Do Symptoms of Sluggish Cognitive Tempo Independently Predict Non-Medical Use of Prescription Stimulants in a College Student Sample?

by

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Abstract

As evidence for the construct of SCT continues to grow, it is important for further research to continue investigating how symptoms of SCT may impact functioning in college students. The current study examined whether SCT symptoms in college students are predictive of nonmedical use of prescription stimulants (NMUPS), above and beyond those of commonly comorbid disorders, including symptoms of ADHD, depression, and anxiety. Participants (N = 1142) were undergraduate college students attending a public, Southeastern university who completed an online survey. Prevalence of NUMPS at least once in the students' lifetime or over the past 12 months was 19% and 13%, respectively. SCT was moderately correlated with ADHD and internalizing symptoms. NMUPS was modestly correlated with ADHD, internalizing symptoms, and SCT. Using hierarchical regression models, ADHD-Inattention and depressive symptoms often significantly and uniquely predicted NMUPS, but the strength or consistency of these findings was dependent upon the timespan over which participants reported their use and whether NMUPS was analyzed based on use/nonuse or frequency of use. SCT did not uniquely contribute to the prediction of NMUPS but often influenced the unique prediction of previously entered clinical variables for the final models. Overall, the current study adds to the existing and growing body of literature investigating SCT as a possibly distinct construct, separate from ADHD. In addition, the current study provides supporting evidence for the associations between ADHD, depression, and substance use.

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In recent years, Sluggish Cognitive Tempo (SCT) has received an increasing amount of interest as a potentially important construct in the field of clinical psychology, particularly with children. Common descriptors of SCT include symptoms such as drowsiness/sleepiness, seeming to be "in a fog," daydreaming, mental confusion, slowness, physical hypoactivity/lethargy, and apathy. Research in SCT symptoms emerged from studies of Attention-Deficit/Hyperactivity Disorder (ADHD) that showed a close relationship. Ongoing studies have sought to investigate whether or not SCT is its own distinct set of symptoms separate from ADHD (Becker, Marshall & McBurnett, 2014). As research continues to grow in this field, more information has become available on the internal and external validity of the SCT construct. This continued interest in SCT also highlights the importance of considering impairment in functioning across multiple domains and the expression of symptoms in a wide range of samples (Becker et al., 2016). Research has documented a considerable and increasing prevalence of non-prescribed stimulant medication use on college campuses (McCabe, Knight, Teter, & Wechsler, 2005). The purpose of this study is to investigate whether SCT symptoms independently predict nonmedical use of prescription stimulants among college students, while taking other clinical symptoms into account.

Inclusion/Exclusion from the DSM

Seminal research found that SCT scores were uniquely elevated in children with Attention Deficit Disorder without Hyperactivity (ADD/noH; Lahey et al., 1988). Barkley, DuPaul, and McMurray (1990) found that children with ADD/noH were uniquely elevated in attentional problems, characterized by sluggishness, drowsiness, slowness, being "lost in a fog," daydreaming, and apathy. These findings stimulated a growing interest in the investigation of ADHD subtypes, a topic that has continued to influence iterations of formal taxonomic systems

(i.e., the *Diagnostic and Statistical Manual of Mental Disorders* [5th ed.; *DSM*-5]; American Psychiatric Association [APA], 2013).

Relative to its predecessor, DSM-III-R (APA, 1987) reflected the elimination of ADD subtypes. Instead, a single disorder (ADHD) was articulated. However, continued research into ADHD and SCT led to the DSM-IV Work Group's decision to revisit the issue of subtypes (Becker et al., 2014). Specifically, including SCT symptoms in the new diagnostic criteria for a non-hyperactive subtype of ADHD was considered, along with distinct sets of symptoms within that inattention designation (Lahey et al., 1994). Among a set of ten proposed symptoms of inattention, three of four SCT symptoms unique to ADD/noH were tested during the field trials of the DSM-IV: forgetfulness, day dreaminess, and sluggish/drowsiness. Forgetfulness was the only SCT symptom included in the diagnostic criteria for DSM-IV ADHD, given its strong positive and negative predictive power (Frick et al, 1994).

Although SCT symptoms were ultimately not included in the DSM-IV (APA, 2013), interest in the construct did not diminish. In fact, Becker et al. (2014) illustrated an exponential increase in articles related to SCT since 2001. Previous research had provided evidence to suggest that the diagnostic criteria for the inattentive subtype identified a very heterogeneous group (McBurnett, Pfiffner, & Frick, 2001; Milich, Balentine, & Lyman, 2001). It was also found that low levels of SCT were present in some individuals with Attention Deficit/Hyperactivity Disorder-Inattentive type (ADHD-I), whereas in others the reverse was true (Carlson & Mann, 2002). Such findings have continued to raise concern over the validity of the ADHD subtypes (e.g., Willcutt et al., 2012).

SCT in Relation to ADHD

A comprehensive review of the association between SCT and ADHD is beyond the scope of this proposal. Responding to the need for an overarching analysis of the validity of the SCT construct, Becker et al. (2016) furnished an authoritative review. In spite of a widely varying set of SCT symptoms, this review of factor analytic research from 23 independent samples (>19,000 participants) showed that a subset of SCT items loaded on factors that were separate from DSM-IV ADHD symptoms of inattention and hyperactivity-impulsivity. A meta-analysis was then conducted from studies that considered SCT with other dimensions of psychopathology. Small to medium effect sizes were found between SCT and other forms of psychopathology. Inattention was associated with larger effect sizes compared to hyperactivity-impulsivity and other externalizing symptoms (e.g., conduct problems). In addition, SCT showed nonsignificant or negative associations with hyperactivity-impulsivity and externalizing symptoms when controlling for inattention. Furthermore, ADHD inattention remained associated with hyperactivity-impulsivity and externalizing symptoms when controlling for SCT symptoms. Overall, Becker et al.'s review and analyses demonstrate the distinctiveness of SCT from ADHD.

Research related to demographic characteristics, SCT, and ADHD has been less systematically evaluated. However, using a nationally representative sample of adults, Barkley (2012) found that SCT may have a later age of onset compared to ADHD. Future research is needed to consider sociodemographic variables such as gender, socioeconomic status, and race/ethnicity (Becker et al., 2016).

Although the empirical literature provides strong support for the distinction between ADHD and SCT, many of these studies have been conducted in populations that were referred for or had the diagnosis of ADHD. For instance, Barkley (2012) found that after not biasing the

sample recruitment toward ADHD referrals, SCT was not found to be a subtype of ADHD but a statistically valid disorder distinct from it. As a result, studies that have a sample recruitment bias (e.g., Garner, Marceaux, Mrug, Patterson, and Hodgens, 2010; Hartman, Willcutt, Rhee, & Pennington, 2004) make it more difficult to determine the unique characteristics specific to SCT (Barkley, 2012).

SCT and Internalizing Symptoms

Becker et al. (2016) points out that some symptoms of SCT are similar to those often associated with anxiety and depression (e.g., psychomotor retardation, fatigue/loss of energy, mind going blank). Therefore, it is not surprising that SCT ratings are moderately correlated with internalizing disorders, at a level comparable to that found between SCT and inattention (e.g., Becker, Langberg, Luebbe, Dvorsky & Flannery, 2014). These researchers investigated SCT symptoms in two college student samples in relation to internalizing symptoms. One of these college student samples were diagnosed with ADHD and the other was a general college student sample. The results of this study suggest that SCT symptoms are strongly associated with internalizing symptoms in college students with and without ADHD. They suggest that the association between inattention and internalizing symptoms in college students may be due primarily to SCT. Overall, studies consistently find that the association between SCT and internalizing symptoms remain significant, when controlling for inattention (Becker et al., 2016). Given the association among SCT, ADHD, and internalizing symptom, it is important to consider the degree to which SCT relates to psychosocial difficulties, after controlling for other related clinical symptoms, especially in non-ADHD samples.

Psychosocial Functioning and SCT

Assisting in the establishment of external validity, our knowledge of SCT and its relation to functional impairment is evolving. To date, findings have been quite consistent. Barkley (2014) highlights findings that SCT impairs different facets of daily functioning, including writing language, reading, organization, homework completion, and peer relations in youth and adolescents. Barkley (2012) found that adult areas of impairment included friendships, romantic relationships, home life and parenting, occupational functioning, management of finances, and health maintenance. Combs, Canu, Broman-Fulks, and Nieman (2014) found that SCT was associated with poorer quality of life in adults, even after controlling for symptoms of ADHD. Becker, Langberg et al. (2014), previously mentioned in regard to internalizing symptoms, found that SCT symptoms were associated with lower academic functioning in their college sample, after controlling for ADHD and other clinical symptoms. Other related studies in samples of college students have found that SCT remained significantly associated with several domains of academic, daily living skills, and social functioning, after controlling for demographics and symptoms of ADHD, anxiety, and depression (Flannery, Becker, & Luebbe, 2014; Flannery, Luebbe, & Becker, 2017; Jarrett, Rapport, Rondon, & Becker, 2017; Langberg, Becker, Dvorsky, & Luebbe, 2014; Wood, Lewandowski, Lovett, & Antshel, 2017). Research is increasing in the areas of risk factors and possible predictors of those affected by SCT symptoms. Continued research in this area of SCT in college students can further the current knowledge of SCT's development through the lifespan.

Determining a Unified Set of SCT Symptoms

As highlighted by the comprehensive review offered by Becker and colleagues (2016), a major limitation in the SCT literature is the lack of universal agreement over the best symptom set for defining and assessing SCT. Becker and colleagues (2016) suggest that future research

consider whether SCT is a transdiagnostic construct versus one that has separate diagnostic incremental utility. Indeed, determining a unified set of SCT symptoms would assist in this and other critical questions.

Several SCT rating scales have been derived for children and adults since 2009. For example, the Barkley Adult ADHD Rating Scale – IV *(*BAARS-IV*;* Barkley, 2011) was the first to include a theoretically and empirically derived SCT subscale for adults. Becker et al.'s (2016) meta-analysis highlighted that previous studies have used over 150 different items (some being wording variants of each other) to characterize SCT. Through a detailed coding process, 18 core SCT constructs were identified. Thirteen items were identified as optimal, based on their consistent loading on an SCT factor that was statistically distinct from ADHD and inattention specifically in exploratory factor analytic studies. In addition, a study conducted by Garner et al. (2017) found that although SCT symptoms were strongly associated with inattention, the symptoms loaded onto a factor independent of ADHD. To further validate this unified set of items, Becker et al. (2018) derived the Adult Concentration Inventory, which was be used in the current study. Becker et al. (2018), used exploratory CFA and found that SCT remained uniquely associated in structural regression analyses. These findings support the use of the ACI to examine SCT in adulthood.

Nonmedical Use of Prescription Drugs

Nonmedical use of prescription drugs (NMUPD) is defined as the use of a controlled substance without a prescription, or the use of a prescribed medication in a manner that was not intended by the prescribing medical professional (McCabe, Teter, & Boyd, 2006). In a national internet survey that evaluated NMUPD in the U.S. general adult population, lifetime use of any prescription drug was 35.1% (Cassidy et al., 2015). According to results from the Monitoring the

Future (MTF) study, college students reported higher rates of non-medical use of stimulant medication (5.7%) than their same-age peers not attending college (2.5%) in the past year (Johnston, O'Malley, & Bachman, 2003). A subsequent national survey of over 10,000 randomly selected college students from 199 four-year colleges found that non-medical use of stimulants in the past year was 4.1% (McCabe et al., 2005).

Despite the efficacy of prescription stimulants for the treatment of ADHD symptoms (Barkley, 2015; Greenhill et al., 2002), the non-medical use of prescription stimulants (NMUPS) represents a problem among young adults and college students alike (Babcock & Byrne, 2000; Johnston et al., 2003; Teter, McCabe, Boyd, & Guthrie, 2003). NMUPS has been found to be associated with negative consequences, such as engaging in illegal activities to obtain drugs, withdrawal symptoms, cardiovascular risk, and interpersonal consequences (McCabe & Teter, 2007). Other side effects include sleep difficulties, reduced appetite, nausea, abdominal pain, and headaches (Craig, Davies, Schibuk, Weiss, & Hechtman, 2015; Weyandt et al., 2014). These findings highlight the importance of examining stimulant medications as they are the second most commonly misused psychotherapeutic drug following prescription opiates (McCabe et al., 2006).

Many studies have investigated risk factors and self-reported effectiveness for young adults and college students who engage in stimulant use. The national survey of college students conducted by McCabe et al. (2005) indicated that NMUPS was higher in students who were male, white, members of fraternities and sororities, had lower grade points averages (GPAs), attended colleges located in the North-eastern region of the United States and attended more selective colleges. Self-treatment, or self-medication, is motivated by the desire to alleviate symptoms consistent with the prescription drug's pharmaceutical main indication (Boyd &

McCabe, 2008). Considering that non-diagnosed students report using ADHD medication to help with concentration, studying, and alertness, it would be reasonable to hypothesize that some students turn to non-prescribed stimulants because they experience difficulties in these areas. This hypothesis was confirmed in a study by Rabiner et al. (2009). Another study by McCabe, Boyd, and Teter (2009) suggest that self-treatment motivates a substantial portion of NMUPD among adolescents and young adults. Their results also found that among those who reported such lifetime misuse, approximately 12.6% were classified into the recreational subtype, while 39.1% were in this self-treatment subtype, and 48.3% were in the mixed subtype. Teter, McCabe, Cranford, Boyd, and Guthrie (2005) added to the understanding of NMUPS by examining the motives for this behavior. Their study found that the most commonly reported motives were to help with concentration (58%), to help with alertness (43%), and to "get high" (43%). Verdi, Weyandt, and Zavras (2016) extended these findings to graduate students, with 16.2% reporting "to perform better in my schoolwork," followed by "to feel more energetic" (12.3%). More recent studies have investigated symptoms of ADHD as they relate to misuse of stimulant medication (Arria et al., 2018; Benson and Flory, 2017; Benson et al., 2018; Prosek et al., 2018). Results found that college students who report ADHD symptoms are more likely to engage in NMUPS in an effort to improve their academic performance and increase alertness. In terms of favorability ratings, Rabiner et al. (2009) reported that 70% of students rated the overall impact of taking ADHD medication positively or very positively, with higher ratings being associated with greater frequency of use. Conversely, only about 5% of the students in the study believed that using ADHD medication had affected them negatively.

Psychological variables have also been found to be associated with prescription stimulant use. These variables include depression, anxiety, and stress (Dussault & Weyandt, 2013; Huang

et al., 2006a; Rabiner et al., 2009; Teter, Falone, Cranford, Boyd, & McCabe, 2010; Weyandt et al., 2009). For example, Rabiner et al. (2009) examined depressive symptoms of college students engaging in NMUPS. Results revealed that those who reported stimulant misuse and attention difficulties had lower GPAs, more academic concerns, and higher levels of depressive symptoms than individuals who reported less attention difficulties. Teter et al. (2010) found that among college students engaging in NMUPS, approximately 50% reported a past-month depressed mood. A multi-faceted picture was illustrated by Weyandt et al. (2009) who showed that participants reporting higher rates of NMUPS also reported higher rates of psychological distress specifically related to somatization, obsessions, compulsions, sensitivity, depression, anxiety, hostility, phobia, paranoia, and psychoticism.

The Proposed Study

Overall, there is still much to learn regarding SCT and nonmedical use of prescription drugs, despite the increase in knowledge on these topics. In addition, there is a lack of literature focusing on SCT in adults, particularly college students. The proposed study aims to increase understanding of nonmedical use of prescription drugs in college students with SCT symptoms, and to help facilitate future studies on college students and adults with SCT.

The primary purpose of the proposed study is to examine whether SCT symptoms are predictive of NMUPS, above and beyond those of commonly comorbid disorders, including symptoms of ADHD, depression, and anxiety, in college students. Specific hypotheses are as follows:

1) Self-report ratings of SCT will be moderately correlated with ratings ADHD, depression, and anxiety symptoms.

2) Endorsement of NMUPS will correlate significantly with depressive and ADHD-Inattention symptoms.
3) Lastly, it is hypothesized that self-reported SCT symptoms will be significantly associated with NMUPS above and beyond the other mental health dimensions included in this study.

Method

Participants and Procedures

The sample used in this study consists of 1142 full-time undergraduate college students recruited from psychology courses offering extra credit for research participation via SONA-systems at a Southeastern university. The average age of the sample was 19.43 (SD = 1.28) years old (Range = 18 to 25). Most participants were in their first year of college (48.2%) with the remainder in their second (23.6%), third (16.4%), and fourth (11.8%). The majority of the participants self-identified as female (76%) and White (89.6%).

This study was approved by the University's Institutional Review Board. After reading an Information Letter and providing consent, participants completed the study measures anonymously on a computer of their choice. All participants completed an online Qualtrics survey of the study measures.

Measures

ADHD symptoms. The Barkley Adult ADHD Rating Scale-IV (BAARS-IV; Barkley, 2011) is a self-report measure that includes 18 items corresponding to *DSM-IV* (APA, 1994) ADHD criteria. The questionnaire uses a 4-point Likert scale ("Never or rarely" to "Very Often"). The ADHD scales of the BAARS-IV have shown satisfactory internal consistency and test-retest reliability over a 2-3-week period with no significant changes in scores (Barkley,

2011). The use of the BAARS-IV is also supported through research documenting its construct validity, discriminant validity, criterion validity and rating relationship with adverse outcomes in several domains (Barkley, 2011). In the current study, subscale internal consistency was good for both ADHD-Inattention and ADHD-Hyperactivity/Impulsivity (α = .88 and .81, respectively).

SCT symptoms. The Adult Concentration Inventory (ACI; Becker et al., 2018) is a 16-item self-report that was validated using a large, multi-university sample. Using exploratory CFA, 10 of the 16 items were distinct from ADHD-I symptoms as well as symptoms of anxiety and depression, thus establishing convergent and discriminant validity (Becker et al., 2018). These SCT items also displayed criterion/concurrent validity, correlating uniquely with a variety of external criterion measures above and beyond ADHD symptoms. Items are rated on a four-point scale ("Not at all" to "Very Often") based on the past six months. In the present study, Cronbach's α = .93, indicating excellent internal consistency.

Depressive symptoms. The Patient Health Questionnaire (PHQ-8; Kroenke et al., 2009) is a valid and widely used diagnostic and severity measure for depressive symptoms. The PHQ depression scale is the self-administered version of the primary care evaluation of mental disorders (PRIME-MD) assessment that has been validated in two large studies that involved 3,000 patients in 8 primary care clinics and 3,000 patients in 7 obstetrics-gynecology clinics (Spitzer et al., 1999; Spitzer et al., 2000). The PHQ has excellent internal reliability, sensitivity and specificity. The PHQ-8 includes eight of the nine symptom criteria for depressive disorders in the *DSM-IV* (APA, 1994) and uses a 4-point Likert scale ("Not at all" to "Nearly every day"). The excluded symptom criterion is related to suicidal or self-injurious thoughts. This item was removed by the test developers and was the least frequently endorsed item on the PHQ-9 (Huang, Chung, Kroenke, Delucchi, & Spitzer, 2006b; Kroenke & Spitzer, 2002). Kroenke and

Spitzer (2002) found that patients who did endorse the ninth item did so at a very low threshold. The correlation between the PHQ-8 and the PHQ-9 was also found to be high, r = .998 (Corson, Gerrity, & Dobscha, 2004). In the current study, internal subscale consistency was good (α = .87).

Anxiety symptoms. The Generalized Anxiety Disorder Scale (GAD-7; Spitzer, Kroenke, Williams, & Lowe, 2006) is a 7-item screening measure that inquires about frequency of symptoms over the past two weeks using a 4-point Likert scale (Not at all" to "Nearly every day"). The GAD-7 has excellent psychometric characteristics and the scores are not influenced by age, sex, or racial ethnicity (Kroenke, Spitzer, Williams, Monahan, & Lowe, 2007; Spitzer et al., 2006). Validity was established in a large, population-based study along with factor analysis that demonstrates a one-dimensional structure with good internal consistency of α = .89 (Lowe et al., 2008). The GAD-7 also demonstrates good sensitivity and specificity as a screener for generalized anxiety, panic, social anxiety, and post-traumatic stress disorder (Lowe et al., 2008; Spitzer et al., 2006). In the current study, internal subscale consistency was good (α = .89).

Non-Prescription Use of Stimulants. A revised self-report survey as described by McCabe et al. (2009) was used in the current study to assess the prevalence for NMUPS. Participants were asked: "On how many occasions have you used the following stimulant medications either without the recommendation of a health professional, or for any reason other than a health professional's instructions to do so? a) Methylin, Metadate, Ritalin, Concerta, Daytrana, Focalin, Dexedrine, Procentra, Vyvanse, Adderall, Evekeo, Methylphenidate, Dexmethylphenidate, Dextroamphetamine, Lisdexamfetamine, b) Do not include Strattera/atomoxetine in your answers below." The response scale was (1) no occasions, (2) 1-2 occasions, (3) 3-5 occasions, (4) 6-9 occasions, (5) 10-19 occasions, (6) 20-39 occasions, and (7)

40 or more occasions. Participants were asked about usage in their lifetime and the past 12 months.

Analytic Approach

Survey validity checks. To address potential careless and invalid responses screening methods outlined by Meade and Craig (2012) were used. First, items were placed throughout the survey in an effort to identify participants that were not carefully reading the items, or randomly responding (e.g., "How many times have you been president of the United States?"). Second, a self-report question of response quality was included at the end of the survey, asking how accurate the participants' responses were over the course of the survey. The participants were informed that regardless of their answer, their class credit would not be affected. Finally, a response time threshold was established, based on pilot work and descriptive statistics, with very fast survey completion time assumed to be low quality in nature. Missing data was accounted for based on the particular measure from which they were missing. Participants were removed from the data analyses if more than 20% of their data were missing, further guarding against validity concerns (Peng, Harwell, Liou, & Ehman, 2006). Overall, 18% of the original participants were excluded based on the abovementioned data screening methods. No discernible pattern among the demographics or study measures was evident for excluded participants. All analyses were completed using the *Statistical Package for the Social Sciences (SPSS), Version 23* (IBM Corp, 2014).

Statistical analyses.

First, for responses about NMUPS (lifetime and past 12 months), frequency distributions were obtained. Second, due to an expectantly large percentage of non-users and a highly positively skewed distribution of use, descriptive statistics of all potential predictor variables

were calculated separately for non-users and users. Third, zero-order correlational analyses were conducted for all study variables. Correlations involving NMUPS were conducted in two ways: 1) dichotomized into non-users versus users, and 2) frequency of (non-zero) use. Fourth, hierarchical regression analyses were conducted to examine the unique effects of the mental health dimensions in relation to NMUPS. A hierarchical logistic regression was conducted to examine mental health variables in relation to the dichotomous NMUPS variable. A hierarchical multiple regression was used to examine mental health variables in relation to NMUPS (non-zero) frequency. Specifically, variables were entered in the following sequence: (1) age, gender, and race (primarily serving as control variables); (2) BAARS-IV ADHD subscales (Inattention and Hyperactivity-Impulsivity); (3) the GAD-7 and PHQ-8; and (4) the Adult Concentration Inventory (SCT). Only those variables showing a significant zero-order correlation were entered into the regression analyses. Regression analyses were conducted separately for reported lifetime use and past 12-month use. Overall, therefore, the above approach yielded two sets of related regression analyses. To test for multicollinearity, variance inflation factors (VIF) and tolerance values were examined for each predictor in the model. Furthermore, statistical assumptions relevant to the two regression approaches were explored.

Results

Table 1 provides the frequency distribution of reported NMUPS. Approximately 19% and 13% of participants reported engaging in nonmedical use of prescription stimulants in their lifetime and in the past 12 months, respectively. Descriptive statistics for all predictors are provided in Tables 2 and 3.

Analyses related to both logistical and multiple regression indicated that the assumptions of multicollinearity, homoscedasticity, linearity were not violated. Inspection of standardized

residuals, Cook's statistics, and goodness of fit statistics did not suggest poor model fit or an unacceptable number of influential cases, considering sample size (Field, 2018; Pallant, 2013). However, based on inspection of the histograms and Normal P-P Plots of standardized residuals for both multiple regressions, a non-normal distribution of residuals was noted.

Lifetime NMUPS

Table 4 provides the intercorrelations among the study variables for lifetime use, separating associations for frequency of use and dichotomized use/non-use. Regarding the latter, significant correlations were observed with all study variables except for race. SCT showed a significant negative correlation with age and race, and much stronger significant positive correlations with all other clinical measures. For those reporting non-zero NMUPS, frequency of use was positively correlated with age, ADHD-Inattention, ADHD-Hyperactivity/Impulsivity, and SCT. SCT showed a significant negative correlation with age, and much stronger significant positive correlations with all other clinical measures.

Results of the hierarchical logistic regression analysis examining SCT and other clinical variables in relation to none vs. any NMUPS are summarized in Table 5. After entering age and gender (Block 1), ADHD-Inattention and ADHD-Hyperactive/Impulsive were added to the model (Block 2), which resulted in ADHD-Inattention significantly contributing to the prediction of NMUPS. When internalizing symptoms (i.e., anxiety and depression) were added to the model, depressive symptoms significantly added to the prediction of NMUPS (Block 3). Finally, when SCT was added the model, it did not significantly contribute in predicting NMUPS (Block 4). Thus, SCT does not uniquely predict NMUPS above and beyond other clinical variables. The full model was statistically significant, χ^2 (7, N = 1140) = 69.75, $p < .001$, indicating that, relative to the baseline model, the derived model was able to distinguish between respondents who

reported and did not report NMUPS (Nagelkerke R^2 = .10). Age, ADHD-Inattention, and depressive symptoms were significantly and uniquely positively associated with whether participants used prescription stimulants or not, with the clinical variables showing a small effect size (i.e., odds ratio slightly over 1.0).

Results of the hierarchical multiple regression analysis of SCT and other clinical variables in relation to NMUPS, users only, are summarized in Table 6. Age was significantly associated with NMUPS (Step 1). Introducing the ADHD variables (Step 2) explained an additional 6% variance ($p < .001$), with Inattention showing a significant unique prediction. Introducing SCT as the fourth variable did not yield a significant change in accounted variance. Age remained as the only significant and unique predictor, but Inattention showed a marginal unique contribution ($p = .10$).

Past 12 Month NUMPS

Table 7 provides the intercorrelations among the study variables for NMUPS during the past twelve months, separating associations for frequency of use and dichotomized use/non-use. Regarding the latter, significant correlations were observed with all study variables. SCT showed a significant negative correlation with age and gender, and much stronger significant positive correlations with all other clinical measures. For those reporting non-zero NMUPS, frequency of use was positively correlated with ADHD-Inattention and ADHD-Hyperactivity/Impulsivity. SCT showed a strong significant positive correlation with all other clinical measures.

Results of the hierarchical logistic regression analysis examining SCT and other clinical variables in relation to none vs. any NMUPS are summarized in Table 8. After entering age, race, and gender (Block 1), ADHD-Inattention and ADHD-Hyperactive/Impulsive were added to the model (Block 2), which resulted in ADHD-Inattention was significantly contributing to the

prediction of NMUPS. When internalizing symptoms (i.e., anxiety and depression) were added to the model, depressive symptoms added to the prediction of NMUPS and ADHD-Inattention was no longer significant (Block 3). When SCT was added to the model (Block 4), it was not significantly associated with NMUPS. Therefore, SCT did not uniquely contribute to the prediction of NMUPS above and beyond other clinical variables. The full model was statistically significant, χ^2 (8, N = 1142) = 50.17, p < .001, indicating that, relative to the baseline model, the derived model was able to distinguish between respondents who reported and did not report NMUPS (Nagelkerke R^2 = .08). Age was significantly and uniquely positively associated with whether participants used prescription stimulants or not; gender (0 = female, 1 = male) was negatively associated. Of note, depression and ADHD-Hyperactive/Impulsive showed a marginally positive association (p = .055, p = .09, respectively).

Results of the hierarchical multiple regression analysis of SCT in relation to NMUPS, users only, in the past 12 months are summarized in Table 9. ADHD-Inattention and ADHD-Hyperactive/Impulsive significantly contributed to the regression model and accounted for 5% of the variation in NMUPS use frequency. However, neither variable uniquely contributed to the prediction of use when the effect of the other variable was held constant.

Discussion

Research related to SCT continues to grow as more information becomes available on the internal and external validity of the construct. Past research has suggested that, while closely related and often co-occurring, SCT symptoms load onto a factor that is separate from ADHD and internalizing symptoms. Therefore, it is important to consider the degree to which SCT relates to psychosocial difficulties, after controlling for these other related clinical symptoms. A substantial body of research has supported that a significant number of college students are

engaging in NMUPS (Johnston et al., 2003; McCabe et al., 2005). Previous findings suggest that self-treatment, or self-medication, is motivated by the desire to alleviate symptoms consistent with the prescription drug's pharmaceutical main indication (Boyd & McCabe, 2008). The current study examined SCT's unique contribution to college students' engagement in nonmedical use of prescription stimulants (NMUPS), while controlling for ADHD and internalizing symptoms.

SCT, Internalizing, and ADHD Symptoms

The first hypothesis, which proposed that SCT symptoms would moderately correlate with internalizing and ADHD symptoms, was supported. SCT symptoms were found to have a significant and positive correlation with all clinical measures. However, SCT was found to show a stronger, significant, and positive correlation with ADHD-Inattention and depressive symptoms. This finding is consistent with previous investigations of SCT (Becker et al., 2016; Becker, Langberg, Luebbe, Dvorsky, & Flannery, 2014). Specifically, previous research has found large effect sizes for inattention and depressive symptoms in comparison to hyperactivity-impulsivity and anxious symptoms. Additionally, previous research has found SCT symptoms to be a distinct symptom dimension separable from ADHD and other dimensions of psychopathology (Becker et al., 2016). Such findings support the internal validity of SCT. However, given the current results showing the strong correlation between SCT, ADHD-Inattention and depressive symptoms, further research is needed to clarify the evidence between the symptoms. Given previous research regarding depressive symptoms and their comorbidity to ADHD, and SCT's relation to ADHD, it stands to reason that the current results investigating SCT symptoms would find correlations between common comorbid disorders such as depression.

NMUPS, Depressive, and ADHD-Inattention Symptoms

The second hypothesis, which proposed that depressive and ADHD-Inattention symptoms would be significantly correlated with NMUPS, was supported. This finding is consistent with previous literature that investigated the relative/combined influence of depressive and ADHD symptoms as they related to NMUPS (Weyandt et al., 2009). The findings suggest that students who experience depressive symptoms, which is often comorbid with ADHD (particularly inattention), are at a greater risk to engage in NMUPS. In a large national comorbidity study, Kessler et al. (2006) found that ADHD often co-occurs with depression. Specifically, they found 18.6% of individuals with ADHD have major depressive disorder and 1.4% engaged in drug abuse. In addition, they found that 9.4% of individuals with major depressive disorder have ADHD and 7.2% engaged in drug abuse. These findings suggest adult ADHD is significantly comorbid with a range of disorders.

Studies, such as one conducted by Peterkin et al. (2011) in a college student sample, found that 71% of students who reported misuse of stimulant medication screened positive for ADHD symptoms. More recently, in a study by Benson and Flory (2017), 890 college students were surveyed to examine the relations between the misuse of stimulant medication and symptoms of depression and ADHD. They found that symptoms of depression and ADHD, particularly inattention, were significantly related to misuse. Overall, this growing body of research suggests that ADHD and depression are significant predictors of stimulant medication misuse.

Norwalk, Norvilitis and Maclean (2009) provided additional support for a pattern of comorbid problems college populations. Due to concerns about depression confounding results, Norwalk and colleagues controlled for depressive symptoms to investigate the relationship

between ADHD and academic adjustment difficulties, study skills, and GPA. They found that the inattentive symptoms of ADHD may have a particularly negative effect on success in college. Considering previously mentioned literature that suggests academic reasons are the most common motive for college students engaging in NMUPS, it stands to reason that college students who experience ADHD or depressive symptoms are at a greater risk to engage in NMUPS. Additionally, SCT has been investigated as a form of pathological mind wandering or maladaptive daydreaming (Adams, Milich, & Fillmore, 2010; Langberg, Becker, Dvorsky, & Luebbe, 2014). These findings suggested that excessive mind wandering also can adversely affect academic performance (Smallwood, Fishman, & Schooler, 2007). When this information is considered in conjunction with other findings suggesting that the main reason students engage in NMUPS is to self-medicate (Rabiner et al., 2009), one could postulate that students who experience psychological distress (i.e., depressive and ADHD symptoms) will turn to stimulants to help mitigate their symptoms. The current study did not collect data on academic functioning difficulties as a predictor of NMUPS. It would be worthwhile for future research to continue investigating this relationship as specific academic functioning difficulties, previous ADHD diagnoses, and other comorbid symptoms may result in different motivations for engaging in NMUPS. It would also be worthwhile for future research to continue investigating this possible association of SCT with pathological mind wandering as it appears to impair academic functioning.

SCT and NMUPS

The third hypothesis, which proposed that SCT symptoms would uniquely contribute to predicting NMUPS after accounting for other mental health variables, was not supported. Although SCT was not found to be a predictor of NMUPS in the current study, previous research

has shown that SCT is uniquely associated with a range of functional problems (Becker et al., 2016). Specifically, univariate associations have found SCT and functional impairment to have a significant impact on global, social, and academic achievement, with moderate effect sizes in each of these domains. In addition, Barkley (2012) reported that SCT was associated with a wide range of aspects of functional impairment such as friendships and romantic relationships, home life and parenting, occupational functioning, management of finances, and health maintenance. Multivariate analyses showed that SCT was associated with multiple aspects of academic impairment after ADHD symptoms were controlled. In addition to these areas of functional impairment, several studies have suggested that SCT may be related to psychosocial stress (Becker et al., 2016). Similar results to the current study were found by Kirk (2018), who investigated SCT as a predictor of risky behavior. They found that SCT did not uniquely contribute to the prediction of alcohol or cannabis use, although future research is needed to confirm these findings. In fact, Kirk (2018) found that risky behaviors (problematic driving behaviors, risky sexual practices) were not uniquely associated with SCT after controlling for other clinical symptomatology. It is also possible that symptoms of SCT (feeling lethargic and sleepy) make individuals less likely to engage in risky behaviors, or in the current study, less likely to seek out stimulant medication to mitigate their symptoms. Clarification regarding the potential factor structure of SCT measures may help to hone in on differential patterns of predictors (Becker et al., 2018; Garner et al., 2014; Willcutt et al., 2014).

Although SCT was not found to uniquely contribute to the prediction of NUMPS, depressive and ADHD-Inattention symptoms were, which is consistent with existing literature on college students and NMUPS. As previously mentioned, researchers have found college students with ADHD and depressive symptoms to be at a higher risk for NMUPS (Benson & Flory, 2017;

Kessler et al., 2006; Peterkin et al., 2011). In addition, the current study did not collect data on socioeconomic status as it relates to prescription drug expenditures and history related to current prescription drugs being taken, which may be an additional risk factor for NMUPS in college students (Pickover, Messina, Correia, Garza, & Murphy, 2016). Preliminary studies have also suggested that college students to whom stimulants are prescribed for the first time appear to have significantly higher rates of stimulant misuse as well as rates of alcohol and other drug use (Kaloyanides et al., 2007). Reasons for the increased use of prescription stimulants, alcohol, and other drugs remain unclear. However, it can be speculated that students who were previously untreated for ADHD or depression are at a greater risk for NMUPS. The motives for students who misuse prescription stimulants may provide some insight into this area.

The current study adds to the existing literature in important ways. Specifically, this study examined SCT and its relation to NMUPS in college students, by using the ACI, which allowed for the opportunity to assess SCT symptoms based on the construct validation findings by Becker et al. (2016). In addition, our results support the existing evidence that other closely related or comorbid symptomatology, such as ADHD-Inattention and depression, may predict NMUPS in college student populations. No studies have investigated stimulant medication effectiveness specifically with individuals with SCT and only one study investigated a nonstimulant medication. However, recent research has reported that higher SCT symptoms predicted a poorer response to stimulant medication (Froehlich et al., 2018). Considering SCT seems to have a lower response to stimulants compared to ADHD, the current study's findings may suggest that SCT symptoms are distinct from ADHD symptoms as originally hypothesized. Lastly, the current study extended the investigation of SCT in relation to potentially risky psychosocial behavior.

Limitations

The current study is not without limitations that must be considered when interpreting the results. First, the current study relied solely on self-report of symptoms (Rosenman, Tennekoon, & Hill, 2011; Verdi, Weyandt, and Zavras, 2016). Informant assessment is more difficult with adults being evaluated/surveyed, making it necessary to base assessment largely on self-report (Kessler et al., 2016). However, methodological studies, such as one conducted by Zucker, Morris, Ingram, Morris, and Bakeman (2002), have found patterns of underestimation in adult self-reports compared to child and adolescent reports. These findings suggest that our prevalence estimates may be conservative. It may also be that the nature of the NMUPS question may have led participants to underreport use. Second, the present study was also limited by demographics. Specifically, the population was majority White and female college students. Furthermore, for both multiple regressions, a non-normal distribution of residuals was noted. Thus, the results may not be generalizable to other settings and populations. Lastly, this study did not examine potential mediators/moderators in the form of motivations for engaging in NMUPS. Recent literature indicates the importance of motivations for use for those who engage in NMUPS (Cassidy et al., 2015). A study by Arria et al. (2018) found that 28.6% of college students engaged in NMUPS for perceived academic benefit.

Implications/Future Directions

If academic and attention motives are important considerations in NMUPS, connecting students who might be struggling to support services should be prioritized. Eisenberg, Golberstein, and Gollust (2007) found that in a sample of students who screened positive for depression and felt like they needed help, but did not get help, the primary factor associated with not getting support was not knowing what was available to them. If similar trends hold for

NMUPS, raising student awareness of on-campus support services could be a critical step, and could inform students of these services following a positive screen. Additional longitudinal studies of SCT and NMUPS are needed in order to further explore the relationship of perceived benefits (and harms) to future use and academic outcomes. Longitudinal studies will also increase our understanding of the developmental course and consequences of SCT.

Previous research has found correlations between stimulant misuse with other substances (Prosek, 2018). It would behoove clinicians who work with college students to assess for stimulant medication use directly on their intake forms. Clinicians should also be aware of the signs and symptoms of stimulant medication misuse, including the possible side effects. Lastly clinicians may use the prevalence rate statistics from the current study to advocate for on-campus programming about stimulant medication misuse. Consistent with the current study, Messina et al., (2014) investigated prevalence and correlates of NMUPS in a college student population. Their findings also suggested that college students were at a greater risk for engaging in NMUPS. For example, Botvin and Griffin (2005) found that Life Skills Training programs to enhance coping, decision making, interpersonal, assertiveness, and refusal skills effectively decreased drug and alcohol use among adolescents. Other prevention efforts that provide training in the areas of coping skills, refusal strategies, goal identification, academic planning, decision making, health and body image issues, and successful development of peer groups without drugs and alcohol, may prove to be effective in this college student population. In addition, mindfulness-based treatments have been found to be associated with reductions in anxiety, depression, and substance use (Bowen et al., 2014). This form of treatment has been shown to help individuals who engage in substance use, including stimulants, to remain in contact with and relate differently to challenging affective or physical states, use alternative forms of coping,

recognize underlying reasons for maladaptive behaviors, and identify and increase contact with natural contingencies. Previous research has also suggested that exercise could be a promising treatment for NMUPS (e.g., Trivedi et al., 2017).

There is also a great need for research on treatments that specifically target SCT symptoms rather than just assuming that those therapies for ADHD can be applied equally as well to SCT. Given the distinctive but related nature of SCT from ADHD, treatments need to be designed expressly for the symptoms and impairments linked to SCT. Considering the efficacy of Cognitive-Behavior Therapy (CBT) and Social Skills Training (SST) for internalizing disorders, and SCT's significant linkage to those disorders, it would reasonable to expect CBT or SST to be worth exploring for the management of the cognitive and social problems occurring in SCT (Barkley, 2014).

As interest in SCT increases, a primary limitation for the field has been the lack of a unified set of symptoms for assessing SCT. Future research on SCT should continue to refine its measurement (e.g., Becker et al., 2017) in order to ensure that researchers are examining the same set of validated symptoms across studies. In order to have more generalized results, future studies should obtain a more diverse sample that includes participants from a variety of races and locations. Considering the amount of attention given to the assessment and treatment of ADHD and its related problems, it is concerning to consider that approximately 13% of college students, most of whom have no diagnosis or treatment, may be experiencing SCT symptoms (Wood et al, 2017). The results of this study serve to highlight the importance of continued investigation into SCT as a prevalent, likely impairing, and possibly distinct condition.

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Table 1

Frequency of Nonmedical of Prescription Stimulants (Lifetime and 12 Months)

Frequency	Lifetime, n (%)	12 Months, n (%)
No occasions	923 (80.8)	998 (87.3)
1-2 occasions	78 (6.8)	66 (5.8)
3-5 occasions	40 (3.5)	26 (2.3)
6-9 occasions	35 (3.1)	21 (1.8)
10-19 occasions	27 (2.4)	12 (1.0)
20-39 occasions	18 (1.6)	7 (.6)
40+ occasions	19 (1.7)	12 (1.0)
Total	1140	1142

Table 2

Final Sample Descriptives (Lifetime)

	Non-Users (N = 923)	Users (N = 217)
Age		
Mean (SD)	19.37 (1.26)	19.69 (1.31)
Min/Max	18/25	18/25
Skewness	1.09	.82
Kurtosis	1.33	.55
Gender [n (%)]		
Female (0)	707 (76.6)	160 (73.7)
Male (1)	216 (23.4)	57 (26.3)
Race [n (%)]		
White (0)	816 (88.4)	206 (94.9)
Non-White (1)	107 (11.6)	11 (5.1)
ADHD1		
Mean (SD)	15.55 (4.81)	18.38 (5.83)
Min/Max	9/36	9/34
Skewness	1.06	.73
Kurtosis	1.26	-.02
ADHD2		
Mean (SD)	15.83 (4.54)	17.87 (5.07)
Min/Max	9/36	9/35
Skewness	1.00	.71
Kurtosis	1.06	.38
PHQ-8		
Mean (SD)	14.11 (4.90)	16.34 (5.23)
Min/Max	8/32	8/31
Skewness	1.04	.52
Kurtosis	.76	-.46
GAD-7		
Mean (SD)	12.96 (4.89)	14.65 (5.21)
Min/Max	7/28	7/28
Skewness	.91	.63
Kurtosis	.09	-.29
SCT		
Mean (SD)	21.66 (6.28)	24.29 (6.47)
Min/Max	10/40	11/40
Skewness	.69	.52
Kurtosis	.14	-.48

Note. ADHD1 = Attention-Deficit/Hyperactivity Disorder – Inattentive; ADHD2 = Attention-Deficit/Hyperactivity Disorder – Hyperactive-Impulsive; PHQ-8 = Patient Health Questionnaire-8; GAD-7 = Generalized Anxiety Disorder-7; SCT = Sluggish Cognitive Tempo

Table 3

Final Sample Descriptives (12 Months)

	Non-Users (N = 998)	Users (N = 144)
Age		
Mean (SD)	19.40 (1.28)	19.63 (1.25)
Min/Max	18/25	18/23
Skewness	1.09	.64
Kurtosis	1.36	-.34
Gender [n (%)]		
Female (0)	769 (77.1)	100 (69.4)
Male (1)	229 (22.9)	44 (30.6)
Race [n (%)]		
White (0)	887 (88.9)	136 (94.4)
Non-White (1)	111 (11.1)	8 (5.6)
ADHD1		
Mean (SD)	15.77 (4.99)	18.26 (5.60)
Min/Max	9/36	9/34
Skewness	1.07	.75
Kurtosis	1.20	.11
ADHD2		
Mean (SD)	15.95 (4.62)	18.06 (4.97)
Min/Max	9/36	10/32
Skewness	1.03	.45
Kurtosis	1.23	-.42
PHQ-8		
Mean (SD)	14.30 (4.96)	16.40 (5.30)
Min/Max	8/32	8/31
Skewness	.98	.53
Kurtosis	.57	-.39
GAD-7		
Mean (SD)	13.10 (4.91)	14.60 (5.36)
Min/Max	7/28	7/28
Skewness	.88	.62
Kurtosis	.05	-.41
SCT		
Mean (SD)	21.82 (6.30)	24.58 (6.60)
Min/Max	10/40	11/40
Skewness	.68	.45
Kurtosis	.11	-.61
NMUPS		
Mean (SD)	-	3.33 (1.62)
Min/Max	-	2/7
Skewness	-	1.05
Kurtosis	-	-.05

Note. ADHD1 = Attention-Deficit/Hyperactivity Disorder – Inattentive; ADHD2 = Attention-Deficit/Hyperactivity Disorder – Hyperactive-Impulsive; PHQ-8 = Patient Health Questionnaire-8; GAD-7 = Generalized Anxiety Disorder-7; SCT = Sluggish Cognitive Tempo; NMUPS = Non-medical Use of Prescription Stimulants

Table 4

Intercorrelations for Study Variables (Lifetime)

	1	2	3	4	5	6	7	8	9	10
1. Age	-	.01	-.03	-.02	-.08	-.17*	-.09	-.14*	-	.18**
2. Race	.04	-	.15*	.02	-.04	-.13	-.07	-.06	-	.06
3. Gender	.04	.04	-	-.03	-.07	-.02	-.18**	-.12	-	.04
4. ADHD1	-.01	-.05	.02	-	.62***	.51***	.51***	.69***	-	.23**
5. ADHD2	-.06*	-.16***	-.06*	.65***	-	.43***	.55***	.53***	-	.18**
6. PHQ-8	-.02	-.00	-.15***	.57***	.46***	-	.77***	.69***	-	.09
7. GAD-7	-.01	-.04	-.18***	.51***	.51***	.78***	-	.69***	-	.09
8. SCT	-.09**	-.13***	-.05	.69***	.55***	.73***	.68***	-	-	.16*
9. N vs. A	.10**	.03	-.08**	.22***	.17***	.17***	.13***	.16***	-	-
10. NMUPS Freq	-	-	-	-	-	-	-	-	-	-

Note. Upper right matrix reflects correlations for users (n = 217); lower left matrix reflects correlations for users vs. nonusers (n = 923). For Race, 0 = White, 1 = Non-White; For Gender, 0 = Female, 1 = Male; ADHD1 = Attention-Deficit/Hyperactivity Disorder – Inattentive; ADHD2 = Attention-Deficit/Hyperactivity Disorder – Hyperactive-Impulsive; PHQ-8 = Patient Health Questionnaire-8; GAD-7 = Generalized Anxiety Disorder-7; SCT = Sluggish Cognitive Tempo; N vs. A = None vs. Any NMUPS; NMUPS Freq = Users of Non-medical Use of Prescription Stimulants.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 5

Hierarchical Logistic Regression Predicting Likelihood of None vs. Any Non-Medical Use of Prescription Stimulants (Lifetime, All Participants)

	Block 1				Block 2				Block 3				Block 4			
	B	SE	Wald	OR (Exp β) (95% CI)	*B*	SE	Wald	OR (Exp β) (95% CI)	*B*	SE	Wald	OR (Exp β) (95% CI)	*B*	SE	Wald	OR (Exp β) (95% CI)
	χ^2 (2) = 11.10, p < .01 Nagel R^2 = .02				χ^2 (2) = 53.31, p < .001 Nagel R^2 = .09				χ^2 (2) = 5.34, p = .07 Nagel R^2 = .10				χ^2 (1) = .00, p = .96 Nagel R^2 = .10			
Age	.18	.06	10.60***	1.2 (1.08, 1.34)	.21	.06	12.69***	1.23 (1.10, 1.38)	.21	.06	12.91***	1.23 (1.10, 1.38)	.21	.06	12.73***	1.23 (1.10. 1.38)
Gender	-.13	.17	.57	.88 (.62, 1.23)	-.15	.18	.71	.86 (.61, 1.22)	-.21	.18	1,27	.81 (.57, 1.17)	-.21	.18	1.27	.81 (.57, 1.17)
ADHD1					.08	.02	18.97***	1.08 (1.05, 1.12)	.06	.02	9.11**	1.06 (1.02. 1.22)	.06	.02	7.45**	1.06 (1.02, 1.11)
ADHD2					.03	.02	2.54	1.03 (.99, 1.08)	.03	.02	2.35	1.03 (.99, 1.08)	.03	.02	2.34	1.03 (.99, 1.08)
PHQ-8									.05	.03	4.82*	1.06 (1.01, 1.11)	.05	.03	4.25*	1.06 (1.00. 1.11)
GAD-7									-.02	.03	.83	.98 (.93, 1.03)	-.02	.03	.82	.98 (.93, 1.03)
SCT													.00	.02	.00	1.00 (.96, 1.04)

Note. N = 1140. For Gender, 0 = Female, 1 = Male ; ADHD1 = Attention-Deficit/Hyperactivity Disorder - Inattentive; ADHD2 = Attention-Deficit/Hyperactivity Disorder – Hyperactive-Impulsive; PHQ-8 = Patient Health Questionnaire-8; GAD-7 = Generalized Anxiety Disorder-7; SCT = Sluggish Cognitive Tempo; Nagel = Nagelkerke; OR = odds ratio

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

Table 6

Hierarchical Multiple Regression Analyses Predicting Non-Medical Use of Prescription Stimulants (Lifetime, Users Only)

	Step 1				Step 2				Step 3			
	B	SE	β	*t*	*B*	SE	β	*t*	*B*	SE	β	*t*
	F (1,215) = 7.42**				F (2, 213) = 7.03***				F (1, 212) = 0.14			
	R^2 = .03, ΔR^2 = .03				R^2 = .09, ΔR^2 = .06				R^2 = .09, ΔR^2 = .00			
Age	.23	.09	.18	2.72**	.25	.08	.19	2.96**	.25	.08	.20	2.97**
ADHD1					.05	.02	.18	2.19*	.05	.03	.16	1.62
ADHD2					.03	.03	.09	1.04	.03	.03	.08	.97
SCT									.01	.02	.03	.37

Note. N = 217. ADHD1 = Attention-Deficit/Hyperactivity Disorder – Inattentive; ADHD2 = Attention-Deficit/Hyperactivity Disorder – Hyperactive-Impulsive; SCT = Sluggish Cognitive Tempo

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

Table 7

Intercorrelations for Study Variables (12 Months)

	1	2	3	4	5	6	7	8	9	10
1. Age	-	.07	-.13	-.07	-.15	-.17*	-.10	-.16	-	.09
2. Race	.04	-	.17*	-.03	-.04	-.04	-.10	-.09	-	-.01
3. Gender	.04	.04	-	.01	-.08	-.13	-.23**	-.15	-	.01
4. ADHD1	-.01	-.05	.02	-	.58***	.56***	.52***	.70***	-	.21*
5. ADHD2	-.06*	-.16***	-.06*	.65***	-	.46***	.58***	.54***	-	.18*
6. PHQ-8	-.02	-.00	-.15***	.57***	.46***	-	.74***	.67***	-	.11
7. GAD-7	-.01	-.04	-.18***	.51***	.51***	.78***	-	.70***	-	.11
8. SCT	-.09**	-.05	-.13***	.69***	.55***	.73***	.68***	-	-	.04
9. N vs. A	.06*	-.06*	.06*	.16***	.15***	.14***	.10***	.14***	-	-
10. NMUPS Freq	-	-	-	-	-	-	-	-	-	-

Note. Upper right matrix reflects correlations for users (n = 144); lower left matrix reflects correlations for users vs. nonusers (n = 998). For Race, 0 = White, 1 = Non-White; For Gender, 0 = Female, 1 = Male; ADHD1 = Attention-Deficit/Hyperactivity Disorder – Inattentive; ADHD2 = Attention-Deficit/Hyperactivity Disorder – Hyperactive-Impulsive; PHQ-8 = Patient Health Questionnaire-8; GAD-7 = Generalized Anxiety Disorder-7; SCT = Sluggish Cognitive Tempo; N vs. A = None vs. Any NMUPS; NMUPS Freq = Users of Non-medical Use of Prescription Stimulants

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

Table 8

Hierarchical Logistic Regression Predicting Likelihood of None vs. Any Non-Medical Use of Prescription Stimulants (12 Months)

	Block 1				Block 2				Block 3				Block 4			
	B	SE	Wald	OR (Exp β) (95% CI)	*B*	SE	Wald	OR (Exp β) (95% CI)	*B*	SE	Wald	OR (Exp β) (95% CI)	*B*	SE	Wald	OR (Exp β) (95% CI)
	χ^2 (3) = 12.81, p < .01 Nagel R^2 = .02				χ^2 (2) = 29.76, p < .001 Nagel R^2 = .07				χ^2 (2) = 6.39, p < .05 Nagel R^2 = .08				χ^2 (1) = 1.21, p = .27 Nagel R^2 = .08			
Age	.13	.07	3.88*	1.14 (1.00, 1.30)	.15	.07	4.93*	1.16 (1.02, 1.33)	.16	.07	5.17*	1.17 (1.02, 1.33)	.17	.07	5.75*	1.18 (1.03, 1.35)
Gender	-.40	.20	4.07*	.67 (.46, .99)	-.44	.20	4.70*	.65 (.44, .96)	-.51	.21	5.93*	.60 (.40, .91)	-.52	.21	6.28*	.59 (.39, .89)
Race	.81	.38	4.58*	2.25 (1.07, 4.73)	.67	.39	2.97	1.95 (.91, 4.15)	.73	.39	3.50	2.07 (.97, 4.43)	.73	.39	3.50	2.07 (.97, 4.44)
ADHD1					.06	.02	6.90**	1.06 (1.01, 1.10)	.03	.02	2.02	1.03 (.99, 1.08)	.02	.03	.72	1.02 (.97, 1.08)
ADHD2					.04	.02	3.46	1.05 (1.00, 1.10)	.04	.03	3.10	1.04 (1.00, 1.10)	.04	.03	2.87	1.04 (.99, 1.09)
PHQ-8									.07	.03	5.92*	1.07 (1.01, 1.13)	.06	.03	3.68	1.06 (1.00, 1.13)
GAD-7									-.03	.03	1.12	.97 (.92, 1.03)	-.04	.03	1.56	.96 (.91, 1.02)
SCT													.03	.02	1.22	1.03 (.98, 1.08)

Note. N = 1142. For Gender, 0 = Female, 1 = Male; For Race, 0 = White, 1 = Non-White; ADHD1 = Attention-Deficit/Hyperactivity Disorder - Inattentive; ADHD2 = Attention-Deficit/Hyperactivity Disorder – Hyperactive-Impulsive; PHQ-8 = Patient Health Questionnaire-8; GAD-7 = Generalized Anxiety Disorder-7; SCT = Sluggish Cognitive Tempo; Nagel = Nagelkerke; OR = odds ratio

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

Table 9

Hierarchical Multiple Regression Analyses Predicting Non-Medical Use of Prescription Stimulants (12 Months, Users Only)

	Step 1			
	B	SE	β	*t*
	F (2, 141) = 3.51*			
	R^2 = .05, ΔR^2 = .05			
ADHD1	.05	.03	.16	1.55
ADHD2	.03	.03	.09	.87

Note. N = 144. ADHD1 = Attention-Deficit/Hyperactivity Disorder – Inattentive; ADHD2 = Attention-Deficit/Hyperactivity Disorder – Hyperactive-Impulsive; SCT = Sluggish Cognitive Tempo

*$p < .05$.