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## RISK FACTORS FOR ABUSE OF PRESCRIPTION STIMULANTS IN COLLEGE STUDENTS: A DISSERTATION

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RISK FACTORS FOR ABUSE OF PRESCRIPTION STIMULANTS IN COLLEGE  
STUDENTS: A DISSERTATION

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DISSERTATION

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A dissertation submitted in partial fulfillment of the requirements for the degree of  
Doctor of Philosophy in the College of Arts and Sciences at the University of Kentucky

By

Eric Andrew Haak

Lexington, Kentucky

Director: Dr. Peggy S. Keller, Professor of Psychology

Lexington, Kentucky

2017

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## ABSTRACT OF DISSERTATION

### RISK FACTORS FOR ABUSE OF PRESCRIPTION STIMULANTS IN COLLEGE STUDENTS: A DISSERTATION

The abuse of prescription stimulants among college students is a growing public health concern. While these substances are often viewed as safe, “smart drugs”, they are associated with a number of maladaptive outcomes, ranging from poorer academic performance to cardiovascular incidents and even death. To date, the majority of research on the abuse of these substances have focused on demographic factors which are not amenable to intervention, such as race, Greek organization status, and class rank. The current study examined family factors, academic stress, and impulsivity as potential risk factors which are amenable to intervention. In a sample of 335 undergraduate students, no associations were found between family variables and prescription stimulant abuse or academic stress and prescription stimulant abuse. Inconsistent support was found for an association between impulsivity and prescription stimulant abuse.

**KEYWORDS:** Prescription stimulants, college students, smart drugs, academic stress, impulsivity

Eric Andrew Haak

10/17/17

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## Introduction

Non-prescription use of stimulant medications (NPS), such as Adderall and Ritalin, is a growing public health concern. Lifetime estimates of NPS may be as high as 43% of adolescents and young adults (Advokat, Guidry, & Martino, 2008) and are on the rise (Blanco et al., 2007; Johnston, O'Malley, Bachman, & Schulenberg, 2013). Although NPS users often believe stimulants are safe because these drugs are FDA approved (DeSantis & Hane, 2010), NPS can have very serious consequences. NPS is linked to cardiovascular incidents, seizures, and even sudden death (Arria, Caldeira, O'Grady, Vincent, Johnson, & Wish, 2008; NIDA, 2010). Concerns about potential health risks are exacerbated by the fact that many NPS users admit to having little to no information about dosage or side effects (DeSantis & Hane, 2010). Indeed, NPS-related emergency department visits increased nearly fourfold between 2005 and 2010 (SAMSHA, 2013). NPS is also associated with other risky behaviors, such as the use of illicit drugs (Teter, McCabe, Boyd, & Guthrie, 2003). It is therefore critical for research to identify factors that contribute to NPS. Unfortunately, there are few quantitative studies addressing this need. The following study tested a model of risk factors for NPS, including NPS for academic reasons and for social reasons. Three risk factors were examined: academic stress, parenting, and impulsivity.

## NPS for Academic Reasons

Prescription stimulants are primarily used to treat attention deficit/hyperactivity disorder, specifically, the attention deficit symptoms associated with the disorder (e.g., Volkow et al., 2001). Prescription stimulants have consistently been shown to be effective and safe



in reducing the attention difficulties associated with this condition (Biederman, et al., 2002; Wolraich et al., 2001). As a result, members of the general public may consider prescription stimulants to be “smart drugs” (Talbot, 2009). This may explain why college-attending individuals are more likely to utilize prescription stimulants in a non-prescription manner than same-age peers who do not attend college (Herman-Stahl, Krebs, Kroutil, & Heller, 2007; Johnston, O’Malley, Bachman, & Schulenberg, 2004). This conceptualization of prescription stimulants as “smart drugs” may also promote use through the belief that taking these stimulants is safe and moral (DeSantis, Webb, & Noar, 2008). In fact, the most commonly cited justification for engaging in NPS is that, since it is being done to improve grades, it is different from other illicit drug usage and is more acceptable (DeSantis & Hane, 2010). However, NPS is actually associated with low school achievement (DeSantis, Webb, & Noar, 2008; McCabe et al., 2005; McCabe et al., 2006; Sharp & Rosen, 2007; Teter et al., 2006). Further, NPS is associated with procrastination (Ford & Ong, 2014; McCabe, 2008; Moore Burgard, Larson, & Ferm, 2014).

### NPS for Social Reasons

Another common context for individuals to engage in NPS is social activities like parties. Previous research has found a positive association between weekly party behavior and NPS (Teter, McCabe, Boyd, & Guthrie, 2003). Students have reported that they take prescription stimulants in order to increase their ability to stay awake during such activities (Barret & Pihl, 2002), as these activities often take place at night and the self-regulation required to engage in self-presentation and social interaction can be taxing (DeWall, Baumeister, Gailliot, & Maner, 2008). Stimulants are believed to counteract the effects of

fatigue and therefore enhance social activities (DeSantis, Webb, & Noar, 2008). Further, social activities in college often involve alcohol, which has a sedative effect that stimulants may be believed to counteract (Barret & Pihl, 2002; Low & Gendaszek, 2002). Students who engage in NPS drink more alcohol than students who drink without taking prescription stimulants (Barrett, Darredeau, & Pihl, 2006). Social motivations were found to be endorsed by 19.3% of NPS users in one study (Arria & Wish, 2006), consistent with the finding that NPS users spent more time going out to socialize than non-users (Arria et al., 2008). A more detailed understanding of factors predicting NPS during social activities is necessary, as social NPS may be combined with other drugs, such as MDMA (3,4-methylenedioxy-methamphetamine) and marijuana (Teter et al., 2003).

#### Academic Stress and NPS

To our knowledge, no study has examined academic stress directly as a risk factor for NPS. Academic stress is pertinent to NPS because students often cite prolonged and more efficient studying as a motivation for abusing prescription stimulants (Arria & DuPont, 2010; Arria & Wish, 2005), and believe that that NPS will improve their grades (Teter, McCabe, LaGrange, Cranford, & Boyd, 2006). Specifically, this study hypothesized that individuals who are high in academic stress will be more likely to engage in NPS.

Support for a role of academic stress in the etiology of NPS comes from the fact that college student NPS is especially high during times of pronounced academic stress. For example, students report using stimulants to “cram” their studying immediately before an exam (Arria et al., 2008). Prices for illicitly-obtained prescription stimulants increase around midterms and finals, corresponding with demand (McCabe, Teter, & Boyd, 2006;

Moore et al., 2014). The self-reported rate of illicit use of prescription stimulants was found to increase 300-400% from the first week of classes to midterms and finals in one sample (Moore et al., 2014). Importantly, this finding was supported by a similar increase in the metabolites of Ritalin and Adderall found in the campus wastewater (Moore et al., 2014). In interviews, students used the fact that their NPS was focused around periods of high academic stress to argue that their NPS is in moderation (DeSantis & Hane, 2010). Interestingly, the rate of illicit prescription stimulant use on college campuses has been estimated to be higher than the rate of medical usage (2.2% medical vs. 5.4% non-medical; McCabe, Teter, & Boyd, 2006), the highest ratio of misuse to use of any class of prescription drug studied.

#### NPS and Family Variables

A guiding theory for the role of family factors in NPS is Social Control Theory (Hirschi, 1969). Unlike many other theories of delinquency, which emphasize factors increasing the likelihood of deviant behavior, Social Control Theory focuses on factors which keep individuals from engaging in such behaviors. Specifically, the theory suggests that the impulse to engage in problem behavior is similar both for delinquent and non-delinquent individuals. However, social factors act to reduce the likelihood of acting on these impulses for non-delinquent individuals. These persons have a stronger bond to conventional society, which disapproves of delinquent behaviors such as NPS. This bond may be manifested as commitments to goals and activities that are approved of by society, internalization of social norms, and attachment to conventional figures, including parents. These provide a strong motivation to override impulses to engage in deviant behaviors, in essence acting as social control agents of behavior. Without this bond to conventional

society, there may be little motivation to override deviant impulses. The current study focuses on the role of parents as social control agents. To our knowledge, no research has examined how family factors influence NPS. This is a particularly pertinent gap in the NPS literature, as the majority of students engaging in NPS report obtaining the drugs from either a friend or relative (Chen, Strain, Crum, Storr, & Mojtabai, 2014).

Social Control Theory emphasizes close, open relationships with parents as promoting their ability to act as social control agents. Such relationships are exemplified by parents who are warm towards their children and involved in and monitor their children's activities. Warm parenting that is high in monitoring creates a closer bond with children, increasing the extent to which children internalizing the goals and values of their parents (e.g., Wright, Cullen, & Miller, 2001). In contrast, parents who are cold, harsh, or manipulative, may be ineffective as social control agents.

Social Control Theory has been supported by empirical research. A lack of parental warmth and involvement is associated with increased use of cigarettes and marijuana (Brook, Whiteman, Nomura, Gordon, & Cohen, 1988). Parenting strategies marked by poor monitoring and a reliance on control through guilt (a form of manipulative parenting) are associated with higher drug use in children and adolescents (Dishion, Patterson, & Reid, 1988). Students who later initiate drug use have been found to desire warmer relationships with their parents and to report more frequent conflicts with them (Elliot et al., 1985; Kaplan et al., 1986).

In contrast to the Social Control Theory view of parental control as a protective factor, Self-Determination Theory (Deci & Ryan, 1985) focuses on the deleterious effect of manipulative control from parents. This manipulative control, frequently termed

psychological control, attempts to control children by making them feel negative emotions (guilt, anxiety, rejection) about misbehavior. Psychologically controlling parents often make their love and attention contingent on the child behaving in accordance with parents' goals. One aspect of psychological control that may be particularly relevant to NPS is parental achievement orientation. Parents high in achievement orientation have high expectations that their children receive excellent grades, perform well in difficult majors, and pursue high-paying, prestigious, but competitive and demanding careers. They may pressure their children to meet their expectations; and if children do not, withdraw love and express disappointment.

According to Self-Determination Theory, autonomy is viewed as a basic psychological need for all humans. Autonomy refers to engaging in behaviors for which the motivation has been internalized by the individual. Behaviors that are engaged in autonomously are done because the individual desires to engage in those behaviors, rather than due to external pressures or demands. Therefore, a goal of parenting from a Self-determination Theory perspective is to foster an autonomous, or internalized, motivation to engage in prosocial behaviors within children (Soenens & Vansteenkiste, 2009). Psychological control is proposed to do the opposite: impede the development of autonomous motivation and, instead, lead to controlled motivation. That is, instead of acting out of one's own will (often internalized goals and values of parents), children feel that their parents' will is being imposed on them without their consent (Deci & Ryan, 2008). Autonomy cannot develop in such circumstances, and the child may struggle to regulate their own behavior when becomes necessary to do so (such as when they eventually move out of their parents' homes and go to college). This may increase risk for

negative behaviors, such as NPS, due to the fact that motivations to avoid substance use may be extrinsically derived. In this case, these motivations would be reduced, particularly when parents are distant. Indeed, autonomous motivations have been demonstrated to facilitate health behaviors, including improved outcomes from substance abuse treatments and weight loss interventions (Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004; Zeldman, Ryan, & Fiscella, 2004). Contrastingly, studies have found that individuals with extrinsically-focused motivations engage in more risky behaviors (Williams, Cox, Hedberg, & Deci, 2000). In the context of NPS, external motivation may drive students to feel the need to achieve without the drive to engage in good studying behaviors throughout the term. NPS may be perceived as a way to help students succeed and to earn parental love, approval, and pride by obtaining good grades despite poor study habits. Consistent with this perspective, Arria and colleagues (2013) report that parents were often aware of, and condoned, students' NPS in the belief that it would improve GPA. Further, family members, including parents, have been identified as a prominent source of prescription drugs for illicit use (McCabe & Boyd, 2005).

This study explored parenting behaviors highlighted by Social Control Theory (warmth, and monitoring) and Self-Determination Theory (psychological control) as predictors of NPS for academic reasons and for social reasons. We hypothesized that lower parental warmth, higher psychological control, and lower monitoring would be associated with greater NPS for any reason. We also hypothesized that greater academic pressure on the part of parents would be associated with NPS for academic reasons.

## NPS and Impulsivity

Impulsivity has been identified as an individual characteristic associated with increased risk for substance use problems (Nigg et al., 2006). Modern models of impulsivity distinguish between three related, but distinct constructs: urgency, sensation seeking, and deficits in conscientiousness (Whiteside & Lynam, 2001). Urgency refers to the tendency to behave impulsively when feeling strong emotions. Positive urgency refers to the tendency to act rashly when feeling positive emotions, while negative urgency refers to the tendency to act rashly when feeling negative emotions. Sensation seeking refers to the urge to find new and exciting activities and openness to new experiences. Deficits in conscientiousness may be subdivided into lack of premeditation and lack of perseverance. Individuals who score high on lack of premeditation evince difficulties in considering the consequences of behaviors. Individuals who are high in lack of perseverance find it difficult to remain on task when engaged in boring or difficult tasks. These individuals are also easily distracted during such tasks. The strongest predictors of risky behaviors such as substance use are those aspects of impulsivity that are associated with emotion: urgency and sensation seeking (Coskuniper, Dir, & Cyders, 2013; Smith & Cyders, 2016). Sensation seeking predicts the frequency of engaging in risky behaviors, while urgency, both positive and negative, predicts the likelihood of experiencing negative outcomes from these behaviors (Cyders & Smith, 2008).

Smith and colleagues have repeatedly found associations between urgency and drug use. Positive urgency predicts college-students' illegal drug use, even when controlling for previous drug use, sensation seeking, lack of planning, and lack of perseverance (Zapolski, Cyders, & Smith, 2009). Thus, individuals high in positive urgency may be at greater risk

for drug use in situations marked by positive affect, such as parties and other social contexts. Similarly, negative urgency has been associated with illegal drug use, controlling for neuroticism and low conscientiousness in college students (Settles et al., 2012). Individuals high in negative urgency may be particularly at-risk during periods marked by high levels of negative affect, such as academic stress. A meta-analytic study found positive and negative urgency to be the strongest impulsivity-related factors associated with problem drinking (Coskunpinar, Dir, & Cyders, 2013). Related to the concept of urgency, sensation seeking and also novelty seeking have been found to predict college students' drinking behaviors (Khan, Jacobson, Gardner, Prescott, & Kendler, 2005; LaBrie, Kenney, Napper, & Miller, 2014).

To our knowledge, no previous study has examined urgency and sensation seeking in the context of NPS, despite strong effects of these variables for other forms of substance use. Given that impulsive behavior is amenable to intervention, identifying the role of impulsivity in NPS is important (e.g., Smith & Cyders, 2016; Zapolski, Settles, Cyders, & Smith, 2010). We proposed that higher sensation seeking and positive urgency is associated with greater NPS for social reasons, and greater negative urgency is associated with NPS for academic reasons. We also proposed that sensation seeking and urgency serve as personality vulnerabilities that exacerbate the effects of academic and family stress on NPS. That is, sensation seeking and urgency moderate associations between family and academic stress and NPS.

### The Current Study

This study examined three risk factors for NPS: academic stress, parenting, and impulsivity (urgency and sensation seeking). It also examined impulsivity as a moderator



of associations between academic stress and NPS and between parenting and NPS. Further, we examined NPS use generally, NPS for academic reasons, and NPS for social reasons. To our knowledge, no study has ever differentiated between academic and social motivations for NPS. The study controlled for race, gender, and Greek membership, as these characteristics have been associated with NPS. Specifically, the average college student who engages in NPS is white, male (although female report of NPS is common as well), and a member of a Greek organization (DeSantis et al., 2008; McCabe et al., 2005). It was expected that the current study would replicate these findings. Regarding Academic NPS, it was specifically hypothesized that: (1) Academic Stress is positively associated with likelihood of engaging in Academic NPS, (2) Impulsivity is positively associated with the likelihood of engaging in Academic NPS, (3) Parental Warmth and Monitoring is negatively associated with the likelihood of engaging in Academic NPS, and (4) Parental Psychological Control is positively associated with likelihood of engaging in Academic NPS. Regarding Social NPS, we specifically hypothesized that: (1) Parental Warmth and Monitoring is negatively associated with Social NPS, (2) Parental psychological control is positively related to Social NPS, (3) Impulsivity is positively associated with Social NPS, and (4) The association between Parenting and Social NPS is stronger for individuals reporting higher impulsivity.

## Methods

### *Participants*

Participants included 335 University of Kentucky Undergraduates recruited via SONA from the psychology subject pool. This is a pool of undergraduate students currently

enrolled in low-level psychology courses (e.g., introduction to psychology, psychology research methods, and statistics for psychology) which require a research experience component. This research experience involves participating in research studies for 4-6 hours, depending on the course. Students who do not wish to participate can instead summarize published research studies. However, most students prefer to serve as participants. History of NPS was assessed via a question in the psychology pool screening questionnaire. This is an optional online questionnaire available to all members of the psychology subject pool. Although all members of the pool were eligible to participate and could self-select into the study, those indicating a positive history of NPS were personally invited to participate via direct email by the researcher to help ensure sufficient variability of NPS in the sample. All other participants were enrolled after contacting the researcher for the study password.

Participants were predominately white (73.4%), female (78.4%) and had a mean age of 18.89 years, with a standard deviation of 1.27 years. These demographics are consistent with the general psychology subject pool at the University of Kentucky. The majority (60.1%) of participants were freshman, followed by sophomores (18.4%), then juniors (14%). The majority of participants, 201 (58.8%) did not belong to a Greek organization. Eighty-three participants (24.2%) reported having engaged in NPS for any reason. The most common reason for NPS was academic, with 79 (23.0%) participants reporting NPS for this reason. In contrast, only 24 (7.0%) participants reported using stimulants for social motives. Twenty participants (5.8%) reported using stimulants for both academic and social motives and 4 participants (1.2%) engaged in NPS for social motives only. Therefore, 25% of academic stimulant users also utilized stimulants for

social motives and 83.33% of social stimulant users used stimulants for academic motives, as well.

### *Procedures*

All data for the study were collected through Qualtrics, a secure online data collection service. Individuals who expressed interest in the study by emailing the principal investigator were sent a link to the informed consent. Only after providing consent were participants allowed to progress to the questionnaires. All data for the study consisted of answers to these online questionnaires. Participants were allowed to skip any question that they did not wish to answer. Following the end of their participation, a debriefing was provided. Participants were awarded one research credit toward their course research requirement.

### *Measures*

**NPS.** Participants were asked about general lifetime and past-year NPS: “Have you ever used prescription stimulants (e.g., Ritalin, Adderall, Vyvanse) without a prescription or in a manner not consistent with your prescription?” for lifetime NPS. Participants who answered “yes” to the general NPS questions were shown follow-up questions asking where the NPS occurred. The provided options included: “Studying either at home or elsewhere,” “In a class,” “Prior to an exam,” “At a party or social event,” “At a bar or club,” or “Other” with a write-in option. Participant responses were coded into two dummy variables: Academic NPS (1 for NPS for academic reasons and 0 for no NPS for academic reasons) and Social NPS (1 for NPS for social reasons and 0 for no NPS for social reasons).

**Academic Stress.** Participants completed the Academic Stress Scale subscale for academic stress developed by Zajacova, Lynch, and Espenshade (2005). This is a 27-item

scale that asks participants to rate from 0-11 how stressful they find a number of items related to academic success. Example items are “Studying,” “Managing time efficiently,” and “Writing term papers.” Scores for these items were then summed to create an academic stress score. Reliability for the current sample was excellent,  $\alpha = .92$ .

***Parenting.*** Participants completed three questionnaires relevant to parental behaviors. Achievement-oriented psychological control was measured via the achievement-oriented subscale of the Dependency and Achievement-Oriented Psychological Control Scale (DAPCS; Soenens, Vansteenkiste, & Luyten, 2010). This measure demonstrates convergent and discriminate validity. In the current study, the reliability was  $\alpha = .96$  for reports of Father Achievement-Oriented Psychological Control and  $\alpha = .94$  for reports of Mothers’ Achievement-Oriented Psychological Control. In order to preserve degrees of freedom, maternal and paternal achievement-oriented psychological control scores were averaged to create a single parental psychological control variable. Parental warmth was measured using the Schuldermann and Schuldermann (1970) 118-item version of the Parental Behavior Inventory-Child Report (Schaefer, 1965). The report of father warmth had a reliability of  $\alpha = .89$  and mother Warmth had a reliability of  $\alpha = .87$ . Again, in order to preserve degrees of freedom, maternal and paternal warmth were combined to form one measure of parental warmth. The measure of involvement monitoring was the Monitoring and Control Questionnaire (Kotchick et al., 1997). The scale asked questions regarding how often parents were aware of the individual’s activities. For example, “Do your parents know where you go when you are out with your friends?” The reliability for this scale was good, Cronbach’s  $\alpha = .87$ .

***Impulsivity.*** Impulsivity was measured using the UPPS-P Impulsive Behavior Scale (Lynam, Smith, Cyders, Fischer, & Whiteside, 2007). This 45-item questionnaire uses a 4-point Likert-type scale. The UPPS-P consists of four subscales: Premeditation, Urgency, Perseverance, and Sensation Seeking. The Urgency and Sensation Seeking subscales were utilized in this study. The scale has been validated in a number of samples (e.g., Cyders & Smith, 2007; Magid & Colder, 2007) and shows excellent reliability (e.g., Cyders, 2013). The reliability for the Urgency scale in the current study was  $\alpha = .90$ . The reliability for the Sensation Seeking subscale was  $\alpha = .89$ .

***Covariates.*** The survey also obtained the following information: sex, race, GPA, and Greek membership. Sex, race, and Greek membership were dummy coded. The reference groups for these codes were female, not white, and not in a Greek organization. Participants in the reference group were given a 0 for that variable and participants not in the reference group were given a 1.

#### Data Preparation and Descriptive Statistics

##### *Missing Data*

Data preparation and analysis was conducted in SPSS 23. Given the nature of the data (illegal drug use), missing data points were expected and observed in the data set. Missing data were imputed using the EM algorithm (Little & Rubin, 2014; Rubin, 1991). The Expectation Maximization (EM) algorithm has been found to perform nearly as well or better than both multiple imputation and Full Information Maximum Likelihood when estimating regression coefficients and standard errors for samples of around 100 participants in Monte Carlo simulation studies (Olinsky, Chen, & Harlow, 2003). The EM algorithm is a single imputation method which assumes data are missing at random (MAR).

MAR is considered to be a reasonable assumption of missingness patterns in most research domains (Schafer & Graham, 2002). Further, violations of the MAR assumption generally have minor influence on model results (Collins, Schafer, & Kam, 2001). Participants with missing data reported significantly higher Parental Achievement-Oriented Psychological Control,  $t(339) = 2.10, p < .05$ . No other significant differences were detected between participants with or without missing data on other study variables.

### *Outliers*

Any data point more than three standard deviations beyond the mean for that variable was examined as a potential univariate outlier. If a score was determined to be an outlier, it was trimmed to three standard deviations beyond the mean. Multivariate outliers were detected using measures of discrepancy and influence. Nine univariate outliers were detected across all the variables. These were all trimmed to three standard deviations beyond the mean. When multivariate outliers were detected, sensitivity analyses were conducted by re-running analyses without these cases and noting changes in the results.

### *Dummy Coding and Centering*

The sex variable was coded 0 for female and 1 for male. The Greek organization membership variable was coded 0 for non-members and 1 for members. The dataset contained two NPS dummy codes; Academic NPS and Social NPS. Participants who did not engage in NPS were coded as 0 for both dummy code variables. Participants who reported Academic NPS were represented with a 1 for that variable. Participants who engaged in Social NPS were represented with a 1 in that variable. Continuous variables were mean-centered prior to the computation of interaction terms. Interactions were probed by calculating the simple slopes of the independent variable on the dependent variable at

one standard deviation above and below the mean of the moderator following procedures outlined in Aiken and West (1991).

### *Descriptive Statistics and Preliminary Analyses*

Descriptive statistics are presented in Table 1. Correlations between predictor variables are presented in Table 2. Male participants were significantly older than female participants in this study,  $t(332) = 3.35, p < .05$ . Men also scored significantly higher on Sensation Seeking than women in this study,  $t(332) = 2.49, p < .05$ . Women in the study reported higher levels of Parental Monitoring than did men,  $t(332) = -2.36, p < .05$ . No other study variables differed significantly by gender.

Participants with a history of Academic NPS were older than participants without a history of Academic NPS,  $t(340) = 5.66, p < .05$ . These participants also scored higher on Sensation Seeking,  $t(340), 3.95, p < .05$ . Finally, individuals who endorsed having engaged in Academic NPS had lower Perseverance and Premeditation scores,  $t(327) = 3.95$  and  $t(340) = 3.43$ , respectively, both  $p < .05$ . Participants with a history of Academic NPS did not differ significantly from non-Academic NPS participants on any other study variable. Similarly, participants with a history of Social NPS were older than participants without,  $t(340) = -4.63, p < .05$ . These participants also reported greater Academic Stress  $t(340) = -2.10, p < .05$ . Participants with a history of Social NPS had higher scores on Urgency,  $t(340) = -3.51, p < .05$ , but lower scores on Perseverance and Premeditation,  $t(327) = 3.16$  and  $t(327) = 2.94$ , respectively, both  $p < .05$ . The semester (Spring or Fall) in which participants completed the study was not associated with likelihood of Academic NPS or Social NPS,  $\chi^2(1) = 2.56$  and  $\chi^2(1) = 2.38$ , respectively, both  $p > .05$ .

Table 1. Descriptive Statistics for Independent Variables.

Variable	Mean	Standard Deviation	Possible Range
Age	18.88	1.27	18+
GPA	3.34	0.66	0-4
Academic Stress	178.65	38.91	0-280
Parental Warmth	23.38	6.30	0-45
Parental Monitoring	52.80	10.00	14-140
Psychological Control	17.87	7.41	9-45
Urgency	25.80	7.25	12-48
Sensation Seeking	32.30	7.84	12-48



Table 2. Correlations. \*p < .05

	1	2	3	4	5	6	7	8	9	10	11	12
1. Academic NPS												
2. Social NPS	.39*											
3. Age	.29*	.24*										
4. Female	.03	.08	-.19*									
5. GPA	-.09	-.04	-.21*	.09								
6. Greek Organization	.04	.01	-.12*	.20*	.11*							
7. Academic Stress	-.04	.11*	.00	.10	-.08	.07						
8. White	.09	.07	.04	.11	-.00	.28*	.05					
9. Monitoring	-.07	-.12	-.10	.16*	.15*	.02	-.07	-.23*				
10. Urgency	.09	.19*	.07	.10	.00	.12*	.30*	.12*	-.18*			
11. Sensation Seeking	.21*	.08	.15*	-.13*	.00	-.00	-.07	.00	-.16*	.13*		
12. Warmth	-.02	.10	-.04	-.05	.01	.03	.29*	.00	-.35*	.08	-.04	
13. Psychological Control	.01	.07	.01	-.01	-.13*	-.03	.19*	-.10	-.03	.26*	.05	.18*

## Primary Analyses

### *Primary Analyses*

Hypotheses were tested using a hierarchical binomial logistic regression model. Two separate models were fit to the data. The first model predicted likelihood of engaging in Academic NPS and the second model predicted likelihood of engaging in Social NPS.

The first model estimated the likelihood of engaging in Academic NPS. In the first step, the dependent variable of Academic NPS use was predicted by the control variables age, sex, GPA, Greek organization membership, and race. Of these, only age was significantly associated with the likelihood of engaging in Academic NPS,  $B = .48, p < .05$ . In the second step of the model, the main effects of academic stress, impulsivity, and parental warmth, monitoring, and psychological control were entered into the model. This step and the full model were both significant,  $\chi^2(6) = 18.34$ , and  $\chi^2(11) = 42.24$ , respectively, both  $p < .05$ , Cox & Snell  $R^2 = .17$ . Contrary to hypotheses, parental warmth and monitoring were not associated with Academic NPS,  $B = .01$  and  $B = .00$ , respectively, both  $p > .05$ . Parental Achievement-oriented Psychological control was also not significantly associated with likelihood of engaging in Academic NPS,  $B = .04, p > .05$ . Similarly, the effect of Academic Stress on Academic NPS was not significantly different from zero,  $B = -.01, p > .05$ . Urgency was not a significant predictor of Academic NPS,  $B = .02, p > .05$ , however, Sensation Seeking was associated with Academic NPS,  $B = .09, p < .05$ . Coefficients for this model are presented in Table 3. Eight potential multivariate outliers were identified using a discrepancy criterion of Studentized residual greater than 2. A sensitivity analysis was conducted by removing these cases. After removing these potential outliers, membership in a Greek organization and academic stress became

Table 3. Logistic regression results for model predicting academic NPS. \*  $p < .05$

Variable	B Coefficient	Exp(B)
Age	.48*	1.61
Female	-.65	.52
GPA	-.53	.59
Greek Organization	-.63	.53
White	-.40	.67
Academic Stress	-.01	.99
Parental Monitoring	.00	1.00
Parental Warmth	.01	1.01
Parental Psychological Control	.04	1.04
Urgency	.02	1.09
Sensation Seeking	.09*	1.09

significantly associated with Academic NPS,  $B = -1.00$  and  $B = -.02$ , respectively, both  $p < .05$ . It should be noted that both of these findings are in the opposite direction as hypothesized. Further, age and Sensation Seeking remained significantly associated with Academic NPS,  $B = 0.63$  and  $B = .12$ , respectively, both  $p < .05$ .

The second model predicted the likelihood of engaging in Social NPS. In the first step, the dependent variable of Social NPS use was predicted by the control variables age, sex, GPA, Greek organization membership, and race. Of these, only age was significantly associated with the likelihood of engaging in Social NPS,  $B = .63$ ,  $p < .05$ . In the second step, main effects of impulsivity, parental warmth, and parental monitoring were entered. Contrary to hypotheses, parental warmth, monitoring, and psychological control did not significantly predict likelihood of engaging in social NPS,  $B = .02$ ,  $B = -.05$ , and  $B = .06$ , respectively, all  $p > .05$ . Similarly, Sensation Seeking was not associated with likelihood of engaging in Social NPS,  $B = .00$ ,  $p > .05$ . However, Urgency was positively associated with the likelihood of engaging in Social NPS,  $B = .10$ ,  $p < .05$ . In the third step interactions between impulsivity and parental warmth, as well as impulsivity and parental monitoring, were entered into the model. The full model was significant,  $X^2(15) = 31.14$ ,  $p < .05$ , Cox & Snell  $R^2 = .13$ . However, the step did not predict significant variance,  $X^2(4) = 2.76$ ,  $p > .05$ , suggesting that the model from step 2 should be preferred. Again, contrary to hypotheses, none of these interactions were significant, all  $B \leq -.004 \leq .005$ , all  $p > .05$ . Since none of the hypothesized interactions reached the  $p < .05$  significance criteria, no follow-up analyses were conducted to probe these interactions. Coefficients for this model are presented in Table 4. Nine cases were identified with a Studentized residual greater than 2. Again, a sensitivity analysis was conducted by removing these potential

Table 4. Results for model predicting Social NPS. \*  $p < .05$

Variable	B Coefficient	Exp(B)
Age	0.63*	1.88
Female	-1.73	0.18
GPA	-0.05	0.95
Greek Organization	-0.13	0.88
White	-0.89	0.41
Academic Stress	0.00	1.00
Parental Monitoring	-0.05	0.96
Parental Psychological Control	0.06	1.06
Parental Warmth	0.02	1.02
Urgency	0.10*	1.11
Sensation Seeking	0.00	1.00
UrgencyxWarmth	0.00	1.00
UrgencyxMonitoring	0.00	1.01
SensationSeekingxWarmth	-0.00	1.00
SensationSeekingxMonitoring	0.01	1.00

multivariate outliers and re-running the model. Following the removal of these cases, Age and Urgency were no longer significantly associated with Social NPS. No other coefficients changed in their significance.

#### *Post-Hoc Analyses*

Addition of gender as a moderator in hypothesized models. As previous research has demonstrated that women are more likely to engage in NPS for academic reasons (Smith, DeSantis, & Martel, 2017), it was decided to examine gender as a possible moderator of associations between GPA and Academic NPS as well as Academic Stress and NPS. These interaction terms were included as a third step in a hierarchical binomial logistic model, extending the model predicting Academic NPS from the primary analyses. The step did not significantly improve the model,  $X^2(2) = 1.10, p > .05$ . As such, coefficients should not be examined, following Fisher's Protected t-Test guidelines which prevent inflated Type I error rates. A potential three-way interaction between academic stress, gender, and GPA was also examined. Again, this fourth step did not explain significant variance over and above the prior step,  $X^2(1) = 0.79, p > .05$ , and the regression coefficient was not examined. However, the full model with all four steps did explain significant variance in academic NPS,  $X^2(14) = 44.05, p < .05$ , Cox & Snell  $R^2 = 0.18$ . The full model with all four steps is presented in table 5.

Gender was also examined as a potential moderator of associations between parenting variables and Social NPS as well as Impulsivity and Social NPS. These interactions were entered in place of the Impulsivity and Parenting interactions from the Social NPS model in the primary analyses. The step containing these interaction terms was not a significant improvement to the model without this step,  $X^2(5) = 4.47, p > .05$  and

Table 5. Gender as a moderator of associations. \*  $p < .05$

Variable	B Coefficient	Exp(B)
Age	0.48*	1.61
Female	0.70	2.02
GPA	-0.89	0.41
Greek Organization	0.64	1.90
White	0.42	1.52
Academic Stress	-0.00	1.00
Parental Monitoring	0.00	1.00
Parental Psychological Control	0.04	1.04
Parental Warmth	-0.00	1.00
Urgency	0.02	1.02
Sensation Seeking	0.09	1.09
Female x GPA	0.42	1.52
Female x Academic Stress	-0.01	0.99
Female x GPA x Academic Stress	-0.01	0.99
Sensation Seeking x Monitoring	0.01	1.00

therefore regression coefficients are not examined in order to prevent inflated Type I error rate. The full model with all steps did predict significant variance in Social NPS,  $\chi^2(16) = 32.85, p < .05$ , Cox & Snell  $R^2 = 0.14$ . The full model is presented in table 6.

Separate consideration of positive and negative urgency. Next, the Urgency variable used in the primary analyses was decomposed into Positive and Negative Urgency variables. While there is often overlap between these Urgency components, research suggests that Negative Urgency is particularly salient in regards to substance use (Smith & Cyders, 2016). Separate models were fit for each Urgency subscale to reduce multicollinearity concerns. As such, four total models were fit for these analyses. Coefficients for these models are presented in Table 7 through Table 10. The model predicting Academic use from Negative Urgency was significant,  $\chi^2(11) = 43.58, p < .05$ , Cox & Snell  $R^2 = .17$ . However, Negative Urgency was not associated with likelihood of engaging in NPS for Academic reasons,  $B = 0.02, p > .05$ . There was no significant moderation of the association between Negative Urgency and Academic NPS by participant gender,  $B = .09, p > .05$ . Similarly, the model predicting Academic NPS from Positive Urgency was significant,  $\chi^2(11) = 42.55, p < .05$ , Cox & Snell  $R^2 = .17$ . Again, Positive Urgency was not associated with Academic NPS,  $B = 0.05, p > .05$ . This association was not moderated by participant gender,  $B = .22, p > .05$ .

For the model predicting Social Use with Negative Urgency, the model was significant,  $\chi^2(11) = 25.53, p < .05$ , Cox & Snell  $R^2 = .11$ , but Negative Urgency was not significantly associated with Social NPS,  $B = 0.12, p > .05$ . No moderation of this association by participant gender was found in the current sample,  $B = -.24, p < .05$ . For the model predicting Social NPS using Positive Urgency, the model was significant,  $\chi^2(11)$



Table 6. Gender as a moderator of Impulsivity and Parental associations with Social NPS.

\* $p < .05$

Variable	B Coefficient	Exp(B)
Age	0.65*	1.92
Female	7.23	1385.96
GPA	0.34	1.40
Greek Organization	-0.0.	0.98
White	0.145	1.15
Academic Stress	0.00	1.00
Parental Monitoring	0.08	1.08
Parental Psychological Control	0.23	1.26
Parental Warmth	0.23	1.26
Urgency	0.08	1.08
Sensation Seeking	0.16	1.18
FemalexWarmth	-0.23	0.80
FemalexMonitoring	-0.13	0.88
FemalexGPAXUrgency	0.03	1.03
FemalexSensationSeeking	-0.15	0.86
FemalexPsychologicalControl	-0.18	0.83

Table 7. Negative Urgency predicting Academic NPS.  $*p < .05$

Variable	B Coefficient	Exp(B)
Age	0.49*	1.64
Female	0.71	2.03
GPA	-0.52	0.59
Greek Organization	0.69	1.99
White	0.41	1.50
Academic Stress	-0.01	0.99
Parental Monitoring	0.00	1.00
Parental Psychological Control	0.04	1.04
Parental Warmth	0.00	1.00
Negative Urgency	0.02	1.02
Sensation Seeking	0.09*	1.09

Table 8 Positive Urgency predicting Academic NPS. \* $p < .05$

Variable	B Coefficient	Exp(B)
Age	0.47*	1.60
Female	0.62	1.86
GPA	-0.56	0.57
Greek Organization	0.63	1.88
White	0.40	1.50
Academic Stress	-0.01	0.99
Parental Monitoring	0.00	1.00
Parental Psychological Control	0.04	1.04
Parental Warmth	0.00	1.00
Positive Urgency	0.05	1.05
Sensation Seeking	0.09*	1.09

Table 9 Negative Urgency predicting Social NPS. \* $p < .05$

Variable	B Coefficient	Exp(B)
Age	0.60*	1.82
Female	1.66	5.28
GPA	0.22	1.24
Greek Organization	0.07	1.08
White	0.57	1.76
Academic Stress	0.00	1.00
Parental Monitoring	-0.04	0.96
Parental Psychological Control	0.07	1.07
Parental Warmth	0.02	1.02
Negative Urgency	0.12	1.12
Sensation Seeking	0.02	1.02

Table 10. Positive Urgency predicting Social NPS. \* $p < .05$

Variable	B Coefficient	Exp(B)
Age	0.59*	1.80
Female	1.80	4.39
GPA	-0.04	0.96
Greek Organization	0.13	1.14
White	0.61	1.85
Academic Stress	0.00	1.00
Parental Monitoring	-0.04	0.97
Parental Psychological Control	0.08*	1.08
Parental Warmth	0.02	1.02
Positive Urgency	0.24*	1.27
Sensation Seeking	0.02	1.02

= 31.10,  $p < .05$ , Cox & Snell  $R^2 = .13$ . Contrary to the previous models, Positive Urgency was significantly and positively associated with the likelihood of engaging in Social NPS,  $B = 0.24$ ,  $p < .05$ . Again, potential moderation by participant gender was examined, but was not significant,  $B = .21$ ,  $p > .05$ .

Alternative measures of impulsivity. In order to examine the role of other impulsivity factors, the Planning and Premeditation subscales of the UPPS-P were entered in place of the Urgency and Sensation Seeking subscales from the models in the primary analyses. For the model predicting Social NPS, the full model was significant,  $\chi^2(11) = 32.18$ ,  $p < .05$ , Cox & Snell  $R^2 = .13$ . Perseverance was not significantly associated with likelihood of engaging in Social NPS,  $B = -0.09$ ,  $p > .05$ . However, premeditation was significantly and negatively associated with likelihood of engaging in Social NPS,  $B = -0.13$ ,  $p < .05$ . Therefore, individuals who prefer to form plans are less likely to engage in Social NPS in based on the current sample. Moderation of the association between Premeditation and Social NPS by participant gender was not significant,  $B = .03$ ,  $p > .05$ . Likewise, the association between Perseverance and Social NPS was not moderated by participant gender,  $B = -.00$ ,  $p > .05$ .

The model predicting Academic NPS was significant,  $\chi^2(11) = 54.97$ ,  $p < .05$ , Cox & Snell  $R^2 = .22$ . In contrast to the Social NPS model, Premeditation was not significantly associated with likelihood of engaging in Academic NPS,  $B = -0.08$ ,  $p > .05$ . However, Perseverance was a significant protective factor against Academic NPS in this sample,  $B = -0.15$ ,  $p < .05$ . No significant moderation of associations between Premeditation and Academic NPS or Perseverance and NPS by participant gender was detected,  $B = -.13$  and

$B = -.11$  respectively, both  $p > .05$ . Coefficients for these models are presented in Table 11 and Table 12.

Prediction of alcohol problems. Finally, the models from the primary analyses were used to predict problem drinking, via the Alcohol Use Disorder Identification Test (Babor, De La Fuente, Saunders, & Grant, 1989). This would allow for the identification of factors unique to NPS, rather than substance use in general. Coefficients for the full model are presented in Table 13. The full model predicted significant variance in AUDIT scores, adjusted  $R^2 = .18$ ,  $p < .05$ . However, the third step of the model was not significant,  $\Delta R^2 = .01$ ,  $p > .05$ . Therefore, only coefficients from the second step of the model should be interpreted. In this step, members of Greek organizations had higher AUDIT scores,  $B = 3.24$ ,  $p < .05$ . Urgency was also positively associated with AUDIT scores, as was Sensation Seeking,  $B = .12$  and  $B = .06$  respectively, both,  $p < .05$ . No parenting variable was associated with AUDIT scores in this sample. Next, Urgency was examined separately for Positive and Negative Urgency in separate models. Negative Urgency was not associated with AUDIT scores,  $B = .12$ ,  $p > .05$ . However, Positive Urgency was positively associated with AUDIT scores,  $B = .34$ ,  $p < .05$ . Next, Gender was examined as a potential moderator of associations between Impulsivity and Parenting variables and AUDIT scores. Participant gender did not moderate the associations between Urgency and Sensation Seeking and AUDIT scores,  $B = -.14$  and  $B = .07$  respectively, both,  $p > .05$ . Similarly, no moderation was detected for the associations between Parental Warmth and Parental Monitoring and AUDIT scores by participant gender,  $B = -.03$  and  $B = -.16$ , respectively, both  $p > .05$ .

Table 11. Alternative Impulsivity measures predicting Academic NPS. \* $p < .05$ .

Variable	B Coefficient	Exp(B)
Age	0.52*	1.68
Female	0.35	1.42
GPA	-0.20	0.82
Greek Organization	0.37	1.44
White	0.67	1.89
Academic Stress	-0.01	0.99
Parental Monitoring	0.02	1.02
Parental Psychological Control	0.04	1.04
Parental Warmth	-0.01	1.00
Premeditation	-0.08	0.92
Perseverance	-.15*	0.86



Table 12. Alternative Impulsivity measures predicting Social NPS. \* $p < .05$ .

Variable	B Coefficient	Exp(B)
Age	0.63*	1.87
Female	1.76	5.80
GPA	0.23	1.26
Greek Organization	-0.02	0.98
White	0.62	1.87
Academic Stress	0.01	1.01
Parental Monitoring	-0.02	0.98
Parental Psychological Control	0.09*	1.10
Parental Warmth	0.03	1.03
Premeditation	-0.13*	0.88
Perseverance	-0.09	0.91

Table 13. Study Variables predicting AUDIT scores. \* $p < .05$

Variable	B Coefficient	B Coefficient
Age	0.33	0.12
Female	0.56	0.04
GPA	-0.51	-0.50
Greek Organization	3.24*	0.29
White	1.41	0.12
Academic Stress	0.00	0.02
Parental Monitoring	0.04	0.07
Parental Psychological Control	-0.02	-0.03
Parental Warmth	0.06	0.08
Urgency	0.12*	0.16
Sensation Seeking	0.17*	0.26

## Discussion

The current study examined a number of factors hypothesized to predict students' engagement in non-medical use of prescription stimulants. To our knowledge, this is the first study to examine personality and family factors in the prediction of NPS. While the role of impulsivity was partially supported in both models, in general, hypotheses were not supported. The current study also failed to replicate a number of findings from previous studies regarding associations between demographic factors and NPS. Similarly, while the current study did replicate findings regarding associations between Impulsivity and alcohol use, findings regarding parental influences on college students' drinking behaviors did not replicate in the current sample.

The hypothesis that impulsivity would be associated with both Academic and Social NPS received partial support in the current study. Sensation Seeking was associated with an increased likelihood of engaging in Academic NPS and Urgency was associated with an increased likelihood of engaging in Social NPS (when outliers were included in the analyses). This may suggest different profiles of users, with stimulant use for social motives being driven by impulsive decisions made under the influence of strong affect while academic NPS users may be more strongly motivated by trying new things. Individuals who are high in Sensation Seeking may not find school work such as lectures, homework, and studying as rewarding as more exciting activities. Therefore, these individuals may be less diligent throughout the term, causing them to fall behind and use prescription stimulants to cram and catch up. This would be consistent with the general finding that NPS users are lower achieving than non-NPS users as well as the finding in the current sample that Academic Stress is either not associated with Academic NPS or is

negatively associated with Academic NPS (DeSantis et al., 2008; Ford and Ong, 2014). Further decomposing Urgency into Positive and Negative Urgency did not lead to significant associations between Urgency and Academic NPS. The lack of association between Negative Urgency and Academic NPS is inconsistent with the hypothesis that strong negative affect associated with Academic Stress would increase the risk of engaging in Academic NPS.

In contrast, Urgency was significantly associated with Social NPS in initial models. It is possible that Social NPS is particularly likely for individuals who engage in rash behavior when feeling strong emotions, which may be consistent with findings that weekly party behavior is associated with NPS (Teter et al., 2003). Caution should be used in interpreting this result however, as the association was no longer significant following the removal of multivariate outliers. Examining Positive and Negative Urgency separately suggested that Positive Urgency may underlie the association between impulsivity and Social NPS. Therefore, individuals who are predisposed to act rashly while under the influence of strong positive emotions may be particularly at-risk. This suggests that Social NPS occurs when people are celebrating or in a good mood, rather than as a coping mechanism for stress or depression. This is potentially consistent with the lack of significant associations between negative parenting variables, which can increase stress, and NPS in the current study, as well as the lack of association between Academic Stress and Social NPS in the current study.

In post-hoc analyses, lack of planning was significantly associated with likelihood of Social NPS and lack of perseverance was significantly associated with Academic NPS. This may suggest that individuals who are at-risk for Academic NPS are likely to find class

boring and to have a difficulty persisting on tasks which they find boring. Individuals at risk for Social NPS may be more likely to act rashly when under strong emotional influence, and may show deficits in planning ahead, possibly leading them to encounter more opportunities to engage in illicit behaviors. Given the post-hoc nature of these analyses, replication is required to be sure that these associations are not the result of Type I error. If these associations replicate, intervention efforts may need to be developed with these differing motivations in mind.

The hypothesis that parental warmth, monitoring, and achievement-oriented psychological control would predict both academic and social NPS was not supported. This is inconsistent with a large body of research examining a number of other substances and risky behaviors in adolescents and young adults (e.g., Brook, Whiteman, Nomura, Gordon, & Cohen, 1988; Chen, Strain, Crum, Storr, & Mojtabai, 2014; McCabe & Boyd, 2005). One possible explanation for this difference may be prescription stimulants' reputation as a "smart" drug (Talbot, 2009). Parents who may monitor and disapprove of substance use may be less concerned about NPS, as they may not believe it is as dangerous or unacceptable as other illicit substance use. This would also be consistent with the finding that friends and family are often aware of, approve of and provide the stimulants to students who engage in this behavior (Arria et al., 2013; Garnier-Dykstra et al., 2012; Teter et al., 2005). In this way, the rationalizations presented by the participants of DeSantis and Hanes (2010, p. 35) that "Adderall is definitely not a drug" and that it is ok to misuse these substances may be shared by the individual's parents. Future research should examine parents' attitudes towards these substances as predictors of young adult NPS, as well as examining parenting behaviors specific to NPS. It should be noted, however, that previous

research has combined parents and friends into one category when analyzing participants' sources for these stimulants. These groups should be examined separately to obtain a better idea of how much parents actually support and provide assistance with NPS, as this claim is significantly different than general parental attitudes towards other substances. Another possible explanation may involve the increased influence of peers at this age. Many participants were likely living away from home during this study. As such, parental monitoring may be less effective, particularly when peers appear to approve of NPS. This is consistent with the finding that membership in a Greek organization is a risk factor for NPS, although this finding was not replicated in the current study (DeSanits et al., 2008; McCabe et al., 2005). This is also consistent with findings that individuals who have more friends who engage in NPS and who view these substances as effective study aids are more likely to engage in Academic NPS (DeSantis, Anthony, & Cohen, 2013; Ford and Ong, 2014). Future research is needed which examines parental attitudes towards NPS as a potential moderator of the associations between parenting and NPS. Similarly, extending research questions to examine potential peer influences on NPS would open new areas which are potentially amenable to intervention.

Interestingly, following the removal of outliers, academic stress was negatively associated with the likelihood of engaging in Academic NPS. This was contrary to hypotheses and the current understanding of motivations for NPS (e.g., Kerley, Cope, & Griffin, 2015). Further, since this finding was only revealed following the removal of potential outliers, it is important to be cautious when interpreting it. However, it may reflect the lower academic orientation of those who engage in NPS. Specifically, individuals who engage in NPS are generally low achieving in school (DeSantis, Webb, & Noar, 2008;

McCabe et al., 2005; McCabe et al., 2006; Sharp & Rosen, 2007; Teter et al., 2006). Further, these individuals are likely to engage in more procrastination than non-NPS using individuals (Ford & Ong, 2014; McCabe, 2008; Moore Burgard, Larson, & Ferm, 2014). It should also be noted that, while use of these substances does peak during times which may be considered academically stressful, participants in qualitative studies rarely actually cite stress as a motivation. Instead, these participants focus on how NPS is justified because it helps them succeed academically. For example, a participant in the DeSantis et al. (2010) study argues that these substances are “OK as long as it is for studying” while another states “People that take it are trying to get their work done so they can get through college” (p. 35). In fact, no direct quote from participants in this study contain the word “stress” although one quote does describe finals as “... too crazy not to.” (p. 39). While the timing of use is suggestive of academic stress, it is potentially telling that the word is missing from student’s explanations in 2 qualitative studies (DeSantis et al., 2010; Kerley, Copes, & Griffin, 2015). These findings, combined with the fact that the academic stress measure used in the current study examined trait academic stress, suggests that individuals who engage in NPS may generally show low academic stress and low motivation to engage in studying, then choose to utilize prescription stimulants as a way to cram and compensate for procrastination earlier in the term. Similarly, participants completed the survey at multiple time points throughout the academic semester. If participants were utilizing an anchor and adjust heuristic (Tversky & Kahneman, 1974) to report their trait Academic Stress, then reports may have been biased by the time at which the individual completed the survey, with less stressful points in the term producing lower Academic Stress scores than more stressful times, such as midterms or finals. Anchor and adjust heuristics involve

individuals using current feelings and cognitions (the anchor) as baselines for forecasting future or hypothetical feelings and cognitions, moving from this anchor in the direction they expect the anticipated event to take them (adjusting). For example, a student who is currently struggling in class may report higher levels of anticipated stress regarding a final than they would if asked at a point in which they are excelling in the class. Longitudinal studies which repeatedly measure state academic stress and NPS would be beneficial for clarifying associations.

In post-hoc analyses, Sensation Seeking and Urgency were both positively associated with alcohol use. This is consistent with a number of previous studies, and suggests that NPS may follow similar patterns of associations as other substances. Future studies should include measures of alcohol use and illicit substance use to continue examining potential areas of overlap and divergence in associations. Interestingly, parenting was not associated with alcohol use, which is inconsistent with previous studies (e.g., Barnes, Reifman, Farrell, & Dintcheff, 2000). It is possible that the current sample failed to capture a sufficient range of parental behavior to detect associations between substance use and parenting.

While the current study breaks new ground in the understanding of NPS among college students, it is not without limitations. First, given the low incidence of NPS in the population, the sample of prescription stimulant users may not have been sufficiently large enough to accurately detect the hypothesized effects, particularly the interactions. Interactions typically have small effect sizes (Cohen, Cohen, West & Aiken, 2003). However, the percentage of individuals with a history of NPS in the current study was comparable to previous studies (e.g., Ford and Ong, 2014; Shillington, Reed, Lange, Clapp,



& Henry, 2006). Relatedly, while the sample was consistent with the psychology subject pool at the University of Kentucky, it is possible that sampling bias may have affected results. For instance, the sample was predominately female, who are generally less likely to engage in NPS than males (DeSantis et al., 2008). Similarly, the majority of participants were not members of a Greek Organization, and non-members are less likely to engage in NPS than members (Teter et al., 2003). Further, while the Introduction to Psychology course which comprises a majority of the University of Kentucky subject pool draws students from a number of different majors (the course fulfills a core requirement for University of Kentucky students of all majors), the other courses which comprise the subject pool are almost entirely psychology students. This may have biased the sample if psychology students show different patterns of associations between study variables and NPS.

Additionally, the current study only examined NPS as a dichotomous variable. While identifying factors associated with engaging in NPS is valuable knowledge, it is possible that the hypothesized factors may predict the amount or frequency with which individuals engage in NPS rather than if they engage in NPS at all. Future research should examine NPS as a continuous variable in order to evaluate this possibility. Third, the current study relied on self-report of lifetime NPS. While this is consistent with the majority of published studies on NPS (Arria & DuPont, 2010; Arria & Wish, 2005; Teter et al., 2005), it is possible that participants may have underreported their NPS in a manner which biased the results. Likewise, participants who have misused non-stimulant ADHD medications that they are prescribed (e.g., Strattera) may have reported this as NPS incorrectly, biasing results. Utilizing more objective measures, such as testing urine for

metabolites or collecting multi-informant measures of participants' NPS may address this issue.

Further, the current study was cross-sectional, which limits the ability to draw directional conclusions. This may have been further compounded by the use of lifetime incidence of NPS as a dependent variable. Specifically, it is possible that participants may have experienced different levels of Academic Stress, Parental Warmth and Monitoring, or Psychological Control during different points in their lives. This may have led to a group of participants reporting low Academic Stress and Parental Psychological Control, high Parental Warmth and Monitoring, and a history of NPS. This may have masked important, contemporaneous, associations between these variables and NPS. Longitudinal studies are needed to determine what factors predict onset and trajectories of NPS. Ideally, a study would follow an incoming cohort of undergraduates throughout their time on campus to identify which variables predict NPS use and frequency during their academic careers. Finally, the study assessed motivation for NPS by asking the situation in which the NPS use took place. This is, at best, a proxy for actual motivations underlying NPS. It is also possible that participants may have endorsed a setting which was coded for one motivation, but actually engaged in NPS for other reasons in that setting. For example, when participants endorsed that they engaged in NPS at home with friends, this was coded as social NPS. However, it is conceivable that some participants engaged in NPS in this setting for academic motives, perhaps as part of a study group, or simply studying at home while friends are around.

While the current study addressed important questions regarding college students' abuse of prescription stimulants, a number of avenues remain for future research. One area

that requires further study is the use of prescription stimulants as weight-loss aids. Previous research has emphasized academic and social motives, but there is strong evidence that weight-loss is a strong motivation for using these stimulants, particularly for women in sororities (DeSantis et al., 2008). As the current study identified potentially unique associations based on stimulant use motivation, future research should examine unique predictors of NPS for weight-loss reasons. As stated above, the cross-sectional nature of the current study may have masked some associations and complicates the interpretations of the significant findings in this sample. Future research utilizing longitudinal methods, particularly intensive longitudinal designs, will help elucidate these associations and strengthen claims of directionality. Intensive longitudinal designs utilize a large number of measurements over a short time span in order to capture more discrete patterns of behavior (e.g., Daily Diary studies). Similarly, the use of self-report for NPS may have led some participants to fail to report NPS due to social desirability biases. Future studies utilizing multi-informant or objective measures may help to alleviate this concern. Finally, while the study did specify that NPS included using stimulants in a manner not consistent with their medication -- a common form of NPS identified in previous studies -- participants did not report whether or not they had a prescription for the medication they used. Examining prescription status as a possible moderator of associations may reveal important differential associations which are amenable for intervention. This would be consistent with previous findings that conversations with physicians -- a potential intervention available only to individuals with an ADHD medication prescription -- is protective against distributing these stimulants (DeSantis, Anthony, & Cohen, 2013).

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