SLUGGISH COGNITIVE TEMPO AND ATTENTION-DEFICIT/HYPERACTIVITY DISORDER: ASSOCIATIONS WITH CO-OCCURING SYMPTOMATOLOGY, NEUROPSYCHOLOGICAL FUNCTIONING AND ACADEMIC FUNCTIONING

by

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ABSTRACT

Over the course of studying attention-deficit/hyperactivity disorder (ADHD), the concept of sluggish cognitive tempo (SCT) has surfaced. SCT reflects confusion, sluggishness, and decreased alertness and activity. Research on the relationships among SCT, ADHD, and other psychopathologies has been mixed. Several studies have demonstrated the independence of SCT, but the close relationship it appears to have with inattention and internalizing symptoms makes it challenging to maintain that SCT is a discrete disorder.

The current study adds to the literature on ADHD and SCT by examining differences among children with ADHD + SCT, ADHD Only, and SCT Only. Groups were compared on measures of demographic variables, co-occurring symptomatology and comorbid diagnoses, neuropsychological functioning, and academic achievement. Analyses revealed that those with SCT were often older. Additionally, parent report suggested that those with SCT exhibited more symptoms in domains such as internalizing problems, externalizing problems, sleep problems, and social withdrawal.

In contrast, few differences were found for teacher report, and the trends departed from parent report indicating that those with ADHD had higher levels of attention problems, internalizing problems, externalizing problems and social problems. On neuropsychological tests, those with SCT Only generally appeared less neuropsychologically-impaired than those with ADHD.

Regression analyses involving multiple covariates revealed that SCT symptoms were still uniquely related to social withdrawal, but surprisingly, were positively related to academic achievement scores.

Overall, the findings from this study echo the conception that SCT symptoms contribute to the clinical picture in ways that are important to consider. In particular, SCT symptoms appear to have associations with internalizing problems, more specifically social withdrawal, and sleep problems. Given the limited evidence for neuropsychological impairment in those with SCT Only, treatments for SCT may involve elements designed to address anxiety/depression, sleep, and social withdrawal rather than neuropsychological impairments.

DEDICATION

This thesis is dedicated to everyone who has provided an endless amount of encouragement and assistance in completing this manuscript. In particular, I would like to recognize and thank my family and close friends for their unconditional support throughout this journey.

LIST OF ABBREVIATIONS AND SYMBOLS

SCT	Sluggish Cognitive Tempo
ADHD-I	Attention-Deficit/Hyperactivity Disorder Inattentive
ADHD- H	Attention-Deficit/Hyperactivity Disorder Hyperactive/Impulsive
ADHD-C	Attention-Deficit/Hyperactivity Disorder Combined
ADIS-C/P	Anxiety Disorders Interview Schedule, Child/Parent Versions
MASC	Multidimensional Anxiety Scale for Children
CDI	Children's Depression Inventory
CBCL	Child Behavior Checklist
TRF	Teacher Report Form
VMI	Beery-Buktenica Developmental Test of Visual-Motor Integration
CPT-I/II	Conners Continuous Performance Test, First and Second Versions
ROCF	Rey-Osterrieth Complex Figure
WISC-III/IV	Wechsler Intelligence Scale for Children, Third and Fourth Editions
WIAT- I/II	Wechsler Individual Achievement Test, First and Second Editions
N/ *n*	Number of participants in a given sample or in a given group
κ /ICC	Reliability estimates
α	Cronbach's alpha, a measure of internal consistency
F	Fisher's *F* ratio: a ratio of variances
M	Mean: the sum of a group of numbers divided by the number of observations
SD	Standard deviation: the square root of the variance of sample

p	Probability of obtaining a test statistic as extreme or more extreme than the observed value
η^2_p/ η^2/ d	Measures of effect size
β/ þ	Standardized regression coefficient and unstandardized regression coefficient
ΔR^2	Change in R, represents how much variance in the outcome variables can be attributed to the predictor variables

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CHAPTER 1

INTRODUCTION

Everyone experiences instances when it is more challenging to pay attention or sit still; however, these symptoms vary in terms of frequency, severity, and impairment. When individuals persistently experience difficulty with one or both of these domains, they may meet criteria for a diagnosis of attention-deficit/hyperactivity disorder (ADHD; American Psychiatric Association, 2013). The many ways that ADHD has been defined in the different versions of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM*) demonstrates the challenge of clearly defining the disorder.

History and Evolution of ADHD

ADHD was first recognized in *DSM-II* as Hyperkinetic Reaction of Childhood (Lahey & Carlson, 1991). This version of ADHD was characterized primarily by hyperactivity with minimal consideration of inattention and impulsivity (Lahey & Carlson, 1991). This initial emphasis on hyperactivity shifted in the third edition of the *DSM*. In *DSM-III*, ADHD subtypes were introduced, which redefined ADHD. The two subtypes created were Attention Deficit Disorder with Hyperactivity (ADD/H) and Attention Deficit Disorder without Hyperactivity (ADD/NoH). ADD/H was used to identify children with inattention, impulsivity, and hyperactivity, while ADD/NoH was used to identify children presenting exclusively with inattention and impulsivity (Barkley, 2012; Carlson & Mann, 2002; Lahey & Carlson, 1991). In the revised version of *DSM-III*, *DSM-III-R*, ADHD reverted back to a single disorder, primarily because of the insufficiency in evidence supporting the use of subtypes (Carlson & Mann, 2002;

Lahey & Carlson, 1991).

The indecision on how to capture the disorder continued over time as evidenced by the return of ADHD subtypes in *DSM-IV* (Carlson & Mann, 2002). In *DSM-IV*, hyperactivity and impulsivity were combined to form a single domain (i.e., hyperactivity/impulsivity) and inattention was considered a separate domain. In turn, individuals could be diagnosed with ADHD, Predominantly Inattentive Type (ADHD-I), ADHD, Predominantly Hyperactive/Impulsive Type (ADHD-H/I), or ADHD, Combined Type (ADHD-C). Importantly, ADHD-I no longer included impulsivity symptoms as it did in *DSM-III*.

According to the current diagnostic system, *DSM-5*, a child must exibit six out of nine inattention symptoms or six out of nine hyperactivity/impulsivity symptoms to be assigned an ADHD diagnosis (American Psychiatric Association, 2013). In addition, symptoms of the disorder must be present before age 12, and current symptoms must be present and interfering in at least 2 or more settings (e.g., home, school). When a diagnosis of ADHD is warranted, the "presentation" (i.e., the replacement for "subtype" in *DSM-5*) of ADHD is specified in one of the following three ways: Predominantly Inattentive Presentation (ADHD-I; six or more symptoms from the inattention domain), Predominantly Hyperactive/Impulsive Presentation (ADHD-H/I; six or more symptoms from the hyperactive/impulsive domain), or Combined Presentation (ADHD-C; six or more symptoms from both domains).

The *DSM-5* describes and classifies ADHD somewhat differently from previous versions of the *DSM* (American Psychiatric Association, 2013). As noted above, ADHD is now described in terms of "presentations" instead of "subtypes," given research supporting the idea that there are generally limited differences between what were previously termed subtypes and the instability of these subtypes over time (Willcutt et al., 2012). In addition, ADHD is now grouped

with the neurodevelopmental disorders. In the past, ADHD was grouped with other disruptive behavior disorders such as oppositional defiant disorder and conduct disorder. Moving the disorder to the neurodevelopmental section reflects a shift in the understanding of the etiology of ADHD as a neurodevelopmental disorder.

Identifying the Concept of Sluggish Cognitive Tempo

Through deliberations about how to separate inattention, hyperactivity, and impulsivity, researchers have also identified a unique set of symptoms that appear to be similar to but separate from inattention symptoms. These symptoms have been termed sluggish cognitive tempo symptoms (SCT; Barkley, 2012; Carlson & Mann, 2002; Hartman, Willcutt, Rhee, & Pennington, 2004). These symptoms reflect confusion, sluggishness, and decreased alertness and activity (Bauermeister, Barkley, Bauermeister, Martinez, & McBurnett, 2011; Carlson & Mann, 2002; Garner, Marceaux, Mrug, Patterson, & Hodgens, 2010; Hartman et al., 2004; Lee, Burns, Snell, & McBurnett, 2013).

Initially, SCT symptoms were considered to be uniquely and closely related to ADD/NoH or ADHD-I (Barkley, 2012; Carlson & Mann, 2002; Hartman et al., 2004). This finding increased research efforts examining potential SCT differences between the ADHD subtypes. For example, some studies have proposed that children with ADHD-I can be further distinguished based on the endorsement of SCT symptoms (Adams, Derefinko, Milich, & Fillmore, 2008; Carlson & Mann, 2002; Derefinko et al., 2008). This method suggests that identifying children who make up a more homogeneous inattentive subgroup may clarify the etiology of ADHD (Carlson & Mann, 2002; Hartman et al., 2004; Milich, Balentine, & Lynam, 2001). Conversely, a meta-analysis by Willcutt et al. (2012) found that while children with ADHD-I demonstrate the highest level of SCT, children with ADHD-C also experience SCT and

at higher levels than control children. Overall, when more recent research on *DSM-IV* subtypes of ADHD is examined, differences between ADHD subtypes are generally limited for SCT symptoms.

SCT Reliability, Validity, and Correlates

Factor analytic research on SCT indicates that SCT is a separate but related construct to ADHD (Garner et al., 2010; Hartman et al., 2004; Lee et al., 2013; Penny, Waschbusch, Klein, Corkum, & Eskes, 2009). Interestingly, SCT symptoms appear to correlate differently with the inattention and hyperactivity/impulsivity symptom domains. Hartman et al. (2004) found that SCT symptoms were more highly correlated with inattentive than hyperactive-impulsive symptoms, and more recently, Lee et al. (2013) found that after controlling for inattention, higher levels of SCT predicted lower levels of hyperactivity/impulsivity.

Some research suggests that the demographic variables associated with SCT and ADHD are different. Barkley (2012) found a significant interaction of gender by group with more males in the ADHD groups than in the control and SCT only groups. Additionally, an interaction of age by group was also found with the SCT groups being older than the ADHD and control groups; however, this effect was generally in the small range. As for socio-economic characteristics, differences between parents' highest level of education and income level were found. The parents of children in the ADHD and control groups had completed higher levels of education and had higher incomes than the parents of children in the SCT groups (Barkley, 2012). These findings indicate that there could be differences in the etiology and correlates of SCT and ADHD with SCT potentially being more related to lower levels of family socio-economic status and less related to male gender.

SCT symptoms are also highly correlated with internalizing and social withdrawal

symptoms (Barkley, 2012; Carlson & Mann, 2002; Hartman et al., 2004; Skirbekk, Hansen, Oerbeck, & Kristensen, 2011). Barkley (2012) found no significant differences between SCT Only and a control group on reported anxiety; however, the SCT Only group endorsed more depression symptoms than the control group. In contrast, Skirbekk et al. (2011) found that children with comorbid ADHD and anxiety showed the highest levels of SCT in comparison to children with ADHD or anxiety only. While SCT symptoms appear to be related to internalizing symptoms broadly, the relationship SCT has with the specific domains of anxiety and depression symptoms remains unclear.

SCT is also thought to have multiple dimensions; it has been defined by sleepy, slow, and daydreamy components (Penny et al., 2009). Some researchers claim that SCT is better characterized as a sleep deficiency (Buckhalt, 2011), while others reason that SCT is better defined as an attention disorder (Eme, 2011). Langberg, Becker, Dvorsky, and Luebbe (2014) examined whether SCT and daytime sleepiness appear to be separate constructs using two different samples. In their first sample, confirmatory factor analysis showed that while the constructs are related, they are "empirically distinct" (Langberg et al., 2014). Their second study assessed SCT and daytime sleepiness in college students with ADHD and demonstrated that SCT symptoms predict daytime sleepiness symptoms above and beyond ADHD, anxiety, and depression symptoms (Langberg et al., 2014).

Assessment of neuropsychological functioning is another area where inconsistencies have surfaced. Skirbekk et al. (2011) compared four diagnostic groups (ADHD + anxiety, ADHD Only, anxiety only, and a control group). While no relationships between SCT level and reaction time or reaction time variability on the Attention Network Test were found, higher levels of SCT were associated with more spatial memory variability on a modified version of the

Finger Windows subtest. Wåhlstedt & Bohlin (2010) found that after controlling for ADHD symptoms, SCT was uniquely related to problems in sustained attention, while inattention was uniquely related to executive functioning and state regulation deficits. This finding was subsequently replicated in another study which showed that SCT is uniquely related to sustained attention after controlling for inattention symptoms (Willcutt et al., 2014). Overall, the type and severity of neuropsychological impairment associated with ADHD and SCT remains an area in need of further research, but it appears that SCT may be uniquely related to sustained attention difficulties when inattention symptoms are controlled for. Further, spatial working memory, particularly spatial working memory variability, may be associated with SCT.

Additional research is also needed to gain a better understanding of how SCT alone and in conjunction with ADHD differentially impact academic achievement. Hartman et al. (2004) found that teacher ratings of both SCT and ADHD symptoms were significantly and negatively correlated with reading and math achievement. However, another study demonstrated that inattention was a better predictor of academic achievement than SCT (Bauermeister et al., 2011). Importantly, when academic achievement was looked at in terms of math and reading, SCT symptoms were negatively related with math scores, though it was to a lesser extent than inattention (Bauermeister et al., 2011).

Willcutt et al. (2014) found that both SCT and inattention symptoms were predictive of poorer academic achievement. While inattention symptoms were slightly stronger predictors of poorer math, word reading, and reading comprehension performance, only SCT significantly predicted poorer written language achievement. Barkley (2012) found that while children in the ADHD only group were significantly more impaired on school performance than children in the SCT only group, children in the ADHD + SCT group were the most impaired, which indicates

that the co-occurrence of ADHD and SCT is associated with even greater academic deficits. The extent of this effect and how it is comparable to other diagnoses correlated with SCT is in need of further exploration.

Social functioning is another area where differences between ADHD and SCT correlates have emerged. Carlson and Mann (2002) compared children with ADHD-I with high and low SCT and found that teacher-reported social problems and withdrawn behaviors were rated higher in the high SCT group. Additionally, the ADHD-C group was rated as having higher social functioning than the ADHD-I group with high SCT. In another study, children with high SCT demonstrated different social impairments on a chat room task than children without high SCT (Mikami, Huang-Pollock, Pfiffner, McBurnett, & Hangai, 2007). SCT symptoms were predictive of a decreased ability to pick up on social cues, less memory for the conversation, and less hostility in responses. Further, this study found that SCT symptoms were highest in the ADHD-I group in comparison to ADHD-C and control groups (Mikami et al., 2007).

Willcutt et al. (2014) found that both inattention and SCT symptoms were associated with challenges in social functioning; however, they were related to different components of social functioning. Moreover, SCT was uniquely related to social isolation but was unrelated to probability of being disliked by peers, whereas the reverse relationship was observed for *DSM-IV* inattention and hyperactivity-impulsivity. Another study explored specific areas of social impairment for differences among the following three groups: ADHD-C, ADHD-I with low SCT, and ADHD-I with high SCT (Marshall, Evans, Eiraldi, Becker, & Power, 2014). They found that the ADHD-I with high SCT group had lower levels of leadership and higher social withdrawal than both of the other groups.

Moreover, all three groups did not differ on prosocial behavior and peer liking dimensions, but those with high SCT were less aggressive than the ADHD-C group (Marshall et al., 2014).

Current Study

Although SCT appears to be a valid construct that is unique from core ADHD symptoms (Bauermeister et al., 2011; Garner et al., 2010; Hartman et al., 2004; Skirbekk et al., 2011), relationships with external correlates remain unclear. The current study contributed to the literature on SCT by using multiple measures to examine the relations that SCT and ADHD have with various correlates. Therefore, this study is distinct from past research in that the associations SCT and ADHD have with demographic variables, neuropsychological functioning, academic achievement, internalizing symptoms, sleep problems, and social functioning will be assessed (a) within the same sample, and (b) through the use of multiple informants (i.e., parents, teachers, clinicians) and methods (e.g., report-based measures, laboratory tasks).

As suggested by past research, we predicted that groups with SCT would be made up of older children, and unlike the ADHD groups, both genders would be equally represented (Barkley, 2012). Furthermore, we anticipated finding that the ADHD groups would have higher family incomes and greater levels of education than the SCT group (Barkley, 2012). We expected that the presence of SCT would be associated with elevated internalizing symptomatology, greater sleep problems, and lower levels of social functioning, particularly with respect to social withdrawal. Finally, we hypothesized that the presence of both SCT and ADHD would be related to poorer neuropsychological functioning on measures of sustained attention and academic achievement than the presence of either independently.

CHAPTER 2

METHODOLOGY

Procedure

Data for the current study were collected over the course of approximately 8 years through a psychoeducational assessment clinic in the Mid-Atlantic United States. Children were referred to the clinic by community practitioners, mental health professionals, and schools. Although children were seeking clinical assessments, families agreed to allow their de-identified data to be used for research purposes. The Institutional Review Board approved the study and both child assent and parent consent was obtained prior to the start of the study. No specific inclusion criteria were used for assessment participation.

There were two clinicians assigned per family. One clinician interviewed the parent(s) and administered parent measures while the other clinician separately conducted the child assessment. Children completed intellectual and achievement testing, a clinical interview, several self-report and laboratory measures in addition to a semi-structured diagnostic interview over the course of three sessions. The assessments were administered by trained graduate-student clinicians, enrolled in an American Psychological Association-approved doctoral program in clinical psychology. All clinicians had taken relevant coursework that qualified them to conduct the diagnostic interviews and were blind to the study purpose. In addition, they received training on administering and scoring the diagnostic interview. In training, clinicians were observed by a senior clinician until they were determined to be reliable. All interviews were videotaped. A subset of the child (n = 20) and parent (n = 36) interviews were selected for evaluating inter-rater

reliability. Child interviews ($\kappa = 0.71$) demonstrated good or acceptable inter-rater reliability, and parent interviews ($\kappa = 0.77$) showed excellent inter-rater reliability across the various diagnoses (Grills & Ollendick, 2003).

Following the interviews, consensus team meetings were held to discuss diagnostic impressions. Both of the interviewing clinicians as well as an experienced licensed clinical psychologist participated in the meeting. Each clinician reported their clinical interpretations based on the symptoms and interference reported on the Anxiety Disorders Interview Schedule for Children. Intellectual and achievement assessment scores and school, psychiatric, and medical records were considered when deriving diagnoses (Grills & Ollendick, 2003). Consensus diagnoses were then assigned based on the information discussed.

A total of 173 children were selected from the original sample of 407 children based on a diagnosis of *DSM-IV* ADHD (for the ADHD groups) and the absence of a diagnosis of *DSM-IV* ADHD (i.e., for the SCT Only group). Additionally, participants were excluded if they had Full Scale IQ scores < 80 ($n = 40$) or presence or suspected presence of Autism ($n = 2$), Asperger syndrome, ($n = 12$), Pervasive Developmental Disorder ($n = 15$), Developmental Disorder NOS ($n = 2$) or Bipolar Disorder ($n = 10$).

The participants ranged from 6 to 17 years old ($M = 9.97$, $SD = 2.64$) and 64.4% were male. The majority of the sample identified as Caucasian (92.5%). The remaining identified as African American (3.1%), Hispanic (1.9%), or Other (2.5%). Three groups were created to address study purposes: ADHD Only ($n = 108$; 65.9%), ADHD + SCT ($n = 34$, 20.7%), and SCT Only ($n = 22$; 13.4%). The prevalence of diagnoses that are often comorbid with ADHD was examined across the three groups using chi-square analyses. For analyses, if $n \leq 5$ in any of the groups compared, the *p*-value from Fisher's Exact test is reported. Groups did not significantly

differ on the rate of anxiety disorders, χ^2 (2) = .31, p = .86 or oppositional defiant disorder/ conduct disorder, p = 1.00. The groups did differ on learning disorders, p = .002 and mood disorders, p = .03. In the ADHD + SCT group, 40.0 % had a learning disorder while 12.5% had a mood disorder. In the ADHD Only group, 32.3% had a learning disorder while 3.8% had a mood disorder. Finally, in the SCT Only group, 0% had a learning disorder while 16.7 % had a mood disorder. These results suggest that learning disorders were more common in those with ADHD, and mood disorders were more common in those with SCT.

Measures

Anxiety Disorders Interview Schedule, Child/Parent versions (ADIS-C/P; Silverman & Albano, 1996). The ADIS-C/P versions are semi-structured interviews that assess for a range of child and adolescent psychiatric disorders. The diagnostic information retrieved from guardians and children is combined to create a comprehensive diagnostic image. Assessment items measure the presence or absence of symptoms for various disorders. For endorsed symptoms, interference or impairment is assessed using a 9-point (0-8) scale that increases in severity (e.g., 0 indicating no impairment and 8 indicating very severely disturbing/disabling). Interviewee's ratings are used to highlight pertinent conditions and inform the clinician's severity rating (CSR). A CSR of 4 or above on the scale of 0-8 is indicative of warranting a diagnosis (Silverman & Albano, 1996).

The ADIS-C/P have demonstrated test-retest reliability estimates in the acceptable to excellent range (κ = 0.61-1.00) for diagnoses made based on parent, child, and combined reports for children aged 7-16 (Silverman, Saavedra, & Pina, 2001). Additionally, inter-rater reliability estimates range from excellent for all anxiety disorders (κ = 0.80-1.00), to between good and excellent for mood and externalizing disorders (κ = 0.65-0.77; Lyneham, Abbott, & Rapee

2007). Furthermore, findings from Jarrett, Wolff, & Ollendick (2007) support the concurrent validity of the ADHD module of the ADIS.

Multidimensional Anxiety Scale for Children (MASC; March, 1997; March, Parker, Sullivan, Stallings, & Conners, 1997). The MASC is a 39-item self-report measure that assesses anxiety symptoms in children and adolescents between 8 and 19 years old. Item responses are based on a 4-point Likert scale (i.e., never true, rarely true, sometimes true, and often true.) Symptoms measured are grouped into the following major and subfactor scales: physical symptoms (tense/restless and somatic/autonomic), social anxiety (humiliation/rejection and public performance fears), harm avoidance (perfectionism and anxious coping), and separation anxiety. Additionally, indexes on anxiety disorders, total anxiety, and inconsistency are reported. The MASC has shown high internal consistency (α = 0.54-0.90) as well as adequate test-retest reliability over a 3-week period (ICC = 0.64-0.93).

Children's Depression Inventory (CDI; Kovacs, 1985). The CDI is a 27-item self-report measure that assesses affective, behavioral, and cognitive symptoms of depression in youth between 7 and 17 years old. Youth respond to items by selecting from one of three statements provided. Youth are asked to choose the statement that they believe best represents them. The statements differ in their description of the presence and severity of depressive symptoms. The CDI provides a total score and scores for the following subscales: negative mood, interpersonal problems, ineffectiveness, anhedonia, and negative self-esteem. The CDI has shown acceptable test-retest reliability in boys and girls, as well as high levels of internal consistency and convergent validity (Blumberg & Izard, 1986; Kovacs, 1992; Smucker, Craighead, Craighead, & Green, 1986).

Child Behavior Checklist (CBCL/6-18; Achenbach & Rescorla, 2001). The CBCL/6-18 is a 113-item questionnaire that assesses problem behaviors and competencies in youth between 6 and 18 years old. Items are rated on a scale of 0-2 (0 = never true, 1 = sometimes true, and 2 = often true) and designed to be completed by the caretaker. This study considered the following syndrome and diagnostic scales: sluggish cognitive tempo, internalizing problems (anxious/depressed and withdrawn/depressed), social problems, social withdrawal, sleep problems, attention problems, and externalizing problems (rule-breaking behavior and aggressive behavior). The sluggish cognitive tempo item set has shown adequate reliability in past research with school-age children (Becker, Luebbe, Fite, Stoppelbein, & Greening, 2013; Garner et al., 2010). The reliability of the SCT construct in the current sample was $\alpha = .74$. Further, the reliability of the attention problems construct after removing SCT items was $\alpha = .54$. This modified attention problems construct was used in the subsequent analyses.

Additionally, a social withdrawal construct that Katz, Conway, Hammen, Brennan, and Najman (2011) created using the following five CBCL items ("withdrawn, doesn't get involved with others," "sulks a lot," "refuses to talk," "likes to be alone" and an item assessing a child's approximate number of acquaintances) was examined. Using latent variable modeling, Katz et al. (2011) found that the items loaded significantly on one factor and provided an adequate fit to the data. Using the first 4 items of the construct, the reliability of the social withdrawal construct in this study suggested fair internal consistency, $\alpha = .62$.

Lastly, problems with sleep were assessed using the six items ("experiences nightmares," "sleeps less than most children," "sleeps more than most children," "talks or walks in sleep,""trouble sleeping," and "overtired"). These items were selected based off of previous studies (Becker, Ramsey, & Byars, 2014; Gregory et al., 2011). Becker et al. (2014) evaluated

the convergent validity of the CBCL sleep items with other parent and youth report measures assessing for sleep problems. They found that CBCL sleep items and the CBCL sleep composite correlated with well-validated sleep measures, supporting the use of the CBCL sleep items (Becker et al., 2014). Gregory et al. (2011) also examined the CBCL sleep items but investigated the relationship the items have with sleep diaries, actigraphy, and polysomnography. Similar to Becker et al. (2015), they found correlations between the CBCL sleep items (i.e., "overtired," "sleeps less," "sleeps more," and, "trouble sleeping") and other measures of sleep. In the present study, the internal consistency of the sleep construct was fair, $\alpha = .65$. The general reliability ($\alpha = .63$-$.97$) and validity of the CBCL are well-established (Achenbach & Rescorla, 2001).

Teacher Report Form (TRF/6-18; Achenbach & Rescorla, 2001). The TRF/6-18 is a 113-item assessment that is completed by school personnel designed to measure problem behaviors and clinical syndromes in youth between 6 and 18 years of age. The same scales and constructs examined using the CBCL were also examined using the TRF; however, scores for SCT, sleep problems, and social withdrawal were not be examined, since the current data set did not include item-level data for teachers. The TRF is another frequently used assessment which has shown acceptable reliability ($\alpha = .60$ - $.96$) and validity (Achenbach & Rescorla, 2001).

Neuropsychological, Cognitive, and Academic Functioning

Beery-Buktenica Developmental Test of Visual-Motor Integration- IV (VMI-IV; Beery, 1997). The VMI-IV is an assessment used to identify difficulties with the perception of visual stimuli and fine motor coordination in individuals between 3 and 18 years of age. It can be administered in either full or short format; in this study, the full format assessment was used. Participants are asked to copy 27 geometric figures that increase in difficulty into designated

areas of a workbook. This measure has been used to screen for visual-motor deficits related to learning, behavioral, and neuropsychological problems (Beery, 1997). The reliability and validity of this measure are well-established (Beery, 1997).

Conners Continuous Performance Test (CPT; Conners, 1994, 2000). The CPT is a 14-minute computerized test measuring sustained attention and inhibitory control in children ages 6 and above. Participants are instructed to press the space bar on the keyboard when any letter other than the letter "X" appears on the computer screen. In this study, the measures of interest were commission and omission errors, reaction time, and reaction time variability. Given the time frame of the study, both the Conners' CPT and CPT-II were administered during the course of the study.

Rey-Osterrieth Complex Figure (ROCF; Rey, 1941; Osterrieth, 1944). The ROCF is a neuropsychological assessment tool that takes approximately 10 to 15 minutes to administer. It assesses for visual spatial constructional ability and spatial working memory. Individuals are asked to copy a complex figure with the figure available and then from memory after a short delay. To complete the copy task, individuals view the ROCF figure for a minimum of two-and-a-half minutes and a maximum of five minutes while copying the figure onto a blank sheet of paper using a pencil. The ROCF was scored using modified scoring criteria developed by Rey (Meyers & Meyers, 1995); low scores indicate poor visual and perceptual motor abilities. Inter-rater reliability was obtained for 25% of the figures (n = 76) and found to be highly acceptable.

Wechsler Intelligence Scale for Children (WISC; Wechsler, 1991, 2003). The WISC is used to measure intellectual ability in children between the ages of 6-17 years old. Administration of the full assessment provides a global measure of intelligence, the Full Scale Intelligence Quotient Index (FSIQ), as well as independent subscale scores on verbal

comprehension, perceptual reasoning, working memory, and processing speed abilities. Since the current study was conducted over a number of years, both WISC-III and WISC-IV versions were utilized.

Wechsler Individual Achievement Test (WIAT; Wechsler, 1992, 2002). The WIAT is used in evaluating achievement in individuals between the ages of 4 and 85 years old. It provides scores for reading, mathematics, written language, and oral language skills. The WIAT has shown split-half, test-retest, and inter-rater reliabilities at or above 0.80 (subscales) and 0.90 (composites). Given the time frame of the current study, both the WIAT and WIAT-II were utilized.

CHAPTER 3

RESULTS

Data Analysis

Data were screened for outliers by reviewing standardized *z* scores. Those with extreme *z* scores (i.e., ±3.29; $n = 40$), were adjusted to reflect the raw equivalent of *z* scores of -3.29 or +3.29. Distributions of each measure were also examined for skewness and kurtosis. Although there were some instances of skewness and kurtosis, research suggests that *F* tests control the Type I error rate well under conditions of skew, kurtosis, and non-normality (Glass, Peckham, & Sanders, 1972). Finally, since missing data were limited, listwise deletion was utilized for study analyses.

Data were analyzed using chi square tests, ANOVAs, and linear regressions. For analyses examining measures with multiple sub-domains, alpha levels were adjusted using Holm-Bonferroni corrections. Significant ANOVA results were further explored using Hochberg's GT2 post-hoc comparison technique, given that this post-hoc test is ideal for uneven cell sizes (Field, 2009).

Preliminary analyses compared youth with a diagnosis of ADHD-I to those diagnosed with ADHD-C, since some past research has found subtype differences on variables examined in the current study. These groups were compared on the SCT symptom total score and the level (i.e., high, or low) of SCT symptoms. Individuals were characterized as having high SCT if the total raw scores from the four CBCL SCT items were endorsed with scores of 4 or above. A raw score of 4 was chosen, since this score is associated with a *T*-score of 65 on the CBCL. Since

sub-types did not differ on SCT symptoms, $t(140) = .52$, $p = .76$ or SCT level, $\chi^2(1) = .16$, $p = .69$, they were collapsed into a single ADHD group for subsequent analyses. It should be noted that youth diagnosed with ADHD-C had significantly more ($d = .73$) sleep problems than those diagnosed with ADHD-I, $t(139) = 4.01$, $p < .01$; however, subtypes did not significantly differ on social withdrawal, $t(137) = .54$, $p = .59$.

On demographic variables, groups did not differ on gender, $\chi^2(2) = .16$, $p = .92$, parent-reported marital status, $\chi^2(2) = .34$, $p = .84$, mother's highest education level obtained, $\chi^2(6) = 4.38$, $p = .63$, and father's highest education level obtained, $\chi^2(6) = 6.07$, $p = .42$. In relation to race, a chi-square analysis could not be conducted due to having so few non-Caucasian participants. A one-way ANOVA showed that groups did not differ on family income, $F(2, 124) = 1.87$, $p = .16$. For age, there was a violation of the homogeneity of variance assumption, so groups were compared using a Kruskal-Wallis test. This test resulted in a significant difference $H(2) = 8.34$, $p = .02$. Pairwise comparisons revealed that the SCT Only group ($M = 11.77$, $SD = 3.31$) was significantly older ($d = .66$) than the ADHD + SCT group ($M = 9.76$, $SD = 2.73$) and significantly older ($d=.73$) than the ADHD Only group ($M = 9.67$, $SD = 2.32$).

Table 1 shows the findings comparing the groups on the various symptom domains. On the CBCL, groups differed on Attention Problems, $F(2,151) = 7.28$, $p < .01$. Post-hoc tests revealed that ADHD + SCT had significantly more ($d =.73$, .98, respectively) attention problems than both ADHD Only and SCT Only. ADHD Only and SCT Only did not significantly differ from one another on Attention Problems.[1] Groups also differed on Internalizing Problems, $F(2,160) = 21.72$, $p < .01$. Post-hoc tests showed that ADHD + SCT and SCT Only had significantly higher scores ($d = .78$, 1.50, respectively) than ADHD Only, but did not differ from one another. Since there were significant differences on Internalizing Problems, we explored the

Anxious/Depressed and Withdrawn/Depressed subfactors. For Anxious/Depressed, group differences also surfaced, $F(2,160) = 15.71$, $p < .01$. Post-hoc tests showed the same pattern as Internalizing Problems with ADHD + SCT and SCT Only showing significantly higher scores ($d = .60, 1.13$, respectively) than ADHD Only. Groups also differed on Withdrawn/Depressed, $F(2, 160) = 31.29$, $p < .01$. Again, post-hoc tests showed that ADHD + SCT and SCT Only were significantly higher ($d = .94, 1.74$, respectively) than ADHD Only. Groups also differed on Externalizing Problems, $F(2,160) = 4.34$, $p <.02$. Post-hoc tests revealed that SCT Only was significantly higher ($d = .64$) than ADHD Only. Since there were significant differences on Externalizing Problems, we explored the Rule Breaking behavior and Aggressive behavior subfactors. While groups were not significantly different on either subfactor they were marginally significant differences on Aggressive behavior, $F(2,160) = 4.12$, $p = .02$. Post- hoc tests showed that SCT Only was significantly higher ($d = .64$) than ADHD Only. No significant differences emerged between the groups on Social Problems.

In addition to standard CBCL constructs, we also explored constructs evaluated in past studies including constructs reflecting sleep problems and social withdrawal. For these analyses, ANCOVAs were utilized controlling for age and gender, since these constructs were not age- and gender-corrected *T*-scores. On the sleep construct, groups significantly differed, $F(2, 154) = 9.06$, $p < .01$. Similar to findings with the other CBCL constructs, post-hoc tests revealed that ADHD + SCT and SCT Only were significantly higher ($d= .51, .90$, respectively) than ADHD Only. Lastly, the groups were significantly different on the social withdrawal construct, $F(2, 155) = 14.59$, $p < .01$. Post-hoc tests showed that the SCT groups, ADHD + SCT (d=.70) and SCT Only (d=1.11), presented greater social withdrawal symptoms than the ADHD Only group.

On the TRF, while none of the analyses were significant, several of the comparisons

approached significance: Attention Problems, $F(2,127) = 2.95$, $p = .06$, Internalizing Problems, $F(2,127) = 3.06$, $p = .05$, or Externalizing Problems, $F(2,127) = 2.57$, $p = .08$. For Social Problems, there was a violation of the homogeneity of variance assumption, so groups were compared using a Kruskal-Wallis. The results replicated the non-signifcant ANOVA finding, $H(2) = 5.52$, $p = .06$. Despite not detecting significant group differences, some interesting trends emerged. Generally, teachers rated youth with ADHD as slightly higher on Attention Problems, Internalizing Problems, Externalizing Problems and Social Problems. Of importance, the ADHD + SCT and ADHD Only groups were almost identical on Attention Problems and quite similar on Internalizing Problems. For Externalizing Problems and Social Problems, the ADHD Only group had highest means while the SCT Only group had the lowest means.

Groups were also compared on child-reported internalizing symptoms. On the MASC, various anxiety domains were examined, but no differences were found between the groups on Separation/Panic, $F(2,116) = 1.64$, $p = .20$, Harm Avoidance, $F(2,116) = .06$, $p = .94$, and Physical Symptoms, $F(2, 116) = .78$, $p = .46$. Similarly, on the CDI, no differences appeared between the groups on any of the subscales, including Negative Mood, $F(2, 123) = 1.04$, $p = .36$, Interpersonal Problems, $F(2,122) = .73$, $p = .48$, Ineffectiveness, $F(2, 123) = .30$, $p = .74$, Anhedonia, $F(2, 123) = .88$, $p = .42$, and Negative Self-Esteem, $F(2, 123) = 1.37$, $p = .26$. On the MASC sub-scale Social Anxiety and on the CDI sub-scale Negative Self-Esteem, there was a violation of the homogeneity of variance assumption. Kruskal-Wallis analyses showed the same thing as the ANOVAs; the results were non-significant, $H(2) = .28$, $p = .87$ and $H(2) = 2.16$, $p = .34$, respectively.

Table 1. Group Differences on Symptomatology

CBCL	**ADHD (n = 108)**	**ADHD+SCT (n = 34)**	**SCT (n = 21)**	**F**	***df***	***p***	η_p^2 **or** η^2
Attention Problems	7.47 (2.68)[a]	9.30 (2.34)[b]	6.90 (2.57)[a]	7.28	2, 153	< **.01**	.09
Internalizing Problems	59.04 (10.08)[a]	66.97 (10.22)[b]	72.95 (8.41)[b]	21.72	2, 160	< **.01**	.21
Anxious/Depressed	60.01 (8.21)[a]	65.68 (10.51)[b]	71.38 (11.64)[b]	15.71	2, 160	< **.01**	.16
Withdrawn/Depressed	57.33 (7.31)[a]	65.32 (9.57)[b]	70.24 (7.51)[b]	31.29	2, 160	< **.01**	.28
Externalizing Problems	60.71 (10.77)[a]	64.50 (9.30)	67.10 (9.18)[b]	4.34	2, 160	**.02**	.05
Rule Breaking behavior	59.45 (8.64)	61.50 (9.36)	63.10 (8.24)	1.90	2, 160	.15	.02
Aggressive behavior	62.67 (10.46)	65.50 (10.38)	69.57 (11.26)	4.12	2, 160	.02	.05
Social Problems	40.89 (9.40)	41.70 (7.96)	40.14 (9.38)	.20	2, 157	.82	.002
Additional CBCL	**ADHD (*n* = 107)**	**ADHD+SCT (*n* = 33)**	**SCT (*n* = 19)**	**F**	***df***	***p***	η_p^2
Sleep Problems	1.93 (2.13)[a]	3.12 (2.56)[b]	4.11 (2.69)[b]	9.06	2, 154	< **.01**	.11
Additional CBCL	**ADHD (*n* = 105)**	**ADHD+SCT (*n* = 33)**	**SCT (*n* = 22)**	**F**	***df***	***p***	η_p^2
Social Withdrawal	1.30 (1.40)[a]	2.39 (1.71)[b]	3.27 (2.07)[b]	14.59	2, 155	< **.01**	.16
TRF	**ADHD (*n* = 87)**	**ADHD+SCT (*n* = 26)**	**SCT (*n* =17)**	**F or H**	***df***	***p***	η^2
Attention Problems	64.00 (8.11)	64. 65 (7.85)	59.18 (7.27)	2.95	2, 127	.06	.04
Internalizing Problems	57.16 (10.23)[a]	55.92 (8.10)	50.65 (10.86)[b]	3.06	2, 127	.05	.05
Externalizing Problems	59.51 (9.97)	56.62 (7.63)	54.00 (12.91)	2.57	2, 127	.08	.04
Social Problems	60.26 (9.02)	57.62 (5.50)	55.47 (7.38)	5.52	2	.06	.04
MASC	**ADHD (*n* = 79)**	**ADHD+SCT (*n* = 24)**	**SCT (*n* = 16)**	**F or H**	***df***	***p***	η^2
Social Anxiety	51.58 (14.12)	50.38 (12.82)	48.31 (10.07)	.28	2	.87	.007
Separation/Panic	54.33 (14.58)	52.67 (10.64)	47.63 (12.16)	1.64	2, 116	.20	.03
Harm Avoidance	47.04 (13.36)	48.08 (12.73)	47.38 (12.96)	.06	2, 116	.94	.001
Physical Symptoms	50.89 (12.82)	49.17 (11.42)	46.88 (10.64)	.78	2, 116	.46	.01
CDI	**ADHD (*n* = 85)**	**ADHD+SCT (*n* = 24)**	**SCT (*n* = 17)**	**F or H**	***df***	***p***	η^2
Negative Mood	50.76 (11.78)	47.67 (11.39)	47.53 (10.16)	1.04	2, 123	.36	.02

Interpersonal Problems	52.14 (10.77)	49.83 (10.24)	49.65 (8.22)	.73	2, 122	.48	.01
Ineffectiveness	51.94 (11.27)	51.88 (11.94)	49.65 (9.96)	.30	2, 123	.74	.004
Anhedonia	52.35 (10.93)	50.17 (10.34)	49.24 (7.74)	.88	2, 123	.42	.01
Negative Self-Esteem	48.53 (10.67)	45.46 (7.65)	45.53 (5.98)	2.16	2	.34	.02

Note. CBCL= Child Behavior Checklist; TRF= Teacher Report Form; MASC= Multidimensional Anxiety Scale for Children; CDI= Children's Depression Inventory; Holm-Bonferroni corrections used to adjust alpha levels in analyses of measures with multiple sub-scales; bold *p*-values represent significant differences. Group comparisons for CBCL Attention Problems were completed with the modified sub-scale, after removing SCT items. Effect size was measured as either $\boldsymbol{\eta_p^2}$ **or** $\boldsymbol{\eta^2}$ depending on whether an ANOVA or ANCOVA was used to analyze the data.

Table 2 shows the findings comparing the groups on neuropsychological task performance and on intellectual and academic variables. Since we used raw scores for the CPT, we utilized ANCOVA analyses controlling for age and gender. On the CPT, groups were significantly different on the total number of omissions, $F(2, 141) = 5.30$, $p < .01$. Post-hoc tests showed that the SCT Only group had significantly less (d=1.28) omissions than the ADHD Only group. However, there was a violation of the assumption of homogeneity of variances. No differences emerged across the groups on the overall hit rate, $F(2, 141) = .26$, $p = .77$, hit rate standard error, $F(2,141) = 3.20$, $p = .04$, or total number of commissions, $F(2,141) = 1.89$, $p = .16$. It should be noted, that hit rate standard error was marginally significant after a Holm-Bonferroni correction ($p = .04$) with a trend towards less reaction time variability in those with SCT Only relative to the other groups. On the ROCF, significant group differences emerged on the copy standard score, $F(2, 133) = 4.07$, $p <.05$, but not on the memory standard score $F(2,132) = 2.29$, $p = .11$. Post-hoc tests revealed that SCT Only scored higher than ADHD Only (d= .67). Finally, on the VMI, no group differences emerged, $F(2, 145) = 1.68$, $p = .19$.

On measures of intelligence and academic functioning, groups differed on Full Scale IQ, $F(2, 161) = 3.33$, $p < .05$. Post-hoc tests showed that SCT Only had significantly higher FSIQ scores (d= .58) than the ADHD Only group. Nevertheless, all groups had FSIQ scores in the average range. Additionally, the indices of the WISC were examined for group differences. No significant differences were detected between the groups on any of the four indexes, including Verbal Comprehension, $F(2, 156) = 4.56$, $p = .01$, Perceptual Reasoning, $F(2, 156) = 1.88$, $p = .16$, Working Memory, $F(2, 154) = 1.78$, $p = .17$, and Processing Speed, $F(2, 155) = 2.25$, $p = .11$.

On the WIAT, the groups did not differ on Reading, $F(2, 151) = 3.05$, $p = .05$, Writing, $F(2, 139) = 2.54$, $p = .08$, Mathematics, $F(2, 151) = 2.77$, $p = .07$, and Oral Language, $F(2, 149) = 2.83$, $p = .06$.

Table 2: Group Differences on Neuropsychological, Intellectual, and Achievement Variables

CPT	**ADHD (*n* = 94)**	**ADHD+SCT (*n* = 32)**	**SCT (*n* = 20)**	**F**	***df***	***p***	η_p^2
Omissions	25.13 (19.24)[a]	18.81 (16.22)	6.50 (7.15)[b]	5.30	2, 141	**.01**	.07
Overall Hit Rate	397.63 (97.95)	400.16 (78.65)	356.24 (90.34)	.26	2, 141	.77	.004
Hit Rate Standard Error	15.69 (6.85)	13.45 (6.51)	9.77 (7.90)	3.20	2, 141	.04	.04
Commissions	25.34 (8.48)	23.91 (7.22)	19.70 (7.61)	1.87	2, 141	.16	.03
ROCF	**ADHD (*n* = 88)**	**ADHD+SCT (*n* =29)**	**SCT (*n* = 19)**	**F**	***df***	***p***	η^2
Copy Standard Score	91.94 (13.41)[a]	92.52 (16.13)	102.40 (17.63)[b]	4.07	2, 133	**.02**	.06
Memory Standard Score	92.16 (16.24)	91.10 (13.91)	99.92 (12.78)	2.29	2, 132	.11	.03
VMI	**ADHD (*n* = 98)**	**ADHD+SCT (*n* = 31)**	**SCT (*n* = 19)**	**F**	***df***	***p***	η^2
Scaled Score	96.35 (12.66)	92. 87 (17.98)	100.05 (9.77)	1.68	2, 145	.19	.02
WISC- IV	**ADHD (*n* = 108)**	**ADHD+SCT (*n* = 34)**	**SCT (*n* = 22)**	**F**	***df***	***p***	η^2
FSIQ	99.30 (12.33)	102.06 (13.00)	106. 64 (12.93)	3.33	2, 161	**.04**	.04
Verbal Comprehension*	100.19 (15.06)	107.47 (13.54)	108.24 (16.46)	4.56	2, 156	.01	.06
Perceptual Reasoning	102.51 (12.15)	105.19 (13.51)	107.76 (10.83)	1.88	2, 156	.16	.02
Working Memory	96.04 (13.33)	96.88 (10.86)	101.95 (14.94)	1.78	2, 154	.17	.02
Processing Speed	94.90 (13.86)	89.81 (12.40)	96.67 (11.56)	2.25	2, 155	.11	.03
WIAT-IV	**ADHD (*n* = 101)**	**ADHD+SCT (*n* = 32)**	**SCT (*n* = 21)**	**F**	***df***	***p***	η^2
Reading Composite	98.35 (15.29)	100.19 (13.88)	107.33 (16.56)	3.05	2, 151	.05	.04
Math Composite	96.46 (13.85)	98.13 (14.54)	104.57 (16.59)	2.77	2, 151	.07	.04
Writing Composite	92.76 (13.43)	95.61(11.89)	100.39 (16.92)	2.54	2, 139	.08	.04
Language Composite	108.81 (14.42)	110.84 (12.36)	116.76 (14.21)	2.83	2, 149	.06	.04

Note: CPT= Conners' Continuous Performance Test; ROCF= Rey- Osterrieth Complex Figure; VMI= Test of Visual Motor Integration; WISC=Wechsler Intelligence Scale for Children; WIAT= Wechsler Individual Achievement Test; Holm-Bonferroni corrections used to adjust alpha levels in analyses of measures with multiple sub-scales; bold *p*-values represent significant differences.* For Verbal Comprehension the *p*-value was marginally significant, it was equivalent to the alpha level. Effect size was measured as either $\boldsymbol{\eta_p^2}$ **or** $\boldsymbol{\eta^2}$ depending on whether an ANOVA or ANCOVA was used to analyze the data.

Regression Analyses

Multiple regression analyses were used to further explore how SCT symptoms *uniquely* relate to youth functional impairments (e.g., social functioning, academic functioning) after controlling for common covariates that are associated with functional impairments. Hierarchical regressions were utilized with SCT symptoms in Step 1, co-occurring symptoms in Step 2, and neuropsychological variables in Step 3. For Step 2, the following CBCL symptom domains were evaluated: Attention Problems, Internalizing Problems, Externalizing Problems, and Sleep Problems.[2] For Step 3, variables included reaction time variability, visual and perceptual ability, and fine motor control. The outcome variables in the regression analyses included CBCL Social Problems, CBCL Social Withdrawal, and Reading, Math, and Writing Composites from the WIAT.

Table 3 presents the results for social functioning from the multiple regression analyses. For the CBCL Social Problems, Step 1 was significant ($p < .05$) with SCT Symptoms positively relating to CBCL Social Problems ($\beta = .35$; $\Delta R^2 = .12$). For Step 2, the overall step was significant ($p < .05$; $\Delta R^2 = .29$). SCT Symptoms became nonsignificant with significant associations for Attention Problems ($\beta = .22$), Internalizing Problems ($\beta = .25$), Externalizing Problems ($\beta = .23$), and Sleep Problems ($\beta = .15$).[2] Step 3 was nonsignificant ($p > .05$). The final model included the following significant predictors: Attention Problems ($\beta = .21$), Internalizing Problems ($\beta = .26$), Externalizing Problems ($\beta = .22$) and Sleep Problems ($\beta = .15$).

For CBCL Social Withdrawal, Step 1 was significant ($p < .05$; $\Delta R^2 = .22$) with SCT Symptoms positively relating to CBCL Social Withdrawal ($\beta = .47$). For Step 2, the overall step was significant ($p < .05$; $\Delta R^2 = .19$). SCT Symptoms remained significant ($p < .05$; $\beta = .24$) with additional significant associations for Internalizing Problems ($\beta = .42$) and Externalizing Problems ($\beta = .20$). Step 3 was nonsignificant ($p > .05$).

The final model included the following significant predictors: SCT Symptoms ($\beta = .25$), Internalizing Problems ($\beta = .42$), and Externalizing Problems ($\beta = .19$).

Table 3: Multiple Regression Results: Predicting Mother- Reported Social Functioning

	Social Problems						Social Withdrawal					
	Step 1		Step 2		Step 3		Step 1		Step 2		Step 3	
Predictor	*b*	β	*b*	β	*b*	β	*b*	β	*b*	β	*b*	β
Constant	56.37		32.76		34.35		.78		-3.69		-3.91	
SCT Symptoms	1.66**	.35**	.03	.01	.06	.01	.42**	.47**	.21**	.24**	.22**	.25**
Attention Problems			.62**	.22**	.59**	.21**			-.04	-.07	-.04	-.07
Internalizing Problems			.19**	.24**	.19**	.26**			.06**	.42**	.06**	.42**
Externalizing Problems			.18**	.25**	.17**	.22**			.03**	.20**	.03**	.19**
Sleep Problems			.59*	.15*	.57*	.15*			-.05	-.08	-.05	-.07
Hit Rate Standard Error					.03	.04					.01	.10
Copy Standard Score					.00	.00					.01	.03
VMI Scaled Score					-.02	-.03					.00	.00
Total R^2	.12**		.41**		.41		.22*		.40*		.41	
N			194						193			

Note: **= *p*<.01; *= *p*< .05; *b*= unstandardized regression coefficient; β= standardized regression coefficient.

Table 4 shows the multiple regression results for academic functioning as measured by the WIAT. For the Reading Composite, Step 1 was nonsignificant ($p > .05$) with CBCL SCT Symptoms not significantly relating to the Reading Composite. For Step 2, the overall step was significant ($p < .05$; $\Delta R^2 = .08$). Significant associations were found for CBCL SCT Symptoms ($\beta = .20$) and CBCL Attention Problems ($\beta = -.28$). Step 3 was also significant ($p < .05$; $\Delta R^2 = .18$). The final model included the following significant predictors: CBCL Attention Problems ($\beta = -.16$) and the VMI Score ($\beta = .42$). CBCL SCT symptoms were marginally significant ($p = .05$, $\beta = .16$) in the final model.

For the Math Composite, Step 1 was nonsignificant ($p >.05$) with CBCL SCT Symptoms not significantly relating to the Math Composite. For Step 2, the overall step was significant ($p < .05$; $\Delta R^2 = .09$). Significant and marginally significant associations were found for CBCL Attention Problems ($\beta = -.24$) and CBCL SCT Symptoms ($p = .05$, $\beta = .17$). Step 3 was also significant ($p < .05$; $\Delta R^2 = .10$). The only significant predictor in the final model was the VMI Score ($\beta = .27$).

Finally, for the Writing Composite, Step 1 was nonsignificant ($p > .05$) with CBCL SCT Symptoms not significantly relating to the Writing Composite. For Step 2, the overall step was significant ($p < .05$; $\Delta R^2 = .08$). CBCL Attention Problems was the only significant predictor ($\beta = -.31$). Step 3 was also significant ($p < .05$; $\Delta R^2 = .12$). The final model included the following significant predictors: CBCL Attention Problems ($\beta = -.21$) and the VMI Score ($\beta = .36$). CBCL Externalizing Problems were marginally significant ($p = .05$, $\beta = .18$) in the final model.

Table 4: Multiple Regression Analyses Predicting Academic Achievement

Reading Composite

	Step 1		Step 2		Step 3	
Predictor	*b*	β	*b*	β	*b*	β
Constant	99.37		104.31		61.41	
SCT Symptoms	.55	.07	1.64*	.20*	*1.30*	*.16*
Attention Problems			-1.36**	-.28**	-.78*	-.16*
Internalizing Problems			.03	.02	-.12	-.10
Externalizing Problems			.03	.02	.10	.07
Sleep Problems			-.82	-.12	-.46	-.07
Hit Rate Standard Score					-.08	-.07
Copy Standard Score					.07	.04
VMI Scaled Score					.45**	.42**
Total R^2	.01		.09**		.26**	
N	188		188		188	

Math Composite

	Step 1		Step 2		Step 3	
Predictor	*b*	β	*b*	β	*b*	β
Constant	100.37		116.97		88.24	
SCT Symptoms	.01	.00	*1.41*	*.17*	1.03	.13
Attention Problems			-1.15**	-.24**	-.70	.14
Internalizing Problems			-.06	-.04	-.15	-.12
Externalizing Problems			-.13	-.10	-.09	-.07
Sleep Problems			-.42	-.06	-.08	-.01
Hit Rate Standard Score					-.12	-.12
Copy Standard Score					.16	.09
VMI Scaled Score					.28**	.27**
Total R^2	.00		.19**		.20**	
N	189		189		189	

Writing Composite

	Step 1		Step 2		Step 3	
Predictor	*b*	β	*b*	β	*b*	β
Constant	95.21		96.51		64.67	
SCT Symptoms	.18	.02	1.11	.14	.99	.13
Attention Problems			-1.39**	-.31**	-.96*	-.21*
Internalizing Problems			-.09	-.08	-.20	-.17
Externalizing Problems			.20	.15	*.23*	*.18*
Sleep Problems			-.23	-.04	-.03	-.00
Hit Rate Standard Score					-.03	-.03
Copy Standard Score					-.02	-.01
VMI Scaled Score					.36**	.36**
Total R^2	.00		.08**		.20**	
N	172		172		172	

Note: *=p<.05, **= p<.01. italicized values indicate marginal significance (*p*=.05); *b*= unstandardized regression coefficient. β= standardized regression coefficient.

CHAPTER 4

DISCUSSION

In recent years, there has been an increase in research to understand how SCT relates to ADHD as well as other clinical diagnoses and areas of impairment. The present study aimed to extend this literature by examining differences between diagnostic groupings and the unique predictive effects of SCT. Distinguishing factors of this study include data on various aspects of child functioning collected from a large clinical sample, ratings from multiple informants (i.e., parents, teachers, clinicians), and the use of a variety of methods (e.g., report-based measures, laboratory tasks).

Diagnostic Group Analyses

Results were mixed regarding our predicted demographic differences between groups. Most of our comparisons were not significant; however, like Barkley (2012), we found that SCT groups had older children than the ADHD Only group. Contrary to his findings, we did not find significant differences across the groups on gender representation, family income, or parent's highest level of education. Perhaps these differences were absent in our sample because we had a smaller sample than Barkley and, of particular importance, a smaller SCT Only group than both ADHD groups. Further, our study used data from a clinic-referred sample rather than in the population (as in Barkley's study). These sample differences may also partially explain differences in findings.

Informed by past research (Barkley, 2012; Carlson & Mann, 2002; Hartman et al., 2004; Skirbekk et al., 2011), we expected to observe differences in co-occurring symptomatology

across the groups, particularly in domains such as internalizing problems, sleep problems, and social withdrawal. Interestingly, group differences were significant for parent-reported symptoms from the CBCL but not for teacher ratings from the TRF or child ratings from the MASC and CDI. While teacher ratings did not show significant differences between the groups, unlike CBCL ratings, TRF ratings suggested that children with ADHD Only had higher levels of attention problems, internalizing symptoms, externalizing symptoms, and social problems than those with SCT Only. Moreover, those with ADHD + SCT were rated similarly to those with ADHD Only on attention problems and internalizing problems; however, on externalizing problems and social problems, those with ADHD Only were worse off than those with SCT Only and those with ADHD + SCT.

Future studies with larger teacher samples may yield greater evidence for teacher-reported differences. Further, Garner et al. (2010) found that teacher ratings of SCT were better able to distinguish ADHD subtypes than parent ratings. They concluded that different informants may perceive the presence of symptoms differently depending on the setting in which they interact with or observe the child. This finding supports continued consideration of teacher report, particularly in assessment of ADHD and SCT symptoms.

We predicted that SCT groups would have more internalizing symptoms, social problems (particularly social withdrawal), and sleep problems than the ADHD Only group but less externalizing symptoms than ADHD groups. Parent responses indicated that SCT groups were more elevated than the ADHD Only group on almost every CBCL sub-scale examined in the current study (i.e., Attention Problems, Anxious/Depressed, Withdrawn/Depressed, Sleep Problems, and Social Withdrawal). The significant elevation in internalizing symptoms found in the SCT groups compared to the ADHD Only group is consistent with past research

(Bauermeister et al., 2011; Carlson & Mann, 2002; Garner et al., 2010; Hartman et al., 2004; Milich et al., 2001; Penny et al., 2009). While we expected SCT groups to have more CBCL Social Problems than the ADHD Only group based on previous research (Becker et al., 2013; Garner et al., 2010), our prediction was not supported. At the same time, our finding of differences on the Social Withdrawal composite suggests that children with SCT may be more impaired on social withdrawal than social problems broadly. This finding is also consistent with some other past studies (Carlson & Mann, 2002; Mikami et al., 2007; Willcutt et al., 2014).

Previous studies (Carlson & Mann, 2002; Lee et al., 2013) demonstrated a negative relationship between SCT and externalizing symptoms or disorders characterized by externalizing problems. Therefore, we anticipated that individuals with SCT would have less externalizing symptoms than those with ADHD. Contrary to our prediction, the SCT Only group had more parent-reported externalizing problems than those in the ADHD Only group. However, our results replicated the slight positive relationship between SCT and externalizing problems that Garner et al. (2010) observed.

Importantly, the effect size (d=.64) for this finding is not as compelling as the effects found when groups were compared on attention, internalizing, and the withdrawn/depressed CBCL sub-scales, ranging from d =.78 to d = 1.74. To further investigate this relationship, the differences between the groups on rule breaking behavior and aggressive behavior were examined. The findings suggest that in particular, the difference between SCT Only and ADHD Only on aggressive behavior may account for the difference observed between the groups on externalizing problems. Furthermore, there are two items (e.g., sudden changes in mood or feelings and sulks a lot) representing aggressive behavior on the CBCL that may also capture

individuals with mood disturbances. Perhaps, the presence of comorbid mood disorders explains the elevation in externalizing problems in the SCT Only group.

For neuropsychological tasks, we found partial support for our predictions. We expected ADHD groups to show greater impairment (with ADHD + SCT demonstrating the most impairment) than the SCT Only group on a continuous performance test and on tasks measuring visual-motor abilities; instead, we found that the ADHD Only group made significantly more omission errors and copying errors than the SCT Only group. Our results depart from past research (Wåhlstedt & Bohlin, 2010; Willcutt et al., 2014) which found that SCT was related to a measure of sustained attention (which included the number of omissions). In addition, based off of a study that found a significant association between SCT and spatial memory variability (Skirbekk et al., 2011), we predicted that those with SCT symptoms would have greater working memory difficulties; however, scores from the WISC on working memory and the ROCF showed no significant differences between the groups.

Further, though groups were only marginally different on reaction time variability on the CPT, the SCT Only group appeared to have lower reaction time variability than the ADHD groups, suggesting better sustained attention. These results are consistent with literature suggesting increased reaction time variability in children with ADHD (Derefinko et al., 2008) and provide evidence for the claim that inattention, but not SCT, is independently assoicated with reaction time variability (Wåhlstedt & Bohlin, 2010). Perhaps these results suggest that while ADHD may have a consistently detrimental effect on some aspects of neuropsychological performance (e.g., reaction time variability), SCT alone may be associated with less neuropsychological impairment.

Lastly, as with neuropsychological performance, we expected the ADHD groups to show

poorer academic performance on the WIAT than the SCT Only group based on past research examining the relationship between academic performance and ADHD and SCT symptoms (Bauermeister et al., 2011; Hartman et al., 2004; Milich et al., 2001). Moreover, we predicted that the ADHD + SCT group would have the most impairment in academic performance, as Barkley (2012) found. Group comparisons on intellectual and academic functioning showed few significant differences. Groups differed on FSIQ with the SCT Only group scoring significantly higher than the ADHD Only group; however, all three groups had FSIQ scores characterized as average. Although groups came close to differing on the VCI, no significant differences emerged on any of the WISC sub-scales. Similarly, for academic performance, group differences approached significance on all subject areas but remained non-significant.

Regression Analyses

The regression analyses examined the unique predictive relationship that SCT has with social and academic functioning after controlling for other symptomatology (e.g., attention problems, internalizing problems, externalizing problems, sleep problems) and neuropsychological functioning. The following were positively correlated with parent reported social problems: attention problems, internalizing problems, externalizing problems, and sleep problems. Interestingly, although SCT symptoms were not retained as a significant predictor of parent- reported social problems, SCT symptoms, along with internalizing problems and externalizing problems were positively related to parent-reported social withdrawal. This finding replicates the positive association between social withdrawal and SCT symptoms that past research has reported (Marshall et al., 2014; Willcutt et al., 2014).

For academic functioning, some associations emerged that differed from our hypotheses. The VMI score was positively related to reading performance and SCT symptoms were

marginally positively related to reading performance, while parent-reported attention problems was negatively associated with reading performance. These findings differ from the results of Hartman et al. (2004), where parent and teacher ratings of SCT were negatively correlated with reading achievement. However, other research found that parent reported SCT was not significantly related to reading performance and was instead related to inattention (Bauermeister et al., 2011). One potential explanation for the marginally positive relationship between SCT symptoms and reading performance is a suppression effect. Hence, it may be that SCT symptoms are in fact virtually unrelated to reading performance (as shown in step one of the regression); but, when combined with other variables that are correlated to reading performance a relationship emerges.

The only significant predictor for math performance was performance on the VMI. For writing performance, there was a negative association with parent-reported attention problems but a positive association with performance on the VMI. Like with reading performance, an unusual relationship emerged. Writing performance was marginally positively related to externalizing problems. The same interpretation applied to the results of reading performance may explain the relationship between writing performance and externalizing problems.

Overall, performance on the VMI was consistently positively (β =.27 to .42) correlated with academic functioning indicating the value of including it when performing comprehensive assessments. Further, perhaps the visual-spatial skills that are involved in this task are also critical to academic functioning.

This study has several limitations that deserve mentioning. First of all, only a small SCT Only group was available in our data set, which potentially affected the power to detect differences between the groups. Additionally, the limited variability in race of the sample makes

generalizing the findings to more diverse samples difficult. While past research has used the CBCL as a measure of SCT, we recognize the limitations of the CBCL SCT scale (e.g., small number of items). A more comprehensive measure of SCT that contains items that load independently on SCT without cross-loading on other symptom domains would simplify the process of interpretation. In any case, we were able to modify the attention problems sub-scale by removing the SCT items, to clarify differences that emerged between groups on this sub-scale and predictive relationships of SCT and attention problems with social and academic functioning. Another limitation was the lack of item-level teacher data. For instance, we could not examine the predictive relationship between SCT symptoms and teacher-reported social functioning or social withdrawal because of an inability to access item-level teacher data. Moreover, conclusions are also bound by the fact that groups were created using parent-reported SCT symptoms.

Future Research and Clinical Implications

Future research should continue to investigate the relation SCT has with social withdrawal. Using multiple methods and considering various informants might help conceptualize SCT and inform treatment recommendations. In particular, studies examining the presence of SCT symptoms through teacher, self, and parent reports might provide clarification on when symptoms are causing the most problems and determine which informant is most sensitive or aware of the interference brought on by SCT. Also, using thorough measures of SCT in future research would promote a deeper understanding of the various symptom dimensions that may be contributing to SCT. Studies should examine SCT in more diverse samples in order to consider the relation that demographic variables (e.g., race, ethnicity, socio-economic status) have with SCT.

Examining other pieces of information like parental characteristics, parental psychopathology and home environment might help explain the onset and development of SCT as well as risk and protective factors.

In addition, continued efforts to understand the relationship that SCT has with neuropsychological and academic functioning could explain nuances in attention problems and how they influence impairment. More specifically, examining how individuals with SCT alone depart from individuals with clinical diagnoses and those without diagnoses on neuropsychological and academic performance could reveal more about the correlates unique to SCT. A better understanding of the symptoms and types of impairment associated with SCT relative to other psychopathology will result in recommending more effective interventions.

In the latest edition of the *ADHD Handbook for Diagnosis and Treatment*, Barkley (2015) reviewed a study examining the use of non-stimulant ADHD medication in improving SCT symptoms in children with ADHD and dyslexia, ADHD only, and Dyslexia only. The findings from this study appeared promising; atomoxetine appeared to decrease SCT symptoms (Barkley, 2015). Given the positive effect of a non-stimulant medication in lowering SCT, Barkley speculates about the potential other types of medication might have in treatment. The current study suggests that SCT is most associated with sleep problems, social withdrawal, and internalizing problems, supporting the idea that other medications (e.g., SSRIs, anti-narcoleptics) might prove advantageous in managing SCT symptoms (Barkley, 2015).

In addition to medication treatment, some have argued that treatments such as cognitive behavioral therapy (CBT) may prove beneficial for treating SCT, even though CBT is not traditionally recommended to treat ADHD (Barkely, 2015). CBT is frequently used to treat individuals with internalizing symptoms, and there is evidence to suggest that CBT for anxiety

when combined with parent training, may have beneficial effects on ADHD symptoms (Jarrett & Ollendick, 2012). Additionally, CBT alone and CBT in combination with medication are approaches frequently used by mental health professionals to treat mood disorders. Our findings imply that individuals with SCT both have more internalizing symptoms and have a higher rate of mood disorders; therefore, cognitive behavioral therapy could be appropriate.

Other treatment components that might be worth investigating are social skills training and interventions to improve sleep. Barkley (2015) cites a study that examined the use of a social skills training approach with children diagnosed with ADHD. This study along with past research suggests that social withdrawal is an area that might need to be targeted in intervention; therefore, it seems as though evaluating the use of social skills training in individuals with SCT could be very informative. Furthermore, an intervention study examined the use of a behavioral psychosocial treatment (Child Life and Attention Skills Program; CLAS) for ADHD-I. The researchers found that in comparison to the control group, ADHD-I youth who received CLAS showed a reduction in inattention and sluggish cognitive tempo symptoms as well as improved social and organizational skills (Pfiffner et al., 2007). Future treatment investigations seeking to improve SCT symptoms may also benefit from targeting sleep difficulties. In particular, including sleep hygiene information and behavioral strategies to address sleep problems might provide a unique and valuable addition to treatment.

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FOOTNOTES

1. Using an ANCOVA, controlling for age and gender, groups were also compared on CBCL Attention Problems excluding the cross-loading SCT items.

2. When CBCL Attention Problems was entered as a predictor variable in step 2 of regression analyses the adjusted sub-scale was entered to prevent including SCT items on two steps of the model.

APPENDIX

THE UNIVERSITY OF ALABAMA | Office of the Vice President for Research & Economic Development
Institutional Review Board for the Protection of Human Subjects

March 24, 2016

Ana Rondon
Graduate Student – Department of Psychology
Tuscaloosa, AL 35487

Dear Ms. Rondon:

The Univesity of Alabama Institutional Review Board for the Protection of Human Subjects (IRB) has reviewed your request pertaining to work involving human subjects performed for the completion of the requirements for your master's degree (Title of Research: Sluggish Cognitive Tempo and Attention-Deficit/Hyperactivity Disorder: Associations with Co-occurring Symptomatology, Neuropsychological Functioning and Academic Functioning).

At this time, the IRB has determined that the application does not meet the criteria for IRB review and therefore cannot be reviewed by the IRB for the following reason:

> The information provided indicates that the study has been conducted and also indicates that data analysis has been conducted.

Human subject research must be submitted to the IRB prior to conducting the research because federal regulations do not allow the IRB to issue retrospective approval for research activity conducted prior to approval by the IRB. Because of this non-compliance you have already taken the necessary training and provided a corrective action plan to avoid future occurrences, as required by UA IRB policies and procedures.

The information provided indicates that the project involved a secondary data analysis set collected from an IRB approved project at Virginia Tech with written permission to analyze these data. Although the project cannot be approved by the UA IRB, it appears that the project meets the requirement of the IRB and would have been approved for conducting the study at The University of Alabama.

If I can be of further assistance, please feel free to contact me.

Sincerely,

[redacted]

Carpantato T. Myles, MSM, CIM, CIP
Director & Research Compliance Officer

358 Rose Administration Building | Box 870127 | Tuscaloosa, AL 35487-0127
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Title
Sluggish Cognitive Tempo and Attention-Deficit/Hyperactivity Disorder: Associations with Co-occurring Symptomatology, Neuropsychological Functioning and Academic Functioning

Several students working with Dr. Jarrett have conducted research projects working off of an existing de-identified data set that was collected at Virginia Tech. In the past, Dr. Jarrett has submitted an individual IRB for each student project along with a letter of support from the PI at Virginia Tech. See attached for a sample IRB approval and a letter of support. I recently analyzed data for my thesis project using this data set. I submitted my thesis to the Graduate School, and one of the revisions that came back was to include the IRB forms. In the process of looking for these forms, I realized that I did not submit a separate IRB for this project specifically. This was my oversight and therefore I am taking corrective action to address this.

1. Purpose
1a. Provide a 3-5 sentence lay summary of the purpose of the study: The current study contributed to the literature on Sluggish Cognitive Tempo (SCT) by using multiple measures to examine the relations that SCT and ADHD have with various correlates. Therefore, this study is distinct from past research in that the associations SCT and ADHD have with demographic variables, neuropsychological functioning, academic achievement, internalizing symptoms, sleep problems, and social functioning were assessed (a) within the same sample, and (b) through the use of multiple informants (i.e., parents, teachers, clinicians) and methods (e.g., report-based measures, laboratory tasks).

1b. What does the investigator hope to learn from this study? The results of this study will further our understanding of the relations among SCT, other symptomatology, neuropsychological functioning, academic achievement and social functioning. Additionally, the findings may impact conceptualizations of intervention differences for individuals with SCT.

2. Study procedures
2a. Describe all study procedures.
The current study is cross-sectional and involves a secondary data analysis of an existing data set. The sample consists of 405 children and adolescents who were referred to an outpatient clinic at Virginia Tech. Two graduate student clinicians in an American Psychological Association (APA)-approved doctoral program in clinical psychology conducted the assessments. One clinician was assigned to work with the parent, while another clinician was assigned to work with the child. The child clinician assisted with all child measures, while the parent clinician assisted with all parent measures. After participating in the assessment, de-identified data were entered into a database for future analysis.

3. Background: Factor analytic research on SCT indicates that SCT is a separate but related construct to ADHD (Garner et al., 2010; Hartman et al., 2004; Lee et al., 2013; Penny, Waschbusch, Klein, Corkum, & Eskes, 2009). Furthermore, SCT symptoms appear to correlate differently with the inattention and hyperactivity/impulsivity symptom domains (Hartman et al., 2004). Findings from Barkley (2012) suggest that the demographic variables associated with SCT and ADHD are different. Other research finds that SCT symptoms are also highly correlated with internalizing and social withdrawal symptoms (Barkley, 2012; Carlson & Mann, 2002; Hartman

et al., 2004; Skirbekk, Hansen, Oerbeck, & Kristensen, 2011). Additionally, SCT is thought to have multiple dimensions; it has been defined by sleepy, slow, and daydreamy components (Penny et al., 2009). Langberg, Becker, Dvorsky, and Luebbe (2014) examined whether SCT and daytime sleepiness appear to be separate constructs using two different samples. Their findings suggested that SCT and daytime sleepiness are related but distinct. Assessment of neuropsychological functioning is another area where inconsistencies have surfaced. Skirbekk et al. (2011) found no relationships between SCT level and reaction time or reaction time variability but higher levels of SCT were associated with more spatial memory variability. Moreover, Wåhlstedt & Bohlin (2010) controlled for ADHD symptoms and found that SCT was uniquely related to problems in sustained attention, while inattention was uniquely related to executive functioning and state regulation deficits. Willcutt et al. (2014) replicated this finding. Additional research is also needed to gain a better understanding of how SCT alone and in conjunction with ADHD differentially impact academic achievement. Hartman et al. (2004) found that teacher ratings of both SCT and ADHD symptoms were significantly and negatively correlated with reading and math achievement. In another study, Bauermeister et al., (2011) found that, SCT symptoms were negatively related with math scores, though this was to a lesser extent than inattention. Willcutt et al. (2014) found that inattention symptoms were slightly stronger predictors of poorer math, word reading, and reading comprehension performance but only SCT significantly predicted poorer written language achievement. Social functioning is another area where differences between ADHD and SCT correlates have emerged. Willcutt et al. (2014) found that both inattention and SCT symptoms were associated with challenges in social functioning; however, they were related to different components of social functioning. Another study explored specific areas of social impairment, Marshall, Evans, Eiraldi, Becker, & Power, (2014) found that the ADHD-I with high SCT group had lower levels of leadership and higher social withdrawal than both of the other groups.

4a. State how many subjects will be involved and describe the type of subjects (e.g., students, patients with cardiac problems, particular kind of cancer, etc.) and state the reason for using such subjects.

The sample consisted of 404 children and adolescents who were consecutively referred to an outpatient clinic in Southwestern Virginia. These subjects were chosen, since we are interested in understanding how SCT and ADHD relates to various correlates in children.

4b. State the age range, gender, and ethnic background.

The sample is 64.4% male and has a mean age of 9.97 (SD = 2.64). The racial make-up of the sample is largely Caucasian (92.5%), with 3.1% African-American, 1.9% Hispanic, 2.5% other.

4c. State the number and rationale for involvement of potentially vulnerable subjects to be entered into the study, including minors, pregnant women, economically and educationally disadvantaged, decisionally impaired, and homeless people. Specify the measures being taken to minimize the risks and the chance of harm to the potentially vulnerable subjects.

We are examining children, since we are interested in how ADHD and SCT are related to various correlates in children. There are no risks, since the data have already been collected and the data are de-identified.

6. Benefits: This study will help us to learn more about the correlates of ADHD and SCT and will inform future intervention studies.

7. Procedures to Maintain Confidentiality
7a. Describe procedures protecting the privacy of the subjects and for maintaining confidentiality of data, as required by federal regulations, if applicable.

The dataset is de-identfied, so there is not risk of breaching confidentiality.

7c. Specify where and under what conditions study data will be kept, how samples will be labeled, who has access to data, and what will be available to whom.
The dataset will be kept on a password-protected computer in the PI's laboratory space in a locked room. Only Dr. Jarrett and Ms. Rondon will have access to the database.

THE UNIVERSITY OF ALABAMA | College of Arts & Sciences
Department of Psychology

Dear University of Alabama Institutional Review Board (IRB),

I am writing to obtain assistance regarding my master's thesis. My thesis involved a secondary data analysis using data collected from an IRB-approved project at Virginia Tech. My doctoral advisor, Dr. Matthew Jarrett, has previously submitted IRBs to the University of Alabama IRB to analyze data from this project with multiple undergraduate honors students. Although these data are de-identified and we have written permission to analyze these data, I failed to submit an IRB to analyze these data for my thesis project. I realized this after the Graduate School requested my IRB approval for the final document. Dr. Jarrett and I have discussed this issue further, and I believe we had a miscommunication about the need to submit an IRB for secondary data analyses. Although I have taken the ethics training through the National Institutes of Health multiple times, this program does not explicitly address secondary data analysis. Dr. Jarrett and I have discussed this issue further along with the need to submit an IRB for de-identified data. I apologize for this oversight, but I believe that Dr. Jarrett and I have taken corrective action to further educate myself on IRB issues surrounding secondary data analysis. I hope that this letter will provide sufficient evidence of corrective action to process my thesis through the Graduate School. If you would like any additional information or further corrective actions, I would be happy to comply. Thank you for your assistance with this matter.

Sincerely,

[redacted]

Graduate Student
Department of Psychology

[redacted]

Assistant Professor
Department of Psychology