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Predictors of Prescription Stimulant Misuse in College Graduates

A thesis submitted in partial fulfillment for the Bachelor of Science Degree in Psychology

Megan D. McCarthy

Trinity College

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Abstract

A large body of research has shown that prescription stimulant misuse (PSM) is prevalent among college students, with rates ranging from 12-37% (McNiel et al., 2011; Judson and Langdon, 2009; Emanuel et al., 2013; White et al., 2006). Further, research has shown that attending a fulltime college significantly increases an individual's risk for PSM later in life (Schepis et al., 2018). While these prevalence rates have been reported, no studies have conducted an in-depth examination of predictors of continued PSM following college. Accordingly, using The Theory of Triadic Influence, we examined predictors of PSM from three domains (intrapersonal, sociocultural, and environmental) to explore factors associated with maturing out of PSM. We utilized Amazon's Mechanical Turk to survey 219 adults in the United States (55% male, mean age=32.5) with a college degree and a history of PSM in college. As predicted, participants who scored higher on sensation-seeking were more likely to engage in post-graduate PSM. Contrary to my hypotheses, depression and workplace stress did not predict continued PSM. Misuse of prescription stimulants by close friends and approval of PSM in one's social environment also were not predictors of PSM. Implications of these findings are discussed, in addition to exploratory analyses showing significant differences in how postgraduate users of stimulants obtain and use stimulants in college and differences in their substance use behavior following college.

Predictors of Prescription Stimulant Misuse in College Graduates

The mass manufacturing of prescription stimulant medications has increased drastically over the past several decades. Between 1990-2000 alone, amphetamine production increased twenty-fold (McNiel et al., 2012). With the increase in production of these medications has also come an increase in the number of individuals prescribed prescription stimulant medications. For example, in 2012, 2.6 million adults in the United States were prescribed ADHD medication, which was a 53% increase in the number of adults who were prescribed these medications in only a four-year period (Schwarz, 2015). Of concern, the mass production, marketing, and prescription of these medications has been accompanied by a rise in emergency room visits among adults ages 18-24 presenting with symptoms related to prescription stimulant misuse and overdose (Schwarz, 2015). These data suggest that the mass production of medicinal amphetamines, an influx of individuals being prescribed, and prescription stimulant misuse are interrelated phenomena.

One major factor that contributes to the increase in individuals being prescribed medicinal amphetamines is that both pharmaceutical companies and prescribers are now more likely to treat individuals who have “fallen through the cracks” in terms of their ADHD symptomatology. The use of prescription stimulants is no longer limited to youth and adolescents; indeed, ADHD persists into adulthood for approximately 29% of individuals. Further, adult ADHD has been found to be correlated with rates of early death due to suicide (Barbarese et al., 2013), which may compel prescribers to treat adults who present with symptoms consistent with an ADHD diagnosis in adulthood. With any rise in the legitimate use of a prescription medication comes a greater potential for people *without* a prescription to use, a phenomenon that has been referred to as “pharmaceutical leakage” (Lovell, 2006). Accordingly,

it is important to investigate the prevalence and correlates of prescription stimulant misuse in the emerging adult population, which were the major aims of the current study.

Background

Prescription stimulant misuse (PSM). There are a variety of terms used to describe the behavior of individuals using prescription stimulants in ways prescribers did not intend. Some researchers utilize the term Nonmedical Use of Prescription Stimulants (NMUPS) while others classify this behavior as Nonmedical Misuse (NMU) (Cassidy et al., 2015; Garnier-Dykstra et al., 2012; Munro et al., 2016; Perlmutter et al., 2017). For the purpose of the present study, we will be utilizing the term prescription stimulant misuse (PSM) to refer to the use of a prescription stimulant in a way a prescriber did not intend. This can include an individual using their own medication in a way a prescriber did not intend (i.e. snorting the medication or stock piling the medication to take a larger dose) or an individual using someone else's medication that the individual him- or herself was not prescribed. Importantly, both behaviors reflect the use of a prescription stimulant in a way a prescriber did not intend. Of note, this is the definition used by the most recent National Survey on Drug Use and Health.

Prevalence of PSM amongst college students. Most of the literature on prescription stimulant use and misuse has focused on college students. A robust finding is that college students are at higher risk for PSM than non-college attending adults (Benson et al., 2015, Garnier-Dykstra et al., 2012; Judson & Langdon, 2009; Munro et al., 2016; Underhill & Langdon, 2013). Researchers have found that by their fourth year of college, nearly 62% of students report having been offered a prescription stimulant at least once (Garnier-Dykstra et al., 2012). Rates of PSM similarly are high, ranging from 18-37% amongst college students (Garnier-Dykstra et al., 2012; Judson & Langdon, 2009; Munro et al., 2016; Prudhomme-White

et al., 2006; Underhill & Langdon, 2013). While this is a large range, in a random-effects meta-analysis conducted by Benson et al. (2015), the researchers found that the estimated average rate of PSM amongst college students falls somewhere around 17%.

Researchers also have examined factors that might account for why certain college populations have higher prevalence rates of PSM than others. While many of these predictors will be considered later in the paper, some general predictors of high prevalence rates of PSM at certain institutions include if the institution is: private; a competitive institution in terms of acceptance rates; Greek life affiliated; majority white; and in the Northeast (Emanuel et al., 2013; Garnier-Dykstra et al., 2012; McCabe et al., 2005).

Prevalence of PSM in graduate students. Although PSM among college graduates has not been explored as widely in the literature, research suggests that the behavior still persists for a substantial subset of individuals. For example, amongst medical students, rates of PSM have been found to range between 14-18% (Bucher et al., 2012; Emanuel et al., 2013). Amongst dental students, the prevalence of PSM was reported to be 12.4% (McNiel et al., 2011). When considering graduate students in general (without separating them by specific programs), prevalence of PSM was 17.5% (Verdi et al., 2016). Most graduate students (90%) report having initiated PSM during their undergraduate years (Emanuel et al., 2013; McNiel et al., 2011). Evidently, college is a time where students are at greatest risk for initiating PSM. Schepis, Teter, and McCabe (2018) found that even individuals who attended *some* college were at greater risk for PSM as opposed to individuals who had never attended college. Schepis et al. (2018) also found that past year rates of PSM were highest in individuals *who had graduated college* (8.5%) compared to full-time college students, whose prevalence rate was 7.3%, although these prevalence rates were not statistically different. Nonetheless, these data suggest that most

students are not maturing out of this behavior and more research is needed to understand what factors predict continued PSM after college.

The Theory of Triadic Influence (TTI)

The Theory of Triadic Influence is a comprehensive conceptual model that attempts to explain health-related behaviors (HRBs) as a culmination of a variety of factors in an individual's life. Although initially presented as a model to understand adolescent substance abuse, the theory has been generalized to understand a variety of HRBs, including PSM (Bavarian et al., 2014; Flay & Petraitis, 1993). The theory draws from expectancy-value theory (Feather, 1982), social cognitive theory (Bandura, 1986), as well as Ajzen's (1998) theory of planned behavior (Ajzen, 1988) (Bavarian et al., 2012).

Distinct from other models, the TTI encompasses attitudinal, social, and intrapersonal influences on HRBs, while also considering how these factors influence one another to ultimately motivate a behavior (Flay, Snyder, & Petraitis, 2009). Unlike other models that have only generally considered environmental, situational, and personal characteristics, the TTI not only looks at these domains, it also considers the proximity of a factor (i.e., ultimate, distal, and proximal) and its relation to an HRB. Such a comprehensive approach can help researchers better target a specific HRB in terms of intervention (Flay, Snyder, & Petraitis, 2009).

Previous models, such as Roger's (1983) protection motivation theory, proposed that an individual's health-related beliefs are a prominent predictor of HRBs. Conversely, models such as Hirschi's (1969) social control theory of deviance examine the effect social influence has on HRBs via an individual's relationships and interactions with those around them. Furthermore, many models fail to consider factors at different levels of causation and influence. For example, in research concerning substance use during the Vietnam war, Johnston (1991) argued that the

overarching social climate of the country at the time was a large factor in the exhibition of HRBs, yet the author did not consider more proximal predictors of substance use. While the aforementioned theories are valid in their analysis of HRBs, there has yet to be a theory that encompasses several domain of influence, across all levels of causation, on HRBs. The TTI acknowledges there is not one personal, sociocultural, or environmental predictor of a HRB, but rather HRBs are a culmination of all of these factors.

Three domains of the TTI. The TTI is divided into three streams/domains and three levels of causation that all are thought to influence the HRB. The three streams are: personal, sociocultural, and environmental influences on behavior. Specifically, the personal domain influences are an individual's self-control, social skills, and self-efficacy; the sociocultural domain influences are an individual's social bonding and social learning; and the environmental domain influences are an individual's knowledge, values, and attitudes (Flay, Snyder, & Petraitis, 2009).

Three levels of causation. The three levels of causation that influence HRBs are: ultimate, distal, and proximal factors. Ultimate predictors of a behavior are the furthest removed in that they are the most constant, least malleable, and have the smallest immediate influence on a behavior. Examples of ultimate predictors include biological predispositions and personality characteristics (Flay, Snyder, & Petraitis, 2009). Distal predictors of a behavior are a step closer to the HRB in comparison to ultimate factors. Some examples are an individual's self-esteem or interactions with social institutions (e.g., institution of education or employment) (Flay, Snyder, & Petraitis, 2009). Lastly, proximal predictors are closest to HRBs and, therefore, are thought to have the most immediate effect on HRBs. Proximal predictors are the most malleable and tend to change frequently in an individual's life (Flay, Snyder & Petraitis, 2009). Interventions to affect

HRBs have the most impact at the proximal level on account of the fact that these influences tend to be most proximal to the behavior and changeable (Flay, Snyder, & Petraitis, 2009).

Collectively, the numerous layers and components of the TTI model account for both direct and indirect effects on HRBs (Flay, Snyder, & Petraitis, 2009).

The TTI has been used to explain a variety of HRBs, including PSM. As described in the next section, researchers such as Bavarian and colleagues (2014) have been able to gain a more comprehensive understanding of PSM by testing a wide range of predictors from the personal, sociocultural, and environmental domains of influence. In the current study, we similarly examined PSM from each of these three domains and also included constructs from the prototype-willingness model, another theoretical model used to explain PSM, that mapped onto these three domains. Researchers such as Stock et al. (2013) have found that aspects of the prototype-willingness model such as college students' beliefs surrounding negative health effects and positive academic beliefs associated with PSM were correlated with a student's likelihood of engaging in PSM. Thus, in order to further examine the aforementioned concepts as they map onto the TTI, we included them in our study.

Personal stream of the TTI. To explain PSM, the personal stream of the TTI considers several influences on the behavior, discussed below.

Sensation seeking. Sensation seeking is a personality trait characterized by a desire to experience new and intense emotions and is associated with a variety of risk-taking behaviors. Individuals who score higher on sensation seeking typically take more physical, social, legal, and financial risks to chase excitement and novelty (Grinblatt & Keloharju, 2009). Since sensation seeking is a genetically-based personality characteristic that is relatively stable throughout an individual's lifetime, it is considered an *ultimate* personal predictor of a HRB in the TTI. Due to

the fact that sensation seeking is described as an attempt to experience novelty, it is not surprising that this personality trait would be associated with substance use. All forms of substance use allow an individual to strive for a novel experience that is beyond what they can achieve without the substance. Especially when concerning PSM, individuals who identify as sensation seekers might not only be striving for the high associated with the medication, but also the adrenaline rush that might accompany breaking the law and taking a risk. Therefore, several studies have examined sensation seeking and its relation to PSM. For example, college students who reported PSM scored higher on sensation seeking than non-users (Jardin et al., 2011). Similarly, medical students who engaged in PSM scored higher on sensation seeking in relation to average levels of sensation seeking (Bucher et al., 2012). Lastly, in a National Survey on Drug Use and Health (NSDUH) study examining the correlation of PSM with certain demographical, behavioral, and psychosocial characteristics amongst young adults (ages 18-25) in the United States, Herman-Stahl et al. (2007) found that sensation seeking was associated with increased risk of PSM amongst the general United States population. Therefore, sensation seeking appears to be a robust predictor of PSM across age groups.

ADHD symptoms. Symptoms of attention-deficit hyperactivity disorder (ADHD) typically include difficulty completing tasks, remembering appointments or deadlines, keeping still or refraining from fidgeting, unwinding or relaxing, etc. (Barbarese et al., 2013). Since ADHD is a neurological disorder that typically presents in childhood, it also is considered an *ultimate* personal predictor of a HRB in the TTI. ADHD symptoms have been examined as predictors of PSM, especially amongst college students, as students often report feeling the need to “self-medicate” ADHD symptoms they are experiencing. Students may believe they are ameliorating actual ADHD symptoms by engaging in PSM, or that if they react positively to the

medication, they must have undiagnosed ADHD (DeSantis & Hane, 2010). There has been research to support both of these theories of “self-medication.” For example, Judson and Langdon (2009) found that college students who reported PSM felt they had difficulty controlling their behavior without the help of a psychostimulant. That is, the students who reported PSM were more likely to self-diagnose ADHD and feel that if the medication helped them to control their behavior. In a similar vein, authors such as Benson et al. (2015) found that PSM was related to experiencing ADHD symptoms. Essentially, students who reported PSM also were more likely to report a higher prevalence of symptoms associated with ADHD. Taken together, this research validates the contention that students feel they are improving actual attention deficit disorder symptoms through their PSM on account of the positive correlation between ADHD symptoms and PSM.

Depression, anxiety, and stress. Depression, anxiety, and stress all are negative mood states. Since these symptoms can fluctuate over time, yet are more constant in certain individuals than others, they are considered *distal* personal predictors of a HRB. Relations between depression, anxiety, and stress and PSM have been explored as there are compelling reasons to examine these factors. On the one hand, these types of negative affect might promote PSM. Arguably, if an individual is struggling with depression, anxiety, and/or stress they might be more likely to engage in PSM in order to help them focus on certain tasks that are difficult as a result of their depression, anxiety, and/or stress. On the other hand, these types of negative affect might result from PSM. Meaning, PSM might contribute to life stress and turmoil that can consequently feed into symptoms of depression, anxiety, and/or stress. Thus, it is crucial to further examine how these factors might relate to PSM.

In terms of depression, Benson et al. (2015) found that individuals who reported PSM

were significantly more likely to feel depressed when compared to individuals who did not report PSM. When considering anxiety, a variety of studies observed a relation between higher levels of anxiety and PSM (Bucher et al., 2012; Verdi et al., 2016; Weyandt et al., 2014). In terms of the relationship between stress and PSM, Verdi et al. (2016) found that graduate students who reported PSM also reported higher levels of stress. Herman-Stahl et al. (2017) found that amongst young adults in the United States, individuals who had higher levels of psychological distress (or cognitive, behavioral, emotional, and psycho-physiological symptoms associated with a variety of mental disorders measured by the K6 Scale of Non-Specific Psychological Distress) were more likely to report PSM. Furthermore, Huang et al. (2006) found a positive relation between PSM and panic/anxiety disorders as well as a positive correlation between dysthymia and PSM. Therefore, there is an apparent relation between disturbances in mood such as depression, anxiety, and stress and rates of PSM. However, it is important to note that the direction of the relation between mood disturbances and PSM cannot be confidently determined as it is unclear whether PSM leads to disturbances in mood or whether individuals experiencing psychological distress are more likely to engage in PSM to cope with negative emotions (Benson et al., 2015).

Substance use. Substance use includes any behavior in which an individual ingests an illicit substance or ingests a licit substance in a way that is not intended. Therefore, PSM is an example of substance use. Other forms of substance use, such as alcohol, marijuana, and cocaine use, have been found to be strong predictors of whether an individual engages in PSM (Garnier-Dykstra et al., 2012; Herman-Stahl et al., 2007; Jardin et al., 2011; Novak et al., 2007).

Researchers such as Herman-Stahl et al. (2007) have proposed that substance use is very closely correlated with PSM, as once an individual begins engaging in illicit drug use, the behavior tends

to expand into other forms. Also, sensation seeking has been found to be largely predictive of both substance use and PSM, therefore indicating it is most likely a causal factor associated with both of these behaviors (Herman-Stahl et al., 2007; Jardin et al., 2011). Since substance use varies over time, especially by developmental stage, it is considered a *proximal* personal predictor of PSM in consideration of the TTI. Other substance use is among the most consistent predictors of PSM. In terms of alcohol, college students that exhibited an alcohol use disorder were much more likely to report PSM (Garnier-Dykstra et al., 2012). Also, in a national survey examining PSM amongst adults aged 18 to 48 in the United States, 69% of individuals who reported PSM also reported binge drinking in the past month (Novak et al., 2007).

PSM rates are also more prevalent amongst individuals who report frequent marijuana use. For example, college students who reported PSM were significantly more likely to either have a cannabis use disorder or report marijuana use over the past year (Arria et al., 2008; Garnier-Dykstra et al., 2012; Jardin et al., 2011). In the same national survey mentioned above, conducted by Novak et al. (2007) amongst adults aged 18 to 48, the researchers found 54% of individuals who reported PSM also disclosed marijuana use in the past month. The use of several “harder” substances such as barbiturates, ecstasy, tranquilizers, and opioids also have been found to positively correlate with PSM among undergraduate and medical students (Emanuel et al., 2013; Jardin et al., 2011). Thus, there is a significant and crucial relationship between general substance use and the prevalence of PSM across populations.

Prescription stimulant expectancies and beliefs about efficacy. An individual’s beliefs surrounding the efficacy of prescription stimulants refers to their perception that the medication is effective and will help them achieve a goal or state they wish to complete or experience. Beliefs surrounding efficacy are very malleable and influential on the behavior of PSM, therefore

they are a *proximal* personal predictor of PSM. Studies have found that if an individual believes prescription stimulants are effective and will improve their performance in reference to academics, they are more likely to report PSM as compared to individuals who do not believe that prescription stimulants improve performance (Eslami et al., 2014). Therefore, it can be argued that an individual's perception of the effectiveness of prescription stimulants will influence their PSM. Researchers such as Stock et al. (2013) have utilized the Prototype Willingness Model to demonstrate that college students' beliefs surrounding academic improvement as associated with PSM is correlated with a higher willingness to misuse the medication. Meaning, if students had stronger beliefs that PSM would improve their academic abilities, they were more likely to exhibit higher willingness to use in hypothetical scenarios (Stock et al., 2013). Although this study did not link academic beliefs associated with PSM to their actual behaviors, this theory suggests that even if students are not currently engaging in PSM, their beliefs surrounding the academic benefits of the medication could influence their future likelihood to engage in the behavior.

Similar to beliefs surrounding the efficacy of prescription stimulants, an individual's general expectancies in regard to prescription stimulant use are also very influential on the behavior of PSM. Bavarian and colleagues (2013) found that college students who had positive expectancies surrounding the effectiveness of prescription stimulants to increase their academic performance reported significantly higher rates of PSM and not surprisingly, students that endorsed negative expectancies surrounding the effectiveness and side effects associated with the use of prescription stimulants reported significantly lower rates of PSM. Furthermore, research showed that individuals who reported PSM had fewer negative expectancies associated with stimulant use when compared to individuals who do not report PSM (Looby & Earleywine,

2009; Looby et al., 2013). Therefore, it would appear that individuals at highest risk for PSM are those with fewer negative expectancies and stronger beliefs that stimulants are effective, even when used without a prescription.

Beliefs about the safety of prescription stimulants. Similar to the beliefs and expectancies about the efficacy of prescription stimulants, an individual's beliefs surrounding the safety of prescription stimulants has been associated with their likelihood of engaging in PSM. Analogous to expectancies, beliefs about safety also are a *proximal* personal predictor of PSM. A large amount of literature has determined that students who report PSM view the behavior to be safer than students who do not endorse PSM (Judson & Langdon, 2009; Verdi et al., 2016). The aforementioned finding has been consistent within undergraduate and graduate populations and thus informed our predictions in the current study. More specifically, researchers have found that 79% of college students who report PSM are "not at all concerned" with this behavior adversely affecting their health (Prudhomme-White et al., 2006). Students often rationalize PSM as safe by comparing it to drinking coffee, consuming energy drinks, or taking caffeine pills. Some students also have contended that the behavior must be safe because the medication "comes from a medical establishment" and that this class of drugs is safer than other party drugs they could be using (DeSantis & Hane, 2010, p. 36). Of note, when students did acknowledge the risks associated with PSM, they viewed these risks as most likely only with prolonged use. That is, risks such as sleep disturbances, dependence, and mental health issues only were raised when discussing long term PSM rather than concerns they were experiencing presently (Partridge et al., 2013). Conversely, it is not surprising that when students attribute more risk to PSM they are ten times *less* likely to report misuse (Benson et al., 2015).

Researchers such as Stock et al. (2013) have utilized the Prototype Willingness Model to

examine how conscious cognitive processes might influence an individual's willingness to take part in a behavior given a certain scenario. Stock et al. (2013) were curious to determine how certain beliefs surrounding PSM, such as the safety of the medication, would influence an individual's willingness or likelihood to engage in the behavior. Indeed, the researchers found that college students who associated more vulnerability with PSM had lower levels of willingness to use. Although this study did not examine actual behavior and rather beliefs in reference to hypothetical scenarios concerning willingness, the takeaways are still important in that they exemplify the power preconceived beliefs regarding PSM have on future scenarios (Stock et al., 2013).

The aforementioned findings suggest that many students engaging in PSM discount the risks associated with misusing the medication. That being said, these findings can potentially inform the development of PSM preventive interventions. As the beliefs surrounding the safety of prescription stimulants is a proximal predictor of PSM, it is a potentially fruitful place to target intervention efforts to decrease the percentage of students who view PSM as a low-risk behavior, meaning students that do not associate PSM with high-risk consequences. Furthermore, research has yet to examine whether beliefs surrounding safety of prescription stimulants manifest differently in undergraduates versus college graduates, therefore this gap in the literature is important to explore.

Motives for use of prescription stimulants. A large amount of literature has been dedicated to investigating *why* students engage in PSM. Since motives are highly variable and easily influenced they are considered *proximal* personal predictors of PSM. Researchers have determined that most college students report studying as their motivation for use (Garnier-Dykstra et al., 2012). Motives such as wakefulness, increased concentration, productivity,

performance enhancement, and grade improvement also have been reported as motivations and typically fall under the larger umbrella motive of studying (Cassidy et al., 2015; McNiel et al., 2011; Novak et al., 2007; Prudhomme-White et al., 2006; Tuttle et al., 2010). Some motivations that were reported less frequently were for recreational purposes and to counteract the effects of other drugs (Prudhomme-White et al., 2006; Tuttle et al., 2010). Although recreational motives are cited less frequently as a driving factor for use, and students do not appear to report PSM solely for recreational purposes, it is still important to note that these medications are being utilized in nonacademic settings (Benson et al., 2015). Although less frequently reported, Benson et al. (2015) explained that some students endorse PSM in order to get high, lose weight, or prolong the high or effects of other substances. Motives for use do not seem to vary greatly across populations with college and graduate students reporting similar, if not identical factors for why they use. However, it is important to note that the percentage of students who are willing to pay for stimulant medication increases over the four years of college. This trend shows that the willingness and motivation to get the medication increases with time and use (Garnier-Dykstra et al., 2012).

Several unanswered questions remain, however. First, it is unknown whether the motives for PSM change once students have graduated from college. Perhaps students who pursue graduate studies continue to endorse the motive of academic enhancement just as they did in college. But, what factors might motivate someone to use if they are completing general work for an employer? Relatedly, do students' motives for PSM in college distinguish who will continue use after college? Perhaps there is one or more motives for PSM that signals more problematic use, and/or portends continued use after college.

Behavioral intentions for PSM. Behavioral intent, or an individual's perceived intention

to carry out a certain action, is another robust predictor of PSM. Given that this construct immediately precedes someone's decision to use and it has the potential to be influenced, it is considered a *proximal* personal predictor of PSM. Interestingly, most college students report that they do not intend to continue using PSM later in life (Emanuel et al., 2013; Underhill & Langdon, 2009). A majority of college students felt they could moderate their PSM, therefore they were not concerned with the behavior continuing in future years (DeSantis & Hane, 2010). However, this is not necessarily what occurs. Although undergraduates reported lower rates of PSM after college, they predicted that their use would be much less than what it actually was among alumni (Underhill & Langdon, 2009). That is, when alumni were asked about their current PSM and how it compares to what they expected for post graduate life, most alumni report significantly greater post graduate use than they expected while they were still undergraduates (Underhill & Langdon, 2009). Of note, 68% of medical students felt they would not be reporting PSM in 5 years (Emanuel et al., 2013). Therefore, graduate students as well college students have a potentially unrealistic belief of how long their PSM will continue. Evidently, although most students in college and graduate school settings feel as if they have their use under control and will soon stop, this behavior is manifesting for longer period of times than expected.

The sociocultural stream of the TTI. The sociocultural stream considers an individual's relationships with others and the influence of these relationships on social learning. Although social characteristics would appear to have a large influence on an individual's PSM, there is not much research on how these factors influence the HRB (Perlmutter et al., 2017). Therefore, we will consider two influences, subjective and injunctive norms, which have been shown to be sociocultural influences on PSM.

Subjective norms for PSM. Subjective norms refer to how we perceive other people's behaviors. That is, to what extent do we characterize certain behaviors as normal or abnormal based off how much or how often people in our social network engage in these behaviors (Eslami et al., 2014; Judson & Langdon, 2009). Applied to PSM, we consider how much people believe others in their social network engage in PSM and, consequently, how this belief influences their willingness to engage in PSM. Researchers have argued that subjective norms are most likely related to PSM in that they help individuals engaging in the behavior rationalize their actions by deeming them as socially acceptable (Judson & Langdon, 2009), such that an individual is more likely to engage in PSM if they do not perceive the behavior as a risk to their social relationships. Since an individual's perception of their social network's behaviors is subject to change depending on new information such as a change in their social network, this norm is considered a *proximal* sociocultural predictor of PSM. Also, norms are highly influential and close to any given behavior, making this factor proximal to PSM. Eslami et al. (2014) found that if a person's friends endorsed PSM, s/he was much more likely to use. The authors also found that subjective norms associated with PSM accounted for about 25% of the variation in intent and willingness to engage PSM. Therefore, there is a clear association between an individual's perception of how much their peers, friends, coworkers, etc. are reporting PSM and if the individual will report PSM themselves.

Injunctive norms for PSM. Injunctive norms are similar to subjective norms in that they are determined by our social networks; however, injunctive norms refer to the extent to which an individual believes his/her behaviors will either be approved of, or considered socially acceptable by the people in his/her social network. With respect to PSM, it is useful to examine how the approval or disapproval of PSM by one's social network might increase or decrease

one's PSM, given the potential for intervention in this area. Just as subjective norms are proximal sociocultural predictors of PSM due to their proximity and malleability, injunctive norms also are *proximal* sociocultural factors. Not surprisingly, students who engage in PSM view their use as more socially acceptable and therefore likely are less concerned with others in their social network shaming them for engaging in this behavior (Judson & Langdon, 2009). Students also report that they do not perceive any negative social consequences associated with PSM. For example, many students contend that there is no apparent control of prescription stimulants by police or other authority figures, so the behavior must not be that dangerous or negative in the eyes of society (DeSantis & Hane, 2010). Evidently, individuals who consider PSM to be a socially acceptable behavior are more likely to report use. Further research is needed, however, to determine whether injunctive norms continue to be positively associated with PSM after college. It is possible that, after college, approval from friends in particular becomes a less salient predictor of PSM.

The environmental stream of the TTI. The environmental stream of the TTI is concerned with environmental influence on knowledge, values, and attitudes. In the current study, we considered two influences from the environmental stream of the TTI and their associations with PSM: workplace/academic climate and medication availability.

Workplace and/or academic climate. The climate of an individual's workplace and/or academic environment, such as whether it is supportive, competitive, hostile, fast-paced, slow-paced, can have a pronounced influence on behavior. But, because this influence is not fixed, yet also not highly malleable, it is considered a *distal* environmental predictor of a HRB. When considering a stressful academic environment, it has been found that graduate students in an accelerated, and therefore more demanding, pharmacy program reported higher stress levels than

graduate students in a regular paced, and therefore less demanding, pharmacy program. Also, the students in the advanced program with higher stress levels reported higher rates of PSM (Frick et al., 2011). In a literature review of 21 studies concerning PSM, Robitaille and Collin (2016) found that prescription stimulants are used as a means of trying to cope with, and control external stressors associated with academics and other demands. While this finding was largely evident within college student populations, their literature review showed that these external stressors were associated with PSM in adulthood as well (Robitaille & Collin, 2016). Also, individuals have reported that PSM allows them a lifestyle in which they can partake in social activities while still maintaining a rigorous work ethic that is expected of them (Robitaille & Collin, 2016). Therefore, stressful and demanding work/academic environments likely contribute to an individual's likelihood of engaging in PSM.

Related behaviors on the TTI. Behaviors that are not directly within one stream of the TTI, but likely still influence PSM are considered “related behaviors”. Two related behaviors that may be especially salient in understanding PSM following college are medication side effects and medication source(s), described below.

Side effects of prescription stimulant use. The most common side effects of prescription stimulant use include weight loss, dry mouth, insomnia, nausea, headache, dizziness, feeling jittery, and anxiety (Weyandt et al., 2014). Adverse effects associated with PSM include decreased appetite, insomnia, irritability, stomachaches, experiencing social difficulties, and sadness (Benson et al., 2015). More severe consequences of PSM include cardiac infarction, cardiomyopathy, psychosis, and sudden death (White et al., 2006). Although the relationship between an individual's experience of certain side effects and their rates of PSM has not been studied extensively, research has been conducted concerning the side effects experienced by

prescribed users versus non-prescribed users (individuals engaging in PSM). Smith et al. (2017) discovered that amongst undergraduates, individuals engaging in PSM were less likely to report side effects when compared to undergraduates who were prescribed/properly using the medication. The authors found that the side effects most commonly associated with PSM were; loss of appetite, insomnia, and rapid heart rate. They also discovered that females engaging in PSM were more likely to report adverse effects such as nausea, insomnia, paranoia, dizziness, headaches, and nervousness whereas males were more likely to report loss of sex drive and sweating as adverse consequences of their PSM (Smith et al., 2017).

In light of the aforementioned findings, it is interesting to consider how the adverse side effects of PSM might influence an individual's desire to continue engaging in the behavior. For example, if an individual experiences largely negative side effects (loss of appetite, insomnia, and rapid heart rate) from PSM, these experiences could potentially reduce the likelihood they will continue to engage in the behavior. Conversely, if an individual does not report adverse side effects as a result of their PSM, they might be more inclined to continue using as they have not experienced the positive punishment associated with PSM. Since side effects result from PSM, and could either reinforce or deter the behavior, they are considered *related behaviors* in regards to PSM in the TTI.

Source of medication. Research suggests that the availability of stimulant medication also might influence the likelihood of engaging in PSM. A wide array of research has found that both undergraduates and post graduates report getting the medication from a friend, relative, peer, etc. (Cassidy et al., 2015; Emanuel et al., 2013; Ford & Lacerenza, 2011; Tuttle et al., 2010). Individuals also report obtaining prescription drugs from a doctor or buying the drugs from friends or family members; however, these sources are less frequently reported (Ford &

Lacerenza, 2011). Not surprisingly, individuals that have a consistent, inexpensive, and reliable source amongst a peer are more likely to report higher rates of PSM (Ford & Lacerenza, 2011). Evidently, most individuals are receiving these medications for free from people in their immediate environment, thus creating more opportunities for PSM. However, an unexplored question is whether the sources of prescription stimulants change as students transition out of college, possibly having less contact with peers who have stimulant prescriptions. Since an individual's source of medication could promote or diminish the prevalence of the behavior, source of medication is considered a *related behavior* of PSM in regards to the TTI.

Rationale of The Current Study

Though various predictors of PSM have been established in college students, such as being white, male, part of a Greek organization, higher on sensation seeking, previously attending private school, and other episodes of substance use, limited research has examined factors that predict continued PSM after college (Emanuel et al., 2013; Garnier-Dykstra et al., 2012; McCabe et al., 2005; McCabe et al. 2018). Within the last decade, PSM has increased amongst college students. Therefore, it is crucial that researchers examine trajectories of PSM after college students graduate and take on new responsibilities associated with graduate school, employment, and adulthood (Schwarz, 2015). Emerging adults in the work force may feel pressure to compete and to improve performance and productivity; accordingly, researchers should examine both predictors for continuing PSM into post graduate life and predictors of “maturing out” of PSM (Perlmutter et al., 2017).

The concept of “maturing out” has been studied by other researchers in reference to substances such as alcohol. “Maturing out” refers to the idea that at a certain age, individuals outgrow a behavior they once frequented. For example, when considering college students’

alcohol use, researchers have found that the increased possibility of substance-related consequences involved with fraternity engagement is not limited to college. Essentially, students involved in fraternities and sororities in college often do not outgrow their binge drinking habits and are actually more likely to have higher levels of long-term alcohol use disorder symptoms later in life (McCabe et al., 2018). This association also was found for marijuana use, with fraternity and sorority members reporting higher levels of marijuana use later in life in comparison to non-fraternity/sorority members (McCabe et al., 2018). Since researchers have found that there are specific populations that do not necessarily “mature out” of the harmful behaviors associated with college life, it is essential to examine other behaviors that may fit this profile, so as to inform interventions for emerging adults transitioning out of college. PSM is one such behavior.

While a variety of substances, such as alcohol and cannabis, have been considered in terms of college versus post graduate use, PSM has not been widely researched, even though this behavior remains prevalent among college graduates. Schepis, Teter, and McCabe (2018) reported that college graduates had the highest rates of PSM in comparison to full-time college students, part-time college students, high school graduates, and individuals with no high school experience. Other researchers such as Herman-Stahl et al. (2007) have reported similar findings in that rates of PSM were highest amongst current college students and college graduates as compared to participants who had never attended college. Interestingly, Schepis et al. (2018) noted that college graduates reported the lowest rates of opioid drug misuse compared to full time college students, part-time college students, high school graduates, and individuals with no high school experience. These data contradict the narrative that prescription opioids are the most misused prescription drugs in emerging adults. While the misuse of these drugs can have

devastating effects, a focus on prescription stimulant misuse clearly is warranted when considering the health and well-being of college graduates.

As aforementioned, there has been little to no research on predictors that might account for the continuation of PSM in college graduates. Furthermore, the research that has been conducted largely has been based on national surveys that simply report prevalence rates, rather than specific predictors of PSM in this population. Also, analyses of large national surveys have not yet focused on an especially vulnerable population, namely college graduates with a history of PSM. Since national surveys are purposely representative of the United States, they often include individuals from non-college educated backgrounds; as a result, prevalence rates of PSM often are lower but underestimate the scope of the problem among college graduates. For example, PSM is around 7-9% based on the data of national surveys (Cassidy et al., 2015; Herman-Stahl et al., 2007; Novak et al., 2007), much lower than the rates of PSM in college students of 12-37% (Benson et al., 2015; Garnier-Dykstra et al., 2012; Judson & Langdon, 2009; Munro et al., 2016; Prudhomme-White et al., 2006). While it is important to obtain demographically representative sample for a host of research questions, it is imperative to focus on individuals from college educated backgrounds in order to get the most nuanced understanding of PSM and what predicts its persistence.

Research Questions and Hypotheses

In this study, we are attempting to understand what predictors might account for the continuation and discontinuation of PSM in college graduate populations. More specifically, which individuals are able to cease misusing prescription stimulants upon leaving the college environment and which continue to use? Is environment the deciding factor; that is, does an individual's assessment of the stress in their job or academic setting after college determine if

they will continue to report PSM? Or are sociocultural factors, such as the behavior in an individual's social network, more closely associated with PSM? Perhaps individual characteristics, such as depression, anxiety, or stress are most influential? It seems most probable that environmental, sociocultural, and personal characteristics interact to determine an individual's likelihood to either continue or cease their PSM after college. In order to explore the aforementioned questions, we utilized the TTI to examine what predictors might account for the continuation or cessation of PSM after college. I formulated four hypotheses, three of which correspond to one of the three streams of the model and one of which corresponds to the related behaviors domain.

H1: First, in the personal domain, I hypothesized that individuals higher in sensation seeking will be more likely to report PSM after college compared to individuals who are lower on sensation seeking. Sensation seeking is consistently considered a predictor of various forms of substance use, including PSM (Bucher et al., 2012; Herman-Stahl et al., 2007; Jardin et al., 2011).

H2: Second, in the sociocultural domain, I hypothesized that individuals who believe PSM is a more acceptable behavior, either because their peers/coworkers are using or because their peers/coworkers condone the behavior, will be more likely to report PSM after college. As aforementioned, subjective and injunctive norms are highly influential when considering an individual's HRBs, specifically their likelihood to report PSM (DeSantis & Hane, 2010; Eslami et al. 2014; Judson & Langdon, 2009).

H3: Third, in the environmental domain, I hypothesize that if an individual has higher stress in their work/academic environment in combination with more depressive symptoms, they will be more likely to report PSM after college. Since research has shown that demanding work

and academic environments lead to higher rates of stress and PSM in individuals, it is reasonable to expect that this trend will continue in college graduates (Frick et al., 2011). In addition, I explored how depressive symptoms might interact with this influence, such that people with a vulnerability to depression, anxiety, and stress may have fewer coping skills in the face of workplace/academic stress and may be more likely to turn to prescription stimulants to enhance productivity and/or for mood enhancement. Since it has also been found that rates of PSM are highly correlated with feelings of depression, I predict that demanding work/academic environments in combination with depressive symptoms will result in higher rates of PSM (Benson et al., 2015; Huang et al., 2006).

H4: Lastly, in the related behaviors domain, I hypothesize that individuals will be more likely to report the source of medication that involves buying a prescription stimulant from a stranger/dealer after college as compared to during college. Researchers such as Ford and Lacerenza (2011) found that individuals who endorsed more frequent prescription stimulant misuse were also more likely to report sources of buying from a friend or dealer. Based on the research conducted by Ford and Lacerenza (2011), it appears that students that report PSM due to the accessibility of being given the medication by a friend/family member do not endorse as high frequency of the behavior. Therefore, I predict that when individuals graduate college and are no longer in an environment that potentially has more access to prescription stimulant medication, those that continue to engage in PSM will be more likely to endorse sources of medication that involve purchasing the drug, particularly from a dealer or stranger.

I also formulated three research questions that I addressed through exploratory analyses.

RQ1: How do the current substance use behaviors differ between participants that report post-graduate PSM and those that do not? It has been found that substance use generally is

related to PSM but does this relation look different between post-graduate users and post-graduate nonusers?

RQ2: How might the motives for PSM in college differ amongst those who continue to use after college and those who cease to continue the behavior? Do those who continue to use after college have more motives for their behavior? Are post-graduate users more likely to report non-academically driven motives even in college?

RQ3: Do negative side effects experienced in college potentially deter an individual from continuing to use? Does an accumulation of side effects (experiencing several) deter an individual from continuing to use? Are there specific side effects experienced in college that are associated with ceasing to report PSM later in life?

Method

Participants

A total of 219 college graduates completed the online survey: 56 (26%) graduated from a private (not religiously affiliated) college/university, 141 (64%) from a public college/university, 20 (9%) from a private (religiously affiliated) college/university, and 2 (1%) were unsure which type of college/university they had attended. The average participant age was 32.5 years ($SD=7.12$) with 121 (55%) identifying as male and 97 (44%) as female. A majority of participants were single (59%); 76 participants (35%) reported being married and 13 (6%) were divorced/separated. The breakdown by race was: 180 (82%) White, 7 (3%) African-American/Black, 8 (4%) Asian/Asian American, 6 (3%) Hispanic/Latino, and 18 (8%) Bi-racial/multiracial. Participants were from all regions of the United States: 61 (28%) from the Northeast, 74 (34%) from the South, 52 (24%) from the Midwest, 31 (14%) from the West, and 1 participant (1%) was from either Hawaii or Alaska.

There was a wide range of graduation years in terms of participants' bachelor's or associate's degrees, ranging from 1972-2018, with the most representation from 2010 (11%). Forty-five participants (20%) were involved in a fraternity or sorority in college. A small percentage of participants ($n=16$) (7%) reported current enrollment in a graduate school program. With respect to workplace involvement, 177 participants (81%) were employed full-time, 24 (11%) were employed part-time, 11 (5%) were unemployed (i.e. no job but looking for work), and 5 (2%) were not in the workforce (i.e. retired, homemaker, student, and looking for work). It is important to note that many of the graduate students reported work involvement, and were therefore not included in the 2% of participants who reported not being in the workforce. Approximately one quarter of participants ($n=53$; 24%) had been diagnosed with ADHD or ADD by a healthcare professional at some time in their life. The average age of onset for PSM was 19.57 ($SD=3.33$), with a minimum age reported of 13 and a maximum age reported of 38. Additional detail about participants' demographic characteristics is available in Table 1.

Measures

Substance use. We adapted questions about substance use and their response choices from the National Survey on Drug Use and Health (2018). Specifically, participants reported on their tobacco and alcohol use with the options: within the past week, within the past month, more than one month ago but within the past year, more than 12 months ago but within the past 3 years, more than 3 years ago, and I have never smoked/vaped or I have never drank alcohol. We asked if participants had ever used marijuana, hashish, cocaine, heroin, prescription opioids, PCP, LSD, or psilocybin. If they reported using any of the aforementioned substances we asked how recently they had used each substance, respectively, using the same response options for alcohol/tobacco use. We asked more detailed questions about PSM use, as it was the focus of our

study. Specifically, participants noted which type(s) of prescription stimulants they had ever used, how many times they used in college (on a scale from 1-100), route(s) of administration (snorting, swallowing, etc.), and current patterns of use. If a participant reported PSM in the previous month, we inquired about the number of days they used in the past month.

Sensation seeking. In order to determine participants' proclivity for sensation seeking, we administered the Brief Sensation Seeking Scale (Hoyle et al., 2002). Participants selected how much they agreed/disagreed with 8 statements ($\alpha=.824$) concerning sensation seeking behavior on a 5-point Likert scale ranging from 1=*strongly disagree* to 5=*strongly agree*. A higher mean score on the BSS denoted higher-sensation seeking. The 8 statements corresponded to the following four subscales of sensation seeking;

- *Experience seeking*: "I would like to explore strange places" and "I would like to take off on a trip with no pre-planned routes or timetables"
- *Boredom susceptibility*: "I get restless when I spend too much time at home" and "I prefer friends who are excitingly unpredictable"
- *Thrill and adventure seeking*: "I like to do frightening things" and "I would like to try bungee jumping"
- *Disinhibition*: "I like wild parties" and "I would love to have new and exciting experiences, even if they are illegal"

Side effects associated with PSM. In order to explore the relation between negative side effects and PSM, we asked participants to report how often they experienced a variety of side effects associated with PSM *in college*. We obtained the list of side effects from Smith et al.'s (2017) study of PSM side effects in undergraduates. The side effects were; loss of sex drive, loss of appetite, depression, dry mouth, diarrhea, dizziness, headaches, heartburn, irritability, nausea,

insomnia, sweating, increased heart rate, nervousness, and paranoia. Participants were asked to rate the experience of each side effect on a 5-point Likert-type scale from 1=*never* to 5=*always*. There was a sixth option of “cannot recall.” If a participant reported PSM within the last year they were then asked to complete the measure again, but concerning their PSM *within the last year*. Participants rated their experiences of the same aforementioned side effects on the same 5-point Likert scale. (The option “cannot recall” was not provided as participants were reporting on recent use).

Workplace climate. In order to determine how workplace environment might contribute to PSM, individuals who were currently employed, either full or part-time, completed the Workplace Climate Questionnaire (Kirby et al., 2003). Although the initial measure consists of 10 statements, we only included 7 from the two subcategories of the WCQ that applied to our specific study, 3 items ($\alpha=.726$) concerning support and 4 items ($\alpha=.818$) concerning workload. Participants were asked to rate how strongly they agreed/disagreed with the 7 statements regarding their workplace environment on a 5-point Likert scale, 1=*strongly disagree* and 5=*strongly agree*. The statements were broken down into two subscales:

- *Supportive-receptive*: “My coworkers are supportive and friendly toward me,” “My colleagues and coworkers really try hard to get to know one another,” and “The people I work with make a real effort to understand difficulties people in my position may be having with their work.”
- *Workload*: “There is a lot of pressure on people in my field of work,” “My workload is too heavy,” “My position requires me to do too many things,” and “There seems to be too much work to get through in my position.”

Graduate school climate. If individuals were attending graduate school, they completed a modified version of the workplace climate questionnaire that we adapted to be applicable to an academic environment. Participants were asked to rate how strongly they agreed/disagreed with 7 statements regarding their graduate school environment, 3 items ($\alpha=.769$) concerning support and 4 items ($\alpha=.777$) concerning workload. Responses were scored on a 5-point Likert scale, 1=*strongly disagree* and 5=*strongly agree*:

- *Supportive-receptive*: “My classmates and teachers are supportive and friendly toward me,” “My classmates really try hard to get to know one another,” and “The faculty in our program make a real effort to understand difficulties people in my position may be having with their graduate work.”
- *Workload*: “There is a lot of pressure on people in my field,” “My workload is too heavy,” “Graduate students in my program are required to do too many things,” and “There seems to be too much work to get through in my program.”

ADHD symptomatology. In order to determine how the experience of symptoms associated with ADHD might relate to PSM we administered the 18-item ($\alpha=.932$) Adult ADHD SRS (Gray et al., 2014). Participants were asked to, “select the option that best described how you have felt and conducted yourself over the past 6 months” on 5-point Likert scale from 1=*never* to 5=*always*. Sample questions included: “how often do you have trouble wrapping up the final details of a project, once the challenging parts have been done?” to “how often do you have problems remembering appointments or obligations?” Individuals with a higher average score are determined to have higher rates of ADHD symptomatology.

Injunctive norms. Injunctive norms are the norms established by how much the people in our sociocultural networks would approve of our behavior. To assess whether these norms

were associated with PSM we asked participants, “how would the following people react if they knew you used prescription stimulants in ways that a prescriber did not intend?” (Schultz et al., 2017). Participants were asked to indicate how much their friends, significant other/romantic partner, family member, faculty advisors/manager/supervisors would approve/disapprove of their PSM ($\alpha=.73$). Participants rated their responses on a 5-point Likert scale ranging from 1=*strongly disapprove* to 5=*strongly approve*. We created a composite score based on participants’ ratings on the four items, with higher mean scores denoting more approval for PSM in a participant’s social network.

Subjective norms. Subjective norms refer to participants’ perceptions of how much the individuals around them are engaging in a certain behavior (in this case, PSM). To explore the relation between subjective norms and PSM we asked two questions ($r=.623$) concerning PSM amongst participant’s friends and peers, namely: “To the best of your knowledge, how many of your coworkers or classmates use prescription stimulants in ways that a prescriber did not intend?” and “To the best of your knowledge, how many of your friends use prescription stimulants in ways that a prescriber did not intend?” (Stock et al., 2013). For both questions, participants chose from the following options: none, 1-2, 3-5, and more than 5.

Motives for PSM: In college and at present. To examine the motives associated with PSM we first asked participants to select all the reasons they used prescription stimulants in college. These motives, taken from the SSQ (Weyandt et al., 2009), included: to focus better on my work, to perform better on work-related tasks, to help me socialize better, to help me lose weight, to feel more energetic, to perform better, to feel better about myself, and to get high. If a participant reported PSM since graduating college they indicated all of their motives for using prescription stimulants *after college*. Participants selected all of the motives that applied.

Intentions for PSM after college. We asked participants, “Did you intend to continue using prescription stimulants in ways a prescriber did not intend after college?” The response options were: yes, no, unsure/I can’t remember (Underhill & Langdon, 2013).

Source of medication. To determine whether participants’ acquired prescription stimulant medication from different sources (during college compared to after college) we first asked all participants to indicate how they obtained prescription stimulants during *college*. The options were: obtained directly from a prescriber, given to you by a friend/relative for free, bought from friend/relative, took from friend/relative without their knowledge, bought from dealer/stranger, traded another drug for a prescription stimulant, and stole it from a friend, relative, pharmacy, hospital, or doctor’s office (Ford & Lacerenza, 2011). Participants were also able to self-identify another way in which they obtained the medication (Ford & Lacerenza, 2011). Participants could select all sources that applied. If a participant reported PSM since college they were presented with the same list of sources and asked to report how they obtained prescription stimulants *after completing college*.

Negative affect. In order to examine the relationship between depression, anxiety, and stress with PSM we administered the Short-form of the Depression, Anxiety, and Stress Scale (DASS) to all participants (Lovibond & Lovibond, 1995). The DASS includes 21 questions that gauge an individual’s levels of depression ($\alpha=.90$), anxiety ($\alpha=.84$), and stress ($\alpha=.86$). Individuals were asked to indicate if they had experienced any of the circumstances included in the scale *within the last week*. Some example scenarios were; “I felt I was close to panic,” “I couldn’t seem to experience any positive feeling at all,” and “I found myself getting agitated.” Answer options were: 0=*did not apply at all*, 1=*applied to me some of the time*, 2=*applied to me a good part of the time*, and 3=*applied to me most of the time*. In accordance with scoring

instructions for the DASS, responses were summed for each subscale, respectively, and multiplied by two to obtain equivalence with the longer, 42-item DASS. Of note, we excluded the question “I felt that life was meaningless” since endorsement of this question might imply suicidality and we did not have a mechanism for following up with participants who endorsed this question. Exclusion of this question mean that our scores for the depression subscale were not entirely comparable to other studies using this measure.

Design and Procedure

We distributed our survey via Amazon’s Mechanical Turk, a crowdsourcing website that allows researchers to recruit participants from a variety of locations and backgrounds. Participants were deemed eligible to participate if they screened in during the screening stage. In line with best practices to ensure that participants meet inclusion criteria for the study (Wessling, Huber, & Netzer, 2017), we distributed a screening test that inquired about a host of demographic characteristics and substance use behaviors. This broad-based screening allowed us to identify eligible participants while reducing the likelihood that participants were misrepresenting themselves in order to gain access to the survey. In order to screen in (i.e., be offered the opportunity to complete the survey) participants had to indicate that they held a college degree (Associate’s or Bachelor’s) and that they engaged in at least one episode of PSM in college. Individuals who met the aforementioned criteria were then invited to complete our online survey. Once individuals provided consent via our online form they were directed to our survey, which on average took about 12-13 minutes to complete. Participants were compensated a nominal amount (\$.02) for completing the screener; compensation for completing the survey was \$2.00.

In order to answer our hypotheses concerning who continues PSM after college versus who ceases use, we broke participants into two groups; those who had used since college ($n=121$, 55%) and those who had not ($n=98$, 45%). Given that there was considerable heterogeneity in the amount of time since participants had graduated from college, we completed exploratory analyses in which we divided participants into three, rather than two groups based on their recency of PSM. Specifically, we separated participants into *non-recent users*, *semi-recent users*, and *recent users*. *Non-recent users* were the group that had not engaged in PSM within the last three years, they made up 42% ($n=91$) of the sample. *Semi-recent users* were comprised of the group that had reported PSM in the last three years, but not within the last year. They made up 23% ($n=50$) of the sample. Lastly, *recent users* were classified as individuals who had reported PSM either in the last year or within the last month. They made up 36% ($n=78$) of the sample.

Results

Slightly more than half (55%; $n=121$) of participants reported misusing prescription stimulants (subsequently referred to as “users”) since they had graduated college. The remaining 45% ($n=98$) had not misused prescription stimulants since graduating (subsequently referred to as “nonusers”). Users reported significantly higher rates of PSM in college than nonusers $t(216)=-5.172, p<.001$. Furthermore, users were more likely to have an ADHD diagnosis and to have a prescription for stimulant medication than nonusers. Slightly more than one quarter (27%) of users reported an ADHD diagnosis, compared to only 20% of nonusers. Furthermore, 17% of users had a prescription for stimulant medication, whereas only 8% of participants of non-users had a prescription for stimulant medication. See Table 1 for more detail on participants’ demographic characteristics.

In regard to psychosocial functioning, there were a few ways in which users differed from nonusers. Users were significantly more likely to report more ADHD symptoms compared to nonusers, $t(217)=-2.45, p=.015$. Also, users were significantly more likely to endorse higher levels of sensation seeking than nonusers, $t(217)=2.93, p=.004$. Although no other psychosocial functioning variables varied significantly based on user group, there were two trends identified in the analysis. First, users were more likely to report higher levels of anxiety in comparison to nonusers, $t(216.24)=-1.78, p=.077$. There also was a trend for users to report that their friends, significant other/romantic partner, family, faculty advisors/professors or manager/supervisor would be more approving of their PSM compared to nonusers, $t(217)=-1.86, p=.065$. Table 2 provides the means, standard deviations, and independent t-tests comparing the two groups on the study's psychosocial measures.

In order to test my first three hypotheses, I ran three logistic regressions. The logistic regression was utilized to determine if the factors that I predicted might affect whether an individual continues to engage in PSM after college were associated significantly with the continuation of the behavior. A logistic regression is used when the dependent variable, in this case whether or not an individual continues PSM after college, is dichotomous. Meaning, the dependent variable can be answered by a yes or no question. The model then considers theoretically-relevant independent variables that might be contributing to the presence or absence of the dependent variable.

Sensation Seeking Predicting Post-Graduate Use

I hypothesized that participants who reported higher levels of sensation seeking would be more likely to endorse PSM after graduating college. I ran a logistic regression to determine if sensation seeking predicted post-graduate PSM. The logistic regression model predicting post-

graduate PSM (0=no, 1=yes) in regard to sensation seeking was significant ($\chi^2=8.407$, $df=1$, $p=.004$). The Nagelkerke R^2 value estimated that 50% of the variance between the two groups could be accounted for by sensation seeking. Consistent with my hypothesis, sensation seeking was a predictor of post-graduate use; $B(SE)=.48(.17)$; Odds Ratio [OR]=1.61; 95% confidence intervals [CIs]=1.16, 2.24 (see Table 3). This finding was still significant when accounting for the amount of times an individual reported PSM in college.

Subjective and Injunctive Norms Predicting Post-Graduate Use

I hypothesized that participants who believed PSM to be more acceptable, either because their peers/coworkers/friends were using or because their peers/coworkers/friends condoned the behavior, would be more likely to report PSM after college. I ran a logistic regression to determine if subjective and injunctive norms, respectively, were predictors of post-graduate use. The logistic regression model predicting post-graduate PSM (0=no, 1=yes) with the aforementioned factors did not reach significance at $p < .05$, but there was a trend ($\chi^2=5.014$, $df=2$, $p=.082$). Contrary to my hypothesis, subjective norms were not a predictor; $B(SE)=.17(.14)$; OR=1.19; CIs=.91,1.55. Injunctive norms also were not a predictor; $B(SE)=.27(.17)$; OR=1.32; CIs=.94,1.84. The Nagelkerke R^2 value estimated that 30% of the variance between the two groups could be accounted for by the predictors (see Table 3).

Workplace Climate and Depressive Symptoms Predicting Post-Graduate Use

I hypothesized that participants with higher stress in their work/academic environment in combination with more depressive symptoms, would be more likely to report PSM after college. I ran a logistic regression to examine if the interaction between workplace climate and depressive symptoms was a valid contributor to post-graduate PSM. The logistic regression model predicting PSM after college (0=no, 1=yes) with the previously mentioned predictors was not

significant ($\chi^2=2.67$, $df=3$, $p=.446$). Contrary to my hypothesis, workplace stress as measured by workplace support [$B(SE)=-.04(.13)$; $OR=.97$; $CI=.75, 1.23$]; and workload [$B(SE)=.14(.01)$; $OR=1.15$; $CI=.96, 1.4$] were not predictive of post-graduate use. Depression also was not a predictor; $B(SE)=.06(.021)$; $OR=1.006$; $CI=.97, 1.05$. The Nagelkerke R^2 value estimated that a mere 2% of the variance between the two groups was accounted for by the predictors. Further, the addition of the interaction term (workplace stress X depression) did not increase the amount of the variance accounted for by the model (see Table 3).

Source of Medication in Relation to Post-Graduate PSM

I hypothesized that participants would be more likely to buy stimulant medication from a dealer or stranger after college. This hypothesis was not supported, as participants were more likely to endorse this medication in college as compared to after college. Although the aforementioned hypothesis was not supported, I performed an exploratory analysis to determine whether the sources from whom participants sought out medication *during college* differed between users and nonusers. I ran a crosstabs with chi square in order to examine what sources of medication during college might have been more common amongst users and non-users. Post-graduate users were significantly more likely to endorse buying stimulant medication from a dealer or stranger during college: $\chi(1)=8.69$, $p=.003$. The analysis also showed a trend that post-graduate users were more likely to buy stimulant medication from a friend/relative while in college: $\chi(1)=3.23$, $p=.07$ (see Figure 3).

Exploratory Analyses

Since I gathered a large amount of data examining predictors that might contribute to the continuation of PSM after college, I was able to complete several exploratory analyses examining predictors that I did not formulate hypotheses around. In the first section below, I

describe findings related to how users and non-users differed according to their motives for use in college, their past-year substance use, and side effects experienced in college. In the second section I describe exploratory analyses where I divided participants into three groups to examine how certain factors might not only influence if an individual has engaged in PSM since college but also the recency of an individual's PSM.

Motives of PSM during college. In order to examine if motives reported during college were different between user groups I ran a cross tab with chi-squares. The analysis revealed that users who engaged in PSM after college were more likely to report motives of socializing better ($\chi(1)=6.0, p=.014$); helping to lose weight ($\chi(1)=6.8, p=.009$); feeling more energetic ($\chi(1)=12.64, p<.001$); and getting high ($\chi(1)=10.9, p=.001$) during college when compared to participants who did not engage in PSM after college (see Figure 2).

Substance use. In order to examine how substance use behaviors might vary between users and nonusers I ran a cross tab with chi-squares. Participants who reported post-graduate PSM were more likely to also report past year tobacco/nicotine use ($\chi(1)=5.61, p=.018$), cocaine use ($\chi(1)=4.41, p=.036$), and prescription opioid use ($\chi(1)=7.65, p=.006$) as compared to participants who did not report PSM after college (see Figure 1).

Side effects experienced in college. With the purpose of exploring how the side effects experienced in college might influence an individual's likelihood to continue using after college I ran a t-test to compare means. Participants who reported post-graduate PSM were significantly more likely to endorse a loss of appetite as a result of their PSM during college as compared to individuals who did not report post-graduate PSM, $t(185.53)=-.684, p=.004$.

Effects of recency of PSM on key study variables. Nearly half of the sample (42%) had not used within the last three years and made up the *non-recent users* group. 50 participants

(23%) reported use within the last three years but not within the last year. They made up the *semi-recent users* group. Lastly, 78 participants (36%) either disclosed PSM within the last year or the last month and therefore made up the *recent users* group. To determine if these three groups differed on the variables I tested with the two groups (i.e., sensation-seeking, injunctive norms, descriptive norms, depression, and workplace stress), I ran four one-way ANOVAs, respectively.

Sensation seeking. In order to determine if levels of sensation seeking varied between user groups I ran a one-way ANOVA. The three groups varied significantly on their reported means of sensation seeking [$F(2,216)=7.442, p=.001$]. In order to determine more specifically how the means of the three groups varied I ran a Tukey post hoc test. The *semi-recent users* reported higher levels of sensation seeking in comparison to the *non-recent users* ($p=.001$). The *recent users* also reported higher levels of sensation seeking in comparison to *non-recent users* ($p=.016$). *Recent users* and *semi-recent users* did not significantly differ in their endorsement of sensation seeking characteristics ($p=.515$).

Subjective and injunctive norms. To explore if the endorsement of subjective and injunctive norms varied between user group I ran a one-way ANOVA. The three groups varied significantly on their endorsement of injunctive norms, $F(2,216)=3.57, p=.03$. However, Tukey post hoc test revealed that none of the groups differed significantly on their individual means although there was a trend between *semi-recent users* reporting that their peers/friends/advisors/etc. were more approving of their PSM as compared to *non-recent users* ($p=.056$). The three groups also varied significantly on their endorsement of subjective norms $F(2,216)=7.91, p<.001$. The Tukey post hoc test showed that *recent users* reported that significantly more of their friends/coworkers/peers were engaging in PSM as compared to the

semi-recent users ($p=.046$) and the *non-recent users* ($p<.001$). *Semi-recent users* and *non-recent users* did not significantly differ on their endorsement of subjective norms ($p=.59$).

Workplace climate and depression. To examine if the three groups differed in their endorsement of workplace stress and depression, I ran a one-way ANOVA. The means reported by the three groups did not vary significantly on support in the workplace $F(2,189)=.26, p=.77$, workload $F(2,189)=2.69, p=.07$, and depression levels $F(2,216)=.52, p=.59$.

In summary, sensation seeking was the only significant predictor of post graduate PSM. Subjective norms and injunctive norms as well as the workplace climate x depression interaction were not significant predictors of post graduate PSM. However, when dividing participants based on recency of use, sensation seeking as well as subjective and injunctive norms were predictors of the recent PSM. Furthermore, exploratory analyses revealed several differences between the reported rates of substance use, motives for PSM, and experienced side effects when comparing those who endorsed PSM after college and those who did not.

Discussion

The present study aimed to explore which factors predict the continuation of PSM in a post-graduate population. While researchers such as Bucher et al. (2012), Emmanuel et al. (2013), McNiel et al. (2011), and Verdi et al. (2016) have examined PSM in post-graduate populations, much of their research is focused solely on graduate students and/or large national surveys that focus on prevalence rates of PSM rather than specific predictors of the behavior. This study aimed to address the gap in the literature by examining factors that might predict the continuation of a behavior that is highly prevalent on college campuses. Our key findings were that sensation seeking was a significant predictor of the continued PSM while subjective norms, injunctive norms, workplace climate, and depression were not. Although not addressed in formal

hypotheses, I also found that motives for use in college as well as source of prescription stimulant medication in college were predictors of post-graduate use. The data collected in this study can inform eventual preventive intervention efforts that focus on predictors of continued PSM, thereby reducing the probability that people who use stimulants non-medically will continue to do so after college.

Sensation Seeking and PSM

The hypothesis that individuals who reported higher levels of sensation seeking would be more likely to report PSM after college was supported. This hypothesis was based on extensive literature that reports a correlation between an individual's sensation seeking and his/her consequent report of general substance use as well as PSM specifically (Bucher et al., 2012; Herman-Stahl et al., 2007; Jardin et al., 2011). Importantly, this study showed that sensation seeking not only predicts concurrent PSM and other substance use behavior, but that it is a risk factor for continued PSM after college. Essentially, if an individual is engaging in PSM in college they are much more likely to continue to exhibit that HRB if they are also someone who endorses characteristics consistent with sensation seeking. The aforementioned finding is not surprising as sensation seeking is an ultimate personal predictor of HRBs, therefore it is not malleable and, presumably, predates the substance use. Thus, sensation seeking appears to be a significant predictor of HRBs across an individual's lifetime, even when certain environmental factors change (such as college versus post-college environment).

Not surprisingly, sensation seeking also was related to how recently an individual had engaged in PSM. Both *recent users* and *semi-recent users* were more likely to report higher levels of sensation seeking than *non-recent users*. However, *recent users* and *semi-recent users* did not vary on their reported levels of sensation seeking characteristics. These data suggest that

sensation seeking is related to both recent and semi-recent PSM, and that individuals lower on sensation seeking also are not likely to report any form of recent PSM. These data are important in terms of intervention efforts as they show that sensation seeking does not simply predict continued PSM, but that it is associated with recency of use.

Subjective Norms, Injunctive Norms, and PSM

The hypothesis that participants who believed PSM to be more acceptable, either because their peers/coworkers/friends were using (subjective norms) or because their peers/coworkers/friends condoned the behavior (injunctive norms), would be more likely to report PSM after college was not supported. It was notable that there was a trend for these constructs to predict continued PSM, however. Had our sample size been larger, it might have been easier to demonstrate this effect. This hypothesis was based on research showing that subjective and injunctive norms are highly influential on our behavior, specifically HRBs, since these norms are proximal to the behavior. For example, researchers such as Eslami et al. (2014) found that if an individual's friends endorse PSM the individual is more likely to report use as well. Similarly, Judson and Langdon (2009) found that subjective norms were important predictors of PSM as they allow individuals to rationalize their actions and deduce that their behavior does not risk disapproval in their social relationships. That being said, researchers have typically reported an association between subjective norms and PSM in college populations, a time period in which subjective norms might be more influential on an individual's reported HRBs. Arguably, college is a time in which emerging adults are still attempting to fit in. Because we focused on college graduates, it is possible that subjective norms become less of a determinant of people's behavior as they get older and more mature.

Similarly, injunctive norms have been found to be a predictor of PSM, but largely amongst college populations. For example, researchers found that students who report PSM view their behavior as socially acceptable in the eyes of their social network (Judson & Langdon, 2009). Furthermore, students who engage in PSM in college tend to report that they do not perceive PSM as negative in the eyes of their culture or society (DeSantis & Hane, 2010). Again, it is possible that this finding was not replicated in our study as injunctive norms might be less potent after college, a time of approval seeking. It is possible that as individuals age, they place less importance on the approval of those around them, especially those in positions of authority, and therefore do not report injunctive norms as influential predictors of their behavior (in this case, PSM).

Although subjective and injunctive norms did not significantly predict post-graduate PSM, they did predict recency of use. In terms of injunctive norms, all three user groups significantly differed on this construct. More specifically, *semi-recent users* were more likely to report that their peers/friends/advisors were approving of their use as compared to *non-recent users*. In terms of subjective norms, all three user groups significantly varied on their report of the amount of their friends/peers/coworkers/etc. that engaged in PSM. Not surprisingly, *recent users* were significantly more likely to report that more of the people in their social networks were engaging in PSM as compared to *semi-recent users* and *non-recent users*. Interestingly, *semi-recent users* and *non-recent users* did not vary significantly on their endorsement of subjective norms. Therefore, it appears subjective norms are most influential to the group of users who are reporting current/recent use. This may be due to the fact that *recent users* might be younger and therefore more influenced by their social networks. It is also possible that this finding reflects Judson and Langdon's (2009) research that we surround ourselves with people

who engage in similar behaviors in order to rationalize our own. Therefore, it would be plausible that *recent users* are more likely to endorse subjective norms because they are purposefully surrounding themselves with other consistent users to thus rationalize and support their own PSM behavior.

Workplace Climate, Depression, and PSM

I hypothesized that individuals who had more stressful workplace climates and higher depressive symptoms would be more likely to report post-graduate PSM; however, I did not find support for this interaction. Furthermore, neither workplace climate nor depression were significant predictors of post-graduate PSM when examined as independent predictors. This hypothesis was based on research conducted amongst students showing that individuals in advanced, accelerated, high-stress programs typically report higher rates of PSM than students in more supportive and slow-paced programs (Frick et al., 2011). This finding has been somewhat replicated in adult working populations in that Robitaille and Collin (2016) found that adults viewed PSM as a way to partake in social activities while still maintaining a rigorous work ethic. Therefore, I hypothesized that individuals in a high stress and rigorous work environment would be more likely to report PSM after college. Although there was not a relation between workplace climate and post-graduate PSM in our study, it is possible that a different measure attempting to capture the rigor of a work environment might better illuminate the relation between PSM and the workplace. Furthermore, it is also plausible that post-graduates have learned how to mitigate stress and adapt to their workplace environments (compared to college), making the relation between PSM and post-graduate work environment less pronounced.

Since I was also curious about how psychosocial functioning might influence an individual's ability to cope with stress and demands in any given work environment, I included

the workplace climate and depression interaction in my hypothesis. Based on previous findings, college students that report PSM are also significantly more likely to endorse feeling depressed (Benson et al., 2015). Furthermore, authors such as Huang et al. (2006) have found a relationship between dysthymia being more common amongst individuals reporting PSM. Therefore, I thought that the interaction of high depressive symptoms with a poor workplace climate would potentially act as an interactive predictor of PSM.

Although this hypothesis was not supported, it is possible that other forms of negative affect would have a significant interaction with workplace climate to act as a potential predictor for post-graduate PSM. For example, while depression did not interact with workplace climate in predicting PSM, stress or anxiety levels might. In exploratory analyses, I did find that post-graduate users reported higher levels of overall anxiety than those who had not engaged in PSM since college. Therefore, this aspect of psychosocial functioning might have a significant interaction with workplace climate. Furthermore, the measure used to assess workplace climate has three components (i.e., workplace stress, supportive-receptive, and workload), each of which corresponds to a different aspect of workplace climate. We chose to only utilize questions from the supportive-receptive and workload aspects of the measure; had we included the third subscale of the measure (workplace stress), we might have found a relation between workplace climate and PSM.

Source of Medication

My final hypothesis was that participants would be more likely to buy prescription stimulants from a dealer or stranger after college as compared to during college. This hypothesis was not supported, as individuals were more likely to endorse this source during college as compared to after college. The aforementioned hypothesis was based on the research conducted

by Ford and Lacerenza (2011) who found students who endorsed more frequent prescription stimulant use were more likely to report buying their medication from either a friend, dealer or stranger. Ford and Lacerenza (2011) argued that students who report PSM solely because of accessibility (i.e. getting the medication for free from a friend/family member) do not use as frequently and therefore when they do not have easy accessibility to the medication, they would most likely not engage in PSM. Thus, I hypothesized that participants who most likely use(d) frequently, since they have used since college, but were not in a college environment where prescription stimulants were presumably more available, would be more likely to report buying from a dealer/stranger.

There are several reasons why this hypothesis may have not been supported. First, it is possible that post-graduates have more concerns about potential legal consequences that could come from buying drugs from someone after college than they did in college. Now that they are potentially employed, and likely have more to lose if they were to face legal consequences, there might be more reticence associated with buying drugs on the street/online/etc. Second, it is possible that individuals who continue to engage in PSM after college have sought out consistent and sustainable ways to maintain their habit. Meaning, they may have feigned symptoms to a prescriber or they may have secured a relationship with a friend in which they get a few of their pills each month.

Although my initial hypothesis was not supported, there were some interesting findings associated with medication source acting as a predictor for post-graduate use. The data showed that individuals reporting post-graduate PSM were also more likely to *buy* from a dealer or stranger during college than post-graduate nonusers. This finding more accurately reflects Ford and Lacerenza's (2011) argument that frequent users are more likely to resort to buying

medication as opposed to infrequent users. Post-graduate users used more frequently during their undergraduate years, foreshadowing an inability/unwillingness to cease the behavior upon graduation. Therefore, it appears that post-graduate nonusers were using in college solely out of convenience or to “fit in” to their social networks, therefore they were never seeking out prescription stimulant medication from a dealer or stranger. Conversely, post-graduate users appear to have been using in college for reasons beyond the convenience of the prescription stimulant medication and more so because they actively wished to seek out the drug on their own.

Substance Use

A research question I examined was how current substance use behavior differed between post-graduate prescription stimulant misusers and nonusers. While substance use has been found to be largely related to the endorsement of PSM, this relationship has yet to be examined in the context of post-graduate use (Garnier-Dykstra et al., 2012; Herman-Stahl et al., 2007; Jardin et al., 2011; Novak et al., 2007). Hypothetically, both post-graduate users and nonusers still reported PSM in college, therefore one could argue that their rates of substance use would be largely similar since PSM in general is related to the endorsement of other forms of substance use. However, there has yet to be research that considers which forms of current substance use might be unique to the group of individuals that continue PSM after college.

Interestingly, results showed that post-graduate users were significantly more likely to report past year tobacco/nicotine use, cocaine use, and prescription opioid misuse. The relationship between post-graduate PSM and tobacco/nicotine and cocaine use is not surprising as all the aforementioned substances are stimulants. Therefore, it is highly plausible that individuals engaging in all of these behaviors are seeking a desired effect from stimulating

substances. More surprising was the relation found between post-graduate PSM and prescription opioid misuse. While the aforesaid substances have opposite effects on the brain and body, it is plausible that if individuals are comfortable with misusing one form of prescription medication they are comfortable with misusing other forms of prescription medications. This assumption is further supported by the fact that participants reporting post-graduate PSM were not more likely to report heroin use, another opioid with the same effects as prescription opioids. Thus, the relationship between PSM and prescription opioid misuse likely is one that is based on the prescription nature of both substances. The aforementioned findings are notable in terms of understanding PSM in emerging adulthood and beyond, as they show that continued PSM may portend other high risk HRBs. This finding also suggests that PSM after college may be part of a constellation of other substance use behaviors, as would be predicted by the Triadic Theory of Influence (Bavarian et al., 2012).

Motives for Use

Another research question was centered around how the motives for PSM in college might differ amongst post-graduate users and nonusers. Since PSM is typically motivated by a desire to focus and to complete academic work, it seemed unlikely that this motive for using in college would differentiate the two groups. Not surprisingly, the data showed that post-graduate users and nonusers did not differ in their endorsement of academic-related motives for use in college. However, the two groups did diverge with respect to their endorsement of the following motives: socialize better, lose weight, feel more energetic, and get high, with post-graduate users reporting using more frequently for these reasons in college.

The aforementioned data suggest that students who report PSM for solely academic motives are more likely to cease the behavior once they are out of a purely academic

environment and that pressure is lifted. Conversely, students who report PSM for a variety of motives; social, recreational, dietary, etc. have more motives to continue the behavior even once they are removed from the academic environment. Essentially, once the academic motive is removed, most college users no longer feel the need to engage in PSM. However, post-graduate users engage in the behavior for other reasons, which may be one key factor motivating their continued use after college.

Side Effects

The final research question was formulated to determine whether negative side effects experienced in college might potentially deter an individual from continued use. Meaning, how might either negative or frequent experiences of side effects influence an individual's willingness to continue engaging in PSM after college? The only significant finding was that participants who reported post-graduate PSM were significantly more likely to endorse a loss of appetite as a result of their PSM during college. This finding potentially relates to the previous discovery that post-graduate users were more likely to report taking prescription stimulants as a motive to lose weight. If individuals discover that PSM causes them to lose their appetite, and to subsequently lose weight they might continue to engage in PSM if they deem weight loss reinforcing. This assumption would account for why post-graduate users were more likely to report loss of appetite during college as a result of their PSM *and* why they were more likely to endorse utilizing prescription stimulants to help them lose weight.

Implications and Importance

The current findings are important in terms of determining which college students are “at risk” for post-graduate use. Such information can be crucial in efforts to design and implement interventions. There is no disputing that PSM is prevalent on college campuses; several

researchers (Benson et al., 2015, Garnier-Dykstra et al., 2012; Judson & Langdon, 2009; Munro et al., 2016; Underhill & Langdon, 2013) have reported its prevalence, predictors, and consequences. Yet, scant research has explored what happens when college students who report PSM graduate. Do they continue using? Which aspects of their functioning during college portend continued PSM after graduation? What can we do to target these individuals while they are still in college to increase the likelihood of their use being limited to the college years? Since many undergraduate students report PSM at least once in their college career it is challenging to tease out who is genuinely “at risk” and who is potentially using only a few times in college and never revisiting the behavior. If college campuses were aware of risk factors present in college that were indicative of continued use after college, they could target this group of students. Therefore, investing resources in an intervention would not be a “waste” on students that arguably do not need an intervention.

When combined with other studies similar to this one, findings from the current study could be utilized to form a profile of which students engaging in undergraduate PSM are “at risk” for continuing to use. Our study showed that amongst users in college, those that exhibit higher levels of sensation seeking should be targeted in terms of intervention as they possess a personal and relatively stable characteristic that puts them at higher risk for continuing to exhibit the HRB after college. Based on the TTI, it is known that ultimate personal predictors of a behavior are not typically malleable, therefore having a consistent impact on HRBs overtime. Thus, intervention efforts could include providing the individuals with alternate activities that appeal to individuals that have sensation seeking personalities. Since the individual is unlikely to change their personality, intervention could be focused on alternative forms of novelty seeking that do not involve substance use (specifically PSM).

Second, the data showed that students who reported buying from a dealer/stranger during college were significantly more likely to report post-graduate PSM. Third, the study showed that students who endorsed using prescription stimulants in order to socialize better, lose weight, feel more energetic, and get high were much more likely to endorse post-graduate PSM. Both the aforementioned findings could be highly influential to include in a profile of what an “at risk” college student looks like. If college personnel, friends, family members, etc. were somehow able to recognize these predictors while the individual was still completing his/her undergraduate education, it might be possible to prevent the behavior from continuing into later life.

Especially in consideration of the findings concerning the increased likelihood of post-graduate users to endorse other high risk forms of substance use such as cocaine, tobacco/nicotine, and prescription opioids it is crucial that we intervene at the right time and target the most at-risk people. PSM is evidently not a behavior that is solely restricted to college, and it is a behavior that clearly relates to other aspects of an individual’s life. Noticeably, PSM is a persistent behavior for many individuals even once they graduate college. Furthermore, this HRB is related to other concerning behaviors that are associated with poorer psychological and physiological outcomes in adulthood.

Limitations

Although the utilization of Amazon Mechanical Turk allowed us to access a heterogeneous sample, our sample size still was relatively small and likely limited our ability to detect small effects. Also, even though Amazon Mechanical Turk did provide us with a very heterogeneous sample, researchers must always be somewhat aware of the quality of data received from an online crowdsourcing site. These platforms allow for larger sample sizes and a more diverse sample, but also may lend themselves more easily to manipulation and deceit.

While research has supported Amazon Mechanical Turk as a valid and reliable way to gather data, it is still important to acknowledge crowd sourcing websites as a limitation in any study (Buhrmester et al., 2011). Although most of the data gathered, if not all, was most likely not fabricated there is potential that one or more participants rushed through the survey without providing truthful answers, therefore skewing the data. In order to minimize the likelihood individuals would falsely take our survey we included a qualifier test and check questions throughout the survey so participants were known to fit the necessary criteria and were prompted to pay close attention throughout the entirety of the survey (Wessling, Huber, & Netzer, 2017). Nonetheless, it is still possible a participant could have falsely represented themselves, a possibility in any online survey study.

Another limitation of the current study was that the measures we used to assess the constructs were somewhat limited in scope. That is, we utilized brief measures of many constructs (e.g., 7-item measure of depressive symptoms) in an attempt to see which constructs were associated with post-graduate PSM. As the research in this area is very limited, we thought it critical to test a wide range of constructs, but in doing so, we may not have measured all constructs comprehensively, or we may have missed some constructs that are critical to predicting post-graduate use and opposed to PSM in undergraduates. It is especially important that research in this area continue to consider post-graduate populations in order to further narrow the scope of how this behavior manifests, what specific factors are predicting it, and how can we intervene to best address it.

Lastly, one limitation of our study was that it relied on participants reporting retrospective memories from college. While portions of our survey were concerned with current behaviors and environments there were also extensive components that focused on behaviors

present in college, specifically PSM. Some participants, by virtue of their current age and when they attended college, were reflecting on experiences from many years ago. Therefore, it is possible that the data collected was not entirely representative of the behaviors we were interested in during college.

Future Directions

As mentioned, this study sought to fill an important gap in the literature. While PSM has been widely studied at the undergraduate level there has yet to be in-depth research examining how this behavior manifests in post-graduate users and what factors might contribute to whether or not people continue using. Therefore, since this study was one of the first in this area of literature, it is important to continue to expand on this component of the research. With rates of PSM growing at the undergraduate level it is crucial that we begin to understand what happens when these individuals graduate. While this study pointed to several risk factors associated with the continuation of PSM including; sensation seeking, certain motives of PSM endorsed during college and, certain sources of prescription stimulant medication endorsed during college, these findings need to be replicated so that we can more confidently describe a profile of the “at risk” college user. Furthermore, we must begin to see PSM as a continuous behavior rather than a behavior that is limited to college. Of concern, this behavior not only continues for many individuals into later adulthood, but it is also associated with several other risk related substance use behaviors. Therefore, it is essential that we begin to look at this behavior across age groups and life stages. We cannot pretend that PSM is a college isolated behavior and we cannot ignore that it has negative associations with other risk related HRBs.

Conclusion

The current study contributes to the extensive body of research surrounding PSM by proposing a variety of predictors, factors, and characteristics that might contribute to the continuation of PSM after college. By utilizing the TTI to understand which predictors are more malleable, and which are more constant, this study has sought to not only determine what predictors are the most significant at influencing the continuation of PSM after college but where intervention efforts might best be focused. While the present study identified several predictors that potentially contribute to the continuation of PSM after college, whilst also identifying important findings about how PSM impacts an individual's behaviors after college, future research must replicate these findings and investigate other factors that might contribute to the continuation of PSM, and which factors lend themselves to change through an intervention.

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Table 1

Demographic Characteristics for Sample Overall and by Misuse Group

Study variable	Overall sample <i>N</i> = 219	Post-graduate use <i>n</i> = 121	No Post-graduate use <i>n</i> = 98
Age [<i>M</i> (<i>SD</i>)]	32.5(7.1)	32.7(6.7)	32.3(7.6)
Gender			
Male	55%	55%	56%
Female	45%	45%	44%
Race/ethnicity			
White	82%	84%	81%
African American/Black	3%	3%	4%
Asian/Asian American	4%	5%	2%
Hispanic/Latino	3%	2%	4%
Bi/Multiracial	8%	7%	9%
Employment status			
Employed full time	81%	85%	76%
Employed part time	11%	11%	11%
Unemployed	5%	4%	6%
Not in the workforce	2%	-	5%
Enrolled in graduate school	7%	7%	7%
Relationship status			
Single	59%	55%	63%
Married	35%	40%	29%
Divorced/separated	6%	5%	7%
ADHD Diagnosis	24%	27%	20%
Prescription for stimulant medication	13%	17%	8%
Geographic location			
Northeast	28%	25%	32%
South	34%	36%	32%
Midwest	24%	29%	17%
West	14%	10%	19%
Hawaii or Alaska	1%	1%	-
College type attended			
Private, no religious affiliation	26%	24%	28%
Public	64%	69%	59%
Unsure	1%	-	2%
Private, religious affiliation	9%	7%	11%

Table 2

Psychosocial Functioning for the Sample Overall and by Misuse Group

Study variable	Overall Sample N=219	Post-graduate use n=121	No Post-graduate use n=98	<i>t, df, p</i>
ADHD symptoms	2.6	2.7	2.4	$t(217)=-2.45, p=.015$
Sensation seeking	3.0	3.2	2.8	$t(217)=-2.93, p=.004$
Negative affect				
Depression	6.9	6.8	6.9	$t(217)=.213, p=.832$
Anxiety	5.9	6.6	4.9	$t(216.24)=-1.78, p=.077$
Stress	10.5	11.1	9.8	$t(217)=-1.15, p=.251$
Workload	4.2	4.3	3.9	$t(217)=-1.57, p=.118$
Injunctive norms	3.0	3.1	2.9	$t(217)=-1.86, p=.065$
Subjective norms	2.5	2.6	2.4	$t(194.153)=-1.54, p=.126$

Table 3

Logistic Regression Results for Three Models Testing Hypotheses

Domain and Predictor	<i>B</i> (<i>SE</i>)	Odds ratio	95% <i>CI</i> s
Personal stream			
Sensation seeking	.48(.17)*	1.61	1.16,2.24
Sociocultural stream			
Subjective norms	.17(.14)	1.19	.91,1.55
Injunctive norms	.27(.17)	1.32	.94,1.84
Interactive personal-environmental model			
Workplace support	-.04(.13)	.97	.75,1.23
Workplace workload	.14(.01)	1.15	.96,1.4
Depression	.006(.021)	1.006	.97,1.05

Note. † $p < .10$, * $p < .05$

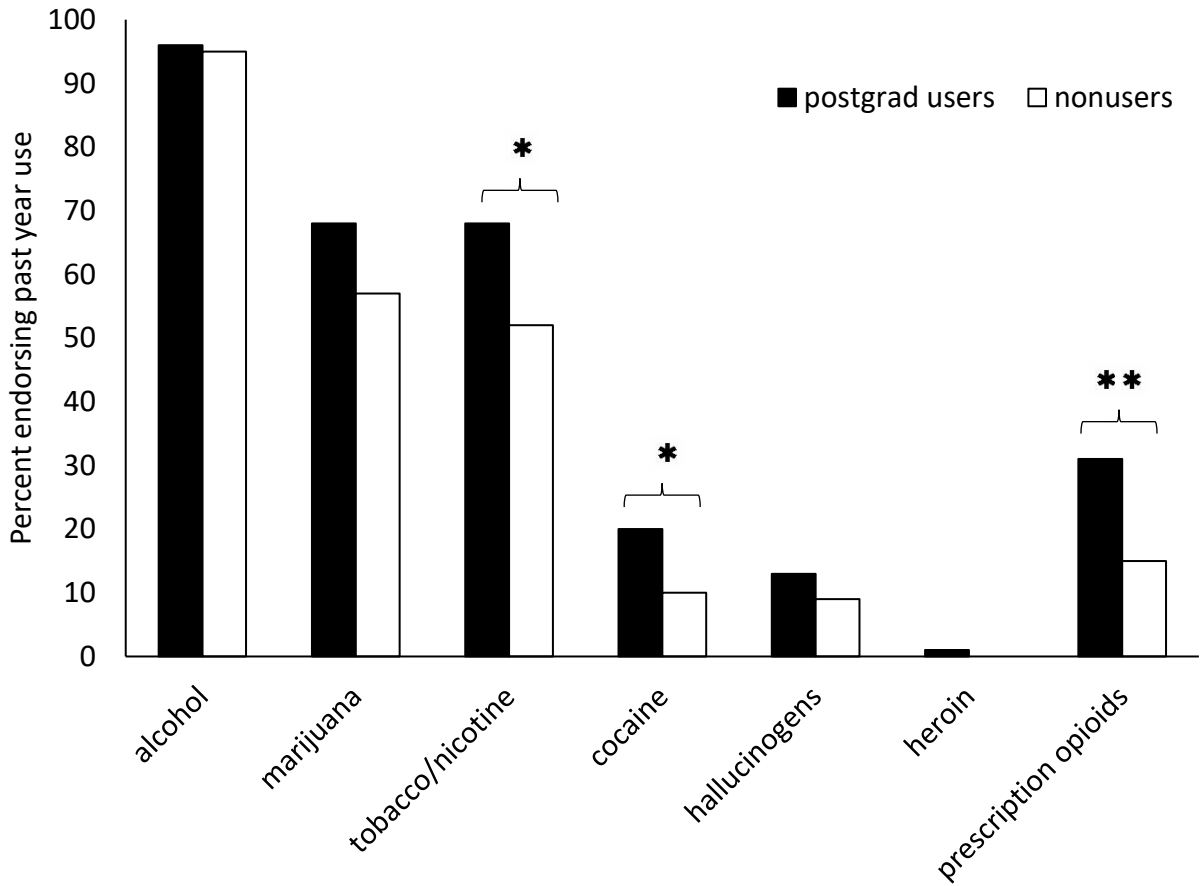


Figure 1. Reported substance use within the last year by user group. A significantly greater percentage of post-grad users (vs. non-users) endorsed prior year nicotine, cocaine, and prescription opioid use. * $p < .05$, ** $p < .01$.

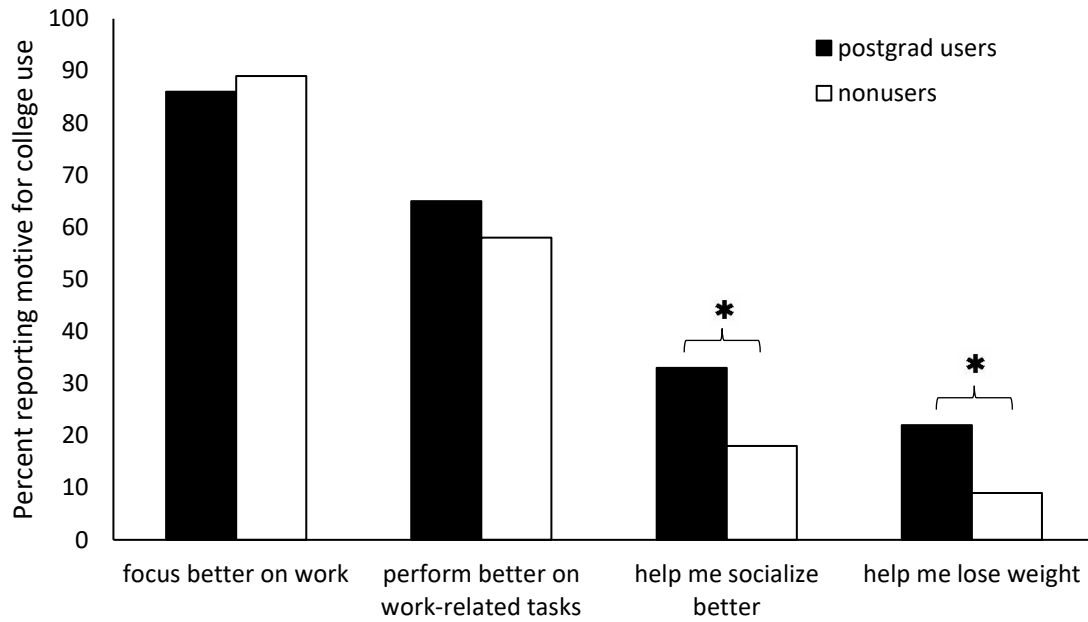


Figure 2a. Motives for engaging in PSM in college by user group. * $p < .05$.

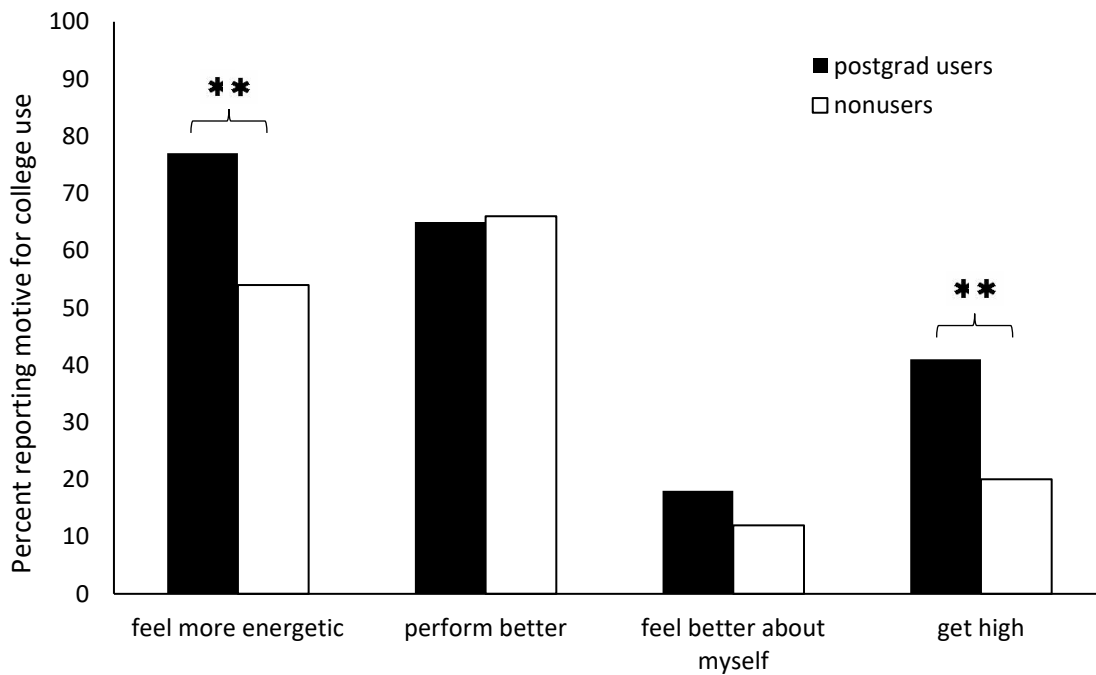


Figure 2b. Motives for engaging in PSM in college by user group. * $p < .05$, ** $p \leq .01$.

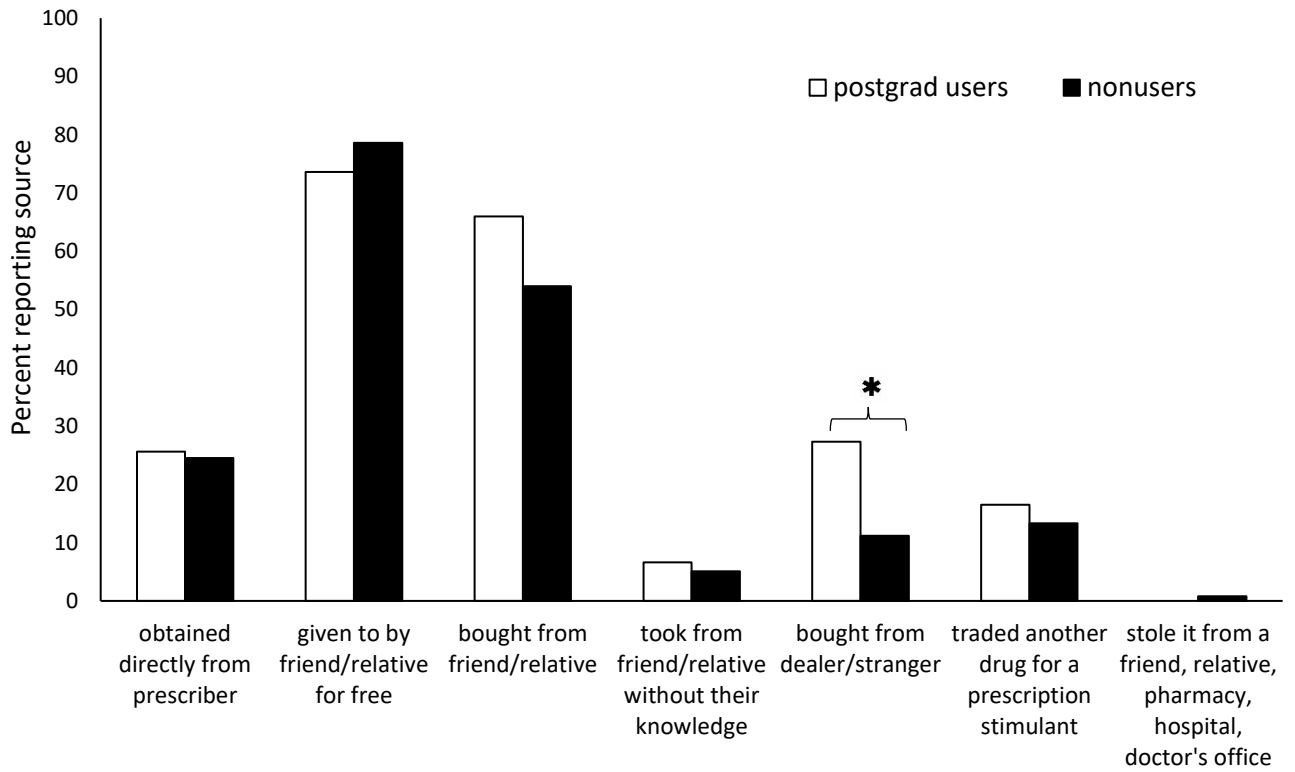


Figure 3. Sources of prescription stimulant medication in college by user group. * $p < .05$.

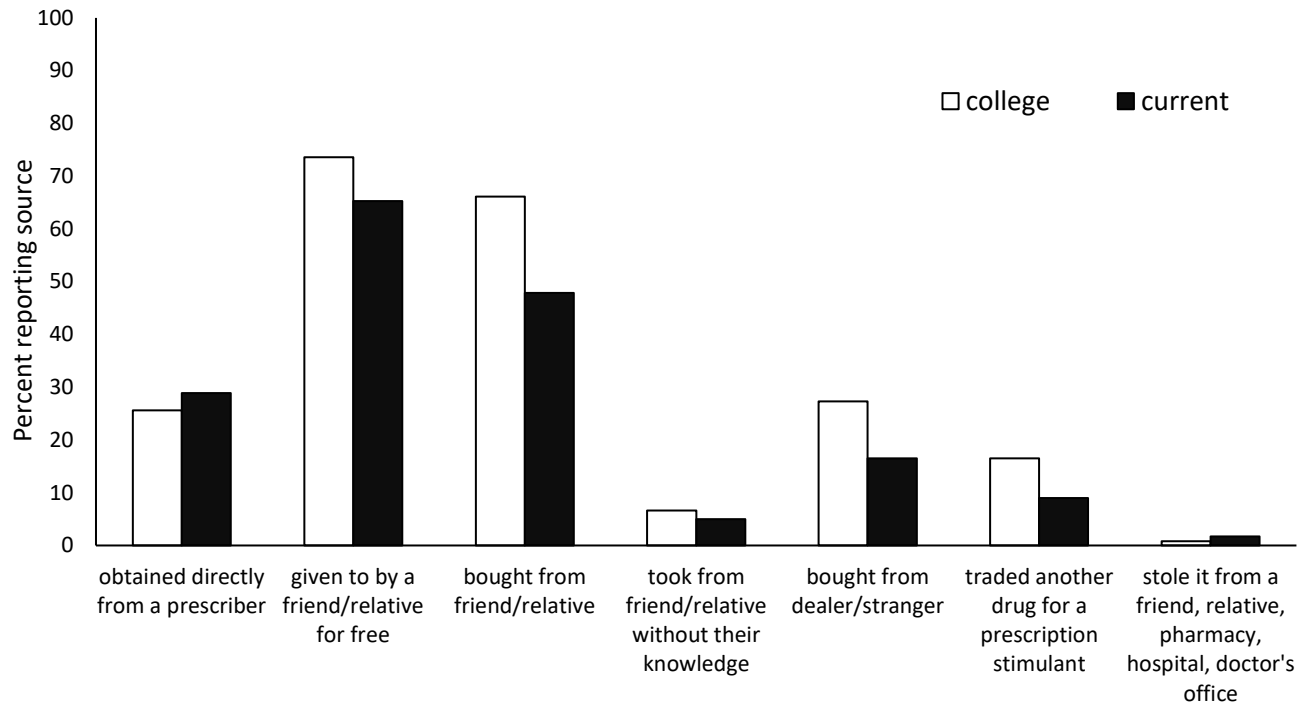


Figure 4. Percent of post-grad users utilizing each source of prescription stimulant medication in college versus current.