual abuse. The maltreated and non-maltreated were matched on gender, school, grade, residential neighborhood and age. The study found that for children in grades 2 to 8, maltreated children scored significantly below their non-maltreated peers on Iowa reading and math tests. Interestingly, no interactions between maltreatment and gender were found. Maltreatment did interact with overall grades, such that the effect of maltreatment on overall grades was more pronounced for children in lower grades. Then, for children in grades 1 through 12, maltreated children's grades in

school were also significantly below the non-maltreated. Maltreatment only interacted with public assistance in predicting overall grades, such that the difference between the maltreated and non-maltreated groups was larger for those children whose families were not receiving public assistance. For both the standardized tests and overall grades, those children that were sexually abused scored higher than those children in the control, neglected alone, physical abuse alone, neglect and physical abuse, and neglect and sexual abuse groups. This is an interesting finding that is not consistent with more recent studies (De Bellis, Woolley, & Hooper, 2013). Consistent with previous research, this study also showed that those children that were physically abused and neglected scored the lowest on standardized tests and overall grades. This study highlights the impact of various types of maltreatment on school performance.

More recent studies examining how trauma impacts cognitive functioning in children aimed to comprehensively assess all domains of neuropsychological functioning, however few studies exist. In a pilot study, Beers & De Bellis (2002) examined neuropsychological functioning of 14 maltreated children with PTSD and 15 normative children. The battery included measures assessing language, visuospatial skills, memory and learning, attention, executive functioning and fine motor skills. The Vocabulary subtest of the Wechsler Intelligence Scale for Children-III (WISC-III; Wechsler, 1991) was used to estimate language ability. The RCFT Copy Trial (Osterreith, 1944) and Judgment of Line Orientation (JLO; Benton, Varney, & Hamsher, 1978) measures were used to assess visuospatial skills providing estimates of visuoconstructive abilities and two-dimensional visual-spatial functioning. The WISC-III Block Design subtest was used to assess visual-spatial reasoning. Verbal memory and learning were assessed with the

CVLT-C (Delis, Kramer, Kaplan, & Ober, 1994) and visual memory and learning were assessed with the RCFT Recall Trial (Osterreith, 1944). Attention was measured using the Digit Vigilance Test (Lewis, 1995) time score and omission errors score and the WISC-III Digit Span subtest. Executive functioning and abstract reasoning were measured using the Trail Making Test Part B, STROOP, WCST perseverative responses and categories scores, WISC-III Similarities, and COWAT (Gladsjo, Schuman, Miller, et al., 1999; Heaton et al., 2004). Fine motor speed was measured using the Grooved Pegboard, Trail Making Test Part 1, and WISC-III Coding subtest. Results showed that maltreated children with PTSD performed poorer than the normative control on the measures of attention and executive functioning only.

Yasik and colleagues (2007) examined memory functioning of 29 traumatized children with PTSD, 62 traumatized without PTSD, and 40 normative children. The Wide Range Assessment of Memory and Learning (WRAML; Sheslow & Adams, 1990), which consists on nine subtests assessing verbal and visual memory, was administered to all participants. Traumatized children with PTSD scored significantly lower than non-traumatized controls on the indices of General Memory, Verbal Memory, and Learning and specific subtests such as verbal sentence memory, sound learning, visual learning, and visual learning delayed. Traumatized children with and without PTSD performed similarity on all subtests except for verbal sentence memory subtest, where those with PTSD performed significantly lower than both other groups.

Samuelson, Krueger, Burnett, & Wilson (2010) examined neuropsychological functioning of an ethnically diverse community sample of 62 children with and without PTSD who had witnessed domestic violence. Results showed that both groups of children

performed below average on measures of executive functioning, attention, and IQ.

However, there was significant differences in performance on CVLT-C (Delis, Kramer, Kaplan, & Ober, 1994), such that those with PTSD showed slower and less effective learning, higher sensitivity for the interference list, and lower delayed recall.

DeBellis and colleagues (2013) recently conducted a study comparing neuropsychological functioning of 60 maltreated children with PTSD, 38 maltreated children without PTSD, and 104 normative children between the ages of 6 and 18. Maltreatment was defined by positive forensic CPS investigation indicating abuse or neglect. The battery included the Kiddie Schedule for Affective Disorders and Schizophrenia-Present and Lifetime Version semistructured interview; CBCL; (Achenbach & Rescorla, 2001); and measures assessing IQ, academic achievement, language, visuospatial skills, memory and learning, attention, executive functioning and fine motor skills. The abbreviated Wechsler Intelligence Scale for Children-III (WISC-III; Wechsler, 1991) was used to estimate IQ. Academic achievement in reading and math were measured using the subtests from the Woodcock Johnson III Tests of Achievement (WJ-III; Woodcock, McGrew, & Mather, 2001). The Peabody Picture Vocabulary Test-III (PPVT-III; Dunn & Dunn, 1997) was used to estimate receptive language ability. The RCFT Copy Trial (Osterreith, 1944) and Judgment of Line Orientation (JLO; Benton, Varney, & Hamsher, 1978) measures were used to assess visuospatial skills providing estimates of visuoconstructive abilities and two-dimensional visual-spatial functioning. Verbal memory and learning were assessed with the CVLT-C (Delis, Kramer, Kaplan, & Ober, 1994) and visual memory and learning were assessed with the Symbol-Digit Paired Associate Learning Test (Ryan & Butters, 1980) and Test of

Learning and Memory (TOMAL; Reynolds & Biglet, 1996) Paired Recall Subtest. Attention was measured using the CPT-II errors of omission and variability score. Executive functioning was measured using the CPT-II errors of commission for inhibitory control, STROOP for inhibitory control, WCST perseverative responses for cognitive flexibility, and Woodcock Johnson III Tests of Cognitive Abilities (Woodcock, McGrew, & Mather, 2001b) Numbers Reversed Subtest for working memory. Fine motor skills were assessed using the Finger Tapping Test (Shimoyama, Ninchoji, & Uemura, 1990) for fine motor speed and Grooved Pegboard for more complex fine motor speed and control. Both maltreated groups performed significantly lower than the control group on the test measuring IQ (WISC-III), reading and math academic achievement (WJ-III), receptive language (PPVT), visual memory and learning (TOMAL), working memory (WJ-III), cognitive flexibility (WCST), attention variability (CPT), and visuoconstruction ability (ROCFT). Maltreated children with PTSD performed significantly worse than maltreated children without PTSD on the test of visuoconstruction abilities. All three groups significantly differed on the Child Dissociation Checklist and CBCL internalizing score, with maltreated with PTSD with the highest elevations. Maltreated children with PTSD CBCL externalizing scores were also significantly higher than both other groups, which were not significantly different. This study supports on the importance of comprehensively examining neuropsychological functioning of children and youth with trauma histories and need for further research to corroborate these findings.

Previous research examining the impact of trauma on children demonstrate the differences in academic achievement and between children and adolescents with and without trauma history. Saigh, Mroueh, & Bremner (1997) explored whether academic

deficits in a sample of adolescents were associated with PTSD by comparing a trauma history with PTSD, trauma history only, and a control group. With IQ as a covariate, the study found that those with trauma history and PTSD scored significantly lower on tests of mathematics, spelling, vocabulary, reading, language, and science, compared to those in the trauma history only and control groups. Duplechain and Colleagues (2008) explored the relationship between trauma exposure and reading achievement with a sample of urban elementary school-aged children. Results indicated that children exposure to violence showed significantly lower reading achievement. Ozer & McDonald (2006) similarly showed that exposure to violence was associated with lower grades in school among adolescents. Thompson & Massat (2005) found that lower academic achievement as measured by the Iowa Test of Basic Skills (ITBS; Hieronymus, Lindquist, & Hoover, 1979) was significantly associated with PTSD among urban African American children ages 11-13. Similar results have been found with disaster related trauma exposure; for instance, children displaced after Hurricane Katrina had lower achievement scores in mathematics, language arts, and reading than those not displaced (Ward, Shelley, Kaase, & Pane, 2008). Studies have also shown that adolescent girls with trauma history and PTSD showed poorer school performance compared to those with trauma history only (Lipschitz, Rasmusson, Anyan, Cromwell, & Southwick, 2000). Other studies have not found significant differences in academic achievement for those with trauma history (Bolton, Hill, O’Ryan, Udwin, Boyle, & Yule, 2004; McLean, Rosenbach, Capaldi & Foa, 2013). Researchers have hypothesized that discrepant results may be due to using different measures of academic functioning. Further research is

therefore needed with standardized measures of academic achievement to clarify the association between trauma history and impaired academic performance.

The relationship between emotional and behavioral functioning of children exposed to trauma has been more widely studied and stronger evidence for the association between trauma history and psychiatric problems in children exist. DeBellis et al. (2002) suggested that individuals with trauma history and PTSD show higher rates of overall distress and tend to have higher caregiver rated CBCL Scales than individuals without trauma histories. A recent meta-analysis by Infurna and Colleagues (2000) discussed several studies that demonstrate the strong association between different types of child maltreatment and the development of depression. The findings from a study by Martin, Viljoen, Kidd, & Seedat (2014) examining the relationship between trauma exposure suggest that adolescents who experience high levels of trauma are more likely to have high levels of anxiety. These findings are consistent with previous studies demonstrating an association between trauma history and anxiety (Hensley & Varela, 2008; Maniglio, 2012; McLaughlin & Hatzenbuehler, 2009; Weems, Pina, Costa, Watts, Taylor, & Cannon, 2007). Research also shows trauma history is associated with increased prevalence of somatic complaints, such as stomachaches, headaches, and muscle tension (Bovanie, Gils, Janssens, & Rosmalen, 2015; Hensley & Varela, 2008; Kugler, Bloom, Kaercher, Truax, & Storch, 2012). Kugler and Colleagues (2012) specifically show that higher caregiver rated CBCL Somatic Complaint Scale score are significantly correlated with PTSS. Devanarayana and Colleagues (2014) demonstrated that those with trauma histories tend to report more gastrointestinal problems than those without trauma history.

Studies suggest that children and adolescents with trauma history are at increased risk for developing behavioral disorders (Hussey, Chang, & Kotch, 2006; Lehmann, Havik, Havik, & Heiervang, 2013). Ford, Gagnon, Connor, & Pearson (2011) found that past exposure to interpersonal trauma was related to more severe disruptive behavior problems. Kerig and Colleagues examined the relationships between PTSD, trauma history, mental health problems, and juvenile delinquency. The study showed that with a sample of adolescents detained in a juvenile correction facility that PTSD mediates the relationship between interpersonal trauma and mental health problems (Kerig, Ward, Vanderzee, & Moeddel, 2009). Several studies have also shown that trauma exposure is associated with higher scores on the CBCL Externalizing Problem Scale than those children and adolescents without trauma history (Fujiwara, Yagi, Mashiko, Nagao, Okuyama, 2014; Milot, Ethier, St-Laurent, Provost, 2010). Children with trauma history also tend to report more chronic stress and a higher number of current stressful life events which exacerbates psychosocial dysfunction and more mental health problems. (Zetterqvist, Lundh, L., & Svedin, 2013; Harkness, Lumley, & Truss, 2008; Harkness, Bruce, & Lumley, 2006). There have also been a few studies looking at the significant association between trauma and borderline personality traits in adolescents (Grilo, Sanislow, Fehon, Martino & McGlashan, 1999; Venta, Kenkel-Mikelonis, & Sharp, 2012).

Although the association between trauma history and psychopathology is well established, not many studies have comprehensively examined and compared the neuropsychological, academic, and emotional/behavioral functioning of children and youth with trauma histories. Studies that look comprehensively at the functioning of

children and adolescents with trauma history may contribute to establishing the needed trauma-informed approach to clinical practice and assessment.

Rationale for Current Study

The goal of the current study is to examine neuropsychological, academic achievement, and emotional differences in children who have been exposed to trauma and are positive for the CBCL-PTSD profile (CBCL-PTSD + Trauma History), children who have been exposed to trauma and are negative for the CBCL-PTSD profile (Trauma History), children who have not been exposed to trauma and are positive for the CBCL-PTSD (CBCL-PTSD Only), and children who have not been exposed to trauma and are negative for the CBCL-PTSD profile (Clinical Control). Although some neuropsychological, academic, and emotional functioning differences have been identified between children exposed to trauma with PTSD and without PTSD, no studies of these differences have used the CBCL-PTSD profile. The results of the present study will provide evidence as to whether the CBCL-PTSD can identify PTSD in children and whether the CBCL-PTSD profile predicts neuropsychological and academic impairment. If the study shows that the CBCL-PTSD profile is predicative of the hypothesized neuropsychological and academic impairments, the results will also provide support for clinicians to consider the CBCL-PTSD profile when making recommendations for neuropsychological and educational testing. Additionally, the results of the study will contribute to the developing literature surrounding neuropsychological, academic, and emotional functioning in children exposed to trauma. Also, performance on specific neuropsychological, academic, and emotional functioning measures that have not previously examined will be compared in the present study.

Research Questions and Hypotheses

The aims of the study were to determine whether the CBCL-PTSD is a valid and reliable screener of PTSS and whether the CBCL-PTSD profile is associated with impairment in children and adolescents that have experienced trauma. The study therefore aims to examine how neuropsychological, academic achievement, and emotional functioning differs in children who have been exposed to trauma and positive for the CBCL-PTSD profile (CBCL-PTSD + Trauma History), exposed to trauma and are negative for the CBCL-PTSD profile (Trauma History Only), not exposed to trauma and positive for the CBCL-PTSD profile (CBCL-PTSD Only), and not exposed to trauma and negative for the CBCL-PTSD profile (Control).

The author proposes the following hypotheses to address the aims of current study.

Hypotheses are based on previously reported research and results.

CBCL-PTSD Utility

- 1) The CBCL-PTSD profile will be a valid and reliable screener of PTSS as demonstrated by fair to good sensitivity and specificity scores.

Neuropsychological Functioning

- 2) The CBCL-PTSD + Trauma History group will demonstrate significant impaired performance on verbal memory learning compared to the other three groups as measured by the total score for Trials 1-5 on the Rey Auditory Verbal Learning Test (RAVLT).
- 3) The CBCL-PTSD + Trauma History group will demonstrate significant impaired performance on verbal short-term memory compared to the other three groups as

measured by the immediate recall score on the Rey Auditory Verbal Learning Test (RAVLT).

- 4) The CBCL-PTSD + Trauma History group will demonstrate significant impaired performance on verbal long-term memory compared to the other three groups as measured by the delayed recall score on the Rey Auditory Verbal Learning Test (RAVLT; Schmidt, 1996).
- 5) The CBCL-PTSD + Trauma History group will demonstrate significant impaired performance on visual memory compared to the other three groups as measured by the Recognition Score of the Rey Complex Figure Test (RCFT; Osterrieth, 1944).
- 6) The CBCL-PTSD + Trauma History group will demonstrate significant impaired performance on visuospatial planning compared to the other three groups as measured by the Copy Score RCFT.
- 7) The CBCL-PTSD + Trauma History group will demonstrate significantly impaired performance in sustained attention compared to the other three groups as measured by Omission Errors on the Test of Variable Attention (TOVA; Universal Attention Disorders, 1999) and Intermittent Visual and Auditory CPT (IVA; 1995).
- 8) The CBCL-PTSD + Trauma History group will demonstrate significant impairment in alternating attention compared to the other three groups as measured by Part B of the Trail Making Test (TMT; Reitan, 1992) or Progressive Figures test (Retian & Davison, 1974).

- 9) The CBCL-PTSD + Trauma History group will demonstrate significantly greater difficulty with problem solving, set shifting, and cognitive flexibility than the other three groups as measured by Perseverative Errors score from the Wisconsin Card Sorting Test (WCST; Heaton, Chelune, Talley, Kay, & Curtiss, 1993).
- 10) The four groups will not differ significantly in their fine motor control as measured by the Grooved Pegboard (Lafayette Instrument, 1989).

Academic Achievement

- 11) The CBCL-PTSD + Trauma History group will demonstrate significant impaired performance on basic mathematics skills compared to the other three groups as measured by the Arithmetic subtest of the Wide Range Test of Achievement, Forth Edition (WRAT 4; Jastak & Jastak, 1993).
- 12) The CBCL-PTSD + Trauma History group will demonstrate significant impaired performance on word reading and spelling skills compared to the other three groups as measured by the Reading and Spelling subtests of the WRAT 4.

Emotional Functioning

- 13) The CBCL-PTSD + Trauma History group will have significantly higher scores than other three groups on the relevant Clinical Scales (Anxious Feeling, Depressive Affect) of the Millon Adolescent Clinical Inventory (MACI) or the relevant Clinical Scales (Anxiety/Fears, Depressive Moods) of the Millon Pre-Adolescent Clinical Inventory (M-PACI).
- 14) The CBCL-PTSD + Trauma History group will have significantly higher scores than other three groups on the on the following CBCL scales per caregiver report: Internalizing Problems, Externalizing Problems, Total Problems, Affective

Problems, Anxious/Depressed, Withdrawn/Depressed, Anxiety Problems, and Somatic Complaints.

Personality Patterns

15) The CBCL-PTSD + Trauma History group will have significantly higher scores than other three groups on the relevant Personality Pattern Scales (Inhibited, Submissive, Unruly, Borderline Tendency) of the Millon Adolescent Clinical Inventory (MACI) or the relevant Personality Pattern Scales (Inhibited, Submissive, Unruly, Unstable) of the Millon Pre-Adolescent Clinical Inventory (M-PACI).

Stressful Life Experiences

- 16) The CBCL-PTSD + Trauma History and CBCL Only group will have significantly higher current levels of stress than other two groups.
- 17) The CBCL-PTSD + Trauma History group will have significantly higher scores than other three groups on the Millon Adolescent Clinical Inventory (MACI) Child Abuse and Family Discord Scales.

CHAPTER II

METHOD

Participants

Participants were 630 referred child and adolescent outpatients seen in a private psychological clinic located in a primary care facility in the Midwestern United States. Participants received comprehensive psychological assessments from two doctoral level clinical psychologists between August 1st 2012 and August 1st 2015. Patients seen in the clinic for psychological evaluation ranged in age from approximately 2 years old through 22 years old.

The study was approved under the Research Involving Pre-Existing Records or Data Exempt Certification of the Institutional Review Board (IRB) of the University of North Dakota. Further, participant information in the present study was de-identified of the 18 pieces of protected health information (PHI) listed in the Health Insurance Portability and Accountability Act (HIPAA); therefore, it qualified for the De-identified Information exception of the IRB's HIPAA Compliance Application.

Participant selection. Selection criteria was based on age of participant, completion of a CBCL Parent Form, the completion of a comprehensive psychological evaluation, and no intellectual disability. Participants between ages 7 and 18, inclusively, were included in the study due to the target population and age ranges of assessment measures selected. A total of 183 outpatients were younger than 7 and 24 were older than

18, resulting in 471 of the 678 referred child and adolescent outpatients included the study. Of the 423 participants, 107 participants did not have completed CBCL Parent Form. Furthermore, 4 had abbreviated assessments and could not be included and 6 assessment files could not be located. Participants were also excluded if they had an IQ<70, intellectual disability (mild, moderate, severe, or profound), pervasive developmental disorder, or autism, which excluded 19 more participants. Please see Figure 1 for a detailed description of participant flow.

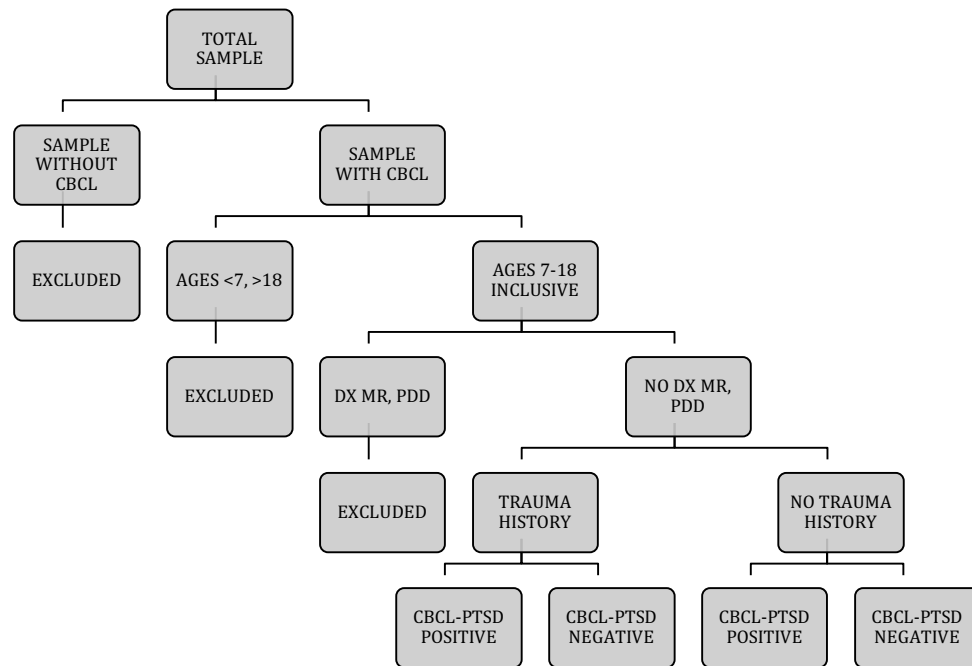


Figure 1. Process of Participant Selection and Assignment.

Participant characteristics. The final sample included 287 participants between 7 and 18 years old (59.2% males and 40.8% females). The mean age of the group was 10.69 ($SD=3.07$). The ethnic distribution was 79.4% Caucasian, 6.5% Native American, 2.5% African American, .7 % Asian American, 4.2% Hispanic American, 5.9% Biracial

and .4% other; which is reflective of the Midwest region. Please see Table 1 for a further explanation of participant sociodemographic characteristics for the total sample and for each group.

Group selection. Following the examination of the CBCL-PTSD profiles and optimal cutoff score determined, participants were then assigned to one of four groups after trauma history and parent report CBCL-PTSD scores were examined: exposed to trauma and positive for the CBCL-PTSD profile (CBCL-PTSD + Trauma History), exposed to trauma and are negative for the CBCL-PTSD profile (Trauma History Only), not exposed to trauma and positive for the CBCL-PTSD profile (CBCL-PTSD Only), and not exposed to trauma and negative for the CBCL-PTSD profile (Control). Only participants with completed CBCLs were included in the study given the necessity of completed CBCLs for group selection.

Fifty-five participants were assigned to CBCL-PTSD + Trauma History group, 14 participants were assigned to Trauma History Only group, 130 participants were assigned to CBCL-PTSD Only group, 88 participants were assigned to the Control group.

Procedure

Participants were referred for comprehensive psychological evaluations from a variety of sources. Almost all evaluations were completed between the hours of 9:00 AM and 12:00 PM on weekdays. Typical test time was around two and a half hours. Tests in the battery were not administered in a standardized order.

Table 1*Participant Demographics by Group and Total Sample*

Source	Trauma Hx + CBCL- PTSD n=55	Trauma Hx Only n=14	No Trauma Hx + CBCL- PTSD n=130	Control n=88	Total Sample n=287
Sex					
% Male	58.2	42.8	60.0	61.4	59.2
% Female	41.8	57.2	40.0	38.6	40.8
Ethnicity					
% Caucasian	65.4	58.3	87.4	79.1	79.4
% Native American	11.6	25.0	2.4	6.8	6.5
% African American	7.7	0.0	1.6	1.2	2.5
% Asian American	0.0	0.0	.7	1.2	.7
% Hispanic American	3.8	0.0	4.7	4.7	4.2
% Biracial	11.5	16.7	3.2	5.8	5.9
% Other	0.0	0.0	0.0	1.2	.4
Age in years: M (SD)	11.24 (2.97)	12.07 (3.10)	10.51 (3.03)	10.40 (3.15)	10.69 (3.07)
Primary Caregivers					
% Both Biological Parents	10.9	0.0	53.1	68.2	47.0
% Biological Mother	14.5	0.0	23.1	15.9	18.1
% Biological Father	0.0	0.0	2.4	0.0	1.0
% Biological Mother & Sig Other	5.5	7.1	16.9	8.0	11.5
% Biological Father & Sig Other	5.5	0.0	3.1	4.5	3.8
% Adoptive Parents	25.5	57.1	0.0	0.0	7.7
% Foster Parents	14.5	35.8	0.0	0.0	4.5
% Family Member	14.5	0.0	.7	2.3	3.8
% Residential Treatment	9.1	0.0	.7	1.1	2.4
IQ: M (SD)	97.75 (15.47)	93.97 (12.04)	100.64 (13.24)	101.50 (11.76)	99.97 (12.97)

Measures

The following neuropsychological, achievement, personality, emotional/behavioral functioning, current stress, and PTSS measures were included in the study.

Intellectual functioning. Reynolds Intellectual Assessment Scales (RIAS; Reynolds & Kamphaus, 1998). The RIAS is used to estimate intellectual functioning with the Composite Intelligence Index (CIX). The CIX is comprised of the VIX (Verbal Intelligence Index) and the NIX (Nonverbal Intelligence Index). The subtests Guess What (GWH), and Verbal Reasoning (VRZ) load on the VIX and the subtests Odd Item Out (OIO) and What's Missing (WHM) load NIX. The GWH subtest requires participants to identify an object or concept with two to four verbal clues. The VRZ subtest asks participants to complete verbal analogies with one or two words. The OIO subtest requires participants to identify which item does not belong to the group of items. The WHM subtest asks participants to identify what detail is missing in each presented picture. The RIAS demonstrates high internal consistency reliability estimates across age, gender, and ethnicity. RIAS indexes have reported Cronbach's alpha values that range from 0.9 to 0.95 (Andrews, 2007). The RIAS also has good concurrent validity with WISC-III (.76) and WAIS-III (.75) (Andrews, 2007). The Composite Intelligence Index (CIX) was used in this study as an estimate overall intellectual functioning.

Learning and memory. Rey Auditory Verbal Learning Test (RAVLT; Schmidt, 1996). The RAVLT is a test of verbal learning and memory. The test presents participants with a list of fifteen words five times and a distractor word list. After the distractor list, the participant is asked to recall as many words as possible from the first list. After a

fifteen-minute delay the participants are asked to recall as many words as possible from the first list. This is followed by a recognition trial where the participant is asked to identify the target words from other words. Like in previous studies, total recalled words on trials 1-5 was used to measure verbal learning, total words on the immediate recall was used to measure short-term memory, total words on the delay recall was used to measure long-term memory, (De Bellis et al., 2013). Internal reliability for the RAVLT is reportedly high (Cronbach's $\alpha=.90$) (Strauss, Sherman, & Spreen, 2006).

Rey Complex Figure Test and Recognition Trial (RCFT; Osterrieth, 1944). The Rey Complex Figure Test and Recognition Trial first requires participants to copy the figure presented as accurately as possible. The figure is then removed and after about a three-minute delay, the participant is asked to reproduce as much of the figure as possible. After a thirty-minute delay, the participant is asked to reproduce as much of the figure as they can again. Finally, the participant is asked to identify parts of the original figure from similarly constructed figures. The RCFT Copy Trial is used to assess planning and organization, the immediate trial is used to assess short-term memory, and the delay and recognition trials are used to assess long-term memory. As in previous studies, the RCFT Copy Trial was used to assess planning and organization and the RCFT Recognition Trial was used to measure long-term recognition (De Bellis et al., 2013; De Bellis et al., 2010). The scoring system has demonstrated inter-rater reliability between 0.93 and 0.99 (Lieberman, Stewart, Seines, & Gordon, 1994).

Attention. Participants were administered either the TOVA or IVA as part of the test battery. The test administered was based on test availability.

Test of Variable Attention (TOVA; Universal Attention Disorders, 1999). The TOVA is a commonly used test to assess sustained attention. The test requires participants to discriminately respond to a designated stimulus that flashes among other stimuli on a computer monitor using a specially designed microswitch. The Errors of Omission score was used in this study to measure sustained attention. The Errors of Omission score is the total number of times the participant did not press the microswitch in response to the target. The Errors of Omission score has been used by similar studies as a measure of sustained attention (De Bellis et al., 2013) Previous research has shown the TOVA to have good reliability and has demonstrated good specificity and selectivity in the identification of ADHD (Leark, Dupuy, Greenberg, Corman, & Kindschi, 1999).

Intermittent Visual and Auditory Plus (IVA+; Standford & Turner, 1995). The IVA+ is also a commonly used test to assess sustained attention. The test requires participants to discriminately respond when hearing or seeing a “1” on a computer monitor using a specially designed microswitch. There are quotients for response control and attention for both the auditory and visual components of the test. The Visual Attention Quotient was used in this study to measure sustained attention, as it has been used in other studies attention (Corbett & Constantine, 2006; McCandless & O’Laughlin, 2007). Previous research has shown the IVA+ to have excellent concurrent validity when compared to other continuous performance tests and parental rating forms for diagnosing ADHD (Sandford & Turner, 1995).

Executive functioning. Wisconsin Card Sorting Test (WCST; Heaton, Chelune, Talley, Kay, & Curtiss, 1993). The WCST is a commonly used test of executive functioning for individuals 8 years and older, specifically measuring problem solving,

cognitive flexibility, set shifting, and interference control. The measure requires participants to sort 128 cards by matching each card to one of four key cards. The participant is purposefully not told the rules of the task, but is told whether their placement of each card is correct or incorrect. The goal of the task is for the participant to determine the correct sorting rule, and reconfigure as the rule changes. The WCST can be administered to individuals between ages 6 and 89. The WCST Total Perseverative Errors score was used in this study as an indication of impaired executive functioning, with standard scores of 84 and below falling in the impaired range. This measure of performance is in accordance with previous studies (Greve, Stickle, Love, Bianchino, & Stanford, 2005). The WCST has shown good concurrent validity with other cognitive tests (Strauss, Sherman, & Spreen, 2006).

Trail Making Test Part B (TMT Part B; Reitan, 1992). The TMT Part B is another commonly used neuropsychological test used to assess planning and alternating attention. TMT Part B requires participants to draw a line connecting alternating numbers and letters in chronological and alphabetical order. The child version TMT can be administered to individuals between ages 8 and 15 and the adult version TMT can be administered to individuals older than 15. Adequate test-retest reliability (.65) has been reported for the TMT Part B with children (Barr, 2003). Excellent inter-rater reliability (.90) has been reported for Part B (Fals-Stewart, 1991). The test has also shown good concurrent validity with other cognitive tests (Strauss, Sherman, & Spreen, 2006).

Psychomotor speed. Grooved Pegboard (Lafayette Instrument, 1989). The Grooved Pegboard is a commonly used test of fine motor ability and speed. The participant is required to pick up the pegs one at a time and place them into holes. The

task is first completed using the dominant hand and then non-dominant hand. Children aged 5-8 only complete the first two rows, those above 8 years old complete all 5 rows. Moderate to high reliability coefficients are reported for test-retest reliability (Strauss, Sherman, & Spreen, 2006).

Academic achievement. Wide Range Achievement Test, Forth Edition (WRAT 4; Jastak & Jastak, 1993). The WRAT 4 has three subtests that measure reading, spelling, and arithmetic performance and the standardized scores of all three tests were used in this study. The reading subtest requires participants to read a list of visually presented words out loud. The spelling subtest requires participants to write orally presented words. The arithmetic subtest requires the participants to complete written computations. The WRAT 4 can be administered to individuals between ages 5 and 18. The WRAT 4 is reported to have good content and construct validity (Wilkinson and Robertson, 2006). High levels of internal consistency are reported for the WRAT-4 overall and moderate levels for within subtests (Dell, Harrold, & Dell, 2008).

Personality traits and emotional/behavioral functioning. Millon Pre-Adolescent Clinical Inventory (M-PACI; Millon, Tringone, Millon, & Grossman, 2005). The M-PACI is a 97-item self-report measure of personality traits and emotional and behavioral functioning. The M-PACI has seven clinical signs and seven personality patterns. Four of the M-PACI Personality Pattern Scales, Inhibited, Submissive, Unruly, Unstable, and two of the Clinical Scales, Anxiety/Fears and Depressive Mood were relevant for the study and so used to compare the groups. The test can be administered to individuals between 9 and 12 years old.

Millon Adolescent Clinical Inventory (MACI; Millon, Tringone, Millon, & Grossman, 2005). The MACI is a 160-item self-report measure of personality traits and emotional and behavioral functioning. Four of the MACI Personality Pattern Scales, Inhibited, Submissive, Unruly, Borderline Tendency, and two of the Clinical Scales, Anxious Feelings and Depressive Affect, were relevant for the study and so used to compare the groups. The test can be administered to individuals between 13 and 19 years old. The MACI internal consistency alpha ranges from 0.73 to 0.91 for different scales and test-retest reliability scores between 0.57 and 0.92 (Millon, Tringone, Millon, & Grossman, 2005).

Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001). The CBCL is a 113-item measure of emotional and behavioral functioning completed by a child's primary caretaker (CBCL-Parent Report) and teacher (CBCL-Teacher Report Form). The child is rated on a likert scale of 0 (not true), 1 (somewhat or sometimes true), or 2 (very true or often true) for each item. The CBCL has eight clinical scales (Anxious/Depressed, Withdrawn/Depressed, Somatic Complaints, Social Problems, Thought Problems, Attention Problems, Rule-Breaking Behavior, Aggressive Behavior) and nine problem scales (Externalizing Problems, Internalizing Problems, Total Problems, Affective Problems, Anxiety Problems, Somatic Problems, ADHD Problems, Oppositional Defiant Problems, Conduct Problems). The inventory has good reliability and validity, specifically found to predict symptom severity within diagnostic groups (Achenbach, 1991; Achenbach & Edelbrock, 1989). The current study will use the following CBCL scales per caregiver report: Internalizing Problems, Externalizing Problems, Total

Problems, Affective Problems, Anxious/Depressed, Withdrawn/Depressed, Anxiety Problems, and Somatic Complaints.

Current stress, trauma history, and post-traumatic stress symptoms. Trauma history and current stressful life events data were collected from the clinical interview and assessment intake packet. Number of current stressful life events endorsed was totaled to form a current stress score. Stressful life events listed included family conflict, financial difficulties, job loss/change, loss of a loved one, bullying, and change in caregiver.

PTSS were measured by the CBCL-PTSD profiles developed by different researchers. Data for four scales were calculated. Total score was calculated by summing the ratings for each item included. For each scale, the optimal cut-off score to identify individuals with PTSD was determined following examination of ROC Curve. See Table 2 for comparison of each scale's items.

Sim and Colleagues (2005) CBCL-PTSD profile is comprised of 16 items from the CBCL 6-18 Parent Report Form and forms the Dissociation Scale (3 items), PTSD Scale (7 items), and Combined PTSD and Dissociation Scale (16 items). The profile was developed using expert ratings and Confirmatory Factor Analyses. Only the Sim et al. (2005) CBCL-PTSD Scale was used in this study.

Milot and colleagues (2013) CBCL-PTSD profile is compromised 15 items from the CBCL 6-18 Parent Report Form and forms the Dissociation Scale (6 items) and PTSD Scale (12 items). It was developed following an examination of the factor structure of Sim et al (2005) CBCL-PTSD subscales with maltreated children aged 6-18. The results

supported a two factor model, PTSD and Dissociation separately. The results suggested 12 of the 16 items load significantly on the PTSD factor.

Wolfe, Gentile, & Wolfe (1989) proposed a 20-item CBCL-PTSD profile using items from the CBCL 6-18 Parent Report Form. The profile was developed based off the DSM-III criteria for PTSD and an examination of discriminate validity between abused children with PTSD, abused without PTSD, and normative samples.

Dehon and Scheeringa (2006) removed the items from the Wolfe et al. (1989) PTSD subscale that were exclusive to the CBCL Ages 6-18 form so that the profile could be used with the 3-5 and 6-18 year old forms. This resulted was a 15-item CBCL-PTSD profile.

Table 2*Comparison of CBCL-PTSD Profiles*

Item Number	Item Wording	Wolfe et al. (1989)	Dehon & Scheeringa (2006)	Sim et al. (2005)	Milot et al. (2013)
Item 3	Argues a lot	X	X		
Item 8	Can't concentrate or pay attention for long	X	X		X
Item 9	Cant get his mind off certain things; obsessions	X		X	
Item 11	Clings to adults or too dependent	X	X		
Item 29	Fears certain animals, situations, or places	X	X	X	X
Item 34	Feels others are out to get him/her	X			
Item 40	Hears sounds or voices that aren't there				X
Item 45	Nervous, high-strung, or tense	X	X	X	X
Item 47	Nightmares	X	X	X	X
Item 50	Too fearful or anxious	X	X	X	X
Item 52	Feels too guilty	X			
Item 56b	Headaches	X			
Item 56c	Nausea and feels sick	X	X		
Item 56f	Stomachaches	X	X		
Item 56g	Vomiting, throwing up	X	X		
Item 66	Repeats certain acts over and over; compulsions				X
Item 69	Secretive and keeps things to self	X			
Item 76	Sleeps less than most kids			X	X
Item 84	Strange behavior				X
Item 86	Stubborn, sullen, or irritable	X	X		
Item 87	Sudden changes in mood or feelings	X	X		X
Item 92	Talks or walks in sleep				X
Item 100	Trouble sleeping	X	X	X	X
Item 103	Unhappy, sad, or depressed	X	X		
Item 111	Withdrawn, doesn't get involved with others	X	X		

CHAPTER III

RESULTS

The results are divided into four major sections: Data Screening and Preliminary Analyses, Overall Trauma Exposure and PTSS, Psychometrics of CBCL-PTSD Profiles, and CBCL Group Differences on Functioning. The first section outlines the process of data screening and discusses the preliminary analyses used to inform the main analyses.

Data Screening and Preliminary Analyses

Following the procedures outlined by Mertler & Vannatta (2010), descriptive statistics and frequency distributions were visually inspected for missing values and to identify potential data entry errors or extremely unusual scores. Graphic and statistical analyses for univariate and multivariate outliers were subsequently conducted using boxplots, stem-and-leaf and Mahalanobis distance. For participants with more than 5% of random missing data or whose data appeared to be nonrandom and incomplete for known reasons not related to the outcome measures, were dropped from the dataset. Using this criteria, data from one participant was eliminated. Individual missing items were replaced with the mean of the respective variable.

The analyses were run including and excluding the outliers identified through box plots and stem-and-leaf plots. The outliers determined to be valid and entered correctly were retained and adjusted to the extreme minimum/maximum value depending on the direction of the outlier. Several variables contained outliers and required the stated

adjustments; these included CBCL-PTSD Profiles; WRAT Reading, Spelling, Mathematics; CBCL Anxious-Depressed, Withdrawn-Depressed, Somatic, Affect Problems, Total; Pegboard Dominant Hand Time; RCFT Copy and Recognition; TMT B Time; RAVLT Total, and Immediate Recall; and RIAS Composite. The percent of data from these variables that was adjusted ranged between .3% and 6.3%. Normality was assessed using measures of skewness and kurtosis, as well as the visual inspection of the distribution using histograms as recommended by Tabachnick & Fidell (2007). To meet normality assumptions, logarithm transformations for the extremely positively skewed variables including TMT B and CBCL Anxious, Somatic, Affect Problems were conducted.

Overall Trauma Exposure and PTSS

Sixty-nine children (24%) reported one or more DSM-5 criteria traumatic events. The most prevalent type reported was abuse (physical, sexual, emotional) and/or neglect (68%), being removed from one's primary caregiver (42%), witnessing domestic violence (14%), being in an accident or fire (7%), witnessing the death of a close family member or friend by violence (4%), and exposure to war (1%). One-Hundred-and-Forty-Two participants (50%) of the total sample were currently experiencing one or more stressors, whereas, 46 participants (67%) of those with a trauma history were currently experiencing one or more stressors. Of the 69 children that had reported one or more DSM-5 criteria traumatic events, 11 (16%) met diagnostic criteria for PTSD and were diagnosed with PTSD by two clinical psychologists. Fifty-five (80%) of the children that had a trauma history were diagnosed with more than one diagnosis. Of the children with a trauma history, 23 (33%) were diagnosed with an Adjustment Disorder, 4 (5%) with

Reactive Attachment Disorder, 20 (30%) with an Anxiety Disorder, 22 (32%) with a Depressive Disorder, 7 (10%) with a Disruptive Behavior Disorder, and 40 (58%) with ADHD by two clinical psychologists. Furthermore, 46 (67%) were currently experiencing current stress. See Table 3 for a further explanation of trauma exposure, diagnoses, and current stress for the total sample and for each CBCL group.

Table 3

Trauma History, PTSD Diagnosis, Post-Traumatic Stress Symptoms, Current Stressors by Group and Total Sample

Source	Trauma Hx + CBCL-PTSD n=55	Trauma Hx Only n=14	No Trauma Hx + CBCL-PTSD n=130	Control n=88	Total Sample n=287
Diagnoses					
% Diagnosed with PTSD	18.1	14.3	0.0	0.0	4.2
% Diagnosed with Adjustment D/O	32.7	35.7	17.7	25	23.7
% Diagnosed with Depressive D/O	30.9	35.7	30.8	9.1	25.1
% Diagnosed with RAD	3.6	14.3	0.0	0.0	1.4
% Diagnosed with an Anxiety D/O	32.7	14.3	33.1	14.8	26.5
% Diagnosed with a Disruptive Behavior D/O	10.9	7.1	.1	13.8	10.8
% ADHD	46.4	57.1	65.4	71.6	65.5
% Experiencing Current Stress	63.6	78.6	50.8	36.4	50.2

Psychometrics of CBCL-PTSD Profiles

The reliabilities of the various CBCL-PTSD profiles were examined. Streiner (2003) and Tavakol & Dennick (2011) recommend acceptable Cronbach's alpha values of .70 to .90. The Wolfe et al. (1989) CBCL-PTSD profile demonstrated an acceptable

internal consistency (Cronbach's $\alpha = .82$). The other profiles also demonstrated acceptable internal consistency, but were somewhat lower likely due to having a fewer number of items. The Dehon & Scheeringa (2006) 15-item CBCL-PTSD profile produced $\alpha = .78$, the Milot et al. (2013) 12-item CBCL-PTSD profile $\alpha = .73$, and the Sim et al. (2005) 7-item CBCL-PTSD profile $\alpha = .72$. Please see Table 4 for means and standard deviation for each CBCL-PTSD profile for the total sample and for each group.

Table 4

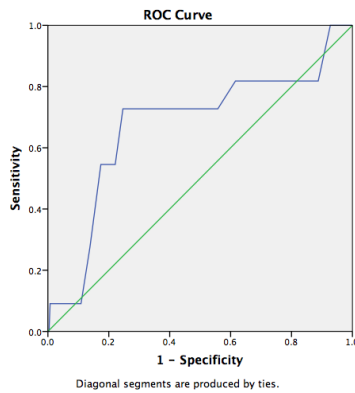
Means and Standard Deviations of the different CBCL-PTSD Profiles by Group and Total Sample

Source	Trauma Hx + CBCL-PTSD n=55	Trauma Hx Only n=14	No Trauma Hx + CBCL-PTSD n=130	Control n=88	Total Sample n=287
CBCL-PTSD Profile					
Wolfe et al. (1989)	16.95 (5.81)	7.57 (3.52)	15.09 (5.30)	6.34 (2.96)	12.40 (6.48)
Dehon & Scheeringa (2006)	13.24 (4.36)	5.57 (2.90)	11.69 (4.26)	4.91 (2.18)	9.61 (5.07)
Sim et al. (2005)	6.87 (2.72)	.86 (.95)	5.39 (2.39)	1.33 (1.21)	4.21 (3.11)
Milot et al. (2013)	9.95 (3.47)	2.21 (1.31)	8.19 (3.10)	2.53 (1.12)	6.50 (4.05)

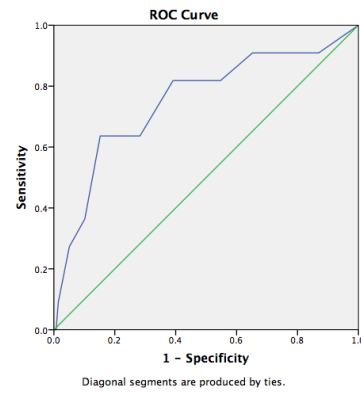
To examine the accuracy and utility of the CBCL-PTSD profiles, receiver operating characteristic (ROC) curves were calculated for the different CBCL-PTSD profiles. The ROC curves are graphical plots of the sensitivity vs. specificity at different cut-off points. The area under the curve (AUC) quantifies the overall ability of a scale to discriminate between those individuals with PTSD and those without. A truly worthless scale has an area of 0.5 (which means true positives could be identified equally by chance), whereas a perfect scale has an area of 1, indicating a sensitivity and specificity of 100% (McFall & Treat, 1999; Swets, 2014). AUC score between .51-.69 indicates a

poor test, AUC score between .7-.79 indicates a fair test, AUC score between .8-.89 indicates a good test, AUC score between .9-.99 indicates an excellent test (Hanley & McNeil, 1982; Rosner et al., 2012). Changes in sensitivity and specificity at different cut-off points are illustrated by ROC curves for each scale predicting PTSD according to assessment diagnosis (see Figure 2).

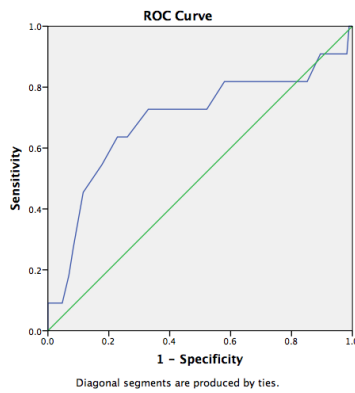
Wolfe et al. (1989)



Sim et al. (2005)



Dehon and Scheeringa (2006)



Milot et al. (2013)

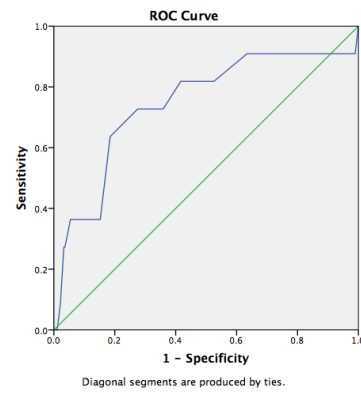


Figure 2. ROC curves for each scale predicting PTSD according to assessment diagnosis.

The area under the ROC curve (AUC) is .67 (95% CI: .49-.86) for the Wolfe et al. (1989) CBCL-PTSD profile, which means its capacity to predict PTSD is poor.

Similarly, the Dehon and Scheeringa (2006) CBCL-PTSD profile area under the ROC

curve (AUC) is .69 (95% CI: .50–.89), which also suggests poor predictive capacity. The other two profiles received better results with an AUC of .74 (95% CI: .57–.92) for Sim et al. (2005) profile and an AUC of .75 (95% CI: .59–.92) for Milot et al. (2013) profile. For both the Sim et al. (2005) and Milot et al. (2013) profiles, the AUC was significantly different from .50, $p = .006$ and $p = .005$ respectively.

The profiles of Sim et al. (2005) and Milot et al. (2013) produced the highest AUC of the four profiles. With the AUC for both profiles being so similar, Sensitivity, Specificity, Positive Predictive Power (PPP), Negative Predictive Power (NPP), False Positive Rate, False Negative Rate, Overall Classification Rate, and Kappa for each profile was examined to determine which profile should be used for this study. For Sim et al. (2005), the best cut-off point was a score of ≥ 2 , with a sensitivity of .91 and a specificity of .34. Using this cut-off resulted in the correct classification of 10 out of 11 positive cases of the present sample and yielded 1 false negative. It yielded 211 false positives, which means it is erring on the side of sensitivity. For Milot et al. (2013), cut-off points of ≥ 4 and ≥ 8 were examined. Using a cut-off score of ≥ 4 , resulted in sensitivity of .91 and specificity of .28. This cut-off resulted in the correct classification of 10 out of 11 positive cases of the present sample and yielded 1 false negative. It yielded 199 false positives, which means it is also erring on the side of sensitivity. If the cut-off point of ≥ 8 is used, this produces sensitivity of .73 and specificity of .64. This cut-off resulted in the correct classification of 8 out of 11 positive cases of the present sample and yielded 3 false negatives. It yielded 99 false positives, which means it is erring on the side of slightly lower sensitivity and poorer specificity. Since the aim of the profile is to screen for possible PTSD to trigger further assessment of PTSD, sensitivity is more important

than specificity, but overall accuracy is best. The Sim et al (2005) cut-off 2 and Milot et al. (2013) cut-off 4 profiles have equal sensitivity, but Milot et al. profile has slightly better specificity, therefore Milot et al. (2013) CBCL-PTSD profile with a cut-off 4 was used. See Figure 3 and Figure 4 for Sim et al. (2005) cut-off 2 and Milot et al. (2013) cut-off 4 CBCL-PTSD profiles test data and Table 5 for complete psychometrics of both profiles.

		PTSD DIAGNOSIS		TOTAL
		POSITIVE	NEGATIVE	
TEST	POSITIVE	a=10	b=211	a+b =221
	NEGATIVE	c=1	d=65	c+d =66
TOTAL		a+c=11	b+d=276	N (a+b+c+d)=287

Figure 3. Presentation of Sim et al. (2005) CBCL-PTSD Profile Test Data

		PTSD DIAGNOSIS		TOTAL
		POSITIVE	NEGATIVE	
TEST	POSITIVE	a=10	b=199	a+b =209
	NEGATIVE	c=1	d=77	c+d =78
TOTAL		a+c=11	b+d=276	N (a+b+c+d)=287

Figure 4. Presentation of Milot et al. (2013) CBCL-PTSD Profile Test Data

Table 5.
Psychometrics of CBCL-Profile Test Data.

	Sensitivity	Specificity	NPP	PPP	False Positive Rate	False Negative Rate	Overall Correct Classification	K
Sim e tal. (2005)	.91	.34	.98	.05	.76	.09	.26	.0
Milot et al. (2013)	.91	.28	.99	.05	.72	.09	.30	.0

* Note.

Sensitivity	$=a/(a+c)$
Specificity	$=d/(b+d)$
Negative Predictive Power	$=d/(c+d)$
Positive Predicative Power	$=a/(a+b)$
False Positive Rate	$=b/(b+d)$
False Negative Rate	$=c/(a+c)$
Overall Correct Classification	$=(a+d)/N$
Observed Agreement (Po)	$=(a+d)/N$
Chance Agreement (Pc)	$=[(a+b)(a+c) + [(c+d)(b+d)] / N^2$
Kappa	$=(Po-Pc)/(1-Pc)$

Determining Covariates

Several variables were examined to determine possible group differences that might impact overall performance on measures of neuropsychological, academic, and emotional/behavioral functioning. These variables included intelligence estimates (RIAS Composite), participant age, participant sex, and participant race.

Differences between groups and participant intelligence estimates (IQ) were examined using one-way analysis of variance (ANOVA). The analysis indicated that IQ was statistically different for the four groups, $F(3, 283) = 4.833, p = .003$. The effect size was calculated using eta and the resulting partial eta squared value of .049 is approximating a medium effect. Post-hoc comparisons using Tukey HSD test indicated that the mean IQ score for Trauma History Only ($M = 89.86, SD = 9.21$) was significantly lower than Control ($M = 101.11, SD = 12.62$) and than CBCL Only ($M = 101.45, SD = 11.73$), but not significantly lower than Trauma + CBCL group ($M = 97.22, SD = 14.38$). No other significant differences were found between the groups. This finding suggests the necessity of controlling for IQ in subsequent analyses looking at group differences. Similarly, participant's age in years was compared using a using one-way ANOVA. The analysis indicated that the groups did not differ significantly in age, $F(3, 283) = 1.958, p = .120$. This finding suggests it is not necessary to control for age in subsequent analyses looking at group differences. Since the measures used are normed using age, age is somewhat already controlled.

A 2X4 Chi Square analysis was conducted to examine gender distribution among the different groups. The test indicated no significant gender differences among the groups, $\chi^2(3, N = 287) = 1.78, p = .620$. This finding suggests it is not necessary to

control for gender in subsequent analyses looking at group differences. A 2X7 Chi Square analysis was conducted to examine race distribution of among the different groups. The test indicated there were significant differences in race among the groups, $\chi^2(18, N = 277) = 31.63, p = .024$. The effect size was calculated using eta and the resulting partial eta squared value of .169 is strong effect. However, Chi Square analysis requires a minimum frequency of 5 in each cell for an accurate analysis and interpretation. The sample's unequal distribution of race does not meet these requirements and therefore, race will not be used as a covariate.

CBCL Group Differences in Functioning

To examine the differences in neuropsychological, academic, and emotional/behavioral functioning between the four participant groups a series of one-way multivariate analyses of covariance (MANCOVA) and univariate analyses of covariance (ANCOVA) were conducted to specifically address the research hypotheses. For any significant MANCOVA or ANCOVA, univariate procedures were conducted to examine which task produced the group differences and pairwise comparisons using Bonferoni were conducted to examine which groups were different from one another. The variable used as a covariate within the analyses was intelligence estimates.

Neuropsychological functioning. A series of MANCOVA and ANCOVAs were conducted to determine differences in neuropsychological functioning between the four participant groups. Several domains of neuropsychological functioning were examined, including memory, attention, visuospatial, executive functioning, and fine motor.

Unadjusted Means and Standard Deviation of each measure for the total sample and for

each group are presented in Table 6. A summary of ANCOVA results for neuropsychological functioning are presented in Table 7.

The memory domain included verbal learning (RVALT Total), verbal short-term memory (RVALT Immediate Recall), verbal long-term memory (RVALT Delayed Recall), and visual long-term memory (RCFT Delayed Recognition). No significant difference in memory domain was found among the groups with MANCOVA, Wilk's $\Lambda = .9643$, $F(12, 738) = 1.369$, $p = .175$, $\eta_p^2 = .019$. Separate ANCOVAs were also conducted to examine differences in specific memory scores. Significant differences were found for verbal long-term memory on RVALT Delayed Recall, $F(3, 282) = 2.78$, $p = .042$, $\eta_p^2 = .029$]. Pairwise comparisons using Bonferroni test indicated that the mean RVALT Delayed Recall score for CBCL + Trauma History was significantly lower than the Control group. No other significant differences were indicated between the groups on RVALT Delayed Recall. Furthermore, no significant differences were found in verbal learning on the RVALT Total, $F(3, 282) = 1.74$, $p = .160$, $\eta_p^2 = .018$; verbal short-term memory on the RVALT Immediate Recall, $F(3, 282) = 1.75$, $p = .157$, $\eta_p^2 = .018$; and visual long-term memory on RCFT Delayed Recognition, $F(3, 282) = 1.639$, $p = .180$, $\eta_p^2 = .017$.

The executive functioning domain included scores from measures of alternating attention (TMT B Time) and cognitive flexibility (WCST Perseverative Errors). No significant difference in executive functioning domain was found with MANCOVA, Wilk's $\Lambda = .988$, $F(6, 458) = .477$, $p = .826$, $\eta_p^2 = .006$. Separate ANCOVAs were also conducted to examine differences in executive functioning scores. No significant difference was found in alternating attention using TMT B Time, $F(3, 230) = .373$, $p =$

.773, $\eta_p^2 = .005$, and cognitive flexibility using WCST Perseverative Errors, $F(3, 231) = .529$, $p = .663$, $\eta_p^2 = .007$.

The attention domain was measured by sustained attention using Omission Errors score from TOVA or IVA. The ANCOVA indicated that attention was not statistically different for the four groups, $F(3, 282) = 1.572$, $p = .196$, $\eta_p^2 = .016$.

The visuospatial domain was measured by RCFT Copy Score. The ANCOVA indicated that visuospatial domain was not statistically different for the four groups, $F(3, 282) = 1.043$, $p = .374$, $\eta_p^2 = .011$.

The fine motor domain was measured by Grooved Pegboard Dominant Hand Time. The ANCOVA indicated that fine motor domain was statistically different for the four groups, $F(3, 236) = 2.726$, $p = .042$. The effect size was calculated using eta and the resulting partial eta squared value of .034 is a small effect. Pairwise comparisons using Bonferroni test indicated that the mean fine motor domain score for CBCL + Trauma History was significantly higher than Control, but not significantly different than Trauma History Only or CBCL Only group. No other significant differences were found between the groups.

Academic achievement. A MANCOVA was conducted to determine differences in academic performance between the four participant groups on scores from the WRAT-4 subtest mathematics, spelling, and reading. No significant difference in academic achievement was found among the groups with MANCOVA, Wilk's $\Lambda = .950$, $F(9, 681) = 1.626$, $p = .104$, $\eta_p^2 = .017$.

ANCOVAs were conducted to determine differences in academic performance on WRAT-4 subtest mathematics, spelling, and reading between the four participant groups.

Table 6*Unadjusted Means and Standard Deviations for Neuropsychological Functioning Measures by Group and Total Sample*

Source	Trauma Hx + CBCL-PTSD	Trauma Hx Only	No Trauma Hx + CBCL-PTSD	Control	Total Sample
Memory	<i>n</i> =55	<i>n</i> =14	<i>n</i> =130	<i>n</i> =88	<i>n</i> =287
RAVLT Learning Trials 1-5 Total	41.78 (10.24)	44.93 (10.72)	42.95 (9.86)	45.38 (10.56)	43.57 (10.23)
RAVLT Immediate Recall	8.69 (3.37)	8.93 (3.43)	8.79 (3.31)	9.76 (3.28)	9.07 (3.33)
RAVLT Delayed Recall	8.13 (3.43)	8.86 (4.29)	8.95 (3.29)	9.87 (3.35)	9.07 (3.43)
RCFT Delayed Recognition SS	90.43 (21.08)	92.071 (16.38)	93.59 (22.36)	98.28 (15.83)	94.35 (20.15)
Executive Functioning	<i>n</i> =47	<i>n</i> =13	<i>n</i> =107	<i>n</i> =69	<i>n</i> =236
TMT B Time in Seconds (Transformed)	1.75 (.22)	1.74 (.24)	1.74 (.22)	1.72 (.17)	1.73 (.21)
WCST Perseverative Errors SS	98.68 (14.46)	100.03 (13.04)	103.66 (15.33)	102.47 (15.42)	102.12
Attention	<i>n</i> =55	<i>n</i> =14	<i>n</i> =130	<i>n</i> =88	<i>n</i> =287
Sustained Attention (TOVA/IVA)	62.94 (33.16)	76.46 (31.34)	72.72 (32.51)	67.16 (32.98)	69.32 (32.81)
Visuospatial	<i>n</i> =55	<i>n</i> =14	<i>n</i> =130	<i>n</i> =88	<i>n</i> =287
RCFT Copy SS	76.08 (30.05)	76.00 (26.81)	82.98 (24.77)	85.77 (24.53)	82.17 (26.01)
Fine Motor	<i>n</i> =47	<i>n</i> =13	<i>n</i> =107	<i>n</i> =69	<i>n</i> =236
Grooved Pegboard DH in Seconds	81.16 (23.95)	79.74 (22.12)	69.21 (20.76)	67.60 (22.25)	66.72 (24.04)

Note.

Grooved Pegboard DH in Seconds = Grooved Pegboard Dominant Hand in Seconds

Table 7

Inivariate Analyses of Covariance F Ratios for Neuropsychological Functioning Measures

		ANCOVA									
Source		RAVLT Total	RAVLT Imm	RAVLT Delay	RCFT Recog	TMT B Time	WCST PE	Sustained Attention	RCFT Copy	Grooved Pegs DH	
		<i>F</i>	<i>F</i>	<i>F</i>	<i>F</i>	<i>F</i>	<i>F</i>	<i>F</i>	<i>F</i>	<i>F</i>	
Covariate											
IQ		4.30	3.79	5.37*	4.91*	19.09***	16.23***	7.58**	18.69***	43.85***	
Group		1.74	1.75	2.78*	1.64	.37	.53	1.57	1.04	2.73*	

Note.

$p < .05$

* $p < .01$

** $p < .001$

RAVLT Total = RAVLT Learning Trials 1-5 Total; RAVLT Imm = RAVLT Immediate Recall; RAVLT Delay = RAVLT Delayed Recall; RCFT Recog = RCFT Delayed Recognition; TMT B Time = TMT B Time in Seconds (Transformed); WCST PE = WCST Perseverative Errors; Sustained Attention = Sustained Attention (TOVA/IVA); Grooved Pegs DH = Grooved Pegboard Dominant Hand in Seconds

Table 8
Unadjusted Means and Standard Deviations for Academic Achievement Measures by Group and Total Sample

Source	Trauma Hx + CBCL-PTSD <i>n</i> =55	Trauma Hx Only <i>n</i> =14	No Trauma Hx + CBCL-PTSD <i>n</i> =130	Control <i>n</i> =88	Total Sample <i>n</i> =287
ACADEMIC ACHIEVEMENT					
Mathematics SS	89.58 (15.92)	89.86 (21.29)	95.68 (15.78)	98.17 (15.45)	95.99 (16.24)
Reading SS	95.42 (12.79)	92.07 (13.36)	99.38 (14.08)	99.44 (12.61)	98.28 (13.42)
Spelling SS	94.35 (14.50)	98.29 (19.07)	97.99 (14.71)	99.83 (14.95)	97.87 (15.01)

Unadjusted Means and Standard Deviations for Academic Achievement Measures by Group and Total Sample

Table 9*Univariate Analyses of Covariance F Ratios for Academic Achievement*

Variables	ANCOVA		
	Mathematics	Reading	Spelling
	<i>F</i>	<i>F</i>	<i>F</i>
Covariates			
IQ	48.907***	70.27***	50.61***
Group	2.262	.478	1.51

*Note.** $p < .05$ ** $p < .01$ *** $p < .001$

No significant difference was found in mathematics, $F(3, 282) = 2.262, p = .081, \eta_p^2 = .024$; spelling, $F(3, 282) = 1.511, p = .212, \eta_p^2 = .016$; or reading, $F(3, 282) = .478, p = .698, \eta_p^2 = .005$. Unadjusted Means and Standard Deviation of each score for the total sample and for each group are presented in Table 8. A summary of ANCOVA results examining differences in academic performance in reading, spelling, and mathematics are presented in Table 9.

Emotional/behavioral functioning: CBCL Scales. A series of MANCOVAs and ANCOVAs were conducted to determine differences in emotional and behavioral functioning between the four participant groups. Several domains of emotional and behavioral functioning were examined with the CBCL Scales, including overall emotional/behavioral functioning, depression symptoms, and anxiety symptoms. Unadjusted Means and Standard Deviation of each score for the total sample and for each

group are presented in Table 10. A summary of ANCOVA results examining differences in emotional and behavioral functioning on CBCL Scales are presented in Table 11.

A MANCOVA was conducted to determine differences in overall emotional and behavioral functioning between the four participant groups on CBCL Scales Total Problems, Internalizing Problems, and Externalizing Problems. A significant difference was found, Wilk's $\Lambda = .524$, $F(9, 681) = 23.016$, $p < .001$, $\eta_p^2 = .23$. The ANCOVA on CBCL Total Problems was statistically different for the four groups, $F(3, 282) = 63.387$, $p < .001$, $\eta_p^2 = .403$. Pairwise comparisons using Bonferroni test indicated that the mean CBCL Total Problems score for CBCL + Trauma History was significantly higher than Control and Trauma History Only, but not significantly different than the CBCL Only group. The CBCL Only group was also significantly higher than Control and Trauma

Table 10*Unadjusted Means and Standard Deviations for Emotion/Behavior Functioning on CBCL Scales*

Source	Trauma Hx + CBCL-PTSD	Trauma Hx Only	No Trauma Hx + CBCL-PTSD	Control	Total Sample
EMOTIONAL/BEHAVIOR	<i>n</i> =55	<i>n</i> =14	<i>n</i> =130	<i>n</i> =88	<i>n</i> =287
CBCL Total Problems TS	69.20 (7.02)	58.43 (6.62)	67.28 (6.76)	55.59 (7.62)	63.63 (9.10)
CBCL Internalizing Problems TS	67.27 (8.75)	56.86 (6.84)	66.09 (7.87)	52.55 (8.52)	61.71 (10.41)
CBCL Externalizing Problems TS	65.33 (10.16)	56.21 (11.76)	61.91 (10.89)	53.40 (11.14)	59.68 (11.75)
Depression					
CBCL Anxious-Depressed TS	66.38 (10.06)	54.21 (4.30)	65.12 (8.89)	54.22 (5.44)	61.49 (9.70)
CBCL Withdrawn Depressed TS	65.26 (11.12)	61.36 (7.71)	64.20 (9.34)	56.94 (8.40)	62.04 (9.95)
∞ CBCL Affective Problems TS (Transformed)	1.83 (.06)	1.76 (.05)	1.82 (.05)	1.75 (.05)	1.79 (.06)
Anxiety					
CBCL Anxiety Problems TS (Transformed)	1.82 (.04)	1.72 (.02)	1.80 (.06)	1.73 (.04)	1.78 (.06)
CBCL Somatic Complaints TS (Transformed)	1.80 (.07)	1.74 (.05)	1.79 (.06)	1.74 (.04)	1.77 (.06)

Note.

* < .05

** < .01

*** < .001

Table 11

Univariate Analyses of Covariance F Ratios for Emotional/Behavior Functioning CBCL Scales

Source	ANCOVA									
	CBCL Tot Prob <i>F</i>	CBCL Int Prob <i>F</i>	CBCL Ext Prob <i>F</i>	CBCL Affect Prob <i>F</i>	CBCL Anx/Dep <i>F</i>	CBCL With/Dep <i>F</i>	CBCL Anx Prob <i>F</i>	CBCL Som Com <i>F</i>		
Covariates										
IQ	1.14	.08	2.98	.01	.69	2.51	.34	.48		
Group	63.79***	58.74***	17.43***	46.91***	42.91***	13.00***	66.21***	12.07***		

Note.

* $p < .05$

** $p < .01$

*** $p < .001$

CBCL Tot Prob = CBC Total Problems; CBCL Int Prob = CBCL Internalizing Problems; CBCL Ext Prob = CBCL Externalizing Problems;

CBCL Affect Prob = CBCL Affective Problems; CBCL Anx/Dep = CBCL Anxious/Depressed; CBCL With/Dep = CBCL Withdrawn/Depressed

CBCL Anx Prob = CBCL Anxious Problems; CBCL Som Com = Somatic Complaints

history Only. No other significant differences in the groups on CBCL Total Problems were indicated. The ANCOVA on CBCL Internalizing Problems was statistically different for the four groups, $F(3, 282) = 58.738, p < .001, \eta^2 = .385$. Pairwise comparisons using Bonferroni test indicated the same pattern of differences between the groups on CBCL Total Problems Scale.

The ANCOVA on CBCL Externalizing Problems was also statistically different for the four groups, $F(3, 282) = 17.429, p < .001, \eta_p^2 = .156$. Pairwise comparisons using Bonferroni test indicated a different pattern of group differences. The mean CBCL Externalizing Problems score for CBCL + Trauma History was only significantly higher than the Control group. The CBCL Only group was also significantly higher than the Control group. No other significant differences were found between the groups on the CBCL Externalizing Problems Scale.

A MANCOVA was conducted to determine differences in depression symptoms between the four participant groups on CBCL scales Anxious-Depressed, CBCL Withdrawn-Depressed, and CBCL Affective Problems. A significant difference was found, Wilk's $\Lambda = .593, F(9, 681) = 18.166, p < .001, \eta_p^2 = .160$. Follow-up ANCOVAs indicated that CBCL Anxious-Depressed, CBCL Withdrawn-Depressed, and CBCL Affective Problems were all significantly different between the groups. The ANCOVA on CBCL Anxious-Depressed was statistically different for the four groups, $F(3, 282) = 42.911, p < .001, \eta_p^2 = .313$. Pairwise comparisons using Bonferroni test indicated that the mean CBCL Anxious-Depressed score for CBCL + Trauma History was significantly higher than Control and Trauma History Only, but not significantly different than the

CBCL Only group. CBCL Only was also significantly higher than Trauma History History and Control groups.

The ANCOVA on CBCL Withdrawn-Depressed was statistically different for the four groups, $F(3, 282) = 13.004, p < .001, \eta_p^2 = .122$. Pairwise comparisons using Bonferroni test indicated that the mean CBCL Withdrawn-Depressed score for CBCL + Trauma History was only significantly higher than Control. CBCL Only was also significantly higher than the Control group.

The ANCOVA on CBCL Affective Problems was statistically different for the four groups, $F(3, 282) = 46.917, p < .001, \eta_p^2 = .333$. Pairwise comparisons using Bonferroni test indicated that the mean CBCL Affective Problems score for CBCL + Trauma History was significantly higher than Control and Trauma History Only, but not significantly different than the CBCL Only group. CBCL Only was significantly higher than Trauma History and Control groups.

A MANCOVA was conducted to determine differences in anxiety symptoms between the four participant groups on CBCL scales Anxiety problems and Somatic Complaints. A significant difference was found, Wilk's $\Lambda = .578, F(6, 562) = 29.500, p < .001, \eta_p^2 = .240$. Follow-up ANCOVAs indicated that CBCL Anxiety Problems and CBCL Somatic Complaints were significantly different between the groups. The ANCOVA on CBCL Anxiety Problems was statistically different for the four groups, $F(3, 282) = 66.209, p < .001, \eta_p^2 = .413$. Pairwise comparisons using Bonferroni test indicated that the mean CBCL Anxiety Problems score for CBCL + Trauma History was significantly higher than Control and Trauma History Only, but not significantly different

than the CBCL Only group. CBCL Only was significantly higher than Trauma History History and Control groups.

The ANCOVA on CBCL Somatic Complaints was statistically different for the four groups, $F(3, 282) = 12.067, p < .001, \eta_p^2 = .114$. Pairwise comparisons using Bonferroni test indicated that the mean CBCL Somatic Complaints score for CBCL + Trauma History was only significantly higher than the Control group. CBCL Only was also significantly higher than the Control group.

Emotional/behavioral functioning: Millon Clinical Scales. A series of ANCOVAs were conducted to determine differences in emotional and behavioral functioning on the Millon Clinical Scales between the four participant groups. Domains of emotional and behavioral functioning were examined, including depression symptoms and anxiety symptoms. Unadjusted Means and Standard Deviation of each scale for the total sample and for each group are presented in Table 12. A summary of ANCOVA results examining differences Millon Clinical Scales are presented in Table 13.

The ANCOVA indicated that Millon Depressed Scale was not significantly different between the groups, $F(3, 188) = 1.435, p = .234, \eta_p^2 = .022$.

The ANCOVA indicated that Millon Anxiety Scale was not significantly different between the groups, $F(3, 188) = .750, p = .524, \eta^2 = .012$.

Personality patterns. A MANCOVA and ANCOVAs were conducted to determine differences in personality traits between the four participant groups on scores from the MACI/M-PACI Submissive, Unruly, Inhibited, and Unstable Scales. No significant difference between the groups was found using MANCOVA, Wilk's $\Lambda = .912, F(12, 489) = 1.563, p = .141, \eta_p^2 = .030$. ANCOVAs indicated no significant

Table 12*Unadjusted Means and Standard Deviations for Emotion/Behavior Functioning and Personality for Millon Scales*

	Trauma Hx + CBCL-PTSD	Trauma Hx Only	No Trauma Hx + CBCL-PTSD	Control	Total Sample
EMOTIONAL/BEHAVIOR	n=43	n=13	n=86	n=51	n=193
Depression					
Millon Depression BR	60.75 (28.82)	60.55 (24.31)	54.18 (30.12)	46.81 (30.60)	54.12 (29.85)
Anxiety					
Millon Anxiety/Fears BR	69.78 (17.46)	68.50 (16.73)	65.78 (25.20)	61.96 (25.51)	65.85 (23.30)
PERSONALITY	n=43	n=13	n=86	n=51	n=193
Millon Submissive BR	66.47 (15.58)	66.55 (8.90)	62.65 (18.14)	58.47 (22.04)	62.66 (18.41)
Millon Unruly BR	50.56 (26.32)	39.13 (28.57)	46.57 (25.67)	40.46 (25.82)	45.34 (26.15)
Millon Inhibited BR	64.17 (20.04)	58.29 (25.83)	56.68 (21.89)	53.99 (21.24)	57.75 (21.74)
Millon Unstable BR	48.13 (25.37)	42.14 (16.73)	42.94 (26.92)	31.70 (23.50)	41.07 (25.67)

Note.

* < .05

** < .01

*** < .001

Table 13
Univariate Analyses of Covariance F Ratios for Emotional/Behavioral Functioning and Personality Millon Scales

Variables	ANCOVA					
	Millon Depression <i>F</i>	Millon Anxiety/ Fears <i>F</i>	Millon Submissive <i>F</i>	Millon Unruly <i>F</i>	Millon Inhibited <i>F</i>	Millon Unstable <i>F</i>
Covariates						
IQ	2.21	.45	.02	1.75	.700	.26
Group	1.44	.75	1.66	1.62	1.52	3.72**

Note.

* $p < .05$

** $p < .01$

*** $p < .001$

difference in groups for the Submissive scale, $F(3, 188) = 1.446, p = .177, \eta_p^2 = .026$; Unruly scale, $F(3, 188) = 1.624, p = .185, \eta_p^2 = .025$; and Inhibited scale, $F(3, 188) = 1.519, p = .211, \eta_p^2 = .024$. However, ANCOVA showed that the groups differed significantly on the Unstable scale, $F(3, 188) = 3.724, p = .012, \eta_p^2 = .056$. Pairwise comparisons using Bonferroni test indicated that the mean Millon Unstable Scale score for CBCL + Trauma History was significantly higher than Control, but that no other significant differences were indicated. Unadjusted Means and Standard Deviation of each score for the total sample and for each group are presented in Table 12. A summary of ANCOVA results examining differences personality traits are presented in Table 13.

Stressful life experiences. A MANCOVA and ANCOVAs were conducted to determine differences in stressful life experiences between the four participant groups. Unadjusted Means and Standard Deviation of each score for the total sample and for each group are presented in Table 12 and Table 14. A summary of ANCOVA results examining differences in stressful life experiences are presented in Table 13 and Table 15.

A MANCOVA was conducted to determine differences in stressful life experiences between the four participant groups on a linear combination of the MACI Family Discord and Child Abuse scores. A significant difference was found, Wilk's $\Lambda = .800, F(6, 148) = 2.92, p = .010, \eta_p^2 = .106$.

ANCOVA indicated that the MACI Family Discord Scale was not statistically different for the four groups, $F(3, 75) = .404, p = .5750, \eta_p^2 = .016$.

ANCOVA indicated that the MACI Child Abuse Scale was statistically different for the four groups, $F(3, 75) = 5.418, p = .002, \eta_p^2 = .178$. Pairwise comparisons using

Table 14*Unadjusted Means and Standard Deviations for Stressful Life Experiences*

	Trauma Hx + CBCL-PTSD	Trauma Hx Only	No Trauma Hx + CBCL-PTSD	Control	Total Sample
STRESSFUL LIFE EXPERIENCES					
Current Stress	n=55 1.04 (.94)	n=14 1.14 (.77)	n=130 .72 (.83)	n=88 .53 (.84)	n=287 .75 (.87)
Millon Family Discord BR	n=20 61.43 (22.74)	n=6 55.00 (29.39)	n=33 58.33 (16.82)	n=21 53.50 (21.94)	n=80 57.59 (20.60)
Millon Child Abuse BR	49.79 (20.49)	42.17 (21.14)	27.99 (15.45)	25.65 (19.95)	33.89 (20.70)

Note.

* < .05

** < .01

*** < .001

Table 15*Univariate Analyses of Covariance F Ratios for Stressful Life Experiences*

Variables	ANCOVA		
	Millon Child Abuse <i>F</i>	Millon Family Discord <i>F</i>	Current Stress <i>F</i>
Covariates			
IQ	3.50	2.13	.75
Group	5.42**	.40	4.45**

*Note.** $p < .05$ ** $p < .01$ *** $p < .001$

Bonferroni test indicated that the mean MACI Child Abuse score for CBCL + Trauma History was significantly higher than Control and CBCL Only groups, but not significantly different than the Trauma History Only. No other significant differences in the groups were found on the MACI Child Abuse scale.

An ANCOVA was conducted to determine differences in amount of current stress between the four participant groups. A significant difference was found, $F(3, 282) = 4.448, p = .005, \eta_p^2 = .045$. Pairwise comparisons using Bonferroni test indicated that the mean current stress for CBCL + Trauma History was only significantly higher than Control. No other significant differences in the groups were found on current stress.

CHAPTER IV

DISCUSSION

The purpose of the present study was to further examine the validity and utility of the CBCL PTSD profile as a screening tool for PTSS within psychological assessment and explore whether the CBCL-PTSD profile is associated with neuropsychological, academic, and emotional/behavioral impairment in children and adolescents that have experienced trauma. The following discussion examines the present study's obtained results and the extent to which the study's hypotheses were supported or rejected. The study's strengths, limitations, and future directions are also discussed.

Is the CBCL-PTSD Profile a reliable and valid screener of PTSS?

CBCL-PTSD Profiles have been developed and used in several studies examining trauma in children; however, the results have been mixed and so, it is questionable whether the profiles assess genuine PTSS or general distress. This study examined the four CBCL-PTSD profiles and found that the Sim et al. (2005) and Milot et al. (2013) profiles might be useful as a screener for PTSS. The study sample included only 11 cases of PTSD and numbers this small restrict interpretation of results. The AUC scores of the Sim et al. (2005) and Milot et al. (2013) profiles indicate fair predictive value and reliably better than chance at identifying possible PTSD. Examination of sensitivity and specificity of each profile showed the Milot et al. (2013) profile to be a more accurate screener. An optimal cut-off score of 4 for the Milot et al. (2013) yielded a very high

sensitivity and poorer specificity. However, an overly sensitive measure can then lead to high numbers of false positives which can lead to overdiagnosing. If the Milot et al. (2013) CBCL-PTSD profile is used as a screener of PTSS that prompts additional assessment, higher sensitivity would lead to additional assessment and not necessarily over diagnosis. Higher sensitivity often comes at the cost of poorer specificity, but depending on the purpose of the measure this combination may be acceptable. Generally higher sensitivity is preferable for screening measures to ensure minimal false negatives. The purpose of this profile is to screen for trauma symptoms to indicate whether a more thorough assessment is needed, so high sensitivity is key because it is the clinician's role to discriminate between trauma symptoms and general distress. Rosner et al. (2012) and Sim et al. (2005) have noted that poor specificity suggests the profile reflects general distress and does not adequately discriminate general distress from PTSS, however the high comorbidity rates between posttraumatic stress symptoms (PTSS) and other mental health disorders actually make this discrimination difficult.

The problem is that clinicians are not adequately screening or assessing for trauma history and trauma symptoms. The high prevalence rates of trauma exposure among children and adolescents is a major public health concern due to the many ways trauma can adversely impact cognitive, emotional, and social development and functioning. High rates of comorbidity between posttraumatic stress symptoms (PTSS) and other mental health disorders also leads to complex diagnostic pictures. This combination necessitates adequate screening and assessment for trauma exposure and related symptoms when conducting psychological, educational, or neuropsychological evaluations to ensure accurate diagnoses and appropriate recommendations for treatment

and interventions are made. Interestingly, 55 of the 69 participants that endorsed trauma history, had a positive Milot et al. (2013) CBCL-PTSD profile. This result brings to questions whether the clinicians were taking a trauma informed approach to the evaluation and assessed sufficiently for PTSD or Other Stressor/Trauma Related Disorder. No trauma specific measures were used by the clinicians and so it is possible that a trauma related diagnoses and recommendations therefore missed. If the Milot et al. (2013) CBCL-PTSD profile had been used as a screener to prompt additional assessment and diagnostic clarification, it is possible a trauma related diagnosis would have been identified for some of the individuals with a trauma history and appropriate recommendations for treatment and interventions made.

The current study found similar AUC, sensitivity, and specificity results for the Milot et al. (2013) profile as Rosner et al. (2012) found for the Dehon and Scheeringa (2006) profile. Rosener et al. concluded that although the results suggested the profile may be a useful screening tool, further research was needed with larger and more representative samples to establish whether the scale may sensitive and specific enough to be useful. The current study used a larger sample ($n=287$) than Rosner et al. ($n=36$) and included a broader sample in terms of age, diagnoses, and trauma history. Therefore the results of the current study are further evidence that a CBCL-PTSD profile may be a useful screener. However, additional studies should examine the differences between the Milot et al. (2013) and Dehon and Scheeringa (2006) profiles since this has previously not been done.

The results from the current study show the Milot et al. (2013) CBCL-PTSD profile to have good sensitivity to PTSS and may be a useful screener for PTSS.

Clinicians already administering the CBCL should therefore consider the benefit of reviewing the profile to determine whether additional trauma assessment is indicated. The results suggest there is some utility in using this profile as a screener, however a larger sample is needed to obtain stronger statistical results. Additionally, the optimal cut-off score of 4 that is proposed for Milot et al. (2013) CBCL-PTSD profile needs further validation.

CBCL Group Differences in Functioning

Neuropsychological functioning. It was hypothesized that the individuals in the CBCL + Trauma History group would perform significantly lower than the individuals in the other groups on several measures of neuropsychological functioning in the domains of memory, executive functioning, attention, visuospatial skills, and fine motor skills.

Memory. It was hypothesized that individuals in the CBCL + Trauma History group would perform significantly lower compared to individuals in other groups on measures of verbal learning (RVALT Total), verbal short-term memory (RVALT Immediate Recall), verbal long-term memory (RVALT Delayed Recall), and visual long-term memory (RCFT Delayed Recognition). The mean scores of individuals in the CBCL + Trauma History group were lower than those of the other groups on each of these measures; however, no significant differences were obtained. Lower performance on measures of memory for individuals with trauma history with PTSD is consistent with previous research, however other studies have shown the differences are significant. Previous research not using the CBCL-PTSD Profile has shown that individuals with trauma history and PTSS demonstrate greater impairment on measures of verbal short-term memory and visual long-term memory compared to those with trauma history only

and controls; and those with trauma history with and without PTSD perform similarly and significantly lower than controls on measures of verbal learning and verbal long-term memory (DeBellis et al., 2013; Samuelson et al., 2010; Yasik et al., 2007). It is possible that using the CBCL-PTSD Profile to differentiate groups may therefore be interfering with significant findings. Overall these results suggest that trauma history with a positive CBCL-PTSD Profile is associated with lower memory recall, but not significant impairments in memory function.

Executive Function. It was hypothesized that individuals in the CBCL + Trauma History group would demonstrate significant impairments in alternating attention (TMT B Time) and cognitive flexibility (WCST Perseverative Errors) compared to individuals in other groups. The mean scores across the groups showed that the individuals in the CBCL + Trauma History group had poorer alternating attention and cognitive flexibility, but the differences were also not significant. Poorer performance on measures of executive functioning for individuals with trauma history with PTSD is consistent with previous research; however, other studies not using the CBCL-PTSD Profile tend to show significant differences in cognitive flexibility using WCST Perseverative Errors score (Beers & De Bellis, 2002; DeBellis et al., 2013). Using the CBCL-PTSD Profile to differentiate groups may be masking significant findings. The results suggest that trauma history with a positive CBCL-PTSD Profile is associated with poorer executive functioning, but not significant impairments in executive functioning.

Attention. It was hypothesized that individuals in the CBCL + Trauma History group would demonstrate significantly poorer sustained attention (TOVA/IVA Omission Errors) compared to individuals in other groups. The mean scores across the groups

showed that the individuals in the CBCL + Trauma History group had poorer sustained attention, but the differences were not significant. Studies not using the CBCL-PTSD Profile also show poorer sustained attention for individuals with trauma history with PTSD and that finding significant differences in sustained attention is less common (Beers & De Bellis, 2002; DeBellis et al., 2013; Samuelson et al., 2010). These results suggest that trauma history with a positive CBCL-PTSD Profile is associated with poorer sustained attention, but not significantly impaired sustained attention.

Visuospatial. It was hypothesized that individuals in the CBCL + Trauma History group would demonstrate significant impairments in visuospatial planning compared to the other three groups as measured by the RCFT Copy Score. The mean scores across the groups showed that the individuals in the CBCL + Trauma History and Trauma History Only groups were equally lower in visuospatial planning ability than the other two groups, but that the differences were not significant. The results from studies not using the CBCL-PTSD Profile vary regarding visuospatial planning ability, some studies show no differences and others show significant differences between those with trauma history and PTSD and those with trauma history only and controls (Beers & De Bellis, 2002; DeBellis et al., 2013; Samuelson et al., 2010; Yasik et al., 2007). The results from this study support the evidence that suggests that trauma history is not associated with significantly poorer visuospatial ability.

Fine motor. It was hypothesized that no significant differences in fine motor skills (Grooved Pegboard DH Time) would exist across the groups. Interestingly, individuals in the CBCL + Trauma History group showed slower performance on the fine motor task than all the other groups and were significantly slower compared to those in the Control

group. Previous research not using CBCL-PTSD Profile has shown slower performance on measures of fine motor skills for individuals with trauma history with PTSD, but generally without significant differences (Beers & De Bellis, 2002; DeBellis et al., 2013). These results suggest that the trauma history with a positive CBCL-PTSD Profile is associated with significantly slower fine motor performance than individuals without a positive profile for CBCL-PTSD Profile and no trauma history.

The one significant finding and majority non-significant findings for the measures of neuropsychological functioning disconfirmed the hypotheses related to neuropsychological functioning. There are several possibilities that minimal significant differences were observed. The lack of significant differences may be an issue of statistical power. The Trauma History Only group was small ($n=14$), and this small sample size may have reduced the ability to detect significant differences between the groups. The characteristics of the sample may also be contributing to a lack of significant results. The participants in the Control group were still a clinical sample, whereas typically a control group includes healthy, non-affected, community participants. Participants were placed in the control group if they did not endorse trauma history and were not elevated on the CBCL-PTSD profile, but the participants were still clinical. Alternatively it may be due to the fact that using the CBCL-PTSD Profile to differentiate group differences is masking significant findings.

Academic achievement. It was hypothesized that the individuals in the CBCL + Trauma History group would perform significantly lower than the individuals in the other groups on measures of academic achievement in mathematics, reading, and spelling.

Mathematics. It was hypothesized that individuals in the CBCL + Trauma History group would demonstrate impaired performance on basic mathematics skills compared to the other three groups as measured by the WRAT4 Arithmetic subtest. The mean scores across the groups showed that the individuals in the CBCL + Trauma History and Trauma History Only groups performed equally lower on the WRAT4 Arithmetic subtest than the other two groups, but that the differences were not significant. Lower performance on measures of basic mathematics skills for individuals with trauma history with PTSD is consistent with previous research, however other studies have shown the differences with control groups are significant (DeBellis et al., 2013). The results from this study suggests that the trauma history with a positive CBCL-PTSD Profile is not associated with significant impairment in basic mathematics skills.

Reading. It was also hypothesized that individuals in the CBCL + Trauma History group would demonstrate significantly poorer word reading (WRAT4 subtest) compared to the other three groups. The mean scores across the groups showed that the individuals in the Trauma History Only groups performed lower on the WRAT4 Word Reading subtest than the all other groups and the individuals in the CBCL + Trauma History group performed lower than only the CBCL Only and Control groups; but no differences were significant. Previous studies not using the CBCL-PTSD Profile show that individuals with PTSD perform significantly lower on reading tests than those with trauma history without PTSD and controls (DeBellis et al., 2013; Duplechain, Reiger, Packard, 2008). The results from this study suggests that the trauma history with a positive CBCL-PTSD Profile is not associated with significantly poorer word reading skills.

Spelling. It was also hypothesized that individuals in the CBCL + Trauma History group would demonstrate significantly poorer spelling (WRAT4 subtest) compared to the other three groups. The mean scores across the groups showed that the individuals in the Trauma History Only groups performed lower on the WRAT4 Spelling subtest than the all other groups and the individuals in the CBCL + Trauma History group performed lower than only the CBCL Only and Control groups; but no differences were significant. No previous studies have examined differences in spelling performance of children with and without trauma history, as the studies that have looked at academic achievement focused on reading (De Bellis et al. 2013; Duplechain et al., 2008). Therefore, the findings of the current study cannot be compared to previous research. The results from this study suggests that the trauma history with a positive CBCL-PTSD Profile is associated with lower spelling performance, but not that the difference is not significant.

The lack of significant findings for the measures of academic achievement disconfirmed the study's hypotheses. Previous research clearly shows significant differences between children with trauma history and controls (De Bellis et al. 2013; Duplechain et al., 2008); therefore, it is likely that no differences were found because lower academic performance is associated with other psychiatric diagnoses and a clinical control group was used (Nelson, Benner, Lane, & Smith, 2004; Sijtsema, Verboom, Penninx, Verhulst, & Ormel, 2014). Once again, the lack of significant differences may be an issue of statistical power due to the unequal group sizes and one particularly small group ($n=14$). Using the CBCL-PTSD Profile to differentiate group differences may also have interfered with identifying significant differences.

Emotional and behavioral functioning.

CBCL Scales. It was only hypothesized that individuals in the CBCL + Trauma History group would demonstrate significantly higher internalizing problems, externalizing problems, total problems, affective problems, depression symptoms, and anxiety symptoms as measured by the CBCL compared to the other three groups. Several significant differences between the groups and various CBCL subscales emerged. The CBCL + Trauma History scores were higher than all groups on the Total Problems, Internalizing Problems, Externalizing Problems, Affective Problems, Depressed-Withdrawn, Anxious-Depressed, Anxiety Problems, and Somatic Complaints scales; however, the no significant differences between CBCL + Trauma History and CBCL Only were found on the scales. CBCL + Trauma History and CBCL Only groups were both significantly higher than the the Trauma History Only and Control groups on the Total Problems, Internalizing Problems, Affective Problems, Anxious-Depressed, and Anxiety Problems scales. The CBCL + Trauma History scores was only significantly higher than the Externalizing Problems, Depressed-Withdrawn, and Somatic Complaints scales. These results show that those in the CBCL + Trauma History group overall had more symptoms and distress on the CBCL that those in the other groups, but the where that group was most differentiated was on the Externalizing Problems, Depressed-Withdrawn, and Somatic Complaints scales. De Bellis et al., (2013) found that individuals with PTSD score significantly higher on the CBCL Total Problems and Internalizing Problems scales than those with trauma history without PTSD and controls, but for CBCL Externalizing Problems both groups with trauma history score significantly higher than the control group. The current study had similar findings to De Bellis et al.,

however two groups with trauma history were not equivalent on any scales. A study that similarly compared a trauma history sample with a clinical control on the CBCL only identified differences on the Anxious-Depressed Scale. There are few studies that have examined the differences on CBCL scales between those with and without trauma histories, which makes comparing the current study's results to previous research difficult. Furthermore, no study has used the CBCL-PTSD profile to differentiate the groups and then compared the differences on the CBCL scales. However, the results from the current study are concurrent with other studies demonstrating that significant associations between trauma history and depression (Infurna, Reichl, Parzer, Schimmenti, Bifulco, & Kaess, 2016), anxiety (Maniglio, 2012), somatic complaints (Devanarayana, Rajindrajith, Perera, Nishanthanie, Karunanayake, & Bennin, (2014; Hart, Hodgkinson, Belcher, Hyman, & Cooley-Strickland, 2013), and disruptive behavior (Lehmann, Havik, Havik, & Heiervang, 2013).

Millon Clinical Scales. It was hypothesized that individuals in the CBCL + Trauma History group would demonstrate significantly higher scores on the Millon (MACI/M-PACI) Depression Clinical Scale and Millon (MACI/M-PACI) Anxiety/Fears Clinical Scale compared to the other three groups. The mean scores across the groups showed that the individuals in the Trauma History + CBCL groups had higher scores on both scales compared to the other 3 groups, however no significant differences between the groups were found on either scale. No previous studies have examined differences on these MACI/M-PACI scales of children with and without trauma history and so, the findings of the current study cannot be compared to previous research. Since significant differences were found on the CBCL depression and anxiety scales, the lack of

significant findings on the Millon scales are more likely due to the issue of statistical power since the older age range of the measures decreased the sample size.

Personality Patterns

It was only hypothesized that individuals in the CBCL + Trauma History group would demonstrate significantly higher scores on the Millon (MACI/M-PACI) Submissive, Unruly, Inhibited, and Unstable Personality Scales as measured by the CBCL compared to the other three groups. The mean scores across the groups showed that the individuals in the Trauma History + CBCL groups had higher scores on the Unruly and Inhibited scales compared to the other 3 groups, and that Trauma History Only and Trauma History + CBCL groups were both higher on the Submissive scale. Significant differences were found on the Unstable scale, where Trauma History + CBCL was significantly higher than the other 3 groups. No previous studies have examined differences on these MACI/M-PACI scales of children with and without trauma history and so, the findings of the current study cannot be compared to previous research. Studies examining personality patterns and traits in adolescents with trauma histories tend to focus on resilience (Heetkamp & de Terte, 2015), there have however been a few studies looking at trauma and borderline personality traits in adolescents (Venta, Kenkel-Mikelonis, & Sharp, 2012). The significant finding on the Unstable scale supports further research exploring borderline-personality traits and trauma among adolescents.

Stressful Life Experiences

Stressful life experiences. It was hypothesized that individuals in the CBCL + Trauma History and CBCL Only groups would demonstrate significantly higher levels of current stress than the other two groups. Only Trauma History + CBCL was significantly

higher in current stress from the Control group only. This finding is consistent with the other results of the study, indicating that the participants in the Trauma History + CBCL, Trauma History Only, and CBCL Only groups were all experiencing higher distress. These results are in line with other studies that show individuals with trauma history report high number of stressful life events (Zetterqvist, Lundh, L, & Svedin, 2013).

Millon Scales. CBCL + Trauma History and CBCL Only groups would demonstrate significantly higher scores on the MACI Child Abuse and Family Discord Scales than the other three groups. CBCL +Trauma History was higher than the Trauma History Only group and significantly higher on the MACI Child Abuse scale than the CBCL Only and Control group. This finding suggests that the parent report of trauma symptoms on the CBCL is consistent with child report of trauma history on the MACI. This finding is consistent with the other results of the study, indicating that the participants in the individuals in the Trauma History + CBCL are experiencing the highest current stress, but that the other groups are also experiencing stress. No previous studies have examined differences on these MACI scales of children with and without trauma history and so, the findings of the current study cannot be compared to previous research.

Limitations and Future Directions

There are a number of limitations, both broad and specific, that may have influenced the results. One broad limitation is the use of a clinical sample from one clinic, instead of both community and clinical participants from the general public. The participants in the Control group were a clinical sample, however typically a control group includes healthy, non-affected, community participants. Additionally, the ethnic

distribution of the participants was similar to the region the population was selected from, however, this distribution is not similar to the general population of the United States as found in the latest Census (Humes, Jones, & Ramirez, 2011). A further limitation to the generalizability of the results is that the sample only included children and adolescents between ages 7 and 18 and so the results cannot be generalized to younger children. Replication of the findings of this study using a sample with both clinical and community participants and a larger age range would increase the generalizability of the results.

Another broad limitation includes the unequal distribution of the participants across the groups. As mentioned above, previous research has indicated significant differences in neuropsychological functioning and trauma history with PTSD, however this study failed to replicate such findings. There are many reasons the study may have failed to replicate significant findings, namely the control group was clinic referred, which likely contributed to an underestimate of the impact of trauma. Regardless, future research is needed with a larger, more representative sample to discount or support the study's findings.

An important limitation is that diagnoses were not based on structured interviews, which is the gold standard in clinical research. Although experienced clinical psychologists made the diagnoses, lack of concordance between structured clinical interviews and typical clinical evaluations has been noted in the literature (Rettew, Lynch, Achenbach, Dumenci, & Ivanova, 2009). Replication of this study using a structured clinical interview to inform diagnoses would strengthen the results. Another limitation is that no screening tool for PTSD was used to inform diagnosis and research indicates that using child report ratings on a PTSD screening measure “provided better fit

to a ‘best estimate diagnostic picture’ than parents’ ratings” (Rosner et al., 2012; Schemesh et al. 2005). Therefore, the next step in determining whether the CBCL-PTSD profile is a valid predictor of PTSS is to evaluate the CBCL-PTSD profile against a gold standard criterion for child report because parent report can fail to predict and child report has shown to be more reliable.

Another limitation of the study is the use of a minimally validated measure, the Milot et al. (2013) CBCL-PTSD profile. Before this study, this profile had not been compared to the other profiles and so it is important that additional studies examine the differences between the profiles to discount or support the study’s findings. Additionally, the optimal cut-off score of 4 that is proposed in this study for the Milot et al. (2013) CBCL-PTSD profile needs further validation.

Conclusion

Researchers have identified the need for more research on the impact of trauma on the functioning of children and adolescents, and further examination of PTSD screening tools (Beers & Bellis, 2002; Rosner et al., 2012). This study begins to address these needs by examining a screening profile for PTSS that could be easily incorporated into psychological assessments and contributing to the developing literature surrounding neuropsychological, academic, emotional, and behavioral functioning in children exposed to trauma. The results from this study suggest there is some utility in using the Milort et al. (2013) CBCL-PTSD profile as a screener for PTSS, however the limitations discussed in this study should be addressed to obtain stronger statistical results. The results suggest that the individuals with trauma history and elevation on the CBCL-PTSD profile are likely to have slower fine motor skills, higher externalizing problems, higher depression

symptoms, more somatic complaints, more unstable personality traits, and higher current stressful experiences than clinical controls. The results also suggest those with trauma history and elevation on the CBCL-PTSD profile and those with an elevation on the CBCL-PTSD profile and no trauma history are likely to have higher internalizing problems, anxious-depressed symptoms, and anxiety symptoms than clinical controls and those with trauma history only. Overall the study showed that those with trauma history and elevation on the CBCL-PTSD profile tend to perform lower on neuropsychological and academic functioning measures and have non- higher psychiatric symptoms than those those with trauma history only, elevated CBCL-PTSD profile only, and clinical controls. The study provides necessary support for exploring the relationship between neuropsychological, academic, emotional, and behavioral functioning in children exposed to trauma further. Although there are several limitations due to the nature and design of this study, it is hoped that this exploratory study will led to more in-depth research in the future.

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