THE ASSOCIATION BETWEEN COMPLEX TRAUMA
AND EXECUTIVE FUNCTIONING
AMONG AN ADOLESCENT INPATIENT POPULATION

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Abstract

The purpose of this study was to examine the association between executive functioning and complex trauma within an adolescent inpatient population. This study utilized archival data on 39 subjects from the University of Massachusetts Continuing Care Adolescent Treatment Program, an inpatient long-term psychiatric facility that is funded by the Massachusetts Department of Mental Health. The study explored the contribution of theory through a developmental transactional model and attachment perspective, and reviewed the neurobiological underpinnings typically present among individuals with a history of chronic and severe trauma. Using a descriptive group comparison approach, the study hypothesized that adolescents with complex trauma, defined as history of being in custody of the Massachusetts Department of Children and Families (DCF), would have decreased executive functioning scores on standardized neuropsychological testing measures. Clinical restraint was also explored as a potential behavioral indicator of executive functioning. Predictor variables were condensed using exploratory factor analysis. Results suggested lower performance in the executive realm of categorization, switching and inhibitory skills in the DCF custody group. A higher incidence of restraint over course of hospitalization was found among adolescents with a history of DCF custody. However, when controlling for trauma history using stepwise linear regression, no relationship was found between executive functioning skills and incidence of clinical restraint. This finding suggests that contributions other than executive functioning skills may play a role in incidence of restraint, such as language and history of
trauma. The results suggest a vulnerability to ongoing risk for neurodevelopmental challenges in adolescents with a chronic and severe trauma history. Future research might strive to identify effective strategies to improve cognitive outcome and potentially diminish the long-term consequences of child abuse and neglect.
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DEDICATION

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Chapter One

Statement of the Problem

In the year 2008, approximately 772,000 children were found by child protective agencies to be victims of maltreatment (US Department of Health and Human Services, 2010). Adults, whom should be relied upon for proper caregiving and nurturance, are a source of terror in the lives of many children. When the perpetrator of violence is a caregiver, the betrayal a child experiences can be devastating and multifaceted. Children exposed to chronic and severe trauma are at risk for a loss of core capacities for self-regulation and interpersonal relatedness. They often experience lifelong problems, such as cognitive, legal, vocational, and family difficulties, which place them at risk for additional trauma exposure and cumulative impairment, such as psychiatric and addictive disorders and chronic medical illness.

Children who have been exposed to chronic and severe trauma are vulnerable to lifelong neurobiological implications. Preliminary studies have shown that many factors can adversely impact the neurodevelopment of maltreated children. This process of altered development often manifests itself as delays in or deficits of multisystem developmental achievements in cognitive and psychosocial function, behavioral and emotional regulation, antisocial behaviors, and poor academic achievement.

While studies have identified deficits in cognitive functioning among this population, there remains a lack of knowledge about the specific neuropsychological
implications found in inpatient adolescents with complex trauma histories, especially in regard to executive functioning (De Bellis, Hooper, Spratt, & Woolley, 2009). Executive functioning is linked to the integrity of the prefrontal cortex, which appears to be especially vulnerable to the effects of childhood trauma (De Bellis, Keshavan, & Shifflett, 2002). The current study explored this topic in an effort to gain a more thorough understanding of the impact that complex trauma may have on the developing brain.

This chapter begins with a description of acute versus chronic trauma, followed by a discussion of the current difficulties clinicians face in the diagnosis of trauma in terms of distinctions among traumatic events. A discussion concerning the diagnoses that are employed as a result of traumatic events follows, including the limitations of the PTSD diagnosis and the introduction of complex trauma, which is a more recent conceptualization of trauma and an alternative diagnostic term to PTSD. Next, the consequences of complex trauma are presented, which include removal from the home and placement in state custody as an indicator of a complex trauma history, and the impacts on cognitive functioning, executive functioning, and behavioral functioning. Finally, a summary and rationale for the current study is presented, including the research questions and hypotheses, and a brief description of the data source.
Trauma and Distinctions Among Traumatic Events

Psychological trauma is an emotional or psychological injury typically resulting from an extremely stressful or life-threatening situation. In contrast to how trauma has historically been understood, not all experiences of trauma lead to the same or similar outcomes (Friedman, 2010). Clinical experience with the PTSD diagnosis has shown that there are individual differences regarding the capacity to cope with catastrophic stress. Therefore, while some people exposed to traumatic events do not develop PTSD, others go on to develop the full-blown syndrome. Such observations have prompted the recognition that trauma, like pain, is not an external phenomenon that can be completely objectified. Like pain, the traumatic experience is filtered through cognitive and emotional processes before it can be appraised as an extreme threat. Because of individual differences in this appraisal process, different people appear to have different trauma thresholds some more protected from and some more vulnerable to developing clinical symptoms after exposure to extremely stressful situations (Friedman, 2010).

Currently, psychologists are advised to follow criteria determined by the American Psychiatric Association (APA) in assessing trauma. However, beyond the symptoms of Posttraumatic Stress Disorder (PTSD) as spelled out in the current *Diagnostic and Statistical Manual of Mental Disorders Fourth Edition-Text Revision* (DSM-IV TR; APA, 2000), there is growing recognition that both the severity and length of the traumatic experience have important implications in terms of the clinical effects of interpersonal violence on children.
**Acute trauma.** The distinction between *acute* and *chronic* trauma is crucial in understanding the implications for psychological adjustment during and after exposure to trauma (Garbarino, Kostelny & Dubrow, 1991). The symptoms of acute trauma are considered the result of a single incident and are often largely resolved after an initial adjustment phase. Children who have experienced an acute trauma, such as a serious one-time bullying incident at school, or the death of a loved one, typically can assimilate and make sense of their experience with the help of a supportive caregiver or a trained mental healthcare provider. Although the effects of an acute trauma can be longstanding, such as those associated with a hurricane and subsequent loss of home, reassurance that the child is safe again (over a period of time) is typically the extent of treatment required (Garbarino et al., 1991). The cognitive, emotional and behavioral consequences of acute trauma are typically short-lived and often fully resolved.

**Chronic trauma.** Chronic trauma is a more prolonged, repeated and severe exposure to a traumatic experience often with multifaceted consequences, including impaired brain development (National Child Traumatic Stress Network Complex Trauma Task Force, 2003). Chronic trauma in children and adolescents is often associated with neglect, beginning in early childhood, in addition to physical and sexual abuse. Cognitive, emotional and behavioral alterations in functioning typically take place within the victim and usually include the persistent symptoms of PTSD, as described in the *DSM-IV TR* (APA, 2000), as well as major changes in personality and in patterns of behavior. The effects are far-reaching in terms of overall
functioning, often persisting into adolescence and adulthood (Grossman, et al., 2003; Green, et al., 2000; Heim & Nemeroff, 2001).

In situations of chronic or prolonged trauma, clinical treatment typically builds on the child’s primary relationships (Ford, 2005; Garbarino et al., 1991). However, when a child cannot fall back on their primary relationships for support and reassurance, as is the case with most victims of chronic trauma, a young child is often left with minimal means of adaptation. In fact, children forced to cope alone in these circumstances often adapt in a dysfunctional manner (Lyons-Ruth, Zeanah, & Benoit, 1996; Smyke, Dumitrescu, & Zeanah, 2002). Lacking a sense of security, a child can have difficulty exploring the world through play, developing self-confidence, and maintaining motivation. A parent’s unpredictable or violent behavior can lead his/her child to have difficulty forming personal attachments, may foster relationships that are based on fear and insecurity, and can have long-lasting cognitive, emotional, and behavioral effects (Sroufe, Egeland, Carlson, & Collins, 2005). In a study evaluating psychosocial functioning in preadolescent youth who were placed in out-of-home care, interpersonal functioning, self-perception, mental health, and behavioral difficulties were found to be negatively impacted by emotional maltreatment (Taussig & Culhane, 2010).

**Diagnostic Categorization as a Result of Trauma**

Trauma has long been recognized as playing an important role in the development of mental disorders. However, it was only after the persisting triad of
symptoms (re-experiencing, avoidance, and hyperarousal) was better documented in Vietnam veterans and rape victims in the 1970s, that the diagnostic entity known as Posttraumatic Stress Disorder (PTSD) came to be formally recognized (Perrin, Smith, & Yule, 2000). Since then, concerns about the validity of the diagnostic criteria have been raised, particularly in regard to very young children or to the long-term effects of sexual and physical abuse (Herman, 1992a; Scheeringa, Zeanah, Drell, & Larrieu, 1995). The following sections will describe the historical diagnosis of PTSD and the diagnostic limitations, including an introduction to the term “complex trauma.”

**Posttraumatic Stress Disorder (PTSD).** PTSD is a syndrome defined by the intrusive re-experiencing of a trauma, avoidance of traumatic reminders, and persistent physiological arousal. PTSD is associated with high levels of comorbidity and may increase the risk for additional disorders over time. In 1980, the American Psychiatric Association added PTSD to the third edition of its Diagnostic and Statistical Manual of Mental Disorders (DSM-III) nosologic classification scheme. Although controversial when first introduced, the PTSD diagnosis has filled an important gap in psychiatric theory and practice (Friedman, 2010). From a historical perspective, the significant change ushered in by the PTSD concept was the stipulation that the etiological agent was outside the individual (i.e., a traumatic event) rather than an inherent individual weakness (i.e., trauma-induced anxiety; Friedman, 2010). The key to understanding the scientific basis and clinical expression of PTSD is the concept of "trauma."
There is considerable evidence that PTSD is a common outcome following exposure to both acute and chronic traumatic events, as has been demonstrated repeatedly by numerous major epidemiological studies and by the PTSD Field Trial (e.g. Kilpatrick, et al., 1998; Saunders, Kilpatrick, Hanson, Resnick, & Walker, 1999). Research supports that PTSD, with minor diagnostic modifications, is an adequate diagnosis to capture the effects of single incident trauma (i.e., acute trauma) in children who live in safe and predictable caregiving systems (Ackerman, Newton, McPherson, Jones, & Dykman, 1998). However, there have also been numerous studies demonstrating that exposure to a traumatic event increases the risk of many Axis I (Clinical) and Axis II (Personality) DSM-IV disorders (American Psychiatric Association [APA], 1994) and can also lead to long-term brain impairment. Clinicians and researchers are now beginning to speculate that a diagnosis of PTSD may not capture the full picture of the multifaceted consequences of severe and chronic trauma, more recently termed “complex trauma” (van der Kolk, Roth, Pelcovitz, Sunday, & Spinazzola, 2005).

**Diagnostic limitations of the current Posttraumatic Stress Disorder diagnosis.** PTSD, as it is understood historically, appears to be only part of a central posttraumatic response following exposure to a traumatic event, particularly if the event involves chronic and severe interpersonal violence (Dube et al., 2001). In fact, prolonged trauma often results in a loss of core capacities for self-regulation and interpersonal relatedness, in addition to long-term cognitive effects that are not captured under the label of PTSD (Bremner & Narayan, 1998; Bremner, Vermetten, &
Vythiligam, 2004; De Bellis, Keshavan, & Shifflett, 2002). In terms of cognitive effects, neuroimaging studies suggest brain structure may be altered and brain function may be impaired for women with childhood abuse-related PTSD when compared with either women who were abused but not diagnosed with PTSD or women with no abuse histories. A corresponding risk of chronic problems is seen in two self-regulatory domains: attention and information processing, and affect regulation (Ford, 2005). Research with rape victims (Burgess & Holstrom, 1974; Woon, Sood, & Hedges, 2010), battered women (Rollstin & Kern, 1998), and concentration camp survivors (Derevenco, 2004; Krystal, 1968) has shown significant long-term problems in the areas of attention, self-regulation, and personality structure. Complicated adaptations to severe and prolonged trauma are not confined to adulthood. Many longitudinal studies of traumatized children have found problems with maladaptive behaviors such as unmodulated aggression and impulse control (e.g. Burgess, Hartman, & McCormack, 1987), attentional and dissociative problems (e.g. Teicher, Andersen, Polcari, Anderson, Navalta, & Kim, 2003), and difficulty negotiating relationships with caregivers, peers, and subsequently, marital partners. These types of difficulties are often described as symptoms associated with many Axis I and II DSM-IV disorders.

Despite the ubiquitous occurrence of numerous posttraumatic problems other than PTSD, such as developmental alterations in biological, psychological, and interpersonal regulatory capacities (Allen & Oliver, 1982; Beers & De Bellis, 2002; Cassidy & Mohr, 2001; Dube et al., 2001; Felitti et al., 1998), the relationship
between PTSD and these multiple other symptoms associated with early and prolonged trauma has historically received surprisingly little attention. The magnitude of psychological difficulties inevitably leads clinicians to apply numerous diagnostic labels to the child to fully capture their presenting concerns (National Child Traumatic Stress Network, 2003; van der Kolk, et al., 2009), which is considered a significant limitation to the current *DSM-IV* PTSD diagnosis (Cook et al., 2005; Ford, 1999).

In the PTSD literature, psychiatric problems that do not fall within the framework of PTSD are generally referred to as “comorbid conditions,” seeming to indicate an additional disorder that might mistakenly be viewed as unrelated to the primary diagnosis of PTSD (Ford, 1999; van der Kolk, Roth, Pelcovitz, Sunday, & Spinazzola, 2005). In relegating other disorders to an additional diagnostic category, fundamental trauma-related disturbances, such as brain impairment, aggressive behavior or somatization, might not receive as much research attention as is warranted, and clinicians run the risk of applying treatment approaches that are not the most direct or helpful (Amaya-Jackson & DeRosa, 2007; see also Spinazzola, Blaustein, & van der Kolk, 2005).

**Complex trauma.** The traumatic stress field has adopted the term “complex trauma” to describe the multifaceted experience of multiple, chronic and prolonged developmentally adverse traumatic events, most often of an interpersonal nature (i.e., sexual or physical abuse) and with early-life onset (National Child Traumatic Stress Network Complex Trauma Task Force, 2003). Exposure to trauma that is considered
chronic and severe often occurs within the child’s caregiving system and includes physical, emotional and educational neglect and general child maltreatment beginning in early childhood (National Child Traumatic Stress Network Complex Trauma Task Force, 2003).

There is great developmental risk for children who live in violent homes and who routinely operate in “survival mode.” They may begin to create a manner of skewed, yet adaptive, functioning that can permeate every aspect of their lives. For example, a child experiencing physical abuse at the hand of a primary caregiver in their home environment might seek to gain control in his life through self-mutilation. This behavior is adaptive in the sense that it provides a means of coping with a traumatic experience that is otherwise psychologically unbearable. Children exposed to complex trauma often experience lifelong cognitive, emotional and behavioral problems that place them at risk for additional trauma exposure and cumulative impairment extending into adulthood (Dube et al., 2001).

In most cases of treatment with children and adolescents who have been exposed to complex trauma, PTSD is not the most common psychiatric diagnosis (Putnam, 2003). As discussed above, children exposed to chronic trauma often meet diagnostic criteria from the DSM-IV for depression, attention-deficit/hyperactivity disorder (ADHD), oppositional defiant disorder (ODD), conduct disorder, anxiety disorders, eating disorders, sleep disorders, communication disorders, separation anxiety disorder, or reactive attachment disorder. In one study of 364 abused children (Ackerman, Newton, McPherson, Jones, & Dykman, 1998), the most common
diagnoses in order of frequency were separation anxiety disorder, ODD, phobic disorders, PTSD, and ADHD. Each of these diagnoses appears to capture only a limited aspect of the traumatized child’s complex self-regulatory and relational impairments (Busuttil, 2009; van der Kolk, 2005), whereas a single diagnosis might fully capture the entire scope of dysfunction allowing for more precise and effective treatment (Najjar, Weller, Weisbrot, & Weller, 2008).

Whether or not they exhibit symptoms of PTSD, children who have developed in the context of ongoing danger, maltreatment, and inadequate caregiving systems are believed to be ill-served by the current diagnostic system, as it frequently leads to no diagnosis, multiple unrelated diagnoses, an emphasis on behavioral control without recognition of interpersonal trauma, and a lack of attention to ameliorating the developmental disruptions that underlie the symptoms (van der Kolk et al., 2009). Valid diagnostic classification of complex trauma sequelae in children awaits formal epidemiological research. However, leading researchers in the field (such as authors of the National Child Traumatic Stress Network White Paper on Complex Trauma in Children and Adolescents) believe that the “phenomenologically-based framework for the impact of complex trauma exposure possesses sufficient clinical utility to serve as a vitally needed starting place for research, treatment development, and policy initiatives bearing on children’s adaptation to complex trauma exposure” (p.6).

The DSM-IV field trial for PTSD was conducted between 1990 and 1992 to (a) investigate the placement of various PTSD symptom clusters (Kilpatrick, et al., 1998) and (b) to explore whether victims of chronic interpersonal trauma as a group
tended to meet diagnostic criteria for PTSD or whether their psychopathology was more accurately captured by another constellation of symptoms, such as those commonly mentioned in the research literature on child abuse, concentration camp victims, and domestic battering that were not captured by the PTSD criteria. The committee thoroughly reviewed the research on these populations and organized the most frequently studied symptoms under the rubric of disorders of extreme stress not otherwise specified (DESNOS; Herman, 1992a).

The DESNOS symptom constellation was the result of a collaborative effort between two groups, one based in New York (Spitzer, Kaplan, & Pelcovitz as cited in Pelcovitz et al., 1997), the other in Boston (see Herman & van der Kolk, 1987) in order to capture the multifaceted consequences of interpersonal violence on children. The two groups reviewed the existing research literature on trauma in children, on female victims of domestic violence, and among concentration camp survivors. They generated a list of 27 symptoms frequently described in, but not addressed, by DSM-III-R criteria for PTSD. Judith Herman (1992a, 1992b) arranged these 27 symptoms shown by research to be associated with early interpersonal trauma into seven categories most recently described by Courtois (2008) below.

1. *Alterations in the regulation of affective impulses*, including difficulty with modulation of anger and self-destructiveness. This category has come to include all methods used for emotional regulation and self-soothing.

2. *Alterations in attention and consciousness*, leading to amnesias and dissociative episodes and depersonalization. This category includes
emphasis on dissociative responses different than those found in the *DSM* criteria for PTSD.

3. *Alterations in self perception*, such as a chronic sense of guilt and responsibility, and ongoing feelings of intense shame.

4. *Alterations in perception of the perpetrator*, including incorporation of his or her belief system. This criterion addresses the complex relationships and belief systems that ensue following repetitive and premeditated abuse at the hands of primary caretakers.

5. *Alterations in relationship to others*, such as not being able to trust and not being able to feel intimate with others.

6. *Somatization and/or medical and cognitive problems*. Somatic reactions and medical conditions may relate directly to the type of abuse suffered and any physical damage that was caused or they may be more diffuse. They have been found to involve all major body systems.

7. *Alterations in systems of meaning*. Chronically-abused individuals often feel hopeless about finding anyone to understand them or their suffering. They despair of ever being able to recover from their psychic anguish.

The field trial workgroup hypothesized that (a) chronic interpersonal trauma starting an at early age gives rise to a greater prevalence of DESNOS symptomatology than either interpersonal trauma later in the life cycle or in victims of accidents and natural disasters; and (b) a substantial number of individuals with histories of childhood trauma would meet criteria for DESNOS but not for PTSD. Participants in the “treatment seeking” sample (n=400) were seeking mental health
treatment after exposure to high or low magnitude stressful life events. The community sample (n=128) was recruited from 704 adults via telephone interviews using random digit dialing (Kilpatrick et al., 1998). Structured interviews were used to screen for high or low magnitude stressful life events and PTSD. The prevalence of each of the DESNOS symptom items was examined with the Structured Clinical Interview (SCID-DESNOS) instrument specifically designed for purposes of the study.

Findings from the *DSM-IV* PTSD Field Trial (Kilpatrick et al., 1998) demonstrated the following:

1. Early (e.g., in childhood) interpersonal traumatization gives rise to more complex posttraumatic psychopathology than later (e.g. in adulthood) interpersonal victimization.

2. Symptoms occur in addition to PTSD symptoms and do not necessarily constitute a separate cluster of symptoms.

3. The younger the age of onset of the trauma, the more likely an individual is to suffer from the cluster of DESNOS symptoms, in addition to PTSD.

4. The longer individuals were exposed to traumatic events, the more likely they were to develop both PTSD and DESNOS.

5. Although the community sample and the treatment-seeking sample had approximately the same prevalence of PTSD symptoms, almost half of the treatment-seeking sample and not the community sample also met criteria for DESNOS, suggesting that DESNOS symptoms, rather than PTSD, may cause individuals to seek treatment.

The *DSM-IV* Field Trial for PTSD supported the notion that trauma, particularly trauma that is prolonged, that first occurs at an early age and that is of an
interpersonal nature, can have significant effects on psychological functioning beginning in childhood and extending throughout adulthood above and beyond the current PTSD symptomatology (Kilpatrick et al., 1998; van der Kolk et al., 2005). These effects include problems with affect dysregulation, aggression against self and others, dissociative symptoms, somatization, and later character pathology in adults. The various symptoms tend to cluster into distinct patterns, are highly interrelated, and fall under the Disorders of Extreme Stress, Not Otherwise Specified (DESNOS) symptom constellation.

Since the DSM-IV PTSD Field Trial, these symptoms have come to be referred to as Developmental Trauma Disorder, which is a construct developed by researchers to investigate potential inclusion in the upcoming DSM-5 given the support the diagnosis has received particularly in the past five years (Najjar et al., 2008). According to proponents of the diagnosis, the goal of introducing the diagnosis of Developmental Trauma Disorder is to capture the reality of the clinical presentations of children and adolescents exposed to chronic interpersonal trauma, thereby guiding clinicians to develop and utilize effective interventions and for researchers to study the neurobiology and transmission of chronic interpersonal violence (Busuttil, 2009; Najjar et al., 2008; van der Kolk et al., 2009).

**Developmental Trauma Disorder and DSM-5 Planning**

Publication of the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) is scheduled for May of 2013. The workgroup assigned to
the revision of the Posttraumatic Stress Disorder (code 309.81) diagnosis has focused considerable discussion on the merits of adding Developmental Trauma Disorder as a new syndrome to DSM-5. Developmental Trauma Disorder, as well as Disorders of Extreme Stress, Not Otherwise Specified are constructs that are considered “under review” and workgroups will make a recommendation about their inclusion after further assessment of the empirical evidence for each individual diagnosis.

In addition to the two new trauma diagnoses described in the preceding paragraph, the trauma workgroup has also proposed a revision to the current Posttraumatic Stress Disorder diagnosis to include the following symptom criteria:

Negative alterations in cognitions and mood that are associated with the traumatic event(s) (that began or worsened after the traumatic event(s)), as evidenced by 3 or more of the following: NOTE: In children, as evidenced by 2 or more of the following:

1. Inability to remember an important aspect of the traumatic event(s) (typically dissociative amnesia; not due to head injury, alcohol, or drugs).

2. Persistent and exaggerated negative expectations about one’s self, others, or the world (e.g. “I am bad,” “no one can be trusted,” “I’ve lost my soul forever,” “my whole nervous system is permanently ruined,” “the world is completely dangerous”).

3. Persistent distorted blame of self or others about the cause or consequences of the traumatic event(s)
4. Pervasive negative emotional state—for example: fear, horror, anger, guilt, or shame

5. Markedly diminished interest or participation in significant activities

6. Feeling of detachment or estrangement from others

7. Persistent inability to experience positive emotions (e.g., unable to have loving feelings, psychic numbing) ([www.DSM5.org](http://www.DSM5.org), 2012)

**Indicators and Consequences of Complex Trauma**

The following sections will introduce research findings related to the indicators and consequences associated with exposure to complex trauma, including the high frequency of children and adolescents in state custody; the relationship between a complex trauma history and impaired cognitive and executive functioning, as well as the behavioral consequences, including the use of various coping strategies; and the occurrence of chemical and physical restraint on psychiatric inpatient units.

**State custody as an indicator/consequence.** The Department of Children and Families (DCF) is the Massachusetts state agency charged with the responsibility of protecting children from child abuse and neglect. The state of Massachusetts has developed Screening, Investigation and Assessment Guidelines for professionals in the Department of Children and Families (DCF) in order to provide direction to county social service agencies; to promote statewide consistency in definition and practice; and to inform the general public about types of child safety concerns that
should be reported (Department of Children and Families, 2010). According to the Director of Adolescent Services in the Department of Children and Families Central Office (M. Fallon-Messeder, personal communication, December 14, 2010), there are three overarching reasons why the state will assume custody of an adolescent. The first is through a CHINS, or Child in Need of Services petition. A Child in Need of Services (CHINS) matter is a court case in which the Juvenile Court tries to help parents and school officials deal with troubled youth. The person filing the CHINS petition must show the judge that the child (a) regularly runs away from home, or (b) constantly disobeys the commands of a parent or legal guardian, or (c) misses school on a regular basis, or (d) constantly fails to follow school rules. If the judge or jury concludes that the child is a Child in Need of Services, the judge may decide to place the child or adolescent in the care and custody of DCF.

The second reason for seeking custody is one in which the parent/caregiver initiates removal of the adolescent from the home. This type of request most typically occurs when the parent is unable to care for the adolescent due to medical reasons. The third reason that the state may seek custody is via substantiated cases of neglect, physical or sexual abuse or maltreatment. When maltreatment is suspected, such as neglect, physical or sexual abuse, or psychological maltreatment, state protective services launch an investigation. Neglect, in particular, is defined as failure to provide for or supervise one’s child (De Bellis, Hooper, Spratt, & Woolley, 2009). In a young child, caregiver neglect can be life-threatening. If maltreatment is substantiated, the
State is required to physically separate or remove the victim(s) from their primary caregiver.

State social workers rely on written criteria and guidelines for removing a child from the home that speaks to a chronic and severe pattern of maltreatment in order to justify residential placement outside of the home. By definition, removal from the home and placement in state custody via a substantiated case of neglect or maltreatment means that a child or adolescent has experienced multiple traumatic events occurring within the caregiving system over a prolonged period of time, which defines the nature of the term, complex trauma. Typically, complex trauma exposure refers to the simultaneous or sequential occurrences of child maltreatment, including emotional abuse and neglect, sexual abuse, physical abuse, and witnessing domestic violence, that are chronic and begin in early childhood.

State custody is found throughout the trauma literature as having a positive association with a complex trauma history (Lyons, Kisiel, Dulcan, Cohen, & Chesler, 1997; Masten et al., 2008; Romansky, Lyons, Lehner, & West, 2003). Children and adolescents in state custody often demonstrate a full range of psychiatric impairment. In fact, research found, in a sample of 383 children and adolescents in state custody, that risk behaviors including suicidality, dangerousness, and runaway tendency are a significant predictor of psychiatric hospitalization (Lyons, Kisiel, Dulcan, Cohen, & Chesler, 1997). Review of custody status has also been highlighted by researchers as part of a recommended clinical interview/assessment when evaluating individuals with a trauma history (Courtois, 2008).
Impact of complex trauma on cognitive functioning. Of particular concern are prospective studies that have shown that children of abusive and neglectful parents demonstrate impaired cognitive functioning by late infancy when compared with non-abused children (Egeland, Sroufe, & Erickson, 1983). Under the stress of chronic trauma, abused and neglected children’s analytical capacities tend to disintegrate, leaving them with disorganized cognition (Teicher, Andersen, Polcari, Anderson, & Navalta, 2002). The sensory and emotional deprivation associated with chronic trauma appears to be particularly detrimental to cognitive development; neglected infants and toddlers demonstrate delays in expressive and receptive language development, as well as deficits in overall IQ (Culp et al., 1991).

By early elementary school, children with trauma histories are more frequently referred for special education services. Trauma exposure is associated with lower grades and poorer scores on standardized tests and other indices of academic achievement. These children have three times the dropout rate of the general population. Similar findings have been demonstrated across a variety of trauma exposures (e.g., physical abuse, sexual abuse, neglect, exposure to domestic violence) and cannot be accounted for by the effects of other psychosocial stressors, such as poverty (Shonk & Cicchetti, 2001; Trickett, McBride-Chang & Putnam, 1994). In a study examining the association between child maltreatment (abuse and neglect) and long-term cognitive outcomes within a prospective birth cohort of 7223 children, Mills et al. (2011) found that both child abuse and child neglect are independently associated with impaired cognition and academic functioning in adolescence. The
principal predictor variable in this study was notification to the state child-protection
authority for suspected maltreatment (abuse, neglect, or both). These findings suggest
that both abuse and neglect have independent and important adverse effects on a
child's cognitive development.

**Impact of complex trauma on executive functioning.** Executive functions
are a collection of processes that are responsible for guiding, directing, and managing
cognitive, emotional, and behavioral functions, particularly during active, novel
problem-solving (Gioia et al., 2000; Lezak et al., 2004). According to Baron (2004),
executive functions are metacognitive capacities that allow an individual to perceive
stimuli from his or her environment, respond adaptively, flexibly change direction,
anticipate future goals, consider consequences, and respond in an integrated or
common-sense way, utilizing all of these capacities to serve a common purposive
goal.

In middle childhood and adolescence, the most rapidly developing brain areas
are those responsible for three core features of executive functioning necessary for
autonomous functioning and engagement in relationships (Zillmer & Spiers, 2001).
These features, involving primarily the prefrontal cortex, are conscious self-
awareness and genuine involvement with other people, the ability to assess the
valence and meaning of complex emotional experiences, and the ability to determine
a course of action based on learning from past experience. Developed executive
functioning also includes the ability to conduct oneself based on an accurate
understanding and appreciation for another person’s perspective (Strauss, Sherman, &
Spreen, 2006). In addition, the executive functions entail goal setting, anticipating consequences, and initiating and carrying out plans. These abilities are all highly important by the time children reach their adolescent years in order for them to achieve academic and social success and for establishing vocational goals (Dawson & Guare, 2010; Massachusetts Advocates for Children, 2005). Traumatic stressors or prior deficits in self-regulatory abilities that manifest during adolescence, in the absence of sustaining relationships (which in adolescents often involves peers as well as adults), may lead to disruptions in self-regulation (e.g., eating disorders), interpersonal mutuality (e.g., conduct disorders), reality orientation (e.g., thought disorder), or a combination of these critical competencies (e.g., borderline personality disorder; chronic addiction), as highlighted in a White Paper (2003) written by the National Traumatic Stress Network Complex Trauma Task Force.

Developmental studies through adolescence demonstrate a time-related course of emergence for specific subdomains of executive function, including inhibitory control (Diamond, 1991; Keele, Ivry, Mayr, Hazeltine, & Heuer, 2003; Passler, Isaac, & Hynd, 1985), flexible problem solving (Chelune & Baer, 1986; Rothbart, Ellis, Rueda, & Posner, 2003), and planning (Klahr & Robinson, 1981). In their book entitled, “Executive Skills in Children and Adolescents,” Dawson and Guare (2010) note that the self-regulation and self-control skills such as planning, time management and especially inhibition, begin to develop in early infancy and continue to develop well into adolescence and early adulthood. As is the case with most dimensions of psychological and neuropsychological development, the development of executive
Control functions vary across individuals in terms of both the timing of the emergence of specific subdomains and the final endpoint (Rueda, Posner, & Rothbart, 2005); however, research indicates that a second period of significant growth (after the initial peak at age five) begins around age 11 or 12. Research indicates that this growth spurt in the brain prior to adolescence occurs primarily in the frontal lobes (Dawson & Guare, 2010; Ford, 2005), as if the brain is preparing itself both for the development of executive skills as well as for the significant demands that will be made on executive skills during adolescence (Dawson & Guare, 2010).

In order to study the development of executive attention in children, Rueda et al. (2005) used conflict tasks, combined with parent-reported questionnaires. The ability to deal with conflict in young children appears to be related to parent-reported measures of effortful control, supporting the connection between executive attention and self-control skills. The authors found considerable improvement in the ability to resolve conflict between 2 and 5 years of age, and continuous improvement up to 7 years, when children appear to reach the adult level of performance.

A traumatized adolescent can develop a narrowed and bleak perspective, expectations of failure, a low sense of self-worth, and a foreshortened view of the future, all of which disrupt their ability to plan, anticipate and hope (National Child Traumatic Stress Network Complex Trauma Task Force, 2003). Van der Kolk (2005) theorizes that because traumatized children often have distorted inner representations of the world, they have no “internal maps to guide them” and that, consequently, they “act instead of plan” (p. 403), suggesting a deficit in executive functioning. Recent
research findings have in fact shown in a high-risk sample (based on low socioeconomic functioning, familial alcoholism, family psychopathology, and other risk factors) of both boys and girls (n=498) in contrast to a community sample of families drawn from the same neighborhoods that personality and executive functioning were related to the development of problem behavior in children (Martel et al., 2007). Specifically, poor response inhibition, low reactive control, and low resiliency contributed to the development of internalizing and externalizing problems.

It is of particular interest that by early childhood, children with trauma histories demonstrate less flexibility and creativity in problem-solving tasks than same-age peers. Children and adolescents with a diagnosis of PTSD secondary to abuse or witnessing violence demonstrate deficits in attention, abstract reasoning, and executive function skills (Beers & De Bellis, 2002). In an ethnically diverse sample of 62 children who witnessed intimate partner violence (n = 27 with PTSD and 35 without PTSD), children with PTSD exhibited slower and less effective learning, heightened sensitivity to interference, and impaired effect of rehearsal on memory acquisition on the California Verbal Learning Test - Children's Version, a word list learning task. Both groups performed in the below average range on measures of executive functioning, attention, and intellectual ability (Samuelson, Krueger, Burnett, & Wilson, 2010).

A failure to engage effectively in higher order processing is consistent with what researchers know about the effects of trauma on the developing child’s brain (De Bellis, 2005; van der Kolk, 2003). The prefrontal cortex, described above as the
area of the brain primarily responsible for the development of the executive functions, has been shown to be adversely affected by trauma (De Bellis, 2005). One study found significant deficits in executive function and abstract reasoning among 14 pediatric psychiatric outpatients with maltreatment-related PTSD (mean age = 11) when compared to 15 socio-demographically similar children (mean age = 12) who were healthy with no history of trauma (Beers & De Bellis, 2002). Although based on a small number of subjects, the authors concluded that the results support cognitive differences between children with and without maltreatment-related PTSD. In another study, boys from early childhood to middle-school age with severe abuse histories had particular difficulty with executive function tasks that required them to refrain from taking actions that would lead to adverse consequences (Mezzacappa, Kindlon, & Earls, 2001). In contrast, the non-abused, psychiatrically-impaired children in this study showed a gradual increase in executive function skills that lags behind but, over time, approximates the growth curve of normative matched controls. Overall, the findings from this study suggested that child abuse in boys may negatively influence the expected developmental progression of competence in certain executive functions, suggesting that further study is warranted.

There are limitations, however, to the foregoing studies. The Mezzacappa et al. (2001) study was limited in that the sample did not include females and only non-standardized measures of executive functioning were utilized. Beers and De Bellis (2002) studied neuropsychological function, which included executive control, in
children with maltreatment-related posttraumatic stress disorder, but did not
differentiate between complex trauma and a *DSM-IV* PTSD diagnosis.

**Impact of complex trauma on behavioral functioning.** Complex childhood
trauma is associated with both under-controlled and over-controlled behavior patterns
that may be due to the re-enactment of specific aspects of traumatic experiences (e.g.,
aggression, self-injurious behaviors, sexualized behaviors, controlling relationship
dynamics; Cook et al., 2005). Such behaviors serve a number of functions for
children with trauma histories, including automatic behavioral reactions to reminders
(e.g., the child might avoid situations reminiscent of the trauma), attempts to gain a
sense of mastery or control, avoidance of intolerable levels of emotional arousal, or
attempts to achieve acceptance and intimacy. Children with abuse histories may
demonstrate rigidly controlled behavior patterns as early as the second year of life
(Crittenden & DiLalla, 1988). Childhood trauma exposure also has been shown to be
associated with the development of aggressive behavior and oppositional defiant
disorder extending into adolescence (Lyons-Ruth, Zeanah, & Benoit, 1996).

Abused children cope with threatening events and feelings of helplessness by
restricting their processing of what is happening around them and may use one of two
strategies to cope: over-controlled or under-controlled behavior. Over-control is a
strategy that may counteract the feelings of helplessness and lack of power that are
often a daily struggle for chronically-traumatized children. Abused children
demonstrate rigidly-controlled behavior patterns, such as compulsive compliance
(Crittenden & DiLalla, 1988). Many traumatized children are very resistant to
changes in routine and display rigid behavioral patterns, including inflexible 
bathroom rituals and eating problems with rigid control of food intake.

Under-controlled, or impulsive behavior, may be due in part to deficits in 
executive functions, most specifically related to decreased inhibition (Beers & De 
Bellis, 2002; Mezzacappa, Kindlon, & Earls, 2001). One consequence of impaired 
executive functioning is an increase in aggression both toward self and others (Beers 
& De Bellis, 2002). Research has shown that early trauma is significantly associated 
with the development of impulse control disorders such as Oppositional Defiant 
Disorder (ODD), a behavioral disorder associated with decreased inhibition. In 
addition, Martel et al. (2007) reported positive findings related to the development of 
externalizing problem behavior in a high-risk sample that was described earlier in this 
chapter.

To clarify whether the PTSD diagnosis is specifically associated with 
pathological behaviors or if traumatic exposure alone in the absence of a PTSD 
diagnosis (non-symptomatic individuals) is associated with significant impairments, 
Saigh and colleagues (2002) conducted a study that found adolescents diagnosed with 
PTSD to have significantly higher scores on the externalizing indices of the Child 
Behavior Checklist (CBCL; Achenbach, 2001) compared to adolescents with trauma 
histories without a PTSD diagnosis and compared to nonclinical controls. In another 
study examining complex posttraumatic sequelae, clinicians reported that a large 
percentage of the children they treated exhibited several forms of posttraumatic 
sequelae not captured by the symptoms of PTSD (Spinazzola et al., 2005). Notably,
50% or more of the children in the study were reported to exhibit significant
disturbances in several domains, including behavioral functions, such as impulse
control and aggression or risk-taking. In addition, approximately one-third of the
sample demonstrated problems with conduct or oppositional behavior.

There are limitations, however, to the foregoing studies which examined
complex trauma and the potential for impact on behavioral functioning. Saigh and
colleagues (2002) did not differentiate between acute trauma, as it was described
above, versus a history of complex trauma. An examination of behavioral functioning
in the adolescent inpatient population is clearly an area warranting further study, as
externalizing symptoms have been shown to be associated with trauma exposure in
childhood and adolescence. Analysis of occurrence of clinical restraint on an inpatient
unit, a dependent measure in the current study, provides insight into the relationship
among executive functioning, behavioral functioning and a complex trauma history.

**Impact of complex trauma on frequency of clinical restraint.** A breakdown
in self-regulation and in the ability to communicate can escalate to such a level
among children and adolescents with a complex trauma history that physical or
chemical restraint may be required on an inpatient psychiatric unit. In fact, research
has shown that children living with unpredictable violence and repeated abandonment
often fail to develop appropriate language and verbal processing abilities, which may
lead to an increased need for restraint/seclusion (De Bellis, Hooper, Spratt, &
Woolley, 2009; Siegel, 1999). Due to language and learning challenges associated
with decreased executive functioning (De Bellis, Hooper, Spratt, & Woolley, 2009),
adolescents with these difficulties cannot as readily absorb therapeutic interventions and they have not been able to internalize coping skills, such as the ability to self-soothe in order to avoid behavioral escalation. They often lack the ability to self-monitor and self-regulate, which are skills necessary for metacognition.

Isquith, Crawford, Espy, and Gioia (2005) have raised questions about the ecological validity of clinical measures of executive skill. Yet metacognition, a large part of executive functioning, is difficult to measure in an ecological manner. Executive skills are most in demand in the face of complex, open-ended tasks requiring problem solving, such as the difficulties that arise on a daily basis on an inpatient psychiatric unit.

Research has reported the association between externalizing problems and executive function weaknesses in a high-risk sample of children, a finding which suggests that there may be an increased need for clinical restraint/seclusion among a traumatized inpatient adolescent population (Martel et al., 2007). In addition to aggression, restraint may also be put in place due to suicidal ideation or other behaviors suggesting a tendency to self-harm.

Evaluation of psychiatric restraint is important, as individuals who experience inpatient seclusion or restraint often describe the experience as traumatic (Bonner, Lowe, Rawcliffe, & Wellman, 2002). This is particularly salient for individuals with a previous history of trauma, as the experience can lead to a re-experiencing of previous trauma (National Association of State Mental Health Program Directors,
Physical and chemical restraint and seclusion measures are to be considered a last resort among psychiatric nursing staff and only put in place in order to avoid harm to the patient him/herself or to others in the nearby vicinity (National Association of State Mental Health Program Directors, 2007).

The state of Massachusetts has called for a Restraint/Seclusion Reduction Initiative (RSRI) and all state-funded psychiatric hospitals must comply. Specifically, in November 2000, the Massachusetts Department of Mental Health (DMH), through its Licensing and Child/Adolescent Services Divisions, embarked on a mission to reduce and ultimately eliminate the use of restraint and seclusion in all child and adolescent inpatient and intensive residential treatment facilities in the state. Between November 2000 and January 2005, episodes of restraint and seclusion (per 1,000 patient days) decreased 84.4%, 80.4% and 78.7%, respectively, in child (ages 5-12), adolescent and mixed child/adolescent units. This work is ongoing.

In the fall of 2004, the Massachusetts DMH was one of eight states selected by the United States Department of Health and Human Services (HHS) Substance Abuse and Mental Health Services Administration (SAMHSA) to receive a State Infrastructure Grant (SIG) to develop alternatives to restraint and seclusion in DMH-operated and contracted adult inpatient facilities, which also include three adolescent inpatient units. DMH began this new initiative to reduce/eliminate restraint and seclusion in their facilities in July of 2005. Given the importance of the Restraint/Seclusion Reduction Initiative in Massachusetts and the belief that restraint among individuals with a trauma history can actually be more harmful, part of this
study explores the relationship among incidence of restraint, history of complex trauma, and executive functioning.

**Summary and Rationale for the Current Study**

Complex trauma exposure is the experience of multiple or chronic and prolonged, developmentally adverse traumatic events, most often of an interpersonal nature and with early-life onset. These exposures often occur within the child’s caregiving system and include physical and emotional neglect and maltreatment beginning in early childhood (Cook et al., 2005). Many children with a history of complex trauma are removed from their primary caregiver and often placed in the custody of the state. Although affected children and adolescents often meet criteria for PTSD, expressions of psychopathology typically extend beyond the symptoms captured by the current PTSD diagnosis, and often include psychiatric disorders and functional deficits in the areas of attachment, anxiety, mood, eating, substance abuse, attention and concentration, impulse control, dissociation, somatization and chronic medical problems, sexual behavior and development, and learning and scholastic performance (Spinazzola et al., 2005). In addition, cognitive and behavioral consequences have been identified by clinicians working with the complex trauma population as particularly salient and far-reaching into adolescence and throughout the lifespan.

Authors of the *DSM-IV* Field Trial study concluded that it “seems of paramount importance to address critically the fact that psychiatric disorders,
categorically defined, frequently occur together, and that many disorders, in particular PTSD, seem to occur rarely in pure form, without comorbidities. It is clear that traumatized individuals develop a range of shifting maladaptive patterns, depending on their stage of development, social support, and relationship to the origin of the trauma” (van der Kolk et al., 2005, p. 396). The DSM-IV Field Trial paved the way for potential inclusion of Developmental Trauma Disorder and/or DESNOS symptoms in the DSM-5. It was therefore deemed highly important to investigate the potential cognitive associations that may occur with complex trauma in an effort to enhance the literature and highlight the importance of this proposed diagnosis.

Individuals with histories of complex interpersonal trauma are unique in the sheer magnitude of the multifaceted consequences. Although typically referred for internalizing and externalizing disorders, adolescents hospitalized for inpatient psychiatric care are often found to have a high rate of complex trauma histories, which are often treated only secondarily. The distinct implications of trauma on so many different areas of mental and behavioral functioning are just beginning to be fully understood. The presence of symptoms associated with complex trauma have been shown to be a powerful negative prognostic indicator of treatment outcome and behavioral disturbance in diverse clinical samples, further indicating a need for in-depth evaluation of each of the seven domains of impact related to complex trauma, which were outlined earlier in this chapter (e.g. Ford & Kidd, 1998). In traumatized patients with histories of early abuse, the treatment of other problems, such as loss of emotional regulation, dissociation and interpersonal problems, or cognitive
difficulties might be prioritized because they theoretically cause more functional impairment than the typical PTSD symptoms (van der Kolk et al., 2005).

The adverse effects of complex trauma can impair the natural developmental progression of cognitive ability, and specifically, the development of executive control. In some realms of cognitive function, early injury, such as that imposed by chronic trauma beginning in childhood, may disrupt the acquisition of basic competencies which provide necessary foundations for later development. There is therefore emerging speculation that chronic trauma may have an impact on the development of the prefrontal cortex of the brain. The effects can be long-lasting, extending through adolescence and into adulthood (Beers & De Bellis, 2002). Investigation of executive functioning ability associated with complex trauma beginning in early childhood may be useful in order to identify more specific cognitive strengths and weaknesses that may confront adolescents with a history of complex trauma. Limitations in the current literature include a failure to differentiate between acute and chronic trauma (Saigh et al., 2002), the use of non-standardized neuropsychological measures (Mezzacappa et al., 2001), and a paucity of research studying the relationship between executive functioning and a history of complex trauma among the adolescent population.
Chapter Two

Introduction

Childhood trauma, including abuse and neglect, is one of the most pressing public health challenges in the United States, a challenge that has the potential to be positively impacted by appropriate prevention and intervention. Each year, more than 3 million children are reported to authorities for abuse or neglect in the United States; about 772,000 of those cases were substantiated in 2008 (US Department of Health and Human Services, 2010).

The most prevalent form of trauma often begins at home with the child’s parent typically responsible for maltreatment (about 80%; US Department of Health and Human Services, 2010). It is estimated that in 2008, 267,000 children in the nation were removed from their homes as a result of a child maltreatment investigation. Approximately one-fifth of victims (20.9%) were placed in foster care in 2008 as a result of an investigation. More than two-thirds (68.5%) of the victims who were removed from their homes suffered from neglect, 8.8 percent from physical abuse, and 3.0 percent from sexual abuse. Nearly 16 percent (15.7%) of victims suffered from more than one type of maltreatment (US Department of Health and Human Services, 2010).

Consequences of Trauma

The effects of trauma are multifaceted and were uniquely identified through the Adverse Childhood Experiences (ACE) study, developed by Kaiser Permanente.
and the Centers for Disease Control and Prevention (Felitti et al., 1998). This large-scale epidemiologic study of the influence of stressful and traumatic childhood experiences on the origins of behaviors revealed that adverse childhood experiences, such as abuse, neglect, and family dysfunction, appear to have a powerful predictive relationship with adult health a half-century later. Specifically, those adults who had witnessed domestic violence or suffered abuse as children were more likely to engage in risky activities such as drinking, smoking and substance abuse. In addition, histories of childhood physical and sexual assaults are associated with a host of psychiatric problems in adolescence and adulthood, such as borderline personality disorder and antisocial personality disorder. Eating, dissociative, affective, somatoform, cardiovascular, metabolic, immunological, and sexual disorders are also prevalent in children with a history of physical and sexual assault (e.g. Cloitre, Tardiff, Marzuk, Leon, & Portera, 2001; Dube et al., 2001).

During infancy and early childhood, children form an early working model of the world and develop the basic cognitive building blocks of later life. Prospective studies have shown that children of abusive and neglectful parents have impaired cognitive functioning by late infancy, compared with control children (Egeland, Sroufe, & Erickson, 1983). Stress during the preschool years has also been discussed as a negative influence on cognitive development (Barton & Zeanah, 1990). More recent studies reported that in later childhood and adolescence, participants with PTSD secondary to abuse or to witnessing violence performed more poorly on measures of attention and abstract reasoning/executive function, supporting the
finding that cognitive differences between children and adolescents with and without maltreatment-related PTSD exist (Beers & DeBellis, 2002; Mills et al., 2011).

Executive functioning, or cognitive control, is thought to be involved in processes such as planning, cognitive flexibility, abstract thinking, rule acquisition, initiating appropriate actions and inhibiting inappropriate actions, as well as selecting relevant sensory information (Dawson & Guare, 2010). The extent to which traumatic exposure, related to maltreatment, alters the development of cognitive processes, specifically executive functioning, is an area of the literature that requires additional research.

The foregoing findings identify childhood trauma as an important public health concern because of the widespread and longstanding consequences of such trauma. Although researchers have long studied the effects of childhood trauma, literature concerning the implications of trauma throughout the lifespan and upon the individual as a whole, is relatively recent. Research appears to have moved in this direction in order to better serve the needs of those individuals throughout adolescence and adulthood.

Particular limitations in the literature center on understanding and identifying the multifaceted consequences related to the extent of trauma, including a lack of knowledge about the specific neuropsychological consequences found in adolescents with chronic trauma histories, especially in regard to executive functioning skills (De Bellis, 2005; De Bellis, Hooper, Spratt, & Woolley, 2009). This chapter continues
with a presentation of the background of the PTSD diagnosis. It specifically addresses how this diagnosis does not fully capture the symptoms associated with chronic and severe exposure to trauma, beginning in childhood. Rather, a new school of thought terms this type of chronic and severe abuse as Complex PTSD (CPTSD), or complex trauma. Then, three major theoretical perspectives are discussed with a focus on the historical and theoretical understanding of childhood trauma and the symptomatology associated with complex trauma. They include the Developmental Transactional Theory, Attachment Theory, and Neurobiological perspectives. Following the review of theory, the topic of neuropsychology is introduced in order to identify assessment findings related to executive functioning among children and adolescents who have a history of complex trauma. Finally, conclusions formed from the literature review are presented and the direction and goals of this dissertation are presented.

**Background of the Trauma Diagnosis**

The diagnosis of PTSD was included in the *Diagnostic and Statistical Manual of Mental Disorders, 3rd Edition (DSM-III; APA, 1980)* partially in response to a social demand to describe the pervasive psychological problems present in many returning Vietnam veterans. The creation of a formal diagnosis offered legitimacy to the idea that traumatic experiences could result in serious psychological repercussions and was a critical first step in naming the often overwhelming and disabling somatic and psychic symptoms that followed exposure to war and other traumatic events. Furthermore, it opened the possibility to investigate systematically how other types of traumatic events affect people who have not experienced combat. At the time that the
PTSD construct was being developed, a rather limited literature on “traumatic neuroses” was available to guide in its creation. Although descriptions of some other traumatized populations were available and other posttraumatic syndromes had been proposed that concentrated more on the effects of traumatic events on self-perception and on the negotiation of interpersonal relationships (e.g., “battered women’s syndrome”), the DSM-III diagnosis nevertheless focused on the following three categories of symptoms that were identified in adult male combatants exposed to war trauma: re-experiencing, numbing, and hyperarousal, as the core criteria for making the diagnosis.

Since 1980, several teams of researchers began to explore the notion that the diagnosis of PTSD captures only a limited aspect of posttraumatic psychopathology (Briere, 1987, 1992; Courtois, 1988; Finklehor, 1984; Herman, 1992a, 1992b). They suggested that the reactions of those involved in combat were likely significantly different from those of immature individuals (children) whose exposure to traumatic stress was ongoing and related to family life. Many researchers conducted factor analyses of the findings of available studies of trauma related to child abuse (findings summarized in Herman, 1992a, 1992b) and determined that the effects of such trauma, although posttraumatic in nature, were significantly different from PTSD as defined in the DSM–III (American Psychiatric Association, 1980). Results of these studies led to the development of a new field of study – traumatic stress studies.

The term complex trauma came about in the literature and refers to a type of trauma that occurs repeatedly and cumulatively, usually over a period of time and
within specific relationships and contexts during which the victim is entrapped and conditioned in a variety of ways (Courtois, 2008). In the case of child abuse, the victim is psychologically and physically immature resulting in seriously compromised development caused by repetitive abuse and inadequate response at the hands of family members or others on whom he or she relies for safety and protection (Courtois, 2008).

Subsequently, when the DSM-IV (APA, 1994) was under development, the APA organized a field trial for PTSD to investigate the impact of several proposed changes to the PTSD diagnosis and, secondarily, to explore the psychopathology of complex trauma, or otherwise labeled disorders of extreme stress, not otherwise specified (DESNOS). As mentioned briefly in Chapter One, Spitzer, Kaplan and Pelcovitz (1989) generated a list of symptoms which had been repeatedly described in the literature regarding individuals exposed to extreme trauma and which were not addressed by DSM-III-R criteria for PTSD. Symptoms were generated from a systematic review of the literature on the emotional and behavioral sequelae of childhood sexual abuse, physical abuse, crime, rape, incarceration in concentration camps, torture and spouse abuse (Pelcovitz et al., 1994).

Feedback on the face validity of the criteria was obtained in two ways. Letters were sent to approximately 50 authorities on psychological reactions to extreme stress asking for feedback whether specific criteria should be included or deleted. They were asked to recommend other colleagues in their areas of expertise who in turn recommended further modification. At the end of this process a panel of 12
researchers in the area of PTSD, representing expertise in a range of traumatized populations, agreed on a final list of 27 symptoms (Pelcovitz, van der Kolk, Roth, Mandel, Kaplan, & Resnick, 1997). Independently, in Boston, Massachusetts, Herman and van der Kolk had started to delineate a similar cluster of symptoms in response to prolonged trauma (Herman & van der Kolk, 1987). Eventually, the 27 symptoms generated by the New York and Boston groups were arranged by Herman into seven categories: regulation of affect and impulses; attention or consciousness; self-perception; perception of the perpetrator; relations with others; somatization; and systems of meaning. Items were put in a structured interview format which was revised by the field trial coordinators prior to inclusion of the instrument in the field trials protocol. The measure consists of 48 items measuring lifetime and current alterations in the seven areas. Items were scored dichotomously, i.e., each question is answered with either a "yes" or "no."

The findings of the DSM-IV Field Trial supported the existence of a complex, but consistent, adaptation to chronic interpersonal violence, in both children and adults (Van der Kolk, Roth, Pelcovitz, Sunday & Spinazzola, 2005). However, the PTSD Field Trial (Kilpatrick, et al., 1998; Pelcovitz, van der Kolk, Roth, Mandel, Kaplan, & Resnick, 1997) only measured one Axis I disorder (i.e. PTSD) and one other mental health outcome (i.e. DESNOS or complex PTSD). Based on this research design, it was impossible to establish the specificity of DESNOS with respect to its comorbidity with PTSD because no other Axis I or II disorders were measured. Thus, there was no way to determine if the findings attributed to Complex
PTSD/DESNOS were specific to this proposed diagnosis and instead did not reflect a general comorbidity. To establish that Complex PTSD (CPTSD)/DESNOS has specificity or incremental validity, the research design would require careful assessment of exposure to potentially traumatic events, and assessment of PTSD and DESNOS as well as several other Axis I and Axis II disorders. Analyses demonstrating that DESNOS adds something unique, above that of other comorbid disorders, to the understanding of people who have experienced child victimization or other forms of chronic interpersonal violence would also be necessary. Given that 92% of the people that met criteria for CPTSD/DESNOS also met criteria for PTSD, CPTSD/DESNOS was not listed as a separate diagnosis. DESNOS was listed in the *DSM-IV* and *DSM-IV-TR*, not as a freestanding diagnosis, but many characteristics are mentioned as “associated constellation of symptoms” (APA, 2000, p.465). A growing body of researchers urge the inclusion of Developmental Trauma Disorder, as complex trauma has come to be called, and/or DESNOS as a separate diagnosis in DSM-5 because they argue that treatment methods for a PTSD diagnosis may result in inadequate treatment for more complex forms of trauma (for review see Busuttil, 2009; Najjar, Weller, Weisbrot, & Weller, 2008; van der Kolk et al., 2009).

**Diagnosing PTSD in a Chronically Traumatized Population**

For a substantial proportion of traumatized patients, PTSD symptoms capture only a small part of their difficulties, as noted above. In diagnosing traumatized patients with complicated clinical presentations with a singular diagnosis of PTSD, clinicians run the risk of applying treatments geared toward PTSD that may not only
be irrelevant to them, but may, in fact, be harmful (Ford, Courtois, Steele, Van der Hart, & Nijenhuis, 2005). Posttraumatic problems that are not captured in the current *DSM-IV* PTSD criteria include affective, anxiety, dissociative and somatoform disorders, as well as substance abuse. These conditions are generally referred to by researchers and clinicians as “comorbid” issues and do not appear to capture the developmental effects that are often found in individuals with a history of complex trauma.

In recognition of the fact that more than 80% of patients with PTSD suffer from “comorbid conditions,” the Treatment Guidelines of the International Society for Traumatic Stress Studies (Foa, Freidman, & Keane, 2000) refers readers to the “rich empirical literature of these comorbid conditions” (p. 375) for treatment guidance. Yet, no studies to date have demonstrated that treatment manuals for these other conditions are, in fact, useful in treating these comorbid conditions in patients who also have PTSD. On the contrary, research shows that bipolar, anxious, suicidal, substance abusing, dissociative, and depressed patients with childhood trauma exposure often do not respond to conventional treatments for these conditions (Ford, Courtois, Steele, Van der Hart & Nijenhuis, 2005). Accordingly, the most current research reflects a trend examining the likelihood that the psychological issues listed above do not constitute comorbid diagnoses, but rather are somatic, affective, and behavioral manifestations of chronic interpersonal trauma and are thus part of the primary disorder.
An Expanded Trauma Diagnosis: Complex PTSD/DESNOS

The question of how best to organize the very complex emotional, behavioral and neurobiological sequelae of childhood trauma has vexed clinicians for several decades. Since the complex PTSD/DESNOS diagnosis was first conceptualized (Herman, 1992a), at least 30 research studies have provided some support for this construct (see Amaya-Jackson & DeRosa, 2007; Courtois, 2008; van der Kolk & Courtois, 2005), such as the development of assessment instruments that evaluate the various dimensions of complex trauma and their relative degree of severity (described by Briere and Spinazzola, 2005).

The National Child Traumatic Stress Network Workgroup on Diagnosis (NCTSN) proposed that a new diagnosis is necessary in order to provide a clear delineation of the enduring developmental effects of trauma. As noted earlier, Complex PTSD/DESNOS was suggested as a more appropriate diagnostic label (van der Kolk and Courtois, 2005) although this label is more recently known as Developmental Trauma Disorder. The NCTSN team proposed that an expanded diagnosis may help to conceptualize the complex adaptations to trauma over the lifespan. It is organized around the issue of triggered dysregulation in response to traumatic reminders, stimulus generalization, and the anticipatory organization of behavior to prevent the recurrence of the trauma effects. These effects, or symptoms, include “complex disruptions of affect regulation, disturbed attachment patterns, rapid behavioral regressions and shifts in emotional states, loss of autonomous strivings, aggressive behavior against self and others, failure to achieve
developmental competencies, loss of bodily regulation in the areas of sleep, food, and
self-care, altered schemas of the world, anticipatory behavior and traumatic
expectations, multiple somatic problems (from gastrointestinal distress to headaches),
apparent lack of awareness of danger and resulting self-endangering behaviors, self-
hatred and self-blame, and chronic feelings of ineffectiveness” (van der Kolk, 2005;

The proposed Developmental Trauma Disorder diagnosis is based on the
concept that multiple exposures to interpersonal trauma, such as abandonment,
betrayal, physical or sexual assaults, or witnessing domestic violence, have consistent
and predictable consequences that affect many areas of functioning. These
experiences engender intense affects, such as rage, betrayal, fear, resignation, defeat,
and shame. Efforts to ward off the recurrence of intense affect often include the
avoidance of experiences that precipitate these feelings or engagement in behaviors
that create a subjective sense of control for the child in the face of potential threats.
As such, these children tend to reenact their traumas behaviorally, either as
perpetrators (e.g., aggressive or sexual acting out against other children) or in frozen
avoidance reactions. In addition, the physiological dysregulation associated with
complex trauma may lead to multiple somatic problems, such as headaches and
stomachaches, in response to fearful and helpless emotions (Cook et al., 2005).

Persistent sensitivity to reminders of the trauma can interfere with the
development of emotional regulation and cause long-term emotional dysregulation
and precipitous behavior changes. Over- and under-reactivity is manifested on
multiple levels: emotional, physical, behavioral, cognitive, and relational. The children have been found to have fearful, enraged or avoidant emotional reactions to minor stimuli that would otherwise have no significant effect on secure children. After having become aroused, they have a great deal of difficulty restoring homeostasis and returning to baseline. Insight and understanding about the origins of their reactions seems to have little effect on emotional and behavioral functioning (Cook et al., 2005).

In addition to the conditioned psychological and emotional responses to reminders characteristic of PTSD, children with complex trauma develop a view of the world that incorporates their betrayal and hurt (Beeghly & Cicchetti, 1996). They anticipate and expect the trauma to recur and respond with hyperactivity, aggression, defeat, or freeze responses to minor stresses. Cognition in these children is also affected by reminders of the trauma (Beers & De Bellis, 2002). The children tend to become confused, dissociated, and disoriented when faced with stressful stimuli. They easily misinterpret events in the direction of a return of trauma and helplessness, which causes them to be constantly on guard, frightened, and over-reactive.

An expectation of a return of the trauma also permeates the child’s relationships. This traumatic response is often expressed as negative self-attributions, loss of trust in caregivers, and loss of the belief that somebody will look after them and make them feel safe (Amaya-Jackson & DeRosa, 2007). All of these problems described above are expressed in dysfunction in multiple areas of functioning: educational, familial, peer-related, legal, and work-related.
In addition to the impact of trauma on the areas listed above, the small amount of research on brain and cognitive development in children with trauma histories also indicates a negative relationship with trauma exposure. Most of these studies have focused on the broadly defined outcomes of intellectual ability and academic function. In prospective studies, childhood trauma is associated with significantly delayed cognitive development and head growth in young children (Strathearn, Gray, O’Callaghan, & Wood, 2001) and lower IQ and academic achievement in adulthood (Perez & Widom, 1994). Chugani et al. (2001) reported that previously institutionalized Romanian adoptees exhibited deficits on tasks dependent on prefrontal function (i.e., attentional and social deficits). These children showed significantly decreased metabolism in brain structures involved in cognitive function, social intelligence, and anxiety compared to children with chronic epilepsy and healthy adults.

It is evident both in research and particularly in clinical practice, that children with chronic and severe trauma histories have adverse cognitive, behavioral and emotional affects. Research identifying potentially adverse brain development and the specific compromised neuropsychological and psychosocial outcomes has been recently expanding over the past decade.
Theoretical Explanations that Link Early Experience with Later Psychological Disturbance

Developmental Transactional theory is presented first in order to provide a basis for understanding the link between early experience and later disturbance in emotional and cognitive functioning. Second, an understanding of the implications of childhood trauma is presented from the perspective of attachment theory. Finally, neurobiological perspectives are presented to examine the impact of complex trauma on the developing brain.

Developmental Transactional Theory

Developmental Transactional Theory provides a basis for understanding the link between early experience and later disturbance in emotional and cognitive functioning. This theoretical view of disturbance holds that emotional and behavioral problems are developmental outcomes; that is, problems are a derivative of a process of successive transactions between the child and the environment (Sroufe, 1997). Most developmental viewpoints are inspired by the work of Bowlby’s (1973) elaboration of Waddington’s (1957) developmental pathways model. The implications of the model include the following: (a) there are multiple pathways to the same or similar outcomes, (b) the same initial pathway, because of the possibility for divergent patterns, can lead to multiple outcomes, (c) change is possible at many (any) points in development, and (d) change is constrained by prior development. Given the immature status of the human at birth, early care (and the context of early
Care), play prominent roles in early adaptations and thus in initiating a cumulative developmental process. This process can lead to healthy (normative) development or may lead to different types of disturbance among individuals.

Sroufe, Egeland, Carlson and Collins (2005) point out that early experience is not destiny. With subsequent experience, different individuals who began on the same path may diverge into various patterns of adaptive or maladaptive functioning. A vast collection of ongoing circumstances (e.g. the presence of a supportive or inspirational teacher or grandparent) can lead to normal adaptation whereas a lack of support might lead to potentially deviating developmental pathways. Early beginnings can constrain to some extent a child’s possibility of reaching positive outcome in later adolescence and adulthood. In the developmental-transactional view, child characteristics are only one feature of the developmental process, and they cannot be viewed as independent of the context of development (Sroufe et al., 2005).

**Developmental Transactional theory and complex trauma.** A developmental transactional view of disturbance therefore holds that emotional and behavioral problems are developmental outcomes; that is, they are derivatives of a process of successive transactions of the child and the environment (Sroufe, 1997). Disturbance is a reflection of a dynamic developmental process, not a condition that a child has. Thus, disturbance is created by the interplay of multiple factors operating over time, and links between antecedent conditions and disturbance are probabilistic and nonlinear. In other words, disturbance is the outgrowth of patterns of
maladaptation interacting with ongoing challenging circumstances in the absence of adequate support (Sroufe et al., 2005).

This probabilistic, systemic approach to the development of disturbance is congruent with transactional models of risk and protection (e.g., Sameroff, 2000). Even when a clear organic condition plays a role in disturbance, developmental processes must be considered (Grossman et al., 2003). The impact of any organic feature depends on the total developmental context. Early compromised experience and early maladaptation may be seen as risk factors for disturbance. However, as outlined above, it is important to emphasize that like any other risk factor (biological parent with disturbance, low SES, harsh living conditions), being at risk does not mean being destined for disorder (Sroufe et al., 2005). In predicting competent outcomes across the lifespan, researchers have found that it was not early care or attachment alone that was most predictive, but the cumulative history of the individual (Egeland et al., 1990; Erickson et al., 1985; Sroufe et al., 1999). The same thing is true when it comes to the prediction of psychopathology (Sroufe et al., 2005).

Children with complex trauma histories are often given more than one diagnostic label because the diagnosis of PTSD does not capture all of the presenting concerns. In fact, multiple possible diagnoses appear to be the rule, not the exception. From a developmental point of view, this is understandable given the common core of arousal-and emotion-regulation issues underlying most common childhood problems (Sroufe et al., 2005). Children exposed to complex trauma fall into a maladaptive pattern of functioning rather than an adaptive pattern, because of their difficulties
with internal regulation caused by the nature of the context surrounding them. Indeed, complex trauma exposure results in a loss of core capacities for self-regulation and interpersonal relatedness. According to developmental theory, children with trauma histories are therefore at risk for lifelong problems including additional trauma exposure and cumulative impairment (e.g. psychiatric and addictive disorders; chronic medical illness; legal; vocational; and family problems). These problems often extend from childhood through adolescence and into adulthood. The transactional model therefore is an important perspective to consider when examining disorders of extreme stress.

**Attachment Theory**

John Bowlby (1982) described attachment as a vital process in human ontogeny that enhances adaptive personality development across the lifespan, along with increasing the likelihood of survival in infancy. Children’s attachment to their primary caregiver is believed to reflect the prior quality of interaction with that caregiver and to predict later socio-emotional competence (for reviews see Ainsworth, Blehar, Waters, & Wall, 1978; Lamb, Thompson, Gardner, & Charnov, 1985). Leading researchers in the attachment field have identified three main categories of attachment classifications. These include secure, insecure (avoidant and ambivalent) and disorganized attachment.

Sensitive, nurturant care is thought to be the basis of a *secure* attachment. In addition, healthy patterns of internal regulation promote, to the extent possible,
closeness with a particular caregiver. For children with secure histories who received responsive care, ample proximity may be maintained through a flexible balance of exploration and direct signaling when in need. Sustained periods of alert organization and cycles of brief upset followed by relaxation are repeatedly experienced, supported by the infant’s confidence in the caregiver’s availability. Through such experience, there is a tuning of the central nervous system (Sroufe et al., 2005; see also Schore, 1994).

Infants with an insecure attachment style of the avoidant type can be identified by their exhibition of frequent distress at separation. The mothers of these infants respond to their child in a rejecting way, and deny the babies’ request for close bodily contact (Ainsworth et al., 1978). Infants with an insecure attachment style of the ambivalent type exhibit an ambivalence regarding the physical contact of their caregiver; however they do seek physical contact appropriately. Ainsworth and her colleagues (1978) describe these infants as slower to be soothed in relation to the insecure-avoidant and secure attachment styles, express excessive anger toward their mother, and seem sensitized to separation from their mother. Research has shown that these children have increased cognitive impairment, are easily frustrated, and are over-reliant on their mother. They also exhibit poor-problem-solving skills (Cicchetti et al., 1995). Like securely attached children, those with insecure attachment styles (anxious histories) also establish patterns in their dyadic regulation efforts. By minimizing signals of need that may further alienate rejecting caregivers, or by emitting chronically heightened signals of need toward an only intermittently
responsive caregiver, those with avoidant attachments promote proximity to the caregiver to the extent that they possibly can.

In the 1980s, researchers began to report on high-risk infants who did not fit into the above classification system. Main (1986) and her colleagues subsequently developed and validated a new attachment pattern, labeled Type D or disorganized/disoriented. In laboratory studies, disorganized babies, in contrast to securely and insecurely attached babies, appeared to possess no coherent coping mechanism in situations that were designed to provoke a stress response. Disorganization was characterized by the following: decreased predictability in behavior; incomplete or undirected movements; stilling (motionless or silent), slow movements, freezing, and depressed affect; and direct indices of apprehension toward the parent (see Main & Solomon, 1986). Similar to children with a secure or insecure attachment style, even disorganized attachment behavior (simultaneous approach-avoidance; freezing, etc.) enables a degree of proximity in the face of a frightening parent and serves to regulate dyadic regulation, albeit in a dysfunctional manner.

**Attachment theory and complex trauma.** Attachment researchers, drawing from the work of John Bowlby (1988) and his followers, have highlighted the significance of nonresponsive or abusive caregivers and other disruptions in attachment within a disorganized family. Under most conditions when children are hurt or in danger, parents and other caregivers are able to help the children restore a sense of safety and control. However, when caregivers are emotionally absent, inconsistent, demeaning, violent, intrusive, neglectful, or are themselves dealing with
unresolved trauma and loss, they usually cannot serve as a source of security for their offspring. Under those conditions, children are liable to become intolerably distressed and to develop a sense that the environment is intrinsically unsafe. If children are exposed to unmanageable stress, and if caregivers are unable to help them modulate their arousal (the usual case when children are exposed to family violence), the children are unable to organize themselves physiologically and fail to categorize experiences in a coherent fashion. This failure results in a breakdown in the capacity to process, integrate, and categorize what is happening both internally and externally. At the core of traumatic stress is a breakdown in the capacity to regulate internal states.

For children in each attachment group, these early patterns become prototypes for subsequent regulation, even when apart from the caregiver. While in an important way the dysfunctional patterns can be serviceable early on to promote proximity to the caregiver, patterns of regulation of the anxiously attached groups seriously compromise later functioning (e.g., Kobak, Ruckdeschel, & Hazan, 1994). Blunting feelings so as not to express needs, isolating oneself, feeling alienated from others, and failing to make direct contact with others when stressed all make life very difficult, especially in the social arena. Chronic vigilance, apprehension, and worry about needs being met all promote lowered ego resiliency, inability to cope with frustration, and a pervasive presence of negative affect (Sroufe et al., 2005).

Results of empirical studies conducted on the consequences of insecure and disorganized attachment in infancy and about children raised in institutions converge
to suggest that attachment difficulties in infancy are likely to be related to a number of subsequent problems (Lyons-Ruth, Zeanah, & Benoit, 1996). For example, the consistent relationship between harsh and ineffective parental discipline and aggressive behavior problems has been a well-documented finding and has been emphasized in most theories of the etiology of conduct disorder (Loeber & Dishion, 1983).

If careful consideration is paid to the contribution of attachment dynamics to the experience of trauma, then it becomes clear that there is an important difference not between direct and secondhand exposure to traumatic stressors, but between traumas inflicted by an attachment figure and traumas inflicted by an anonymous destructive force (Liotti, 2004). Attachment theory predicts that the potential for harm to the individual by an attachment figure (caregiver) is much greater than that of an anonymous individual or societal force. This difference highlights the magnitude of importance that interpersonal factors play in the experience of individuals with a complex trauma history.

Given the centrality of emotional regulation and regulation of social relationships in all major psychiatric diagnoses, it is plausible to expect a relation between early attachment and later adolescent disturbance (Cole et al., 1994; Sroufe et al., 2000). In fact, Carlson (1998) found clear and confirming results in her prospective longitudinal study examining the antecedents and consequences of attachment disorganization/disorientation. The relations of attachment disorganization/disorientation to endogenous (e.g., maternal medical history, infant
temperament) and environmental (e.g., maternal caregiving quality, infant history of abuse) antecedents and to behavioral consequences from 24 months to 19 years were examined. For the 157 participants drawn from a longitudinal study of children and families, attachment disorganization was correlated significantly with environmental antecedents (e.g., maternal relationship and risk status, caregiving quality, and infant history of maltreatment), but not with available endogenous antecedents. Infant history of attachment disorganization was correlated with consequent variables related to mother-child relationship quality at 24 and 42 months, child behavior problems in preschool, elementary school and high school, and psychopathology and dissociation in adolescence. The author used structural models and suggested that disorganization may mediate the relations between early experience and later psychopathology and dissociation. The strongest single predictor of global pathology (number and severity of diagnoses) from the first 6 years of life was disorganized attachment. Thus, severe dysregulation in the caregiver-infant dyad alone is associated with more extreme disturbance at the end of adolescence.

In addition, Aber and Allen (1987) found that during early childhood, maltreatment disrupts a dynamic balance between the motivation to establish safe, secure relationships with adults and the motivation to venture out to explore the world in a competency-promoting fashion. As adults, survivors of childhood maltreatment are at risk not only for PTSD (Widom, 1999) but also for other anxiety, affective, addictive, psychotic, and personality disorders (Heim & Nemeroff, 2001; see also McCauley, Kern, & Kolodner, 1997), suicidality (Molnar, Berkman & Buka, 2002),
revictimization (Nelson, Heath, & Madden, 2002; see also Felitti et al., 1998), and
even diabetes, heart disease and immune disorders (Heim & Nemeroff, 2001).

**Neurobiological Perspectives on Trauma**

Although much has been written about the psychological aspects of trauma
and attachment, the literature still continues to grow with new findings in regard to
how the brain responds to trauma, how it organizes the complex behavior of
attachment, or even how attachment alters brain organization. In general, children
who have been subjected to ongoing abuse and neglect in the context of their primary
relationships, and whose family environments have lacked adequate support, have
been found to differ in their neurological (structural) and neurobiological (chemical)
development from children who have *not* been abused or neglected.

The period from birth to adulthood is marked by progressive physical,
behavioral, cognitive, and emotional development. Paralleling these stages are
changes in brain maturation. Many factors can adversely impact the
neurodevelopment of maltreated children. In fact, De Bellis (2005) hypothesized that
child neglect may lead to adverse brain development through multiple mechanisms.
This process manifests itself as delays in or deficits of multisystem developmental
achievements in behavioral and emotional regulation, cognitive and psychosocial
function, antisocial behaviors, and poor academic achievement.

Neuroscience research findings regarding the impact of abuse on the brain
have thus far been consistent with developmental research (for a review see De Bellis,
In particular, clinical research has started to spell out the impact of one-time traumatic incidents versus exposure to chronic abuse and neglect. These studies have shown that isolated traumatic incidents tend to produce discrete conditioned behavioral and biologic responses to reminders of the trauma. In contrast, unavoidable recurring traumatization has been found to have pervasive effects on neurobiologic development and will be described in detail in the paragraphs below (for review see De Bellis, 2005; Jackowski, de Araujo, de Lacerda, Mari, & Kaufman, 2009; van der Kolk, 2003).

The developmental neurobiology of PTSD has three general areas of impact on three interrelated developmental pathways: (1) on the maturation of specific brain structures at particular ages, (2) on physiologic and neuroendocrinologic responses, and (3) on the capacity to coordinate the higher-level brain processes involved in cognition, emotional regulation, and behavior. Each area of impact is described below.

**Impact of trauma on brain maturation.** Experiences of abuse and/or neglect throughout childhood have the potential to create not only attachment disorders, but *organic* changes within the brain. In fact, neuroimaging studies suggest brain structure may be altered and brain function impaired in women with childhood abuse-related PTSD, when compared with either women who were abused, but are not diagnosed with PTSD, or women with no abuse histories (for an in depth review of this literature, see Ford, 2005). Specifically, decreased capacity in brain areas associated with focusing attention and categorizing information (i.e., cerebellum; left
hippocampus) has been shown, respectively, by functional (Teicher, Andersen, Polcari, et al., 2002) and volumetric studies (Elzinga & Bremner, 2002; Pederson, Maurer, Kaminski, et al., 2004). Another study reported that women with abuse-related PTSD who engaged in processing conflicting visual-semantic stimuli, such as in the color Stroop task, showed increased activation in brain areas associated with automatic detection of threats, but reduced activation in brain areas associated with attention, visual imagery, associations and memory, spatial perception and processing, facial recognition, and conscious fear awareness and emotion (Bremner, Vythiligam, & Vermetten, 2003) relative to controls.

Ito, Teicher, Glod and Ackerman (1998) described findings also supporting the hypothesis that early severe abuse may have a deleterious effect on brain development, specifically in regard to coherence (a measurement of the similarity of frequency between two sites on the scalp). Using quantitative EEG with a sample of 15 hospitalized children with a history of severe physical or sexual abuse (confirmed by Massachusetts Department of Children and Families) and 15 children with no history of abuse, they found that abused children had higher levels of left hemisphere coherence and a reversed asymmetry, with left hemisphere coherence significantly exceeding right hemisphere coherence when compared to non-abused children. Left hemisphere coherence decreased more rapidly across electrode distance in subjects without an abuse history, suggesting that increased left coherence in abused patients stemmed from a deficit in left cortical differentiation.
Quantitative magnetic resonance imaging (MRI) has provided a safe and novel approach to measure brain maturation in healthy children. Longitudinal MRI studies of typically developing children and adolescents have greatly advanced knowledge of human brain development. Researchers have begun to use MRI to measure brain maturation in maltreated children. In 1997, Teicher, Ito, Glod, Andersen, Dumont and Ackerman published results identifying a smaller corpus callosum in children who were hospitalized at psychiatric facilities with a documented history of trauma, which included abuse and neglect, as compared to psychiatric control children with no trauma history. This negative effect appeared to be more significant in males. Teicher et al. (2004) found that the total corpus callosum area in abused/neglected patients was 17% smaller than in control subjects (p =.0001) and 11% smaller than in psychiatric patients who had not been abused or neglected (contrast group; p =.01). Interestingly, neglect was the strongest experiential factor and was associated with a 15%-18% reduction in corpus callosum total area (p<.02). In contrast, sexual abuse seemed to be the strongest factor associated with reduced corpus callosum size in girls.

Similarly in 2003, De Bellis and Keshavan used MRI to study sex differences in a population of children with chronic PTSD secondary to abuse. Findings of larger prefrontal lobe cerebrospinal fluid volumes and smaller midsagittal area of the corpus callosum were seen in both boys and girls with maltreatment-related PTSD compared to gender-matched healthy controls. Subjects with PTSD did not show the normal age
related increases in the area of the total corpus callosum and this finding was more prominent in males with PTSD.

Teicher, Glod, Surrey and Swett (1993) found that early abuse can also affect the development of the limbic system. During initial psychiatric evaluation, 253 outpatients completed a self-report scale, the Limbic System Checklist-33 (LSCL-33), designed to measure somatic, sensory, behavioral, and memory symptoms suggestive of temporal lobe epilepsy, along with a questionnaire about physical and sexual abuse. Physical abuse was associated with a 38% increase in LSCL-33 scores, sexual abuse with a 49% increase, and combined abuse with a 113% increase. Physical or sexual abuse alone was associated with elevated LSCL-33 scores only if the abuse occurred before age 18. In a longitudinal study of 290 Canadian females, adolescents with a combination of prolonged rather than brief sexual abuse combined with other types of abuse, with a background of family disruption and poverty, and also with a child's impaired coping skills (reflecting poorer cognitive capacity and central nervous system problems) were most likely to have markedly impaired emotional functioning at age 17 (Bagley & Mallick, 2000).

Many studies have been conducted on Romanian orphans, who lived with a low staff to child ratio (1 to 60), and lacked stimulation, appropriate medical care, and proper nutrition throughout their young lives. Researchers found that cognitive development was hampered in this population. A random sample of 200 orphaned Romanian children living in these conditions suffered from physical growth delays, including smaller body size and head circumference (an indication of less brain
growth), poor social skills, and delays in cognitive and language development, when examined at 3 years of age (Macovei, 1986; Rutter & O’Connor, 2004).

**Impact of trauma on physiologic and neuroendocrine responses.** In addition to the structural changes described above, neurobiologic studies document dysregulation in the hypothalamic-pituitary-adrenal (HPA) axis stress response systems and the associated neurotransmitters and neuropeptides among women who are survivors of childhood abuse (Heim & Nemeroff, 2001; see also van der Kolk, 2003). Research has suggested that neuropeptides may be important as neural modulators for several complex behaviors. Maltreatment appears to prevent the natural development of healthy attachment and triggers the release of stress hormones (cortisol) in the brain from the HPA axis (Carlson & Earls, 1997; Carrion, Weems, Ray, Glaser, Hessl, & Reiss, 2002). In general (and in contrast to the cortisol studies of adults with PTSD), traumatized children show significantly elevated cortisol levels compared with control groups. Even infants with disorganized or disoriented attachment responses were found to have higher cortisol levels during the Strange Situation Test (Hart, Gunnar, & Cicchetti, 1996). It is highly probable that many of the mental health symptoms and learning problems associated with child neglect arise in conjunction with alterations of this biological stress system (De Bellis, 2005). Chronic trauma (prolonged stress) thus interferes with neurobiological development and the capacity to integrate sensory, emotional and cognitive information into a cohesive whole.
Impact of trauma on the coordination of higher-level brain processes. A corresponding risk of chronic problems is seen in trauma victims in the capacity to coordinate cognition, emotional regulation, and behavior. In particular, two self-regulatory domains, attention and information processing, as well as affect regulation are impacted. Each is described in the following paragraphs. It is notable that most research has been retrospective, utilizing samples of women who experienced non-specified abuse in their earlier years.

Abuse-related PTSD in women is associated with impairment in the ability to focus their attention and categorize information due to reduced capacity and heightened demand in the brain areas responsible for these functions (for a review see Ford, 2005). It is also related to impairment in access to verbal language due to reduced activation in key brain areas when encoding neutral memories or reacting to neutral stimuli. Attention and memory encoding appear to be focused on detecting threats rather than on becoming oriented perceptually and emotionally in response to neutral stimuli (Ford, 2005).

The second chronic risk problem in women with abuse-related PTSD, affect dysregulation, appears to involve an automatic attempt to scan for threats in response to emotional stimuli. Corresponding impairment is apparent in conscious recognition, interpretation (i.e., deriving personal meaning), and reflective memory and decision-making (Bremner, Vythiligam, & Vermetten, 2003). Bremner and his colleagues (2003) reported that women with abuse-related PTSD have decreased brain activation in areas related to coordinated monitoring, conscious awareness, and initiating
effortful correction of conflict or problems (i.e., cerebellum, pons, anterior cingulate, insula), and increased brain activation related to vigilant visual scanning (precuneus) when distracted by emotional stimuli while attempting to make perceptual judgments.

Taken together, these neurobiological and neuropsychological findings suggest that central nervous system (CNS) development may be compromised and self-regulation impaired in adulthood as a result of childhood trauma, leading researchers to speculate whether compromised development can also be found in adolescence. A potential specific etiological relationship among adult victims of developmentally adverse interpersonal trauma occurring in childhood is suggested by a finding noted by Bremner and his colleagues (1999). Specifically, women who experienced abuse-related PTSD in childhood were found to have decreased activation of hippocampal and cortical (PFC, temporal and parietal cortices) brain areas involved in sensory and spatial perception, autobiographical working memory, and language. Increased brain activation was found in areas related to emotional memory or action (posterior cingulate, motor cortex) when women underwent symptom provocation (i.e., reminders and purposeful remembering of traumatic experiences). Still, study results are variable. For example, some studies report deficits in short-term and delayed declarative and working memory among women with child abuse-related PTSD (Pederson, Maurer, & Kaminski, 2004); however, others do not (Bremner et al., 2003).

In summary, neurobiological research highlights the enduring effects of childhood complex trauma. Similar to women with abuse histories described above,
children with trauma histories have been found to have a variety of abnormalities in brain development that affect their long-term psychological, educational and physiological functioning (De Bellis, 2005; see also Van der Kolk, 2003 and Anda et al., 2006). Childhood maltreatment has been linked to a variety of changes in brain structure and function and stress-responsive neurobiological systems. Particularly during critical periods of brain development, child maltreatment can impair, often permanently, the activity of major neuroregulatory systems, with profound and lasting neurobehavioral consequences (Bremner & Vermetten, 2001; De Bellis & Thomas, 2003; Heim & Nemeroff, 2001; Repetti, 2002; Teicher, 2000; Teicher et al., 2004).

**Neuropsychology: Pathways to Understanding the Impact of Complex Trauma on Cognitive and Behavioral Development**

Efforts to understand mind-body relationships and their relative contributions to health and well-being extend at least back to Plato, Descartes, and Kant. Like many other sciences, neuropsychology has evolved from related fields and is a subspecialty of psychology. It is the study of how complex properties of the brain allow behavior to occur. This section of Chapter Two will review the use of neuropsychological tools to understand brain-behavior relationships and then will specifically address how the experience of trauma can produce changes in thought and behavior that relate to the brain’s structural or cognitive integrity, ultimately impacting executive functioning in adolescence.
Neuropsychological Assessment

Neuropsychological assessment can be conceptualized as a method of examining the brain by studying its behavioral products (Zillmer & Spiers, 2001). Because the subject matter of neuropsychological assessment is behavior, it relies on many of the same techniques and assumptions as traditional psychological assessment. As with other psychological assessments, neuropsychological evaluations involve the intensive study of behavior by means of standardized tests that provide relatively sensitive indices of brain-behavior relationships. Neuropsychological tests have been used on an empirical basis in various medical and psychiatric settings, are sensitive to the organic integrity of the cerebral hemispheres, and can often pinpoint specific neurologic or psychological deficits (Zillmer & Spiers, 2001). Neuropsychological assessment has become a very useful tool for clinical service delivery and for research regarding the behavioral and cognitive aspects of psychiatric and medical disorders (Zillmer & Spiers, 2001).

The strategy behind the use of neuropsychological tools is to generate a hypothesis about which area of the brain is involved in a particular behavior and then employ a behavioral test to evaluate this hypothesis. Ideally, a person is able to differentiate one behavior from another using a cluster of tasks or by applying such tasks to both normative and clinical populations. In terms of elucidating brain-behavior relations in normative samples, neuropsychological tools are frequently adopted that have first been used in animal models or in clinical populations of humans. The use of neuropsychological tools has received extensive study in the
developing human and has several advantages over metabolic procedures that can also be utilized: (a) they are completely noninvasive, (b) they can be used across the lifespan, (c) parallel studies can be conducted across species, and (d) they can provide insight into specific behaviors. However, the neuropsychological approach also has shortcomings. These tools only indirectly couple brain structure and function and thus may lack precision with regard to this relation. Nevertheless, many neuropsychological assessment tools are accompanied by excellent references that provide in-depth discussions of both the historical foundations and general administration guidelines.

**Neuropsychological assessment as a tool for understanding complex trauma.** Neuropsychological tools are often used to understand the relationship between child psychopathology and cognitive functioning. For example, it has been shown that school-age children with serious conduct disorder often exhibit early reading problems and deficits in verbal skills. Moffitt (1993), in a review of 47 published studies, concluded that one of the most robust findings in the study of antisocial behavior is an IQ deficit of 0.50 standard deviation, or about 8 points, compared with non-deviant peers. This deficit is manifest primarily on verbal subtests, so that performance intelligence quotients (IQ’s) consistently exceed verbal IQ’s among delinquent groups. Studies of this nature often conclude that causal relations among neuropsychological functioning, school achievement, family environment, and aggressive behavior remain unclear. It is largely understood that
complex transactional effects are most likely involved (Hinshaw, 1992; Moffitt, 1993).

As discussed earlier in this chapter, children and adolescents with complex trauma histories often lack a sense of predictability. The result is often a compromised sense of cause and effect and of their own contributions to their own functioning. Theoretically, without internal maps to guide them, they act instead of plan, and show their wishes in their behaviors, rather than discussing what they want (Main & Solomon, 1986; Lyons-Ruth, Zeanah, & Benoit, 1996). These children also have difficulty appreciating novelty. Without an internal map to compare and contrast, anything new is potentially threatening. What is familiar tends to be experienced as safer, even if it is a predictable source of terror.

When left to their own devices, chronically traumatized children show deficits in emotional self-regulation, which often leads to both internalizing and externalizing disorders (Lyons-Ruth, Zeanah, & Benoit, 1996). This results in problems with self-definition as reflected by a lack of a continuous sense of self, poorly modulated affect and impulse control, including aggression against self and others, and uncertainty about the reliability and predictability of others (Aber & Allen, 1987; Carlson, 1998; Smyke, Dumitrescu, & Zeanah, 2002). These difficulties all relate to compromise in the area of the brain called the prefrontal cortex, where executive functioning skills originate (De Bellis, 2005; De Bellis & Thomas, 2003; Teicher, et al., 2003; De Bellis, Keshavan, & Shifflett, 2002).
Executive Functions

Learning from experience means that incoming input must be registered in consciousness, compared with what the child already knows, and evaluated for an appropriate response. These are all functions of an area of the brain termed the frontal cortex. The capacity for representational memory, a cornerstone for the development of a delayed response, depends on the maturation of the frontal cortex (Zillmer & Spiers, 2001). Executive functions are linked to the integrity of the prefrontal cortex and consist of attention; working and delayed memory; the ability to learn, regulate emotions and behavior, and problem solve; as well as perform psychomotor tasks (Dawson & Guare, 2010). In addition, executive functions control the behavioral processes of planning, execution, self-regulation, maintenance, spatiotemporal segmentation, and sustained mental productivity (Daigneault, Braun, & Whitaker, 1992).

Humans are not born with the ability to engage in abstract reasoning or any other executive function skills. These skills are developed and refined, usually not fully until adolescence or early adulthood (Zillmer & Spiers, 2001). There is actually little validated data regarding the exact nature of the neurobiological changes that occur around the time that executive function skills are developed. Behavior changes occurring around adolescence are tied to the acquisition of executive function skills (Rains, 2002). One longitudinal study found that during adolescence, the subcortical gray matter and limbic system structures (hippocampus, amygdala), which are the brain structures involved in attention, emotional regulation, and memory, increase in
volume nonlinearly and peak at age 16.6 (Giedd, Blumenthal, Jeffries, Castellanos, Liu, Zijdenbos, et al., 1999). It has been shown that neurons in the prefrontal cortex are fully myelinated during the second decade of life, but continue to mature into the third decade (Alexander & Goldman, 1978; Goldman, 1971; Rains, 2002). A number of functional magnetic resonance imaging (fMRI) investigations have been published in recent years that have examined the prefrontal cortical activity of healthy children during the performance of attention and working memory tasks, and studies utilizing fMRI with children with a history of maltreatment has become a popular research topic.

Executive functions and trauma. Studies of infant rats and monkeys show that maternal deprivation results in persistent deficits in social, behavioral and cognitive development, such as impaired executive function. The seminal studies of Harlow, Harlow, and Suomi (1971) demonstrated that the nature, age of onset, duration of physical neglect, and availability of an enriched environment during infancy were all important variables in the normal adult function of nonhuman primates. Interestingly, the researchers found that monkeys reared in deprived environments were similar to monkeys reared in enriched environments in the development of some less complex intellectual processes (discrimination tasks, delayed-response tasks, and complex learning-set tasks), but the monkeys raised in enriched environments demonstrated superior scores on complex problem-oddity-learning sets (i.e., executive functions).
The prefrontal cortex, the area of the brain primarily responsible for the development of the executive functions, has been shown to be adversely affected by trauma in humans as well. Children with trauma histories have been found to have serious problems carrying out a host of executive functions, thought to be a result of excessive subcortical activation, combined with decreased cortical inhibition (Hart, Gunnar, & Cicchetti, 1996). To respond adaptively to his or her environment, a child must feel calm enough to form an accurate perception of incoming stimuli. Arousal is mediated, at least in part, by elevated norepinephrine, which is associated with impaired function of the prefrontal cortex (Crittenden, 1997). When traumatized children feel threatened and activate their noradrenergic alarm system, the fast nature of the limbic system is activated before the slower prefrontal cortex has a chance to evaluate the stimulus (Bevans, Cerbone, & Overstreet, 2005). Hyperarousal interferes with the activation of the orbitofrontal cortex, which is needed for subtle stimulus discrimination, learning, and problem solving. Bremner and Narayan (1998) and Shin, Kosslyn, McNally, Alpert, Thompson, and Rauch et al. (1997) found a relative failure of orbitofrontal activation with traumatic imagery in adult patients with histories of childhood trauma-related PTSD. It has been proposed that the social and executive function demands of late adolescence, in particular, are likely to overload the late developing prefrontal cortex, giving rise to prefrontal dysfunction and a lack of inhibitory control over the “acting out” that peaks at this age (Shaw et al., 2002). When coupled with a history of complex trauma, this period of time during adolescence can be particularly challenging.
Although little is known about the impact of complex trauma on executive control, adults with diagnosed PTSD are known to have problems on tests of sustained attention, mental manipulation, initial acquisition of information, and retroactive interference. Their performance also is characterized by errors of commission and intrusion (Beers & De Bellis, 2002). Similar findings were documented in children with abuse-related PTSD (Teicher et al., 1993). When compared with healthy controls, children with PTSD performed more poorly on measures of attention and abstract reasoning/executive function and were more distracted and impulsive than controls. In addition, the same study revealed significant deficits with the Stroop and the Wisconsin Card sort tests, which are measures of frontal lobe function. Although based on a small number of subjects (14 pediatric psychiatric outpatients), Beers and De Bellis (2002) also found cognitive differences between children with and without maltreatment-related PTSD. Namely, the children with PTSD, when compared to 15 children who had not been maltreated, performed more poorly on measures of attention and abstract reasoning/executive function.

De Bellis et al. (2003) reported lower cognitive functioning in medically healthy children who were found by social services to be victims of neglect, who had no history of severe physical abuse, sexual abuse, prenatal substance exposure, or perinatal insults compared to a group of non-maltreated control children on all cognitive domains of the NEPSY, a standardized neuropsychological battery tapping attention and executive functions, language, memory and learning, visual-spatial
abilities, and sensorimotor functions. All child participants with a history of neglect had witnessed domestic violence and were diagnosed with PTSD. These subjects performed significantly worse on measures of attention and executive functions and visual-spatial functions than those children with a neglect history without PTSD, suggesting that children with a history of neglect and PTSD may also have specific deficits in attention and executive functions and visual-spatial functions. Thus, preliminary studies suggest that children with neglect histories have deficits in prefrontal cortex function and difficulty with executive functions.

In another study, Mezzacappa and his colleagues (2001) examined executive functions such as the capacity to inhibit an act in progress, and the capacity to passively avoid responses associated with adverse consequences in a sample of 126 boys ranging in age from 6.2 to 16.2 years. Children were classified into groups based on whether the Department of Children and Families (DCF) had investigated and confirmed allegations of abuse, and on their schools of origin (therapeutic or public school). The boys were split into the following 3 groups; therapeutic school/abused, therapeutic school/non-abused, and public school. Results revealed that boys with severe abuse histories had particular difficulty with executive function tasks that required them to refrain from taking actions that would lead to adverse consequences, thus indicating that trauma exposure appears to affect what boys anticipate and focus on and how they organize the way they appraise and process information. Given that the sample consisted solely of boys, gender differences among abuse victims were not examined. In addition, assessment tools included the Revised Behavior Problem
Checklist (R-BPC), the Stop Signal task and the Passive Avoidance Learning task. The Stop Signal and Passive Avoidance Learning Task were developed by the authors and justified as derivatives of more widely used measures. It remains to be seen whether more widely validated measures will reveal similar results.

Most recently, De Bellis and his colleagues published a study in 2009 examining the neurocognitive effects of neglect in two groups of non-sexually abused medically healthy children with neglect histories, one with DSM-IV diagnosed PTSD and one without, and a demographically similar healthy non-maltreated control group. Neglect was defined as a child having a history of Department of Social Services (DSS) defined neglect with the absence of sexual abuse. Controls were recruited through schools and pediatric clinics from the same surrounding community. The neuropsychological measures chosen in this study were described as “broadly designed to examine cognitive function” given the “limited research in this area” (p. 870). In regard to the examination of executive functioning in particular, the NEPSY Tower and NEPSY Visual Attention subtests were the only measures used. Results revealed significantly lower IQ, reading, mathematics, and selected differences in complex visual attention, visual memory, language, verbal memory and learning, planning, problem solving, and speeded naming in the neglect groups. Negative correlations were reported between PTSD symptoms, PTSD severity, and maltreatment variables, and IQ, academic achievement and neurocognitive domains. Children with a history of neglect demonstrated significantly lower neurocognitive outcomes and academic achievement than controls. The authors concluded that lower
IQ, neurocognitive functions, and achievement may be associated with more PTSD symptoms (particularly re-experiencing symptoms), greater PTSD severity, and a greater number of maltreatment experiences.

**A behavioral measure of executive functioning.** Seclusion and restraint (S/R) is a controversial topic in the field of psychiatry, due in part to the high rates of childhood maltreatment (i.e., trauma history) found among psychiatric inpatients. The trauma-informed care perspective suggests that the use of S/R with previously abused inpatients may result in re-traumatization due to mental associations between childhood trauma and the experience during S/R (Hammer, Springer, Beck, Menditto, and Coleman, 2011). Given the controversial nature of the use of S/R in trauma patients, it seems worthwhile to examine the incidence of restraint among adolescent inpatients with and without a complex trauma history. The plausible association between incidence of restraint and executive control, primarily due to difficulties with language and learning (i.e. problem-solving, planning, inhibition) is also interesting. Therefore, an analysis of the relationship among trauma and incidence of restraint in an adolescent psychiatric inpatient population and executive functioning is included as a component in the proposed study.

Many states have put forth initiatives to reduce the use of S/R in state hospitals. The members of the National Association of State Mental Health Program Directors (NASMHPD) believe that seclusion and restraint, including “chemical restraints,” are safety interventions of last resort and are not treatment interventions. NASMHPD’s position statement on seclusion and restraint, which was approved and
reaffirmed by the NASMHPD membership July 15, 2007, purports that the use of seclusion and restraint creates significant risks for all individuals involved. These include serious injury or death, re-traumatization of people who have a history of trauma, and loss of dignity and other psychological harm. In light of these potential serious consequences, it is recommended that S/R only be used when there exists an imminent risk of danger to the individual or others and no other safe and effective intervention is possible (NASMHPD, 2007).

Hammer et al. (2011) examined the relationship between S/R use and childhood abuse among psychiatric inpatients. According to the authors, the study was motivated by research that suggests that trauma victims may be more likely than other inpatients to experience S/R. They sought to clarify that possibility by examining whether the presence or absence and chronicity of childhood sexual and physical abuse differed among three groups of adult inpatients. Groups were determined based on a statistical analysis of their naturally occurring S/R trajectory over the course of a patient’s hospitalization (i.e. their need for restraint over the course of their hospitalization was categorized as high, medium and low). Results revealed that the class of inpatients who experienced the most instances of S/R over time was significantly more likely to have experienced childhood physical and sexual abuse and the abuse experienced was of a more chronic nature.

Only two studies were identified in the literature with a focus on children with abuse histories and the occurrence of S/R during hospitalization. One found that male and female inpatients whom had experienced physical abuse, as well as female
inpatients whom experienced abuse of any kind, were more likely to have been secluded or restrained at least once while living on a child/adolescent psychiatric ward (Fryer, Beech, & Byrne, 2004). The only other identified study conducted in a children’s psychiatric unit found that those patients who had experienced physical and/or sexual abuse were more likely to have been placed in seclusion while residing on the unit (Millstein & Cotton, 1990). Neither study accounted for the chronicity of the abuse and no study to date, as far as this author is aware, has examined the relationship between executive control and the occurrence of S/R among adolescent inpatients.

**Conclusions and Study Directions**

The literature reviewed throughout Chapter Two provides a basis for understanding the far-reaching effects of complex trauma. Childhood trauma is an important public health concern because of the widespread and longstanding consequences throughout the lifespan. Over the past several decades, there has been an increase in research with infants and children regarding how caregivers are the “hidden regulators” (Hofer, 1984) of their child’s immature endocrine and nervous systems. For children without nurturing and supportive caregivers, the psychological effects range from abnormal brain development to loss of self-regulation, leading to lifelong social problems and physical illness.

The multifaceted consequences of complex trauma exposure indicate that the potential cognitive and behavioral implications should be explored further.
Researchers have made significant headway in identifying the consequences of trauma throughout the lifespan in order to better serve the cognitive and behavioral needs of those individuals who have experienced complex trauma and will continue to do so as two new diagnoses (Developmental Trauma Disorder and DESNOS) are considered for inclusion in the DSM-5. Judith Herman and Bessel Van der Kolk (1987) first began this investigation along with their colleagues, and researchers continue to lead this initiative through identification of the multifaceted consequences of chronic and severe trauma (Friedman, et al., 2011; Sar, 2011).

The adverse effects of complex trauma can specifically impair the natural developmental progression of cognitive ability, as well as emotional and behavioral functioning. In some realms of cognitive function, early injury, such as that imposed by chronic trauma beginning in childhood, may disrupt acquisition of basic competencies which provide necessary foundations for later development. Of particular interest in this study is the literature indicating identification of adverse brain development among individuals with complex trauma histories. Much of the impact of trauma on the developing brain is on subcortical structures, which specifically appears to result in altered prefrontal cortex function and impaired limbic system functioning, presenting in childhood and continuing into adolescence and adulthood (Beers & De Bellis, 2002). Preclinical studies of early deprivation and investigations of atypical rearing situations with humans suggest that the absence of a reliable and consistent caregiver for a young child is associated with a negative
impact on the developing brain, which in turn, has effects on the adult brain (De Bellis, 2005) and overall function (McGloin & Widom, 2001).

Studies applying neuropsychological methods have suggested that children with trauma histories and adolescents with diagnosed PTSD show deficits in executive functioning, including abstract thinking and attention (Beers & De Bellis, 2002; De Bellis, Hooper, Spratt, & Woolley, 2009) and in everyday memory (Moradi, Doost, Taghavi, Yule, & Dalgleish, 1999). Given that the developing brain areas most vulnerable to early stress include the prefrontal cortex, hippocampus, and corpus callosum, further study of the relationship between complex trauma and executive control is warranted, especially among an adolescent inpatient population.

**Study Goals**

Given the limitations in the literature regarding the neuropsychological consequences found in adolescents with complex trauma histories, especially in regard to executive functioning skills, this study focuses on the executive functioning of adolescent inpatients with a history of complex trauma. The sample consists of male and female adolescents residing on a state inpatient psychiatric unit who have a variety of presenting psychiatric concerns. Approximately half of the sample has a history of complex trauma, and half has no history of complex trauma. Within the sample, a complex trauma history is defined by a history of severe physical or sexual abuse, neglect or psychological maltreatment, as determined by the state of Massachusetts through removal of parental custody or guardianship.
The executive functions in question involve sequential processing, planning, information processing, cognitive flexibility (shifting rapidly), response inhibition, problem solving, organizational skills, self-monitoring and self-regulation. The executive functions described above will be measured using the Wechsler Intelligence Scales, the Delis-Kaplan Executive Function System (D-KEFS), the Rey-Osterrieth Complex Figure Test, and the California Verbal Learning Test-Children’s Version. These are widely accepted assessment tools in the field of neuropsychology and are fully described in Chapter Three.

A secondary goal of this study was to introduce a behavioral and ecological measure of executive control, as the study of executive control has historically been limited to testing in a clinical environment. Specifically, data regarding the occurrence of clinical restraint of adolescent inpatients were analyzed as an ecological and behavioral measure of executive control. This data provided a unique opportunity to explore the relationship between clinical measure of executive control and ecological measure of executive control, as indicated by occurrence of clinical restraint on an adolescent inpatient unit, while controlling for the presence of trauma history.

In comparison to some of the previous research studies described above, these data helped to identify important trends that can be useful in future research with the adolescent population.
Chapter Three

Method

This chapter describes the research methodology. In order to carry out this dissertation project, a database of information including neuropsychological assessment scores, demographic data, and behavioral data obtained from the University of Massachusetts Continuing Care Adolescent Treatment Program (UMASS-CCA-TP) was used. Within this chapter, a description of the UMASS Treatment Program is provided first, including specifics about the population, setting, diagnostic assessment procedures, and the confidentiality procedures employed on the unit. Next, a description of the development of the UMASS-CCA-TP database used in this study is provided, including the measures administered and the procedures for data collection on the unit. Then the methods and procedures for the study are presented.

UMASS Continuing Care Adolescent Treatment Program

The UMASS Continuing Care Adolescent Treatment Program is a two-unit 32-bed inpatient facility that, at the time of data collection, was located on the grounds of Westborough State Hospital in Westborough, Massachusetts. The child division of the Department of Mental Health is the sole referrer to this program, and most referrals are made for youth who are on acute psychiatric units and who are unable to move to less restrictive environments given the severity of their psychiatric disturbance. The UMASS-CCA-TP is designed to provide long-term hospitalization services to adolescents whose clinical condition requires the utmost structure,
psychiatric management, medical monitoring, and specialized educational approaches. Patients also receive family therapy. While discharge plans could include returning home, most patients are referred to residential programming for at least the remainder of their adolescent years.

The author of this study became familiar with the UMASS-CCA-TP while completing an APA-approved psychology internship at Westborough State Hospital. Along with conducting individual and group therapy with adult patients at the hospital, the internship program also included a specialty rotation in neuropsychology. As part of this rotation, the author was involved in the neuropsychological assessment of 4 adolescents admitted to the UMASS-CCA-TP program, and 10 adult patients admitted to Westborough State Hospital. During this time, the author of this study was presented with the opportunity to use a database of previously gathered information for dissertation research, which is described in detail below.

**Population Served**

Adolescents admitted to the UMASS-CCA-TP range in age from 13 to 18 years. Based upon the demonstrated level of need, clients typically reside on the UMASS-CCA-TP unit anywhere from six to 18 months, which allows for the provision of extensive clinical services. The adolescents are from culturally, ethnically, racially and socioeconomically diverse backgrounds, according to reports of hospital data available on the unit. The percentage of females versus males on the
unit varies at any given time, but typically is about 60% female. The common psychiatric diagnoses that are attributed to the adolescents include Posttraumatic Stress Disorder (approximately 80% of clients have a trauma history), Dissociative Disorder, Anxiety and Mood Disorder, Eating Disorder, and Schizophrenia. These disturbances are often linked with Substance Related Disorders, Conduct Disorders, Attention Deficit Disorders and/or Reactive Attachment Disorder. Approximately half of the clients have been hospitalized in psychiatric facilities or have been placed in residential or multiple foster homes prior to assignment to the UMASS-CCA-TP. Four beds are allocated to forensic services, meaning that clients are referred from the courts for assessment of competency to stand trial, criminal responsibility or aid in sentencing.

**Diagnostic Work-Ups and Development of Treatment Plans**

Following a full diagnostic work-up, which includes interviews with psychiatry, psychology, nursing and social work staff, and often in addition to neuropsychological testing, a program of treatment is developed for each client. Assessment and treatment of clients is provided using a multidisciplinary approach. Each treatment team is comprised of psychiatrists, social workers, nurses, occupational therapists, mental health counselors and psychologists. Psychiatric diagnosis is determined through the use of a collaborative multidisciplinary team format. The treatment program includes an academic component, in addition to a therapeutic component, to allow students to continue their education while hospitalized.
Representatives of the Massachusetts Department of Mental Health (DMH), the Department of Children and Families (DCF), and the Department of Youth Services (DYS) are often involved in the treatment planning process, which is a necessity when an adolescent is a ward of the state. Treatment includes psychopharmacological intervention, individual, group and family therapies, psychological testing, as well as educational, occupational, recreational and milieu treatments.

Each patient’s progress and treatment plan is discussed at morning hospital rounds, which over time, informs the diagnosis given at the time of discharge, in addition to the prescribed follow-up care and residential recommendations.

Confidentiality

The MA-DMH provides the guarantee for confidentiality of all data associated with the patient’s medical record through the Health Insurance Portability and Accountability Act (HIPAA). HIPAA is a far-reaching federal law passed in 1996 that was intended to reform the health insurance market and simplify the health care administrative processes. The MA-DMH must also comply with the Privacy Rule, which was implemented April 14, 2003. It establishes the first national standard for the protection of individually identifiable health information. The Privacy Rule attempts to balance the need to allow the flow of health information to ensure high quality health care, with the need to protect against misuse of individual health information. The rule establishes procedural, administrative and record-keeping
requirements that covered entities must follow, protecting against the improper use or
disclosure of certain health information in any format, including oral, on paper or
electronic. In addition, the Rule protects individual rights regarding their health
information. Finally, the MA-DMH must also comply with the Security Rule, which
was established April 21, 2005. Its requirements were developed to protect the
confidentiality, integrity and availability of individual health information in electronic
format. The Security Rule mandates safeguards for the storage, maintenance,
transmission of and access to electronic health information.

Neuropsychological data collected during the patient’s admission are gathered
as part of their clinical treatment and thus falls under HIPAA confidentiality
requirements. Upon admission to the UMASS-CCA-TP, each adolescent and his/her
family are provided with information about HIPAA and asked to sign a document
ensuring their understanding of their rights to confidentiality. They are also informed
that if agreed, some of the data collected as part of their hospitalization may be used
for research purposes retrospectively, perhaps even after their discharge, in a de-
identified format. The patients are told that all information is confidential, and that no
information with identifiers is to be disclosed to parties outside of the hospital
without a written consent from the patient. This statement is limited by disclosure of
the “Lamb Warning” to both the patient and his or her family, highlighting the limits
of confidentiality, including the need for reporting in cases where information
regarding the abuse of minors, the disabled, or the elderly is presented. In addition,
the clinicians collecting information are trained in methods to help maintain
confidentiality. Completed neuropsychological data are stored within the client’s electronic medical record system in report form in order to provide feedback to the adolescent’s treatment team, as well as within a de-identified spreadsheet of results that was created for research purposes. Both the electronic medical system and the spreadsheet are protected with individual user passwords.

**Development of the Neuropsychological Database of Patients on the UMASS-CCA-TP Unit**

In June of 2005, a systematic collection of neuropsychological data began on the UMASS-CCA-TP unit. Psychiatry and psychology clinical staff members (not including this author) initiated data collection. The idea behind a systematic collection of data was driven by both the potential usefulness of the testing data to inform clinical practice as well as the desire to gather a database of neuropsychological information within an inpatient adolescent population for research purposes. When based on a thorough description of abilities and needs, neuropsychological testing reports lead to recommendations for the rehabilitation and treatment of the adolescent clients, which is particularly useful when planning for patient discharge from an inpatient unit. In fact, neuropsychological evaluation is requested for most patients on the unit by clinical team members in order to inform the therapeutic treatment plan.

**Personnel involved in data collection.** Two to three doctoral interns and one staff neuropsychologist are typically involved in the administration of neuropsychological assessment (with each staff member being assigned to their own
individual client). Interns are instructed to explain the purpose of the evaluation, which is to inform clinical care and for research purposes. Doctoral interns are primarily trained in the administration of testing during academic courses required as part of their doctoral curriculum. When an intern is not familiar with a specific test to be administered, the intern is trained by the staff neuropsychologist.

Subsequent to data collection by the intern, a research assistant to the staff neuropsychologist enters the neuropsychological test results (de-identified) into a research spreadsheet on a password-protected computer.

**Measures.** Measures included in the testing protocol consist of the following and are administered in the order listed: (a) Wechsler Intelligence Scale for Children-4th Edition (WISC-IV; Wechsler, 2003) or Wechsler Adult Intelligence Scale-3rd Edition (WAIS-III; Wechsler, 1997); (b) Wechsler Individual Achievement Test-2nd Edition (WIAT-II; The Psychological Corporation, 2002); (c) Finger Tapping Test (Reitan, 1969); (d) Delis Kaplan Executive Function System Verbal Fluency Test (D-KEFS; Delis, Kaplan, & Kramer, 2001); (e) Boston Naming Test-2nd Edition (Kaplan, Goodglass, & Weintraub, 2001); (f) Rey-Osterrieth Complex Figure Test-Copy (ROCF; Rey, 1941); (g) California Verbal Learning Test-Children’s Version (CVLT-C; Delis, Kramer, Kaplan, & Ober, 1994); (h) Rey-Osterrieth Complex Figure Test-Delayed Recall (ROCF; Rey, 1941); (i) Brief Visuospatial Memory Test-Revised (BVMT-R; Benedict, 1997); (j) D-KEFS Trail Making Test (Delis et al., 2001); (k) D-KEFS Color-Word Interference Test (Delis et al., 2001); and (l) D-KEFS Sorting Test (Delis et al., 2001).
In addition to the neuropsychological data being collected, demographic and behavioral data were entered into the database. This includes custody status, which is listed as a yes/no variable indicating history of removal of guardianship from the primary caregiver, with guardianship being granted to the state of Massachusetts. The database also included information regarding age, gender, ethnicity, psychiatric diagnosis, and numerical report of restraint data occurring on the unit. Number of restraints, both physical and/or chemical, were recorded as the total number of restraint episodes over the entire length of hospitalization, from admission to discharge. On the UMASS-CCA-TP inpatient unit, the staff is encouraged to minimize restraint episodes by using other less invasive measures of behavioral control. However, if an adolescent becomes extremely agitated, the nursing staff will typically provide a medication, such as a benzodiazepine, to reduce anxiety. This type of intervention is considered a “chemical restraint.” A physical restraint is utilized in extreme cases of behavioral agitation when a patient is at risk of harming themself, other patients or staff members.

**Procedures for data collection.** Neuropsychological testing is a routine referral on the UMASS-CCA-TP and typically occurs within the first few weeks of hospitalization. The hope is that testing results will quickly inform an efficient therapeutic plan, which is developed by the patient’s treatment team. Clinicians working on the unit provide the neuropsychology team with a list of patients to be tested, which is typically commensurate with order of admission onto the unit. For the primary purpose of treatment and discharge planning, neuropsychological data are
being gathered only on UMASS-CCA-TP patients who are deemed clinically stable enough to cooperate with the testing process (i.e. no severe active psychosis or severe aggression directed toward others). Clients were also excluded from testing if only a very brief hospitalization was planned (1-2 weeks) or if they participated in other neuropsychological testing in the past year.

In general, evaluations were conducted over the course of 2 to 3 hour-long sessions in a private room. The intern obtained a verbal consent for participation and testing proceeded at a rate commensurate with the patient’s individual needs. The entire neuropsychological assessment was scored by the doctoral intern who administered the testing and was reviewed in a comprehensive manner with the neuropsychology team. After testing and scoring of the data were complete, the staff neuropsychologist provided the clinical team, in addition to the patient and their family when appropriate, with results and recommendations for treatment.

Data were entered in the database by the research assistant working with the staff neuropsychologist. In addition to entering test data, the research assistant also referred to the patient’s medical record in order to gather demographic data, which included custody status, to enter into the database. Restraint data were recorded and entered into the database from the nursing logs at the time of patient discharge. The UMASS-CCA-TP database consisted of neuropsychological information for 39 adolescents.
Method for the Present Study

Participants

Thirty-five participants (from the unit) for whom neuropsychological data were collected were identified for inclusion. Four participants who had a Full Scale Intelligence Quotient (IQ) of less than 70 (Extremely Low range) were excluded from the original database of 39 subjects for purposes of this project in order to rule out the presence of possible confounding factors. Intelligence quotient was determined through use of the Wechsler Intelligence Scales. Participants included in the data set ranged in age from 13 years through age 18 years, 11 months. Of the 35 participants, 15 had a history of DCF custody and 20 had never been in DCF custody. There were no multiple hospitalizations among any of the 35 participants.

Ascertainment of Complex Trauma

Given the strong relationship between the definition of complex trauma and the Massachusetts state criteria for child placement outside of the home in protective custody, complex trauma history, the independent variable in this study, was defined for the purposes of this dissertation project as a “history of being placed in state protective custody” (i.e. “DCF custody”). This population includes adolescents with a substantiated history of at least one of the following three forms of maltreatment: sexual abuse, physical abuse, and/or neglect. The owner of the database reviewed the records of each participant identified as having been in DCF custody in order to determine the nature of the removal. For example, if a participant is identified as having been in DCF custody in the database, his or her Social Work Intake Summary
was reviewed in order to verify that removal was a result of complex trauma, rather than removal through CHINS or through a medical petition, which are the other two reasons for removal as discussed in Chapter One.

**Measures**

The measures used in the current study and described in the following sections were chosen from the UMASS-CCA-TP database. Dependent variables that were chosen are widely used cognitive measures of executive functioning. In addition, restraint data were collected as a dependent measure. The assessment of each is described below.

**Assessment of executive functioning.** In order to assess executive functioning, the following neuropsychological tests were selected from the UMASS-CCA-TP neuropsychological assessment protocol described above.


The Wechsler scale chosen for each participant was dependent upon their age (WISC-IV ages 6 to 16 years, 11 months; WAIS-III ages 16 to 89). One purpose of the WISC-IV and the WAIS-III was to provide a measure of general intellectual function, which was used for exclusionary purposes (IQ<70 = exclusion). The Wechsler tests were also used to obtain a measure of Verbal and Performance IQ. The Working Memory and Processing Speed indices were used as a measure of executive functioning. The subtests that comprise these two indices are Digit Span and Letter-
Number Sequencing (Working Memory), and Coding and Symbol Search (Processing Speed). Each test is described briefly in the following paragraphs.

The Digit Span subtest is primarily a measure of short-term sequential auditory memory and attention (Sattler, 2001). The task also assesses the ability to retain several elements that have no logical relationship to one another and requires sequencing skills. Specifically, Digits Forward appears to involve primarily sequential processing and short-term memory, while Digits Backward appears to involve both planning ability and sequential processing (and may provide some insight into working memory).

Letter-Number Sequencing is reported to measure the construct of working memory (Wechsler, 1997), which is a dynamic short-term memory storage system of limited capacity, used to hold information that is being processed (Baddeley, 1990). The subtest involves attention, short-term auditory memory, and information processing.

The Coding subtest involves, among other abilities, visual-motor coordination, speed of mental operation, attentional skills, and cognitive flexibility (in shifting rapidly from one pair to another). It can be conceptualized as an information-processing task involving the discrimination and memory of visual pattern symbols (Sattler, 2001).

Symbol Search involves perceptual discrimination, speed and accuracy, attention and concentration, short-term memory, and cognitive flexibility. This
subtest can be conceptualized as a task involving visual discrimination and visuoperceptual scanning (Sattler, 2001).

The Wechsler Intelligence Scales are the standard of practice in psychological testing and are often used in research given their established reliability, validity and frequency of administration (Strauss, Sherman, & Spreen, 2006). Subtest specificity, which refers to the proportion of a subtest’s variance that is both reliable and distinctive to the subtest, is important to determine how feasible it is to interpret the unique abilities or traits attributed to a subtest. Kaufman and Lichtenberger (1999) concluded that most subtests (including the four subtests to be analyzed in the proposed study) had reliable and interpretable unique characteristics. The psychometric data is presented below.

*Psychometric data on the WISC-IV.* The WISC-IV is based on a standardization sample of 2200 children in 11 age groups from ages 6 years to 16 years, 11 months (Strauss, Sherman, & Spreen, 2006). Norms were stratified according to 2000 U.S. Census data by age, gender, race, parental education, and geographic region. The internal reliability of the WISC-IV is excellent (ranging from .80-.90+ for different subtests). Standard errors of measurement are fairly small, as would be expected given the high reliabilities of WISC-IV subtests and index scores. The average $SEM$ across age for the FSIQ is 2.68; others range from 3.78 to 5.21 (index scores) and from .97 to 1.38 (subtests). Test-retest stability is high to excellent for index scores, as reported in the test manual (i.e., all index scores in the high .80s or above .90; Wechsler, 2003). The development of the WISC-IV followed five
comprehensive stages and bias analyses were conducted on items, including formal expert review and empirical analyses of bias over-sample. Quality assurance procedures were followed, as was training of examiners. In terms of validity, a study comparing performance of 60 randomly selected children from the standardization indicated no significant mean differences between subtest and composite scores (Wechsler, 2003). Several WISC-IV subtests have ample specificity, and thus can be interpreted as providing unique information not provided by other subtests or by the test as a whole.

*Psychometric data on the WAIS-III.* The WAIS-III is based on a standardization sample of 2450 people, aged 16-89 years (Strauss, Sherman, & Spreen, 2006). Data gathered according to the 1995 U.S. Census data were used to stratify the sample according to age, gender, race/ethnicity, education level, and geographic region. The sample was divided into 13 age groups, with 100 to 200 in each age group. The demographically-adjusted norms provide an estimate of the individual’s current performance relative to peers similar in age, education level, gender, and race/ethnicity. Thus, these norms allow for comparisons in performance (the Psychological Corporation, 2002). They propose a one SD cutoff of demographically corrected factor scores (T scores < 40) to define cognitive impairment. This results in an 85% specificity rate that is constant for the three ethnicity groups and is not affected by differences in age, education, or gender. The WAIS-III FSIQ score is the most reliable score, with an average split-half reliability coefficient across the 13 age groups of .98. The average split-half reliability
coefficients for the other IQ and index scores are also high (VIQ: .97, PIQ: .94, VCI: .96, POI: .93, WMI: .94, PSI: .88). In general, reliability coefficients are higher for the verbal than for the nonverbal scales. Internal consistencies were relatively lower for samples of children with ADHD/ADD and learning disabilities, although not statistically different from the standardization sample.

According to the test manual, average standard errors of measurement (SEMs) across age groups are smallest for FSIQ (2.33). The remainder of SEMs ranged between 2.55 (VIQ) and 5.13 (PSI) standard score points for the IQ/index scores. In terms of test/retest reliability, a subset of the standardization sample (394) participants was retested with the WAIS-III following an interval of about 35 days. For the four subgroups (16-29, 30-54, 55-74, and 75-89 years), reliability coefficients are very high, ranging from .94 to .97 for VIQ, .88 to .92 for PIQ, and .95 to .97 for FSIQ.

There is substantial correlation (.80 and above) between the WAIS-III and its predecessor, the WAIS-R (WAIS-III/WMS-III Technical Manual, 1997). The WAIS-III and WISC-IV also appear to measure similar constructs (Wechsler, 2003). The WAIS-III and WISC-IV were given to 198 children, aged 16, in counterbalanced order, with a testing interval of 10-67 days ($M=22$ days). The correlations between index scores of the two measures are relatively high, ranging from .73 for PRI-POI to .89 for FSIQ-FSIQ and from .56 (Symbol Search) to .83 (Vocabulary) for subtests. There is also substantial correlation (.6-.92) between the WAIS-III FSIQ and other measures of intelligence, including the Standard Progressive Matrices, the Stanford-
Binet-IV (the Psychological Corporation, 1997), the GAMA (Martin et al., 2000), the Dementia Rating Scale (the Psychological Corporation, 2002), and the WASI (Axelrod, 2002; the Psychological Corporation, 1999). Notably, the correlation between years of education and WAIS-III IQ scores is moderately high (.46-.55).

**Delis Kaplan Executive Function System (D-KEFS; Delis, Kaplan, & Kramer, 2001).** Subtests utilized from this test included the Verbal Fluency Test, Color-Word Interference Test, Trail Making Test and the Sorting Test. The Verbal Fluency Test examines fluent productivity in the verbal domain on various conditions, including a less structured letter-naming task, a more structured category task, and a switching task. Scores were obtained from both the Letter Fluency and Category Fluency subtests. The Color-Word Interference Test looks at verbal inhibition and shifting sets. Scores were obtained from Color-Word Conditions 3 and 4. Condition 3 is an inhibition task (name the ink color in which color words are printed) and Condition 4 is an inhibition and switching task (switch back and forth between naming the dissonant ink colors and reading the conflicting words). The Trail Making Test taps into mental flexibility in a visual format. Scores were obtained from Trail Making 4, which is the number-letter switching condition. Finally, the Sorting Test assesses problem solving, verbal and spatial concept formation, and mental flexibility. Scores were obtained from Condition 1, the Free Sorting task.

**Psychometric data on the D-KEFS.** The D-KEFS was normed on a sample of 1750 individuals, aged 8 to 89 years, selected to match the United States population in terms of age, gender, race/ethnicity, education and geographic region (Strauss,
Sherman, & Spreen, 2006). The D-KEFS provides a comprehensive assessment of executive function and was designed to detect even mild forms of executive dysfunction (Delis, Kaplan, & Kramer, 2001). This instrument is the first set of standardized tests to evaluate higher-level cognitive functions in people as young as eight (Delis et al., 2001) and is comprised of nine subtests.

As the Delis-Kaplan is a relatively new measure (2001), there was not much validity and reliability data regarding this battery when Baron conducted a thorough review in 2004. However, Strauss, Sherman and Spreen (2006) commented in their review of the D-KEFS that “although additional study of validity is needed” (p. 448), the D-KEFS is a “flexible instrument” that has been shown to have “considerable clinical utility” (p. 449). In a study published in 2007 (Parmenter, et al.), the validity of the DKEFS Sorting subtest was explored in multiple sclerosis (MS) patients and found to modestly or strongly correlate with MRI indices of brain atrophy or lesion burden and overall appeared to have good validity in the MS population. In a correlational study comparing the D-KEFS with another measure of executive functioning, as reported by the authors in the D-KEFS Technical Manual (Delis et al., 2001), they found modest/high correlations (.31-.59) between Wisconsin Card Sorting Task (WCST; Heaton, Chelune, Talley, Kay, & Curtis, 1993) measures (number of categories completed) and various D-KEFS measures from the nine subtests (including D-KEFS Sorting). The implication is that the D-KEFS and the WCST are assessing similar, though not identical, processes.
As reported by Strauss, Sherman, and Spreen (2006), internal consistency was evaluated for the primary measures in the normative sample and the coefficients ranged from inadequate (e.g. Verbal Fluency Category Switching total correct) to adequate/high on other subtests, depending on the particular measure and the age group. Test-retest correlations ranged from low (e.g. Trail Making) to adequate/high (e.g. Letter and Category Fluency total correct). The authors report (Technical Manual) numerous within and between-task correlational analyses broken down by specified age bands of the normative sample. The magnitude of the correlations of scores within tasks varies greatly by task, measure, and age group. In general, primary measures derived from the same test correlate more highly than scores across tests. Correlations between tasks tend to be low.

The authors of the D-KEFS stress (D-KEFS Examiner’s Manual, p.14) the usefulness of selecting certain subtests from this system to assess executive function skills as these tasks “in either experimental studies or clinical practice, have demonstrated sensitivity in the detection of frontal-lobe dysfunction.” Even critics of the Delis-Kaplan (Baron, 2004) report that validity data for the subtests have existed for years, only for slightly different versions. Although the D-KEFS is a relatively new instrument, it is considered quite useful as evidenced by its sheer prevalence in the domains of psychological and neuropsychological assessment of both adults and children, and was therefore considered a useful measure for the purposes of this dissertation.
Rey-Osterrieth Complex Figure Test-Copy (ROCF; Rey, 1941). The ROCF has a long history in the field of neuropsychology and is one of the most commonly used tests in the field (Camara et al., 2000). Its popularity derives from the fact that it permits assessment of a variety of cognitive processes, including planning, organizational skills, and problem-solving strategies, as well as perceptual, motor, and episodic memory functions (Meyers & Meyers, 1995; Waber & Holmes, 1986). The test can be given to individuals aged 6 to 93 years. There are numerous scoring systems available. The L.B. Taylor scoring criteria was used on the UMASS-CCA-TP unit (Taylor, 1991) and therefore utilized in this study.

Psychometric data on the ROCF. The ROCF has been shown to have good internal, test-retest and interrater reliability (for a review see Strauss, Sherman, & Spreen, 2006). The internal consistency of the Rey Figure was evaluated by treating each detail as an item and computing split-half and alpha coefficients (Berry et al., 1991; Fasteneau et al., 1996). Both split-half and coefficient alpha reliabilities were greater than .60 for the copy condition and greater than .80 for recall conditions in adults, suggesting that all of the details tap into a single factor.

In terms of validity, the precise cognitive operations required for adequate performance are thought to include visual perception, visual-spatial organization, motor functioning, and, on the recall condition, memory (Chervinsky et al., 1992). Overall, the data from correlational and factor analytic studies support the validity of the ROCF as a measure of visual-constructional ability and memory. There is less evidence concerning the specific executive functions contributing to task
performance; however, qualitative copy scores have been shown generally in the literature to correlate moderately with measures of executive ability (Bernstein & Waber, 1996; Stern et al., 1999).

Overall, Strauss et al. (2006) reported in their review of the ROCF that it provides a “rich source of information about a variety of cognitive processes, including visual-spatial skills, visual-construction ability, visual memory, and executive dysfunction in adults as well as children” (p.835).

California Verbal Learning Test-Children’s Version (CVLT-C; Delis, Kramer, Kaplan, & Ober, 1994). The CVLT-C was developed to measure memory and learning using a process-oriented approach. It was designed to assess memory within the context of an “everyday memory task,” which consists of remembering items from a shopping list, in a multiple-trial list-learning paradigm. The test can be given to individuals aged 5 years to 16 years, 11 months.

As noted by Beebe, Ris, and Dietrich (2000), most of the process variables included within the CVLT-C relate to abilities subsumed under executive functioning, for example, the use of organizational strategies during encoding (e.g., semantic clustering) or the use of self-monitoring (e.g. perseverations). Beebe et al. (2000) do note, however, that the relationship between these process variables and the true nature of executive functioning should be further explored. In a more recent study of executive control and learning pattern on the CVLT (Lebowitz et al., 2006), the authors reported finding an isolated executive control weakness, namely difficulty
with inhibition, that is associated with a specific pattern of learning. Executive control provides a mechanism for the inhibition of irrelevant information present within the environment. Thus, when an executive control weakness is present, tasks that require suppression of interference, such as the CVLT, are likely to be disproportionately compromised. Although the study was limited in its ability to infer executive control correlates of frontal dysfunction or to learning patterns other than those included in the study, the research does provide insight into the executive contribution to learning and recall performance on verbal list learning tasks.

*Psychometric data on the CVLT-C.* Strauss et al. (2006) comment that the CVLT-C is a well-designed, sophisticated tool for measuring verbal memory in children and note that a number of studies have examined CVLT-C performance across a wide variety of clinical syndromes of childhood, supporting its sensitivity and utility in both clinical and research settings. The normative sample consists of 920 children in 12 age groups, ranging in age from 5 years to 16 years 11 months. Norms were stratified based on 1988 U.S. Census data.

The authors of the CVLT-C note that recall tests pose special difficulties for the estimation of internal consistency because of problems with item interdependence within and between trials. Accordingly, the authors used three approaches to estimate internal consistency for the CVLT-C, based on the Total Recall score on each of the List A learning trials: across-trial consistency, across-semantic-trial consistency, and across-word consistency (see test manual for details). These analyses indicated good internal consistency of the total recall scores for the CVLT-C trials.
Analyses conducted by the authors of the CVLT-C indicated adequate to high test-retest reliability coefficients (Delis et al., 1994, 2000). Across age, SEMs are on average about 4 T score points for the total number of words recalled. Factor analyses of the performance measures of the CVLT-C appear to support its construct validity (Strauss et al., 2006) and the test has strong ecological validity (Delis et al., 1994).

**Assessment of executive functioning in an ecological environment.**

Restraint data (i.e. the total number of physical and chemical restraints per adolescent inpatient admission) were selected for use as a behavioral measure of executive control. These data were gathered on a daily basis by the nursing staff and kept in a log available for review by hospital staff.

**Procedures**

The principal researcher, after obtaining permission from the appropriate Internal Review Boards at the Department of Mental Health (DMH), (see Appendix A) and Northeastern University (see Appendix B), received a copy of the UMASS-CCA-TP de-identified database in order to perform analyses. Independent and dependent variables, along with demographic information such as gender, age, ethnicity, and psychiatric diagnoses were copied into a new Statistical Package for the Social Sciences Version 19 (SPSS v.19) spreadsheet and utilized by the principal researcher for data analysis (SPSS, 2010).
Study Design

This study examined the relationship between a complex trauma history, as determined by a history of or current placement in DCF protective custody, and executive functioning. Different manifestations of executive functioning were studied through the use of both neuropsychological and behavioral data (i.e. incidence of restraint) gathered on the inpatient unit. A descriptive group comparison approach was used in order to explore and describe the existing distribution of variables in the two groups.

Planned Analyses

First, descriptive statistics (mean, standard deviation, minimum, maximum, skewness and kurtosis) and independent t-tests between the history of DCF custody and no history of DCF custody groups were computed for all interval-level variables in this study. These variables included scores on the following measures: WISC-IV or WAIS-III Verbal and Performance IQ scores, Working Memory and Processing Speed Index scores; D-KEFS Verbal Letter and Category Fluency subtests, Color-Word Interference Conditions 3 and 4, Trail Making 4; and Sorting; ROCF Test-Copy; CVLT-C; and the total number of chemical and physical restraint episodes.

Calculation of values of skewness and kurtosis for each of these variables allowed for determination of whether the variables followed a normal distribution. If skewness and kurtosis are within the [-1, +1] range, this indicates that the variables follow a normal distribution. In order to reduce the number of variables, a factor
analysis was conducted on all of the measures neuropsychological measures to select the strongest combined measure(s) of executive functioning.

Research Questions and Hypotheses

The research questions followed by the corresponding hypotheses are presented below. Also included are the specific analyses that were carried out for each question:

**Question 1.** What is the relationship between a complex trauma history and executive functioning among adolescent inpatients?

It was hypothesized that adolescents who have experienced complex trauma, as determined by a history of being in DCF custody, will show lower executive functioning on neuropsychological measures as compared to adolescent inpatients without a complex trauma history (i.e. no history of being in DCF custody).

A one-way ANOVA was used to analyze the relationship between a history of complex trauma and executive functioning ability. The dependent variable was the value(s) of the executive functioning component extracted from the Principal Component Analysis, a type of factor analysis. The predictor (independent) variable was custody status. This variable had two categories “complex trauma history/DCF custody,” and “no complex trauma history/no history of DCF custody.”

One of the assumptions of ANOVA, that the variance of the dependent variable is equal across groups (history of DCF custody and no history of DCF custody).
custody), was explored using Levene’s test. Approximately equal variance was indicated, thereby eliminating the need to use Welch’s ANOVA, a test that is robust to the heterogeneity of variance. Additionally, given that the skewness and kurtosis statistics showed that the variables were not normally distributed, a nonparametric test (Mann-Whitney’s U) was used instead of ANOVA to compare the means of the dependent variables between the DCF custody and non-DCF custody groups.

**Question 2.** What is the relationship between a complex trauma history and necessity of restraint among adolescents residing in an inpatient psychiatric setting?

It was hypothesized that adolescents who have a history of complex trauma will have a higher frequency of restraint during hospitalization as compared to adolescent inpatients without a history of complex trauma.

For this question, a similar procedure as in Research Question 1 was used. A single one-factor ANOVA was conducted. The dependent variable in this analysis was the number of restraint episodes per participant over the course of their single hospitalization. The independent variable was DCF custody status. The assumptions (normality and homogeneity of variance) were tested in the same fashion as described previously. Given that the “number of restraints” variable did not satisfy the normality assumption for the ANOVA, the analysis was repeated using a non-parametric test, the Mann-Whitney U.
The significance level for these analyses was set at .05. As there were less than 3 measures to compare, it was not necessary to adjust the significance level with a Bonferroni correction.

**Question 3.** What is the relationship between executive functioning and need for clinical restraint among adolescents residing in an inpatient psychiatric setting, controlling for trauma history? It was hypothesized that there will be an inverse relationship between executive functioning as assessed through neuropsychological measures and the need for clinical restraints, and that this association will persist when controlling for trauma history.

For this question, stepwise linear regressions were conducted. The dependent variable in each case was the behavioral measure of executive functioning, the number of restraint episodes over the course of hospitalization for each participant. The following 2 diagnoses were considered as control variables in the regression analyses, as they are conditions associated with weaknesses in executive skills:

1. Attention Deficit-Hyperactivity Disorder (ADHD) diagnosis
2. Autism Spectrum diagnosis

The independent variables were entered as follows. In Step 1, the control variables of ADHD and Autism were included, as well as the extracted Executive Functioning component score(s). In Step 2, DCF Custody Status was entered. The significance of Executive Functioning was examined before and after including DCF Custody Status in order to examine any change in relationship. Next, a model with
only Executive Functioning as a predictor was run to examine whether or not Executive Functioning on its own predicts incidence of restraint, without the effect of the control variables. An inspection of the model coefficients’ significance allow for determining whether there is a relationship between executive functioning and need for clinical restraint, and whether this association persists when controlling for trauma history.
Chapter Four

Results

The objective of the present study was to examine the relationship between complex trauma history and executive functioning among adolescent inpatients. To address this objective, a statistical analysis of a database of 35 adolescents at the University of Massachusetts Continuing Care Adolescent Treatment Program (UMASS-CCA-TP), an inpatient psychiatry unit, was conducted. In this chapter, the sample is described and the participants’ performance on the dependent variables is presented. Following that, results of the factor analysis, one-way ANOVAs, Mann-Whitney U and stepwise linear regression analyses are presented. The chapter concludes with a summary.

Description of the Sample

The sample consisted of 35 participants, presented in Table 4.1. As can be seen, the slight majority of participants were female (54.3%). Additionally, the most common ethnicity was Caucasian (71.4%), followed by African American (17.1%). The average age of participants was 16.4 years ($SD = 1.65$), with a range from 13 to 18 years.

There were 15 participants (42.9%) who had a history of being in the custody of the State of Massachusetts Department of Children and Families (DCF). The mean duration of hospitalization was 46 days across the total sample. Length of hospitalization was also characterized as a categorical variable; “long” (greater than 6 weeks) or “short” (less than 6 weeks) and the frequency was found to be similar
across groups. Additionally, 5.7% of the participants had been diagnosed with an Autism Spectrum diagnosis, 8.6% had been diagnosed with Attention Deficit-Hyperactivity Disorder (ADHD), and 54.3% had been diagnosed with Posttraumatic Stress Disorder (PTSD). According to the frequency analysis conducted to provide a demographic profile of the participants, which was based on their custody status, slightly more participants in the custody group versus the non-custody group had been diagnosed with PTSD (80% vs. 65%).
Table 4.1

Frequency Distribution of Study Variables

<table>
<thead>
<tr>
<th></th>
<th>Total Sample</th>
<th>DCF Custody</th>
<th>No History of DCF Custody</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
</tr>
<tr>
<td>DCF Custody Status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>20</td>
<td>57.1</td>
<td>--</td>
</tr>
<tr>
<td>Yes</td>
<td>15</td>
<td>42.9</td>
<td>--</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>19</td>
<td>54.3</td>
<td>9</td>
</tr>
<tr>
<td>Male</td>
<td>16</td>
<td>45.7</td>
<td>6</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>25</td>
<td>71.4</td>
<td>7</td>
</tr>
<tr>
<td>African-American</td>
<td>6</td>
<td>17.1</td>
<td>5</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1</td>
<td>2.9</td>
<td>1</td>
</tr>
<tr>
<td>Asian-American</td>
<td>3</td>
<td>8.6</td>
<td>2</td>
</tr>
<tr>
<td>Autism Diagnosis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>33</td>
<td>94.3</td>
<td>13</td>
</tr>
<tr>
<td>Yes</td>
<td>2</td>
<td>5.7</td>
<td>2</td>
</tr>
<tr>
<td>ADHD Diagnosis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>32</td>
<td>91.4</td>
<td>14</td>
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<td>3</td>
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<td>PTSD Diagnosis</td>
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<tr>
<td>No</td>
<td>16</td>
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<td>3</td>
</tr>
</tbody>
</table>
Neuropsychological Variables

Neuropsychological testing scores were obtained on ten variables across four different measures. A data reduction strategy was implemented to limit the number of neurocognitive variables in order to create manageable domains of data and provide support for their internal consistency. As a result, the WAIS-III/WISC-IV Working Memory and Processing Speed Index scores were utilized to represent the following four WAIS-III/WISC-IV individual subtest scores: Digit Span and Letter-Number Sequencing (Working Memory Index) and Coding and Symbol Search (Processing Speed Index). This manner of grouping is consistent with the author recommended index scoring on the WAIS-III/WISC-IV. Also for the sake of parsimony, the D-KEFS Verbal Category Fluency and Sorting subtest scores were averaged together for each participant, given the similarity in the construct that each subtest measures, i.e. categorization and flexibility in thinking. The same is true for the D-KEFS Color-
Word subtests 3 and 4, both of which are measures of inhibition of an overlearned response.

Table 4.2 presents the descriptive summary statistics on all of the dependent study variables, as well as Verbal and Performance IQ, separated by group (DCF custody vs. no history of DCF custody). As can be gleaned from this table, the average scores on all variables were higher (i.e. better) for the “No Custody” group. The standard deviation values for the variables analyzed were large, which indicated that the values of the scores for each variable were widely spread, as is typical in a small sample. An independent samples t-test was conducted, rather than MANOVA which is typically reserved for testing the effects of two independent variables, to determine whether there were significant differences between the scores of the respondents in the history of DCF custody compared to the no history of DCF custody group.

Results reported in Table 4.2 show that adolescents with a history of placement in state custody (i.e. a complex trauma history) showed significantly lower scores on five of the ten variables. The scores of the respondents who had no history of state custody were significantly higher for the following dependent measures: CVLT-C Trials 1-5 Total \(t(26.384) = -2.986, p = .006\), Rey-O Complex Figure Copy \(t(18.818) = -3.617, p = .002\), Verbal Category Fluency/Sorting \(t(24) = -2.322, p = .029\), and Color Word 3 & 4 \(t(14.883) = -2.510, p = .024\). These results indicate that custody status might be a contributing factor when studying neurocognitive differences. Specifically, the adolescents with a history of DCF
custody displayed lower performance in the following domains of executive functioning: (a) verbal memory, as measured with the CVLT-C; (b) spatial memory calling for organizational skills, as measured with the Rey-Osterrieth Complex Figure Copy; (c) fluent productivity in the verbal domain, specifically calling for categorizing skills, problem skills and mental flexibility, as measured with the D-KEFS Verbal Category Fluency and Sorting subtests; and (d) inhibition of an overlearned response and flexibility in shifting cognitive set, as measured with the D-KEFS Color-Word Interference Conditions 3 and 4.

Table 4.2

*Mean Performances and Standard Deviations on Dependent Measures, by Custody Group*

<table>
<thead>
<tr>
<th>Variable</th>
<th>DCF Custody</th>
<th>No Custody</th>
<th>T</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>Verbal Letter Fluency</td>
<td>9.18</td>
<td>4.94</td>
<td>12.00</td>
<td>4.83</td>
<td>22</td>
</tr>
<tr>
<td>Working Memory Index</td>
<td>88.73</td>
<td>14.53</td>
<td>96.11</td>
<td>21.55</td>
<td>1.00</td>
</tr>
<tr>
<td>Processing Speed Index</td>
<td>83.42</td>
<td>17.10</td>
<td>92.06</td>
<td>19.88</td>
<td>-1.22</td>
</tr>
<tr>
<td>Trail Making 4</td>
<td>6.55</td>
<td>5.56</td>
<td>9.15</td>
<td>4.04</td>
<td>-1.29</td>
</tr>
<tr>
<td>CVLT-C Trials 1-5 Total</td>
<td>78.43</td>
<td>16.06</td>
<td>100.38</td>
<td>23.87</td>
<td>-2.97</td>
</tr>
<tr>
<td>Rey-O Complex Fig. Copy</td>
<td>80.29</td>
<td>21.72</td>
<td>103.60</td>
<td>10.86</td>
<td>-3.62</td>
</tr>
<tr>
<td>Verbal Cat. Fluency/Sorting</td>
<td>8.29</td>
<td>2.90</td>
<td>11.32</td>
<td>3.63</td>
<td>-2.32</td>
</tr>
<tr>
<td>Color-Word 3 &amp; 4</td>
<td>7.32</td>
<td>4.60</td>
<td>11.23</td>
<td>2.35</td>
<td>-2.51</td>
</tr>
<tr>
<td>Verbal IQ</td>
<td>90.08</td>
<td>21.46</td>
<td>108.42</td>
<td>20.41</td>
<td>-2.39</td>
</tr>
<tr>
<td>Performance IQ</td>
<td>98.17</td>
<td>20.14</td>
<td>103.00</td>
<td>12.79</td>
<td>-7.4</td>
</tr>
</tbody>
</table>

*Note.* Significant *p* values are highlighted in boldface.
Verbal and Performance IQ were included in this table to provide a measure of general cognitive functioning, primarily as a reference point to allow for interpretive differentiation between global deficits in cognitive functioning as compared to specific deficits in executive functioning, such as attention, working memory, inhibition or switching skills. As reported above in Table 4.2, Verbal IQ was found to be significantly lower in the DCF Custody group ($t(29) = -2.389, p = .024$), whereas no difference was found among the groups in Performance IQ (Average range performance measured in both groups).

**Factor Analysis of WISC-IV/WAIS-III/D-KEFS/CVLT-C and Rey-O Scores**

In order to address all three research questions, a Principal Component Analysis (PCA) with Varimax rotation was initially conducted on eight of the neuropsychological testing variables in order to reduce them into a more highly correlated and smaller grouping scheme for subsequent ANOVA and stepwise linear regression analyses performed in the current study (as noted above Verbal and Performance IQ were not included). The results suggested that a one-factor model best fit the data for the total sample; that is PCA analysis of the eight neuropsychological testing variables produced one extracted component, which represents a summary of the executive functioning data. Specifically, factor analysis results indicated one eigenvalue greater than one (unrotated eigenvalues = 5.44, 0.72). This single factor explained 67.95% of the variance of all scores, with a relatively high internal consistency (Cronbach’s alpha value of .863). Notably, the DKEFS Verbal Category Fluency and Sorting subtests were averaged into one score (as
mentioned above) and the DKEFS Color-Word subtest trials 3 and 4 were averaged into one score before the PCA. The Verbal and Performance IQ scores were not included in the PCA, as they were considered to be descriptive of general cognitive functioning, rather than executive functioning and therefore not utilized as dependent variables.

Table 4.3 presents the results of the factor analysis. The sample size (n=35 participants multiplied by 8 variables=280 cases) was small; however, according to Comrey and Lee’s guidelines for assumption testing and sample size (1992), the number of cases and variables in this study falls in the “fair” range. Given the small sample size, missing values for the variables were replaced with variable mean substitution, in order to avoid losing observations. This method is considered a conservative means of replacement (Glass & Hopkins, 1996). These replaced values demonstrated no certain pattern across subject or item and were less than 2.7 percent of all data points.
Table 4.3

*Factor Loadings for Principal Component Analysis With Varimax Rotation of Neuropsychological Measures*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-KEFS Verbal Letter Fluency</td>
<td>.93</td>
</tr>
<tr>
<td>WAIS-III/WISC-IV Working Memory Index</td>
<td>.76</td>
</tr>
<tr>
<td>WAIS-III/WISC-IV Processing Speed Index</td>
<td>.84</td>
</tr>
<tr>
<td>D-KEFS Trail Making Condition 4</td>
<td>.85</td>
</tr>
<tr>
<td>CVLT-C Trials 1-5 Total Score</td>
<td>.71</td>
</tr>
<tr>
<td>Rey-Osterrieth Complex Figure Copy</td>
<td>.76</td>
</tr>
<tr>
<td>D-KEFS Verbal Category Fluency &amp; Sorting</td>
<td>.87</td>
</tr>
<tr>
<td>D-KEFS Color-Word Interference Conditions 3 &amp; 4</td>
<td>.87</td>
</tr>
</tbody>
</table>

*Note.* Test scores utilized in analysis were scaled scores for the WISC-IV/WAIS-III and D-KEFS subtests and standard scores for the CVLT-C and Rey-O. Factor loadings > .70 are in boldface.

Given the strong reliability score, the eight variables can be considered a highly related and consistent measure of executive functioning. The key functions assessed by the neuropsychological measures that were associated with the extracted component achieved through factor analysis are categorizing skills, inhibitory skills, switching, fluent productivity, verbal learning, attention and concentration, and verbal and visual memory.

**Relationship between Complex Trauma History and Executive Functioning**

Research Question 1 asked: “What is the relationship between a complex trauma history and executive functioning among adolescent inpatients? It was hypothesized that adolescents who have experienced complex trauma, as determined by a history of being in DCF custody, will be more likely to show decreased executive functioning on neuropsychological measures as compared to adolescent...
inpatients without a complex trauma history (i.e. no history of being in DCF custody).”

In order to assess this question, the value of the executive functioning component (i.e. the mean value of the regression factor) that was extracted from the Principal Component Analysis was compared through a one-way ANOVA. The grouping variable for the ANOVA was DCF Custody Status (DCF custody vs. no history of DCF custody). Descriptive statistics on this variable and the ANOVA results are presented in Table 4.4.

Table 4.4

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group</th>
<th>M</th>
<th>SD</th>
<th>F(1, 33)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Functioning</td>
<td>DCF Custody</td>
<td>-.44</td>
<td>1.02</td>
<td>5.79</td>
<td><strong>.022</strong></td>
</tr>
<tr>
<td></td>
<td>No Custody</td>
<td>.33</td>
<td>.87</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. Significant p value is highlighted in boldface.*

As indicated in Table 4.4 and consistent with the results of Table 4.2, the average of the variables was higher for the “No Custody” than for the “DCF Custody” group. The difference was significant for Executive Functioning (F(1, 33) = 5.79, \( p = .022 \)). The results support Hypothesis 1. Adolescents with a history of being in DCF Custody had lower scores on the neuropsychological tests measuring executive functioning. The dependent variable satisfied the normality assumption for the ANOVA, as skewness and kurtosis calculations were inside the [-1, +1] range.
Relationship between Complex Trauma History and Necessity of Restraint

Research Question 2 asked: “What is the relationship between a complex trauma history and necessity of restraint among adolescents residing in an inpatient psychiatric setting? It was hypothesized that adolescents who have a history of complex trauma will have a higher frequency of restraint during hospitalization as compared to adolescent inpatients without a history of complex trauma.”

In order to assess this question, a one-way ANOVA was conducted to compare the average number of restraints between the “DCF Custody” and “No Custody” groups. The average number of restraints for the “DCF Custody” group was $M = 10.867$ ($SD = 6.423$), and for the “No Custody” group was $M = 6.60$ ($SD = 11.0$). Although the average was higher for the “DCF Custody” group, this difference was not significant at the .05 level ($F(1, 33) = 1.79$, $p = .190$). As can be seen in Table 4.1, there are no significant differences among the groups in terms of length of hospitalization. Descriptive statistics on this variable and the ANOVA results are presented in Table 4.5.

Table 4.5

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group</th>
<th>$M$</th>
<th>$SD$</th>
<th>$F(1, 33)$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Restraints</td>
<td>DCF Custody</td>
<td>10.86</td>
<td>6.42</td>
<td>1.79</td>
<td>.190</td>
</tr>
<tr>
<td></td>
<td>No Custody</td>
<td>6.60</td>
<td>11.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The “number of restraints” variable did not satisfy the normality assumption for the ANOVA, since its skewness and kurtosis were outside the [-1, +1] range.
Therefore, the analysis was repeated using the Mann-Whitney U test, one of the most well-known non-parametric statistical hypothesis tests that does not rely on the assumption of normality. The Mann-Whitney U test is useful for assessing whether one of two samples of independent observations tends to have larger values than the other. The results are presented in Table 4.6. As can be seen, using the non-parametric test, the difference in the average number of restraints between the groups was significant at the .05 level ($z = -2.88, p = .004$).

Table 4.6

*Mann-Whitney U Test Comparing Number of Restraints between DCF Custody and No Custody Groups.*

<table>
<thead>
<tr>
<th></th>
<th>Number of Restraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mann-Whitney U</td>
<td>64.00</td>
</tr>
<tr>
<td>Wilcoxon W</td>
<td>274.00</td>
</tr>
<tr>
<td>$Z$</td>
<td>-2.88</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>.004</td>
</tr>
</tbody>
</table>

Results of the Mann-Whitney U test support Hypothesis 2. Adolescent participants with a history of DCF custody had a higher incidence of restraint over the duration of their hospitalization when compared to adolescent participants with no history of DCF custody.

**Relationship between Executive Functioning and Need for Clinical Restraint**

Research Question 3 asked: “What is the relationship between executive functioning and need for clinical restraint among adolescents residing in an inpatient
psychiatric setting, controlling for trauma history? It was hypothesized that there would be an inverse relationship between executive functioning and need for clinical restraint, and that this association would persist when controlling for trauma history.”

To address this question, a stepwise linear regression was conducted. The dependent variable was the number of restraints. The predictor variables were set up in the following manner, in order to examine whether the relationship between executive functioning and incidence of restraint disappears or becomes stronger when accounting for history of trauma. In the first step, the control variables of Autism Spectrum and ADHD diagnoses were included, as well as Executive Functioning. In the second step, DCF Custody Status was entered. The significance of Executive Functioning was examined before and after including DCF Custody Status to verify whether the significance changed. The results are presented in Table 4.7.
As indicated in Table 4.7, individuals with ADHD generally had a significantly higher number of restraints ($p < .05$). However, the executive functioning variable did not have a significant effect on the number of restraints, neither before nor after controlling for DCF Custody Status ($p > .05$). Therefore, after controlling for an Autism diagnosis, ADHD diagnosis and for DCF Custody Status, there was no significant relationship between executive functioning and incidence of clinical restraint. These results do not support Hypothesis 3.

The stepwise linear regression was then repeated in order to evaluate whether executive functioning on its own predicts restraints, without controlling for diagnoses of ADHD and Autism, which are diagnoses that are often highly associated with
deficits in executive functioning. In the prior model, these diagnoses had been
excluded in order to eliminate any potential contribution of other symptoms
associated with these disorders, such as hyperactivity in ADHD and the non-verbal
component of Autism. In the first step, the executive functioning variable was
entered. In the second step, DCF Custody Status was entered. The significance of
Executive Functioning was examined before and after including DCF Custody Status
to examine whether there was a change in relationship. The result of the regression is
presented in Table 4.8.

Table 4.8

<table>
<thead>
<tr>
<th>Model</th>
<th>B</th>
<th>Std. Error</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>8.43</td>
<td>1.56</td>
<td>5.41</td>
</tr>
<tr>
<td></td>
<td>Executive Functioning</td>
<td>-2.56</td>
<td>1.58</td>
<td>-1.62</td>
</tr>
<tr>
<td>2</td>
<td>(Constant)</td>
<td>12.67</td>
<td>5.62</td>
<td>2.25</td>
</tr>
<tr>
<td></td>
<td>Executive Functioning</td>
<td>-2.04</td>
<td>1.73</td>
<td>-1.18</td>
</tr>
<tr>
<td></td>
<td>DCF custody</td>
<td>-2.70</td>
<td>3.44</td>
<td>-.79</td>
</tr>
</tbody>
</table>

Note. Model 1: R² = .272, F(1,33) = 2.626, p = .115; Model 2: R² = .302, F(2,32) = 1.606, p = .216

Once again, the executive functioning variable did not have a significant
effect on the number of restraints, neither before nor after controlling for DCF
Custody Status (p > .05). Therefore, in this study, there was no significant
relationship between executive functioning and need for clinical restraint, even when
control variables were excluded. In concert with Table 4.7 above, these results do not
support Hypothesis 3.
Chapter Five

Discussion

The goal of this study was to examine the relationship between a history of complex trauma and executive functioning in adolescent psychiatric inpatients. Complex trauma history was defined as a history of being placed in state protective custody, thereby identifying adolescents with a substantiated history of chronic and severe maltreatment by a caregiver including sexual abuse, physical abuse, and/or neglect. The current findings suggest a vulnerability to ongoing risk for neurodevelopmental challenges in adolescents with a chronic and severe trauma history, particularly in the area of executive functioning. First, the descriptive results pertaining to the sample and neuropsychology measures will be discussed, followed by the results of the three hypotheses. Finally, strengths, limitations, and future directions will be addressed.

Neuropsychological Interpretation of the Descriptive Results

The descriptive statistics reported in Chapter Four revealed that adolescent participants with a history of DCF custody showed decreased scores on all 10 neuropsychological measures, and this finding was significant on half of the administered measures. A more in-depth analysis revealed that mean scores were in the Low Average range on seven out of the ten dependent variable measures, all of which measure executive functioning. These measures were the WISC-IV/WAIS-III Working Memory and Processing Speed indices, D-KEFS Trail Making 4, CVLT-C Trials 1-5 Total, Rey-Osterrieth Complex Figure Copy, D-KEFS Verbal Category
Fluency/D-KEFS Sorting, and D-KEFS Color-Word Trials 3 and 4. The relevant executive skills are attention and concentration for verbal material, cognitive switching, inhibition, planning/organization, learning and memory, and flexibility in thinking and problem solving. In fact, it is likely that this study may even overestimate executive functioning skills.

The everyday situations in which executive skills such as inhibition, flexibility and planning and organization are called upon are typically more time-pressured and may be personally stressful, producing thinking that is even less systematic and reflective, and more dependent on prior knowledge.

The remaining three neuropsychological tests (D-KEFS Verbal Letter Fluency, Verbal IQ and Performance IQ) had mean scores in the Average range and are considered more generalized measures of cognitive functioning. The WAIS-III and WISC-IV Verbal and Performance IQ scores were tabulated in the current study in order to compare global cognitive functioning to the more specific findings on the neuropsychological measures related to executive functioning. The mean Verbal and Performance IQ scores were within the Average range of functioning for both groups, which ruled out lowered cognitive functioning in general in the DCF custody group. Nevertheless, the two groups differed from one another in that the Verbal IQ was significantly less for the children in the history of DCF custody group, which suggests that they have relatively weaker cognitive skills in the verbal domain.

Previous research has identified poor language comprehension in subjects who have a history of neglect (Allen & Oliver, 1982; DeBellis et al., 2009), and
neglected infants and toddlers have been shown to demonstrate delays in expressive and receptive language development that are also associated with sensory and emotional deprivation (Culp, Watkins, Lawrence, & Letts, 1991). Decreased verbal learning capacity has also been identified in a population of neglected children (Lee & Hoaken, 2007; Pears & Fisher, 2005).

In the current study, when compared to the no history of DCF Custody group, adolescents with a history of DCF custody had significantly lower Verbal IQ scores (scores at the very low end of the Average range) and Low Average range D-KEFS Verbal Category Fluency scores, further complicated by Low Average range executive functioning skills related to cognitive switching, learning and memory, organization and inhibition. These results translate into difficulty with fluent language production and efficiency, such as the ability to generate words that belong to a designated semantic category, as well as verbal knowledge, verbal reasoning and verbal conceptualization. Adolescents with language weaknesses, coupled with difficulties with executive functioning and self-regulation, might feel as if too much information is flooding their minds at once, with difficulty sifting through details in order to determine what is important and how to effectively express themselves both in writing or with language. In the absence of well-developed executive skills, adolescents with a history of trauma might struggle as they try to develop a future plan of action, find it difficult to hold their plan and action sequences in working memory until executed, and also have significant difficulty inhibiting irrelevant
actions. When coupled with language difficulties, these weaknesses in executive functioning are further compounded.

Decreased performance on measures of verbal IQ and executive functioning suggest that inpatient adolescents with a history of DCF custody might be vulnerable to difficulties both in processing and producing language. It may be the case that the adolescents with a history of DCF custody may have had reduced language functioning as very young children, relative to the non-custody group, which may have predisposed them to abuse and neglect. Alternatively, maltreatment may have had an impact on the development of language, which is supported by research (DeBellis, 2005; DeBellis et al., 2009; Saltzman, Weems, & Carrion, 2006). It is of note that the two groups had similar Performance IQ scores, although reduced Performance IQ has been reported in relation to childhood neglect in other research (DeBellis et al., 2009). Perhaps the small sample size in this study may have impacted the results.

Neuropsychological measures that evaluated working memory and processing speed were also examined in the current study and are two domains of functioning that are associated with full scale IQ, or global cognitive ability. The two subtests that comprise the Working Memory Index (Digit Span and Letter-Number Sequencing) assessed attention and concentration for verbal material, whereas the subtests that comprise the Processing Speed Index (Coding and Symbol Search) assessed speed of mental and graphomotor processing. Both the working memory and processing speed cognitive domains were characterized by Low Average range performance in the
DCF custody group, while the no history of DCF custody group performed within the Average range. This difference was not significant, yet speaks to relative weaknesses in executive functioning, as well as general cognitive functioning, among inpatient adolescents with a history of DCF custody. Both neurological and neurobiological underpinnings might be implicated when considering the impact of complex trauma on the developing brain (DeBellis, 2005).

**The Association between Trauma History and Executive Functioning: Findings and Implications**

A primary focus of this study was to explore executive functioning in inpatient adolescents with a history of complex trauma. Specifically, the hypothesis associated with the first research question was:

> “Adolescents who have experienced complex trauma will be more likely to show decreased executive functioning on neuropsychological measures, as compared to adolescent inpatients without a complex trauma history.”

The results supported this hypothesis and revealed that adolescents with a history of DCF Custody had significantly lower scores on the neuropsychological measures that were associated with the extracted executive functioning component when compared to adolescents without a history of being in DCF Custody. The key functions assessed by the neuropsychological measures, which were associated with the extracted component are categorizing skills, inhibitory skills, switching, fluent productivity, verbal learning, attention and concentration, and verbal and visual memory.
The association between a history of complex trauma and executive functioning in adolescent psychiatric inpatients was expected based on a review of prior research. On the CVLT-C, which is a measure of verbal learning and memory that requires a level of cognitive planning and organization for success, children with a history of neglect consistently demonstrated weaker verbal memory when compared to control subjects (DeBellis, Hooper, Spratt, & Woolley, 2009). Similarly, the scores on this measure in the current study were in the Low Average range. Differences in scores on the Rey Osterrieth Complex Figure Copy, a measure of visual-spatial and organizational planning, were also seen in neglected children with PTSD (DeBellis et al., 2009), similar to the current findings. Analytical capacities appear to disintegrate under the stress of chronic trauma, leaving youth with a trauma history with often disorganized cognition (Teicher, Andersen, Polcari, Anderson, & Navalta, 2002).

Based on the results of this study, it also appears that cognitive weaknesses documented in children with a trauma history extend through adolescence. The current findings illustrate lowered performance in adolescents with a trauma history in the executive realms of categorization, switching and inhibitory skills. This finding suggests relative weaknesses in neurological functioning involving stress sensitive areas, such as the dorsolateral and medial prefrontal cortex, right hemisphere, and hippocampal regions in adolescents with a complex trauma history, without the confounding effects of borderline IQ or mild mental retardation, which were exclusions in this study. Similar findings have been documented in adults with a childhood trauma history, highlighting a lifelong progression of cognitive difficulties.
for adults who have experienced complex trauma as children (Eisen, Goodman, Qin, Davis, & Crayton, 2007).

As a result of their identified neurocognitive weaknesses, this sample of inpatient adolescents may have difficulty perceiving stimuli in the environment, responding adaptively, flexibly changing direction, anticipating future goals and considering consequences and responding in a common-sense manner. Executive skills allow adolescents to be self-aware, to be genuinely involved with others, and to assess the valence and meaning of complex emotional experiences. They also allow individuals to determine a course of action based on their past experiences. Adolescents with weaknesses in executive skills might need considerable guidance as they progress through adolescence, which can be an overwhelming developmental period for even typically-developing adolescents.

The Association between Trauma History and Incidence of Restraint: Findings and Implications

A secondary focus of this study was to explore the association among complex trauma and the frequency of clinical restraint among adolescent inpatients. Specifically, the hypothesis in regard to the second research question was:

“Adolescents who have a history of complex trauma will have a higher frequency of restraint during hospitalization, as compared to adolescent inpatients without a history of complex trauma.”

The findings support this hypothesis. A history of complex trauma was significantly associated with a higher frequency of restraint among adolescents
residing on an inpatient unit. The group with no history of DCF Custody had an average of seven restraint episodes during the course of their hospitalization, whereas the group with history of DCF Custody had an average of 11 restraint episodes while hospitalized. The length of hospitalization was similar for both groups. Although the finding related to this hypothesis was significant, it is important to note that both groups seem to be experiencing a concerning level of restraint. This result may indicate the presence of factors beyond a trauma history, such as language weaknesses among patients, which is discussed below, or clinical staff policies.

Findings from the present study are, however, consistent with recent research relating a higher incidence of restraint and seclusion in participants with an abuse history. For example, among a class of inpatients who had experienced the most restraint and/or seclusion instances, 70% of the members had a history of child abuse (Hammer, Springer, Beck, Menditto, & Coleman, 2011). Another study found that male and female inpatients who had experienced physical abuse, as well as female inpatients who experienced abuse of any kind, were more likely to have been secluded or restrained at least once while living on a child/adolescent psychiatric ward (Fryer et al., 2004).

Seclusion and restraint (S/R) is a controversial topic in the fields of psychology and psychiatry in part due to the high rates of childhood physical and sexual abuse found among psychiatric inpatients, as found in this study. The trauma-informed care perspective, outlined by the Massachusetts Department of Mental Health Task Force, proposes to limit the use of S/R on inpatient units. The report
suggests that the use of S/R with previously abused inpatients may result in re-traumatization due to mental associations between childhood trauma and the experience during S/R (Carmen et al., 1996). Despite such contraindication, the current study and prior research suggest that trauma victims may actually be more likely to experience S/R in such settings. Given their more complex clinical presentations, it seems logical to assume that inpatients with child abuse histories may more frequently engage in acts such as self-injury or injury to others that may unfortunately increase their risk for being secluded or restrained in a perhaps well-intended effort on the part of the staff to promote safety. Other theorists speculate that trauma survivors have an unfortunate tendency to re-create abuse scenarios (Fergusson, Horwood, & Lynskey, 1997), meaning that the patients themselves may actually (subconsciously) provoke restraint or seclusion. It seems imperative that researchers continue to work to identify the precursors to restraint and seclusion, both within the patient and among the clinical staff, in order to reduce the occurrence of restraint, consistent with the current initiatives in the Commonwealth of Massachusetts. Given the reduced executive skills that were identified in this population, in combination with decreased language processing, the role that language and executive functioning play in S/R is discussed below.

**Trauma, language and clinical restraint.** In addition to the role that trauma may play in an increased incidence of restraint, weaknesses in language production should also be considered as they relate to precursors to restraint on an inpatient unit. Specifically, adolescents with language impairments have difficulty expressing
themselves verbally, especially when strong emotions are involved (Cohen, 2001). Therefore, adolescents with language disabilities may be more likely to resort to physical aggression directed toward themselves and others because their language disability makes it difficult for them to effectively use verbal resolutions (Cohen, 2001). Adolescents with language and learning challenges, as identified in the current study, cannot as readily absorb therapeutic interventions and they have difficulty internalizing coping skills, which includes the ability to self-soothe, a skill necessary in order to avoid restraint on an inpatient unit. Results of the current study identified that relative to the non-custody group, the custody group had significantly lower verbal cognitive skills.

Findings from this study revealed that in a traumatized population of adolescents, deficits in executive functioning may be complicated further by the presence of language-based weaknesses (significantly lower VIQ and D-KEFS Verbal Category Fluency scores). Language-based learning disabilities are often found clinically to be coupled with lowered executive functioning and these combined deficits may also partially explain the higher incidence of clinical restraint in the traumatized adolescent population studied.

Vygotsky (1962) argued that speech plays a central role in the development of self-control, self-direction, problem-solving, and task performance. When trauma is present, the development of these skills can be significantly hindered, as highlighted in the current study. Throughout adolescence in particular (Singer & Bashir, 1999) the role of language becomes almost inextricably intertwined with executive function
and self-regulatory processes, and the complex interplay among these processes is increasingly being identified as having a prominent influence on an adolescent’s ability to function in academic and social settings. The complex interplay among these brain functions is described by most researchers as metacognition. Metacognitive strategies consist of routines that are mediated by language. In order to use metacognitive strategies effectively, adolescents must learn to talk to themselves about what they are doing and how they are doing it (Singer & Bashir, 1999).

Without developed executive control processes, adolescents with a language-based learning disability lack the skills necessary to talk through a plan (internally) for future actions, hold plans and action sequences in working memory until they are executed, and inhibit irrelevant actions. Denckla and Reader (1993; p. 433) argued that executive functions are control processes that oversee “all contexts and content domains” and they believe that language is enmeshed with executive control. Other theorists have noted that executive functions are “the connection between human verbal abilities and actual behavioral regulation” (Hayes, Gifford, & Ruckstuhl, 1996; p. 300). The interactive effects of executive functions, self-regulation and language processes are complex and should be assessed and considered when working with adolescents with a history of difficulty in one or more of these areas.

The Relationship among Executive Functioning, Incidence of Clinical Restraint and Trauma History: Findings and Implications

In order to examine the merit of clinical restraint as a behavioral or ecological indicator of executive functioning, the relationship among executive functioning (as
predictor), incidence of clinical restraint and trauma history was explored. Specifically, the hypothesis in regard to the third research question was:

“There will be an inverse relationship between executive functioning and the need for clinical restraint, and this association will persist when controlling for trauma history.”

Findings associated with the final study hypothesis revealed, both before and after controlling for ADHD and Autism diagnoses, as well as for DCF Custody Status, that there was no significant relationship between executive functioning and need for clinical restraint. In the stepwise linear regression utilized to answer this research question, the diagnoses of ADHD and autism were used as control measures in order to examine whether or not executive functioning predicts incidence of restraint, without the impact of the potential behaviors (such as hyperactivity in the case of ADHD, or repetitive behaviors in the case of autism) that are associated with ADHD or autism diagnoses.

When the stepwise linear regression was repeated, without ADHD and autism included as control variables, the results remained similar to the first regression. No relationship was found between executive functioning and incidence of restraint. These results appear to indicate that although history of trauma has been shown in the results of the current study and in prior research to relate to incidence of restraint and seclusion, executive functioning may not play a role. Sample size, however, was a significant limitation in this study and may have impacted the findings.
The possibility was suggested in Chapters One and Two that clinical restraint can be viewed as a behavioral or ecological measure of executive functioning, but the findings of the current study do not support this association. Perhaps this is simply a matter of statistical power, and a relationship might have been identified with a larger sample size. As noted by Hammer et al. (2011), it is important to use appropriate data reduction and grouping strategies when categorizing rate of restraint. They note by example that inpatient subgroups may manifest unique restraint and seclusion use patterns over time and found it useful to group rates of restraint into high, medium and low categories. In the present study, data on restraint frequency was recorded as the total number of restraints over the course of a participant’s hospitalization and it was not possible to review the records in order to alter the grouping technique. Alternatively, it may be that other issues on an inpatient unit bring about an incident of restraint, such as the difficulty that some patients may have processing strong emotions in a healthy manner, or clinical policy issues on the inpatient unit.

**The relationship between Attention Deficit-Hyperactivity Disorder (ADHD)/Autism and incidence of clinical restraint.** The regression analyses conducted in order to examine the third research question revealed that individuals with an ADHD diagnosis had a higher number of restraints. Strong research evidence of the past several decades suggests that executive functioning deficits are present in children and adolescents with ADHD, including boys and girls, and that these deficits are not accounted for by other cognitive or psychiatric factors (Seidman et al., 2005; for a review see Weyandt, 2005). Similarly, research has shown that children and
adolescents with High Functioning Autism (HFA) perform poorly on measures of executive functioning. Verte, Guerts, Roeyers, Oosterlaan and Sergeant (2005) compared children with HFA to typical controls on five major domains of executive functioning: inhibition, visual working memory, planning, cognitive flexibility, and verbal fluency. Children with HFA scored lower than the typically developing control children on all of the domains of executive functioning that were measured.

The findings in the current study identified a significantly higher incidence of restraint among individuals with ADHD, although the sample size was very small. Only three participants were diagnosed with ADHD and only two with autism. A higher incidence of restraint was not found among participants with an autism diagnosis. It is possible that adolescents with ADHD had a higher incidence of restraint because of weaknesses in executive functioning; however, conclusions cannot be made in regard to this speculation due to the limited sample size and the difficulty in ruling out other factors based on the analyses that were performed. It also could be the case that adolescents with ADHD had a higher incident of restraint based on the active nature of behavior that is typically associated with the diagnosis.

**Strengths of the Present Study**

The findings in the present study are consistent with, and complement, previous research examining the cognitive functioning of children and adolescents with a history of maltreatment including neglect, sexual and physical abuse. The current data and findings draw upon several strengths.
Inclusion of a critical developmental period: Adolescence. Unlike many research articles currently present in the literature base on the topic of complex trauma and cognitive functioning, and in particular executive functioning, the present study focused on adolescence as an important developmental time period. Adolescence has increasingly become a critical time period for youth in today’s society, as preparation for adult work roles now requires years of schooling and preparation for adult family roles has become even more complex (Petersen & Leffert, 1995). Our increasingly pressured society has made it even more difficult for adolescents to understand what kinds of adults they are to become and how they are to accomplish this task.

Children who enter adolescence already vulnerable psychologically or socially are likely to experience a more difficult adolescent decade under challenging social circumstances. For example, an adolescent, hospitalized for clinical depression related to a history of trauma at the hands of a caregiver, will miss important developmental opportunities, such as developing interpersonal relatedness skills, during this period of healing. The results of the present study suggest that complex trauma may have important implications in regard to executive functioning, which in turn has the potential for direct negative impact on an adolescent’s ability to navigate this critical developmental time period.

Study of specific executive functions. The study of specific executive functions is particularly salient as this study focused on the cognitive areas of mental flexibility and organization, verbal processing including categorization,
memory/learning, and inhibition, as potentially vulnerable processes among traumatized youth. In the case of research on child abuse and cognitive development, typically more global neuropsychological indices have been used in research (Mezzacappa, Kindlon, & Earls, 2001; Rueda et al., 2005), rather than indices reflecting more specifically identified neuropsychological processes and functions.

**Study of incidence of restraint in a traumatized population.** The issue of restraint and seclusion is a controversial topic in the fields of psychiatry and psychology, due in part to the high rates of childhood physical and sexual abuse found among psychiatric inpatients (Bonner et al., 2002; Carmen et al., 1996; NASMH, 2007). The trauma-informed care perspective suggests that the use of restraint and seclusion with previously abused inpatients may result in re-traumatization due to mental associations between childhood trauma and the experience during S/R (Carmen et al., 1996).

The present study highlights the importance of ongoing research involving the use of restraint and seclusion in vulnerable populations, such as those individuals with a trauma history. Previous studies have explored the rate of adult restraint and seclusion (Bonner et al., 2002; Hammer et al., 2011); however, as mentioned earlier, the adolescent population is under-researched. Hammer and colleagues (2011) reported that adult inpatients experiencing the highest relative rates of restraint and seclusion use over time were significantly more likely to have suffered childhood physical and sexual abuse, similar to the finding in the present study. This is a
noteworthy finding that has implications for inpatient welfare, clinical practice, and institutional policy.

**Distinguishing among varying degrees of experienced trauma.** The independent variable utilized in this study – DCF custody status – is considered a significant strength of the research. Historically, researchers have used a diagnosis of PTSD as the independent variable when studying the cognitive and behavioral effects of trauma. A diagnosis of PTSD may not fully capture the nature of complex trauma, because grouping individuals together who in actuality may have varying degrees of trauma exposure may not accurately represent the true meaning of complex trauma. Exposure to trauma beginning in early childhood, which is considered chronic and severe, and often occurring within the child’s caregiving system, may be a very different traumatic experience for an adolescent to cope with when compared to an inpatient peer, also with a PTSD diagnosis, who may have been sexually abused once by a distant relative, but with a supportive home life and caregiving system.

By using DCF custody as the grouping factor, the researcher may have created a more distinct and accurate difference between participant groups with and without a history of chronic and severe trauma. Notably, both groups had similar rates of PTSD diagnosis (80% versus 65% in the no history of DCF custody group). Confirmation by DCF of neglect, physical, and sexual abuse within a child’s (now adolescent’s) caregiving system may have selected for a degree of maltreatment and psychopathology not generally representative of children with a PTSD diagnosis who have experienced abuse in the inpatient community at large. As a result, the present
findings may be representative of the more severe end of the spectrum where both maltreatment and psychopathology are concerned. It should be noted, however, that firm conclusions cannot be drawn from the findings as discussed above, as the researcher was unable to systematically measure the level of posttraumatic stress in each participant and the sample size was small.

**Limitations of the Present Study**

The current data and findings should be considered with three limitations in mind.

**Sampling considerations.** Given the nature of the sample utilized in the present study, a number of questions can be raised as to the generalizability of the findings. Simple random sampling is the most widely used and acceptable way to sample, though there are other appropriate methods such as systematic sampling (Glass & Hopkins, 1996). Simple random or systematic sampling was not a possibility given the time and confidentiality constraints associated with this database. The author of the present study utilized a database of participants who were chosen for neuropsychological evaluation by clinical staff, either for diagnostic clarification or to inform treatment approach, rather than for research purposes. This type of selection is biased as the individuals may have been chosen for evaluation because they were exhibiting neuropsychological deficits. Ideally, if a database of information had not been available, the author would have systematically chosen participants (e.g. every 5th admission to the unit). Convenience samples, as in the case of the current study, cannot be generalized beyond their specific group (i.e., those
referred on inpatient units for neuropsychological evaluation; Glass & Hopkins, 1996); it was therefore impossible to estimate the degree of error due to chance (sampling error), as is the case with random or systematic sampling.

Further, the sample size utilized was small (n=35). Ordinarily, statisticians advise to take the largest sample that is practical and then determine if the sample size has adequate power for detecting a difference large enough to be of interest (Glass & Hopkins, 1996). Glass and Hopkins (1996) noted, however, that more often researchers find power is low even for detecting differences large enough to be of practical importance. Given that the author utilized a database of existing participants, rather than collecting data from the outset, power was not calculated as it would not inform data collection. Despite the sample size, the data and findings are consistent with the literature and may provoke useful thought in considering future research topics.

**PTSD Diagnosis in the DCF Custody group.** It should be noted that not all participants included in the complex trauma group were diagnosed with PTSD, which can be considered a limitation. Specifically, three of the 15 subjects with a history of DCF custody did not have PTSD listed as a diagnosis on their Discharge Summary (20% of the sample group). Again, current literature, especially as was commissioned through DSM-5 workgroups, centers on the relevance of the current PTSD diagnosis in a complex trauma population. Some individuals with a history of complex trauma fail to meet criteria for diagnosis, as the PTSD criteria have never been particularly sensitive to the effects of trauma in very young children or to the long-term effects of
sexual and physical abuse (Friedman et al., 2011; Herman, 1992a; Scheeringa, Zeanah, Drell, & Larrieu, 1995). Notably, in the research cited throughout this chapter, DeBellis et al. (2009) created a study with two neglect groups to differentiate between those with and without a *DSM-IV* PTSD diagnosis. Neglect was defined as having a history of Department of Social Services substantiated neglect. Except for one measure, the authors did not find major significant differences in neurocognitive abilities between the neglected children with PTSD and those neglected children without a PTSD diagnosis. The authors suggested that their findings call into question the relevance of the *DSM-IV* PTSD diagnosis of children and therefore the inclusion of participants without a PTSD seemed warranted in this study.

**Interpretation of factor analysis results.** Finally, a limitation regarding the conclusions about the grouping made via factor analysis should be noted. Interpreting factor analysis is based on using a "heuristic," which is a solution that is "convenient even if not absolutely true" (Darlington, 2004; Glass & Hopkins, 1996). More than one interpretation can be made of the same data factored the same way, and it should be noted that factor analysis cannot identify causality (Darlington, 2004). The researcher utilized knowledge based on her clinical understanding of neuropsychology, as well as through collaboration with colleagues and mentors, in order to select measures and identify the nature of the extracted component (as described earlier in the chapter) that was achieved through factor analysis. Nevertheless, alternative interpretations of commonalities among the data are plausible.
Intervention and Future Research

The findings in the present study are consistent with previous research and indicate that a pattern of neurocognitive weaknesses may be present in adolescents with a history of complex trauma, particularly in the area of executive functioning. Interventions for adolescents should address the complex and reciprocal influences of trauma and executive function, as well as language processes. The process of combining neuropsychological assessment with standard trauma specialty evaluation would help clinicians gain a comprehensive understanding of each adolescent’s unique set of cognitive strengths and weaknesses, within a trauma-informed framework. That is, an individual’s experience of trauma should guide the treatment, or therapy, and symptoms should be viewed as stemming from the trauma, rather than as disparate experiences. This process can be a vital aid in conceptualizing, diagnosing, and designing effective interventions for youth with a trauma history. Under the current diagnostic framework, clinicians tend toward assigning multiple diagnoses that suggest a host of unrelated symptoms. Within a trauma framework, all symptoms are viewed as related and through treatment of the trauma experience, it is hoped that the other symptoms will likely dissipate. The goal is to avoid the common misdiagnoses that lead to ineffective treatment. A trauma-informed framework may also work to reduce the incidence of restraint and seclusion, as patients with a trauma history are more likely to experience S/R, perhaps as a result of unresolved emotional experiences associated with the trauma.
In addition to screening for PTSD symptoms associated with complex trauma, neurocognitive screening for adolescents referred for treatment with evidenced-based interventions may work to reverse long-term neuropsychological implications (Courtois, 2008). Once neuropsychological and trauma screenings are included in initial evaluations, the great challenge will then be for research to focus on identifying the most effective strategies to improve cognitive outcomes and potentially diminish the long-term consequences of child abuse and neglect.

Researchers and theorists have suggested that inpatient psychiatric adolescents with a lowered IQ capacity should receive treatments tailored to their cognitive level (including modeling of appropriate behaviors and instruction in basic skill-building approaches, versus, for example, extended talk- and insight-oriented psychotherapy; Marlowe, 2000). Behavioral consultants can address the specialized therapy needs of adolescents with cognitive weaknesses as a result of complex trauma by training the staff in how to model adaptive behaviors and how to better instruct adolescents with a trauma history in basic coping skills (e.g., self-monitoring, identifying symptoms and conflicts, applying rehearsed skills to the situation at hand, checking with staff for support; Ford, Courtois, Steele, Van der Hart, & Nijenhuis, 2005).

When evaluating language concerns, clinicians should consider and address executive functions and self-regulation within the language intervention program. Specifically, the design of intervention requires the integration of both metacognitive and linguistic strategies. Intervention focused at the metacognitive level can have a
substantial influence on numerous levels of the productive language system (Singer and Bashir, 1999).

Based on the current findings related to an increased incidence of restraint among adolescents with a trauma history, inpatient clinicians who are treating adolescents should continue to study which treatment components (e.g., therapy/behavioral support, medication, academic involvement, etc.) might be most effective in reducing restraints and contributing to overall treatment gains (Ford, 2005). As recommended by Hammer et al. (2009), administrators should strive to involve clients in policy and intervention development and practice whenever possible. Second, all clients should be assessed for trauma histories at admission. This procedure would supply the information necessary to co-create individualized treatment and “de-escalation” plans for the client, thereby collaboratively involving the individual in his or her own recovery. Third, if S/R use does occur, staff should immediately debrief and request feedback from the client. An investigation of the root cause should be undertaken, and the resultant findings incorporated into future care considerations for that client.

Adolescence is a critical time period for children in general and increasingly so for adolescents with a trauma history; therefore this population should be explored with further research. Adolescents who are coping with a trauma history, in addition to coping with the deficits in executive functioning that were highlighted in this study, tend to be less aware of potential risks in decision-making and may fail to consider future consequences. Disinhibited and disorganized decision-making,
difficulties with planning and organization, coupled with lowered cognitive ability, can lead to problem behaviors that overwhelm even the typically-developing adolescent. Real-life decision-making for an adolescent with a complex trauma history is likely an arduous task, one that requires support and guidance. The findings reported by Mills et al. (2011) and the findings from the current study suggest that impacts on cognitive processing appear to endure throughout adolescence, and even into adulthood (Perez & Widom, 1994). These findings point to the need to find strategies to improve young people’s cognitive outcomes in order to diminish the long-term consequences of childhood abuse and neglect.

Finally, some authors propose that complex trauma or “Complex PTSD” is associated with PTSD, but when present, should be considered a superordinate diagnosis (Dorahy et al., 2009). Alternatively, it may also be considered a subtype of the existing category of PTSD, which could provide a potential solution in forthcoming versions of the DSM-5 criteria to cover chronic developmental traumatization (Sar, 2011). Assessing and treating the sequelae of complex trauma provides an alternative approach to remediating complicated and severe behavior problems in adolescents, thus promoting more effective management and treatment options. Future work in the pediatric literature should consider cumulative PTSD symptoms as opposed to the DSM-IV PTSD classification in their analyses (Carrion et al., 2001; Scheeringa et al., 2006).
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Appendix A

Northeastern

Notification of NU IRB Action

Date: August 18, 2011  IRB# 11-07-16
Principal Investigator: Karin Lifter
Lauren Gallo Ziady
Department: Counseling and Applied Educational Psychology
Address: 404 International Village
Northeastern University
Title of Project: The Association Between Complex Trauma and
Executive Functioning Among an Adolescent
Inpatient Population
Approval Status: Approved
Participating Site: Massachusetts Dept. of Mental Health - forthcoming
DHHS Review Category: Exempt, Category #4

C. Randall Colvin, Ph.D., Chair
Northeastern University Institutional Review Board

Nan C. Regina
Director, Human Subject Research Protection

This approval applies to the protection of human subjects only. It does not apply to any other university approvals that may be necessary.

No further action or IRB oversight is required, as long as the project remains the same. However, you must inform this office of any changes in procedures involving human subjects. Changes to the current research protocol could result in a reclassification of the study and further review by the IRB.

Northeastern University FWA #: 4630
Appendix B

The Commonwealth of Massachusetts
Executive Office of Health and Human Services
Department of Mental Health
25 Staniford Street
Boston, Massachusetts 02114-2575

DEVAL L. PATRICK
Governor
TIMOTHY F. MURRAY
Lieutenant Governor
JUDEA BERC, M.D.
Secretary
BARBARA A. LEAHMUL, M.S., M.R.A.
Commissioner

Lauren Ziady, MA

December 1, 2011

Dear Ms. Ziady:
The Central Office Research Review Committee has reviewed your research "The Association Between Complex Trauma and Executive Functioning Among An Adolescent Inpatient Population." It has been assigned the CORRC tracking number #2011-06. Please use this number in your correspondence with the CORRC regarding this project. This project is approved on this date. This approval is for one year, or until the next Periodic Review.

The following is the record of the review.

Abstract
Data was compiled during a 3-5 year effort on the adolescent unit at Westborough State Hospital in an attempt to describe the population and how it might differ from other adolescent populations. Specifically, demographic and neuropsychological data was extracted and compiled in a de-identified spreadsheet for Performance Improvement (PI) purposes. Clinical staff to further develop clinical care and be better meet the medical needs of the cohort they were serving. At this time, use of the de-identified spreadsheet is being requested by the Department of Mental Health by the investigator in order to carry out a dissertation project. The goal of the research is to compare performance on neuropsychological tests of executive functioning in adolescent psychiatric inpatients with and without a history of complex trauma. There is no external funding for this project. It is a doctoral dissertation project through Northeastern University.

Discussion
This project was reviewed by the full committee of the Central Office Research Review Committee. The following points were raised in the review:

Discussion was largely concerned with whether or not a review by CORRC was necessary given that the research involves data that was collected and de-identified for Performance Improvement purposes and the principal investigator will be working only with this de-identified data. We reviewed the description of how the data was originally collected and de-identified and concluded that there is a risk of loss of confidentiality to the people involved. Based on 105 CMR Section 31.05 (b), we concluded that informed consent and authorization is not required. Additionally, the principal investigator will be advised that ‘the study must be written in such a way so that no person can be identified.’ Because of the sensitivity of the data involved, it was decided that we will maintain oversight of the research study.
Discussion also focused on how the independent variable, the presence or absence of a history of complex trauma, is defined for the purposes of this study. We reviewed the principal investigator’s email of 11/25/11 in which she explained that her review of the literature found that in Massachusetts the criteria used to support decisions to place children in protective custody are consistent with the widely accepted definition of complex trauma. The principal investigator has investigated the criteria used for the coding of the database data and learned that “history of state custody” was limited to those instances when the person was placed into state custody because of a history of maltreatment (sexual abuse, physical abuse and/or neglect). People placed into state custody because of a CHINS order or a medical petition were coded as having ‘no’ history of state custody for the purposes of this database.

**Actions Taken**

The Committee reviewed this research protocol using its internal checklist and has determined that the level of risk is no more than minimal (risk = 1) and that there is no prospect for direct benefit to the subjects (benefit = 1). The CORRC has determined that this project should be monitored annually.

The Committee moved to approve study and it was approved by majority vote (Y=7, N=0, A=0).

The DMH Area Director and Area Medical Director have been notified of this project. It is your responsibility to cooperate with them regarding any additional information they may require from you. You may not change these approved materials without notifying the CORRC and seeking re-approval for any changes in the protocol or other materials associated with the project. Adverse events must be reported using the guidelines in the Principal Investigator’s Package. We will also conduct periodic reviews, at least annually, of the project.

Best wishes for the successful completion of your project.

For the Committee,

[Signature]

Margaret Guyer, PhD  
Chair, Central Office Research Review Committee  
IRB Registration IRB00000302, FWA0000324