

# The Clinical Utility of the Conners' Continuous Performance Test in the Evaluation of Youth with Conduct Disorder

Stephanie Raszkiewicz  
*Marquette University*

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THE CLINICAL UTILITY OF THE CONNERS' CONTINUOUS  
PERFORMANCE TEST IN THE EVALUATION OF  
YOUTH WITH CONDUCT DISORDER

by

Stephanie R. Raszkievicz, B.A., M.A.

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ABSTRACT  
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Stephanie R. Raszkievicz, B.A., M.A.

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The purpose of this study was to investigate neuropsychological factors related to performance on the Conners' Continuous Performance Test, Second Edition (CPT-II) among youth who met criteria for Conduct Disorder when compared to a control group of youth who did not meet criteria for Conduct Disorder (CD). The CPT-II is an instrument commonly used to assess for the presence of ADHD. Since research has shown a strong co-occurrence of CD with ADHD, with some authors reporting it to be as high as 90%, it was important to examine how a group of youth with CD would perform on this instrument and what characteristics of executive functioning might influence these results. The CPT-II performance of 34 youth with CD was compared to that of 35 youth who were members of the control group. The presence of CD was determined using the criteria for this disorder identified by the *Diagnostic and Statistical Manual of Mental Health Disorders, Fourth Edition, Text Revision (DSM-IV-TR, 2000)*. The principal investigator interviewed consenting youth and parents, seeking endorsement of the symptoms of CD from either person, as well as further demographic information before administration of the CPT-II. Initially, seven indices were examined for statistical significance. However, the remaining six indices of the CPT-II were also examined in a secondary analysis to obtain additional support for the findings from the analysis of the research questions. Statistical significance was found between the two groups on the ADHD Confidence Index, Omission Index, Hit Reaction Time-Standard Error Index, Variability, and Hit Reaction Time Block Change Index. Associations were posited regarding the relationship of these indices and the following areas related to executive functioning: inattention, concentration, self-monitoring, and delay of gratification. These results seemed related to not attending to details, low motivation, and quickly dismissing tasks that were not of interest to the youth with CD. Areas for future research and treatment implications were presented.

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Stephanie R. Raszkievicz, B.A., M.A.

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## CHAPTER 1 – INTRODUCTION

“Kids these days.” Each generation seems to question the actions of the next. For many years researchers have worked to understand what contributes to the thought processes of youth and the poor decisions they make (Lynam, 1998; Moffitt, 1993; Quay, 1964). Specifically, youth who commit crimes have been the focus of research examining the cognitive processes contributing to poor decision-making and subsequent criminal behavior. Why do some young people always seem to be in trouble? Why does placement into corrections or a detention center not deter these youth from continued offenses? Although researchers have attempted to answer these questions, young criminals continue to negatively impact communities. Subsequently, their actions place a financial and emotional strain on a society who ultimately becomes responsible for trying to find somewhere or something that will help these youth be successful or at least prevent them from being an ongoing problem in society.

The actions commonly associated with criminal behaviors have also been related to psychological disorders. For example, Conduct Disorder (CD) is a diagnosis that describes a repetitive pattern of behaviors that violate societal norms, rules, and/or laws, similar to the crimes committed by young offenders. Behaviors associated with CD include: skipping school before 12 years old, lying, theft, destruction of property, mugging, and forced sexual activity. This pervasive disorder has been investigated in attempts to explain its origins, and many risk factors have been found that contribute to the development of CD. For example, some researchers have identified characteristics of families and communities that are associated with CD (Bassarath, 2001; Lahey, Loeber, Burke, & Applegate, 2005; Snyder & Sickmund, 2006). Others have looked at specific

biological factors, such as teratogens (Chronis, et al., 2003; Wakschlag & Hans, 2002), lead exposure (Bellinger, 2004), or heritability (Coolidge, Thede, & Young, 2000) that might contribute to CD. However, relatively few researchers have examined neuropsychological factors that might contribute to CD (Moffitt, 1993). Even fewer studies have examined the interaction between CD and executive functions, a specific neuropsychological feature associated with an individual's ability to self-regulate behaviors, exhibit purposeful actions, and organize and plan an appropriate response to stimuli (Lynam & Henry, 2001).

A disorder commonly co-occurring with CD is Attention-Deficit/Hyperactivity Disorder (ADHD; Jensen, Martin, & Cantwell, 1997). Lynam (1998) theorized that the issues of CD coupled with ADHD represent a distinct and challenging subgroup of youth whose clinical presentation is more severe than individuals with CD alone. In addition to a small number of studies examining the relationship between CD and executive functioning, few studies have investigated how characteristics of ADHD might be manifested in the behaviors associated with CD when examining executive functions in these youth (Lynam & Henry, 2001). Since research has already established a connection between ADHD and executive function deficits (Barkley, 1997), the present study seeks to examine how a group of adjudicated adolescents with CD will compare to a control group without the presence of CD on a continuous performance test. A continuous performance test is an instrument commonly used to examine the basic features of ADHD, such as the ability to sustain attention and impulse control.

A continuous performance test frequently used for the assessment of ADHD is the Conners' Continuous Performance Test, Second Edition (CPT-II; Conners, 2004). The

frequently cited overlap between CD and ADHD within the CD population, as well as the overlap in the symptom profiles of these disorders, lends itself to further investigation into the sensitivity of the CPT-II in identifying ADHD in the CD population.

Therapeutically, a better understanding of cognitive factors contributing to criminal behavior in youth could assist in the development of treatment techniques that can target impaired executive functioning. Therefore, the immediate goal of this study is to examine how youth with CD compare to a control group on a measure designed to assess impulsivity, sustained attention, and maintaining a rule set to govern behavior, common features of executive functioning. A long-term goal of this line of research will be to provide enhanced treatment direction for those offering clinical services and to help decrease the incidence of criminal behaviors among young people.

### **Statement and Significance of the Problem**

Statistics related to the prevalence of criminal behaviors, as well as research examining developmental and neuropsychological characteristics in youth further explain the significant problem of CD in youth. For example, in 2002, juvenile courts handled 51.5 delinquency cases for every 1,000 juveniles (Snyder & Sickmund, 2006). This means that approximately 5% of all individuals ages 10-17 were involved in crimes in 2002. In addition, it was determined that nearly 9% of youth ages 14-17 years old were arrested for criminal behavior in 2002, with this group composing 80% of the delinquency caseload (Sickmund & Snyder, 2006). Overall, 15% of males and 20% of females arrested were under the age of eighteen. Information gathered by Farrington, Ohlin, and Wilson (1986) suggested that 5-6% of offenders are responsible for 50% of known crimes. Additionally, Sickmund and Snyder (2006) reported that 25% of those

youth who are committing crimes at 16-17 years old continue to commit crimes at 18-19 years old, suggesting that at least one-quarter of juvenile criminals continue to commit crimes into adulthood.

The cost of providing services to and/or housing these youth continues to rise. The budget for a boys' juvenile correctional facility in Wisconsin listed annual costs will likely reach \$90,000 per offender by the end of the 2007 (*Associated Press-Milwaukee Journal Sentinel*, 2007). Furthermore, Conduct Disorder (CD), a diagnosis associated with repetitive and persistent violations of rules and the rights of others, is reportedly the most frequent presenting problem in youth leading to a referral for clinical services, with reports of 30-50% of childhood psychiatric referrals involving a diagnosis of CD (Kazdin, 1995; Robins, 1991).

When examining statistics, a common reaction is to ask why youth are involved in such behavior. Similar to many areas related to child development in the field of psychology, one begins to question whether it is nature or nurture that leads to the development of criminal behavior in youth. One environmental characteristic commonly associated with CD is low socio-economic status (SES). However, when SES was controlled for, Lynam, Moffitt, and Stouthamer-Loeber (1993) continued to find differences in IQ, with youth exhibiting antisocial behavior having significantly lower scores than those youth that did not engage in these behaviors. Given this information about a common "nurture" factor, it is necessary to look to the "nature" aspect of child development to further understand the presenting issues of youth identified with CD. Moffitt (1993) identified the combination of neuropsychological deficit and environmental risks as leading to the development of CD. Teichner and Golden (2000)

offered an example of this interaction between neuropsychological impairment and the environment. They speculated that if a youth with executive function deficits was exposed to gangs, this person would likely go along with these peers due to a lack of adequate social judgment associated with the neuropsychological impairment.

Unfortunately, research examining neuropsychological impairment in youth with CD has often fallen short in examining features specifically related to CD. Neuropsychological functioning is reportedly most impaired in youth with CD who also exhibit ADHD (Lynam, 1998). Additional research by Teichner and Golden (2000) indicated that most of the research in the area of neuropsychological impairment and CD has failed to objectively diagnose conduct disorder, relying on clinical impressions of the presence of CD or looking at youth who are delinquent without an understanding of the severity of their acting-out behavior.

Behaviors commonly associated with CD, such as poor planning, impulsivity, and aggressive behaviors have been determined to be indicators of frontal lobe deficits and, more specifically, executive dysfunction (Luria, 1973; Mesulam, 2000). Other cognitive abilities attributed to executive functioning include: sustaining attention and concentration, abstract reasoning and concept formation, goal formulation, programming and initiation of purposive sequences of motor behavior, flexibility in thinking, delaying of gratification, effective self-monitoring of behavior and self-awareness, and inhibition of unsuccessful, inappropriate, or impulsive behaviors, with adaptive shifting to alternative behaviors (Luria, 1973; Mesulam, 2000; Moffitt & Henry, 1989). Clinical implications of these deficits include an inability to learn coping strategies if the youth is not able to pay attention to the information being taught, increased confrontations with

others leading to more aggressive behaviors, and difficulty generalizing the consequences and impact of negative behaviors on others. This information supports the importance of the use of assessment instruments to evaluate the level of executive functioning in youth with CD. An adequate determination of executive functions would be of benefit to service providers attempting to assist these youth in the development of socially acceptable behaviors.

### **Purpose of the Study**

Given the need for a greater understanding of potential neuropsychological factors contributing to CD, an investigation of the brain-behavior connections related to the characteristics of CD would likely meet this goal. The primary purpose of this study is to compare the performance of youth with CD to a control group on a test designed to primarily measure one's ability to curb impulsivity and sustain attention, characteristics of executive functioning. Participants will be placed into one of two groups (CD or control) based on the level of endorsement of symptoms of CD, as determined by a simple questionnaire. It is hoped that the results of this study will assist in identification of neuropsychological characteristics related to CD warranting more clinical attention.

### **Research Questions**

1. How do youth who are on court supervision and diagnosed with Conduct Disorder (CD) differ from youth who are not on court supervision and do not have CD on the Attention-Deficit/Hyperactivity Disorder Confidence Index of the Conner's Continuous Performance Test, Second Edition (CPT-II)?



2. How do youth who are on court supervision and diagnosed with CD differ from youth who are not on court supervision and do not have CD on the Commission Index of the CPT-II?
3. How do youth who are on court supervision and diagnosed with CD differ from youth who are not on court supervision and do not have CD on the Omission Index of the CPT-II?
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7. How do youth who are on court supervision and diagnosed with CD differ from youth who are not on court supervision and do not have CD on the Detectability Index of the CPT-II?

## CHAPTER 2 – REVIEW OF THE LITERATURE

The chapter will begin with a presentation of the symptoms of Conduct Disorder (CD), its subtypes and prevalence rates, and the relationship between CD and juvenile delinquency. Since many factors have been found to coexist with CD, an overview of biopsychosocial factors within this group of youth will be provided. A section describing Attention-Deficit/Hyperactivity Disorder (ADHD), its subtypes and prevalence rates, and its co-occurrence with CD will follow. The final section begins with a description of cortical organization and functioning and general neuropsychological deficits identified as related to CD, as well as a conceptualization of the interaction of CD, ADHD, and executive functions, as identified in the literature. This chapter concludes with an explanation of continuous performance tests and their use with youth with CD and/or ADHD.

### Conduct Disorder

The basic feature of CD offered by the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision, (DSM-IV-TR; APA, 2000)* is a “repetitive and persistent pattern of behavior in which the basic rights of others or major age-appropriate societal norms or rules are violated” (p. 98). The problem behaviors listed as symptoms of CD are categorized into four sections: aggression towards people and animals (e.g., bullying/threatening others, initiating physical fights, and using a weapon to cause serious harm to others); destruction of property (e.g., fire-setting, destruction of private property); deceitfulness or theft (e.g., breaking into someone else’s home, building, or car); and serious violation of rules (e.g., stays out at night beginning

before 13 years of age, running away from home overnight at least twice.) Three or more of these behaviors must be present for the last twelve months, with at least one criteria being present in the last six months. A national, retrospective study of 18-44-year-old adults ( $N = 3,199$ ; Nock, Kazdin, Hiripi, & Kessler, 2006) reported that the most commonly reported behavior in youth with CD was staying out at night without parental permission. The least frequently was reported to be forcing some into sexual activity. In addition to the need for an individual to exhibit three out of fifteen behaviors to meet criteria for the diagnosis of CD, the *DSM-IV-TR* (APA, 2000) offers subtypes of CD based on the age of onset of the disorder. The three subtypes are: Childhood-Onset (i.e., onset before age 10), Adolescent-Onset (i.e., onset at age 10 or after), or Unspecified Onset. The first subtype, Childhood-Onset CD, has been characterized as representing a subgroup of youth that have a greater risk of developing Antisocial Personality Disorder (Deckel, Hesselbrock, & Bauer, 1996; Moffitt, 1993; Rutter, 2001).

Alternatively, Moffitt (1993) proposed a dual classification of subtypes of youth with CD as either “life-course persistent” or “adolescent-limited,” with life-course persistent CD being the more severe subtype of the disorder, leading to negative outcomes for these youth upon reaching adulthood. Youth with life-course persistent CD were identified as having neuropsychological deficits. It was also found that there was an increased likelihood that CD would develop when a difficult temperament, developmental deficits, and/or a negative reaction within the youth’s environment were combined with neuropsychological deficits. Moffitt’s (1993) conceptualization of the second subtype of CD, adolescent-limited, suggested that these youth perform criminal acts due to social influences, such as acceptance by peers. These youth later abstain from

criminal behavior because of environmental changes (e.g., they move out of the neighborhood by going to college or the military) or the realization that it can jeopardize future plans (e.g., acceptance into college.)

In addition to the conceptualizations of subtypes related to CD, several factors related to prevalence rates have been identified. For example, the American Psychiatric Association (APA; 2000) reported that the overall prevalence of Conduct Disorder (CD) in youth ranges from less than 1% to 10%. Further analysis based on prevalence among genders found ranges of 6-16% in males and 2-15% in females (APA, 2000; Lambert, Wahler, Andrade, & Bickman, 2001; Maughan, Rowe, Messer, Goodman, & Meltzer, 2004; Nock, Kazdin, Hiripi, & Kessler, 2006). When age was controlled for, Lahey, et al. (1998) reported that a significantly greater proportion of clinic-referred females presented with adolescent-onset rather than childhood-onset CD, suggesting that there is an increase in the diagnosis of CD in girls upon reaching adolescence.

Despite being identified as risk factors for the development of CD (Bassarath, 2001), limited literature was found that examined the prevalence of CD in children/adolescents of different racial or socioeconomic status (SES) backgrounds. Two retrospective studies examined these factors in the United States (Delbello, Lopez-Larson, Soutillo, & Strakowski, 2001; Nock et al., 2006). DelBello, et al., (2001) performed a retrospective chart review of 1,001 cases to examine diagnoses among an urban, inpatient group of adolescents that were provided services three to six years prior to the review. This chart review reported that significantly more African Americans (20%) were diagnosed with CD than Caucasians (13%). Nock, et al. (2006) determined that a lifetime diagnosis of CD was related not only to being male, but also low

educational attainment, living in urban settings, and living in the Western United States (Nock, et al., 2006). This study reported prevalence rates of CD within specific races to be 9.91% of non-Hispanic, white respondents; 9.11% of non-Hispanic, other respondents; 9.09% of Hispanic respondents; and 8.18% of non-Hispanic, Black respondents.

In addition to prevalence rates of CD, it is important to acknowledge the incidence of delinquency among youth, as the behaviors identified as symptoms of CD also involve forms of delinquent acts. According to data collected by the Office of Juvenile Justice and Delinquency Prevention (OJJDP), delinquent youth represent approximately 5.2% out of the total population of juveniles, ages 10-17 years old in 2002 (Snyder & Sickmund, 2006). This data identified 29% of this group as female suggesting that there are more than twice as many males who commit delinquent acts as females. Of the delinquent youth examined in 2002, approximately 67% were White, 29% were African American, and 3% were other races (Snyder & Sickmund, 2006). Even though there were more white juveniles identified as committing crimes, a within-race comparison of juveniles revealed that a disproportionate number of African American youth committed delinquent acts (11.5% of all African American youth) when compared to white youth (6.1% of all white youth; Snyder & Sickmund, 2006). The majority of jurisdictions within the United States provided information for these statistics based specifically on juvenile court records. However, it is important to note that there were not complete records for all of the states of the United States, which might have contributed to these findings.

Given the list of possible behaviors comprising a diagnosis of CD, it might be assumed that youth who have been determined by the juvenile court system to be

delinquent would also meet the criteria for CD. However, not all delinquent youth are diagnosed with CD. In a sample of youth held in a detention center in Cook County, Illinois, only 37.8% of males and 40.6% of females actually met the criteria for CD (Teplin, Abram, McClelland, Dulcan, & Mericle, 2002). Service providers (e.g., youth workers, probation officers, counselors) and researchers overlook the fact that not all youth who exhibit delinquent behaviors meet the criteria for CD. Researchers have suggested that this issue has likely contributed to the limited amount of studies that differentiate subjects with CD from other subjects within the juvenile justice system (Teichner & Golden, 2000). To provide clarification between CD and juvenile delinquency, Moffitt (1993) offered four factors to assist in the differentiation of juvenile delinquency from CD: (1) juvenile delinquency is more prevalent than CD; (2) only one incident of problematic behavior is required for an individual to be considered a juvenile delinquent, whereas CD is determined once a juvenile has committed multiple delinquent acts; (3) CD has no minimum age requirement for diagnosis and juvenile delinquency is typically reserved for youth ages ten years or older; and (4) there is less concern about comorbidity with delinquency.

To summarize, CD is a disorder of externalizing behaviors that can be observed and documented. Given the fifteen behaviors documented as symptoms of CD, Nock, Kazdin, Hiripi, and Kessler (2006) pointed out that there could be 32,647 possible symptom profiles. This number of profiles suggests the likelihood of heterogeneity within the sample due to the symptoms alone. It is the heterogeneity of this population that has frequently been overlooked in the literature (Lynam & Henry, 2001; Nock, Kazdin, Hiripi, & Kessler, 2006). It is important to consider that there can be vast differences

among individuals with CD given the large number of symptom profiles possible in youth with CD. Because of the many characteristics that contribute to a diagnosis of CD, an examination of the factors associated with the development of this disorder follows.

### **Biopsychosocial Factors Associated with Conduct Disorder**

A number of issues have been identified as potentially contributing to a diagnosis of CD. Presenting these factors within a biopsychosocial perspective offers a framework to assist in organizing them (Dodge & Pettit, 2003). Biological factors include prenatal, perinatal, and childhood risk factors, as well as heritable features. In addition, comorbid psychological disorders and social issues, such as peer interactions, family environment, and parent mental health have been associated with the development of CD.

### **Biological Factors Associated with Conduct Disorder**

Multiple biological factors are associated with the development of CD. These factors include: maternal use of tobacco, alcohol, and/or drugs during pregnancy (Chronis, Lahey, Pelham, Kipp, Baumann, & Lee, 2003; Mick, Biederman, Faraone, Sayer, & Kleinman, 2002; Monuteaux, Blacker, Biederman, Fitzmaurice, & Buka, 2006; Wakschlag & Hans, 2002), obstetrical complications (Arseneault, Tremblay, Boulerice, & Saucier, 2002), lead ingestion (Bellinger, 2004; Needleman, Riess, Tobin, Biesecker, & Greenhouse, 1996), the youth's temperament (Moffitt, 1993), and heritable factors examined in twin studies (Coolidge, Thede, & Young, 2000). Many researchers have investigated maternal use of tobacco, alcohol, and/or drugs during pregnancy and the development of CD (Chronis, et al., 2003; Mick, et al., 2002; see review Wakschlag, Pickett, Cook, Benowitz, & Leventhal, 2002). Weissman, Warner, Wickramaratne, and

Kandel (1999) examined the impact of maternal smoking on the development of CD in 147 boys over a ten-year period (age range at follow-up 17-36 years old,  $M = 27$  years old). After controlling for maternal depression and age of the subject at the time of the follow-up interview, these researchers found a three-fold greater risk of the development of CD in male subjects whose mothers smoked during pregnancy. In addition, Wakschlag, et al. (1997) examined 177 clinic-referred, 7-12 year old boys and found that maternal smoking of more than half a pack of cigarettes per day during pregnancy was significantly associated with preadolescent and adolescent diagnoses of CD. By examining the number of symptoms of CD, Wakschlag and Hans (2002) reported that prenatal smoking was a significant factor in the development of CD in boys, but that no effect was observed in girls.

In addition to prenatal exposure to tobacco products, the effects of alcohol and drug use also have been examined in the literature. In a retrospective study of 280 cases of ADHD and 242 youth without ADHD, Mick, et al., (2002) did not find an interaction between CD and alcohol consumption during pregnancy, but did report a 2.5-fold increased risk of ADHD in youth whose mothers consumed alcohol during pregnancy. In addition to alcohol, other studies have examined the impact of cocaine on CD and list other factors (e.g., family environment, parent psychopathology) as also contributing to the development of CD. For example, Chronis, et al. (2003) assessed the impact of parental substance use and parental psychopathology on the development of ADHD in a sample of 214 children, of which 30 met the criteria for ADHD without ODD or CD and 68 met the criteria for ADHD and Oppositional Defiant Disorder (ODD) or CD. It was



found that comorbid ADHD and ODD/CD was associated with maternal cocaine and stimulant dependence.

Other biological areas associated with CD were examined by Bendersky, Bennett, and Lewis (2006) and Delaney-Black, et al. (2000) and included the impact of gender and environmental risk on problematic behaviors. In a study of 206 children from two urban cities it was found that in addition to being male, the results suggested that high environmental risk (e.g., low parent education level, irregularity in the child's schedule, high number of different caregivers, low parental support) and prenatal cocaine exposure were related to higher levels of aggression at five years old (Bendersky, Bennett, & Lewis, 2006). Delaney-Black, et al. (2000) also assessed the impact of prenatal exposure to cocaine on the behaviors of 471 six-year-olds (201 cocaine-exposed) using teacher ratings of behavior. Boys were more likely than girls to score in the clinically significant range on a scale measuring aggressive behaviors, with cocaine-exposed boys being twice as likely to have clinically significant scores on externalizing- and delinquent behavior subscales. In addition to cocaine exposure, the authors reported prenatal alcohol exposure and environmental risk factors (e.g., drug use in the home, exposure to violence in the home, custody changes) to be significantly related to teacher-rated problem behaviors.

These studies suggest that there is an association between CD or problem behaviors and prenatal exposure to tobacco and cocaine. However, the effects of alcohol exposure on the development of CD have not been as consistently identified in the literature. It is important to note that the contribution of prenatal exposure to teratogens in the development of CD is difficult to ascertain, as the studies have indicated other co-occurring factors associated with the development of CD, such as other substance use and

environmental risk factors (Chronis, et al., 2003; Delaney-Black, et al., 2000) might impact the findings. Examples of these additional co-occurring factors associated with prenatal exposure to cocaine included: more neonatal medical complications, mothers who used more alcohol, and mothers who smoked more cigarettes than those who were not exposed to cocaine (Bendersky, et al., 2006).

While teratogens are frequently examined in regard to the development of behavioral issues, researchers have also studied bone- and blood-lead levels to determine if they are associated with the development of antisocial behaviors related to CD (Bellinger, 2004). A study investigating bone-lead levels found that 9-13 year old males ( $N = 301$ ) with elevated bone-lead levels at 11 years old were rated by teachers and parents as more aggressive, had higher scores on a delinquency scale, and had more somatic complaints than their counterparts (Needleman, Riess, Tobin, Biesecker, & Greenhouse, 1996). One study examined the impact of lead exposure on the development of 11-13 year old, Australian children ( $N = 322$ ; Burns, Baghurst, Sawyer, McMichael, & Tong, 1999). The maternal responses on a behavior checklist suggested significant behavior problems in boys and girls with high blood-lead levels, when compared to their counterparts with low/no blood-lead levels. When the results were further examined, girls with higher blood lead levels demonstrated significant externalizing and internalizing behavior problems in comparison to female controls, whereas boys with high blood-lead levels only demonstrated a significant difference in externalizing behaviors when compared to male controls. In another study of blood-lead levels, Wasserman, Staghezza-Jaramillo, Shrout, Popovac, and Graziano (1998) investigated the impact of lead exposure on 706 preschool children in two Yugoslavian towns, one near a lead smelter and one in a

more urban setting. Although blood-lead levels appeared related to behavior scales measuring destructive and withdrawn symptoms, the relationship of blood-lead levels and overall behavior problems were similar in each town. These results appear to support a connection between exposure to lead and behavior problems commonly associated with CD.

Obstetrical complications have also been associated with the development of CD and other related behavior problems. Arseneault, Tremblay, Boulerice, and Saucier (2002) examined the interaction of obstetrical complications and family adversity (e.g., parents' education level, prestige of employment, family status) on the development of violent behaviors during childhood and adolescence in a sample of Canadian boys. Longitudinal data was available for aggressive behaviors at six years of age and for delinquent behaviors at 17 years of age. Obstetric complications of preeclampsia (pregnancy-induced hypertension), umbilical cord prolapse, and induced labor were classified as conditions/procedures with the highest risk. When coupled with family adversity, these high-risk conditions/procedures were associated with the development of violent behavior in these subjects.

In addition to exposure to teratogens and other toxins in childhood and obstetrical complications, researchers have examined temperament as a potential predisposition of youth who develop CD. Lahey and Waldman (2003) characterize temperament as the “substantially heritable and relatively persistent individual differences . . . [that] constitute the foundation of many personality traits” (p. 80). These authors identified three dimensions of temperament: negative emotionality (e.g., neuroticism, quick to experience negative emotions with little provocation), daring (e.g., willingness to take a

risk), and prosociality (e.g., the ability to relate to others.) They reported that those who exhibited high negative emotionality and daring with low prosociality were often associated with having conduct problems. In addition, Olson, et al. (2000) described difficult temperament as predictive of externalizing behaviors in youth.

Since temperament reportedly represents an inherent trait of the individual, investigating other heritable factors through studying twin-pairs provides further information about the biological component of CD. Coolidge, Thede, and Young (2000) examined the heredity of behavior disorders/deficits among 214 twin pairs ( $M = 8.9$  years old). These authors found a reasonably high likelihood of heritability in each of the following: ADHD ( $r = 0.82$ ), executive functions ( $r = 0.77$ ), CD ( $r = 0.74$ ), and ODD ( $r = 0.61$ ). A greater comorbidity between ADHD and ODD and ADHD and executive functions also was found among the twins. There was not a strong comorbidity of ADHD and CD found in this study. However, it is important to recognize that these subjects were from a predominantly non-referred, community-based sample. The age of these subjects would suggest a greater chance of the diagnosis of ODD than CD, as CD is more common in older children. Lynam (1998) offered further support of the idea that ODD may be a precursor to CD and occurs more frequently than CD in younger children.

The connection of many biological factors with the development of CD in youth has been examined in the research. The variables studied include: teratogens, childhood toxins, obstetrical complications, and heritable characteristics. Although the results reported in the literature are not always consistent, the general trend reported in the above studies supports the association between these factors and CD. In addition, gender also appears to impact the development of CD, as many of the studies within this section

reported a higher prevalence of the development of CD in males than females. However, as was reported above, other psychological and social factors are often reported with these biological factors. Because of the potential interaction of these factors, this review of the etiology of CD next examines psychological factors associated with CD.

### **Psychological Factors Associated with Conduct Disorder**

It has been frequently reported that other psychological disorders often co-occur with CD (Abram, Teplin, McClelland, & Dulcan, 2002; Lambert, Wahler, Andrade, & Bickman 2001; Teichner & Golden, 2000). Actual statistics of the rates on comorbidity between CD and other disorders are difficult to obtain, as most samples have examined these youth under the broader category of juvenile delinquency (Abram, Teplin, McClelland, & Dulcan, 2002; Teichner & Golden, 2000; Teplin, Abram, McClelland, Dulcan, & Mericle, 2002). Evidence of this was reported by Abram, et al. (2002) where 56.5% of females and 45.9% of males in the Cook County Juvenile Detention Center met the criteria for two or more disorders (e.g., mood disorders, anxiety disorders, substance use disorders) and only 17.3% of females and 20.4% of males met the criteria for only one disorder. When examining the diagnoses of the youth in this sample, it was determined that 33.6% of females and 24.2% of males still had two or more disorders once the diagnoses of CD and substance use disorders were removed from the disorder group. In another study of this sample, Teplin, Abram, McClelland, Dulcan, and Mericle (2002) found that only 5% of these youth with CD met criteria for CD without any co-occurring disorders. Lambert, Wahler, Andrade, and Bickman (2001) had similar findings in their five-year study of youth with CD, as these youth were found to have an average of 2.2 mental health diagnoses. Given this statistic, the authors suggested that

comorbidity is the norm among youth with CD. It has also been reported that not only do subjects with CD have a tendency to endorse symptoms indicative of internalizing problems, externalizing problems, and overall problems with greater frequency than other youth (Lambert, et al., 2001), but that aggression associated with the symptoms of a psychiatric disorder can place youth at a greater risk for the development of CD (Yeager & Lewis, 2000).

When examining the development of CD, researchers have begun to look at which came first, CD or another co-occurring disorder. As stated earlier, ODD is often seen as a precursor to CD (Lynam, 1998). Hinshaw, Lahey, and Hart (1993) reported that of a sample of 7-12 year old boys with ODD, 50% did not progress to CD, 25% no longer had ODD, and 25% progressed to CD at follow-up in the third year. In addition, it was reported that 84-96% of the youth with CD also met the criteria for ODD. The onset of mood, substance use, impulse control, and anxiety disorders and their chronological relationship with the onset of CD have also been examined (Nock, et al., 2006). This retrospective-interview study reported that CD is more likely to occur before comorbid mood disorders and substance use disorders. It was also found that CD was likely to occur after the onset of impulse-control disorders. Anxiety disorders as a whole appeared to differ from specific and social phobias in onset, as CD tended to occur after the onset of specific and social phobias, but before anxiety disorders in general.

The results of multiple studies examining disorders that co-occur with CD suggest that there are many features that accompany CD. It has also been reported that CD can be a precursor to other disorders and vice-versa, which can complicate the research, as such variables are difficult to control for. In addition to the psychological conditions that can

accompany CD, factors related to the environment are also important to include, as these social factors may interact with the previously identified biological and psychological factors leading to CD.

### **Social Factors Associated with Conduct Disorder**

In addition to physical and mental health issues that have been connected with the development of CD, there are multiple social factors that have been identified as risk factors. These include peer interactions, family environment, and the community. In a review of the literature, Bassarath (2001) reported the following predictors of risk: early onset of antisocial behavior, antisocial peers, social ties, substance use (especially if it began before age 12), being male, antisocial parents, low family socioeconomic status, specific psychological characteristics (e.g., characteristics related to ADHD), school attitude and performance, medical and physical conditions (e.g., head injuries, birth complications when coupled with early maternal rejection), and IQ. This review also identified other family characteristics (e.g., high family stress, large family size, and marital discord), broken home (i.e., divorce, parental separation, or separation from parents), and abusive parents as mildly predictive of CD.

One of the many areas implicated in the development of CD is peer influence (Rutter, Giller, & Hagell, 1998; Vitaro, Tremblay, & Bukowski, 2001). Both of these reports suggested that the increased time spent unsupervised with peers in adolescence provides the youth with the opportunity to exhibit behaviors that the parent would not approve of. In addition, individual characteristics of the youth may predispose them for association with other deviant peers. For example, Rutter, Giller, and Hagell (2001) suggested that youth with hyperactivity might struggle with developing relationships with

prosocial peers because some of their extreme behaviors could deter the attraction of positive peers. Brendgen, Vitaro, and Bukowski (1998) found that a relationship between lowered self-esteem in youth who lacked closeness with their parents led to poor choices in peer groups. This finding suggests that the lack of emotional support by parents might lead to these youth impulsively seeking friends who will support them without considering negative behavior characteristics of these friends.

In addition to peer influence, researchers have examined familial characteristics, such as socio-economic status (SES), family size, parent psychopathology, and parenting strategies (Lahey, Loeber, Burke, & Applegate, 2005; Rutter, Giller, & Hagell, 1998). These factors have been implicated as increasing the likelihood of the development of CD. Despite often being connected with increased risk of the presence of CD, studies controlling for SES demonstrated that this factor had little influence on the presence of CD (Déry, Toupin, Pauzé, Mercier, & Fortin, 1999; Lynam, Moffitt, Stouthamer-Loeber, 1993). However, Lahey, et al. (2005) found that the increased presence of CD in childhood and lower SES correlated with an increased risk of the development of antisocial personality disorder in adulthood. In addition to SES, larger family size has been shown to increase the risk of CD (Bassarath, 2001; Rutter, Giller, & Hagell, 1998).

A frequently investigated component of the family environment is parent characteristics and behaviors. The parent's psychological well-being has been shown to influence the youth's development (Rutter, Giller, & Hagell, 1998). In particular, many authors have suggested that parent's behaviors and children's interactions with their parents strongly influence the development of antisocial behaviors and/or CD (Maughan, 2001; Moffitt, 1993; Rutter, Giller, & Hagell, 1998; Tapert & Brown, 2000; Teichner &



Golden, 2000; Toupin, Déry, Pauzé, Fortin, & Mercier, 1997; Toupin, Déry, Pauzé, Mercier, & Fortin, 2000; Yeager & Lewis, 2000). One study examined the impact of the parent's psychopathology the development of childhood disorders and found significant associations between child ADHD and ODD/CD and maternal mood and anxiety disorders (Chronis, et al., 2003). These mothers had significantly more depressive symptoms than mothers whose children did not exhibit ADHD or ODD/CD. Researchers have also examined antisocial personality disorder (ASPD) in fathers (Lahey, et al., 1998; Kuperman, Schlosser, Lidral, & Reich, 1999). In their study of 219 families (total of 463 children), parental alcoholism and ASPD was associated with increased presence of CD among their offspring. Similar results were found in an examination of characteristics of youth with each subtype of CD (Lahey et al., 1998). The sample for this study was a combination of youth in an institution ( $N = 440$ ) and a community sample ( $N = 1,285$ ) where it was reported that paternal antisocial behavior was associated with the presence of CD regardless of the subtype.

If parents have little patience with their children due to their own psychological difficulties, Moffitt (1993) argued that children with a difficult temperament might already be at risk of development of CD. She suggested that these parents might use harsh ways to manage this behavior and can be reactive to the child. Additionally, these difficult children may not be exposed to alternative ways to manage their own behavior or that of others. Moffitt speculated that traits, environments, and developmental processes lead to the development antisocial behavior. Similarly, Teichner and Golden (2000) reported that a significant proportion of adolescents with CD are neuropsychologically normal and their behavior can better be accounted for by a number

of environmental factors such as abuse, substance use, chaotic families, lack of parental monitoring, and various perceived rewards in maintaining such acts of aggression and delinquency.

However, these researchers also pointed out that a youth with neuropsychological deficits in an unsupportive environment might lead to the development of inappropriate strategies for dealing with adversity. One study investigated this hypothesis by examining the impact of family functioning on the development of ODD/CD in youth ( $N = 54$ ,  $M = 11.46$  years old) after a traumatic brain injury (Max, et al., 1998). These authors reported that family functioning as a whole and a family history of alcohol dependence or abuse correlated with the development of ODD/CD post-injury suggesting that family functioning influenced the development of ODD/CD in these youth and not the injury.

To summarize, there have been many factors associated with the development of CD in youth. Exposure to toxins, difficult temperaments, and heritable factors are biological issues that may contribute to CD in some youth. Comorbid psychological disorders and child/adolescent's environment also might exert some influence over the development of CD. In addition to the association of the above factors and the development of CD, ADHD has been commonly associated with CD. Since this project seeks to investigate the relationship of CD and ADHD in regard to deficits of executive function, further elaboration about ADHD in general, as well as its co-occurrence with CD is described next.

### **Attention-Deficit/Hyperactivity Disorder**

Attention-Deficit/Hyperactivity Disorder (ADHD) has been identified as one of the most common co-occurring disorders with CD, with a range of 40-90% of youth with

CD also having ADHD reported in the literature (Essau, 2003; Jensen, Martin, & Cantwell, 1997). Because of this high co-occurrence, a description of the subtypes and symptoms of ADHD is necessary in order to provide a greater understanding of ADHD and its interaction with CD.

A diagnosis of ADHD can include one of three different subtypes: Predominantly Hyperactive-Impulsive, Predominantly Inattentive, or Combined Types (APA, 2000). The last subtype is associated with youth who meet the criteria for both of the Hyperactive-Impulsive and Inattentive subtypes. Youth with the Hyperactive-Impulsive subtype exhibit behaviors such as: fidgeting, leaving seat frequently when expected to stay seated, always being on the go, interrupting others, and/or having difficulty waiting turn in activities. Of the nine symptoms listed in the *DSM-IV-TR*, six symptoms need to be endorsed in order to meet the criteria for this subtype. The inattentive subtype also lists nine potential symptoms of which the youth needs to meet six. Sample symptoms for this subtype include the following behaviors: making careless mistakes, not appearing to listen when spoken to, difficulty organizing tasks, and/or frequently losing things. The symptoms identified for diagnosis must be present for the last six months and cause significant impairment in two or more settings (e.g., school, home, community). In addition, some symptoms must be present prior to age seven.

Prevalence rates of ADHD indicate that this disorder occurs in approximately 3-7% of elementary school children (APA, 2000). According to the APA, the male-to-female ratio of ADHD ranges from 2:1 to 9:1, depending on the subtype diagnosed and the setting the diagnosis was made in. The male-to-female ratio tends to be less dramatic in those diagnosed with the Predominantly Inattentive Type. Males with ADHD are more

likely to be referred to a clinic for treatment. Prevalence of ADHD related to race and SES has also been examined. A national survey of 10,367 children, ages 13-17 years old (64% White, 16% Hispanic, 15% Black, and 5% other), revealed the specific prevalence of ADHD in males by race to be 5.65% of White children, 4.33% of Black children, and 3.06% of Hispanic children (Cuffe, Moore, & McKeown, 2005). There was a prevalence rate of 1.19% among members of a group classified as other, but the authors indicated that this group had such a low number that it was not statistically sound for further analysis. The only race-related statistics pertaining to the prevalence of ADHD in females deemed to be statistically reliable were White females at 1.98% and Black females at 1.87%. Comparisons by Cuffe and colleagues reported that White/non-Hispanic children were more likely to be diagnosed with ADHD than Hispanic children, and that Black children displayed significantly more ADHD symptoms than Hispanic children. Cuffe, et al. (2005) also reported that children from homes with a household income less than \$20,000 were more likely to be diagnosed with ADHD than those whose household income was greater than \$20,000. According to Barkley (2003), studies investigating the relationship between ADHD and SES have reported conflicting data with confounding variables such as the presence of CD or ODD, which could mediate the relationship between ADHD and SES. The greater incidence of males with ADHD parallels findings on gender prevalence in youth with CD. Also similar to CD are the conflicting findings about race and SES.

As reported previously, the prevalence of ADHD with CD has been reported to be as high as 90% (Jensen, Martin, & Cantwell, 1997). A more recent national survey of youth by Cuffe and colleagues (2005) reported that approximately 65% of the youth with

ADHD also had conduct problems. Since there is an overlap in the symptoms of CD and delinquency, also examining the prevalence of ADHD in delinquent youth is important to the present study. Abram, et al. (2002) found that only 7.6% of a sample of detention center youth met the criteria for ADHD alone. However, 46.3% of the youth were identified as having ADHD, with 38.7% of the sample meeting the criteria for ADHD with another diagnosis (e.g., substance, mood, and/or anxiety disorders). In their sample of 13-year-old youth in New Zealand, Moffitt and Silva (1988) identified 18% of self-reported, delinquent youth as having ADD based on the criteria of the *DSM-III-R* (APA, 1987), compared to the prevalence of 2% among the general child-population at the time of the study. Self-reported measures have been found to be less accurate in determining the presence of ADHD (Fischer, Barkley, Smallish, & Fletcher, 2005), which could account for the discrepancy between the figures of these two studies. Nonetheless, approximately 18-46% of delinquent youth present with ADHD (Abram, et al., 2002; Moffitt & Silva, 1988).

Behavioral reports of youth with both CD and ADHD have noted “greater amounts of physical aggression, a greater range and persistence of antisocial behaviors, more severe academic underachievement, and higher rates of peer rejection” (p. 167, Hinshaw & Lee, 2003). To investigate specific behavioral characteristics of youth with CD and ADHD, Cukrowicz, Taylor, Schatschneider, and Iacono (2006) examined positive emotionality (e.g., talkativeness, cooperation, and assertiveness), negative emotionality (e.g., reactivity to stress and emotional lability), and self-constraint (e.g., responsibility, dependability, and orderliness) among 11- and 17-year old twins ( $N = 1,624$  and  $1,152$ , respectively). The youth were divided into four groups: ADHD-Only,

CD-Only, ADHD+CD, and controls. On these measures, the control group was significantly different than the other three groups on the negative emotionality and self-constraint subscales. The ADHD+CD group demonstrated the lowest scores related to self-constraint and the highest related to negative emotionality. However, statistical significance was only obtained in analyses between the CD+ADHD and the CD-only groups. The authors suggested that the results of the CD+ADHD group on measures related to negative emotionality and self-constraint support the belief that youth with both of these disorders are at a greater risk of the development of other psychopathology. In addition, these characteristics of high reactivity to stress (negative emotionality) and high impulsivity (low self-constraint) support the incidence of more severe behavior issues reported by Hinshaw and Lee (2003).

Lynam (1998) further examined the comorbidity of CD and ADHD and its relationship to severe clinical presentations. This study of 370 boys, 12-13 years of age, from an urban community hypothesized that ADHD was a precursor of CD. The results indicated that the personalities of youth with ADHD and conduct problems more closely resembled adults with antisocial behaviors on objective behavior reports and measures of neuropsychological functioning, than groups with only conduct problems, only ADHD, and neither ADHD nor conduct problems. Additionally, the group with ADHD and conduct problems had more severe delinquent behaviors, such as a higher level of aggression and harm toward others, than the other three groups.

The information in this section highlights the various behavioral and biopsychosocial factors that have been associated with a diagnosis of CD. The symptoms of impulsivity and inattention to the environment suggest an overlap with the disregard

for consideration of laws, values, and social norms of those youth diagnosed with CD. Furthermore, youth with both CD and ADHD appear to represent a unique set of presenting symptoms that reportedly persist into adulthood and indicate the potential for severe behavioral issues. The following sections will present information related to general cortical organization and function and the specific neuropsychological presentation of youth diagnosed with CD, ending with an overview of reported neuropsychological interactions of CD and ADHD.

### **Neuropsychological Factors Related to Conduct Disorder**

Many sources suggest that individuals with CD suffer from impairments in neuropsychological functioning (Moffitt, 1993; Moffitt & Henry, 1991; Moffitt & Silva, 1988; Teichner & Golden, 2000). Neuropsychology is defined as “the measure of brain-behavior relationships and cognitive functioning by examining individual performance on standardized tests” (McNeill, 2000, p. 61). To better understand the specific deficits associated with CD it is important to have a basic understanding of cortical organization and functioning.

### **Cortical Organization and Functioning**

Luria (1973) provided a conceptualization of the brain’s ability to carry out activities and its role in mental processes. He described three principal functional units of the brain each making their own unique contribution to mental activity. In addition, given optimal cortical functioning, information ascends and descends through the functional units in a manner that provides for efficiency in carrying out a task or activity. The first functional unit is located at the level of the brainstem and includes the cerebellum,

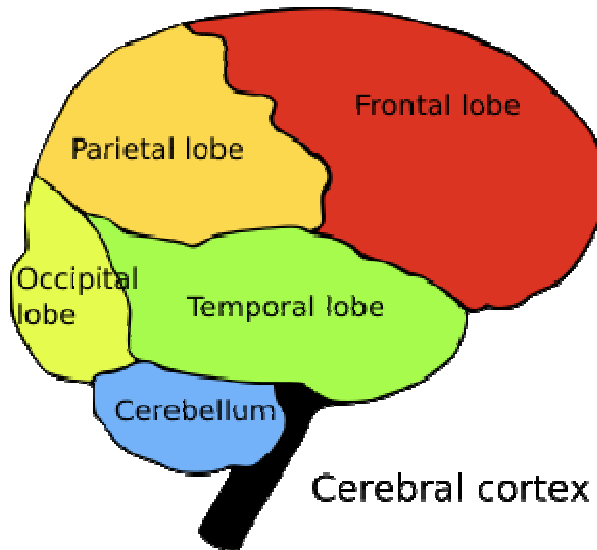
hypothalamus, limbic system, and reticular activating system. It is primarily involved in regulating tone or waking, such as being alert as opposed to comatose, and preparing the mind/body to take in the information. The second functional unit is responsible for obtaining, processing, and storing information and is located in the posterior portion of the cortex, including the temporal, parietal, and occipital lobes. The third functional unit is mainly responsible for programming, regulating, and verifying mental activity, and is often associated with higher-order cognitive skills or the so-called executive skills and is located in the frontal lobes. Although each unit is responsible for specific components involved in the processing of information, Luria (1973) points out that all three functional units are interconnected, interdependent, and operate simultaneously in the carrying out of behavior and mental activity. A basic example of this process is a bike sitting on the sidewalk. The role of the first functional unit involves simply pausing and activating the mind/body to look at it. The ability to see its color (e.g., red) and that it is composed of wheels, handlebars, a chain, a seat, etc. activates the second functional unit where percepts are made and integrated into their meaningful whole. The third functional unit establishes a plan or intention of what will be done with the percept, namely what the person will do with the bike. Assuming optimal cortical functioning, all of these steps are fluid and occur within milliseconds.

In addition to being organized into three functional units, the brain is divided into two hemispheres with each having four lobes that are reasonably symmetrical with their corresponding lobe in the other hemisphere. Listed posterior to anterior they are: the occipital, parietal, temporal, and frontal lobes (see Figure 1). The occipital, temporal, and parietal lobes, located in the posterior portion of the cortex, are involved in the receiving,



Figure 1

Cerebral Cortex



processing, and synthesizing of information. The occipital lobes are primarily responsible for perceptual processing. The temporal lobes are involved in the receipt and production of auditory stimuli. The parietal lobes facilitate the processing and synthesis of perceptual material obtained from the various senses.

The third functional unit, which is comprised of the frontal lobe, is responsible for the planning and carrying out actions or inhibiting action (Luria, 1973). These behaviors associated with the frontal lobe are commonly referred to as executive functions. In addition to the association of specific functions with each lobe, this specificity also applies to each hemisphere. For example, the left hemisphere is commonly associated with language, certain aspects of computation, analytic or linear reasoning, and right-handedness. Skills often attributed to the right hemisphere include visual-spatial skills,

interpretation and understanding of emotionality, musical and rhythmic perceptions, and left-handedness (Rains, 2002). Cerebral hemispheric dominance can also influence an individual's strengths in these areas, as well as the development of handedness in infancy. To explain this further, individuals tend to have a preference for learning and performing in their environment, which is related to their dominant hemisphere. For instance, people who are musically inclined, tend to have strengths in right-brain activities and perform motor skills with left-hand dominance. On the other hand, individuals with left cerebral hemispheric dominance might be more skilled at math and perform motor skills with right-hand dominance. In addition to this foundational understanding of the complex functions of the brain, a more specific explanation of the frontal lobes and executive functions is necessary to adequately address the focus of this project and is presented next.

### **Frontal Lobes and Executive Functions**

A strong connection has been established between the frontal lobes and executive functions (Luria, 1973; Mesulam, 2000). To better understand this relationship it is important to have a basic knowledge of the frontal lobes, including their location, common subdivisions of these lobes, and the processes attributed to this area of the cortex. The frontal lobe is the most anterior area of the cortex and encompasses about one-third of the cortex (Ishikawa & Raine, 2003). The frontal lobe is rostral to the central sulcus and dorsal to the lateral sulcus. It is common that the right frontal lobe is larger than the left. The analogy that the frontal lobe is to the brain, as a conductor is to an orchestra has been offered as a way to describe the role it has within the cortex (Zillmer & Spiers, 2001). These authors indicated that it has become common knowledge in

neuro-development that this is the last area of the brain to fully develop. For example, research has shown that myelination of the frontal cortex occurs between six to ten years of age (Martin, 2006). Myelination is required for accurate and efficient processing of information, as it is like a sheath that goes over wires to prevent frays and shorts. Later in life, between adolescence and young adulthood, a reduction in gray matter has also been observed within the frontal cortex, while little to no change is noted in the other lobes of the brain (Sowell, Thompson, Holmes, Jernigan, & Toga, 1999). Lastly, also throughout adolescence and young adulthood, there is a “pruning” of the connections, also called dendrites, that provides a “streamlined” processing of information throughout the cortex.

Within each hemisphere, the frontal lobe itself is divided further into specific regions, each identified as possessing unique characteristics that contribute to higher cognitive functioning and behaviors. Using Martin’s (2006) description, moving anterior from the central sulcus, along the crown of the head, and around to the area behind the eyes and under the brow, the sections of the frontal lobe are: 1) the precentral cortex (containing the motor cortex), 2) the premotor cortex (containing the premotor region, frontal eye field, and Broca’s area), and 3) the prefrontal cortex (containing the orbito-frontal, medial-frontal, and dorso-lateral regions). The left frontal lobe is identified as regulating speech production. The prefrontal cortex is the anterior portion of the frontal lobe, and occupies approximately half of this lobe. The prefrontal cortex has been identified as playing a critical role in attentional behaviors and working memory (Mesulam, 2000), with dysfunction in this area leading to aggressive behavior (Brower & Price, 2001). Working memory is identified as the “on-line” holding information and its

mental manipulation. In addition, lesions to the prefrontal cortex have also been associated with rude behaviors, such as profanity and grandiosity, as well as the loss of the ability to delay gratification, a lack of organized planning and sequencing of behaviors, and/or becoming excessively concrete or stimulus-bound (Mesulam, 2000).

As mentioned above, the prefrontal cortex is divided into three regions. These regions are known as the orbito-frontal, medial-frontal, and the dorso-lateral regions. They are commonly examined when exploring cognitions, social behavior, personality, and internal regulation. The orbito-frontal region is thought to oversee the areas of cognitive and executive functioning, working memory, conceptual reasoning, and attention. This area is heavily connected to the rest of the cortex and sub-cortex, as it works closely with the reticular formation and the limbic regions. Lesions to this area often lead to the development of a lack of self-control, violent emotional outbursts, poor judgment, and reduced foresight (Luria, 1973; Mesulam, 2000). Functions attributed to the medial frontal region include regulation of the state of attention and focus on an activity. Similar to the orbito-frontal region, the medial frontal region also is associated with the first functional unit due to the need for the body to attend before planning for a task. Additionally, lesions to this area also lead to poor judgment and foresight. Other impairments associated with damage to this area include disturbances in cortical tone, wakefulness, dream states, disturbance of memory leading to confabulations, and a diminished orienting reflex to auditory stimulus (Luria, 1973; Mesulam, 2000). Lastly, functions of the dorso-lateral region include stimulus acquisition, association of stimuli with reward, behavioral self-regulation, and complex decision-making. The manipulation of information attributed to working memory is associated with the dorso-lateral region.

In addition to a disruption of working memory, damage to this area can lead to an amotivational state, emotional blunting, and a slowing of thinking, which contributes to poor decision-making.

Evidence of these distinctions of functions within the frontal lobe has been reported within the literature (Bergeron & Valliant, 2001; Brower & Price, 2001; Luria, 1973; Mesulam, 2000). Some studies have done this by examining behaviors after injury to an area of the frontal lobe. For instance, in a study of 55 adolescent and adult offenders and non-offenders, Brower and Price (2001) found no significant differences between offenders and non-offenders, regardless of age, on an instrument measuring flexibility in thinking and perseveration, which are skills primarily attributed to the dorso-lateral region of the prefrontal cortex. However, these authors did report significant differences on measures of social judgment, foresight, and planning, which are attributed to the orbito-frontal and medial regions of the prefrontal cortex. Drawing conclusions from their review of the literature, Brower and Price (2001) suggested that damage to the dorso-lateral region could be related to birth-related injuries, developmental learning disorders, ADHD, substance misuse, and Antisocial Personality Disorder and attributed the development of these deficits to an organic predisposition. They hypothesized that the subsequent educational and social skill difficulties related to the developmental issues could lead to frustration and the subsequent development of aggression in these individuals and viewed this region as the primary location of the executive functions. Furthermore, Brower and Price (2001) asserted that injuries to the medial and orbito-frontal regions tend to be external and not organic, with the development of violent and

aggressive behaviors being a direct outcome of the damage to structures within these regions.

In addition to specific abilities being attributed to areas of the frontal lobe, the role of this area of the brain has been described in many ways. Despite the variety of descriptions offered, they all tend to support the belief that the frontal lobes are primarily responsible for executive functions. Early on, Luria (1973) identified the general roles of the frontal lobes as regulation of the states of activity, movements and actions, and memory processes (particularly the memory process of encoding and sending the information to short-term memory store) and intellectual activities. A theme of self-regulation, one of the most commonly identified characteristics of executive functions, permeates this early description of the responsibilities of the frontal lobes. A basic definition of the role of the frontal lobes is that of overseeing planning, initiating, and regulating behavior (Luria, 1973; Rains, 2002), further exemplifying the connection between the frontal lobes and executive functioning. Specific abilities often attributed to executive functioning are: self-monitoring/self-regulation, abstract reasoning and concept formation, sustaining attention and concentration, planning abilities and carrying out these plans, the formulation of goals, initiating purposive sequences of behavior, inhibiting impulsive behaviors, and working memory (Moffitt, 1993; Zillmer & Spiers, 2001).

Researchers have sought to identify the impact of lesions in the frontal lobes on executive functions. Teichner and Golden (2000) completed a thorough review of the literature describing various deficits within specific areas of the brain. Like others, these researchers looked at information about frontal lobe deficits. Teichner and Golden

reported that patients with lesions of the frontal lobe tend to be impulsive, have poor insight into their behavior, lack planning ability and good judgment, exhibit inflexible thinking, display defective affect, and may have attentional difficulties. Behavioral disinhibition and impulsive rage attacks may also be exhibited with minimal provocation. Lastly, these authors offered that damage to the prefrontal area in adolescents and others is the most difficult to manage because their behaviors and are more susceptible to negative stimuli (e.g., gangs, dealing drugs, other criminal behavior) in the environment due to this poor self-regulation and impulsivity.

Studies have attempted to identify specific measurable characteristics attributable to deficits in the frontal lobes and executive functioning. A study specifically examining the performance of individuals with frontal lobe impairments reported that in addition to struggling with expressing themselves emotionally, these individuals struggle to see the impact of their behavior on others, as these individuals tend to be egocentric (Golden, Jackson, Peterson-Rohne, & Gontkovsky, 1996). Furthermore, these authors stated that even though the individual with impairment of the frontal lobe may feel sorry for what he/she did, they lack the ability to generalize this behavior to future consequences and are likely to repeat behaviors despite their consequences. Rains (2002) further explained that individuals with lesions to the prefrontal cortex often understand what they are supposed to do, but are unable to organize their behavior to complete the task. One could argue that this is similar to the delinquent youth's ability to recognize right from wrong, but failing to implement an action to demonstrate that he/she knows the right thing to do in a given circumstance.

In summary, the organization of the brain and its interactive processes provide the basic framework of the cortical structure. Of the four lobes, the frontal lobes are seen as the executor of actions and plans and are associated with the third functional unit within the cortex. This area of the brain is associated with executive functions, such as the ability to organize and carry out a plan, make complex decisions, and, more broadly, self-regulation. These cognitive abilities appear deficient in youth with Conduct Disorder (CD), as these youth are characterized as not following rules or thinking through a situation and choosing the best outcome in order to make a good decision. The following investigation of the neuropsychological processes and deficits in these abilities will provide further context about their relationship with CD.

### **Conduct Disorder and Neuropsychological Deficits**

The literature on neuropsychological impairments associated with CD typically falls into three areas: 1) general intelligence quotient (IQ) scores, 2) verbal skills, and 3) executive functions (Moffitt, 1993; Yeager & Lewis, 2000). Some investigators have examined the relationship between general IQ and delinquency/CD (Lynam, Moffitt, & Stouthamer-Loeber, 1993; Moffitt, 1990; Moffitt & Silva, 1988). In general, delinquent youth tend to score eight points lower than nondelinquents on tests of intelligence (Lynam, Moffitt, & Stouthamer-Loeber, 1993; Yeager & Lewis, 2000). In a study of 430 boys, ages 12-13 years old, Lynam et al. (1993) found that the scores on an instrument measuring severity and frequency of delinquent behavior was inversely correlated with overall IQ scores. In addition, impulsivity was determined not to predict IQ in these youth, even when race and social class were controlled. Moffitt (1990) also examined IQ differences among boys that were classified as non-delinquent and delinquent. It was



found that IQ was inversely related to the severity and frequency of delinquent behaviors, with those youth who exhibited antisocial behaviors at a younger age and had a diagnosis of an externalizing disorder (e.g., CD, ADHD, ODD, etc.) having a seventeen-point deficit in their mean IQ score. In this study, those youth with few antisocial behaviors had a one-point deficit. In an earlier study with this sample, Moffitt and Silva (1988) reported that IQ scores were low in both delinquent youth and those youth that self-reported delinquent behaviors that had gone undetected compared to other youth in the study. Moffitt (1990) indicated that the inverse relationship between IQ scores and delinquency remains even before the onset of illegal behaviors in delinquent youth.

Other studies have sought to measure IQ in these juveniles by grouping youth with CD or Oppositional Defiant Disorder (ODD) together (Clark, Prior, & Kinsella, 2000, 2002). Two studies by Clark, Prior, and Kinsella (2000, 2002) divided participants, ages twelve to fifteen, into four groups: ADHD-only, ODD/CD only, ADHD and ODD/CD, and control groups. In these studies, it was determined that these youth fell within normal ranges on IQ scores. However, since CD was combined with ODD, it is not possible to determine how IQ related to CD. It is also important to note that in the later study, the IQ score was based on the results of one subtest, as opposed to using all fourteen or at least a larger portion of the subtests that comprise that particular instrument. In one of the few studies that has specifically examined IQ in youth with CD, Giancola and Mezzich (2000) compared IQ scores among girls in one of four groups: CD-only, substance-related disorder, CD and substance-related disorder-only, and a control group. It was found that girls diagnosed with CD had lower IQ scores, regardless of the presence of a substance-related disorder. Although these scores were lower, they

were still within the normal range. Unlike previous studies, this one used the majority of subtests in the instrument. However, the data provided was obtained using older formats of the Wechsler batteries dated 1981 (WISC-R) and 1972 (WAIS-R), which have since been revised.

Further examination of IQ scores showed that youth with CD demonstrated a significant difference between scores measuring verbal ability and performance ability, with the verbal IQ score often being significantly lower than the performance IQ score (Clark, Prior, & Kinsella, 2000; Lynam, Moffitt, & Stouthamer-Loeber, 1993; Moffitt, 1990; Yeager & Lewis, 2000). This pattern suggests that youth with CD struggle with verbal skills, such as vocabulary, verbal expression, and general knowledge, and have relatively better performance with tasks that require the individual to put puzzles together, design shapes, or spatial processing. Although most of these results can only be generalized to a larger group of delinquent youth, other studies have more thoroughly examined this finding by looking at specific deficits of verbal abilities in youth with CD (Golden & Golden, 2001; Moffitt & Henry, 1989). In a previously cited study, Lynam, et al. (1993) also found that scores on a scale measuring frequency and severity of delinquent behaviors inversely correlated with verbal abilities, meaning that those who exhibited more delinquent behaviors had lower verbal IQ scores.

Golden and Golden (2001) also examined neuropsychological functioning in addition to IQ. Their study included 53 youth ( $M = 13.53$  years old) who were divided into four groups: 1) early-onset CD group, 2) left-hemisphere injured group, 3) right-hemisphere injured group, and 4) normal group. The performance of these youth was assessed on nine instruments measuring the following areas of neuropsychological

functioning: visual-spatial ability, auditory comprehension, general intelligence, verbal fluency, planning and organization, and vocabulary. No significant differences were found when comparing the group with left-hemisphere injuries to the CD group. However, the performance on all of the above neuropsychological variables was significantly different when the CD group was compared to the normal group with the CD group scoring lower on all measures. Golden and Golden (2001) concluded that deficits in youth with early-onset CD might be similar to youth with left-hemisphere insult, an area commonly associated with verbal deficits, given the lack of statistical significance between these groups.

In another study examining the relationship between verbal deficits and CD, Toupin, et al. (1997) classified a clinical sample of 207 boys into two groups based on age (seven to twelve-year-olds and 13-17 year olds), with each of these two groups further divided into two groups based on the presence or absence of CD for a total of four groups. Although the younger group with CD did not demonstrate deficits in language skills (e.g., comprehension of words and phrases, oral fluency, visual naming, sentence repetition) in comparison with the same-age control group, the adolescent group with CD demonstrated significant deficits in this area when compared to same-age controls. Neither the presence of ADHD nor the severity of the conduct problems appeared to impact these results. In another study that assessed 92 youth, seven to twelve years old, the same principle authors (Toupin, et al., 2000) examined language ability using a battery of tests that focused on receptive, expressive, and memory components of speech. These youth were divided into a CD group or a control group. Similar to Toupin, et al. (1997), the children with CD also demonstrated no significant verbal deficits in

comparison to controls. It is important to note that the samples in these two studies were composed of white, French-speaking, Canadian youth, which puts into question whether these results are generalizable to a sample of youth with CD in the U.S. However, an important finding from these studies is the possibility that verbal deficits only relate to adolescents with CD and not to children, as the children in these studies are a younger group of individuals than the previously cited studies. To support this reasoning, Toupin et al. (2000) offered that verbal deficits might worsen with age creating a greater gap between their level and a normal level creating a noticeable verbal deficit.

It could also be argued that the inability to attend and formulate a response due to deficits of executive functions leads to the greater deficits in verbal skills as a child matures. For example, Moffitt (1993) speculated that youth with impaired verbal skills might seek other ways to express themselves that are likely not appropriate such as fighting or other aggressive tactics. This conceptualization was further supported by Henry and Moffitt's (1997) report that deficits of verbal skills are strongest in youth with attentional and conduct problems. Additionally, Teichner and Golden (2000) summarized literature suggesting that the verbal deficits these youth exhibit could negatively affect their abilities to problem solve, deal with verbal conflicts, and learn in school. These deficits could further contribute to struggles with undesirable personality features (e.g., poor social judgment), poor self-regulation, and learning problems. These behavioral descriptions match those previously provided for executive function deficits suggesting the importance of investigating the relationship between CD and executive functions.

## **Conduct Disorder and Deficits in Executive Functioning**

There have been several studies investigating whether there is a connection between CD and deficits of executive function. For example, Teichner, et al. (2000) examined a sample of 77 adolescents, ages 13-17 years old, with CD and a substance-related disorder. The youth were classified into four groups based on neuropsychological deficits: verbal/left hemisphere deficits (e.g., expressive speech, spelling, reading comprehension, and arithmetic deficits), subcortical frontal deficits (e.g., memory and executive functioning deficits), mild-verbal deficits (e.g., minor deficits in reading comprehension and recalling verbal stimuli), and normal functioning. It was reported that the group with subcortical/frontal deficits had the highest scores for thought problems and delinquent behavior when compared to the other groups. These authors suggested that these youth with subcortical/frontal deficits have the most impulsive forms of aggression and delinquency.

In another study examining executive functioning in CD youth, Giancola and Mezzich (2000) compared four groups of 14- to 18-year-old girls on measures of executive functioning. The groups were differentiated as having both CD and a substance use disorder (SUD), CD-only, SUD-only, and control groups. It was found that the subjects with CD demonstrated significant deficits in executive functioning, regardless of the presence of an SUD (Giancola & Mezzich, 2000). In another study of adolescent females, executive functioning deficits were again linked with CD, but age of onset of CD was not associated with these deficits (Giancola, Mezzich, & Tarter, 1998).

Several articles have presented reviews of the impact of deficits in executive functioning on CD (Moffitt, 1993; Teichner & Golden, 2000; Yeager & Lewis, 2000).

These reviews identified the following specific deficits of executive functioning in youth with CD: abstract reasoning and concept formation, recognition of consequences, sustaining attention and concentration, planning abilities, the formulation of goals, initiating purposive sequences of behavior, inhibiting impulsive behaviors, and self-monitoring. Further debate exists around whether this connection between CD and executive function is moderated by the presence of ADHD, as ADHD has commonly been associated with deficits of executive functions (Barkley, 2003). Most of the literature suggests that executive deficits are most distinguishable in youth that present with both ADHD and CD or delinquent behaviors (Aronowitz, et al., 1994; Clark, Prior, & Kinsella, 2000, 2002; Moffitt & Henry, 1989; Moffitt & Silva, 1988). Because of this, it is important to examine the overlap between CD, ADHD, and executive function deficits.

In a study mentioned above, Moffitt and Henry (1989) concluded that although executive functioning was not an indicator of delinquency alone, a unique group of youth with both delinquency and ADD exhibited statistically significant deficits in five specific executive functions: planning, flexibility of thinking, impulsivity, attention, and visual-spatial construction. In addition, a previously mentioned article examining the etiology of CD presented results supporting the differentiation of a subtype of CD comprised of youth with conduct problems and issues with hyperactivity, impulsivity, and attention problems (Lynam, 1998) or an CD+ADHD subtype. Lynam compared this group (ADHD+CD), who he described as having severe forms of delinquency and behavior problems, with three other groups: ADHD-only, CD-only, and a control group. When comparing the ADHD+CD group with controls, statistically significant differences were

found in the number of delinquent behaviors, risk-taking/response disinhibition, delay of gratification, planning and flexibility of thinking, and visual spatial reasoning. The performance of the ADHD+CD group was statistically significant in comparison to the ADHD-only and CD-only groups on delinquent behaviors and risk-taking/response disinhibition, with additional differences from the ADHD-only group on a task measuring delay of gratification and the CD-only group on a task measuring planning and flexibility of thinking. The characteristics of the ADHD+CD group described above mirror those features associated with deficits in executive functioning. Furthermore, the results of a meta-analysis by Oosterlaan, Logan, and Sergeant (1998) supported this reasoning, as measures of response inhibition did not appear to adequately distinguish youth with ADHD from those with CD, suggesting that this may be a shared deficit among these two diagnostic groups. This finding supports an existing theory that CD and ADHD could be a continuum of disruptive disorders, suggesting the two disorders are interrelated (Jensen, Martin, & Cantwell, 1997).

Although studies appear to support the connection between CD and executive functions, some researchers would disagree. For example, in a study of adolescents, aged 13 to 17 years, Déry, et al. (1999) investigated whether neuropsychological performance is associated with CD with or without co-occurring ADHD. The youth were divided into three groups: CD-only, CD+ADHD, and controls, none of which had an ADHD diagnosis. No significant associations between executive functions with CD alone or with co-occurring ADHD were reported in this study. These results suggested that performance on measures of executive functioning is independent of the presence of CD and ADHD. However, similar to the two Toupin, et al. studies (1997, 2000), the sample

of Déry, et al. (1999) included only white, French-speaking, Canadian youth, which puts the generalizability of this study to a similar U.S. sample into question due to the low level of diversity within this sample.

Additional research refutes the combination of CD and ADHD as a subgroup of CD, indicating that these disorders represent two discrete categories. Two studies by Clark, Prior, and Kinsella (2000, 2002) supported this concept. Both studies had four groups of participants, ages twelve to fifteen, in their studies: ADHD-only, ODD/CD only, ADHD and ODD/CD, and control groups. In the first study, it was found that the ADHD-only and ODD/CD+ADHD groups performed poorly on measures of executive functioning. Clark, Kinsella, and Prior (2000) concluded that executive deficits are related to the presence of ADHD, as only those groups with ADHD demonstrated deficits in this area. These authors further speculated that the lack of deficits in executive functioning in the CD-only group indicated that ADHD and CD are two separate disorders. In their later inquiry, Clark, et al. (2002) determined that performance on measures of executive functioning predicted results on tests examining communication and socialization in the three disordered groups of the sample. Specifically youth with ADHD exhibited the lowest performance on measures of communication, with moderately low results in the ODD/CD+ADHD and ODD/CD groups when compared to controls. All three of these groups performed significantly lower than controls on the socialization measure. Although both of these studies presented results of executive functioning, it is important to note that the grouping of ODD and CD together may have influenced the results, as behaviors of individuals with ODD are considered milder than those occurring with CD.



Nigg (2005) provided a theoretical conceptualization of the difference between CD and ADHD in executive functioning. He indicated that ADHD represented a group of youth with executive inhibition. Conversely, he viewed youth diagnosed with CD at a young age as demonstrating issues with inhibition of the motivation to perform appropriate behaviors. In other words, youth with ADHD have difficulty with regulating their behaviors and carrying out activities; whereas, youth with CD then have issues with motivating themselves to comply with behavior expectations.

To summarize, research on neuropsychological deficits in youth with CD tends to examine three areas: IQ, verbal deficits, and executive functioning. Although IQ typically is not found to be a significant deficit, youth with CD exhibit consistently lower scores than controls. There also appears to be a relatively consistent connection between CD and verbal deficits. Although each of these areas could be related to educational needs, it would seem that these deficits are consistently prevalent within youth with CD. However, continued speculation exists as to whether executive functioning has any role in the development and/or presence of CD. Further questions have been raised about how ADHD may or may not play a part in the incidence of deficits of executive functions in youth with CD. Specific deficits reportedly present in youth with CD include: abstract reasoning and concept formation, recognition of consequences, sustaining attention and concentration, planning abilities, the formulation of goals, initiating purposive sequences of behavior, inhibiting impulsive behaviors, and self-monitoring (Golden & Golden, 2001; Moffitt, 1993; Teichner & Golden, 2000; Yeager & Lewis, 2000). Further research has identified the following deficits in youth with co-occurring CD and ADHD: planning, flexibility of thinking, impulsivity, attention, visual-spatial construction/reasoning, risk-

taking/response disinhibition, and delay of gratification (Lynam, 1998; Moffitt & Henry, 1989). Given these findings, additional research with more sophisticated measures of executive functioning has been recommended (Lynam & Henry, 2001; Moffitt, 1993; Moffitt & Henry, 1989). Investigations that more specifically examine the areas of response inhibition, attention, concentration, and delay of gratification among youth with CD are recommended given the discrepancies within the literature. Such an investigation could be accomplished through the use of continuous performance tests.

### **Measuring Executive Functioning in Youth**

As previously mentioned, executive functioning deficits in abstract reasoning and concept formation, recognition of consequences, sustaining attention and concentration, planning abilities, the formulation of goals, initiating purposive sequences of behavior, inhibiting impulsive behaviors/response disinhibition, delay of gratification, planning and flexibility of thinking, visual spatial reasoning, and self-monitoring have been associated with youth identified as having CD (Moffitt, 1993; Teichner & Golden, 2000; Yeager & Lewis, 2000). Many assessment tools have been developed to measure these areas of executive functioning. A group of instruments called continuous performance tests have been used to measure the specific components of executive function of response inhibition (i.e., curbing impulsivity) and sustaining attention and concentration (Conners, 2004). These tests are often used in determining the presence ADHD. Since the overlap of ADHD with CD has been identified to range from 40-90% (Essau, 2003; Jensen, Martin, & Cantwell, 1997), it would be a gross oversight to ignore ADHD when examining CD. To better understand the utility of continuous performance tests in the evaluation of youth with CD, an explanation of this group of tests follows. In addition to

an understanding of the connection between continuous performance tests and executive functioning, the use of these instruments in the evaluation of youth with CD and ADHD, as well as the sensitivity of these instruments in the determination of ADHD when compared to other disorders will be provided.

Continuous performance tests specifically examine an individual's ability to sustain attention and curb impulsivity (Conners, 2004). This is done through the use of a stimuli identified as a target and the examinee's ability to curb his/her responding to non-targets, also known as "noise" targets (Conners, 2004). These tests, typically done on a computer, look at the examinee's responding on multiple levels, including: omissions (failing to respond or missing target stimuli); commissions (responding to non-targets); reaction times (i.e., response latencies) across the testing situation and within intervals, allowing a comparison of the examinee to his/her own responding and/or a normative group; the ability to distinguish targets from non-targets (e.g., detectability or discriminability;) the response style to targets; and the variability of responding. These tests typically require the examinee to remain focused on the task of responding to targets for over ten minutes, with some going as long as 22 minutes. Throughout the testing experience, the computer is collecting data to produce scores on the above-mentioned levels, which later manifests in an overall index score classifying an individual as having a certain probability of matching or not matching a diagnosis of ADHD based on a comparative clinical (ADHD) and non-clinical (not ADHD) sample. All of these scores contribute to a determination of the examinee's ability to sustain attention and curb impulsivity (i.e., response inhibition), two of the identified areas of executive functioning identified in the previous section of this document.

Almost by the nature of the cluster of symptoms used to identify CD alone, it would seem that curbing impulsive behaviors, also identified as response inhibition, is likely deficient, as these youth commit crimes often knowing what their consequences will be, but taking the risk that they might not get caught (Nigg, 2005). Response inhibition is an area commonly identified in the overlap of executive functioning in youth with CD, ADHD, or CD+ADHD (Oosterlaan, Logan, & Sergeant, 1998). When examining the performance of youth with CD on continuous performance tests, few articles examine CD alone, with most researchers including youth with CD or Oppositional Defiant Disorder (ODD) in a group often labeled “disruptive behavior disorders” (Dougherty, et al., 2003; Thompson, Whitmore, Raymond, & Crowley, 2006). For example, Dougherty, et al. (2003) reported that their sample of 22 youth, 13-17 years old, with disruptive behavior disorders exhibited significantly more commission errors when compared to 22 members of a control group. This result is often connected with response disinhibition, even when IQ was controlled for. Although the clinical group exhibited slightly shorter reaction times and less within-group variability, this finding was not significant.

Another similar study by Thompson, et al. (2006) also found no differences in reaction times of 14-18-year-old individuals when comparing a group of 20 youth with CD and substance use disorders to a control group of 20 youth. The clinical group demonstrated greater incidence of impulsivity on self-report measures, as well as on the continuous performance test used in this study with both of these variables being highly intercorrelated when compared to controls. In addition, youth in the clinical group did not discriminate between targets and non-targets as well as others. Poor performance on this

discriminability index was inversely correlated with measures of self-reported aggression and the number of CD symptoms.

Although a few characteristics identified by continuous performance tests have been also found in samples of youth with disruptive behaviors, continuous performance tests have been primarily used to examine characteristics of youth with ADHD. A brief examination of features often associated with ADHD will be helpful in understanding the utility of this group of tests before discussing the sensitivity of these instruments in accurately identifying ADHD. Typically, the inattentive symptoms of ADHD are associated with higher incidence of omission errors, as was found in a study of 95 adults, aged 18-50 years old, (Advokat, Martino, Hill, & Gouvier, 2007). This study compared adults with ADHD, a cognitive disorder, a psychiatric disorder (other than ADHD), and controls. It also reported a correlation among ADHD and increased commission errors and reaction times. Lastly, no significant differences were noted between participants with a cognitive disorder or ADHD on the continuous performance test.

Another study examining 9-17-year-old youth with ADHD or no diagnosis found that the ADHD youth exhibited more omission errors, more commission errors, more variable reaction times, including lower reaction times among youth with impulsive behaviors, and lower detectability scores than the control group participants (Epstein, Erkanli, Conners, Klaric, Costello, & Angold, 2003). Many of these findings are similar to the adults in Advokat, et al. (2007). Contrary to the belief that omission errors are an indicator of inattention, was the finding that omission errors were related to hyperactive symptoms, but not inattentive symptoms. Commission errors were related to all types of ADHD symptoms, demonstrating a significant relationship between thirteen out of the

eighteen symptoms of ADHD. Response style (e.g., focusing on accuracy or focusing on quickness of responding) was significantly related to all eighteen symptoms of ADHD. Detectability of targets versus non-targets was significantly related to all symptoms of ADHD except “loses things necessary for tasks.” Mean hit reaction time was significantly related to all ADHD symptoms. It is important to note that the power of this study may have been affected by the differences in group sizes, as there were only 21 youth with ADHD and 795 controls.

Lastly, Egeland, Johansen, and Ueland (2009) found results contrary to most findings, where commission errors were not significantly different between 9- to 16-year-old youth with ADHD-inattentive type (ADHD-I), ADHD-combined type (ADHD-C), and a control group, yet this item is frequently related to inattention and/or hyperactivity-impulsivity. In addition, omission errors were significantly greater in the ADHD-C group than controls, but this was not found in the ADHD-I group. This is contrary to most conceptualizations of omission errors, as this type of error is typically attributed to inattention to stimuli and missing a response instead of impulsive behaviors, but this was not significant in the ADHD-I group. Typically, certain scores on continuous performance tests are believed to correlate with inattention, impulsivity, and/or vigilance. These authors used a score that is related to inattention (reaction time among blocks of time during the test) as a measure of vigilance and a score related to vigilance (reaction time of stimuli based on the duration of time between presentation of stimuli) as a measure of inattention. However, in this study, this latter score was related to both ADHD groups. Aside from the curious use of the continuous performance test scores in this study, the power of the groups is also questionable, as the ADHD-I group had 27

participants, the ADHD-C group had 40 participants, and the control group had 66 participants.

In reviewing the literature above, information related to the use of continuous performance tests and evidence of their utility in understanding symptoms consistent with disruptive behaviors and ADHD proves to be mixed. To best understand the sensitivity of these instruments in assessing for ADHD, it is also useful to explore potential confounding issues that could impact a valid determination of ADHD, as there are often many co-occurring issues with ADHD (McGee, Clark, & Symons, 2000). Research has examined the potential overlap of symptoms of ADHD and scores on continuous performance tests in regard to cognitive disorders (Advokat, Martino, Hill, & Gouvier, 2007) and, more specifically, reading disorder (McGee, Clark, & Symons, 2000), as well as conduct disorder (CD) and oppositional defiant disorder (ODD; Banaschewski, et al., 2003). As reported earlier, Advokat, Martino, Hill, and Gouvier (2007) found the performance of individuals with ADHD was not significantly different than individuals with a cognitive disorder. Individuals with a reading disorder were included in this latter group. McGee, Clark, and Symons (2000) reported similar findings in their study of 100 individuals, ages 6-11 years old, as the continuous performance test was unable to distinguish individuals with ADHD from individuals with a reading disorder using the ADHD confidence index, commission errors, omission errors, and hit reaction time. Individuals with comorbid reading disorder and ADHD scored the highest on the confidence index, with the reading disorder group scoring slightly lower, and the ADHD group lower than these other two groups. In addition to comparing ADHD and reading disorder on a continuous performance test, this study also found no relationship between

the performance on the continuous performance test and externalizing and internalizing behaviors. Like other studies mentioned, this study also appeared to have unevenly distributed groups, as the ADHD group had 40 participants, the RD group had 14 participants, the ADHD+RD group had 14 participants, and the control group had 32 participants.

Additional examination of the sensitivity of continuous performance tests in distinguishing ADHD from other disorders was completed by Banaschewski, et al. (2003). These researchers examined 64 youth who were diagnosed with either ADHD, ADHD+CD/ODD, CD/ODD, or no diagnosis except reading and/or spelling disorders. These 8-14-year-old participants, exhibited mean reaction times and reaction time-standard deviations that were both slower in youth with ADHD only. No other differences were noted among the other groups when compared to the control group. These authors concluded that there were not similarities in ADHD, ADHD+CD/ODD, or CD/ODD that would support these disorders being related to each other or one being a subgroup of another. Overall, negative correlations were reported among all groups between mean reaction times and commission errors and among all clinical groups between mean reaction times and accuracy, with a positive relationship found between mean reaction times and omission errors in all groups. However, since other studies have identified reading disorder as a potential confound in evaluating for ADHD using continuous performance tests, it would seem that this could be an issue with this study as well since members of the control group may have had a reading or spelling disorder.

These conflicting results in using continuous performance tests to diagnose ADHD often support using additional instruments when making this evaluation.



However, it is important to continue to examine potential confounds, using current equipment and comparable group sizes, including controls. As previously mentioned, verbal skills deficits have been correlated with youth with CD (Golden & Golden, 2001). It is curious how this could impact the performance of youth with CD on a continuous performance test given the lack of sensitivity reported by the continuous performance test in distinguishing ADHD from reading disorder. However, IQ scores were reported to be insignificant when analyzed with the continuous performance test data and have not greatly affected the results of continuous performance tests when controlled for (Banaschewski, et al., 2003; Dougherty, et al., 2003; Egeland, Johansen, & Ueland, 2009).

To further understand the qualities of individuals with ADHD and their performance on continuous performance test, a unique study by Fischer, Newby, and Gordon (1995) examined characteristics of individuals receiving a false negative (i.e., individuals with ADHD that did not test positive for ADHD on a continuous performance test.) These authors found higher reports of conduct and psychosomatic problems by the parents of youth receiving a false negative. They also found that as the youth aged, there was less agreement between continuous performance test scores and the presence of ADHD as determined through other means, such as behavioral reports. Specifically, youth that were 12-17 years old only had a 20% agreement between behavior reports and a continuous performance test when assessing for ADHD. Younger children (e.g., 4-11 years old) had an 80% agreement between these two forms of assessment. This not only suggests the possibility that conduct problems could affect the performance on a continuous performance test, but also that age might affect these results. Many of the

studies in this section examined the performance of younger children or a broad range of youth, as opposed to examining the differences among ages, particularly adolescents, which has been connected with great developmental changes in the brain. Finally, youth with CD present a more severe disorder along the disruptive behavior disorder continuum that should be examined specifically, without ODD, to determine how individuals with this disorder might have neurological deficits that have been overlooked by the current literature.

### **Summary**

There is a high co-occurrence of CD and ADHD within the CD population (Essau, 2003; Jensen, Martin, & Cantwell, 1997). Many factors have been identified as contributing to the development of this disorder (i.e., teratogens, birth complications, comorbid diagnoses, and environmental issues). Furthermore, research has implicated neuropsychological deficits as additional risk factors associated with the diagnosis of CD. In an effort to further examine the impact of executive functions on youth with CD, the overlap of CD with ADHD symptoms, and the clinical utility of continuous performance tests in diagnosing ADHD within this population, this study will examine the performance of youth with CD on the Conners' Continuous Performance Test, Second Edition (CPT-II; Conners, 2004). Further investigation of the overlap of the characteristics of CD and ADHD within the field of neuropsychology has been encouraged because of the interest in whether there is a relationship between CD and ADHD along a behavioral continuum (Lynam, 1998). The ability of continuous performance tests to examine specific executive functions in youth lends itself to further examination of these features in youth with CD.

Many contradictions have been identified in the use of continuous performance tests. Specifically, researchers have reported conflicting information pertaining to the use of these tests among youth with CD and ADHD. In addition, age (e.g., younger vs. older samples) and behavior distinctions (e.g., CD without ODD, CD without ADHD, and CD+ADHD) also seem to lead to convoluted findings when using continuous performance tests. These contradictions coupled with the debate about whether deficits of executive functions are related to the presentation of CD in youth (Lynam & Henry, 2001) seem to warrant further research with this population using continuous performance tests. At this time, few studies were found using the CPT-II (Conners, 2004) with youth diagnosed with CD, so the performance of this population on this measure has likely not been established. The CPT-II is a frequently used instrument within neuropsychological testing batteries. It would also be valuable to identify any potential populations that could compromise the validity and reliability of the CPT-II given its widespread use.

The purpose of this study is to examine the utility of the CPT-II in evaluating youth with CD. Since deficits of executive functions occurring in youth with CD has some support in the literature, comparing youth with CD to a control group could further assist in determining how the areas of response inhibition, attention, and concentration relate to youth with CD. This investigation could prove helpful in future programming and treatment implications for individuals with these disorders, as well as identify a potential diagnostic confound between CD and ADHD.

## CHAPTER 3 – METHODOLOGY

The present chapter describes the study's participants and data collection procedures. In addition to identifying the research design, descriptions of the independent and dependent variables and the instruments used in data collection are provided.

### Participants and Research Design

The 69 participants were fourteen- to seventeen-year-old youth from a large, suburban community. These participants were placed into one of two groups, youth with Conduct Disorder (CD) or a control group. The youth with CD were recruited from case managers of the Racine County Human Services Department, with many of them being a participant in a program designed to prevent placement into a juvenile correctional facility. The youth in this group were involved with court supervision. These participants met the criteria for a diagnosis of Conduct Disorder (CD) based on the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Textbook Revision (DSM-IV-TR; APA, 2000)*, as determined by reports completed by parents and service professionals working with the youth and reviewed by the principal investigator. Individuals assigned to the control group were recruited from a local high school through letters and other materials sent home with the potential participants. They also did not meet the criteria for CD. Exclusion criteria for both groups included a history of traumatic brain injury, participation in special education services due to cognitive disability, and/or symptoms of a psychotic disorder (e.g., hallucinations, delusions, or threats of harm to self or others.) Participants continued to be selected until each group obtained at least 30 eligible subjects to compose a convenience sample. A summary of the participation criteria for

this study is shown in Table 3.1. The independent variable was the presence or absence of CD. Dependent variables were the scores on seven indices of the Conners' Continuous Performance Test, Second Edition (CPT-II; Conners, 2004).

### **Procedures**

Prior to subject recruitment, approval from Marquette University's Institutional Review Board, the Racine County Human Services Department (RCHSD), and the representative school was obtained for this study. RCHSD is a governmental entity that oversees case management and services provided to individuals within Racine County. These services include case management of youth who are on supervision for criminal behaviors, youth who are in need of protective services due to abuse or neglect, and adults with disabilities who need community assistance, as these workers arrange for and oversee services being provided to their clients by contracting agencies and other individuals. The RCHSD Case Managers identified and referred delinquent youth who meet the criteria for CD using the CD Questionnaire (see Appendix A). Once a case manager was able to endorse three or more symptoms on the CD Questionnaire, this individual provided the youth and parent with the Parent/Guardian and Participant Letter (see Appendix B) explaining the purpose of the study. If interested, they completed the form and provided contact information allowing the principal investigator to initiate contact with them. Upon contacting the parent and youth, the principal investigator scheduled a meeting where Parent Consent (Appendix C), Participant Assent (Appendix D), and the Consent to Disclose Confidential Information Forms (Appendix E) were completed to conduct testing with the youth for this project, as well as coordinate communication about the project with the RCHSD Case Manager.

Table 3.1

*Inclusion Criteria*

	Conduct Disorder Group	Control Group
Age	14 – 17 years old	14 – 17 years old
Gender	Similar Proportions	Similar Proportions
Presence of CD	$\geq 3$ symptoms, confirmed by two reporters	$< 3$ symptoms, confirmed by participant and parent
Adequate Cognitive Skills	$\geq 70$	Participation in regular education classes or higher

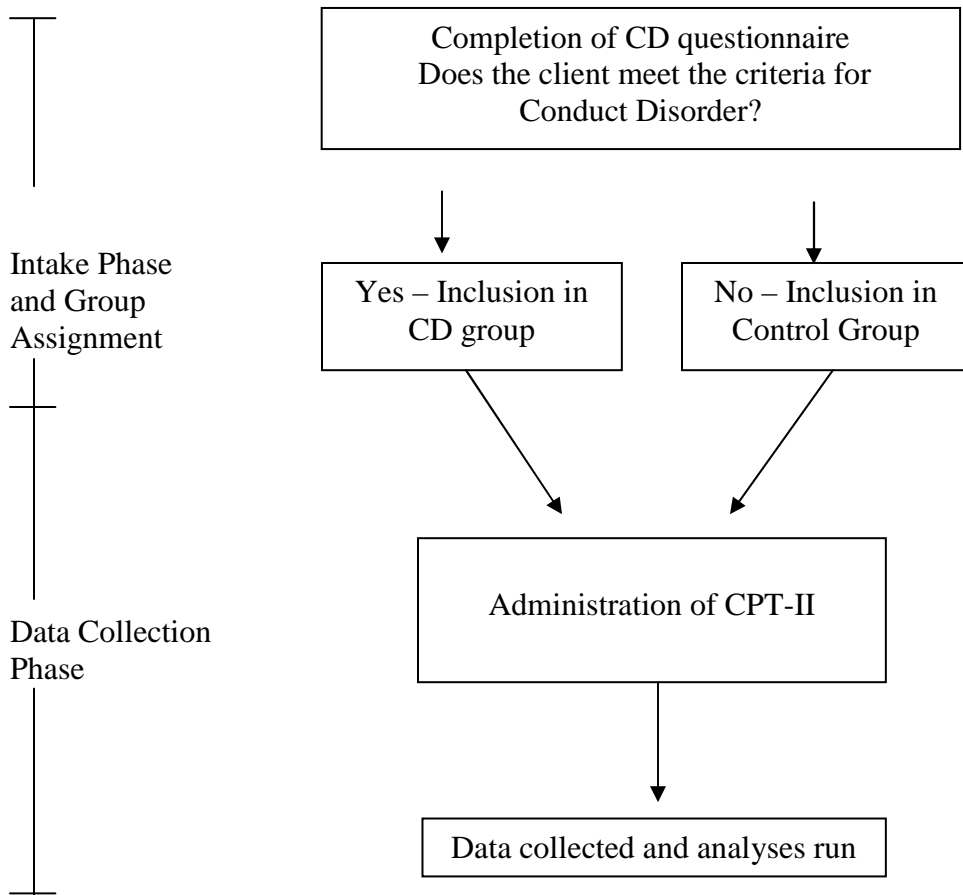
Individuals in the control group were gathered by obtaining permission from school personnel to solicit interest from students. Once a school was identified, the principal investigator met with the identified teacher's class to explain the project. At this time, the following materials were sent home with potential participants: a letter from the school identifying why this information is being requested, a letter from the principal investigator explaining the forms (Appendix F), the Parent Consent Form (Appendix G), the Participant Assent Form (Appendix H), and the Consent to Disclose Confidential Information Form (Appendix I) to allow the principal investigator and school to communicate to coordinate testing. The letter was not included in the appendices to maintain privacy protection due to names and the size of the school. It was requested that the parent(s) review and sign these documents. The principal investigator was available for questions from parents by phone and received calls from two parents prior to completion of the necessary consents for the project. Lastly, upon obtaining both consent and assent, the principal investigator contacted the parent(s) to provide basic information to complete the demographic questionnaire (Appendix K) and answer questions related to the presence of CD (Appendix A), which also provided the parents with an additional opportunity to ask questions, if needed. Recruitment continued until a minimum of 30

youth were identified for each of the groups within this study. To examine the differences in executive functioning, all participants were administered the Conners' Continuous Performance Test, Second Edition (CPT-II; Conners, 2004) to investigate differences in performance.

Aside from the previously mentioned questionnaires that were completed by the principal investigator and other designated reporters, the principal investigator supervised the computer-administration of CPT-II. If a participant from either of the groups was prescribed a stimulant medication for ADHD, he/she was asked not to take it the day of the evaluation until the testing session is completed. Parents and youth were instructed that the assessment will take approximately 20-30 minutes. Testing of youth in the CD group took place at the RCHSD Building. Testing of the youth in the control group occurred in a meeting room within the participant's high school. For compensation for their time, participants identified through RCHSD who met criteria for the study were given a \$10.00 gift card to their choice of McDonald's, Burger King, or Subway upon completion of all of the protocol materials. Because the principal investigator donated time to the classroom to facilitate an experiential learning opportunity, no further compensation was provided to the control group. Lastly, parents were provided \$5.00 for each trip made to either of the testing sites related to the completion of these materials. See Figure 2 for a flow chart further illustrating the selection process for group membership for each of the two groups and the procedures of the study.

Figure 2

*Selection Process for Group Membership*



**Instruments**

**Demographic Questionnaire**

The following information was collected on all participants (Appendix K): 1) Age, 2) Gender, 3) Race/Ethnicity, 4) Years on Delinquency Supervision, 5) Participant's history or current level of substance use, 6) Household income, 7) Parents' level of education, 8) Participant's placement, 9) Information about mother's pregnancy with participant, including her level of tobacco or other substance use, delivery, and birth



complications, 10) Any documented incidence of lead exposure, 11) History of head injury or seizures, 12) History of psychotic behavior, and 13) Current medications.

Lastly, a qualitative question was included on this questionnaire for the youth with CD asking what motivated him/her to commit the crime(s) in order to gain insight into the decision-making process leading to criminal behaviors.

### **Conduct Disorder (CD) Questionnaire**

A questionnaire designed as a symptom checklist for a diagnosis of CD (APA, 2000) was developed by the principal investigator to assist in diagnosis of CD (see Appendix A). An additional item was added to include selling of illegal drugs as a symptom of CD, but it is not listed in the *DSM-IV-TR* (APA, 2000). This criterion is viewed as a serious violation of rules and is being specifically listed due to a large number of youth who have a history of charges for this offense. In the group of youth identified with CD, the principal investigator completed this questionnaire with the youth and parent present. Another service provider familiar with the youth's behavior also completed this form for additional verification of the presence of CD. There must be a minimum of three items endorsed by each of two reporters in order for the individual to be diagnosed with CD and included in the CD group for this study. The principal investigator administered this questionnaire during a telephone call to the parents of members of the control group. To be included in the control group, youth cannot have more than two symptoms of CD endorsed by their parent(s).

**Conners' Continuous Performance Test, Second Edition (CPT-II)**

The Conners' Continuous Performance Test, Second Edition (CPT-II; Conners, 2004) is a computer-based program that measures attention problems in individuals six years of age and older. The examinee is given instructions to press the space bar or click the left mouse button when any letter except the letter "X" appears. These letters appear at varying speeds of one-, two-, and four-second intervals between stimuli and remain on the screen for 250 milliseconds. The computer-scoring of this assessment is broken into six blocks with each block having three sub-blocks. The order of the intervals between stimuli varies between these blocks. A two-minute, practice test is administered before the examinee begins the main test, which lasts approximately 14 minutes. The twelve index scores generated by this instrument are: Omission, Commission, Hit Reaction Time (Hit RT), Hit Reaction Time Standard Error (Hit RT SE), Variability of standard error, Detectability ( $d'$ ), Response Style (Beta), Perseverations, Hit Reaction Time Block Change (Hit RT Block Change), Hit Standard Error Block Change (Hit SE Block Change), Hit Reaction Time Inter-Stimulus Interval Change (Hit RT ISI Change), and Hit Standard Error Inter-Stimulus Interval Change (Hit SE ISI). There are also two confidence indices generated by the computer, ADHD and neurologically impaired, which are reported as percentage scores. However, the neurologically impaired index is only recommended for use with adults. Scores are further calculated by block results assessing performance as the test progresses. In addition, perseverations (a reaction time less than 100ms) and accuracy of responses are also reported. Except for the ADHD Confidence Index, all scores are converted to T-scores and percentiles to ease in

comparing the subject to established norms for the instrument. Table 3.2 provides further information about each of the thirteen index scores obtained by participants in this study.

When interpreting results from the CPT-II, it is recommended that the validity first be examined by looking at the Response Style, Omission, and Perseveration Indices, as well as clinician observations during administration. The T-score on the Response Style will likely be low ( $T < 40$ ) if the individual is impulsively responding, whereas this score will be high ( $T > 60$ ) if the respondent is cautious and hesitant in responding to ensure the response is correct. The CPT-II manual (Conners, 2004) suggests that the omission score can indicate the validity of the profile, as an extremely high T-score (e.g.,  $T > 100$ ) indicates a high percentage of omissions and a strong likelihood that the respondent may have stopped responding during the administration or misunderstood the directions of the test. Perseverations can be interpreted similarly to omissions, as an extremely high number of perseverations (e.g.,  $T > 100$ ) suggests the possibility of random responding or a misunderstanding of the rules of the protocol, leading to a high likelihood of an inaccurate profile. It is important to note that although high omission or perseveration scores could suggest an invalid profile, they could also imply serious attention and or neurological problems. Very high scores in these areas will be evaluated by reviewing the individual profiles with abnormally, high scores in these areas being eliminated to avoid invalid profiles.

When assessing an individual for ADHD, it is recommended that the clinician next look at the ADHD Confidence Index, which will provide a percentage indicating that X out of 100 individuals with this profile tend to have ADHD. This index score is

Table 3.2

*Conners' Continuous Performance Test, Second Edition (CPT-II), Index Score Information*

<b>Index Name</b>	<b>Description</b>	<b>Specific Areas Measured</b>
ADHD Confidence Index	Identifies how the respondent's profile matches that of an individual with ADHD (clinical) or without ADHD (non-clinical) based on an algorithm using the index scores.	Probability of the presence of ADHD
Omission Index	Identifies the individual's failure to respond to targets.	Inattention
Commission Index	Identifies the individual's responses to non-targets.	Inattention and impulsivity
Hit Reaction Time Index (Hit RT)	Measures the average speed of correct responses for the entire test.	Inattention and impulsivity
Hit Reaction Time Standard Error Index (Hit RT SE)	Measures response speed consistency, with higher scores suggestive of greater inconsistency.	Inattention
Variability	Measures the amount of variability the individual shows in 18 separate segments of the test in relation to his/her own overall standard error.	Inattention
Detectability (d')	Measures the ability of the individual to distinguish a target from a non-target based on the distribution of scores.	Inattention
Response Style ( $\beta$ )	Represents an individual's response tendency, where a higher Beta value suggests more cautious responding and a focus on accuracy with a lower Beta value being related to a preoccupation with responding to all targets rather than being accurate.	
Perseverations	Any reaction time that is less than 100ms, as this would suggest that the respondent is anticipating the stimulus rather than choosing a response once the stimulus is presented.	Impulsivity

Table 3.2, continued

*Conners' Continuous Performance Test, Second Edition (CPT-II), Index Score Information*

<b>Index Name</b>	<b>Description</b>	<b>Specific Areas Measured</b>
Hit Reaction Time Block Change (Hit RT Block Change)	Measures change in reaction times across the duration of the test with higher scores representing a slowing in reaction time.	Vigilance, alertness throughout test
Hit Reaction Time Standard Error Block Change (Hit RT SE Change)	Detects changes in response consistency over the duration of the test with higher scores suggesting a loss of consistency.	Vigilance, alertness throughout test
Hit Reaction Time Inter-Stimulus Interval Change (Hit RT ISI Change)	Measures change in average reaction times at different intervals (1, 2, or 4 seconds).	Inattention
Hit Reaction Time Standard Error Inter-Stimulus Interval Change (Hit RT SE ISI Change)	Measures change in the standard error of reaction times, which more closely examines consistency across different intervals.	Inattention

derived through computer scoring using extensive algorithms incorporating the other twelve index scores the individual receives from testing. Further examination of specific scores will provide support for this index score and a clearer picture of whether both inattention and/or hyperactivity/impulsivity are present at a significant level.

Inattentiveness is associated with performance measured by the following index scores: Omission, Commission, Hit Reaction Time (slow), Hit Reaction Time Standard Error, Variability, Detectability/attentiveness ( $d'$ ), Perseverations, Hit Reaction Time Block Change, Hit Reaction Time Inter-Stimulus Interval Change, and Hit Reaction Time Standard Error Inter-Stimulus Interval Change. Impulsivity is often associated with the Commission, Hit Reaction Time (fast), and Perseverations Indices.

Three-month test-retest reliability for the CPT-II reportedly ranges from .05 (hit SE ISI change) to .92 (neurologically-impaired confidence index). The lower reliability coefficients include not only the hit SE ISI change, but also the hit SE block change (.08) and the hit RT block change (.28) with none of these scores being significant, suggesting that these scores do not remain consistent over time. However, the remaining scores are statistically significant with a moderate to good range of reliability. The test-retest correlation coefficient for the ADHD confidence interval (.89,  $p < .01$ ) is important to note, since it is often the first score reviewed for determination of ADHD. The manual lists the split-half reliability for seven of the scores of the CPT-II (hit RT (.95), omissions (.94), commissions (.83), standard error (.87), variability (.66),  $d'$  (attentiveness; .83), and response style (Beta; .73).

Additional psychometrics on the CPT-II includes measures of validity. Scores on the first version of the CPT demonstrated concurrent validity with the parent ratings of the Conners' Rating Scales-Revised (CRS-R; Conners, 1997), where significant correlations were reported with the overall ADHD index score ( $r = .33, p < .05$ ) and the DSM-IV Inattentive Symptoms scale ( $r = .37, p < .05$ ). A significant, negative correlation was reported between the CPT and performance on the perfectionism subscale of the Conners' Teacher Rating Form-Revised (CTRS-R;  $r = -.35, p < .05$ ). This finding supports the construct of a low omission score suggestive of cautious responding and a preoccupation with correct responses commonly associated with perfectionistic tendencies and contradictory to impulsive responding. Additionally, correlations between the cognitive problems subscales, a measure of inattention on both the parent and teacher versions of the CRS-R were also significant (parent rating:  $r = .35, p < .05$ ; teacher

rating:  $r = .44, p < .05$ ). McGee, Clark, and Symons (2000) examined the performance of 110 children on the CPT and found that their teachers also rated those children whose CPT scores suggested ADHD as hyperactive and inattentive.

The CPT-II has been found to discriminate between ADHD and non-clinical youth, with ADHD youth scoring significantly higher on omissions, hit RT, hit RT SE, hit RT block change, hit SE block change, hit RT ISI, hit SE ISI, and ADHD Index. In reviewing the psychometrics of this instrument, the authors frequently cautioned that as with any good assessment, it is not effective to use only one instrument to measure some entity, which is also true of the CPT-II. It is not intended to be a stand-alone measure of ADHD. For this study, the principal investigator will examine the performance of the participants on the following indices: ADHD Confidence Index, omissions, commissions, hit reaction time, hit reaction time standard error, response style, and detectability. To monitor the validity of the profiles generated by this test, the omissions, perseverations, and response style scores will also be considered to avoid including subjects with invalid profiles.

## CHAPTER 4 – RESULTS

The purpose of this study was to investigate neuropsychological factors related to performance on the Conners' Continuous Performance Test, Second Edition (CPT-II), among youth who met criteria for Conduct Disorder when compared to a control group who did not meet criteria for Conduct Disorder (CD). This chapter presents the data that were collected and the subsequent analyses completed to examine the demographic characteristics of the two groups, the potential impact of the presence of CD on the data, and the intercorrelations among the seven CPT-II indices selected for the primary analysis of this project. This chapter concludes by answering the study's seven primary research questions and providing information generated by secondary analyses of the remaining index scores of the CPT-II to explore additional support for the conclusions drawn from the results.

### Demographic Characteristics

The subjects in this study included 69 youth between 14 and 17 years of age ( $M = 15.64$ ,  $SD = .92$ ). Thirty-four of the youth (28 males, 6 females) were on court supervision for delinquent behaviors with Racine County Human Services Department with the remaining 35 participants being students at a local private high school (16 males, 19 females). Ethnic background of the entire sample was described as follows: 30 Caucasian/White (44%), 18 African American (26%), 11 Latino/a (16%), six biracial (9%), and four other (6%). Additional descriptive data on the participants are provided in Table 4.1.



Table 4.1

*Descriptive Characteristics of Participants by Group*

Variable	Conduct Disorder Mean (SD)	Range	N	%	Control Group Mean (SD)	Range	N	%
Age (years)	15.51 (0.82)	14-17			15.76 (1.02)	14-17		
Gender								
Male			28	82			16	46
Female			6	18			19	54
Race								
Caucasian/White			4	12			27	77
Non-White			30	88			8	23
Months on Court								
Supervision	10.32 (10.08)	1-48			0			
Family Income								
\$0-50,000			30	88			9	26
≥ \$50,001			4	12			26	74
Parent Marital Status								
Single, Never Married			16	47			0	0
Single, Divorced			11	32			2	6
Married, Biological Parent			2	6			31	88
Married, Not Biological Parent			5	15			2	6
Placement of Participant								
Both Parents			3	9			34	97
Mom			24	71			1	3
Dad			1	3			0	0
Other			6	18			0	0

Table 4.1, Continued

*Descriptive Characteristics of Participants by Group*

Variable	Conduct Disorder Mean (SD)	Range	N	%	Control Group Mean (SD)	Range	N	%
Mother's years of Education	12.67 (2.61)	7-20			14.40 (3.16)	5-18		
Father's years of Education	12.24 (2.18)	6-19			15.20 (2.92)	7-20		

Note. Non-White = African American, Latino/a, Biracial, or Other

### General Analyses of the Data

For the purpose of comparing the two groups, some of the demographic data were combined into two groups. For example, race was combined into white or non-white. Family income was grouped into \$0 to \$50,000 or greater than \$50,000. Parent marital status was combined into four groups: single, never married; single, divorced; married, biological parent; married, not biological parent. A series of chi-squared analyses were computed to determine if there were significant differences between the group with Conduct Disorder (CD) and the control group. Despite attempts to obtain equal proportions of gender among the groups, the analysis showed that there was a significant difference between the CD and control groups related to gender [ $\chi^2 (1, N = 68) = 5.23, p = .022$ ]. As shown in Table 4.1, there were significantly more males in the CD group than the control group. Although race was combined into two groups, the analysis showed that there was a significant difference in this area between the CD and control groups [ $\chi^2 (1, N = 68) = 17.75, p < .001$ ]. As shown in Table 4.1, there were significantly more non-white individuals in the CD group than the control group.

Several qualities related to the participants' home environment were also significantly different. For example, the analysis also showed that there was a significant difference between the CD and control groups in regard to household income [ $\chi^2 (1, N = 68) = 15.78, p < .001$ ]. As shown in Table 4.1, there was significantly lower household income within the homes of youth in the CD group than the control group. Further analysis showed that there was a significant difference between the CD and control groups in marital status of parents [ $\chi^2 (3, N = 68) = 21.61, p < .001$ ]. As shown in Table 4.1, there were significantly more single parent households in the CD group than the

control group. In addition, the analysis showed that there was a significant difference between the primary placement of participants in the CD group than the control group [ $\chi^2(5, N = 68) = 105.70, p < .001$ ]. As shown in table 4.1, youth in the CD group were primarily placed with their mother, with no father present, than the control group.

In addition to chi-square analyses, T-tests for independent samples were computed to compare the two samples on age and mother's and father's years of education. There were no significant differences between groups in their age. The analysis showed that there were significant differences between the CD- and control groups in education of the participants' mothers [ $t(66) = 2.46, p < .05$ ] and fathers [ $t(62) = 4.51, p < .001$ ]. As shown in Table 4.1, there were significantly fewer years of education obtained by parents of the youth in the CD group than the control group.

In addition to the above identified variables, there were a number of medical conditions related to the development of CD identified in the literature leading to several of these variables being collected for the participants. The descriptive data related to these variables are listed in Table 4.2. Further analyses were not run on these variables due to the limited number of endorsement of several of the items. Content analysis suggested that the two groups appeared to be similar in regard to duration of pregnancy and type of delivery. However, more mothers of the control group participants reported complications during delivery (e.g., induced labor, fetus asphyxiation from the umbilical cord) than those mothers of participants in the CD group. Prenatal complications appeared to be similar between the two groups. It was reported that more mothers of youth the CD group used substances, specifically tobacco, while pregnant than mothers of participants in the control group. More youth in the CD group were

Table 4.2

*Descriptive Characteristics of Contributing Medical Factors by Group*

Variable	Conduct Disorder		Control Group		N	Range	%
	Mean (SD)	Range	Mean (SD)	Range			
Duration of Pregnancy							
Full Term					29		83
Premature Delivery					6		17
Normal					29		83
Cesarean Section					6		17
Birth Complications							
None					23		66
Induced Labor					6		17
Other					6		17
Prenatal Complications							
None					31		89
Yes					4		12
Substance use while pregnant							
None					35		100
Yes, Tobacco					0		0
Lead Exposure					0		0
Head Injury							
No					20		57
Yes, but no injury identified					15		43

reported to have been exposed to lead than youth in the control group. Lastly, there were a number of youth in the control group whose parents reported that they had experienced a concussion, with the majority of these being related to sports injuries (e.g., football, basketball.) All of these parents reported that their child received medical care and was determined to not have any lasting effects or conditions. No individuals in either group were identified as exhibiting or having a history of psychotic behaviors (e.g., hallucinations, suicidal behaviors, homicidal behaviors). Lastly, two youth within the CD group reported being prescribed stimulant medication for ADHD. These youth did not take the medication on the day of testing in order to obtain accurate results on the Conners' Continuous Performance Test, Second Edition (CPT-II).

Additional demographic data was collected regarding the participants' current and history of use of alcohol and other drugs, which is listed in Table 4.3. For the purpose of comparing the two groups, history of alcohol use was combined into two groups: one group who did not endorse any use and one group that did endorse use. History of cannabis use was combined in a similar manner. Although accuracy of reporting is questionable in all adolescents, it seemed that history of use appeared to be the most accurate reporting because it avoided any current consequences for court violations or infractions with school policies. The analysis showed that there were significant differences between the CD group and control group related to history of alcohol use [ $\chi^2(1, N = 68) = 32.01, p < .001$ ] and history of cannabis use [ $\chi^2(1, N = 68) = 12.19, p < .001$ ]. As shown in Table 4.3, the CD group reported significantly more use of these substances than the control group.

Table 4.3

*Participant Self-Reported Substance Use by Substance and Group*

<b>Reported Use</b>	<b>Alcohol</b>				<b>Marijuana</b>				<b>Other</b>				
	Current		History		Current		History		Current		History		
	Control Group	Disorder	Control Group	Disorder	Control Group	Disorder	Control Group	Disorder	Control Group	Disorder	Control Group	Disorder	
No	35	32	34	24	34	34	29	14	35	35	33	35	34
Yes	0	2	1	9	1	1	5	20	0	0	1	0	0

*Note.* Other included opiates, hallucinogens, and benzodiazepines

To further examine the impact of CD on the results of this project, descriptive data was collected related to the onset and symptoms of CD within this group. Table 4.4 lists the results of the analysis of this data. The average number of CD symptoms reported by the participant and his/her parent was nearly five ( $M = 4.82$ ,  $SD = 1.60$ ) out of the total 15 symptoms related to this disorder. The symptom category of aggression seemed to be most frequently endorsed ( $M = 1.74$ ,  $SD = 1.14$ ). The age of onset of these symptoms was reported to be 12 years old ( $M = 12.09$ ,  $SD = 1.91$ ).

Lastly, the performance of the CD group and the control group on the CPT-II was analyzed to assess for any intercorrelations among the seven index scores selected for the research questions. These analyses were run to examine agreement among indices designed to measure similar constructs in order to more thoroughly explore the validity of the performance of the participants in this project. Table 4.5 summarizes the findings of the analyses of the CD group and the control group. This table reflects significant intercorrelations among the ADHD Confidence Index and several index scores, as this is an overall measure based on all scores obtained by an individual on the CPT-II. In the CD group, there were moderate correlations between this index and the Hit Reaction Time Standard Error Index (Hit RT SE Index;  $r = .69$ ,  $p < .001$ ), the Omission Index ( $r = .54$ ,  $p < .01$ ), and the Response Style Index ( $r = .43$ ,  $p < .05$ ). In the control group the ADHD Confidence Index demonstrated a high correlation with the Hit RT SE Index ( $r = .75$ ,  $p < .001$ ) and weak correlations with the Hit Reaction Time Index (Hit RT Index;  $r = .39$ ,  $p < .05$ ) and the Response Style Index ( $r = .37$ ,  $p < .05$ ).



Table 4.4

*Descriptive Characteristics of Conduct Disorder Symptoms*

	Mean (SD)	Total Symptoms	Range
Total CD Symptoms ( $N = 34$ )	4.82 (1.60)	15	3-8
Symptom Category			
Aggression	1.74 (1.14)	6	0-4
Destruction of property	.44 (.50)	2	0-1
Deceit or theft	1.62 (.95)	3	0-3
Serious violation of rules	1.03 (.87)	4	0-3
Age of onset of CD (years)	12.09 (1.91)		8-15 yrs

Table 4.5

*Conners' Continuous Performance Test, Second Edition (CPT-II), Index Intercorrelations by Group*

CPT-II Index	ADHD Confidence	Omission	Commission	Response Style	Hit RT	Hit RT SE
Control Group: ( $N = 35$ )						
Omission	.30					
Commission	-.33	.41*				
Response Style	.37*	.01	.08			
Hit RT	.39*	-.19	-.80***	-.07		
Hit RT SE	.75***	.36*	-.23	.27	.57***	
Detectability	-.25	.37*	.91***	.07	-.70***	-.22
Conduct Disorder Group: ( $N = 34$ )						
Omission	.54**					
Commission	.27	.57***				
Response Style	.43*	.67***	.29			
Hit RT	.24	.20	-.53**	.02		
Hit RT SE	.69***	.60***	.38*	.37*	.25	
Detectability	.19	.33	.71***	.47**	-.23	.16

Note. Hit RT = Hit Reaction Time, Hit RT SE = Hit Reaction Time Standard Error.

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

To better understand the intercorrelations among the remaining index scores, it is useful to divide the indices among the characteristics of ADHD they are reported to measure (i.e., inattention and impulsivity) in order to provide a context for these relationships. First, there are eight total indices that are related to inattention by the interpretive guide for the CPT-II. This group of indices related to inattention includes five of the seven indices examined to answer the research questions for this study. These five indices are: Omission, Commission, Hit RT, Hit RT SE, and Detectability. There were several intercorrelations among these five indices found within the CD group. The most significant correlation in the CD group was between the Commission and Detectability Indices ( $r = .71, p < .001$ ). Moderate correlations were found between the Omission Index and two other indices of inattention: Hit RT SE ( $r = .60, p < .001$ ) and Commission ( $r = .57, p < .001$ ). A weak relationship was uncovered between the Commission and Hit RT SE Indices ( $r = .38, p < .05$ ).

The other area measured by the indices selected for the primary analysis is impulsivity. Two of the seven indices examined by the research questions are related to this characteristic of ADHD: Commission Index and Hit RT Index. These indices are also used in the determination of the presence of inattention so there is an overlap between both of these qualities of ADHD and these indices. There was a moderate, inverse relationship between these two indices ( $r = -.53, p < .01$ ). The Response Style Index is the only score obtained by the CPT-II not used for analysis of characteristics of ADHD. Despite this, it was found to be interrelated with several indices in the CD group: Omission ( $r = .67, p < .001$ ), Detectability ( $r = .47, p < .01$ ), and Hit RT SE ( $r = .37, p < .05$ ).

The intercorrelations obtained for the control group demonstrated some similarities and differences compared to the results of the analysis of the CD group. For example, the most significant correlation found within the control group was between the Commission and Detectability Indices ( $r = .91, p < .001$ ). Similar to the CD group, several intercorrelations among the indices of the control group were related to inattention. The Omission Index demonstrated a moderate relationship with the Commission Index ( $r = .41, p < .05$ ), and weak relationships with the Detectability ( $r = .37, p < .05$ ) and Hit RT SE Indices ( $r = .36, p < .05$ ). Some differences between the two groups on indices connected with inattention included a strong, inverse relationship that was found between the Hit RT and Detectability Indices ( $r = -.70, p < .001$ ) in the control group. A moderate relationship was also found between the Hit RT Index and the Hit RT SE Index ( $r = .57, p < .001$ ).

In the area of impulsivity, similar to the CD group the control group also exhibited an inverse relationship between the Commission and Hit RT indices ( $r = -.80, p < .001$ ), but this connection was much stronger. Another consistent finding across the two groups was the lack of a relationship between the Hit RT and Response Style Indices. Correlations among the two groups on the Omission and Response Style Indices revealed opposite results with the CD group showing a moderate relationship between these indices and the control group showing a complete lack of relationship between the two scores.

### **Statistical Analysis of the Research Questions**

The following section provides the results for the seven research questions. Independent samples t-tests were run to compare the two groups in regard to their

performance on the Conners' Continuous Performance Test, Second Edition (CPT-II). Since this project and subsequent analysis of the data was exploratory in nature, the  $p$ -value was set at .10 to address the potential for false positive results related to the significant findings generated by the analysis. In addition, this assisted with limiting the chance for error due to the number of research questions being analyzed. It is important to note that all of the youth completing this test were observed by the principal investigator and demonstrated a reasonable level of adherence to the rules of the administration consistent with a valid performance on the CPT-II. Further examination of the raw scores obtained by the participants on the CPT-II also revealed few indicators of noncompliance (e.g., excessive perseverative responses or omissions). Table 4.6 summarizes the descriptive data and the significant differences identified among these variables.

### **Research Question 1**

How do youth who are on court supervision and diagnosed with Conduct Disorder (CD) differ from youth who are not on court supervision and do not have CD on the Attention-Deficit/Hyperactivity Disorder (ADHD) Confidence Index of the Conners' Continuous Performance Test, Second Edition (CPT-II)?

This question was addressed by computing an independent samples t-test. The analysis showed that there was a significant difference between the CD and control groups on the ADHD Confidence Index [ $t(67) = 4.24, p < .001$ ]. As shown in Table 4.6, the CD group scores were significantly higher than the control group.

Table 4.6

*Conners' Continuous Performance Test, Second Edition (CPT-II) Results by Group*

	ADHD Confidence Index (%)	Commission Index	Omission Index	Response Style Index	Hit Reaction Time (RT) Index	Hit RT Standard Error (SE) Index	Detectability Index
<b>Control Group</b>							
<i>N</i> = 35							
Mean	34.95	49.80	45.27	47.92	45.34	41.51	50.74
SD	14.59	12.13	4.00	10.31	11.03	6.79	11.65
Range	0.10- 62.19%	21.48- 70.55	42.25- 64.92	38.07- 100.00	20.61- 72.60	24.89- 55.99	13.73- 68.55
<b>Conduct Disorder Group</b>							
<i>N</i> = 34							
Mean	49.23	52.45	48.23	46.06	45.95	47.34	52.91
SD	13.33	7.68	7.29	5.64	7.81	8.91	6.98
Range	28.18- 78.99%	36.73- 67.67	41.55- 74.65	38.58- 62.84	33.49- 70.34	32.19- 64.24	38.97- 71.41
Significant Difference (Yes/No)	Yes***	No	Yes*	No	No	Yes**	No

*Note.* All scored are reported as T-Scores except for the ADHD Confidence Index score.

\**p* < .05. \*\**p* < .01. \*\*\**p* < .001.

### **Research Question 2**

How do youth who are on court supervision and diagnosed with CD differ from youth who are not on court supervision and do not have CD on the Commission Index of the CPT-II?

This question was addressed by computing an independent samples t-test. The analysis showed that there was not a significant difference between the CD and control groups on the Commission Index [ $t(67) = 1.08, p = .283$ ].

### **Research Question 3**

How do youth who are on court supervision and diagnosed with CD differ from youth who are not on court supervision and do not have CD on the Omission Index of the CPT-II?

This question was addressed by computing an independent samples t-test. The analysis showed that there was a significant difference between the CD and control groups on the Omission Index [ $t(67) = 2.10, p < .05$ ]. As shown in Table 4.6, the CD group scores were significantly higher than the control group.

### **Research Question 4**

How do youth who are on court supervision and diagnosed with CD differ from youth who are not on court supervision and do not have CD on the Response Style Index of the CPT-II?

This question was addressed by computing an independent samples t-test. The analysis showed that there was not a significant difference between the CD and control groups on the Response Style Index [ $t(67) = -.92, p = .360$ ].

### **Research Question 5**

How do youth who are on court supervision and diagnosed with CD differ from youth who are not on court supervision and do not have CD on the Hit Reaction Time Index of the CPT-II?

This question was addressed by computing an independent samples t-test. The analysis showed that there was not a significant difference between the CD and control groups on the Hit Reaction Time Index [ $t(67) = .27, p = .792$ ].

### **Research Question 6**

How do youth who are on court supervision and diagnosed with CD differ from youth who are not on court supervision and do not have CD on the Hit Reaction Time Standard Error Index of the CPT-II?

This question was addressed by computing an independent samples t-test. The analysis showed that there was a significant difference between the CD and control groups on the Hit Reaction Time Standard Error Index [ $t(67) = 3.06, p < .01$ ]. As shown in Table 4.6, the CD group scores were significantly higher than the control group.

**Research Question 7**

How do youth who are on court supervision and diagnosed with CD differ from youth who are not on court supervision and do not have CD on the Detectability Index of the CPT-II?

This question was addressed by computing an independent samples t-test. The analysis showed that there was not a significant difference between the CD and control groups on the Detectability Index [ $t(67) = .94, p = .352$ ].

**Secondary Analyses**

Secondary analyses were computed on the remaining index scores of the CPT-II to further examine the characteristics related to the significant findings of the research questions. This analysis, using independent samples t-tests, revealed significant differences between the CD group and the control group on two indices. One index demonstrating a statistically significant difference among the youth with CD and the control group was the Variability Index, which is a measure of response consistency within respondents. The analysis of this index showed a significant difference between the CD group and the control group [ $t(67) = 3.13, p < .01$ ]. As shown in Table 4.7, the scores of youth in the CD group were significantly higher than the youth in the control group. In addition to significant results among the two groups on the Variability Index, the secondary analysis of the index scores showed a significant difference between the CD group and the control group on the Hit Reaction Time Block Change Index [ $t(67) = 2.43, p < .05$ ]. As shown in Table 4.7, the CD group scores were significantly higher than the control group. No other significant results were found in the remaining indices, which



Table 4.7  
*Conners' Continuous Performance Test, Second Edition (CPT-II), Results for Remaining Indices (T-scores)*

	Variability Index	Perseverations Index	Hit RT Block Change Index	Hit RT SE Block Change Index	Hit RT Stimulus Interval Change Index	Hit RT SE Stimulus Interval Change Index
<b>Control Group</b>						
<i>N</i> = 35						
Mean	41.38	48.07	45.23	46.50	45.95	45.84
SD	6.82	7.25	5.31	7.25	6.62	6.30
Range	28.88-68.82	44.85-76.88	34.69-60.21	35.45-69.39	30.49-63.20	32.50-65.93
<b>Conduct Disorder Group</b>						
<i>N</i> = 34						
Mean	47.92	49.00	48.86	49.59	49.05	49.67
SD	10.24	4.95	7.03	8.01	9.42	9.92
Range	27.85-68.82	45.20-66.04	27.87-65.58	30.21-66.90	33.51-74.34	34.07-77.72
Significant Difference (Yes/No)	Yes**	No	Yes*	No	No	No

Note. RT = Reaction Time, SE = Standard Error.  
 \**p* < .05, \*\**p* < .01

included Perseverations (associated with impulsivity), Hit Reaction Time Standard Error Block Change (associated with vigilance or alertness throughout the test), Hit Reaction Time Inter-Stimulus Interval Change (associated with inattention), and Hit Reaction Time Standard Error Inter-Stimulus Interval Change (associated with inattention).

An examination of the performance of the two groups on the remaining indices of the CPT-II using independent samples t-tests was also run to explore the interaction between the number of symptoms of CD and performance on all CPT-II indices. To do this, the number of CD symptoms identified in the youth in the CD group was combined into two groups, those with four or less symptoms or those with five or more symptoms, which provided 17 youth for each group. There were no significant differences found based on the number of CD symptoms on any of the indices meaning that the performance on the CPT-II was not related to the number of symptoms of CD endorsed. Independent samples t-tests were also run to explore the interaction between the age of onset of CD symptoms and performance on all CPT-II indices. With this analysis, the age of onset of the youth in the CD group was combined into two groups: youth where the onset of the first symptom of CD occurred before 12 years old (11 participants) or youth where the onset of the first symptom of CD was at 12 years old or later (23 participants), as the median for this variable was 12 years old. None of the analyses comparing these two groups with all CPT-II indices were significant suggesting that age of onset of symptoms of CD was not related to performance on the CPT-II indices.

Pearson correlation coefficients were also computed among the number of symptoms endorsed within each of the four categories of CD symptoms (e.g., aggression, destruction of property, deceitfulness, and violations of rules) and the CPT-II indices.

This analysis showed a weak relationship between the number of aggression symptoms and the Omission Index of the CPT-II ( $r = .38, p = .03$ ). Pearson correlation coefficients were also computed among the age of onset of CD symptoms using the combined groups identified above, the number of CD symptoms, and four categories of CD symptoms.

This analysis showed only a moderate, inverse relationship between the age of onset of CD symptoms and the number of CD symptoms ( $r = -.43, p < .05$ ).

## CHAPTER 5 – DISCUSSION

The purpose of this study was to investigate neuropsychological factors related to performance on the Conners' Continuous Performance Test, Second Edition (CPT-II) among youth who met criteria for Conduct Disorder when compared to a control group who did not meet criteria for Conduct Disorder (CD). Sixty-nine youth, ages 14-17 years, were recruited for participation and identified as having or not having CD based on the diagnostic criteria for this disorder within the *DSM-IV-TR* (APA, 2000). It was anticipated that the youth with CD would have significantly different scores than the control group on selected indices of the CPT-II. A summary of the demographics and the results of analyses of these indices are presented in the order of the research questions identified for this study. This is followed by a discussion of the connection of these current findings with what has been found in previous research, the limitations of this study, recommendations for future research, and implications suggested by the results of this study.

### Overview of Results

The youth participating in this study were predominantly Caucasian, with significantly more individuals identified as Caucasian within the control group than the CD group. There were significantly more females in the control group than the CD group. Parents of participants in the CD group reported significantly lower income, and were more likely to be unmarried and living in a single-parent household than parents from the control group. The parents of the youth in the CD group also had significantly fewer years of education than the parents of youth in the control group. Parents of members of

the control group did not endorse any symptoms of Conduct Disorder in their children, providing a clear distinction between the control and CD groups.

Further analysis of the data based on the performance of the participants on the CPT-II elicited several intercorrelations among indices related to the areas of inattention and impulsivity. The indices are related to these two areas based on the recommended interpretive analysis presented for this instrument. Several of these areas were significant in both groups. For example, both groups had a high intercorrelation between the Commission and Detectability Indices. Since the Detectability Index is a measure of the individual's ability to distinguish between targets and non-targets (i.e., respond to any letter except "X" and not responding to an "X"), it would make sense that these two indices are highly correlated. The lack of a correlation between the Omission Index with the Detectability index in the CD group and a weak correlation within the control group raises some questions since both the Omission and Commission Indices factor into the score provided by the Detectability Index. Since the Omission Index was significantly different among the two groups, the lack of a correlation could have been impacted by the greater scores obtained by the CD group. Therefore, an explanation of these results could be that an increased level of inattention might not impact an individual's ability to respond accurately.

There was also a high correlation among the ADHD Confidence Index and the Hit Reaction Time Standard Error (Hit RT SE) Index among both of the groups. The ADHD Confidence Index is an overall measure of the presence of ADHD based on a formula incorporating all of the index scores. The Hit RT SE Index is related to the individual's overall consistency in reaction times compared to his/her average reaction time. In

addition, reaction times are examined by the CPT-II in a number of ways, as they tend to be indicators of the ability to sustain attention over an extended period of time and also can indicate impulsive responses. This finding would suggest that the individual's overall performance is strongly related to the consistency of reaction times. Furthermore, this could imply that an individual who is inconsistent would likely be deemed to have ADHD by the CPT-II. The inconsistent presence of correlations between the other index scores and the ADHD Confidence Index was not expected since this is an overall measure of the participant's performance on the CPT-II. However, the index scores identified as significantly different in the analysis of the research questions did show significant correlations with ADHD Confidence Index in the CD group. Although this could be seen as further support for the significant findings among the specific index scores among the two groups of youth, it can also mean that the three indices to achieve significance are interrelated and could bias the results. Given that there are specific indices that represent inattention and impulsivity, it would seem that these intercorrelations should be expected.

A review of the intercorrelations related to the CD youth revealed that there were a number of moderate correlations among the seven indices. These correlations could support the idea that there is an overlap between youth with CD and ADHD among those indices related to inattention. This is further supported by the consistent, inverse correlation across the two groups between the two indices related to impulsivity, the Commission and Hit Reaction Time (Hit RT) Indices. The difficult piece about these two indices is that they have been found to be related to both inattention and impulsivity. However, the fact that neither of these were significant among the analysis of those

indices identified by the research questions likely supports the possibility that they could measure a specific construct that differentiates youth with CD from youth with ADHD. Further explanation of these correlations and the specific index scores analyzed for statistical significance for this project follows.

In addition to the examination of the demographic characteristics of the two groups and the intercorrelations of the CPT-II indices, the results of the analyses of the selected CPT-II indices revealed that three out of the seven indices selected for analysis for this study reached a level of statistically significant difference when comparing the youth with CD and the control group. In the order of the research questions identified for this study, the first index examined was the ADHD Confidence Index. A score of greater than 50% is indicative that ADHD symptoms are present, with a higher percentage-score suggesting a greater likelihood that the individual has ADHD. This analysis revealed that the CD group scored significantly higher on this index than the control group. Since this index is an overall score representative of an individual's performance on the CPT-II, this information suggests that youth with CD have a tendency to perform more poorly than controls on the CPT-II. It is important to note that the mean of the CD group on this index was nearly at 50% ( $M = 49.23$ ,  $SD = 13.33$ ), which would suggest that half of youth with CD also had an elevated index score, indicative of characteristics of ADHD. However, a review of the raw scores showed that approximately 29% of the CD group (10 youth) achieved a "no decision," which means that there was a 50/50 chance that ADHD could be present in these individuals. In addition, another 29% of this group (10 youth) achieved scores greater than 50%, which is indicative of ADHD. This percentage of confirmed ADHD qualities in the data is far below the reported 40-90% of youth with

CD also having ADHD that is commonly identified in the literature (Essau, 2003; Jensen, Martin, & Cantwell, 1997). This information suggests a lack of sensitivity and a strong possibility of obtaining a false negative in regard to the identification of ADHD in youth with CD when using the CPT-II, based on the present sample. This finding, coupled with an overlap of symptoms among the two disorders (i.e., impulsive decision-making and actions and inattention to environment), would suggest some similarities among the disorders and the possibility that the CPT-II could be detecting these qualities.

The second index examined was the Commission Index of the CPT-II. A higher score on this measure would imply that the individual struggles with impulsivity, curbing responses, and inattention. This index is commonly associated with response inhibition, a characteristic of executive functioning identified as overlapping among youth with CD and ADHD (Oosterlaan, Logan, & Sergeant, 1998; Dougherty, et al., 2003), but the results of the CD group were not significantly different from controls within this study on this index. This was unexpected given the disregard for rules and the consequences of violating them often associated with youth with CD, and subsequently, response disinhibition, which can be observed through the actions of youth with CD, as well as the literature cited above. In other words, youth with CD are often viewed as not thinking through the consequences of their actions, yet the results indicated that the group with CD demonstrated adequate ability to inhibit responses on the CPT-II at a level comparable to the control group. The lack of significance between the two groups and the fact that ADHD was not controlled for in the CD group suggests that the Commission Index of the CPT-II is not related to CD. Because of this, it is possible that this index could be more sensitive in distinguishing youth with CD without ADHD from those with



CD and ADHD since there were no significant findings on this index within this data, as well as in other research (Clark, Kinsella, & Prior, 2000).

Since inattention and impulsivity are both characteristics of ADHD, the statistical significance of the ADHD Confidence Index without significance identified on the Commission Index suggested inattention might be an overlapping factor with CD and ADHD. This deduction was supported by the significant difference between the youth with CD and the control group on the Omission Index with the CD group committing significantly more omission errors (e.g., failure to respond to a target.) Despite a description similar to the symptoms of inattention among youth with ADHD, this index has shown inconsistent results among correlations with these symptoms (Advokat, et al., 2007; Epstein, et al., 2003). Although a relationship between omission errors and the combined type of ADHD (inattentive and hyperactive/impulsive) has been documented in the literature (Egeland, Johansen, & Ueland, 2009), inattention is not commonly found in youth with CD. A potential explanation of these results is offered by Nigg (2005). He posited the idea that youth with CD struggle with response inhibition because of a lack of motivation to carry out behavioral expectations, as opposed to an inability to do so. Since struggles with response inhibition were not supported in this study, an explanation about motivation and interest in sustaining attention on a task that the participant finds boring could better address the absence and presence of statistical significance among the commission and omission errors, respectively. In other words, these results could suggest that the inattention is related to a lack of motivation, as individuals who are not interested in a task might become distractible or not offer adequate effort due to decreased motivation to complete a task. In addition, the concept of delay of gratification could also

be related to this decrease in motivation, as individuals who are not getting what they want (e.g., for the test to be over) might lose interest and begin to dismiss and/or not attend to stimuli on a task they find unfulfilling.

A summary of the early findings of these first three indices indicates that the qualities of executive functioning related to the Omission Index (e.g., inattention, lack of motivation, and delay of gratification) could be a subtype of ADHD that overlaps with CD. These characteristics could also be related to a decision-making quality that is preoccupied with acting in an egocentric manner that disregards rules and expected behaviors and focuses on what sounds interesting to the individual at that time. In other words, the individual could make decisions in a simplified manner that takes into consideration his/her own thoughts or desires (i.e., his/her motivation) and not socially acceptable rules or limits related to an action(s). Furthermore, this could provide an alternative explanation for the connection between CD and response inhibition. For example, the perception that youth are making decisions without thinking through the consequences might be better explained through the idea that they dismiss details viewed as unimportant because they do not directly impact the youth with CD rather than responding without considering these details. In other words, they might have considered the details, but then decided they were not important.

In addition to commission and omission errors, the performance on the Response Style Index was evaluated. The Response Style Index is an indicator of the respondent's tendency to be more focused on being accurate, which can slow responding, or responding to all targets and not missing any, which tends to affect accuracy and quicken response time. The two groups did not demonstrate significant differences in their

response styles. This suggests that neither group displayed a preferred approach to responding to targets within the CPT-II. It could be concluded that the previously mentioned belief that there is a connection between response disinhibition and the presence of CD was again not supported by the findings of this study, as a focus on not missing targets tends to lead to a quicker response, an indicator of response disinhibition and/or impulsivity. The lack of a significant difference between the CD group and the control group would suggest that response style did not distinguish youth with CD from the youth without CD.

The next two index scores examined were related to the participants' reaction times. The first index, Hit Reaction Time, measures how long it takes an individual to respond to a target. There were no significant differences found among the two groups on this index. This indicated that the youth with CD did not respond more slowly or quickly to a target when compared to the control group. This is an index associated with inattention and impulsivity within the interpretation of the CPT-II. Although the lack of statistical significance could challenge the previous connections with inattention that have been identified, it again refutes the idea of a connection between impulsivity and CD. It is important to note that commission errors would not have a connection to this index, as it looks specifically at reaction time and not accuracy in responding. This is important because these findings could provide more evidence to refute the connection between response inhibition among youth with CD since it looks at reaction time and not accuracy.

However, the results of the analysis of the other index measuring reaction time, Hit Reaction Time Standard Error (Hit RT SE), indicated significant differences between

the CD group and control group. This index measures response speed consistency compared to same-aged peers. These results suggested that the youth with CD were more inconsistent with their responding to targets across the duration of the CPT-II. This inconsistency in reaction time could further support the evidence about attention, concentration, self-monitoring, lack of motivation, and/or delay of gratification due to waning interest and wanting the testing situation to be over. In turn, this finding supports the interpretation that the individual with CD likely discounts the expectations of others, instead seeking to meet his/her own perceived needs without considering the rights and/or needs of others.

The last research question involved the results of the analysis of the Detectability Index. This measure of the respondent's ability to distinguish between targets and non-targets did not demonstrate significant difference between the CD group and the control group. This again indicated that there were no concerns about accuracy in responding to targets in comparisons among the two groups, which does not support the presence of struggles with response inhibition among the youth with CD. In addition, since these results suggest little to no concern in response accuracy, the significant difference between the CD group and the control group on the Omission Index score could better be explained as being related to a lack of attention, motivation, and/or self-regulation rather than impulsive responding to all stimuli within the CPT-II.

Taking the results of the secondary analyses into consideration, the significant differences between the control group and the CD group on the Variability Index and the Hit Reaction Time Block Change Index further support that the youth in the CD group exhibited inconsistent responding throughout the duration of the administration of the

CPT-II. Examination of the raw data would suggest that there was a slowing in the responses over time. Since this could be related to inattention and/or impulsivity, the impact of this finding must be considered in the context of the other data which would support further evidence of waning interest and delay of gratification in the completion of this test.

An overall examination of these findings indicated that there were statistically significant differences among three out of eight indices associated with inattention, none of the indices associated with impulsivity, and one of the two indices associated with vigilance or alertness throughout the test. The two indices that have been related to both impulsivity and inattention (Commission Index and Hit Reaction Time Index) were not significantly different among the CD group and the control group. This, in addition to none of the measures of impulsivity being measured as significantly different among the two groups in this study, seems to place the contribution of impulsivity into question, and subsequently response inhibition, as a deficit in executive functioning in youth with CD. Because of this lack of connection between impulsivity and CD, these measures of impulsivity might be the indices that could best distinguish youth with ADHD from those who might have CD without ADHD when using the CPT-II. Conversely, there is the possibility that the youth are displaying a behavior related to response disinhibition that cannot be measured by the CPT-II. In this situation, the individual could be acting without attending to the details that a “normal” individual would. In which case, this individual would not impulsively respond to targets as measured by the duration of time between target presentation and response, but would impulsively respond in the sense of not considering/attending all of the information. To better understand the connection with

the findings generated by this study and previous research, the following section will provide information about similarities and differences among the literature when compared to these results.

### **Connection of Results with Previous Research**

The results of the analyses of the CPT-II index scores supported the frequent co-occurrence of CD and ADHD in youth (Essau, 2003; Jensen, Martin, & Cantwell, 1997), as well as deficits in executive functioning characteristics commonly associated with CD, specifically attention, concentration, self-monitoring, and delay of gratification (Lynam, 1998; Moffitt, 1993; Teichner & Golden, 2000; Yeager & Lewis, 2000). The latter two characteristics listed are believed to be connected with Nigg's (2005) conceptualization that youth with CD lack the motivation to comply with behavior expectations, as opposed to youth with ADHD who are seen as not having the ability to respond consistently. As previously mentioned a lack of motivation could be explained through a lack of self-monitoring in the compliance with expectations on the test, as well as a disinterest in the test leading to the delay of gratification in having the test over and completed. In other words, the CD youth were not motivated by the "boring" nature of the CPT-II, which likely led to neglect for compliance with the rules of the test and inattention due to seeking stimulation somewhere else. The lack of support for the presence of deficits in response inhibition was not expected, but was supported in the literature (Clark, Prior, & Kinsella, 2000). The congruency with these findings with the existing literature and the potential interpretations of the impact of these findings follows.

The frequent co-occurrence of CD with ADHD could attribute to the significant difference between the scores on the ADHD Confidence Index among the youth with CD

when compared to the control group, as research suggests that ADHD occurs in 40-90% of youth with CD (Essau, 2003; Jensen, Martin, & Cantwell). Some individuals have argued that CD and ADHD are along a continuum of externalizing behaviors (Lynam, 1998), with CD being the more severe of the two. The results from the present study support the belief of shared qualities among these disorders. Given the significant differences between the CD group and the control group on the ADHD Confidence Index, there are concerns that the CPT-II could provide false negative results in the assessment of youth with CD, which was also found by Fischer, Newby, and Gordon (1995) using a different continuous performance test.

In addition to the significant results on the ADHD Confidence Index, the co-occurrence of statistically significant differences between the youth with CD and the control group on the Omission Index might suggest that deficits in sustained attention and self-monitoring could be connected with CD. This connection between omissions and symptoms of inattention was supported by Advokat, Martino, Hill, and Gouvier (2007) when examining adults with ADHD. The inattention and lack of motivation demonstrated by the youth with CD in this study could be related to Gray's (1987) conceptualization of brain functioning involving three systems: behavioral inhibition, behavioral activation, and flight or flight. This theory postulates that aggressive youth have a stronger activating system that overrides the inhibiting system. They tend to display an increase in behavioral inhibition when presented with situations interpreted as punishment, unrewarding, frustrating, or novel. Integrating this description with the data presented in this project supports the connection between finding the task of completing the test as unrewarding or unfulfilling and then not attending to it due to a rise in behavioral

inhibition and a decrease in action and motivation. An example of this is the aggressive youth's interest in activating stimuli, such as video games or violent movies. Simply put, these individuals often seek stimuli that are intense and/or trigger a response in them, engaging multiple senses. However, others do not need as much stimulation to be engaged in an activity, such as reading a book. Furthermore, in the context of the criminal youth and behavioral inhibition it would seem that when they are held accountable at a high level, such as in a correctional facility, youth with CD tend to moderate their behaviors otherwise they cannot be released. Yet, once they are no longer in an environment with constant monitoring (i.e., perception of punishment), criminal behaviors return (i.e., seeking activation).

Supportive of this assertion of a connection between the Omission Index and inattention are the results of the Hit Reaction Time Standard Error (Hit RT SE) and Variability Indices. All three of these indices, which demonstrated statistical significance in the CD group when compared to the control group, are suggested to be related to inattention within the CPT-II interpretation guidelines (Conners, 2004). The Hit RT SE Index measures the consistency of reaction times across the testing situation and the Variability Index measures the variability the individual shows in 18 separate segments of the test in the respondent's overall standard error. The significant differences in both of these indices indicated that the CD youth became less attentive as the test continued, as scores indicated a slowing of their reaction time throughout the duration of the test. This information suggests a connection between inattention and the presence of CD in youth in this study.



Combining these three indices with the Hit Reaction Time Block Change Index (Hit RT Block Change Index), a measure of vigilance (i.e., the ability to stay alert and aware throughout a situation), led to questions about the ability of youth with CD in the areas of self-monitoring and delay of gratification. This interpretation developed from the assertion by Nigg (2005) related to the motivation of youth with CD to comply with behavior expectations, as opposed to this behavior being related to a lack of ability to do so. One commonality among the Omission, Hit RT SE, Variability, and Hit RT Block Change Indices is the ability to sustain attention over time on the CPT-II. However, these indices also appear to be similar in the reaction to boredom and having to engage in something that the youth finds disinteresting or in other words, not gratifying. The proposed gratification was in completing the test, which might not have been happening soon enough for the frustration tolerance of the youth with CD to withstand since their response times and accuracy decreased over the duration of the test. To incorporate Gray's (1987) theory with this line of reasoning, the youth appeared to be doing the test, which avoided a perceived punishment, but had already lost interest in the activity because it was not stimulating. This could be an increase in behavioral inhibition due to frustration or the belief that there is no reward or the reward is not happening soon enough. This explanation also begins to draw in the possibility of struggles with initiation of behaviors, another executive function.

This line of reasoning is consistent with research of youth and delayed rewards, as well as localization of these functions within the brain. Research supportive of this connection between an increased disinterest when presented with a delay in reward and youth with CD involved a study of 6-17 year olds where smaller rewards that were given

sooner were chosen significantly more often by youth with ADHD over large rewards that were given after a longer period of time (Marco et al., 2009). These researchers noted that the youth with ADHD who exhibited a preference for smaller rewards that were more quickly provided (e.g., sooner, smaller responders) were younger, had lower IQ scores, had more conduct problems, and were more likely to have siblings who were also sooner, smaller reward responders. This research provides support for the idea that there could be a deficit in delaying gratification and self-regulation among youth with conduct problems and ADHD, which also supports the reportedly frequent overlap of ADHD and conduct problems identified in this study.

Other research connecting conduct problems with delay of gratification involved an investigation of the tendency of 18-30 year olds to discount future rewards when considering immediate rewards (i.e., delay discounting; Bobova, Finn, Rickert, & Lucas, 2009). These authors found that alcohol dependence, childhood CD, and being male were significantly related to delay discounting. In addition, individuals with alcohol dependence and childhood CD had higher delay discounting rates than either condition alone. However, this connection between conduct problems and delay of gratification further supports a connection between the level of effort when there is an extended period of time required for compliance in an activity. Furthermore, specific areas of the brain have been associated with this style of reward-seeking. For instance, damage to the nucleus accumbens (da Costa Araújo, et al., 2010) and the anterior cingulate cortex (Walton, et al., 2009) have both been connected to selection of immediate rewards over later, larger rewards. Both of these areas of the brain interact with the frontal cortex and have an integral part in executive functioning. It is also important to note that the nucleus

accumbens is commonly called the “pleasure center” and is not only associated with reward, but also addiction, which often accompanies criminal behavior.

The interaction between the nucleus accumbens, anterior cingulate cortex, and the frontal lobes in regard to executive functions warrants discussion of the literature pertaining to localization of behavior problems consistent with CD within the prefrontal cortex. For example, Brower and Price (2001) found no difference among offenders and non-offenders regardless of age in the area of perseverations, which also did not display statistical significance when the CD group was compared with the control group in the secondary analysis of this study. These authors indicated that perseveration is primarily associated with the dorso-lateral region of the prefrontal cortex. On the other hand, they noted issues with social judgment as being related to the orbito-frontal and medial regions of the prefrontal cortex. Social judgment associated with the poor decisions made by youth with CD could also represent a lack motivation to meet behavioral expectations (Nigg, 2005). Golden, Jackson, Peterson-Rohne, and Gontkovsky (1996) also asserted that a lack of guilt is associated with frontal lobe deficits, which also seems related to a lack of regard for socially appropriate behavior on the part of the youth with CD.

It was also reported that aggression and violence, which are related to social judgment and are characteristics of CD, were most commonly associated with injury to the orbito-frontal and medial regions of the prefrontal cortex (Brower & Price, 2001). Furthermore, da Costa Araújo, et al. (2010) reported a connection between lesions to both the orbito-frontal area and the nucleus accumbens in regard to preference of timing of rewards. Brower and Price (2001) identified injuries to the orbito-frontal and medial regions as primarily external, as opposed to developmental without a known injury. Since

ADHD is often viewed as a condition related to neurochemistry and not injury (Barkley, 1997) and connected to the dorso-lateral region of the prefrontal cortex (Brower & Price, 2001), it would seem that there is evidence that the deficits of CD youth identified in this study could be connected with the orbito-frontal and/or medial regions of the prefrontal cortex. This information is important because it proposes that an acquired insult to these areas would seem related to the development of CD, which also has implications for treatment that will be presented later.

Given the literature related to response inhibition and CD, the lack of significant results on the Commission Index was surprising, as a meta-analysis conducted by Oosterlaan, Logan, and Sergeant (1998) and research by Dougherty, et al. (2003) reported that response inhibition (e.g., inability to curb responding) did not adequately distinguish ADHD from CD. These authors concluded that CD and ADHD might be related to each other based on this information. However, other studies have not been able to support a connection between response inhibition and CD. For example, Clark, Kinsella, and Prior (2000) found that ADHD seemed to predict struggles in executive functioning and not CD. Since commission errors have been strongly related to all symptoms of ADHD, both inattentive and impulsive (Advokat, et al., 2007), the results of this study suggest that this index score could be more sensitive to the presence of ADHD and possibly distinguish youth with CD from youth with ADHD. However, the results of this study would not support that the potential overlap between ADHD and CD suggested by the significant results on the ADHD Confidence Index is related to the area of response disinhibition.

## Limitations

Although attempts were made to minimize the amount of potential confounding variables, several limitations were identified within this project. These limitations were specifically related to demographic characteristics, recruitment procedures, and instrumentation. Specifically related to the demographic characteristics of the sample are the inclusion criteria identified in this project, which included: 14-17 year olds, gender of equal proportions, presence or absence of CD, and no cognitive deficiencies. Three of these four criteria were met, as there were significant gender differences between the two groups with the CD group having significantly more males than the control group. Although there is a greater presence of CD among males (Nock, Kazdin, Hiripi, & Kessler, 2006), which is also found in the ADHD population (APA, 2000), the significant difference in gender composition between the groups is a limitation to this project.

The significant differences between the two groups in regard to the demographics of household income and race are also limitations to this study. Seeking the control group from a private, tuition-paid school was helpful because it led to no endorsement of CD symptoms and limited the potential of cognitive deficits within the control group, but it is likely that this led to the differences in household income and race, as well as parent education. However, these three variables are often found to be different within the literature describing youth with CD, as these youth have a reported higher incidence of households with lower income and fewer years of education by parents (Lahey, Loeber, Burke, & Applegate, 2005; Rutter, Giller, & Hagell, 1998). These factors are often attributed to socio-economic status (SES). However, several authors indicated that SES

demonstrated little influence on the presence of CD (Déry, Toupin, Pauzé, Mercier, & Fortin, 1999; Lynam, Moffitt, & Stouthamer-Loeber, 1993).

In addition to the limitations of this study related to demographic variables, the procedures also restrict the ability to generalize these results, especially in the area of recruitment. As alluded to earlier, the site from which the control group was recruited led to several potential confounds. For example, members of both groups self-selected to participate in this project. Since participation would require a certain level of compliance, it could imply that these youth were more compliant than other perspective youth in their representative group. Furthermore, this sample of convenience did not permit the researcher to place more stringent limits on the recruitment process. For example, youth were recruited for the control group from one teacher's classes. It is unknown how this could have influenced the characteristics of those within the control group, as there was likely a large group of youth not accessed due to approaching one teacher within a school.

The recruitment process for the youth in the CD group was also suspect. These individuals were recruited through case managers at Racine County Human Services Department. Unfortunately, the same few case managers referred their youth to me for this project. One of these case managers oversaw all of the youth in correctional placements and would refer them upon release, which provided a group that would be considered more challenging and/or severe perpetrators since they were sentenced to corrections. It could be concluded that these youth displayed more aggressive behaviors, which has been connected to greater deficits in executive functioning (Moffitt, 1993). These youth also could represent the group of youth with CD and ADHD that are often

viewed as exhibiting more pervasive problems and representing a more severe sub-type of CD (Lynam, 1998). This also could have impacted the results on the CPT-II and their overlap with characteristics of ADHD. The greater severity of symptoms and/or the overlap of CD and ADHD often attributed to a more chronic group of youth with CD could have impacted the significant differences between the control and CD groups on the ADHD Confidence Index. In other words, since youth placed in corrections are often viewed as “the worst of the worst,” the deficits of executive function and severity of symptoms could have influenced the performance of the youth in the CD group on this index. The other two case managers oversaw youth that had not been placed into as severe of a placement prior to their inclusion in this study. It is possible that their choice of who to speak with could have affected the characteristics of the people who were included in this study, such as seeking people that might be seen as more compliant and therefore better at behavior management.

Lastly, the instrument itself, the CPT-II, could be viewed as a limitation due its purpose of examining youth with ADHD, as opposed to CD. It is designed to examine characteristics of ADHD, but it was not designed to be a stand-alone measure of this disorder or executive functions. Because of this, it is important to consider additional resources before making a diagnosis of ADHD or executive function deficits. To best assess characteristics of ADHD, it is recommended that behavior reports accompany the use of the CPT-II (Conners, 2004). Behavior reports assist in making a more accurate determination about the presence of ADHD because they provide contextual data based on statements related to specific behaviors. When coupled with a less subjective instrument like the CPT-II, there is a greater chance of making a solid diagnosis of

ADHD. In addition, to best measure executive functions, there are several instruments that provide a comprehensive overview of these neuropsychological features (e.g., Delis-Kaplan Executive Function System; Delis, Kaplan, & Kramer, 2001) and could provide a more thorough assessment. Either of these recommendations for additional evaluation would provide a more accurate assessment for the presence of these characteristics in youth with CD and provide additional insight into other features that could contribute to the results that have been identified in this study.

### **Recommended Areas for Future Research**

The limitations identified in the previous section provide several areas for future research, such as the overlap of CD and ADHD, the significant differences among the demographics, and the instrumentation. Controlling for potential confounds described in these three areas might provide more significant and thorough information related to youth with CD. However, gaining access to individuals that would meet criteria for such a project and maintaining compliance to complete an adequate battery of tests to measure executive functioning can be costly and time consuming. To encourage interest for such a project, compensation to the participant would likely also be necessary in addition to the cost for materials to complete the testing. Another suggested area for further examination would be the areas of executive function identified as occurring within the CD population (e.g., inattention, response inhibition, self-monitoring, and delay of gratification).

Exploration of the utility of these suggestions follows.

This study provided results suggestive of an overlap between the characteristics of ADHD and CD in youth with CD. The significant differences between the control group and the CD group in regard to an overall rating for ADHD, as well as four other indices,



suggests that it would be beneficial to separate youth with CD identified with ADHD by the CPT-II from those with CD without ADHD to see if the presence of ADHD could somehow moderate the results found in this study. This line of thinking is supported through research confirming that ADHD can be a predictor of impairment in executive functions (Kinsella, et al., 2000). It would be useful to see how these two groups compare in regard to their performance on the CPT-II. In addition, several youth in the CD group (29.4%) obtained a “no decision”. This means that they obtained a 50/50 chance that their performance matched a youth with ADHD or not. Because this would lead to a borderline diagnosis of ADHD, it would be important to further examine why these results would be prevalent in a group of youth with CD in order to identify any additional confounding variables related to the results obtained on the CPT-II by the participants of this project.

Previous research has presented an inconsistent connection between CD and response inhibition. It is wondered if the results of this study could suggest that the index scores related to impulsivity on the CPT-II could be more sensitive to the presence of ADHD. This could also be determined by separating the youth with CD and ADHD from youth with CD without ADHD. If the findings of future research supported that youth with CD and ADHD display poorer performance on index scores measuring impulsivity, it might provide a potential explanation of characteristics that could exacerbate symptoms of CD. In other words, if a connection is found between impulsivity, and subsequently response disinhibition, and youth with CD and ADHD, but not youth with CD without ADHD, this characteristic of ADHD could be the conduit that leads to the magnification of behavioral problems in youth with both CD and ADHD.

An opportunity to further control for race, income/SES, gender, and parent education would likely be beneficial as it would permit a greater generalization of the results to youth with CD as a whole. Retrospective studies have identified a greater occurrence of CD in African Americans (DelBello, Lopez-Larson, Soutillo, & Strakowski, 2001), males, and individuals with low educational attainment (Nock et al., 2006). Finding a control group to better match these areas might provide different results that would better explain the characteristics of youth with CD, as it could provide greater similarities among the two groups and potentially limit several of the confounding variables identified within this study.

Aside from further examination of the impact of the presence of ADHD on the results on the CPT-II and the differences in diversity among the two groups, the validity of the CPT-II should be examined. It has been suggested that the performance on the CPT-II could be affected by age, as older adolescents with CD achieved more false negatives on a different continuous performance test when compared to behavior reports leading to ADHD going undetected (Fischer, Newby, & Gordon, 1995). Although Fischer and colleagues used a continuous performance other than the CPT-II, it had the same basic principles of omission errors, commission errors, reaction times, etc. This could influence results in a study such as this one where CD is being examined in regard to its overlap with ADHD.

Another area for future research is the impact of all of the areas of executive functioning on the development of CD. An examination of the characteristics of executive functioning and their relationship with CD not only applies to how these characteristics might mediate symptoms of CD, but also how the CPT-II compares to

other measures of executive functioning. First, there have been other areas of executive functioning connected with the presence of CD beyond those that could be examined using the CPT-II, such as abstract reasoning and concept formation, planning abilities, and flexibility in thinking (Lynam, 1998; Moffitt, 1993; Teichner & Golden, 2000; Yeager & Lewis, 2000). Examination of these characteristics of executive functioning with a pure group of CD compared to youth without CD would present more conclusive evidence of a connection between CD and executive functions.

Secondly, support of those areas of executive functioning identified by the CPT-II as being related or not related to CD would be beneficial in order to learn more about the neuropsychological features related to the development of CD. This could be accomplished in either of two ways. First, examination of the validity of CPT-II to measure inattention and response inhibition has been established (Conners, 2004). However, achieving similar results using other instruments that measure the same features would assist in proving that the results of this study and others like it are due to inattention or response inhibition and not the instrument. Another way to examine the validity of executive functions in youth with CD measured by the CPT-II would include comparing tests that examine self-monitoring and delay of gratification (e.g., Iowa Gambling Task; Bechara, Damasio, Damasio, & Anderson, 1994) to response consistencies in the CPT-II. Studies comparing tests in these areas would help solidify the explanation offered in this study relating these features to inattention and could provide an overlap of inattention as a response to delay of gratification. For example, the attempts to measure delay of gratification with different sizes and durations between the issuing of

rewards could be compared to the Hit Reaction Time Standard Error and Variability Indices of the CPT-II.

In addition to comparing different measures of executive function with the CPT-II to ascertain validity in the explanation of these findings, it would seem that executive function tests assessing delay of gratification could be beneficial in examining these characteristics in youth with CD. Anecdotally, many youth with CD evidence a struggle with delayed gratification by their seeking out of “short-cuts” to achieve something. Instead of taking the time to earn the money to purchase an item, these youth might steal it. Instead of talking out a situation, they might hit someone because they believe it will end the problem more quickly. Many comments made by these youth when asked why they broke the rules/laws include some undertone of the statement, “I was bored” or “I thought it would be fun.” Although no youth just stopped doing the test and walked out, many asked when it would be done. The CPT-II lasted 14 minutes, and these youth are in classes for 45-90 minutes depending on the type of school schedule they have. This could speak to the struggles these youth have in academics and other tasks requiring sustained mental effort. Research by Marco, et al. (2009) and Bobova, et al. (2009) also would support examining how delaying gratification could impact these results, as the delay of gratification could lead to disinterest in the activity.

### **Implications of Findings within This Study**

Although there are grounds for debate about the ability to generalize these results to youth with CD, it would appear that two main areas identified in this study relate to implications of working with youth with CD, assessment and treatment. In regard to assessment, it would seem that providers should be cautious when using the CPT-II with

individuals with characteristics of CD. The comparison between CD youth and controls elicited significant differences in the ADHD Confidence Index, which is an overall measure of the CPT that is influenced by all twelve of the CPT indices. This would imply that youth with CD show behaviors similar to youth with ADHD. It would also seem that the CPT-II lacks the sensitivity to assess ADHD in youth with CD, which could explain the large number of “no decisions” obtained during this study. Because of this, providers assessing for ADHD and/or CD would benefit from examination of all twelve index scores regardless of the ADHD Confidence Index in order to provide an accurate assessment. This could provide further clarification of the behaviors being exhibited and whether they are representative of ADHD, CD, or both. In addition, the frequently uttered precaution of incorporating additional measures into the assessment of ADHD, such as behavioral reports and/or assessments, is also reinforced through this data.

The impact of CD in assessing individuals using the CPT-II is also important when examining adolescents. It has been noted that the frontal lobe of the adolescent brain is still developing (Sowell, Thompson, Tessner, & Toga, 2001). This would suggest that the functioning of the area primarily connected with executive functioning is fluid and not static at this age. This could lead to different results on tests of executive functions within a short time period when testing youth, specifically adolescents. More frequent testing of youth to get an accurate representation of their current level of functioning should be taken into consideration when examining potential deficits that could remedy themselves through basic development or made worse by environmental stressors or toxins.

The second area, treatment, is related to potential medical and psychological implications suggested by the results of this project. Medically, a physical examination of the brain is important to consider in cases with injury to the orbito-frontal and/or medial areas of the prefrontal cortex. A thorough physical examination is warranted to rule out damage to this area, as developmental or acquired insult to these areas is connected with conduct problems. In addition, if someone presents with injury to either of these areas, it might behoove the patient and/or the physician to explore treatment as a preventative measure to address potential behavioral concerns that could develop.

Aside from medical treatment, implications for psychological treatment include basic pragmatic suggestions, as well as techniques and approaches. The implied struggles with delay of gratification and self-monitoring likely make it difficult to coax an adolescent with CD into therapy to address behavior concerns. Since many youth with CD are involved in the court system to some degree, educating these providers and parents about the necessity to mandate treatment might be required. These youth also might find the process of looking at themselves and their problems as boring and not see the point in making changes to their behaviors since adolescents are often very present-focused. These characteristics of the CD youth suggest that they likely will not easily engage in the therapeutic process.

Therapeutic techniques need to consider the findings of significant differences between the CD and control groups in the areas of inattention and vigilance. First, it would seem that youth with CD would likely get bored with typical talk-therapy. Because of this, engaging individuals with CD through activities using multiple sensory experiences might be beneficial. In addition, providing activities that do not go for a long

period of time or changing activities frequently might keep them engaged in the topic that is trying to be addressed. The use of motivational interviewing techniques with individuals with substance use issues to encourage behavior change has proven to be a useful technique to enhance motivation to change behaviors (Miller & Rollnick, 2002). This technique could be adapted to youth with conduct problems, as these authors have noted a connection between the use of motivational interviewing and improvements in clients' efforts to change criminal behaviors.

The use of experiential techniques provides the hands-on approach that could engage youth in treatment and should be considered in treatment of this population as well. These could include role plays and artistic activities to learn and practice social skills, stories about other youth who are presented with tough decisions or situations similar to those that the youth is getting into trouble for, and games related to the development of social- and decision-making skills. For example, Aggression Replacement Training (ART; Goldstein, Gibbs, & Glick, 1998) incorporates social skills (i.e., Skillstreaming), anger management skills (i.e., Anger Control Training), and decision-making skills (i.e., Moral Reasoning) to cover management of behaviors, emotions, and cognitions, respectively. This intervention has received positive reviews as an empirically supported treatment with this population. Education on reading social cues is also important, as it has been reported that this is an area that is overlooked or misinterpreted by youth who are involved with criminal behavior. In addition, models that breakdown the steps that go into decision-making, such as weighing pros versus cons or good things and bad things about an action, provide youth with the opportunity to slow

down their thinking patterns to incorporate multiple aspects and details that typically are included in the decision-making processes of others who do not get into trouble.

Age should not only be considered with assessment with this population, but also in treatment. The secondary analysis revealed that the earlier the onset of symptoms of CD the more symptoms endorsed as occurring within the youth in the study. This subgroup of youth with CD has also been viewed as a severe, chronic population (Moffitt, 1993). To curb the potentially poor prognosis for individuals with Conduct Disorder, Childhood Onset, it is necessary to intervene early and often. The childhood onset subtype requires the first symptom of CD to be present before age 10 years old. That being said, techniques targeting youth with behavior problems in elementary school or earlier could be a preventative measure protecting these youth from the progression of these behaviors into chronic problems in adolescence.

Lastly, working with family members and other providers to maintain consistent limits through reinforcement and consequence contingencies is another technique recommended for working with this group of youth. The seeking of gratification might suggest that more frequent rewards could lead to a more successful response to behavior management regimens by youth with CD, as this would be consistent with the research conducted by Bobova, et al. (2009) and Marco, et al. (2009). Supportive of this line of thinking is research by Gwinn, et al. (2005) where it was found that greater delays in behavior management contingencies led to increases in challenging behaviors among youth. It is important not to ignore efforts to address changing criminal thinking patterns within youth with CD, as much research has shown great benefits in challenging inaccurate cognitions connected with criminal behaviors (Samenow, 2004). However,



taking into consideration their capacity to engage in this line of treatment might lead to the need to develop alternative strategies to connect with youth with CD at the onset of treatment and keep them engaged during talk therapy sessions.

### **Summary**

This project explored the ability of the CPT-II to assess for ADHD in youth with CD. The areas of inattention, lack of motivation, self-regulation, and delay of gratification with executive functioning were identified as overlapping between youth with CD and ADHD. Response disinhibition was not found to be significant. Interpretations of these results included the egocentric nature of youth with CD and their disregard for social rules, as well as the documented struggles with behavior management and seeking quick rewards. Limitations identified in the data included, gender, race, recruitment procedures, and instrumentation. The results suggest that it would be useful to control for these issues in future projects. In addition, using additional assessment tools to further examine the areas of executive functioning identified as significantly different in this sample in a more precise manner would be recommended, especially in the areas of delay of gratification and response consistencies. Lastly, treatment interventions targeting motivation to change behaviors, social skills, emotion management, and decision-making skills seem to provide the needed skills identified as deficient in this sample.

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## **APPENDICES**

APPENDIX A – Conduct Disorder Questionnaire

APPENDIX B – Parent/Guardian and Participant Letter – RCHSD Referral

APPENDIX C – Parent/Legal Guardian Permission Form – RCHSD Referral

APPENDIX D – Assent Form for Research Participant – RCHSD Referral

APPENDIX E – Consent for Disclosure of Confidential Information – RCHSD Referral

APPENDIX F – Letter from School

APPENDIX G – Parent Letter – School Referral

APPENDIX H – Parent/Legal Guardian Permission Form – School Referral

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APPENDIX J – Consent for Disclosure of Confidential Information – School Referral

APPENDIX K – Demographic Questionnaire

**APPENDIX A**

**Conduct Disorder Questionnaire**

Participant Code Number: \_\_\_\_\_ Age: \_\_\_\_\_

<b>Aggression to people and animals:</b>	<b>Yes</b>	<b>No</b>	<b>Age</b>
Bullies, threatens, or intimidates others	1	0	_____
Initiates physical fights	1	0	_____
Has used a weapon that can cause serious physical harm to others (e.g., bat, brick, broken bottle, knife, gun)	1	0	_____
Has been physically cruel to people	1	0	_____
Has stolen while confronting victim (e.g., mugging, purse snatching, extortion, armed robbery)	1	0	_____
Has forced someone into sexual activity	1	0	_____
<b>Destruction of property:</b>			
Has deliberately engaged in fire setting with the intent of causing serious damage	1	0	_____
Has deliberately destroyed others' property (other than by fire setting)	1	0	_____
<b>Deceitfulness or theft:</b>			
Has broken into someone else's house, building, or car	1	0	_____
Often lies to obtain goods or favors or to avoid obligations (i.e., "cons" others)	1	0	_____
Has stolen items of nontrivial value without confronting a victim (e.g., shoplifting, but without breaking and entering; forgery)	1	0	_____
<b>Serious violations of rules:</b>			
Often stays out at night despite parental prohibitions, beginning before age 13 years	1	0	_____
Has run away from home overnight at least twice while living in parental or parental surrogate home (or once without returning for a lengthy period)	1	0	_____
Often truant from school, beginning before age 13 years	1	0	_____
<i>Has been prosecuted for selling or dealing drugs or drug possession</i>	1	0	_____

**Total:** \_\_\_\_\_

The disturbance in behavior causes clinically significant impairment in social, academic, or occupational functioning Yes                      No

List which areas of impairment (broad area, followed by specific detail):

\_\_\_\_\_ Social: \_\_\_\_\_

\_\_\_\_\_ Academic: \_\_\_\_\_

\_\_\_\_\_ Occupational: \_\_\_\_\_

**APPENDIX B**

**Parent/Guardian and Participant Letter – RCHSD Referral**

Dear Parent/Guardian and Participant:

My name is Stephanie Raszkievicz and I am a doctoral candidate at Marquette University in the Department of Counselor Education and Counseling Psychology. Currently, I am working on my dissertation, which is an investigation of delinquent behaviors and decision-making skills among adolescents. As part of my research I would like to complete testing, which is typically thirty (30) minutes in duration, with your son/daughter to gather data about these issues in youth. This can be done during one sitting. Each youth that completes the necessary paperwork and testing will be given a \$10.00 gift card for his/her participation to a local restaurant. In addition, parents/guardians will be provided with a \$5.00 gas card or bus fare/tokens for each trip to the center for testing. All information will be kept confidential. For this assessment, a computer-based test will be administered to measure impulse control and attention. The results of this test can be shared with you upon your request. However, it will not provide any diagnostic information and would only provide information that might need to be further examined by a mental health professional.

If you are interested in participating in this research, please check the appropriate line and sign below so that I may contact you to arrange to meet to further discuss my study. Also, please provide your phone number where you can be reached and return it to your child’s case manager or send to me in the envelop provided. At this meeting, we will complete a parent/guardian permission form, a participant assent form, and a consent to release information to other service providers in order to obtain information to assist in this evaluation. If you have any questions, please contact me at (262) 638-6553 or (262) 945-7519. You may also contact my advisor at Marquette University, Robert Fox, Ph.D., at (414) 288-1469. Thank you very much for your time and consideration.

Sincerely,  
Stephanie Raszkievicz, MA, LPC, NCC, CSAC, ICS  
Doctoral Candidate, Marquette University  
Counseling and Educational Psychology Department

*Please complete the information below, tear off this bottom portion, and return it to your child’s case manager or to Stephanie Raszkievicz in the envelop provided*

- \_\_\_\_\_ I am interested in discussing my child’s participation in your study. (Please sign and provide phone number below).
- \_\_\_\_\_ I am not interested in participating in this study.

\_\_\_\_\_  
Parent’s/Legal Guardian’s Signature(s)

\_\_\_\_\_  
Date

\_\_\_\_\_  
Parent’s/Legal Guardian’s Name(s)

\_\_\_\_\_  
Phone Number

\_\_\_\_\_  
Child’s Name

## APPENDIX C

### MARQUETTE UNIVERSITY PARENT/LEGAL GUARDIAN PERMISSION FORM

The Utility of the Conners' Continuous Performance Test in the Evaluation of Youth with Conduct Disorder (RCHSD Referral)  
Stephanie Raszkievich, Principal Investigator  
Department of Counselor Education and Counseling Psychology

Your child has been invited to participate in this research study. Before you agree to allow your child to participate, it is important that you read and understand the following information. Participation is completely voluntary. Please ask questions about anything you do not understand before deciding whether or not to give permission for your child to participate.

**PURPOSE:** I understand that the purpose of this research study is to explore and assess neuropsychological factors leading to decision-making by my child. I understand that my child will be one of approximately 60 participants in this research study. These participants will be assigned to one of two groups, youth with Conduct Disorder, a disorder used to identify individuals who habitually commit crimes or get into trouble in some way, and those that do not exhibit these behaviors. These two groups will be compared on their performance on a test examining the factors impacting impulse control and the ability to sustain attention.

**PROCEDURES:** I understand clearly the following procedures will be part of this project: participation in an interview with my child where I provide consent and my child provides assent for participation in this project; completion of questionnaires by myself, my child, and RCHSD Case Managers; administration of a computer-based assessment of ADHD. These procedures will require approximately 30-45 minutes to complete and will be done in one (1) session. My child's name will not be included on any test protocols and a confidential code number will be assigned to him/her. If my child is taking a stimulant medication, it will be requested that he/she not take it before testing. I understand that this request is to ensure an accurate assessment of my child's skills and have been informed of any potential side effects to this request, such as irritability, acting without thinking and possibly making poor decisions, and hyperactivity or fidgety behavior. I will arrange for transportation of my child to the testing location with a responsible, licensed driver and will not allow my child to drive to the testing location. He/she will be able to take the medication at the completion of the testing session, which I will provide to my child upon completion of each testing session. I understand that during the interview, an audio recording of my child's response to a question ascertaining his/her motivation for criminal behavior will be made. This recording will provide an accurate accounting of my child's response, as well as aid in transcription of the response to this question. These tapes will be destroyed after five (5) years beyond the completion of the study. For confidentiality purposes, my child's name will not be recorded. These

recordings will only be used to document the responses and not shared with others unless there is indication that the child planned/plans to harm him-/herself or others or that the child is/was a victim of abuse. In which case, the child's name will need to be disclosed. I understand that during this interview, information related to personal and demographic information about myself and my child will be collected. Finally, if at any time my child does not want to answer a question, he/she may refrain from doing so. In order to allow the principal investigator to collect the most accurate information about my child, I will sign a separate consent to release information form that will allow her to collaborate with Racine County Human Services Department.

**DURATION:** I understand that my child's participation will consist of one (1) session for a total of 30-45 minutes in order to complete an intake interview, demographic questionnaire, and neuropsychological testing. I have been informed that my child can request a break or end the testing for that day at anytime during the testing situation.

**RISKS:** I understand that the risks associated with participation in this study include anxiety/stress related to taking tests and/or emotional discomfort related to bringing up issues by asking questions related to emotional well-being. In addition, I understand that the principal investigator and other service providers (e.g., Case Manager) are mandated reporters and must report any incidents of child abuse or neglect or plans to harm oneself or others. If my child is taking a stimulant medication, it will be requested that he/she not take it before testing. I understand that this request is to ensure an accurate assessment of my child's skills. Some side effects of not taking his/her medication I should be aware of include irritability, hyperactivity, impulsive actions (e.g., acting without thinking), and being easily provoked. I will arrange for transportation of my child to the testing location with a responsible, licensed driver and will not allow my child to drive to the testing location. I will provide the medication to my child at the completion of the testing session.

**BENEFITS:** I understand that the benefits associated with participation in this study include that I will be provided with the opportunity to be given feedback about the observations of my child and his/her testing results once testing is completed. I will also be provided with diagnostic information relevant to my child, as well as referrals for any treatment-related issues. Lastly, it is hoped that this study will provide further insight into poor choices by youth and assist in future services to these youth.

**CONFIDENTIALITY:** I understand that all information my child reveals in this study will be kept confidential. Research data will be kept confidential in a locked file cabinet in an office maintained at my home. All of my child's data will be assigned an arbitrary code number rather than using my child's name or other information that could identify my child as an individual participant. Any forms with my child's name listed or signed on it will be maintained separately from the assessment forms. When the results of the study are published, my child will not be identified by name. I understand that the raw data collected and audiotapes created for this study will be destroyed five (5) years after participation in this project. The computer data files will not include any names and will be kept indefinitely. I understand that the research records may be inspected by the

Marquette University Institutional Review Board or its designees and (as allowable by law) state and federal agencies. Aside from this stipulation, the principal investigator is the only individual who will have access to the research data.

**COMPENSATION:** I understand that my child will be given a \$10.00 gift card to your choice of McDonald's, Burger King, or Subway after completing the entire assessment procedure with the examiner. In addition, I will be provided with a \$5 gas card for each trip to the center for testing.

**EXTRA COSTS TO PARTICIPATE:** Although there are no direct financial costs to the participant, I recognize that I am responsible for any additional transportation costs to and from the study site beyond those provided by the principal researcher.

**INJURY OR ILLNESS:** I understand that Marquette University will not provide medical treatment or financial compensation if my child is injured or becomes ill as a result of participating in this research project. This does not waive any legal rights nor release any claim based on negligence.

**VOLUNTARY NATURE OF PARTICIPATION:** I understand that participating in this study is completely voluntary and that my child may withdraw from the study and stop participating at any time without penalty or loss of benefits to which my child is otherwise entitled by informing the principal investigator in writing of the desire to withdraw participation. If your child is unable to complete all of the assessment instruments for any reason, the data and testing protocols will be destroyed upon completion of this study. However, the electronic data file with this information will be kept indefinitely, as this information might provide information pertaining to attrition issues for future researchers investigating this population.

**CONTACT INFORMATION:** If I have any questions about this research project, I can contact Stephanie Raszkievicz (principal investigator) and/or Robert Fox, PhD (advisor), of the Department of Counselor Education and Counseling Psychology at Marquette University, to answer my questions about procedures. Stephanie Raszkievicz can be contacted at (262) 638-6553 or (262) 945-7519 and Dr. Fox can be contacted at (414) 288-1469. If I have questions or concerns about my child's rights as a research participant, I can contact Marquette University's Office of Research Compliance at (414) 288-7570.

**I HAVE HAD THE OPPORTUNITY TO READ THIS PARENT/GUARDIAN PERMISSION FORM, ASK QUESTIONS ABOUT THE RESEARCH PROJECT, AND AM PREPARED TO GIVE MY PERMISSION FOR MY CHILD TO PARTICIPATE IN THIS PROJECT.**

\_\_\_\_\_  
Parent's/Legal Guardian's Signature(s)

\_\_\_\_\_  
Date

\_\_\_\_\_  
Parent's/Legal Guardian's Name(s)

\_\_\_\_\_  
Phone Number

\_\_\_\_\_  
Child's Name

\_\_\_\_\_  
Researcher's Signature

\_\_\_\_\_  
Date

## APPENDIX D

### MARQUETTE UNIVERSITY ASSENT FORM FOR RESEARCH PARTICIPANTS

The Utility of the Conners' Continuous Performance Test in the Evaluation of Youth with Conduct Disorder (RCHSD Referral)

Investigator: Stephanie Raszkiewicz, Department of Counselor Education and Counseling Psychology

I am doing a research study. A research study is a special way to find out and learn more about specific topic. I want to explore and assess how your brain might influence your behaviors and the decisions you make. In this project, I will compare the performance of youth who break the law and get in trouble with youth who do not commit these behaviors to see what differences might exist.

You can be in this study if you want to. If you want to be in this study, a questionnaire gathering background information (age, race, medications, family information) and a behavior questionnaire will be completed by you, your parent/guardian, and your case manager. You will also be asked to take a test in the computer that looks at how well you can concentrate and make decisions.

I want to tell you about some things that might happen to you if you are in this study. First of all, the testing will last about thirty (30) minutes. Some questions might lead to anxiety/stress related to taking tests or emotional discomfort related to bringing up issues by asking questions related to emotional well-being. However, we do not know for sure that these things will happen.

If you decide to be in this study, some good things might happen to you. You might learn some new things about yourself and how you process information. In addition, you will receive a \$10.00 gift card to your choice of McDonald's, Burger King, or Subway for your time and effort in this study. We might also find out things that will help other children some day.

When we are done with the study, I can tell you how you did. In addition, I will write a summary about what I have found to complete my project for school. I will not use your name in the summary. All of the information you provide will be kept private. No one except the research team will know that you are in the study unless you and your parent/guardian decide to tell them. The only time that I would break this rule would be if you tell us information that I think your parent/guardian need to know to be able to keep you or other people safe, as I am a mandated reporter, which means I have to tell people if you tell me that you are going to harm yourself or anyone else or if you are being or will be harmed by someone else. For example, if you have been or are having serious thoughts about hurting yourself or someone else in some way or that you have been the victim of physical, sexual, or emotional abuse, I would inform your parent/guardian and



other people to help with the situation. Also, any sexual behavior by an individual under the age of 18 in Wisconsin must be reported. I will work with other individuals, such as your case manager, teachers, and/or youth workers, to get the most accurate information about you and your behaviors. You will sign a separate release that will give me permission to speak with these individuals.

Even if your parent/guardian has agreed to let you take part in this study, it is still your decision whether or not to be in the study. You do not have to be in this study if you don't want to. You can say "no" and nothing bad will happen. If you say "yes" now, but you want to stop later, that's okay too. If something about the study bothers you, you can stop being in the study. All you have to do is tell the researcher you want to stop. If there is anything you don't like about being in the study, you should tell me and if I can, I will try to change it for you.

Lastly, if you take stimulant medication, such as Adderall, Concerta, or Ritalin, you will be asked not to take it on the morning of testing, but will be asked to take it upon completion of the testing session. It is important that you understand that you might be irritable or have similar symptoms that you had before you began taking the medication, such as doing things without thinking about their consequences, difficulty focusing, and/or fidgeting. It is important to know that any poor choices you make will not be the responsibility of myself or other entities related to this project (e.g., Marquette University, RCHSD, or others.)

If you have any questions about the study, you can ask the researcher. I will try to explain everything that is being done and why. Please ask me about anything you want to know.

If you want to be in this study, please sign and print your name.

I, \_\_\_\_\_, want to be in this research study.  
(write your name here)

\_\_\_\_\_  
Sign your name here

\_\_\_\_\_  
Date

\_\_\_\_\_  
Investigator signature

\_\_\_\_\_  
Date

APPENDIX E

CONSENT FOR DISCLOSURE OF CONFIDENTIAL INFORMATION

Name: \_\_\_\_\_ Date of Birth: \_\_\_/\_\_\_/\_\_\_

I authorize:

(1) \_\_\_\_\_ Stephanie Raszkievicz – Principal Investigator (Marquette University) \_\_\_\_\_

and

(2) \_\_\_\_\_ Racine County Human Services Department \_\_\_\_\_

to use and/or disclose to one another the following information (Identify specific records authorized for release. Include dates of records, if applicable):

(Initial each category that applies)

- My name and other identifying information
That I am a participant in (alcohol and/or drug) treatment
Psychosocial History
Psychiatric History
Medication History
Admissions/Discharge Summaries: Dates:
Other
Dates of treatment
Attendance
Educational Records
AODA Assessment
Progress Notes
Psychological Evaluation
Alcohol/drug testing results
Medical Evaluation

Purpose or need for Release of Information (Be Specific)

To coordinate on-going treatment and gather information pertaining to behavioral reports and research data, and/or the following:

I understand that my alcohol and/or drug treatment records are protected under the federal regulations governing Confidentiality of Alcohol and Drug Abuse Patient Records, 42 C.F.R. Part 2, and the Health Insurance Portability and Accountability Act of 1996 (HIPAA), 45 C.F.R. Pts. 160 & 164 and cannot be disclosed without my written consent unless otherwise provided for in the regulations. I understand I have the right to inspect and receive a copy of the material disclosed under Wis. Adm. Code section HFS 92.05 and 92.06 (pursuant to HFS 92.03(3)(d)). I understand I have the right to inspect and receive a copy of the material disclosed. I also understand that, by notifying Stephanie Raszkievicz, the principal investigator verbally or in writing, I may revoke this consent at any time except to the extent that action has already been taken in reliance on it (e.g. the provision of treatment upon consent to disclosure the third party payer). Unless revoked, this authorization will remain in effect until (Specify date, event, or condition upon which consent will expire.)

I understand that I might be denied services if I refuse to consent to a disclosure for purposes of treatment or health care operations. I will not be denied services if I refuse to consent to a disclosure for other purposes.

Signature of Patient

Date

Signature of Personal Representative

Date

Nature of authority (e.g., parent, guardian): \_\_\_\_\_

**APPENDIX F**  
**PARENT LETTER – School Referral**

Dear Parent/Guardian,

Thank you for your time in reviewing and completing materials for my dissertation project. As you may have learned, I am a doctoral candidate at Marquette University in their counseling psychology program. The last step in obtaining this degree is to complete my dissertation. In this research project, I am examining youth with Conduct Disorder (e.g., youth who commit crimes and violate rules and laws) with youth who do not exhibit these behaviors on a computer-based test designed to measure an individual's ability to stay focused and on task. The enclosed documents are forms that need your signature to complete testing for my dissertation project. Below is an explanation of each of these forms and their completion:

1. **Parent/Guardian Consent Form** – This form explains my project in detail. It identifies benefits and risks of giving your approval for your son/daughter to participate in this project, as well as limits of confidentiality.
2. **Participant Assent Form** – This form explains my project in more basic terms. Although I will be reviewing this form with your son/daughter, you are welcome to review it with them as well. It only requires his/her signature, but has been enclosed to inform you of its contents.
3. **Consent for Disclosure of Confidential Information** – This form is required to allow me to communicate with the school's faculty to arrange for your son/daughter to participate. Your son/daughter will be asked to initial by the "X's" on the small lines in the top portion of the page and then sign below. This form requires your signature at the bottom of the page. The last line on the page is for you to list how you are able to sign for your son/daughter (e.g., parent, mother, father, guardian.) As noted on this form, this consent will be good for one year or the completion and defense of my project, whichever should happen first in case I should need to follow-up with the school as I am completing my data analysis.

Lastly, upon obtaining your consent on these forms, I will be contacting you to see if you have any questions about this project, as well as to ask you some questions about your family background (e.g., demographic information related to race, education, income) and your son's/daughter's behaviors. Should you have any questions prior to this phone call, you can contact me at (262) 638-6553 or (262) 945-7519.

Thank you again for your time and I look forward to speaking with you.

Stephanie Raszkievicz, MA, LPC, NCC, CSAC, ICS  
Doctoral Candidate, Marquette University

## APPENDIX G

**MARQUETTE UNIVERSITY**  
**PARENT/LEGAL GUARDIAN PERMISSION FORM**  
*The Utility of the Conners' Continuous Performance Test in the Evaluation of Youth  
with Conduct Disorder (School Referral)*  
Stephanie Raszkievicz, Principal Investigator  
Department of Counselor Education and Counseling Psychology

Your child has been invited to participate in this research study. Before you agree to allow your child to participate, it is important that you read and understand the following information. Participation is completely voluntary. Please ask questions about anything you do not understand before deciding whether or not to give permission for your child to participate.

**PURPOSE:** I understand that the purpose of this research study is to explore and assess neuropsychological factors leading to decision-making by my child. I understand that my child will be one of approximately 60 participants in this research study. These participants will be assigned to one of two groups, youth with Conduct Disorder, a disorder used to identify individuals who habitually commit crimes or get into trouble in some way, and those that do not exhibit these behaviors. These two groups will be compared on their performance on a test examining the factors impacting impulse control and the ability to sustain attention.

**PROCEDURES:** I understand clearly the following procedures will be part of this project: participation in a phone interview with the principal investigator to gather demographic information (e.g., age, household members, household income, prenatal information related to parent's pregnancy with participant) and complete a questionnaire related to my child's behavior; a separate assent form that my child will complete before testing; and administration of a computer-based assessment of ADHD. These procedures will require approximately 30-45 minutes to complete and will be done in one (1) session. My child's name will not be included on any test protocols and a confidential code number will be assigned to him/her. If my child is taking a stimulant medication, it will be requested that he/she not take it before testing. I understand that this request is to ensure an accurate assessment of my child's skills and have been informed of any potential side effects to this request, such as irritability, acting without thinking and possibly making poor decisions, and hyperactivity or fidgety behavior. I will arrange for transportation of my child to the testing location with a responsible, licensed driver and will not allow my child to drive to the testing location. He/she will be able to take the medication at the completion of the testing session, which I will provide to my child upon completion of each testing session. Information provided to the principal investigator will not be shared with others unless there is indication that the child planned/plans to harm him-/herself or others or that the child is/was a victim of abuse. In which case, the child's name will need to be disclosed. I understand that during this interview, information related to personal and demographic information about myself and my child will be collected. Finally, if at any time my child does not want to answer a question, he/she may

refrain from doing so. In order to allow the principal investigator to collect the most accurate information about my child, I will sign a separate consent to release information form that will allow her to collaborate with my child's school.

**DURATION:** I understand that my child's participation will consist of one (1) session for a total of 30-45 minutes in order to complete an intake interview, demographic questionnaire, and neuropsychological testing. I have been informed that my child can request a break or end the testing for that day at anytime during the testing situation.

**RISKS:** I understand that the risks associated with participation in this study include anxiety/stress related to taking tests and/or emotional discomfort related to bringing up issues by asking questions related to emotional well-being. In addition, I understand that the principal investigator and other service providers (e.g., Case Manager) are mandated reporters and must report any incidents of child abuse or neglect or plans to harm oneself or others. If my child is taking a stimulant medication, it will be requested that he/she not take it before testing. I understand that this request is to ensure an accurate assessment of my child's skills. Some side effects of not taking his/her medication I should be aware of include irritability, hyperactivity, impulsive actions (e.g., acting without thinking), and being easily provoked. I will arrange for transportation of my child to the testing location with a responsible, licensed driver and will not allow my child to drive to the testing location. I will provide the medication to my child at the completion of the testing session.

**BENEFITS:** I understand that the benefits associated with participation in this study include that I will be provided with the opportunity to be given feedback about the observations of my child and his/her testing results once testing is completed. I will also be provided with diagnostic information relevant to my child, as well as referrals for any treatment-related issues. Lastly, it is hoped that this study will provide further insight into poor choices by youth and assist in future services to these youth.

**CONFIDENTIALITY:** I understand that all information my child reveals in this study will be kept confidential. Research data will be kept confidential in a locked file cabinet in an office maintained at my home. All of my child's data will be assigned an arbitrary code number rather than using my child's name or other information that could identify my child as an individual participant. Any forms with my child's name listed or signed on it will be maintained separately from the assessment forms. When the results of the study are published, my child will not be identified by name. I understand that the raw data collected and audiotapes created for this study will be destroyed five (5) years after participation in this project. The computer data files will not include any names and will be kept indefinitely. I understand that the research records may be inspected by the Marquette University Institutional Review Board or its designees and (as allowable by law) state and federal agencies. Aside from this stipulation, the principal investigator is the only individual who will have access to the research data.

**COMPENSATION:** I understand that the principal investigator will provide my child's classroom with a hands-on learning opportunity in the field of psychology and provide

information related to experimental psychology and the field of psychology as whole to assist my child in a diverse learning opportunity. In addition, I will be compensated with a \$5.00 gas card for any trips made to the school or elsewhere for testing.

**EXTRA COSTS TO PARTICIPATE:** Although there are no direct financial costs to the participant, I recognize that I am responsible for any additional transportation costs to and from the study site beyond those provided by the principal researcher.

**INJURY OR ILLNESS:** I understand that Marquette University will not provide medical treatment or financial compensation if my child is injured or becomes ill as a result of participating in this research project. This does not waive any legal rights nor release any claim based on negligence.

**VOLUNTARY NATURE OF PARTICIPATION:** I understand that participating in this study is completely voluntary and that my child may withdraw from the study and stop participating at any time without penalty or loss of benefits to which my child is otherwise entitled by informing the principal investigator in writing of the desire to withdraw participation. If your child is unable to complete all of the assessment instruments for any reason, the data and testing protocols will be destroyed upon completion of this study. However, the electronic data file with this information will be kept indefinitely, as this information might provide information pertaining to attrition issues for future researchers investigating this population.

**CONTACT INFORMATION:** If I have any questions about this research project, I can contact Stephanie Raszkievicz (principal investigator) and/or Robert Fox, PhD (advisor), of the Department of Counselor Education and Counseling Psychology at Marquette University, to answer my questions about procedures. Stephanie Raszkievicz can be contacted at (262) 638-6553 or (262) 945-7519 and Dr. Fox can be contacted at (414) 288-1469. If I have questions or concerns about my child's rights as a research participant, I can contact Marquette University's Office of Research Compliance at (414) 288-7570.

**I HAVE HAD THE OPPORTUNITY TO READ THIS PARENT/GUARDIAN PERMISSION FORM, ASK QUESTIONS ABOUT THE RESEARCH PROJECT, AND AM PREPARED TO GIVE MY PERMISSION FOR MY CHILD TO PARTICIPATE IN THIS PROJECT.**

_____ Parent's/Legal Guardian's Signature(s)	_____ Date
_____ Parent's/Legal Guardian's Name(s)	_____ Phone Number
_____ Child's Name	
_____ Researcher's Signature	_____ Date

## APPENDIX H

### MARQUETTE UNIVERSITY ASSENT FORM FOR RESEARCH PARTICIPANTS

The Utility of the Conners' Continuous Performance Test in the Evaluation of Youth with Conduct Disorder (school referral)

Investigator: Stephanie Raszkievicz, Department of Counselor Education and Counseling Psychology

I am doing a research study. A research study is a special way to find out and learn more about specific topic. I want to explore and assess how your brain might influence your behaviors and the decisions you make. In this project, I will compare the performance of youth who break the law and get in trouble with youth who do not commit these behaviors to see what differences might exist.

You can be in this study if you want to. If you want to be in this study, a questionnaire gathering background information (age, race, medications, family information) and a behavior questionnaire will be completed by you and your parent. You will also be asked to take a test on the computer that looks at how well you can concentrate and make decisions.

I want to tell you about some things that might happen to you if you are in this study. First of all, the testing will last about thirty (30) minutes. Some questions might lead to anxiety/stress related to taking tests or emotional discomfort related to bringing up issues by asking questions related to emotional well-being. However, we do not know for sure that these things will happen.

If you decide to be in this study, some good things might happen to you. You might learn some new things about yourself and how you process information. In addition, I will be teaching your class about specific topics related to psychology. In addition, you will have the opportunity to learn more about research. We might also find out things that will help other children some day.

When we are done with the study, I can tell you how you did. In addition, I will write a summary about what I have found to complete my project for school. I will not use your name in the summary. All of the information you provide will be kept private. No one except the research team will know that you are in the study unless you and your parent/guardian decide to tell them. The only time that I would break this rule would be if you tell us information that I think your parent/guardian need to know to be able to keep you or other people safe, as I am a mandated reporter, which means I have to tell people if you tell me that you are going to harm yourself or anyone else or if you are being or will be harmed by someone else. For example, if you have been or are having serious thoughts about hurting yourself or someone else in some way or that you have been the victim of physical, sexual, or emotional abuse, I would inform your parent/guardian and

other people to help with the situation. Also, any sexual behavior by an individual under the age of 18 in Wisconsin must be reported. I will work with other individuals, such as your parents, your teachers and/or other faculty members, to get the most accurate information about you and your behaviors. You will sign a separate release that will give me permission to speak with these individuals.

Even if your parent/guardian has agreed to let you take part in this study, it is still your decision whether or not to be in the study. You do not have to be in this study if you don't want to. You can say "no" and nothing bad will happen. If you say "yes" now, but you want to stop later, that's okay too. If something about the study bothers you, you can stop being in the study. All you have to do is tell the researcher you want to stop. If there is anything you don't like about being in the study, you should tell me and if I can, I will try to change it for you.

Lastly, if you take stimulant medication, such as Adderall, Concerta, or Ritalin, you will be asked not to take it on the morning of testing, but will be asked to take it upon completion of the testing session. It is important that you understand that you might be irritable or have similar symptoms that you had before you began taking the medication, such as doing things without thinking about their consequences, difficulty focusing, and/or fidgeting. It is important to know that any poor choices you make will not be the responsibility of myself or other entities related to this project (e.g., Marquette University, your school, or others.)

If you have any questions about the study, you can ask the researcher. I will try to explain everything that is being done and why. Please ask me about anything you want to know.

If you want to be in this study, please sign and print your name.

I, \_\_\_\_\_, want to be in this research study.  
(write your name here)

\_\_\_\_\_  
Sign your name here

\_\_\_\_\_  
Date

\_\_\_\_\_  
Investigator signature

\_\_\_\_\_  
Date



APPENDIX I

CONSENT FOR DISCLOSURE OF CONFIDENTIAL INFORMATION

Name: \_\_\_\_\_ Date of Birth: \_\_\_/\_\_\_/\_\_\_

I authorize:

(1) \_\_\_\_\_ Stephanie Raszkievicz – Principal Investigator (Marquette University)

and

(2) \_\_\_\_\_ (my child's school)

to use and/or disclose to one another the following information (Identify specific records authorized for release. Include dates of records, if applicable):

(Initial each category that applies)

- My name and other identifying information
That I am a participant in (alcohol and/or drug) treatment
Psychosocial History
Psychiatric History
Medication History
Admissions/Discharge Summaries: Dates:
Other
Dates of treatment
Attendance
Educational Records
AODA Assessment
Progress Notes
Psychological Evaluation
Alcohol/drug testing results
Medical Evaluation

Purpose or need for Release of Information (Be Specific)

To coordinate on-going treatment and gather information pertaining to behavioral reports and research data, and/or the following:

I understand that my alcohol and/or drug treatment records are protected under the federal regulations governing Confidentiality of Alcohol and Drug Abuse Patient Records, 42 C.F.R. Part 2, and the Health Insurance Portability and Accountability Act of 1996 (HIPAA), 45 C.F.R. Pts. 160 & 164 and cannot be disclosed without my written consent unless otherwise provided for in the regulations. I understand I have the right to inspect and receive a copy of the material disclosed under Wis. Adm. Code section HFS 92.05 and 92.06 (pursuant to HFS 92.03(3)(d)). I understand I have the right to inspect and receive a copy of the material disclosed. I also understand that, by notifying Stephanie Raszkievicz, the principal investigator verbally or in writing, I may revoke this consent at any time except to the extent that action has already been taken in reliance on it (e.g. the provision of treatment upon consent to disclosure the third party payer). Unless revoked, this authorization will remain in effect until (Specify date, event, or condition upon which consent will expire.)

I understand that I might be denied services if I refuse to consent to a disclosure for purposes of treatment or health care operations. I will not be denied services if I refuse to consent to a disclosure for other purposes.

Signature of Patient

Date

Signature of Personal Representative

Date

Nature of authority (e.g., parent, guardian): \_\_\_\_\_

**APPENDIX J**

**Demographic Questionnaire**

Participant Code Number: \_\_\_\_\_ Age: \_\_\_\_\_ Date: \_\_\_\_\_

Gender:  Male  Female

Race/Ethnicity:  Caucasian/White  African American  
 Latino/a  Biracial (\_\_\_\_\_  
 Other (\_\_\_\_\_)

Years on delinquency supervision \_\_\_\_\_

Participant's current level of substance use:

ETOH  None  Daily  2-3 times/wk  Weekly  Every 2 wks  Monthly  
 Marijuana  None  Daily  2-3 times/wk  Weekly  Every 2 wks  Monthly  
 Other (\_\_\_\_\_)  Daily  2-3 times/wk  Weekly  Every 2 wks  Monthly  
 Other (\_\_\_\_\_)  Daily  2-3 times/wk  Weekly  Every 2 wks  Monthly

Participant's history of substance use:

ETOH  None  Daily  2-3 times/wk  Weekly  Every 2 wks  Monthly  
 Marijuana  None  Daily  2-3 times/wk  Weekly  Every 2 wks  Monthly  
 Other (\_\_\_\_\_)  Daily  2-3 times/wk  Weekly  Every 2 wks  Monthly  
 Other (\_\_\_\_\_)  Daily  2-3 times/wk  Weekly  Every 2 wks  Monthly

Household Income:  \$0 to \$10,000  \$10,001 to \$20,000  
 \$20,001 to \$30,000  \$30,001 to \$40,000  
 \$40,001 to \$50,000  \$50,001 or greater

Parental Marital Status:

Single, never married  Single, divorced  
 Married (If yes, is this the client's biological parent? Y/N)  
 Living with significant other, but not married (# of yrs \_\_\_\_\_)

Years of formal education:

Mom: \_\_\_\_\_ Dad: \_\_\_\_\_

Primary Placement of child:  Mom  Dad  Detention Center  
 Foster home  Group Home  Other (\_\_\_\_\_)

Duration of mother's pregnancy:  Full Term  Premature (\_\_\_\_\_)

Delivery:  Normal, Vaginal  Cesarean Section

Birth Complications:  Induced Labor  Preeclampsia  Other (\_\_\_\_\_)

Prenatal/Pregnancy Complications:  Gestational Hypertension

\_\_\_\_ Gestational Diabetes    \_\_\_\_ Other (\_\_\_\_\_)

Maternal substance use during pregnancy? Y / N (What? \_\_\_\_\_)

Lead Exposure? Y / N

Exemptions to study (if checked, client cannot participate):

\_\_\_\_ Head injury requiring medical attention    \_\_\_\_ Psychotic behavior

Medications: \_\_\_\_\_

*For youth meeting criteria for Conduct Disorder:*

What motivated the youth to commit his/her crime(s)? What was he/she hoping to gain or change by committing the offense? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Describe what happened that led to your arrest? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

What were you thinking? \_\_\_\_\_

\_\_\_\_\_

How were you feeling? \_\_\_\_\_

\_\_\_\_\_