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Research has consistently demonstrated a link between AD/HD and substance use, abuse, and dependence, although why this increased risk occurs remains unclear. The purpose of the current study was to identify the extent to which negative parenting practices and youth conduct problems are associated with symptoms of AD/HD and current use of alcohol, tobacco, and marijuana in adolescents.

Thirty-four adolescents and their female caretakers from the community completed measures of child psychopathology and family functioning. Symptoms of AD/HD did not predict current use of substances. Post-hoc analyses revealed that symptoms of inattention, but not hyperactivity-impulsivity, predicted intent to use substances. The results suggest a stronger role for inattention in predicting substance use than currently exists in the literature.

AD/HD AND ADOLESCENT SUBSTANCE USE: THE IMPACT OF
SUBTYPE, PARENTING PRACTICES, AND
CONDUCT PROBLEMS

by

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CHAPTER I

INTRODUCTION

Attention-Deficit/Hyperactivity Disorder (AD/HD) is a disorder that affects individuals across the life span in multiple ways. A key area of concern for adolescents with AD/HD is research suggesting that they are at an increased risk for using substances. A substantial literature proposes that AD/HD is a risk factor for earlier initiation of substance use and higher rates of substance use in adolescence, including cigarette, alcohol, and illicit drug use (Kuperman et al., 2002; Molina, Marshal, Pelham, & Wirth, 2005; Molina, Smith, & Pelham, 1999). AD/HD has also been associated with polysubstance use, earlier progression to dependence on cigarettes, greater abuse of alcohol, and more functional impairment due to alcohol use in adolescence (Molina & Pelham, 2003; Wilens et al., 1997). Unfortunately, despite work suggesting that AD/HD may confer a higher risk for substance use during adolescence, it remains unclear why youth with AD/HD would be more inclined to use and abuse substances than their peers, and why at earlier ages.

What is better established is that by early adulthood, individuals with AD/HD abuse and depend on substances at higher rates than the normative adult population (August et al., 2006; Biederman et al., 2006; Kessler et al., 2006). AD/HD in adulthood has been linked with higher current substance use and past problems with substances (Faraone et al, 2007). Research has also found that between 17%-45% of adults with

AD/HD will abuse or become dependent on alcohol and between 9%-30% will abuse or become dependent on other drugs (Wilens, 2004; 2006). It thus stands to reason that youth with AD/HD are a necessary target for substance abuse prevention and intervention efforts.

Standard clinical practice for AD/HD may not be sufficient to combat this risk. Medication is the most common form of treatment for AD/HD, and some findings have suggested that medication treatment for AD/HD in childhood may protect against later drug and alcohol use disorders (Wilens & Biederman, 2006; Wilens, Faraone, Biederman, & Gunawardene, 2003). However, more recent research from longitudinal data suggests that although stimulant medication treatment for AD/HD does not contribute to later substance abuse, it does not necessarily protect against substance abuse, either (Biederman et al., 2008; Mannuzza et al., 2008).

These findings highlight the need to develop comprehensive prevention and intervention treatments for adolescents targeting both AD/HD symptoms and substance abuse (Volkow & Swanson, 2008). However, in order to pursue best practice approaches to prevention and intervention for substance use in youth with AD/HD, the field needs a clearer understanding of why AD/HD may lead to a greater risk for substance use during adolescence.

As a first step in addressing this issue, the present study examined known substance use risk factors also known to be related to impairment associated with AD/HD. In particular, conduct problems and poor parenting practices were examined as potential mediators of the pathway from AD/HD symptoms to substance use in

adolescence. As background for this study, this paper will first provide a brief overview of AD/HD and substance use. Next, a psychosocial model for understanding the developmental psychopathological process via which substance use may arise in a youth with AD/HD will be presented. A review of the previous research on AD/HD and substance use in adolescence will then be presented, including research suggesting a direct causal pathway from AD/HD to substance use and other research suggesting mediating factors that may drive this link. Lastly, the specific goals and hypotheses of the proposed study will be provided.

CHAPTER II

REVIEW OF THE LITERATURE

Attention-Deficit/Hyperactivity Disorder

AD/HD is defined as a persistent pattern of developmentally-inappropriate inattention and/or hyperactivity-impulsivity (American Psychiatric Association, 2000). The *Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition-Text Revision* (DSM-IV-TR; APA, 2000) requires that six or more symptoms of hyperactivity-impulsivity and/or inattention be present for at least six months. In addition, some symptoms must have been present before 7 years of age, the symptoms must not be better accounted for by another disorder, and the individual must display functional impairment in multiple domains, such as at school, home, or with peers (APA, 2000). The DSM-IV-TR (APA, 2000) lists three major subtypes of AD/HD: the Predominantly Inattentive Type, Predominantly Hyperactive-Impulsive Type, and the Combined Type, all of which vary as a function of how many symptoms of hyperactivity-impulsivity and/or inattention are present.

Despite its set definition, researchers examining substance use outcomes have defined AD/HD inconsistently. Much of the research using longitudinal data to assess AD/HD and substance use has employed the DSM-III diagnoses of Attention Deficit Disorder with Hyperactivity (ADD+H) and Attention Deficit Disorder without Hyperactivity (ADD; e.g., Barkley, DuPaul, & McMurray, 1990; Elkins, McGue, &

Iacono, 2007), as the current subtypes have only been in existence as of the advent of DSM-IV in 1994. Thus, earlier work examining AD/HD domains in relation to substance use is less relevant despite good methodology.

Associated Impairment. AD/HD is a disorder that affects multiple areas of functioning across the lifespan. Children with AD/HD often struggle in school; students with AD/HD frequently have poorer academic outcomes than normal students, including lower scores in reading, math, and general intellect (Dietz & Montague, 2006). These youth may lack social skills and appear socially immature, making peer interactions and forming positive friendships difficult (Barkley, 2006). The family system is also impacted by a child with AD/HD. Stress associated with rearing a child with AD/HD can result in poor coping in parents (e.g., Wolraich et al., 2005). Substantial evidence suggests that the presence of AD/HD in a child is associated with disrupted parent-child, family and marital functioning; decreased parental self-efficacy; and increased levels of parenting stress and parental psychopathology (e.g., Johnston & Mash, 2001).

Children with AD/HD are frequently diagnosed with a co-occurring disorder, as well. In a study of 6 to 18 year-olds with AD/HD, Elia, Ambrosini and Berrettini (2008) found that Oppositional Defiant Disorder was the most prevalent comorbid condition, occurring in 41% of their sample, followed by Minor Depression/Dysthymia (22%) and Generalized Anxiety Disorder (15%). As summarized by Barkley (2006), approximately 45%-55% of children with AD/HD are additionally diagnosed with Oppositional Defiant Disorder, approximately 35%-45% also have Conduct Disorder, approximately 25-30%

also have Major Depressive Disorder, and around 25-35% have a co-occurring anxiety disorder.

Although AD/HD develops during childhood, upwards of 70%-80% of children continue to demonstrate significant symptoms of AD/HD in adolescence (Barkley, Anastopoulos, Guevremont, & Fletcher, 1991; Barkley, Fischer, Edelbrock, & Smallish, 1990; Weiss & Hechtman, 1993). As summarized by Barkley (2006), the adolescent years with AD/HD may be the most difficult, because while hyperactivity may become less visible, academic problems may become greater with increased cognitive demands and peer problems may become more apparent with the onset of dating and courtship and a higher need for peer group acceptance. Family problems often remain as well. Mothers of adolescents with AD/HD have reported that their relationship with their teen is characterized by more negativity, more conflict, and greater intensity of anger, regardless of the presence of comorbid oppositional defiant disorder (Barkley, Anastopoulos, Guevremont, & Fletcher, 1992).

Substance Use

According to the DSM-IV-TR (APA, 2000), a substance is any drug of abuse, a medication, or a toxin. Substance use is thus the ingestion of substances such as tobacco, alcohol, non-prescription or prescription drugs, and illicit drugs such as marijuana and cocaine. Substance abuse is defined as a maladaptive pattern of substance use marked by persistent and significant negative consequences related to repeated use (APA, 2000). Impairment or distress associated with substance abuse includes use that interferes with obligations, use that results in social problems, and use in physically hazardous

situations. Substance dependence is described as a maladaptive pattern of substance use leading to tolerance or withdrawal and other cognitive, behavioral, and physiological problems as a result of using the substance despite these symptoms (APA, 2000). Together, substance abuse and substance dependence are classified as Substance Use Disorders (SUD; APA, 2000).

Researchers measure and discuss substance use differently; substance use, abuse, and dependence are all separate ways to assess affiliation with substances. Additionally, unless researchers are focusing on one particular drug, they may group items together to comprise a single total substance use measure if use rates are low in the target population. Measurement of substance use may also differ; assessing number of cigarettes consumed in the past 30 days is inherently different than asking an adolescent to rate on a Likert scale how often they smoke. Likewise, current use of substances may be assessed as use within the past week, month, or year. In adolescents, this may overlap with initiation of substance use, or age when use of the substance first occurred. Such subtle but important differences for examining substance use may help explain why researchers have reached different conclusions about substance use in the AD/HD population.

Intention to use substances is another way to assess future use of substances when substance use in a population is suspected to be low, such as with children and adolescents. A behavioral intention is the probability that a person will perform some action or behavior, and behavioral intentions are thought to be the best predictors of actual behavior (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). Intention to use substances may thus be used as a proxy for actual use in a population. Intentions have

been used to predict a variety of health behaviors, both positive and negative. For instance, intentions have predicted negative health behaviors, such as marijuana and alcohol use in adolescents (Ellickson, Tucker, Klein, & McGuigan, 2001; Yanovitzky, 2005).

Substance Use Development. Adolescence is a key developmental phase important in studying substance use and substance use initiation. In general, the two main legal drugs for adults, alcohol and tobacco, are the most likely to be used during adolescence, followed by marijuana. The 2008 results from the ongoing national Monitoring the Future (MTF) Study of American youth (Johnston, O'Malley, Bachman, & Schulenberg, 2009) demonstrate this clearly. By 8th grade alone, 39% of youth have consumed more than just a few sips of alcohol and nearly a fifth (18%) have been drunk at least once. In addition, 21% of 8th graders have tried cigarettes and 7% have already become regular smokers. Substance use rates increase during adolescence. According to the same MTF report, by the end of high school, 72% of youth have consumed alcohol and over half (55%) have been drunk at least once. Additionally, nearly half (45%) of 12th graders have tried cigarettes, over 30% have used marijuana at least once, and one in four (25%) have used an illicit drug other than marijuana.

Historically, rates of illicit substance use and frequency of use have been higher for males than for females during adolescence (Johnston et al., 2009). Trends have been changing, however, as noted by the MTF study (Johnston et al., 2009), with females reporting higher use rates for some illicit drugs in 8th grade. This may vary by type of drug; males still use steroids and smokeless tobacco at higher rates than females.

However, the MTF results demonstrate that current rates of drinking, smoking and marijuana use for males and females in 8th, 10th, and 12th grade are approximately equal.

Although much is already known about risks for using and abusing substances during adolescence, no one particular risk factor has been shown to confer the greatest risk for substance use on its own; there are multiple pathways to drug use and abuse (Bry, McKeon & Pandina, 1982). According to a review by Hawkins, Catalano, and Miller (1992), substance use risk is the result of multisystemic influences, including those of the home, peer, and social environment, as well as individual factors such as age, temperament, and psychopathology. These findings are supported by Bronfenbrenner's (1979) ecological perspective that suggests that children develop in a multilevel system with dynamic developmental contextual influences interacting with the child and with one another.

One major source of influence on youth is their parents, and parents serve as a well-documented risk or protective factor for adolescent substance use. Several distinct types of parental influences have been identified in the youth substance use literature, including modeling of use by the parent, parent-child conflict, poor bonding or attachment, and ineffective parenting practices (Hawkins et al, 1992). The risk for drug use and abuse in youth appears to be increased by parenting practices characterized by low involvement in the child's activities, poor monitoring of behavior, few and inconsistent rewards for positive behavior, and excessively severe and inconsistent punishment for unwanted behavior (Hawkins et al., 1992).

Parenting practices naturally change over time as the child becomes an adolescent; parents' involvement in their children's activities, use of positive discipline strategies, and level of monitoring all decrease as children get older, as does use of corporal discipline (Frick, Christian, & Wootton, 1999). Although these decreases are likely in response to the child's desire for increased autonomy, they may inadvertently lead to substance use. For instance, parental monitoring has been found to moderate the relationship between peer pressure and drug use, such that low parental monitoring often leads to association with deviant peers and thus to likelier substance use (Connell, Dishion, & Deater-Deckard, 2006; Dishion, Capaldi, & Spracklen 1995). Conversely, adolescents who are monitored more by their parents have lower rates of alcohol misuse, illicit drug use, and delinquency over time (Barnes, Hoffman, Welte, Farrell & Dintcheff, 2006). Likewise, longitudinal results demonstrate that adolescents with more family support and involvement have lower levels of alcohol misuse and delinquency initially and across time (Barnes et al., 2006), suggesting that the maintenance of some level of positive involvement by parents is important for reducing the risk of substance use and delinquency in youth (Frick et al., 1999).

Poor parenting practices have also been documented as a risk factor for the development of conduct problems in children (Patterson, 1982), and it is well-established in the substance abuse literature that conduct problems place youth at an increased risk for substance use involvement (e.g., Hawkins et al., 1992). The term *conduct problems* encompasses perpetual acts of delinquency or disrespect for authority and rules that may qualify a youth for a formal diagnosis of Oppositional Defiant Disorder (ODD) or

Conduct Disorder (CD). ODD and CD are frequently jointly referred to as disruptive behavior disorders or conduct problems in the literature. Oppositional defiant disorder (ODD) is defined as a recurrent pattern of negative, defiant, disobedient, and hostile behavior towards authority figures that usually becomes evident before age 8 (APA, 2000). In many cases, ODD serves as a precursor to conduct disorder (APA, 2000). Conduct disorder (CD) is defined as a repetitive and persistent pattern of behavior that violates the basic rights of others and/or age-appropriate social norms or rules that can appear in childhood or adolescence (APA, 2000). Associated features of ODD include early use of alcohol, tobacco, and other drugs, and CD is also associated with an early onset of drinking, smoking, and illegal substance use, as well as other risk-taking and reckless behavior (APA, 2000).

Cumulative Risk Factors

It is understood that with the stage of adolescence comes an increased risk for substance use in general; however, the risk for use and problem use appears to be heightened in the AD/HD adolescent population. But why might this be? To answer this question, integrating knowledge from the substance abuse field and the AD/HD literature may be useful. Social, academic, and familial problems are all known to serve as risk factors for substance use in adolescence, as are conduct problems (e.g., Hawkins et al., 1992), and all are problems associated with AD/HD (Johnston & Mash, 2001). Adopting a cumulative risk factor model to explain the development of substance use may lead to several plausible pathways to drug use and abuse in people with AD/HD during adolescence, just as with any adolescent. Such a model would suggest that the likelihood

of drug use occurring is directly related to the number of risk factors to which the youth is exposed (e.g., Newcomb, Maddahian, Skager, & Bentler, 1987). Because the associated deficits of AD/HD impact multiple domains of functioning across the lifespan, this suggests that youth with AD/HD are more likely to have a greater number of risk factors present (Figure 1). It may therefore be that youth with AD/HD are at a greater risk of substance use because of the impact of their disorder on their social environment, indicating mediating mechanisms that may be excellent targets for intervention efforts.

AD/HD as a Direct Risk for Substance Use

However, is it possible that AD/HD symptoms themselves are enough to transmit risk for substance use directly? Some research examining AD/HD symptoms and substance abuse suggests that the presence of more AD/HD symptoms leads to greater risk for substance use, although research has also suggested that the domains of hyperactivity-impulsivity and inattention translate to different degrees of risk. This literature will be examined next.

Severity. Children with more AD/HD symptoms overall are potentially at the greatest risk for persistent, chronic AD/HD and for having an earlier onset of substance use and abuse (Molina & Pelham, 2003). For example, a study of adolescents with AD/HD found that adolescents rated with higher levels of AD/HD symptoms were more likely than peers with less AD/HD symptoms to drink and smoke (Whalen, Jamner, Henker, Delfino, & Lozano, 2002). A separate study examining adolescent smokers and non-smokers with and without AD/HD found that adolescents with more severe AD/HD

symptoms experimented with smoking at earlier ages (Tercyak & Audrain-McGovern, 2003).

However, using a diagnosis of AD/HD is different from assessing AD/HD dimensionally in a study. Strictly utilizing a formal diagnosis for AD/HD sample recruitment may leave out information about substance use risk, as even a single symptom of AD/HD has been associated with an increased risk for substance use in adolescents (Elkins et al., 2007). On the other hand, simply relying on a rating scale for assessment of AD/HD symptoms, whether for dimensional or categorical purposes, can result in misclassification of these symptoms (Collett, Ohan, & Myers, 2003). For example, an endorsement of “Has difficulty sustaining attention in tasks or play activities” on the ADHD Rating Scale-IV (DuPaul, Power, Anastopoulos, & Reid, 1998) by an informant may represent symptoms of inattention or symptoms of depression. Thus, while it seems important to assess AD/HD severity in a study examining substance use, care must be taken to ensure that endorsed symptoms are not better accounted for by other disorders.

Subtype. It may be that the core domains of AD/HD confer a higher risk for substance use when symptom counts in both domains are high; however, other research on AD/HD and substance use suggests that the AD/HD domains of inattention and hyperactivity-impulsivity are associated with different degrees of risk for substance use. Unfortunately, researchers who have investigated AD/HD subtypes and substance use in youth have come up with conflicting results. For instance, Molina, Smith and Pelham (1999) reported that all associations between AD/HD and substance use were due to

teacher ratings of hyperactivity-impulsivity and not inattention, and concluded that individuals with predominantly hyperactive-impulsive symptoms are potentially at a greater risk of earlier onset substance abuse and conduct disorder. Conversely, in a later study these researchers found that childhood inattention predicted substance use even when partialling out variance associated with CD, while hyperactivity-impulsivity features did not (Molina & Pelham, 2003).

Additionally, it may be that the different subtypes are predictive of different types of substance use and abuse. Burke, Loeber and Lahey (2001) found that ratings of hyperactivity-impulsivity were associated at a two-year follow-up with drinking in adolescence, while ratings of inattention were associated with tobacco use. Elkins and colleagues (2007) also found that the relationship between inattention and nicotine dependence remained significant in a group of adolescents even when accounting for CD and symptoms of hyperactivity-impulsivity. Many studies investigating tobacco use and AD/HD suggest that smoking for stimulation purposes is the primary reason associated with total AD/HD symptoms and inattentive symptoms, and thus smokers with inattentive symptoms may use nicotine as a stimulant to manage deficits in inattention and executive functioning (Lerman et al., 2001; Looby, 2008; Wilens, 2004).

On the other hand, children with AD/HD with predominantly hyperactive-impulsive features may be at especially heightened risk for substance use and abuse overall (Barkley, 2006). In a recent study, dimensionally-rated symptoms of hyperactivity-impulsivity significantly predicted initiation of tobacco, alcohol, and all types of illicit substance use in a cohort of 14-year-old adolescents, and they also

significantly predicted nicotine, alcohol, and cannabis use disorders at a four-year follow-up, even when the significant contribution of CD was taken into account (Elkins et al., 2007).

Behavioral Disinhibition. If AD/HD symptoms translate directly to increased risk for substance use in adolescence, by what mechanisms might they transmit a greater risk? Theory gleaned from the AD/HD literature and the broader literature may help answer this question.

AD/HD has been conceptualized as the indirect result of a deficit in behavioral inhibition (i.e., *behavioral disinhibition*) due to neuroanatomical abnormalities in the prefrontal cortex, responsible for complex cognitive functioning and social control; the limbic system, responsible for emotion, behavior regulation, and memory; and associated brain regions such as the striatum (Barkley, 1997; Winstanley, Eagle & Robbins, 2006). Barkley (1997) has theorized that this lack of inhibition in turn affects four areas of prefrontal executive functioning thought to rely on behavioral inhibition: working memory, emotional regulation, internalization of speech, and reconstitution. A deficit in working memory affects the ability to plan ahead and keep track of time. A deficit in emotion regulation affects the ability to inhibit emotions, perspective-take, and create goal-directed action. A deficit in internal language affects the ability to problem-solve and generate rules for the self, known as rule-governed behavior. Lastly, a deficit in reconstitution affects the ability to synthesize and analyze thoughts and behavior. For people with AD/HD, these deficits are theorized to result in observable problems in

proper motor and behavioral control corresponding to the core domains of inattention, hyperactivity, and impulsivity.

Although behavioral disinhibition has been studied as the underlying deficit behind AD/HD, it has also been studied extensively as a factor related to externalizing pathology more generally. In the broader literature, the term behavioral disinhibition is used to encompass a lack of behavioral control or constraint, high sensation seeking or novelty seeking, and impulsivity. Examining studies on behavioral disinhibition and related constructs in the broader literature may thus provide insight into mechanisms behind substance use development in youth with AD/HD.

Behavioral disinhibition may result in lower levels of developmentally-appropriate behavioral control and greater impulsivity. *Behavioral control* refers to the tendency to express or contain one's impulses, motor responses, and behaviors (Wong et al., 2006) and *impulsivity* is more broadly defined in the literature as "action without foresight" that is recognized as a component of numerous disorders, including AD/HD and substance abuse (Winstanley et al., 2006). Low behavioral control thus shares many elements in common with AD/HD, particularly with hyperactive-impulsive symptoms. A longitudinal study measuring behavioral control in youth over time by Wong and colleagues (2006) demonstrated that children with lower levels of behavioral control in childhood were more likely than others to begin drinking earlier and to report having been drunk in adolescence. Behavioral control is expected to increase along a normal trajectory as a child ages; children are expected to become less impulsive and more controlled as they mature, although some do not. As such, people with AD/HD may be at

an increased risk of impulsively engaging in risky behaviors such as substance use because of lower behavioral control.

Sensation seeking or *novelty seeking* is a personality construct that has been well-documented in relation to substance use behaviors (e.g., Hawkins et al., 1992) in addition to other risky behaviors such as reckless driving, unprotected sex, and minor criminal activity (e.g., Arnett, 1992). Sensation seeking involves attraction to novelty, danger, excitement, and sexual variety, and is phenotypically and genetically correlated with sociability, impulsivity, extraversion, dominance, and aggression (MacDonald, 1996). Sensation seeking is thus another construct that shares many similarities to AD/HD, particularly to symptoms of impulsivity. As summarized by Yanovitzky (2005), high sensation seekers may use drugs because of the stimulation associated with using substances, the stimulation associated with taking risks by using drugs illegally, or because sensation seekers underestimate risks associated with drug use. In his study, Yanovitzky (2005) found that sensation seeking accounted for nearly half of the explained variance in association with deviant peers, pro-drug discussions, and intention to use marijuana in adolescents, all of which are known precedents to substance use initiation.

Behavioral genetic research supports a genetic underlying factor for externalizing psychopathology related to behavioral disinhibition, including AD/HD and substance use disorders. For instance, findings from the Minnesota Twin Family Study (MTFS; Iacono, Carlson, Taylor, Elkins, & McGue, 1999) suggest that a variant of behavioral disinhibition the authors termed *low constraint* serves as a heritable temperament liability

for tobacco, alcohol, and drug use in adolescence. Findings from this study further suggest that low constraint serves as a strong link between the spectrum of externalizing psychopathology (AD/HD, ODD, CD, and antisocial behavior) and substance abuse.

A more recent study by Young and colleagues (2009) also examined behavioral disinhibition, which they defined as an “underlying deficit in the ability to inhibit impulses to act in ways that are attractive because of possible reward, but are socially inappropriate and may result in negative consequences” (p. 118). The researchers examined the results of measures tapping a variety of externalizing problems, including AD/HD, conduct disorder, substance use, and novelty-seeking, from a cohort of adolescents from the Colorado Longitudinal Twin Study (LTS) at age 12 and again at age 17. The researchers found that early substance use and conduct problems are more heritable at age 12 than at age 17, when some experimentation and deviance is more normative and more influenced by family, peer, and other social factors. Genetic and environmental etiology for AD/HD was comparable across the two time points, supporting the idea that AD/HD is a highly stable trait across childhood and adolescence. At age 12, the latent behavioral disinhibition factor was composed primarily of AD/HD and conduct problems, but also included substance use and novelty seeking. In addition, the behavioral disinhibition factor was highly heritable, with 59% of the variance explained by genetic influences. At age 17, behavioral disinhibition was found to be more moderate, with 43% of the variance explained by genetic influences. However, AD/HD and conduct disorder continued to show high loadings on the behavioral disinhibition factor, and substance use and novelty seeking contributions were increased. These

findings suggest that the heritable trait of behavioral disinhibition can provide vulnerability across adolescence to externalizing psychopathology, including AD/HD, conduct problems and substance use. Therefore, the link between AD/HD, conduct problems, and substance use may simply be accounted for by the underlying inheritable trait of behavioral disinhibition thought to result in a more impulsive nature and thus a likelier chance of using substances.

Potential Mediating Factors: Examining the Family System and AD/HD

A problem with behavioral genetics research in general is the inherent difficulty in disentangling genetic and environmental influences. In a sense, genes and environment are inextricably intertwined (Johnston, 1987), so although behavioral disinhibition may translate to a genetic predisposition for AD/HD and conduct problems, the translation of genetic predisposition to symptoms and substance use are influenced by the child's caretaking environment. Additionally, it must also be emphasized that the child with AD/HD and the family environment exert influence on one another (Johnston & Mash, 2001) and that a child's own characteristics may influence parents' beliefs and behaviors toward their children (Mills & Rubin, 1992).

Thus, the pathway from early emerging AD/HD to substance use disorders unfolds in the context of environmental influence. This pathway may unfold as follows: to begin, it is thought that approximately 60%-90% of AD/HD is transmitted genetically, resulting in a biological predisposition to develop AD/HD in childhood (Waldman & Gizer, 2006). An infant who is genetically predisposed to AD/HD may be more poorly regulated and exhibit a more difficult temperament via a tendency towards hyperactivity,

low reactive control, or heightened emotional reactivity (Finzi-Dottan, Manor, & Tyano, 2006; Martel et al., 2009). This in turn could potentially elicit a negative response from parents and may impact attachment negatively, resulting in lower levels of parental support and inappropriate levels of parental discipline. In support of this, a study by Winsler (1998) noted that parent-child interactions with boys with AD/HD were characterized by increased parental negativity, parental control, and child noncompliance when compared with controls. This noted parental negativity may vary as a function of the child's presenting subtype; children diagnosed with Combined or Predominantly Hyperactive-Impulsive Type AD/HD in one study had significantly higher scores than those diagnosed as Predominantly Inattentive Type on anxious and avoidant parent attachment, emotionality, and activity dimensions of temperament; and their parents reported higher levels of controlling styles (Finzi-Dottan et al., 2006).

A negative parental response would be particularly problematic for children with AD/HD, as it might exacerbate the child's early defiant and impulsive behaviors. This may provide an alternate explanation as to why the presence of AD/HD in a child increases his or her risk of developing secondary conduct problems, such as ODD and CD. A combination of difficult temperament factors and harsh parenting often characterizes families with AD/HD, and it is also associated with increases in externalizing behavior problems in young children (Belsky, Hsieh & Crnic, 1998; Johnston & Mash, 2001). Research suggests that youth who develop externalizing disorders comorbid with AD/HD may suffer from more severe AD/HD and live in family environments that may not provide sufficient support for optimal development (Hurtig,

Ebeling, & Taanil, 2007). Conduct problem development may also depend on AD/HD presentation. A recent study by Elia and colleagues (2008) found that youth with Combined and Hyperactive/Impulsive type AD/HD had higher rates of ODD (51% and 42%, respectively) compared to those with Inattentive type (21%). Children with predominantly hyperactive-impulsive symptoms have also been found to have more conduct problems at home and to be more aggressive and delinquent overall than children with predominantly inattentive AD/HD (Barkley, DuPaul, & McMurray, 1990).

The noted bidirectional influence between poor parenting practices and childhood externalizing problems is consistent with Patterson's coercion theory (Patterson, 1982). According to this theory, inefficient parental discipline leads to coercive child behaviors, such as tantrums and other defiant acts. Parents may inadvertently reinforce undesirable child behavior via inefficient discipline such as verbal threats followed by giving in or backing down. This reinforcement in turn produces further antisocial acts at home and at school and continued difficulties in disciplining, potentially resulting in harsher yet still ineffective parenting practices. Defiance may continue on into adolescence without intervention, as problems in parenting are still of importance during adolescence. In one study, parenting practices accounted for more variance in conduct problems in adolescence as opposed to conduct problems in young and middle childhood (Frick et al., 1999). Thus, although conduct problems may in part arise because of genetic vulnerability, it is better understood that they arise as a result of the bidirectionality between inefficient parenting practices and difficult child temperamental factors.

An alternate explanation then for the link between AD/HD and substance use involves adopting a cumulative risk factor model approach and examining common psychosocial links between the AD/HD and substance use literature; namely, conduct problems and parenting practices. Although it is recognized that these two constructs overlap because of the bidirectional nature of their relationship, they are independent constructs. Whereas previous research has already examined conduct problems as a main mediating link, research examining parenting practices in relation to AD/HD and substance use development is noticeably absent.

Unfortunately, the research that does exist that has examined AD/HD and substance use in youth has reached different conclusions as to how conduct problems play a role. Some research suggests that adolescents with AD/HD with comorbid CD are at the highest risk for developing substance use disorders (e.g., Wilens, 2004). For instance, adolescents with AD/HD and comorbid CD have been found to have the highest rates of smoking (Molina et al., 2005). Unfortunately, some studies that have found a relation between AD/HD and substance use have not measured ODD or CD (e.g., Lerman et al., 2001).

Other studies that have measured ODD and CD symptoms have found elevated substance use and abuse rates only in AD/HD groups with these comorbid disorders (e.g., Molina et al., 1999), suggesting that AD/HD is not a risk factor on its own. August and colleagues (2006) longitudinally assessed three community sample groups of adolescents: a control group, adolescents with AD/HD, and adolescents with AD/HD and comorbid ODD or CD. The researchers found that the comorbid group displayed significantly

higher rates of tobacco use, marijuana use, alcohol use disorder, and marijuana use disorder than the other two groups by late adolescence and concluded that AD/HD without the presence of another externalizing disorder did not transmit a greater risk for substance use. Similarly, Disney and colleagues (1999) assessed 626 pairs of 17-year old twins and divided them into four groups: those with AD/HD and CD, those with AD/HD only, those with CD only, and a comparison group. The AD/HD plus CD group and the CD group had the highest rates of substance abuse; however, the researchers found that a diagnosis of AD/HD alone was not significantly associated with substance use and abuse once the effects associated with the CD diagnosis were removed. Such findings have led many researchers to contest that the risk of substance use is only likely in youth with AD/HD with comorbid conduct problems (e.g., Looby, 2008). Yet other studies that have assessed ODD and CD have found that while these disorders confer a higher risk for substance use and abuse when paired with AD/HD, AD/HD alone remains a risk factor (Biederman et al., 1997; Elkins et al., 2007).

Summary

Research indicates that children with more severe and persistent AD/HD are likely at a greater risk for substance use outcomes. Specifically, it appears that adolescents with both hyperactivity-impulsivity and inattention are at a greater risk of using substances. However, it is also likely that the different AD/HD subtypes present different risks for substance use and perhaps for different types of substance use.

Research suggests that the inattentive domain confers greater risk for tobacco use overall, but the hyperactive-impulsive domain confers greater risk for earlier use, abuse and

dependence of alcohol and other drugs. This AD/HD domain has also been linked with an increased risk for developing secondary comorbid ODD/CD problems, which can also lead to a higher likelihood of using substances (Barkley, 2006). Therefore, the presence of AD/HD may confer greater risk for substance use on its own, but the presence of conduct problems with AD/HD, particularly with AD/HD symptoms in the hyperactive-impulsive domain, may present the greatest risk for increased levels of substance use and abuse (Barkley, 2006; Molina & Pelham, 2003).

One explanation for this risk in youth with AD/HD comes from behavioral genetics research suggesting that an underlying trait, such as behavioral disinhibition, accounts for the link between externalizing problems, including AD/HD, conduct problems, and substance use.

An alternative explanation involves adapting a cumulative risk model and examining psychosocial factors that may drive this link during adolescence. It is well-known that poor parenting practices provide an increased risk for conduct problems and substance use in a child. Because research suggests that AD/HD and comorbid conduct problems provide an increased risk for substance use in adolescence, and because poor parenting practices and AD/HD in a child often lead to conduct problems, it is likely that parenting practices play a mediating role in substance use development in youth with AD/HD. If so, parenting practices may be an ideal target for substance use prevention in youth with AD/HD.

It would therefore be beneficial to extend previous work on AD/HD and substance use in adolescence by assessing parenting practices as another potential

mediator of the AD/HD-substance use pathway while also considering AD/HD subtypes and comorbid conduct problems as has previously been done in the literature. Although it is recognized that other features of the child's environment, such as academic performance and the peer group, also exert an influence on substance use, these factors are outside the scope of the proposed study. However, they are part of the larger framework theorized to lead to substance use in youth with AD/HD (Figure 1).

Current Study

Are adolescents with AD/HD symptoms at heightened risk for substance use? If so, why are they at a heightened risk? The current study aims to shed light on the extent to which the core symptoms of AD/HD lead directly to substance use or translate into substance use by means of other parental and individual mediating risk factors (Figure 2). Although it is recognized that adolescents do abuse substances, the current study aims to inform prevention efforts by elucidating reasons for the development of substance use in adolescents with symptoms of AD/HD. As such, current use of alcohol, tobacco, and marijuana were assessed in the present study as opposed to dependence or abuse. These three substances were chosen because they are the most likely to be used in adolescence (Johnston et al., 2009). Additionally, AD/HD severity was assessed dimensionally instead of categorically, as recent research suggests that dimensional predictors of inattention and hyperactivity-impulsivity are more informative as to substance use outcomes than a categorical diagnosis of AD/HD (Elkins et al., 2007).

In particular, the following hypotheses are proposed about the relation between AD/HD symptoms, parenting practices, and conduct problems and their impact on adolescents' current use of substances:

Hypothesis 1. Based on previous empirical support for a relation between AD/HD and substance use and the theoretical implications of a cumulative risk factor model to explain the development of substance use in adolescents with AD/HD symptoms, symptoms of AD/HD will differentially account for unique variance in adolescent substance use, with inattentive symptoms predictive of tobacco use and hyperactive-impulsive symptoms predictive of alcohol, marijuana, and tobacco use. In addition, given theoretical emphasis on impulsivity as predictive of risk behavior, impulsive symptoms alone will better predict current use than symptoms of hyperactivity-impulsivity together.

Hypothesis 2. Based on the theoretical implications of a cumulative risk factor model to explain substance use development and Patterson's coercion theory to explain conduct problem development, parenting practices and adolescent conduct problems will each separately mediate the AD/HD-substance use pathway by each partially accounting for the association between AD/HD symptoms and current use of all three substances.

Hypothesis 3. In support of a bidirectional relationship between parenting practices and conduct problems, parenting practices and conduct problems will remain mediators by both accounting for the association between AD/HD symptoms and current use of all three substances when employed together in one model.

CHAPTER III

METHOD

Participants

Forty three adolescents and their mothers or female guardians were recruited from schools and youth organizations in the Southeastern region of the United States. Only 34 adolescents were able to be reached for follow-up after their mothers had completed their parent packets; thus, only those 34 dyads with complete data were included in the analyses.

As shown in Table 1, adolescent participants ranged in age from 12 to 17 ($M = 14.76$, $SD = 1.46$) and ranged in grade from 7th to 12th grade ($M = 9.35$, $SD = 1.54$). Sixty-eight percent ($N = 23$) of the adolescent sample was female. Racial composition of the adolescent sample was 17.6% Caucasian, 73.5% African American, 2.9% Asian, 2.9% American Indian or Alaska Native, and 2.9% multiracial; 2.9% of the adolescent sample reported being of Hispanic ethnicity. Thirty-five percent of the adolescent sample reported living with both biological parents, while 53% reported living with at least one biological parent. In addition, 17.6% of adolescents reported living with a step parent, 11.7% with one or both grandparents, 2.9% with an aunt, and 2.9% with a housemate. Fifty three percent of the caretaker sample reported that the adolescent they rated lived in a single-parent household.

Female caretakers ranged in age from 29 to 61 ($M = 43.85$ $SD = 8.95$). One caretaker did not report any demographics. Racial composition of the female caretakers was 17.6% Caucasian, 73.5% African American, 2.9% Native Hawaiian or Other Pacific Islander, and 2.9% Asian American. None of the caretakers reported being multiracial or of Hispanic ethnicity. In terms of educational level, 11.8% of female caretakers reported completing some high school; 58.8% reported completing high school, GED, or some college; and 26.5% reported completing a four-year college degree or higher. In terms of combined yearly household income, 29.4% of the caretaker sample reported earning less than \$20,000 per year, 20.6% reported earning between \$20,000 and \$35,000 per year, 29.4% reported earning more than \$35,000 per year, and 17.6% declined to report on income.

Predictor Variable

Adolescent AD/HD Symptoms. Adolescent AD/HD symptoms were assessed by a female caregiver using the home version of the ADHD Rating Scale-IV (ADHD-RS; DuPaul et al., 1998). The ADHD-RS contains 18 items corresponding to the 9 inattention and 9 hyperactive-impulsive symptoms from *DSM-IV-TR* (APA, 2000) presented in alternating order. Items are rated from 0, indicating that the symptom is never or rarely present, to 3, indicating that the symptom is present very often. Scores may be summed across the odd-numbered items to produce an overall inattention severity score, across the even-numbered items to produce an overall hyperactive-impulsive severity score, and across all items to produce a total severity score of symptoms. Internal consistencies for the subscales and total scale range from 0.86-0.92. Test-retest reliability over 4 weeks is

very good at 0.78-0.86. (DuPaul et al., 1998). The symptom severity scores for inattention and hyperactivity-impulsivity were used as predictor measures. Because of the theoretical importance of impulsivity as a predictor of substance use, a sum score of the three impulsivity items was also calculated apart from the six hyperactivity items and included in analyses.

Outcome Variables

Adolescent Substance Use Behaviors. Current use of substances was defined as past 30 day use of alcohol, tobacco, and marijuana, and was assessed using items from the State and Local Youth Risk Behavior Survey (YRBS; Center for Disease Control and Prevention, 2004).

These questions can be found in Appendix A. Alcohol use was defined on the questionnaire as consuming beer, wine, wine coolers, and liquor such as rum, gin, vodka, and whiskey, and did not include using alcohol for religious purposes. All items used the same scale to assess frequency of use in the past 30 days ranging from 0, indicating no days of use, to 6, indicating that the adolescent used the substance on all 30 days. Test-retest reliability studies of the YRBS items have demonstrated substantial to high reliability of items ($\kappa = 0.61$ to 1.00), and indicate that the questionnaire items are best suited for students in or above 8th grade (Center for Disease Control and Prevention, 2004).

Intentions to Use Alcohol and Tobacco In the Future. Additional measures were included to assess intentions to use alcohol and tobacco in the future. These measures can also be found in Appendix A. These items have been used with a

community adolescent population (Scull, Kupersmidt, Parker, Elmore, & Benson, 2009) and demonstrate good internal reliability ($\alpha = 0.89$). Two questions assess intentions to use alcohol and two questions assess intentions to use tobacco in the future. All items used the same scale to assess intentions to use the substance before the legal age, ranging from 0, indicating that the adolescent definitely will not use the substance before the legal age, to 3, indicating that they definitely will. Scores from these items were added together to produce a total intent to use score.

Proposed Mediators

Conduct Problems. The Behavior Assessment System for Children-Second Edition (BASC-2; Reynolds & Kamphaus, 1992) is a broad-band rating scale designed to assess behavioral functioning in children from ages 2 to 18 years of age. The current study used the parent report version of the BASC-2 appropriate for youth ages 12 to 21. This questionnaire assesses five domains of youth functioning: behavioral symptoms, externalizing problems, internalizing problems, school problems, and adaptive skills. Within these five domains of functioning are 14 specific assessment areas, including Conduct Problems, Aggression, Attention Problems, Hyperactivity, and Social Skills. Respondents are instructed to circle items corresponding to how often the behavior occurs, with items rated from 0, indicating that the behavior never occurs, to 3, indicating the behavior almost always occurs. Internal consistency of the scales ($\alpha = .70s - .90$) and composites ($\alpha = .80s - .90s$) is very good. Gender-normed T-scores for the Conduct Problems subscale and the Aggression subscale were utilized as a proxy of severity of CD and ODD symptoms, respectively, in the adolescents. The subscale scores were

added together to provide a composite of overall conduct problems in the adolescent sample. This was done instead of using the Externalizing Problems composite T-score from the BASC-2, because this composite contains information about AD/HD symptoms that overlap with the ADHD-RS-IV.

Parenting Practices. The Alabama Parenting Questionnaire (APQ; Shelton, Frick & Wootton, 1996) is a global parent rating scale consisting of 42 items designed to assess five dimensions of parenting practices: parental involvement, use of positive reinforcement, monitoring and supervision, consistency in discipline, and use of corporeal punishment. A total composite parenting score is derived by summing across the five subscales, with higher scores indicating more negative parenting practices overall. Both the parent and youth versions of the scale were administered. The parent form asks parents to circle numbers corresponding to how often they employ the parenting technique, with items rated from 1 indicating that they never use the technique, to 5, indicating that they always use the technique. The youth version of this form asks analogous questions about parenting practices in general, although both mother and father parental involvement are assessed separately. As with the parent form, youth are instructed to circle how often their parent uses the listed parenting technique. Internal consistency of the subscales for youth report ($\alpha = .43-.90$) and parent report ($\alpha = .48-.82$) is adequate. The youth form has been validated with adolescents and is recommended for use when assessing parenting practices of parents with adolescents (Frick et al., 1999). Thus, the total composite score from the adolescent version of the APQ was used to assess parenting practices in the current study.

Other Variables

Demographics. The parent questionnaires included items regarding basic demographic information on sex, race, ethnicity, age, education level (some high school; completed high school, GED, or some college; or four-year college degree or higher), family structure of the household (one parent or two parent), and yearly household income as a proxy for SES. Adolescent questionnaires included items regarding basic demographic information on sex, race, ethnicity, age, grade level, and current living arrangement.

Depression and Anxiety. To address the possibility that symptoms of anxiety or depression could account for substance use in the adolescent sample, adolescents were asked to complete the Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988) and the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996). The BAI is a 21-question self-report instrument that assesses common symptoms of anxiety, such as numbness, hot and cold sweats, or feelings of dread. The respondent is asked to rate how much he or she has been bothered by each symptom over the past week on a 4-point scale ranging from 0 (Not at all) to 3 (Severely), with higher scores indicating more severe anxiety symptoms. The items are summed to obtain a total score ranging from 0 to 63. The BAI has high internal consistency ($\alpha = 0.92$; Beck, Epstein, Brown, & Steer, 1988). Although the age range for the measure is from 17 to 80, the BAI has been frequently used and has been validated with adolescents ages 12 and older (e.g., Kumar, Steer, & Beck, 1993). The BDI-II is a 21-question self-report instrument that assesses common symptoms of depression, such as feelings of failure, disappointment in self, and

thoughts of suicide. The respondent is asked to rate on a 4-point scale which statement from a group of four statements best describes them in the past two weeks, with answers ranging from 0 for less depressed items to 3 for more depressed items. A higher total score indicates more severe depressive symptoms. The BDI-II is intended for use with people ages 13 and older, and has been found to have a high internal consistency ($\alpha = 0.92$; Beck, Steer, & Brown, 1996).

Social Desirability. Because of the socially sensitive nature of the substance use questions, a true-false social desirability scale was included in the adolescent questionnaire. Items were pulled from the Marlowe-Crowne Social Desirability Scale (Crowne & Marlowe, 1960) to comprise an 11-item short form analyzed and validated by Ballard (1992; $\alpha = .69$) that can be found in Appendix B. The Marlowe-Crowne scale is a scale commonly used to assess social desirability and has been found to be independent of psychopathology (Crowne & Marlowe, 1960). This particular 11-item short form was recommended by Loo and Loewen (2004) and includes items such as “No matter who I’m talking to, I’m always a good listener” and “I’m always willing to admit it when I make a mistake”. Social desirability was correlated with total use and predictor variables in order to determine if adolescents were answering the questionnaire in a socially desirable manner.

Procedure

In order to obtain access to youth and parents in the community, permission was first obtained to recruit through various youth-involved community organizations, including Youth Focus, the Folk Teen Center, the Wise Guys and the Smart Girls teen

pregnancy prevention programs, the Guilford County Tobacco Use Prevention Coalition, Greensboro Housing Authority, and Guilford County Schools. Five other youth-involved organizations were contacted but were not able to be reached or chose not to participate. Individuals were also recruited by approximately 200 flyers distributed through the Center for Youth, Family, and Community Partnerships; the UNCG Psychology Clinic; the AD/HD Clinic at UNCG; and AD/HD parent support group meetings. Presentations were offered free-of-charge to youth groups whose administrators or leaders permitted the researcher to recruit.

To collect data from Greensboro Housing Authority (GHA) communities, the researcher coordinated with the GHA Director of Administration and the GHA Community Programs and Grants Supervisor to meet with the Resident Council Presidents from three GHA communities. Permission was received to recruit through three Greensboro Housing Authority communities and conduct questionnaires at the community site. Approximately 200 flyers were distributed to each community about the project.

Recruitment at Guilford County Schools necessitated further follow-up with administrators at the 27 public high schools to receive additional letters of support and to gain access to afterschool teachers and coaches; this resulted in only one school being interested in the project. After obtaining a letter of permission from this school, the researcher coordinated with the Athletic Director at the school to obtain verbal permission from athletic coaches to recruit adolescents from their teams. Sixty packets were distributed at this school.

One organization was not able to be reached for follow-up after the letter of support was received. Two organizations allowed flyers to be left at their main location instead of allowing direct recruitment of parents and adolescents. Youth were recruited directly at a few locations. The standard procedure for this recruitment involved distributing parent packets containing the questionnaires and consent forms to interested adolescents after the purpose of the project and project confidentiality were explained. Only the mother or female primary caregiver from each household was asked to complete the parent packet in order to eliminate potential variability due to differences in mother and father report. Mothers and female caretakers were given one month to complete and return parent packets to the AD/HD Clinic. The questionnaires were then administered to adolescents at a second scheduled program meeting. Mothers and adolescents were each given \$10 gift cards to Wal-Mart or Target in exchange for their participation. Parents who completed the questionnaires and mailed them back to the AD/HD Clinic were mailed gift cards and adolescents who completed the questionnaires were given gift cards upon completion of measures.

Mothers and adolescents were also recruited together at other program meetings. The procedure for this type of recruitment involved administering questionnaires to both mothers and adolescents after the purpose of the research project and project confidentiality were explained. Consent and assent forms for the project are available in Appendices C and D, respectively. Parents and adolescents that completed the questionnaires were given gift cards. Confidentiality was maintained by substituting

numbers for names on all the questionnaires; parents and adolescents had the same number in order to facilitate data entry.

Because the BDI-II assesses risk for suicide, a suicide risk protocol was in place for the project. Before leaving the study, the suicide item was checked by the researcher. One youth endorsed suicidal intent. The researcher conducted a brief suicide risk assessment, contacted the faculty sponsor for the project, and spoke with the youth's mother. In addition, a list of referrals to local mental health services was provided, including the number for the UNCG Psychology Clinic. This family was sent a follow-up letter one month after the incident.

CHAPTER IV

RESULTS

Preliminary Inspection of the Data

All analyses were conducted using SPSS Version 17.0 (SPSS, 2008). An examination of the data indicated that three variables violated assumptions of normality: total current use, parent-rated impulsivity, and BDI-II scores. Total use was not able to be transformed because of the severely non-normal distribution of the data, as only four of the 34 youth reported any use at all. Total use was instead dummy-coded and dichotomized as “any use” ($N = 4$) or “no use” ($N = 30$) for the analyses. Parent-rated impulsivity and BDI-II scores were log transformed, resulting in normally distributed variables. Final skew statistics for all variables, except total use, ranged from $-.39$ to 1.39 ; final kurtosis statistics for all variables, except total use, ranged from -1.06 to 1.64 . Thus, all data, except for total use, fulfilled the assumptions of the planned analyses.

Description of the Sample

Descriptive statistics for the predictor, outcome, and proposed mediator variables appear in Table 2. In terms of AD/HD symptom counts, the adolescents in this study displayed an average of 1.06 counts of inattention ($SD = 1.91$) and 1.79 counts of hyperactivity-impulsivity ($SD = 3.03$), which are both significantly below the clinical cut-offs for AD/HD diagnoses, indicating a primarily non-AD/HD sample. However, because the study used a community sample, this was expected, and AD/HD symptom severity

was used instead of AD/HD symptom count as a predictor. In terms of AD/HD severity, mean scores were 4.82 ($SD = 5.54$) for inattention, 6.82 ($SD = 7.91$) for hyperactivity-impulsivity, 1.74 ($SD = 2.26$) for impulsivity alone, and 13.38 ($SD = 15.10$) for overall AD/HD symptoms.

In terms of total use, only four of the 34 adolescents reported any use of substances in the past 30 days. Closer inspection of the four who reported any use in the past 30 days revealed that these were older adolescents. One 15-year-old African American female reported drinking alcohol all 30 days and using marijuana between 10 and 19 days; one 16-year-old Caucasian female reported smoking cigarettes all 30 days, using alcohol between 6 and 9 days, and using marijuana between 6 and 9 days; and two 16-year-old African American males reported using cigars, cigarillos, or little cigars between 6 and 9 days and using marijuana between 6 and 9 days.

Because of low use rates, alcohol, tobacco, and marijuana use were combined to produce a total use score ($M = 1.00$, $SD = 2.92$) for the analyses. Overall adolescent-rated parenting practices from the APQ ranged from -51 to 40, with higher scores indicating more negative overall parenting practices ($M = -14.41$, $SD = 17.49$). The parent-rated BASC-2 Aggression and Conduct Problem T-scores were combined to yield a total Conduct Problems score ($M = 101.09$, $SD = 23.34$) used in the analyses. In general, adolescents endorsed mild symptoms of depression on the BDI-II ($M = 9.79$, $SD = 10.91$) and mild symptoms of anxiety on the BAI ($M = 13.18$, $SD = 13.60$).

Correlations among Variables

As shown in Table 3, correlational analyses yielded numerous significant

associations among the various predictor, outcome, and proposed mediator variables. Current use was correlated significantly with more severe symptoms of inattention ($r = .34, p < .05$) and more negative parenting practices ($r = .44, p < .01$). More severe symptoms of inattention were correlated with higher rates of conduct problems ($r = .64, p < .01$), more negative parenting practices ($r = .49, p < .01$), and higher rates of depressive ($r = .40, p < .05$) and anxiety symptoms ($r = .56, p < .01$) in the adolescent. More severe symptoms of hyperactivity-impulsivity were correlated with higher rates of conduct problems ($r = .59, p < .01$) and higher rates of anxiety symptoms ($r = .38, p < .05$) in the adolescent. More severe symptoms of impulsivity alone were correlated with higher rates of conduct problems ($r = .58, p < .01$). Conduct problems were not correlated with negative parenting practices, depression, or anxiety symptoms. Higher rates of negative parenting practices were correlated with higher rates of depression ($r = .52, p < .01$) and anxiety symptoms ($r = .60, p < .01$) in the adolescent. Adolescent-rated anxiety and depression were also significantly related ($r = .77, p < .01$).

Answers from the social desirability scale were uncorrelated with total use. Because of this, social desirability was not included in the analyses as a covariate. However, social desirability was correlated with other adolescent-reported variables, such that higher social desirability scores were associated with less negative parenting practices ($r = -.38, p < .05$), and less depressive symptoms ($r = -.38, p < .05$).

Predicting Current Use

As previously stated, the low rates of substance use in the sample precluded examining tobacco use separately from alcohol and marijuana use. To address the first

hypothesis that symptoms of AD/HD would differentially account for unique variance in current substance use, four logistic linear regressions were run, with the dichotomized total use variable regressed separately on inattention, hyperactivity-impulsivity, impulsivity alone, and total AD/HD symptom severity. None of these four regressions was significant, indicating that symptoms of AD/HD were not related to current use in this sample. Thus, the meditational model was not able to be tested as proposed. A summary of these analyses appears in Figure 3.

Post-hoc Analyses

In order to explore the proposed meditational model, another construct related to current use, *intent to use*, was examined as an alternate outcome measure. This measure was introduced part-way through the study because of the low reported rates of current use. Therefore, only 25 of the 34 adolescents completed the measure and were able to be included in the post-hoc analyses.

Differences between the Samples. One-way ANOVAs, Mann-Whitney U tests and chi-square difference tests were conducted on demographic variables, predictor variables, and outcome variables between the 9 dyads that did not answer the intentions items and the 25 dyads that did to see if any differences were noted. Overall, not many differences between the two samples were noted. The analyses revealed a significant difference in adolescent age ($F = 13.99, p = .001$) and adolescent grade ($F = 16.29, p < .001$), such that the group who did not answer the intentions items was significantly younger and lower in grade. The analyses also revealed a difference in adolescent-reported parenting practices ($F = 5.34, p = .027$) and social desirability ($F = 14.25, p =$

.001), such that the group who did not answer the intentions items reported significantly lower amounts of social desirability and negative parenting practices. No other significant differences between the two groups were found.

Description of the Subgroup. The two intentions to use alcohol items and the two intentions to use tobacco items were combined to yield a total intent score. In terms of intent to use, 12 of the 25 adolescents reported at least some intent to use alcohol or tobacco before the legal age ($M = .48$, $SD = 1.66$). In terms of AD/HD symptoms, mean scores were 5.92 ($SD = 7.80$) for inattention, 4.56 ($SD = 5.65$) for hyperactivity-impulsivity, 1.56 ($SD = 2.10$) for impulsivity alone, and 12.04 ($SD = 15.07$) for AD/HD symptoms overall, indicating a low severity of AD/HD symptoms in the sample. Overall adolescent-rated parenting practices from the APQ ranged from -58.0 to 2.0, with higher scores indicating more negative overall parenting practices ($M = -31.56$, $SD = 13.56$). The parent-rated BASC-2 Aggression and Conduct Problem T-scores were combined to yield a total Conduct Problems score ($M = 101.00$, $SD = 21.80$). In terms of internalizing symptoms, adolescents reported an average of 7.68 symptoms of depression ($SD = 8.26$) and 11.28 symptoms of anxiety ($SD = 10.93$). Clinically, these means suggest that the subgroup sample typically reported mild and non-clinical amounts of depression and anxiety.

Descriptive statistics and frequencies for demographics and included variables were run again for the subgroup of 25 who answered intentions items. A summary of these subgroup sample characteristics appears in Table 4. In this subgroup, only BDI-II scores and total intent were found to be non-normal. Both variables were log transformed

for the post-hoc analyses. After these transformations, the subgroup data did not violate assumptions of normality. Final skewness statistics for all variables ranged from -.73 to 1.44; final kurtosis statistics for all variables ranged from -1.06 to 1.68. Thus, the subgroup data fulfilled the assumptions of the planned post-hoc analyses.

Correlations Among Variables. As shown in Table 5, correlation analyses yielded significant associations among the various predictor, outcome, and proposed mediator variables, some similar to the overall sample and some different. Intent to use was not correlated with total use. Intent to use was correlated significantly with more severe symptoms of inattention ($r = .53, p < .05$) and more anxiety symptoms ($r = .41, p < .05$) in the adolescent. More severe symptoms of inattention were correlated with higher rates of conduct problems ($r = .74, p < .01$), more negative parenting practices ($r = .60, p < .01$), and higher rates of anxiety symptoms ($r = .44, p < .01$) in the adolescent. More severe symptoms of hyperactivity-impulsivity were correlated with higher rates of conduct problems ($r = .69, p < .01$) in the adolescent and more negative parenting practices ($r = .53, p < .01$). More severe symptoms of impulsivity alone were also correlated with higher rates of conduct problems ($r = .77, p < .01$) and more negative parenting practices ($r = .44, p < .01$). Higher rates of conduct problems were correlated with more negative parenting practices ($r = .43, p < .05$). Higher rates of negative parenting practices were correlated with higher rates of anxiety symptoms ($r = .59, p < .01$) in the adolescent. Adolescent-rated anxiety and depression were also significantly related ($r = .76, p < .01$).

Answers from the social desirability scale were uncorrelated with intent to use,

just as they were uncorrelated with current use. Because of this, social desirability was not included in the post-hoc analyses as a covariate. Higher social desirability scores were associated with less negative parenting practices ($r = -.50, p < .05$) but not with depression or anxiety.

Predicting Intent to Use. In order to test the proposed hypotheses, a series of linear regressions was run to determine possible mediation, as per Baron and Kenny (1986). These results are summarized in Table 6. First, the transformed intent to use variable was regressed separately on inattention, hyperactivity-impulsivity, and then impulsivity alone. Contrary to the proposed hypothesis, only inattentive symptoms were found to predict intent to use ($\beta = .53, p = .006$). Therefore, only inattentive symptoms were used for the rest of the meditational analysis.

Secondly, the proposed mediators, conduct problems and parenting practices, were each separately regressed on inattentive symptoms. Inattentive symptoms were found to predict total conduct problems ($\beta = .74, p < .001$) and parenting practices ($\beta = .60, p = .002$). For the third part of the analysis, intent to use was regressed separately on conduct problems and parenting practices. Neither conduct problems nor parenting practices predicted intent to use, suggesting that the meditational models would not be supported. A summary of these analyses appears in Figure 4.

Finally, two separate models were run to confirm that the meditational models would not hold: intent to use was regressed on inattentive symptoms and conduct problems, and then intent to use was regressed on inattentive symptoms and parenting practices. For the model where conduct problems were used to predict intent to use

controlling for inattentive symptoms, inattentive symptoms remained significantly associated with intent to use ($\beta = .77, p < .05$) but conduct problems did not. Similarly, for the model where parenting practices were used to predict intent to use controlling for inattentive symptoms, inattentive symptoms remained significantly associated with intent to use ($\beta = .53, p < .05$) but parenting practices did not. Thus, the data did not support the proposed meditational pathway.

Internalizing Symptoms. Because externalizing problems and parenting practices did not mediate the relation between AD/HD symptoms and intent to use, the possibility that internalizing symptoms might help explain this relationship was considered. Thus, depression and anxiety symptoms were included as mediators in additional post-hoc analyses. These results are summarized in Table 7.

For this set of analyses, inattentive symptoms were again used as the main predictor, as hyperactivity-impulsivity and impulsivity alone were not found to predict intent to use in the first set of post-hoc analyses. Depression and anxiety symptoms were regressed individually on inattentive symptoms. Inattentive symptoms were found to predict anxiety symptoms ($\beta = .44, p = .03$) but not depressive symptoms. Intent to use was next regressed on anxiety symptoms. In support of the exploratory meditational model, anxiety symptoms predicted intent to use ($\beta = .41, p = .04$). Finally, intent to use was regressed on inattentive symptoms and anxiety symptoms together. As with the previous proposed meditational model, inattentive symptoms remained significantly associated with intent to use but anxiety symptoms did not. Therefore, the post-hoc

analyses were not able to identify a mediating variable that could account for the relation between symptoms of inattention and intent to use.

CHAPTER V

DISCUSSION

It is well understood that adults with AD/HD are at greater risk for use, abuse, and dependence on substances (e.g., Faraone et al., & Biederman, 2007). Prior research also seems to indicate that adolescents with AD/HD are at greater risk for substance use and abuse (Burke et al., 2001; Molina & Pelham, 2003), although the exact mechanisms driving this risk remain unclear. Consistent with prior research, the current study hypothesized that symptoms of AD/HD would be related to adolescents' current use of alcohol, tobacco, and marijuana, the three most commonly used substances in adolescence. Specifically, it was predicted that symptoms of inattention would predict tobacco use, while symptoms of hyperactivity-impulsivity would predict alcohol, marijuana, and tobacco use. Additionally, given theoretical importance of impulsivity as predictive of risk-taking behavior more generally, it was hypothesized that impulsive symptoms alone would predict current use above symptoms of inattention and symptoms of hyperactivity-impulsivity.

The current study also adopted a cumulative risk factor model approach to understanding the link between AD/HD symptoms and current use of substances and attempted to look at two possible mediating mechanisms known to increase risk for substance abuse in adolescence; namely, poor parenting practices and conduct problems. Consistent with Patterson's coercion theory (Patterson, 1982) and a cumulative risk factor

model approach (e.g., Newcomb, Maddahian, Skager, & Bentler, 1987), the current study hypothesized that parenting practices and adolescent conduct problems would each separately mediate the relation between dimensional measures of AD/HD symptoms and current use of substances. Additionally, in support of the bidirectional nature of parenting practices and conduct problems, it was hypothesized that that they would both remain mediators when employed together in one model.

AD/HD and Current Use of Substances

Reports of current use were substantially lower than expected in this sample. Because of this, the first hypothesis was not able to be examined as proposed. Instead, current use of any substances was combined for each adolescent to provide a total use score. Because this still resulted in only four out of 34 youth reporting any use, current use of substances was dichotomized into “any use” and “no use” and logistic regressions were run examining inattentive symptoms, hyperactivity-impulsivity symptoms, impulsivity symptoms alone, and total AD/HD severity. Although initial correlational analyses had provided some support for the association between inattentive symptoms of AD/HD and current use, the main regression analyses to test the proposed mediational model were not significant. Thus, the hypotheses were not able to be examined as proposed.

Post-hoc Mediational Pathway to Intent to Use Substances

After the proposed analyses were conducted, post-hoc analyses utilizing another substance use outcome, intent to use substances, were conducted to determine whether the proposed mediational models would fit with this outcome variable instead. Although

intent to use is a documented proxy for actual substance use in youth (e.g., Andrews, Tildesley, Hops, Duncan & Severson, 2003; Ellickson et al., 2001; Yanovitzky, 2005), intent to use substances has not previously been examined in the literature in relation to AD/HD symptoms. The current study used four items to examine intent to use alcohol and intent to use tobacco before the legal age. More adolescents in this sample ($N = 12$) reported any intent to use substances before the legal age as opposed to any actual current use of substances ($N = 4$). It is not surprising that adolescents may be more comfortable answering questions about possible drug use than about actual drug use, as reporting intent to use carries less risk for an adolescent.

Review of the data from the 25 parents and adolescents who were administered the four intent to use items indicated that symptoms of inattention may play more of a role in driving substance use than previously thought. Correlational analyses provided some initial support for an association between inattentive symptoms and intent to use, just as for current use. A series of post-hoc linear regressions were next run to test the proposed mediational models. Inattentive symptoms but not symptoms of hyperactivity-impulsivity or impulsivity alone were found to predict intent to use. Only inattentive symptoms were used for the rest of the mediational analysis. In support of the mediational models, inattentive symptoms were found to predict conduct problems and parenting practices. However, neither conduct problems nor parenting practices predicted intent to use. Thus, the mediational models were not supported by these post-hoc analyses.

Because depression and anxiety are also risk factors for substance use (e.g., Hawkins et al., 1992), symptoms of both were also examined as potential mediators of the inattentive-intention pathway. Inattentive symptoms predicted anxiety symptoms but not depressive symptoms. Furthermore, anxiety was found to predict intent to use, but not when symptoms of inattention were taken into account. Thus, no post-hoc mediational models were supported.

Summary

Consistent with prior research, the current study hypothesized that symptoms of AD/HD would be related to adolescents' current use of substances, with symptoms of inattention predictive of tobacco use, symptoms of hyperactivity-impulsivity predictive of alcohol, marijuana, and tobacco use, and symptoms of impulsivity alone as better predictive of current use. A cumulative risk factor model approach was adopted to explore the link between AD/HD symptoms and current use of substances, and the study attempted to look at two possible mediating mechanisms to explain this link: poor parenting practices and conduct problems. The current study hypothesized that parenting practices and adolescent conduct problems would each separately mediate the relation between dimensional measures of AD/HD symptoms and current use of substances but also that they would both remain mediators when employed together in one model.

Consistent with research by Molina and Pelham (2003), inattentive symptoms were associated with current use and predictive of intent to use substances in this study. This provided some support for hypothesis 1, as the intent items included intent to use tobacco products and inattentive symptoms were found to predict intent overall.

Furthermore, in support of the cumulative risk factor model approach for examining substance use in an AD/HD population, correlational analyses revealed that more severe symptoms of inattention were related to higher rates of conduct problems, negative parenting practices, depression, and anxiety. Although none of these factors emerged as significant predictors of current use or intent to use in the regression analyses, it is possible that the small sample size made it difficult to detect a significant relationship. While it thus remains unclear which subtypes of AD/HD and what psychosocial factors play a more significant role in driving substance use risk, this study adds to the small body of work indicating that inattentive symptoms may play more of a role in driving substance use than previously thought.

In addition, although current use of substances did not predict come out as hypothesized, intent to use substances did. As this study is one of the first known studies examining intent to use substances as a risk outcome for symptoms of AD/HD, the results suggest that intent to use substances may be a useful, albeit unexplored, measure when examining substance use outcomes in regards to AD/HD symptoms in adolescents.

Limitations

The most significant limitation of this study was the small sample size, which impacted the study in multiple ways. As previously mentioned, the sample size limited power and likely restricted the ability to detect significant associations among study variables. It also limited examination of social factors, such as household composition and socioeconomic status, that have been shown to play a role in risk for substance use. Furthermore, the intent to use items were only administered to a subsample of

participants because they were added in as an extra measure of use part-way through the study. It is important to note that, despite restrictions imposed by the small sample size, a significant relation was consistently detected between symptoms of inattention and measures of current use and intent to use.

Small sample size may also in part have led to small amounts of reported current use, which resulted in an inability to parse out and separately examine tobacco, alcohol, and marijuana use as outcome variables. Additionally, low use rates may also have impacted the ability to determine whether significant correlational associations were also indicative of mechanisms of risk for current use. The sample for the current study reported low rates of past 30 day use of alcohol, tobacco, and marijuana that are inconsistent with typical use rates for this age range. According to results from the 2007 Youth Risk Behavior Survey for Guilford County, North Carolina (Center for Disease Control and Prevention, 2008), 20.6% of youth between 9th through 12th grade smoked cigarettes on at least one day in the past 30 days, 39% had had at least one drink of alcohol in the past 30 days, and 37.5% had used marijuana at least once in the past 30 days.

It is unclear why the recruited sample reported a significantly lower amount of substance use than would be expected. The social desirability scale indicated that adolescents did not respond to the current use and intent to use items in socially desirable ways. It did indicate that adolescents with less overall externalizing and internalizing problems and less parenting problems reported more socially desirable answers on the social desirability scale. This direction of report makes sense; in other words, it would be

expected that adolescents with less problems would act in more socially desirable ways. It is possible that recruiting part of the sample from pregnancy and tobacco prevention groups led to the recruitment of more conscientious and less at-risk youth. Similarly, asking youth to bring packets to their parents to complete may have inadvertently led to the recruitment of more conscientious and therefore less at-risk youth. Additionally, the inadvertent recruitment of predominantly low-income, African-American youth and parents may have resulted in more socially desirable responses for a graduate-level Caucasian experimenter.

An additional limitation of this study that may be related to low use rates is the low severity of AD/HD symptoms in this sample. Adolescents with higher levels of AD/HD symptoms have been found to be more likely than peers with less AD/HD symptoms to drink and smoke (Whalen et al., 2002) and to experiment with smoking at earlier ages (Tercyak & Audrain-McGovern, 2003). Adolescents were recruited through the community as opposed to through a clinic, and most adolescents in this sample fell significantly below the clinical cut-offs for AD/HD diagnoses. Although previous research has supported a dimensional approach to examining AD/HD symptoms as a risk factor (Elkins et al., 2007), this study utilized a large sample of adolescents, resulting in a wider range of AD/HD symptoms. It may be that including a larger sample and thus a wider range of AD/HD symptom severity would have led to higher use rates and more significant findings, and this would be important for future studies examining substance use and AD/HD dimensionally. Similarly, examining a clinic-referred group of youth

with AD/HD instead of a community sample may have also led to more significant findings.

Another limitation is the correlational design of this study, which limits the ability to make inferences of causation based on these data. Also, the data provide no indication of the temporal sequence of symptoms of AD/HD, conduct problem symptoms, negative parenting practices, symptoms of depression and anxiety, and substance use. In other words, it is unclear whether child externalizing or internalizing difficulties began prior to the onset of negative parenting practices and substance use or vice versa.

Implications

This study provided support that symptoms of inattention may play a role in substance use in youth with symptoms of AD/HD, whereas most previous research has found support for the role of symptoms of hyperactivity-impulsivity (e.g., Barkley, 2006; Elkins et al., 2007). While symptoms of inattention were related to current use and found to predict intent to use substances in this small study sample, it remains unclear what psychosocial or genetic factors drive this relation.

It may be that there are alternate pathways to substance abuse risk for youth with symptoms of AD/HD that do not involve the externalizing traits of impulsivity and antisocial behavior typically noted in the literature. Other factors not considered in this study that are known to play a role in substance use development include deviant peer affiliation, parent substance use, and academic performance (Hawkins et al., 1992). Consistent with the cumulative risk factor model proposed (see Figure 1), these factors may play a role in substance use development for youth with AD/HD. For instance,

previous research has found that teacher ratings of inattention in adolescence were more strongly correlated with grade point average than ratings of hyperactivity-impulsivity (Molina, Smith, & Pelham, 2001). It may be that impairing inattentive behavior in the classroom impacts academic achievement, leading to gravitation away from conformist peer groups with academic values and towards nonconformist peer groups where substance use is modeled and more prevalent (Molina and Pelham, 2003).

Another alternate pathway that was only partially considered in the current study is the role of trauma and internalizing symptoms (e.g., anxiety, depression) in substance use, particularly for women. A majority of participants in this sample were female, and research suggests that although women are beginning to use and become dependent on substances at similar rates to men (Johnson et al., 2009), women may present alternate pathways to substance use than men because of the prevalence of other psychosocial factors (Center for Substance Abuse Treatment, 2009). Women are more likely than men to have co-occurring mental and substance use disorders (Kessler et al., 1997). In particular, women with substance use disorders often present with major depression, anxiety disorders, including PTSD, and eating disorders (Agrawal et al., 2005). These diagnoses are also common outcomes of violence and trauma, suggesting a pathway from trauma and violence to internalizing disorders, such as anxiety and major depression, and ultimately substance use as a way of managing negative affect (Center for Substance Abuse Treatment, 2009). Past trauma may thus be another potential mediator of the pathway, along with internalizing symptoms, that could help explain the association between AD/HD and substance use, particularly for a predominantly female sample.

Regardless of what drives the link between AD/HD symptoms and substance use, the lack of findings for hyperactivity-impulsivity symptoms but not for inattentive symptoms in this sample speaks to the importance of examining subtypes of AD/HD when examining risk factors and outcomes in an adolescent population.

Furthermore, behavioral intention to use substances was a novel way to examine the pathway from AD/HD symptoms to a risky outcome, such as substance use. Clinically, this suggests that practitioners may not want to rely exclusively on measures of current use. Assessing intent to use may be a useful way to alert professionals about substance use behaviors before substance use occurs, thus assisting in prevention and intervention efforts.

Although the Theory of Reasoned Action has implicated behavioral intentions as the best predictors of actual behavior (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) and has been successful at predicting intentions to engage in some health-impairing behaviors, behavioral intentions have been less successful in predicting others. In other words, intentions demonstrate a “mixed bag” of outcomes when it comes to health behaviors such as substance use (Gibbons, Gerrard, Blanton, & Russell, 1998). Arguably, a fundamental flaw in these rational or deliberative theories is that all behaviors are premeditated. It may stand to reason that not all behaviors are logical or rational, particularly among adolescents (e.g., drunk driving, substance use, and unprotected sex) and particularly among adolescents who are impulsive, such as adolescents with AD/HD. While it may be useful to continue to utilize intent to use substances as a proxy measure for actual use in an adolescent population to understand this unfolding risk pathway, it

may be more useful to examine use in a slightly older population, such as a college population, where substance use is more prevalent and socially acceptable, in order to better understand the link between AD/HD and substance use. Similarly, using other measures of substance use, such as substance use initiation, and using longitudinal assessment, may better assess the reasons for substance use development in youth with AD/HD symptoms or clinical diagnoses.

An additional implication of the current work is the importance of establishing a network of relationships with community agency leaders and a streamlined data collection strategy when conducting research investigating risky outcomes, such as substance use. Despite contact with multiple community agencies, including two agencies with access to a large number of adolescents (Greensboro Housing Authority and Guilford County Schools), recruitment efforts resulted in a relatively small amount of completed questionnaires. Many agencies were reticent to provide permission initially, and even after permission was obtained in some agencies, further permission and coordination were necessary and typically resulted in only a few participants. Furthermore, the multi-step nature of this project, requiring adolescents to first remember to give parents the packets; next requiring mothers to give permission, complete, and mail back packets; and then separate follow-up for adolescents to complete packets; resulted in nearly 100 packets never being returned from parents in the first place and some incomplete adolescent data.

Conclusion

Bearing in mind the limitations of the current study, the obtained findings suggest

that symptoms of inattention may play a larger role in substance use development during adolescence than previously thought. Additionally, the novel use of intent to use substances as a proxy for actual substance use while considering symptoms of AD/HD suggests that assessing intent to use may provide theoretical insight into mechanisms behind substance use risk for an adolescent population and clinical information important in prevention efforts. It remains important to continue exploring mechanisms behind substance use development in youth with AD/HD in order to best inform prevention and intervention efforts.

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APPENDIX A

QUESTIONNAIRE ITEMS ASSESSING CURRENT USE AND INTENTIONS TO USE SUBSTANCES

Current (past 30 day) use of substances^a

1. During the past 30 days, on how many days did you smoke cigarettes?
 2. During the past 30 days, on how many days did you use chewing tobacco, snuff, or dip, such as Redman, Levi Garrett, Beechnut, Skoal, Skoal Bandits, or Copenhagen?
 3. During the past 30 days, on how many days did you smoke cigars, cigarillos, or little cigars?
 4. During the past 30 days, on how many days did you have at least one drink of alcohol?
 5. During the past 30 days, how many times did you use marijuana?
-

Intentions to use substances^b

1. Before you are 21 years old, do you think you will drink beer, wine, or hard liquor (more than just a few sips)?
 2. Before you are 21 years old, do you think you will get drunk or drink a lot of alcohol at one time?
 3. Before you are 18 years old, do you think you will smoke cigarettes?
 4. Before you are 18 years old, do you think you will chew tobacco or use snuff?
-

^a Current use items used the following scale to assess frequency of use in the past 30 days: 0 days, 1 or 2 days, 3 to 5 days, 6 to 9 days, 10 to 19 days, 20 to 29 days, or All 30 days.

^b Intent to use items were rated from 0, indicating "I definitely will not" to 3, indicating "I definitely will," with higher scores indicating a higher intent to use substances in the future.

APPENDIX B

MARLOWE-CROWNE SOCIAL DESIRABILITY SCALE – SHORT FORM

The next questions are a series of True/False statements. Read each item and decide whether the statement is *True* or *False* as it relates to you personally.

1. I sometimes feel resentful when I don't get my way. True False
2. On a few occasions, I have given up doing something because I thought too little of my ability. True False
3. There have been times when I felt like rebelling against people in authority even though I knew they were right. True False
4. No matter who I'm talking to, I'm always a good listener. True False
5. I can remember "playing sick" to get out of something. True False
6. There have been occasions when I took advantage of someone. True False
7. I'm always willing to admit it when I make a mistake. True False
8. I sometimes try to get even rather than forgive and forget. True False
9. When I don't know something I don't at all mind admitting it. True False
10. I am sometimes irritated by people who ask favors of me. True False
11. I have never deliberately said something that hurt someone's feelings. True False

APPENDIX C

PARENT CONSENT FORM

Project Title: AD/HD and Substance Use in Adolescents
Project Director: Jessica Benson, B.A., B.S.
Faculty Supervisor: Arthur D. Anastopoulos, Ph.D.

Mother/Female Guardian Participant's Name: _____
Teenage Participant's Name: _____ Date of Birth: _____

Purpose:

The purpose of this study is to examine whether symptoms of AD/HD (attention-deficit/hyperactivity disorder) are related to teenage use of alcohol and other drugs. You and your teen are invited to participate even if your teen does not have AD/HD.

Description and Explanation of Procedures:

Both you and your teen are being asked to complete a set of questionnaires. Your questionnaires will ask about your teen's behavior and AD/HD symptoms, as well as your relationship with your teen. This set of questionnaires should take about 45 minutes to complete. After finishing the questionnaires, you will mail back the questionnaires and this signed consent form in the provided envelope to project staff at the AD/HD Clinic at UNC Greensboro. Project staff will next ask your teen to fill out a set of questionnaires. Your teen will be asked questions about their prior use of alcohol and other drugs. Your teen's questionnaire will take about 45 minutes to complete, and will be given either during school hours or during a youth group meeting attended by your teenager.

Potential Risks and Discomforts:

There is minimal risk associated with participating in this study. Some questionnaires ask about personal information, such as the substances your teen may have used, which may cause you or your teen to feel uncomfortable. You and your teen may skip any questions that make you feel uncomfortable, and you may call project staff to have your questions answered. Participation is completely voluntary. Even if you participate and give permission for your teen to participate, your teen will still be asked if they want to be a part of the project, and his or her choice will be respected. If you or your teen decides not to be in the project, a teacher or youth group leader will give your child a different activity to do while the other teenagers are completing their questionnaires. You and your teen may also withdraw from the project at any time without penalty.

Benefits:

We hope that this project will help us better understand whether AD/HD symptoms put teenagers at risk for problems such as using alcohol, tobacco, and other drugs; and what can be done to better prevent substance abuse problems in teenagers.

Compensation:

For completing the questionnaires, both you and your teen will be offered \$10 gift cards. You must return this signed consent form and the completed questionnaires by ____/____/_____ to receive your gift card. Teens who complete their questionnaires will receive their gift cards immediately after completing their questionnaires.

Confidentiality:

The answers you and your teen provide will be kept confidential. You and your teen's answers will not be shared with one another. However, if your answers or your teen's answers tell us that they may be at risk for harming themselves or being harmed by someone else, we will need to speak to you and your teen. Names will not be on any of the questionnaires. Instead, you will fill out your name and address and the name of your teen only on this consent form. Once project staff members at the AD/HD Clinic at UNC Greensboro have received the completed parent packet with the set of questionnaires and the signed consent form, each teen will be assigned a special ID number before being given their questionnaire. The only people who will see information about you and your teen are the researchers involved in this project. Your name will not be used in any reports from this study. The forms that you complete will be stored in locked file cabinets. Passwords will protect information that has been entered on a computer. All information will be destroyed five years after the conclusion of this project.

Consent:

By signing this consent form, you agree that you understand the procedures and any risks and benefits involved in this research. You are free to refuse to participate or to withdraw your consent to participate in this research at any time without penalty or prejudice; your participation is entirely voluntary. Your privacy will be protected because you will not be identified by name as a participant in this project. You have two copies of this form; please complete one copy to send back and keep the additional copy for your records.

The University of North Carolina at Greensboro Institutional Review Board, which ensures that research involving people follows federal regulations, has approved the research and this consent form. Questions regarding your rights as a participant in this project can be answered by calling Mr. Eric Allen at (336) 256-1482. Questions regarding the research itself will be answered by calling 336-346-3196 to reach Jessica Benson (ext. 302) or Dr. Arthur Anastopoulos (ext. 303). Any new information that develops during the project will be provided to you if the information might affect your willingness to continue participation in the project.

By signing this form, you are affirming that you are 18 years of age or older and are agreeing to participate in the project described to you above.

Mother/Female Guardian Signature

Date

APPENDIX D

ADOLESCENT ASSENT FORM

We are doing a project to learn more about symptoms of AD/HD (attention-deficit/hyperactivity disorder) and how they might affect teens' decisions to use alcohol, tobacco, and other drugs. We want you to be in the project even if you do not have AD/HD. Ask any questions about this project that you want, so that you understand what you are being asked to do.

Your mother or female guardian has already given permission for you to help us. If you also agree to help, you will complete some short questionnaires that will ask you about your past use of drugs or alcohol and your relationship with your parents. The questionnaires will take about 45 minutes and you will do them either during school or during a youth group meeting that you attend.

There are no right or wrong answers because this is not a test. However, since some questions will ask about certain personal behaviors and past experiences, you may feel a little uneasy. You can ask questions at any time or skip any questions that you do not want to answer. Also, if you decide at any time not to finish, you may stop whenever you want.

By completing the questionnaires, you will provide important information about how teens like you act. You will also receive a \$10 gift card as a thank you.

Your name will not be on the answers you give, so the only people who will see this information are the researchers in this project. Your parents and teachers will never know your answers. However, if your answers tell us that you may be at risk for harming yourself or being harmed by someone else, we will need to speak to you and your parents.

Signing this form means that you have read this or had it read to you and that you want to be in the project. If you don't want to be in the project, don't sign. Remember, being in the project is up to you, and no one will be upset if you don't sign or even if you change your mind later.

Name (please print)

Signature

Date

Signature of Investigator

Date

Table 1. *Demographic Characteristics of Overall Sample*

Characteristic	Adolescent (n = 34)	Mother/Female Guardian (n = 33 ^a)
	<u><i>M (SD)</i></u>	<u><i>M (SD)</i></u>
Age (in years)	14.76 (1.46)	43.85 (8.95)
Grade	9.35 (1.54)	---
	<u>% (n)</u>	<u>% (n)</u>
Sex		
Male	32.4 (11)	---
Female	67.6 (23)	100 (33)
Race		
American Indian/Alaska Native	2.9 (1)	---
Asian	2.9 (1)	2.9 (1)
Black/African American	73.5 (25)	73.5 (25)
Native Hawaiian/Pacific Islander	---	2.9 (1)
White	17.6 (6)	17.6 (6)
Multiracial	2.9 (1)	---
Ethnicity		
Hispanic	2.9 (1)	---
Non-Hispanic	97.1 (33)	100 (33)
Education level		
Some High School	---	11.8 (4)
Completed High School, GED, or some college	---	58.8 (20)
Four year degree or higher	---	26.5 (9)
Household Income		
<\$20,000	---	29.4 (10)
\$20,000-\$35,000	---	20.6 (7)
More than \$35,000	---	29.4 (10)
Prefer not to answer	---	17.6 (6)
Family Structure		
One parent in household	---	52.9 (18)
Two parents in household	---	44.1 (15)
Current Living Arrangement		
Both biological parent	35.3 (12)	---
At least one biological parent	53.0 (18)	---
Step parent	17.6 (6)	---
Grandparent	11.7 (4)	---
Other	5.8 (2)	---

^a One female parent did not complete the demographic information

Table 2. *Descriptive Statistics of Variables for Overall Sample (N = 34)*

	<i>M</i>	<i>SD</i>	Minimum	Maximum	Skew	Kurtosis
<u>Predictor Variables</u>						
ADHD-RS IA Severity	6.82	7.91	0	26	1.21	0.29
ADHD-RS HI Severity	4.82	5.54	0	18	1.39	0.86
ADHD-RS I Severity	1.74	2.26	0	9	1.62	2.52
ADHD-RS I Transformed	0.31	0.32	---	---	0.46	-1.06
ADHD-RS Total Severity	13.38	15.10	0	50	1.30	0.56
<u>Outcome Variable</u>						
Total Current Use	1.00	2.92	0	12	2.94	7.90
<u>Potential Mediating Variables</u>						
BASC-2 CP Composite	101.09	23.39	54	153	0.68	0.07
APQ Parenting Composite	-14.41	17.49	-51	40	0.68	1.64
<u>Additional Variables</u>						
BDI-II Total Score	9.79	10.91	0	44	1.90	3.35
BDI-II Transformed Score	0.83	0.45	---	---	-0.32	-0.35
BAI Total Score	13.18	13.60	0	55	1.36	1.42
Social Desirability Scale	6.29	2.52	1	11	-0.39	-0.42

Note. APQ = Alabama Parenting Questionnaire; BDI-II = Beck Depression Inventory; BAI = Beck Anxiety Inventory; ADHD-RS = ADHD Rating Scale; IA = Inattention; HI = Hyperactivity/Impulsivity; I = Impulsivity alone; BASC-2 CP = Behavioral Assessment System for Children Second Version, Conduct Problems.

Table 3. *Correlations among Variables for Overall Sample (N = 34)*

Variable	1	2	3	4	5	6	7	8	9
1 Current Use	---								
2 ADHD-RS IA Severity	.34*	---							
3 ADHD-RS HI Severity	.15	.87**	---						
4 ADHD-RS I Transformed	.15	.81**	.88**	---					
5 BASC-2 CP Composite	.18	.64**	.59**	.58**	---				
6 APQ Parenting Composite	.44**	.49**	.32	.30	.11	---			
7 BDI-II Transformed Score	.21	.40*	.13	.10	.04	.52**	---		
8 BAI Total Score	.28	.56**	.38*	.34	.06	.60**	.77**	---	
9 Social Desirability Scale	-.21	-.52**	-.49**	-.44**	-.41*	-.38*	-.38*	-.30	---

Note. APQ = Alabama Parenting Questionnaire; BDI-II = Beck Depression Inventory; BAI = Beck Anxiety Inventory; ADHD-RS = ADHD Rating Scale-IV; IA = Inattention; HI = Hyperactivity/Impulsivity; I = Impulsivity alone; BASC-2 = Behavioral Assessment System for Children Second Version; CP = Conduct Problems.

* $p < .05$. ** $p < .01$.

Table 4. *Descriptive Statistics of Variables for Post-Hoc Grouping (N = 25)*

	<i>M</i>	<i>SD</i>	Minimum	Maximum	Skew	Kurtosis
<u>Predictor Variables</u>						
ADHD-RS IA Severity	5.92	7.80	0	26	1.37	.83
ADHD-RS HI Severity	4.56	5.65	0	18	1.44	.90
ADHD-RS I Severity	1.56	2.10	0	7	1.28	.77
ADHD-RS Total Severity	12.04	15.07	0	50	1.37	.72
<u>Outcome Variable</u>						
Intent to Use Score	1.16	1.57	0	6	1.53	2.38
Intent to Use Transformed	.24	.28	---	---	.60	-1.06
<u>Potential Mediating Variables</u>						
APQ Parenting Composite	-31.56	13.56	-58	2	.71	.61
BASC-2 CP Composite	101.00	21.80	77	153	1.06	.26
BDI-II Total Score	7.68	8.26	0	38	2.19	6.80
BDI-II Transformed Score	.75	.45	---	---	-.39	-.70
BAI Total Score	11.28	10.93	0	37	1.11	.31
<u>Additional Variable</u>						
Social Desirability Scale	7.12	2.13	1	11	-.73	1.68

Note. APQ = Alabama Parenting Questionnaire; BDI-II = Beck Depression Inventory; BAI = Beck Anxiety Inventory; ADHD-RS = ADHD Rating Scale-IV; IA = Inattention; HI = Hyperactivity/Impulsivity; I = Impulsivity alone; BASC-2 CP = Behavioral Assessment System for Children Second Version, Conduct Problems.

Table 5. *Correlations among Variables for Post-Hoc Grouping (N = 25)*

Variable	1	2	3	4	5	6	7	8	9
1 Intent to Use Transformed	---								
2 ADHD-RS IA Severity	.53*	---							
3 ADHD-RS HI Severity	.32	.89**	---						
4 ADHD-RS I Severity	.33	.87**	.95**	---					
5 BASC-2 CP Composite	.25	.74**	.69**	.77**	---				
6 APQ Parenting Composite	.33	.60**	.53**	.44*	.43*	---			
7 BDI-II Transformed Score	.36	.23	.01	-.07	-.02	.39	---		
8 BAI Total Score	.41*	.44**	.27	.21	.15	.59**	.76**	---	
9 Social Desirability Scale	-.29	-.60**	-.61**	-.57**	-.54*	-.50*	-.31	-.25	---

Note. APQ = Alabama Parenting Questionnaire; BDI-II = Beck Depression Inventory; BAI = Beck Anxiety Inventory; ADHD-RS = ADHD Rating Scale-IV; IA = Inattention; HI = Hyperactivity/Impulsivity; I = Impulsivity alone; BASC-2 = Behavioral Assessment System for Children Second Version; CP = Conduct Problems.

* $p < .05$. ** $p < .01$.

Table 6. *Multiple Linear Regressions Examining Mediation Pathway for Intent to Use*

Predictor Variable	Dependent Variable	β	R^2	F
Step 1				
ADHD-RS IA	Intent to Use	.53	.25	9.17**
ADHD-RS HI	Intent to Use	.33	.07	2.78
ADHD-RS I	Intent to Use	.33	.07	2.89
Step 2				
ADHD-RS IA	BASC-2 CP Composite	.74	.52	27.44***
ADHD-RS IA	APQ Parenting Composite	.60	.33	12.61**
Step 3				
BASC-2 CP Composite	Intent to Use	.25	.02	1.55
APQ Parenting Composite	Intent to Use	.33	.07	2.71
Step 4a				
ADHD-RS IA	Intent to Use	.77	.27	5.41*
BASC-2 CP Composite		-.31		
Step 4b				
ADHD-RS IA	Intent to Use	.53	.22	4.38*
APQ Parenting Composite		.01		

Note. N = 25. R^2 = Adjusted R^2 ; ADHD-RS = ADHD Rating Scale-IV; IA = Inattention; HI = Hyperactivity/Impulsivity; I = Impulsivity alone; BASC-2 = Behavioral Assessment System for Children Second Version; CP = Conduct Problems; APQ = Alabama Parenting Questionnaire.

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

Table 7. *Multiple Linear Regressions Examining Anxiety and Depression as Potential Mediators of the AD/HD-Intentions Pathway*

Predictor Variable	Target Variable	β	R^2	F
Step 1				
ADHD-RS IA	Intent to Use	.53	.25	9.17**
ADHD-RS HI	Intent to Use	.33	.07	2.78
ADHD-RS I	Intent to Use	.33	.07	2.89
Step 2				
ADHD-RS IA	BDI-II Transformed	.23	.01	1.29
ADHD-RS IA	BAI	.44	.16	5.65*
Step 3				
BAI	Intent to Use	.41	.14	4.73*
Step 4				
ADHD-RS IA	Intent to Use	.44	.26	5.26*
BAI		.22		

Note. N = 25. R^2 = Adjusted R^2 ; ADHD-RS = ADHD Rating Scale-IV; IA = Inattention; HI = Hyperactivity/Impulsivity; I = Impulsivity alone; BDI-II = Beck Depression Inventory; BAI = Beck Anxiety Inventory.

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

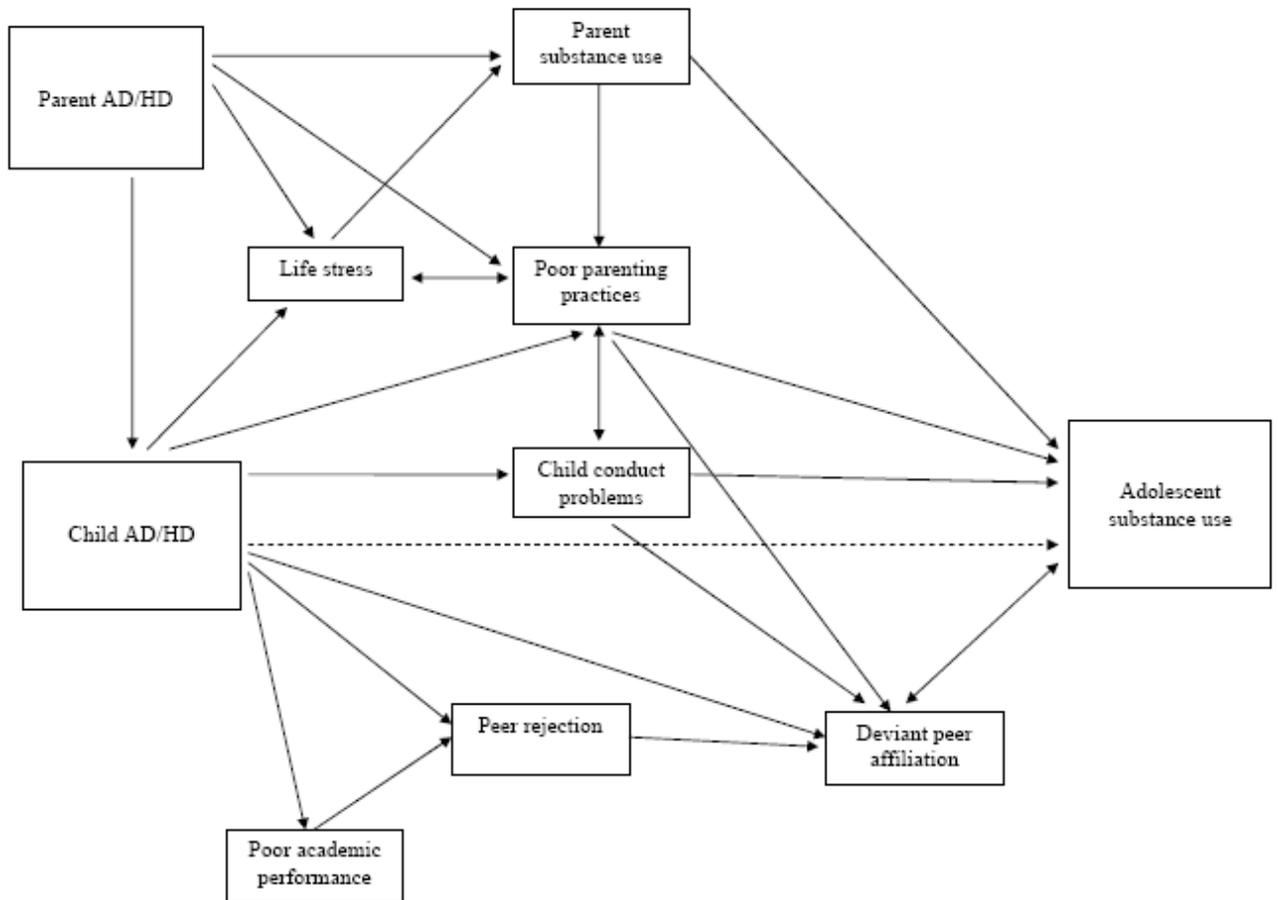
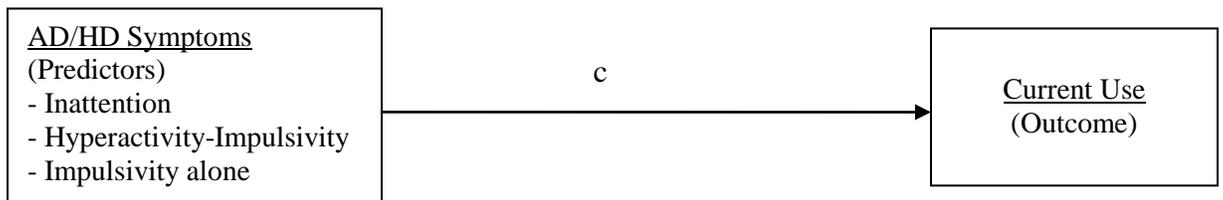
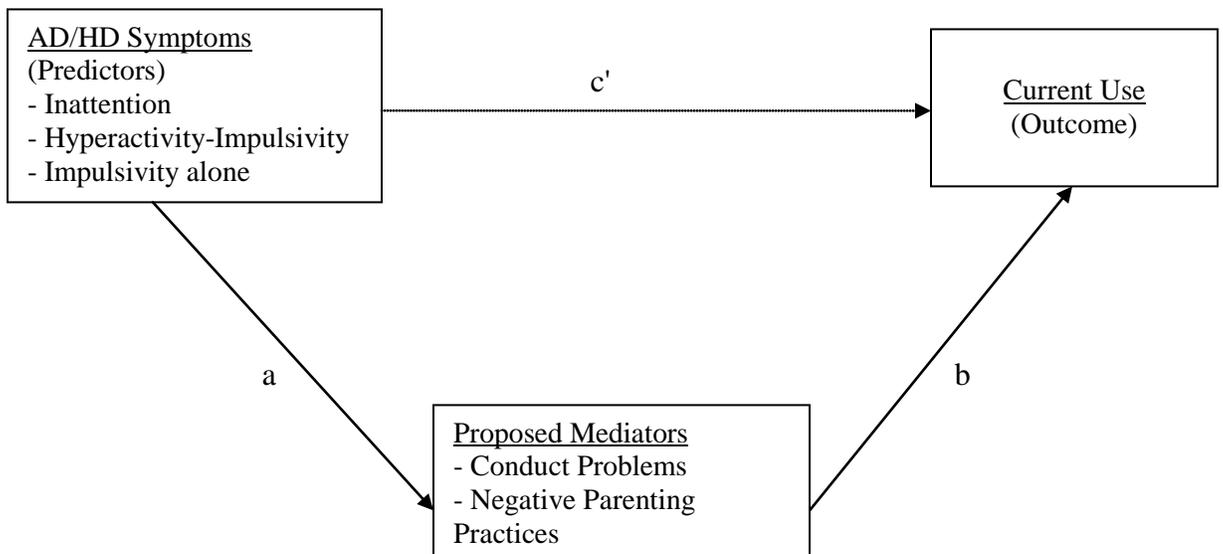


Figure 1. Overarching Theorized Cumulative Risk Factor Model. Overarching theorized cumulative risk factor model for the relation between AD/HD and adolescent substance use.



a) Direct pathway



b) Indirect or Mediated Pathway

Figure 2. Hypothesized Mediation Model. Hypothesized mediational model (on the basis of Baron & Kenny, 1986) testing the relation between AD/HD symptoms and current use of substances.

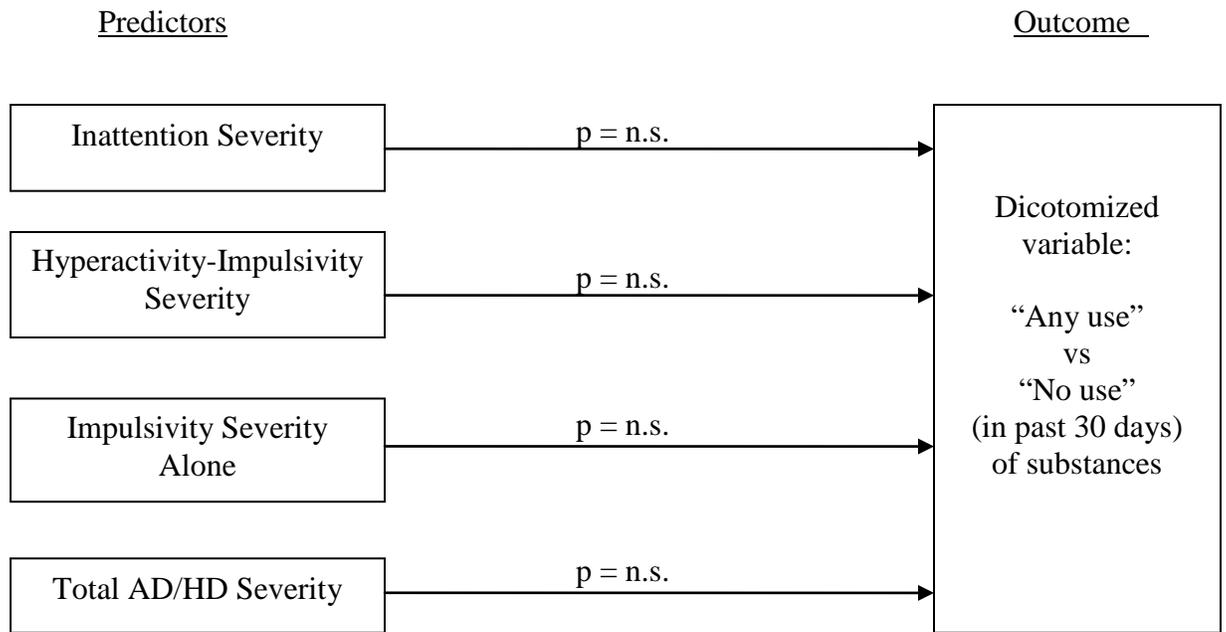


Figure 3. Results of A Prior Hypotheses. Results of a priori hypotheses utilizing logistic regression to test the relation between AD/HD symptoms and current use of substances.

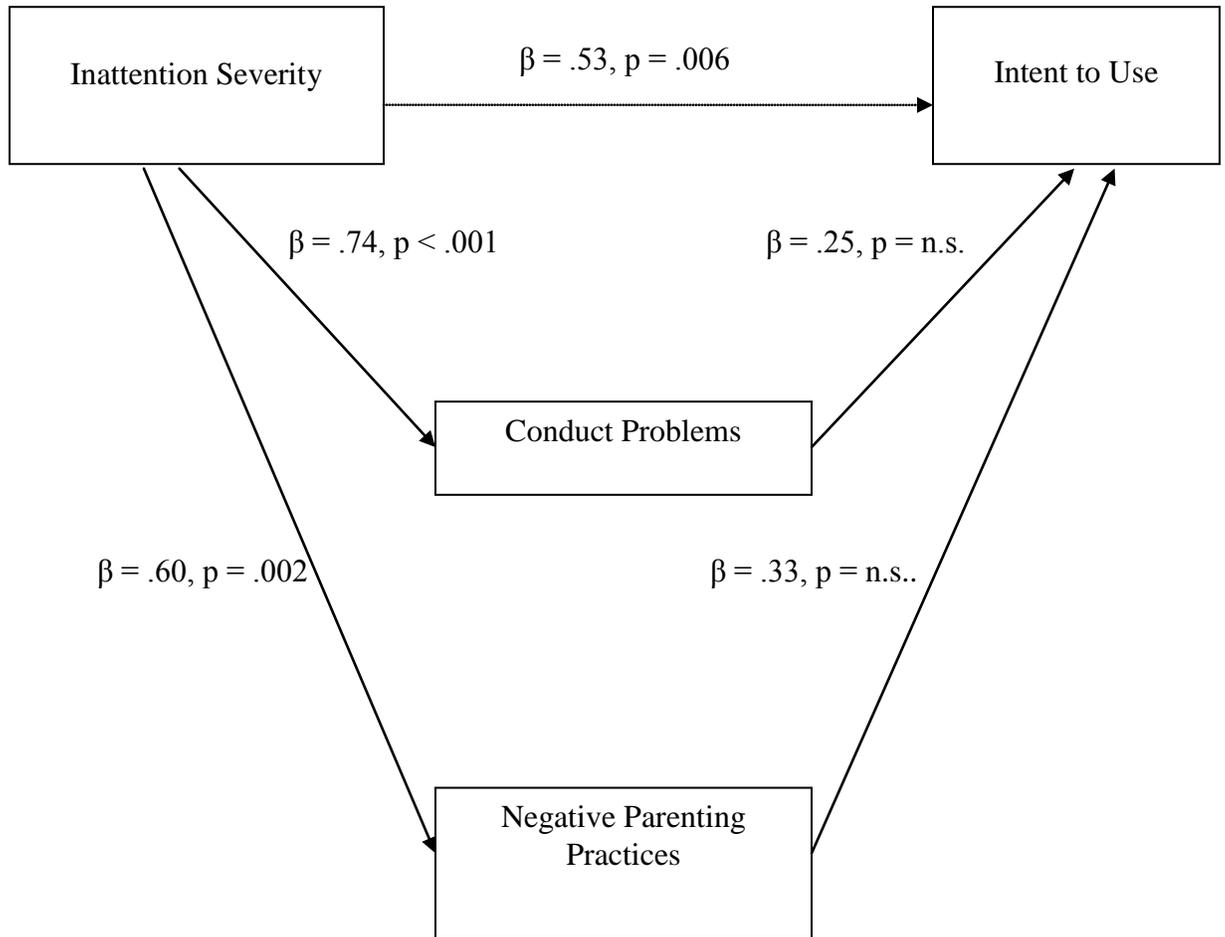


Figure 4. Results of Post-hoc Mediation Analyses. Results of post-hoc mediational analyses testing the relation between AD/HD symptoms and intent to use substances.